# Performance evaluation of the Turkish pension fund system

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## Abstract

**Purpose** – The purpose of this paper is to provide an in-depth performance evaluation of funds offered by the Turkish pension system.

**Design/methodology/approach** – This paper compares aggregate fund index returns with the corresponding asset class returns, estimates a factor model to decompose excess returns to factor exposures, i.e., $\beta$ return and excess return originating from residual $\alpha$ and analyzes persistence of fund returns using migration tables and Fama–MacBeth regressions and tests for market timing ability.

**Findings** – Majority of pension funds are unable to generate excess returns. Majority of funds are unable to generate a positive $\alpha$ and fund returns are predominantly driven factor exposures. There is evidence for slight persistence in returns, mainly due to factor exposures and funds do not exhibit market timing ability.

**Originality/value** – In this paper, the authors perform an in-depth analysis of pension fund performance for the Turkish pension fund system. The authors identify weaknesses and strengths of the pension fund industry and provide policy recommendations for a better design of pension fund system.

**Keywords** Fund performance evaluation, Turkish pension system

**Paper type** Research paper

## Introduction

In the last decades, the transformation in the pension fund industry toward defined contribution plans paves the way to the delegation of investment decisions to individuals, i.e., individuals are responsible for their actions such as participation in a plan, the amount and allocation of contributions, portfolio re-balancing and withdrawal of the accumulated sum at retirement. Even though defined contribution plans are flexible, they are prone to uninformed and sub-optimal decisions in complex and uncertain environments. To mitigate this uncertainty on the part of individual investors, Turkish pension fund industry offers a menu of professionally managed funds with different compositions of asset classes. This approach simplifies the portfolio selection problem as it removes complex actions such as security selection from the decision problem, however, limits the universe of pension portfolio construction to a narrowed set of choices, i.e. options provided by the industry. In such an environment, performance of funds offered to the investors is critical for building pension portfolios, which provide sufficient income at retirement. In this paper, we provide a comprehensive analysis of pension funds in terms of design and performance provided by the Turkish pension fund industry.

A thorough analysis of fund performance in the domain of pension investing requires a well-defined metric that is suitable for life-cycle investment. The main target of a pension portfolio is to provide sufficient income at retirement, which depends on a number of factors and a complex problem. First, considering cross-section of investors, it depends on time to retirement, income level, education, occupation, life expectancy, target level of spending, etc.,



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important determinants of life-cycle investment. Second, given the individual characteristics, as retirement income is evaluated in terms of future purchasing power, investment decisions critically depend on the future path of inflation. Therefore, performance evaluation calls for a strategy based on a risk-adjusted return metric taking into account the effects of inflation.

The literature provides alternative paradigms for the appropriate risk return metric for long-term investing. First, paradigm offers an asset-only approach originating from the one-period portfolio optimization of Markowitz and its multi-period extension by Merton. This strategic asset allocation approach requires continuous portfolio re-balancing with an objective of maximizing nominal returns considering the risk penalty related to asset volatility. Second, paradigm is the liability-driven, i.e. considers present value of potential future retirement expenditures as a liability to the investor. Similar to the asset-only approach, portfolio is re-balanced periodically to maximize the economic surplus together with a risk penalty based on the shortfall probability. As mentioned above, Turkish pension fund system provides investor a menu of fund choices and investors try to optimally decide on their portfolio of funds to meet the targets implied by these objectives. This design requires the construction of funds by portfolio managers that is consistent with the long-term targets of investors, i.e. objectives of both parties need to be aligned. However, on the one side, portfolio managers, to a large extent, rely on the time-weighted excess returns over a benchmark fund and on the other side, for the pension fund investors, the relevant risk return metric is the money-weighted excess returns over inflation consistent with their life-cycle investment goals.

The literature on the performance evaluation for the pension funds in Turkey is rather thin compared to the literature on mutual funds as the Turkish private pension fund system is established in 2003. Notable exceptions are Dağlar (2007), Ege *et al.* (2011) and Ayaydin (2013) which analyze the performance of pension funds using a single index model with the market portfolio used as an index. Furthermore, they use different market portfolios as benchmark and find that pension funds usually underperform the market index. Another strand of the literature focuses on the market timing ability of funds. Korkmaz and Uygurtürk (2007) and Gökgöz (2007) aim to capture market timing ability using quadratic and dummy variable regression models and conclude that most funds do not exhibit market timing ability. Another related paper is Apak and Taşciyan (2009) who use Morningstar rating methodology to evaluate performance of pension funds. They find that pension funds generally have a negative Morningstar value indicating an inferior performance relative to their benchmark and attribute it to the outperformance of treasury bonds in their sample period. The closest paper to ours is Gökçen and Yalçin (2015). Their analysis yields a similar conclusion to ours such that funds typically fail to beat their benchmarks and generate positive $\alpha$. They use a common multi-factor model for all funds and found that the fund industry as a whole does not deliver a positive $\alpha$ and neither does the average fund. The multi-factor model they propose includes eight broad asset class indices, including local and global equity indices, local and global bond indices and USD/TRY exchange rate. Regarding fund return persistence and value of active management, they also test a naive trading strategy that buys the top 10 funds in each year and holds them for the next year and find that this naive strategy earns about the same annual return as a passive strategy of holding a half-and-half blend of Turkish stocks and government bonds.

Our paper complements and extends the previous literature in several dimensions. In our analysis, we treat each fund category separately, i.e. for each fund we construct a set of relevant factors rather than using same set of factors for all fund categories. For example, we use size, value (Fama and French, 1993) and momentum (Carhart, 1997) in our factor regressions for equity funds. Similarly, we construct level, slope and curvature factors for Turkish bond market and employ them in our regressions for bond funds. Our approach allows us to refine the search for $\alpha$ in fund returns. We use the bootstrap method recently proposed by Fama and French (2010) and Kosowski *et al.* (2006) to check the robustness of the role of skill and luck in $\alpha$ generation. Furthermore, relying on migration analysis and Fama–MacBeth regressions, we conduct an in-depth analysis of return persistence for each fund category, which allows us to identify performance persistence purely due to fund management by eliminating the role of factor exposures.

First, we compare aggregate fund index returns with the corresponding asset class returns. Our analysis reveals that, after considering fees and dividends, majority of pension funds are unable to generate excess returns. Second, we estimate a factor model by defining the set of factors separately for each fund category; we decompose excess returns to factor exposures, i.e. $\beta$ return and excess return originating from residual $\alpha$. We show that majority of funds are unable to generate a positive $\alpha$ and fund returns are predominantly driven factor exposures. Third, in order to test robustness of our results and investigate skill and luck components in $\alpha$ generation, we employ a bootstrap test and conclude that $\alpha$ generation is not distinguishable from a pure random outcome. Fourth, we analyze persistence of fund returns using migration tables and Fama–MacBeth regressions and find evidence for a slight persistence in returns, mainly due to factor exposures. Finally, we conduct a test for market timing ability for different fund categories. Our analysis indicate that majority of funds do not exhibit a significant market timing ability.

