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Performance Stability of Turkish REITs

Sema Bayraktar

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Abstract

The main purpose of this study is to analyse the performance stability of REIT Index and individual REITs over different sub-periods. The performance of the REITs is compared to mainly that of BIST 100 Index. For analysing the performance stability, three different risk-adjusted measures, namely Sharpe ratio, Treynor ratio and Jensen's alpha, are employed for four different periods. These periods are determined with respect to important regulatory changes in the Turkish REIT market and also to economic states of the country. The results show that Treynor and Sharpe ratios rank the REITs consistently for the high-growth periods. However, the rankings are not that consistent in low-growth periods and even they may contrast significantly. The results also show us that regulatory changes almost have no impact on the performances of the REITs. On the other hand, time-varying behaviour of betas also makes it difficult to attribute the changes in performances to states of economy

Keywords: REITs, performance, portfolio management, stock market, emerging market

1. Introduction

Turkish Real Estate Investment Trusts (T-REITs) have been legally established in 1995 long before many other developed countries [1] and started to be traded in Stock Exchange in 1997. Like in other markets, T-REITs are important investment vehicles, thus they are encouraged to grow by some favourable regulations [2].

Whether REITs perform better than the other financial assets has been one of the main research questions to be answered in the literature since they have started to be traded in the market. There are quite a number of studies on developed markets' REITs trying to answer this question. However, the studies on the investment performance of emerging markets' REITs are limited. Similarly, the number of studies on the performance of T-REITs can be counted on the fingers of two hands. One of the earliest studies on T-REITs is carried out by Kıyılar and

Hepşen [3]. This study compares the performance of the REIT sector with the ISE-100 index using the Sharpe and Jensen indices using monthly data for 2000–2008. Results of the study show that most of the T-REITs have higher monthly returns than those of ISE-100, but they also have higher variabilities. Thus, for most of them, Sharpe indices are lower than those of ISE-100. Although Jensen's indices are positive for most of the cases, it is not possible to claim that T-REITs perform better than common stocks since the indices are not statistically significant. Erol and Tırtıroğlu [4] compare hedging characteristics of T-REITs against inflation with stock indexes between December 1999 and December 2004. They show that REITs provide better hedge against both unexpected and expected inflation compared to stock indices and that property of T-REITs is more effective in high-inflation periods.

Erol and İleri [5] try to determine which macroeconomic factors influence BIST sector indices and individual REIT companies by analysing data between 2002 and 2011. The results show that Turkish REIT stocks act more like the stock market than the real estate sector. T-REITs, like the same BIST sectoral indices, provide negative protection against inflation, exhibit a positive correlation with real sector volatility and are heavily influenced by the ISE risk premium. The study by Aktan and Ozturk [6] investigates the risk-return relationship for T-REITs over the period 2002–2008 by using CAPM and Single Index Model (SIM) and shows that linearity assumption of these models are rejected. Altınsoy et al. [1] analyse whether the declining beta property of REITs observed in many markets also prevail for Turkey and the results show that it is true for 2002–2009. Their results show that T-REITs' betas – correlation between REITs and stock market – decreases over time. On the other hand, REIT returns more closely track stock market in high-growth economic states than low-growth economic states, unlike to the findings from other countries. Another study [2] examines the portfolio diversification and risk/return characteristics of T-REITs using monthly data between 2008 and 2015. The study shows that Fama-French model is better than CAPM in capturing the variation of T-REITs' returns. Additional macroeconomic factors also improve the explanatory power of the model.

All of these studies cover only short-term periods. Thus, the questions of how well the T-REITs have performed over a long period and how stable the performance of T-REITs remain unanswered. Previous research shows that different sampling periods may result in different performance results [7]. Thus, it is important to adapt a longer period and try to analyse whether there are significant differences in the investment performance of T-REITs.

The objective of this study is to investigate the performance of T-REITs with respect to stock market by using risk-adjusted measures. By using a relatively longer period over 2002–2017, the study is going to investigate the stability of performance of T-REITs. In this study, we analyse four periods: 2001–2005; 2006–2008; 2009–2013 and 2014–2017. This separation allows us to distinguish both pre- and post-crisis periods and also the effects of some important regulation changes in Turkey. For example, in 2007, the new regulations regarding mortgage loans were introduced. This change was expected to increase the demand for real estate and thus to have a positive effect on the future of REITs. At the beginning, T-REITs were supposed to invest at a minimum 75% of their portfolios in real estate and real-estate backed securities with the 1998 Communique, Article 27. Later, that ratio has been decreased to 50% in 2013, so the flexibility of T-REITs with respect to investment has increased. Also, with the amendment made in 2013, requirement to have a leader entrepreneur (partner or partners having a minimum of 25% of the

company's capital) has been abolished, real estate investment companies started to be able to issue real estate certificates as an extra means of finance instrument and some procedural obligations have been reduced, all of these resulting in easing of management of T-REITs. So, if not in the third period due to the financial crisis, REIT performance may be expected to be increased in the fourth period. In addition, the frequency of the data that is used in this study may give us some additional information about the time-varying behaviour of T-REITs. The study by Altınsoy et al. [1] used both daily and weekly data in analysing the time-varying behaviour of T-REITs' betas and different frequency data led them to find different empirical results, namely, they observe declining beta for the weekly data but more stable beta for daily data. The data used in this study is monthly data. Thus, it is interesting to know how using monthly data is going to contribute to this observation in the study by Altınsoy et al. [1]. The period before 2008 has also been divided into two periods based on the results of [1]. This study has also shown that tracking behaviour of REIT returns of stock market change from high-growth economic states to low-growth economic states. Thus, following this study, in defining the periods, the author also paid attention to low-growth and high-growth states. Accordingly, 2001–2005 and 2009–2013 periods are accepted to be high-growth periods; on the other hand, 2006–2009 and 2014–2017 periods are taken to be low-growth periods[1]. The study ends up analysing four different periods with the aim of observing the changes in the performance of T-REITs of these important structural changes.