## Data and empirical analysis

We obtain funds' specific data from the "Financial Information News Network" (FINNET), a private up-to-date data provider about capital and financial markets (accessed: 2018). All pension funds in Turkey are required to report their net asset value in daily basis to be in compliance with the regulations. As FINNET sources the data from regulatory filings, the data we use are free from reporting bias. Our sample starts with the launch date of the new private pension system in Turkey, i.e. October 2003, and ends in December 2018. Our funds' specific data contain price, asset under management (AUM), fee, their own benchmark details (return, weights, indices, etc.) and asset weights. Furthermore, funds' descriptive information like their managers, founder, category, foundation date, closing date if the fund is closed during the sample period are available. We include closed funds to our analysis to be free of survivorship bias. We define main fund categories as money market, local currency bond (LC Bond), foreign currency bond (FC Bond), equity, balanced and gold. BIST Market Indices used to calculate asset class indices/returns and in factor regressions are obtained from Borsa Istanbul.

As data on daily returns are noisy, we calculate monthly returns using the first and last day of the month. We also observe that some funds switch their category without changing their name. Each category has different obligations about market operations; thus, to such funds, we behave as a different fund after the date they switched their category.

## Do pension funds generate excess returns?

First, we investigate whether pension funds are able to generate excess returns. To this end, we construct a data set consisting of aggregate fund index returns and the corresponding asset class returns. Index returns are calculated as the asset (AUM) weighted average of daily fund returns for each fund category. Asset class indices used in the analysis are money market, LC Bond, FC Bond, equity, balanced and gold. Detailed information on the composition of asset class indices is provided in Table I.

We define excess return as the difference between the average of annual geometric returns (i.e. cumulative average growth rate (CAGR)) for the fund index and the corresponding asset class index. We also use tracking error (TE), information ratio (IR), calculated as the ratio of excess returns to the TE and relative maximum drawdown. Table II presents performance metrics regarding excess returns for each fund category. We observe that for all fund categories excess returns are negative implying portfolios formed using pension funds in each category underperform the corresponding asset class indices.

Next, we explore performance heterogeneity among pension funds by repeating the same analysis at the fund level to understand whether the conclusion for the index returns carry over to individual fund returns. To this end, we calculate two versions of excess returns, one using the corresponding asset class as in the previous exercise and second, using the benchmark index constructed by the fund. We present our results in Table III.

We define a "typical" fund in each category as the one which provides an excess return at the mean/median level. We observe that only funds investing to a large extent in LC Bond, equity and balanced categories are able to generate excess returns before fees. As a matter of fact, these are the fund categories portfolio managers in Turkey predominantly invest as evident from the high shares in total fund flows. Furthermore, in these categories majority of funds outperform their corresponding asset class before fees. Percentage of positive excess returns are 96.2 percent for LC Bond, 89.4 percent in balanced funds and 86.4 percent in equity. On the other hand, considering fees, only the typical fund in the balanced category can generate a positive excess return against the corresponding asset class index. Figures 1 and 2 show that distributions of excess returns after subtracting fund fees have mean/median values close to 0 in equity and balanced funds and approximately −80 basis points for LC Bonds. Furthermore, typical funds in money market, FC Bond and gold categories, we do not observe a positive excess return before or after fees.

Comparing fund returns to the corresponding benchmark returns, all categories except the FC Bond generate positive excess returns; however, after fees taken into account, only equity funds exhibit an outperformance. For the equity funds, price indices do not account or the dividend returns, which are approximately 2.5 percent per annum in Borsa Istanbul, can be collected by pension funds through stock investments. Furthermore, for a typical equity fund, after-fee excess return is around 1.78 percent not covering the dividend return yielding to a negative excess return. Thus, we conclude that after considering the effects of fees and dividends, typical pension funds are not able to generate excess returns compared to their corresponding asset class indices or benchmarks.

For the remainder of our analysis, we focus on the excess returns using the corresponding asset classes rather than fund's own benchmarks. The main reason is that differences in own

| Category | Asset class index |
|---|---|
| Money market | BIST-KYD 91 Day Bond Index |
| LC Bond | BIST-KYD All Bonds Index |
| FC Bond | 50% BIST-KYD USD Eurobond Index + 50% BIST-KYD EUR Eurobond Index |
| Equity | BIST All Total Return Index |
| Balanced | 10% 91 Day Bond + 25% BIST All Total Return + 65% BIST-KYD All Bonds |
| Gold | BIST-KYD Gold Index |

**Table I.** Definition of asset class indices

| Category | Start date | CAGR (%) | TE (%) | IR | RMDD (%) |
|---|---|---|---|---|---|
| Money market | October 24, 2003 | −1.5 | 0.9 | −1.67 | 23.7 |
| LC Bond | October 24, 2003 | −1 | 1.6 | −0.62 | 20.1 |
| FC Bond | October 24, 2003 | −1.9 | 3.9 | −0.49 | 29.6 |
| Equity | October 24, 2003 | −1.5 | 10.7 | −0.14 | 28.6 |
| Balanced | October 24, 2003 | −0.7 | 5.9 | −0.12 | 28.1 |
| Gold | April 15, 2013 | −2.2 | 8 | −0.28 | 16.6 |

**Table II.** Pension fund index performance vs asset class indices

| Category | Balanced | Equity | FC Bond | Gold | LC Bond | Money market |
|---|---|---|---|---|---|---|
| Fee | 1.81 | 2.06 | 1.71 | 1.38 | 1.72 | 1.39 |
| *N* | 85 | 26 | 26 | 12 | 33 | 23 |
| *Asset class (gross)* | | | | | | |
| PP | 89.4 | 84.6 | 15.4 | 8.3 | 84.8 | 47.8 |
| Mean | 3.84 | 2.13 | −1.43 | −0.56 | 0.80 | −0.02 |
| Q25 | 1.03 | 1.18 | −2.19 | −0.83 | 0.34 | −0.36 |
| Q50 | 2.32 | 2.09 | −1.25 | −0.46 | 0.89 | −0.04 |
| Q75 | 3.70 | 3.21 | −0.26 | −0.29 | 1.32 | 0.46 |
| *Asset class (net)* | | | | | | |
| PP | 62.4 | 50.0 | 0.0 | 0.0 | 6.1 | 4.3 |
| Mean | 1.79 | −0.19 | −3.39 | −2.20 | −1.13 | −1.58 |
| Q25 | −1.00 | −1.48 | −4.11 | −2.41 | −1.47 | −1.98 |
| Q50 | 0.38 | −0.18 | −3.49 | −2.26 | −0.87 | −1.70 |
| Q75 | 1.84 | 1.06 | −2.32 | −1.94 | −0.61 | −0.76 |
| *Benchmark (gross)* | | | | | | |
| PP | 85.5 | 100.0 | 24.0 | 50.0 | 75.8 | 78.3 |
| Mean | 1.64 | 4.21 | −0.60 | 0.06 | 0.38 | 0.53 |
| Q25 | 0.62 | 3.86 | −0.70 | −0.52 | 0.02 | 0.04 |
| Q50 | 1.32 | 4.29 | −0.33 | 0.06 | 0.28 | 0.53 |
| Q75 | 2.66 | 4.94 | −0.03 | 0.38 | 0.72 | 0.83 |
| *Benchmark (net)* | | | | | | |
| PP | 37.3 | 80.8 | 0.0 | 0.0 | 3.0 | 8.7 |
| Mean | −0.38 | 1.87 | −2.57 | −1.58 | −1.53 | −1.01 |
| Q25 | −1.81 | 0.77 | −2.84 | −2.15 | −1.90 | −1.42 |
| Q50 | −0.56 | 1.82 | −2.51 | −1.65 | −1.59 | −1.01 |
| Q75 | 0.51 | 2.85 | −2.01 | −1.23 | −0.92 | −0.85 |

**Table III.**
Fund excess return statistics

benchmarks are driven by the strategies to overcome investment constraints thus fund managers typically compare fund performances with the relevant asset class index since the design of the benchmark is at fund managers discretion.

Next, we explore on the underlying factors leading to positive and negative performances. To this end, we decompose excess returns in two parts: positive/negative excess return due to factor exposures, i.e. $\beta$ return, and the excess return originating from residual $\alpha$. This decomposition allows us to identify the difference between security selection ability of fund managers and static exposure to traditional return factors.

For the analysis, we estimate a factor model, i.e. regress fund returns to several factor returns, defined separately for each fund category.

For equity funds, we use BIST-KYD 91 Day Bond Index, BIST ALL Stocks Total Return Index that includes dividends together with size, value and momentum factor returns. We employ factor construction framework by Eugene F. Fama and French (1993) and Carhart (1997) with two modifications. First, we remove any stock with negative book value from our calculations. Second, we use monthly re-balancing relying on balance sheet data rather than annual re-balancing with end-of-year balance sheet data as in the study of Fama and French (1993). Clifford and Frazzini (2013) show that monthly re-balancing with timely balance sheet data yields better results.

For LC Bonds, we use BIST-KYD 91 Bond Index and BIST-KYD All bonds index to capture aggregate market return along with long-short factor indices. Litterman and Scheinkman (1991) show that "level," "slope" and "curvature" factors generated from the yield curve data capture most of the variation in bond returns. Following a similar path, we

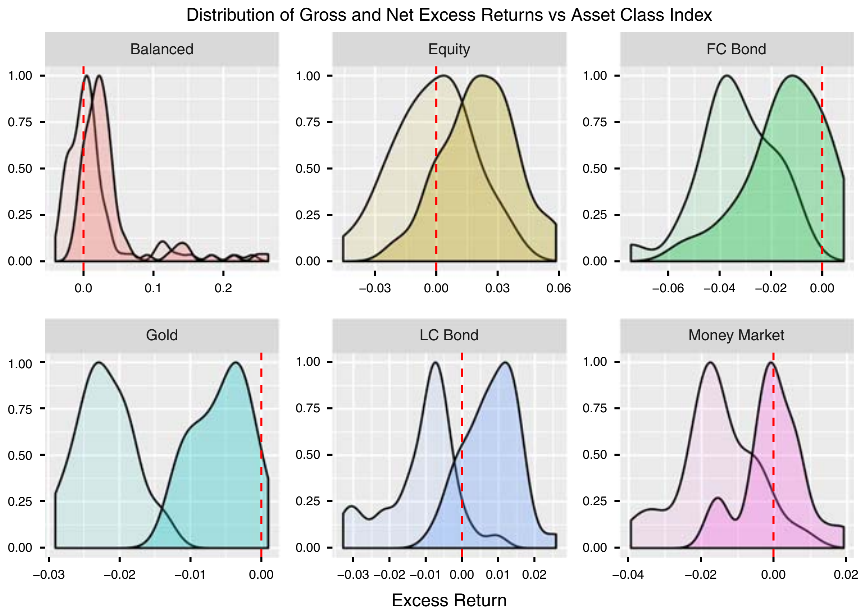


**Figure 1.**
Excess return distributions vs asset class index

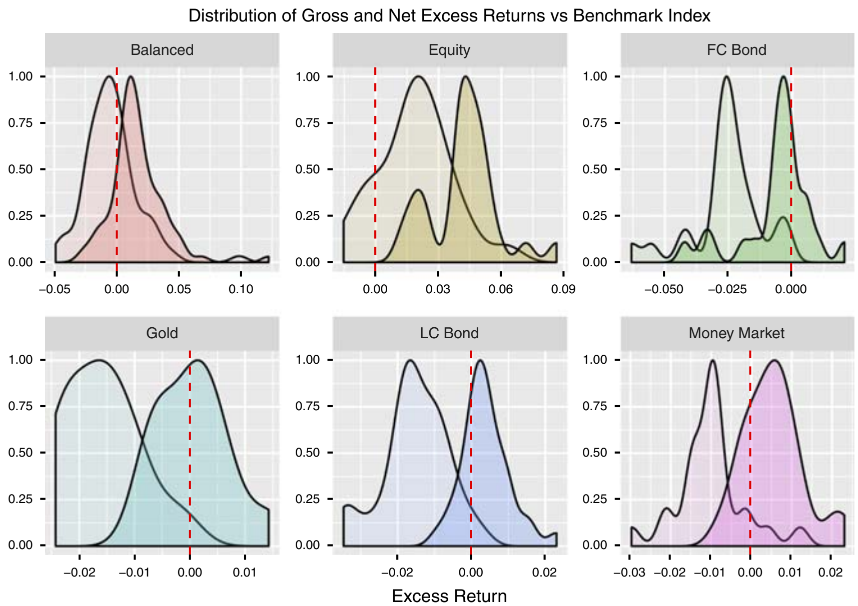


**Figure 2.**
Excess return distributions vs fund benchmarks

construct a "slope" factor based on the difference between BIST-KYD All Bonds Index and BIST-KYD 182 Day Bond Index. "Curvature" factor is generated as the return of a portfolio taking a unit long position in BIST-KYD All Bonds Index and BIST-KYD 182 day index and simultaneously holding two short positions in BIST-KYD 365 day bond index. Finally, we include the return difference BIST-KYD All Bonds Index and BIST-KYD Inflation Linked Bonds Index as our final factor.

For foreign currency funds, we use BIST-KYD 91 Day Bond Index and BIST-KYD USD Eurobond Index (in Turkish lira), together with two exchange rates, i.e. USD/TRY, EUR/USD. Furthermore, we include "slope" and "curvature" factors in our analysis. For balanced funds, we employ all factors described above.

For each fund category, we regress asset-weighted fund indices on the constructed factors. First, in our baseline regression, we regress fund indices on the short-term bond return index – BIST-KYD 91 Day Bond Index – and main market indices. Baseline regression model is specified as follows:

$$Y_t^i = \alpha^i + \beta_1^i \times BAll_t^i + \beta_2^i \times BIST_t^i + \beta_3^i \times Bond91_t^i + \beta_4^i \times EBond_t^i + \epsilon_t^i,$$

where $BAll_t^i$ is the BIST-KYD All Bonds Index; $BIST_t^i$ the BIST All Stocks Total Return Index that includes dividends; $Bond91_t^i$ the BIST-KYD 91 day bond index; and $EBond_t^i$ the BIST-KYD USD Eurobond Index (in Turkish lira). The set of covariates changes depending on fund category. We present our results in Table IV.

Second, we extend our baseline model by including other factors described above and perform regressions for each fund category and present results in Table V. Our main focus is to identify funds that generate a positive $\alpha$. Our results suggest that for all pension fund categories, in both baseline and extended regressions, asset-weighted aggregate fund portfolio are not able to generate a statistically significant $\alpha$.

Next, we focus on the individual fund returns and estimate similar factor models separately for each fund to uncover the heterogeneity in fund performances. We present our regression results in Table VI and Figure 3. In Table VI, we show the number of funds with statistically significant $\alpha$ values for each fund category and in Figure 3, we provide the distribution of estimated $\alpha$ values for each fund category. Our results confirm our average prediction as majority of funds are not able to generate a positive and statistically significant $\alpha$ which is consistent with our prediction that fund returns predominantly are due to factor/style exposures rather that stock selection ability.

## Is it luck or skill?

In this section, we further explore the significance of $\alpha$ by using bootstrap tests suggested by Kosowski *et al.* (2006) and extended by Eugene F. Fama and French (2010)[1]. The aim of

**Table IV.**
Fund index factor regression results

| Variable | Coef | All | Balanced | Bond | EBond | Equity |
|---|---|---|---|---|---|---|
| $\alpha$ | Estimate | −0.0019 | −0.0014 | −0.0021 | −0.0009 | 0.001 |
| $\alpha$ | *t*-stat | −2.1705 | −0.6021 | −4.3941 | −0.7283 | 0.4485 |
| *BAll* | Estimate | 0.2282 | −0.4141 | 0.7838 | | |
| *BAll* | *t*-stat | 9.659 | −6.5398 | 65.7824 | | |
| *BIST* | Estimate | 0.133 | 0.2991 | | | 0.9131 |
| *BIST* | *t*-stat | 24.8574 | 20.1607 | | | 70.0354 |
| *Bond*91 | Estimate | 0.5505 | 1.1752 | 0.3297 | 0.082 | −0.0807 |
| *Bond*91 | *t*-stat | 6.7889 | 5.2033 | 7.1541 | 0.7571 | −0.4183 |
| *EBond* | Estimate | 0.1304 | | | 0.8319 | |
| *EBond* | *t*-stat | 11.5179 | | | 52.2845 | |
| | $R^2$ | 0.8727 | 0.7044 | 0.9711 | 0.9382 | 0.9648 |

**Notes:** Dependent variable is AUM weighted fund category indices. BAll stands for BIST-KYD All Bonds index. BIST is BIST ALL Stocks Total Return Index that includes dividends. Bond91 is the short-term bond return index which is BIST-KYD 91 Day Bond Index and EBond is BIST-KYD USD Eurobond Index (in Turkish lira)

| Variable | Coef | All | Balanced | Bond | EBond | Equity |
|---|---|---|---|---|---|---|
| $\alpha$ | Estimate | −0.0017 | −0.003 | −0.0015 | −0.0011 | 0.0007 |
| $\alpha$ | *t*-stat | −2.1016 | −1.5376 | −3.15 | −1.2319 | 0.3017 |
| *BAll* | Estimate | −0.1036 | −1.3757 | 0.7933 | | |
| *BAll* | *t*-stat | −0.5496 | −3.0844 | 7.7201 | | |
| *BIST* | Estimate | 0.1249 | 0.2721 | | | 0.9004 |
| *BIST* | *t*-stat | 22.2208 | 20.457 | | | 67.6843 |
| *Bond*91 | Estimate | 0.9115 | 2.2122 | 0.2531 | 0.1245 | −0.0419 |
| *Bond*91 | *t*-stat | 3.9098 | 4.0101 | 1.9589 | 1.5525 | −0.2219 |
| *Curvature* | Estimate | −0.1501 | −0.5728 | −0.1053 | −0.1025 | |
| *Curvature* | *t*-stat | −3.2755 | −5.2836 | −3.9824 | −2.4319 | |
| *EBond* | Estimate | 0.0713 | 0.1203 | | 0.7252 | |
| *EBond* | *t*-stat | 3.8228 | 2.725 | | 34.7642 | |
| EURUSD | Estimate | 0.027 | 0.0445 | | 0.1797 | |
| EURUSD | *t*-stat | 2.0547 | 1.4318 | | 11.9445 | |
| Momentum | Estimate | 0.0006 | −0.048 | | | −0.0564 |
| Momentum | *t*-stat | 0.0653 | −2.0976 | | | −2.0225 |
| Size | Estimate | −0.0085 | −0.0563 | | | 0.0224 |
| Size | *t*-stat | −0.7921 | −2.2134 | | | 0.7239 |
| Slope | Estimate | 0.6353 | 1.7749 | 0.0247 | 0.027 | |
| Slope | *t*-stat | 3.0551 | 3.6074 | 0.2085 | 0.5714 | |
| TIPS | Estimate | 0.1427 | 0.2575 | −0.0145 | | |
| TIPS | *t*-stat | 4.262 | 3.2508 | −0.7518 | | |
| USDTRY | Estimate | 0.0605 | 0.0686 | | 0.1238 | |
| USDTRY | *t*-stat | 3.09 | 1.4789 | | 6.0373 | |
| Value | Estimate | 0.0039 | −0.0283 | | | 0.0565 |
| Value | *t*-stat | 0.3358 | −1.0269 | | | 1.6772 |
| | $R^2$ | 0.8992 | 0.8314 | 0.9747 | 0.9697 | 0.9667 |

**Notes:** Dependent variable is AUM weighted fund category indices. Slope is defined as difference between BIST-KYD All Bonds Index and BIST-KYD 182 Day Bond Index. Curvature is generated as the return of a portfolio taking a unit long position in BIST-KYD All bonds index and BIST-KYD 182 day index and simultaneously holding two short positions in BIST-KYD 365 day bond index. USDTRY and EURUSD stand for exchange rates. TIPS is the return difference BIST-KYD All Bonds Index and BIST-KYD Inflation Linked Bonds Index. Size, Value and Momentum are factors from Fama and French (1993) and Carhart (1997) with two modifications. We remove any stock with negative book value, and use monthly re-balancing. Other covariates are defined in Table V

**Table V.** Fund index multi-factor regression results

| Category | *N* | Pos | Neg | Perc_Pos | Perc_Neg |
|---|---|---|---|---|---|
| Balanced | 85 | 13 | 7 | 0.1529412 | 0.0823529 |
| Bond | 33 | 0 | 11 | 0.0000000 | 0.3333333 |
| EBond | 26 | 1 | 3 | 0.0384615 | 0.1153846 |
| Equity | 26 | 1 | 0 | 0.0384615 | 0.0000000 |

**Table VI.** Funds with statistically significant $\alpha$

this analysis is to identify for each fund category a significant positive value of estimated $\alpha$ is due to the skill of fund manager or luck. To this end, in our bootstrap test, for each fund category, we estimate a factor model and store $\alpha$ values, corresponding $t$-statistics, factor $\beta$s and residuals. For each bootstrap iteration, we randomly select $T$ dates from historical data with replacement where $T$ is the number of months in the original analysis. For each $T$, we obtain factor returns and fund residuals. For each fund category, we generate a counterfactual monthly return by combining original factor $\beta$s, resampled factor returns and residuals. Note that by construction, counterfactual returns have 0 true $\alpha$. Using the

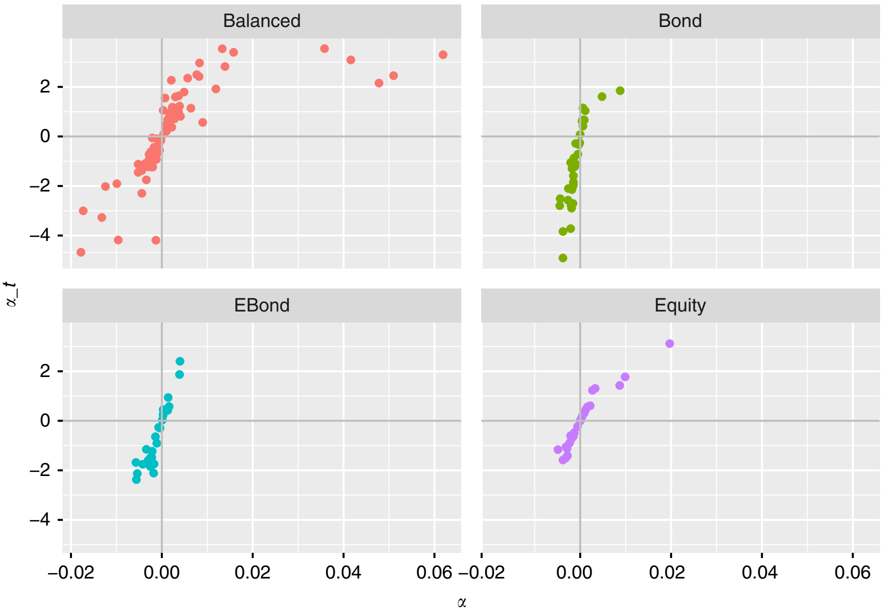


**Figure 3.**
Factor regression $\alpha$s

entire set of $T$-month counterfactual returns, we reestimate our factor model and obtain estimated $\alpha$ and corresponding $t$-statistic and sort estimated $\alpha$s and $t$-statistics associated with the top $N$th fund. We perform 10,000 iterations and obtain a distribution for the top $N$th fund's $\alpha$ and $t$-statistic. Finally, we compare the original top $N$th fund's $\alpha$ values/$t$-statistics) with its bootstrap distribution and construct simulated $p$-values, and present our results in Tables VII and VIII. Based on our bootstrap test, we conclude that $\alpha$s are predominantly not distinguishable from a pure luck outcome without any skill component, with the exception of a very small number of funds.

## Testing for market timing ability

In this section, we test for market timing ability of pension funds by repeating the estimation of the factor model for each fund category augmented with an additional covariate capturing market timing effect. We follow the study of Treynor and Mazuy (1966) and use squared market returns to identify market timing ability. We present our results in Table IX which suggests that there are only 5 funds out of 85 with a significant market timing ability.

## Return persistence

In this section, we focus on the sustainability of fund performance, i.e. persistence of return generation. To this end, we first identify the best performing fund for each category that provides at least 10 years of observation window. We calculate the number of years that the selected fund

**Table VII.**
Summary of bootstrap results

| Number of funds | Balanced | Bond | EBond | Equity |
|---|---|---|---|---|
| All | 85 | 33 | 26 | 26 |
| Positive significant | 11 | 0 | 0 | 1 |
| Negative significant | 2 | 24 | 7 | 0 |

| Rank | Balanced | Bond | EBond | Equity |
|---|---|---|---|---|
| Top 1 | 0.285 | 0.765 | 0.332 | 0.046 |
| Top 2 | 0.090 | 0.651 | 0.321 | 0.270 |
| Top 3 | 0.053 | 0.795 | 0.786 | 0.331 |
| Top 4 | 0.023 | 0.759 | 0.844 | 0.255 |
| Top 5 | 0.023 | 0.898 | 0.829 | 0.222 |
| Top 6 | 0.013 | 0.826 | 0.757 | 0.572 |
| Top 7 | 0.018 | 0.780 | 0.791 | 0.535 |
| Top 8 | 0.036 | 0.808 | 0.749 | 0.527 |
| Top 9 | 0.020 | 0.949 | 0.796 | 0.572 |
| Top 10 | 0.026 | 0.992 | 0.905 | 0.577 |
| Bottom 10 | 0.457 | 0.999 | 0.967 | 0.724 |
| Bottom 9 | 0.635 | 1.000 | 0.958 | 0.699 |
| Bottom 8 | 0.682 | 1.000 | 0.961 | 0.642 |
| Bottom 7 | 0.690 | 1.000 | 0.947 | 0.726 |
| Bottom 6 | 0.748 | 0.999 | 0.894 | 0.740 |
| Bottom 5 | 0.956 | 0.998 | 0.853 | 0.655 |
| Bottom 4 | 0.943 | 0.996 | 0.799 | 0.603 |
| Bottom 3 | 0.990 | 1.000 | 0.788 | 0.662 |
| Bottom 2 | 0.941 | 0.998 | 0.690 | 0.559 |
| Bottom 1 | 0.853 | 0.992 | 0.560 | 0.367 |

**Table VIII.** Bootstrap $p$-values for $\alpha$ $t$-statistics

| Category | Number_of_Funds | Positive | Negative |
|---|---|---|---|
| Bond | 33 | 3 | 4 |
| EBond | 26 | 0 | 7 |
| Equity | 26 | 2 | 3 |

**Table IX.** Funds with statistically significant positive and negative market timing ability

underperforms the median fund and provide our results in Table X. We observe that even for the best performing funds there are not negligible numbers of periods with a significant underperformance indicating the hardship of the long-term persistence outperformance.

Next, we analyze whether past performance has any predictive power for future performance. We generate migration matrices which show the transition probabilities for the top quartile funds, i.e. top 20 percent of funds with highest excess returns against the asset class index. Migration matrices are constructed for five non-overlapping six-month periods. Table XI provides the migration matrix with the transition probabilities for the quartiles of return distribution. For the case of pure random transition probabilities, we expect a convergence to 20 percent for large sample sizes. However, we have five observations, thus we interpret our results with the caveat of small sample bias as transition probabilities might deviate from 20 percent by just pure sampling variation. We observe that the probability that a top quartile fund stays at the top quartile in the next six-month period is above 20 percent for all fund categories, implying some persistence in returns.

For a more thorough analysis of return persistence, we formally test it using Fama–MacBeth regressions. We conduct monthly weighted cross-section regressions of monthly

| Category | Equity | Bond | EBond | Balanced | Money market |
|---|---|---|---|---|---|
| Number of years | 10 | 14 | 6 | 4 | 11 |
| Number of years underperformed | 2 | 5 | 2 | 0 | 2 |
| % of years underperformed | 20 | 35.7 | 33.3 | 0 | 18.2 |

**Table X.** Number of years in which top fund underperforms the median fund excess returns using four covariates, i.e. age, AUM, fund fee and past excess returns and employ logarithm of fund assets as regression weights. We separately run regressions for the 1, 3, 6, 12 and 36 month periods. We observe that statistically the most significant slope coefficients are obtained for the case with six-month excess returns. Table XII presents our regression results with six-month excess return along with time series averages and Newey–West adjusted *t*-statistics. We observe that, in most fund categories monthly excess returns are statistically significant for the funds with lower fees and higher past excess returns indicating a slight persistence in returns and higher after-fee excess returns.

Even though our results confirm slight persistence in fund performance, this observation might not lead to above average returns for pension fund investors. As a further investigation, we construct a fund selection strategy by selecting, separately for each fund category, the top funds based on past six-month excess returns on a bimonthly basis and analyze its performance. We present our results in Figure 4.

We observe that for some fund categories, it is feasible to achieve above average excess returns by selecting funds based on recent past performance, however, this outperformance is limited. Furthermore, this outperformance is predominantly due to differences in persistent risk exposures rather than fund management ability.

## Asset allocation performance of balanced funds

Turkish pension fund system is based on a defined contribution plan, i.e. pension investors make their own asset allocation decisions among the funds provided by the pension fund companies. In this regard, a common critique for retail investors is that investors typically do not rebalance their portfolios and thus their asset allocations might suffer from weight drifts. However, for balanced funds, both asset allocation and security selection decisions are performed by professional portfolio managers, and they are expected to improve upon the performance of other funds provided by the pension system.

| | Q1 | Q2 | Q3 | Q4 | Q5 |
|---|---|---|---|---|---|
| Equity | 27.9 | 17.2 | 19.7 | 18.9 | 16.4 |
| LC Bond | 36.0 | 16.5 | 12.8 | 16.5 | 18.3 |
| FC Bond | 31.0 | 15.9 | 17.5 | 15.9 | 19.8 |
| Balanced | 23.4 | 20.3 | 13.2 | 20.0 | 23.1 |
| Money market | 76.3 | 19.5 | 2.5 | 0.8 | 0.8 |

**Table XI.** Migration probabilities for top quartile funds

| Variable | Coefficient | Money market | Bond | Eurobond | Equity | Balanced |
|---|---|---|---|---|---|---|
| Constant | Estimate | 0.0093084 | −0.0040152 | 0.0046645 | 0.0090741 | 0.0106462 |
| Constant | *t*-stat | 1.9459457 | −0.6624383 | 1.2526722 | 2.2705594 | 1.8376081 |
| Age | Estimate | −0.0602682 | 0.0398259 | −0.0171990 | −0.0158141 | −0.0177172 |
| Age | *t*-stat | −4.0353460 | 1.8271925 | −0.8755647 | −0.6446834 | −0.8442972 |
| log(AUM) | Estimate | 0.1225293 | −0.0336772 | 0.0224034 | −0.0109258 | 0.0129909 |
| log(AUM) | *t*-stat | 5.2178909 | −1.1859143 | 0.9196532 | −0.4010925 | 0.5271588 |
| ER_6m_ | Estimate | 0.6749366 | 0.1176601 | 0.1055419 | 0.0691977 | 0.1130430 |
| ER_6m_ | *t*-stat | 18.6356665 | 2.8531708 | 1.8899594 | 2.1064968 | 2.0979973 |
| Fee | Estimate | −0.0711548 | −0.1127756 | −0.0126320 | −0.0587908 | −0.0470808 |
| Fee | *t*-stat | −2.6280769 | −4.0827056 | −0.5648525 | −2.6888131 | −2.8575794 |
| | $R^2$ | 0.6928360 | 0.3823345 | 0.5528880 | 0.2393175 | 0.4102138 |

**Notes:** Dependent variable is monthly excess returns. Age stands for the difference between the fund foundation date and last price announcement date in year terms. AUM is asset under management. ER_6m is past six months excess return. Logarithm of fund assets is used as regression weights

**Table XII.** Fama–MacBeth regression results for monthly excess returns

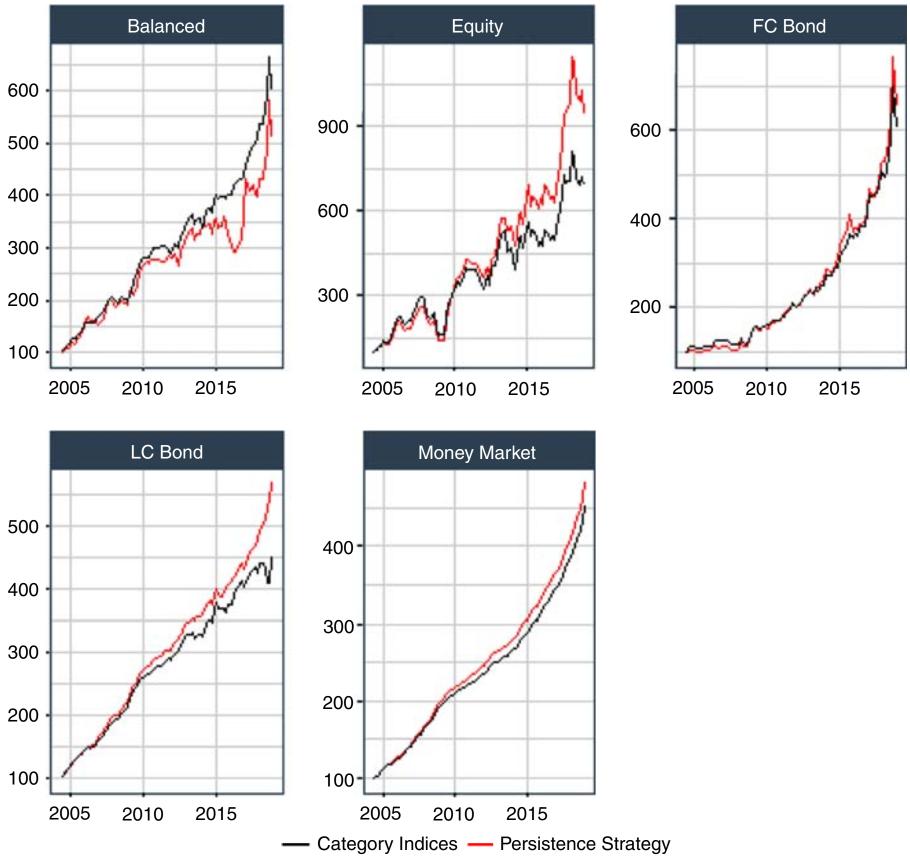


**Figure 4.** Performance of persistence strategy

In order to answer this question, we compare performance of balanced funds with the aggregate performance of all pension funds. To this end, we calculate fund indices from the asset-weighted average performance of all funds for each category and compare them with the performance of balanced funds.

The performance of balanced funds is presented in Figure 5. Balanced fund index has 13.6 percent annual returns, while all pension funds index has 12.4 percent. Their volatilities are 7.3 and 3.8 percent. Thus, balanced funds seem to outperform the overall pension portfolio while with a higher volatility.

Furthermore, we perform a one-sided $t$-test to test whether the return difference of balanced funds is statistically significantly. The test yields a statistic of $t = 0.99$ with a $p$-value of $p = 0.1602$ indicating that outperformance of balanced funds is not statistically significant.

## Performance of government contribution funds

In 2013, Turkish Government initiated a government contribution plan for pension fund investing where government, for a certain upper limit, provides investors with an additional 25 percent based on investor's plan contribution. The government contributions are obliged to be managed in a predefined pension fund and create an important incentive for pension investors. In this section, we provide a performance comparison of government contribution funds with other major funds and asset categories. For all government contribution funds,

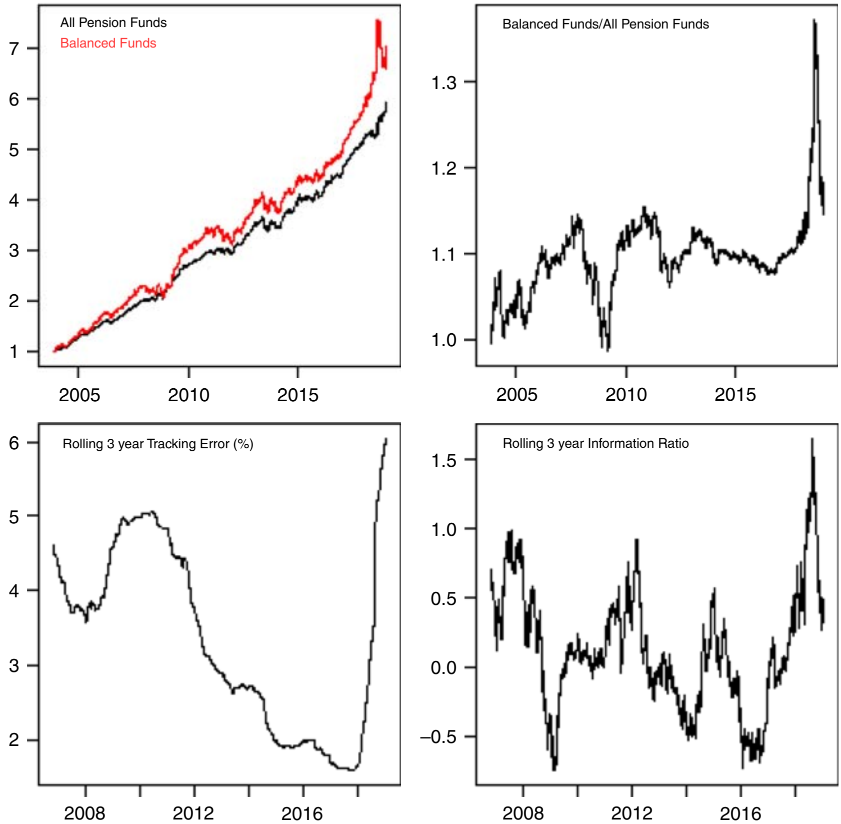


**Figure 5.**
Performance of balanced funds

regulation imposes a single performance benchmark and this benchmark includes BIST-KYD All Bonds Index as its main constituent. As shown in Figure 6, the performance of government contribution funds closely tracks the performance of BIST-KYD All Bonds Index, meaning that they incur a significant amount of duration and both had a deep drawdown during 2018. By looking at this close correlation, we can assume that most of these funds are actually passively managed with no strong implication of active risk management strategy and we may expect similar volatility and drawdowns in these funds whenever bond yields increase sharply. Furthermore these funds significantly underperform short-term bonds, inflation index bonds and average pension funds. Given the special nature and poor performance of government contribution funds it may be wise to rethink the design of the regulatory benchmarks for these funds. As a regulatory benchmark, rather than using BIST-KYD All Bonds Index, it may be more appropriate to use BIST-KYD Inflation Index Bond Index which is much less volatile, eliminates any inflation risk and thus more appropriate as a safe investment for a long-term pension investor.

Furthermore, we compare asset-weighted and money-weighted returns from the perspective of a typical pension fund investor. First, we construct money-weighted returns for the typical investor by assuming that she contributes a fixed amount on a monthly basis to the pension portfolio and we increase her fixed contribution by the amount of realized inflation.

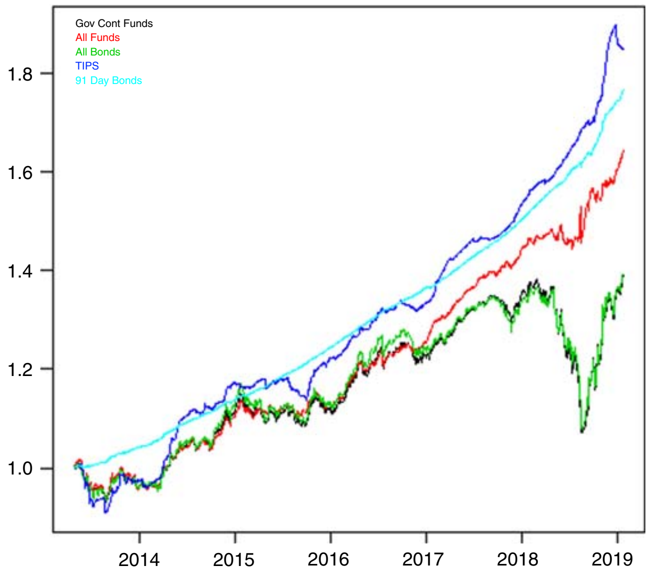


**Figure 6.**
Performance of government contribution funds

We observe that even though time-weighted returns for asset class indices and aggregate fund portfolio yield returns higher than inflation, money-weighted returns for the typical investor is only marginally higher than inflation. The government contribution only boosts returns around 100 basis points and based on our portfolio back testing exercise investing government contribution funds to TIPS might improve their performance. We show that active fund selection improves performance only up to 50 basis points (Figure 7).

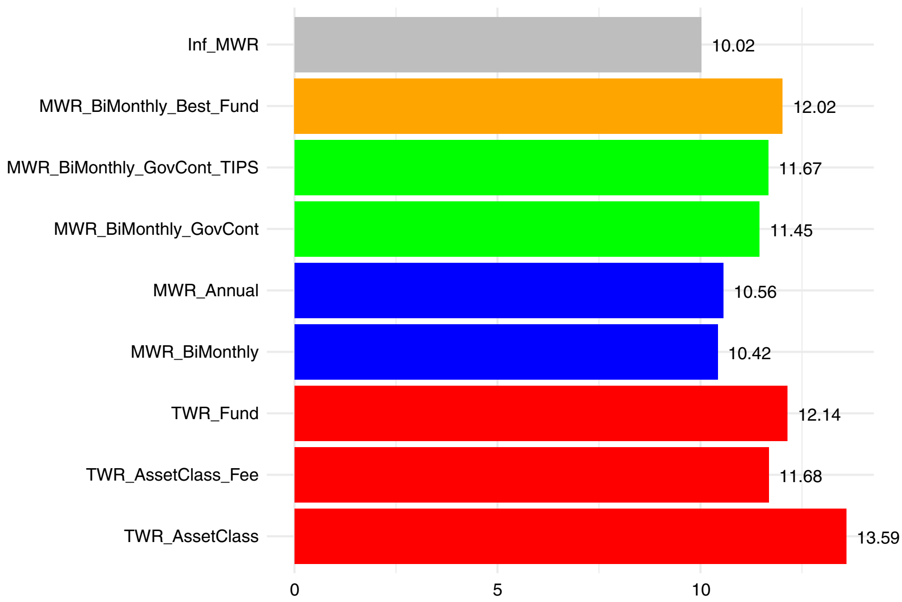


**Figure 7.**
Sources of money-weighted investor returns

## Conclusion

Introduction of defined contribution plans in the Turkish pension system lead to the delegation of investment decisions to individual investors. Despite the flexibility defined contribution plans provide, they are prone uninformed and sub-optimal decisions in complex and uncertain environments. Turkish pension fund system offers professionally managed funds to pension investors to mitigate this uncertainty, however, leave investors with a narrow set of choices. In such an environment, performance of funds offered to the investors is crucial for building pension portfolios, which provide sufficient income at retirement. Our goal in this paper is to present an in-depth performance evaluation of funds offered by the Turkish pension system.

Our analysis reveal that majority of pension funds are not able to generate excess returns when compared to the corresponding asset class returns. Furthermore, they do not generate significant $\alpha$ values and excess returns are predominantly driven by factor exposures indicating a minuscule role of active fund management. This observation is confirmed by our bootstrap results, i.e. $\alpha$ generation is not distinguishable from a pure random outcome. We analyze return persistence for pension funds using migration tables for different return quartiles and Fama–MacBeth regressions. We find evidence for a slight return persistence. As a further analysis, we evaluate the performance of a fund selecting strategy based on past six month's performance. We observe that for some fund categories, it is feasible to achieve above average excess returns by selecting funds based on recent past performance, however, this outperformance is limited and again mainly due to factor exposures.

Our analysis provides several policy recommendations regarding the design of pension funds in Turkey. First of all, in a volatile economic environment like Turkey, finding an excess return in general is a difficult task. This performance should in addition could not find a persistence in fund performance. Therefore, a typical pension fund investor who is completely different from a mutual fund investor should be offered a less risky fund with a plain benchmark. Generous government support to the pension system might produce an excess return had a better financial asset been chosen. For instance, an inflation protected bond could have been a much better alternative than that of a long-term government bond as a government contribution tool. The generous government support has a relatively more conservative portfolio, therefore the choice of asset universe and investor profile is needed to be studied further. Furthermore, in order to use inflation as a benchmark, inflation hedging instruments such as swaps should be allowed in portfolio construction process. Our common conclusion is that it is essential to improve the longer term risk/return ratio for the pension fund managers. This can be obtained by using more ETF alternatives, less risky government contributions and using more inflation hedging instruments. As a conclusion, pension fund system in a volatile macroeconomic environment, different tools should be utilized to design a more sustainable system.

## Note

1. They run a bootstrap simulation mimicking the properties of the actual fund returns, and set the value of $\alpha$ to 0 in the population distribution, i.e. these simulations provide the distribution of $\alpha$s when there are no abnormal returns. Finally, they compare the distribution of $\alpha$s obtained from simulations with $\alpha$ estimates for actual fund returns and infer the existence of skilled managers.

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