Section 2 describes the data and explains the methodology employed. In Section 3, preliminary results of performance comparison between T-REITs and some financial variables are given and also its findings are reported and discussed. Final section gives the summary of results and some concluding remarks.

2. Data and methodology

Turkey currently has 28 REITs, each of which is reflected by a certain weight in the constructed REIT index. **Table 1** shows their Ticker, Names, and their weights in the index. As shown in **Table 1**, 16 out of 28 REITs has a weight less than 1%. On the other hand, the other 12 REITs comprise 92.55% of the REIT index in total. For the sake of clarity and integrity of the chapter, the aim of the study would be to analyse the performance stability of these REITs that have larger weights in the REIT index. We also add Pera GYO (PEGYO) to the sample since it is the only REIT that survived throughout the whole period. The data used is the monthly prices of these REITs over more than 14-year period from January 2001 to July 2017. For each REIT, the monthly returns are calculated based on data gathered from the Bloomberg database by taking the log of difference between two subsequent observations[2]. Monthly return of BIST 100 which is also gathered from Bloomberg serves as a proxy for market return. The monthly interest rate values of 1-year Treasury bills are employed to proxy for risk-free rate. Interest rate values are obtained from Federal Reserve Bank of St. Louis for the period 2001–2004 and from investing.com website for the period 2005–2017.

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[1]Average growth rates for the periods of 2001–2005, 2006–2008, 2009–2013 and 2014–2017 are 0.80, −0.05, 0.54 and 0.01, respectively.
[2]Interest rates are not transformed to their logarithms since data for interest rates were already obtained as percentages.

Ticker	Name	Weight
XGMYO index		
EKGYO TI Equity	Emlak Konut Gayrimenkul Yatirim Ortaklig	57.721044
YGGYO TI Equity	Yeni Gimat Gayrimenkul Ortakligi AS	9.283066
ISGYO TI Equity	Is Gayrimenkul Yatirim Ortakligi AS	5.904721
TRGYO TI Equity	Torunlar Gayrimenkul Yatirim Ortakligi A	5.315489
AKSGY TI Equity	AKIS Gayrimenkul Yatirimi AS	3.383685
ALGYO TI Equity	Alarko Gayrimenkul Yatirim Ortakligi AS	1.988418
HLGYO TI Equity	Halk Gayrimenkul Yatirim Ortakligi AS	1.87651
SNGYO TI Equity	Sinpas Gayrimenkul Yatirim Ortakligi AS	1.555767
KLGYO TI Equity	Kiler Gayrimenkul Yatirim Ortakligi AS	1.550455
VKGYO TI Equity	Vakif Gayrimenkul Yatirim Ortakligi AS	1.49898
AKMGY TI Equity	Akmerkez Gayrimenkul Yatirim Ortakligi A	1.373071
NUGYO TI Equity	Nurol Gayrimenkul Yatirim Ortakligi AS	1.100913
RYGYO TI Equity	Reysas Gayrimenkul Yatirim Ortakligi AS	0.948177
OZKGY TI Equity	Ozak Gayrimenkul Yatirim Ortakligi	0.855248
PAGYO TI Equity	Panora Gayrimenkul Yatirim Ortakligi	0.823887
AKFGY TI Equity	Akfen Gayrimenkul Yatirim Ortakligi AS	0.777751
YKGYO TI Equity	Yapi Kredi Koray Gayrimenkul Yatirim Ort	0.502913
DGGYO TI Equity	Dogus Gayrimenkul Yatirim Ortakligi A.S.	0.499015
YGYO TI Equity	Yesil Gayrimenkul Yatirim Ortakligi AS	0.489101
OZGYO TI Equity	Ozderici Gayrimenkul Yatirim Ortakligi A	0.456993
PEGYO TI Equity	Pera Gayrimenkul Yatirim Ortakligi AS	0.444152
AVGYO TI Equity	Avrasya Gayrimenkul Yatirim Ortakligi AS	0.4257
AGYO TI Equity	Atakule Gayrimenkul Yatirim Ortakligi	0.363115
MRGYO TI Equity	Marti Gayrimenkul Yatirim Ortakligi AS	0.282384
TSGYO TI Equity	TSKB Gayrimenkul Yatirim Ortakligi AS	0.239008
ATAGY TI Equity	Ata Gayrimenkul Yatirim Ortakligi AS	0.207019
SRVGY TI Equity	Servet Gayrimenkul Yatirim Ortakligi AS	0.092782
MSGYO TI Equity	Mistral Gayrimenkul Yatirim Ortakligi AS	0.040637

Table 1. REIT indices in Turkey.

Basically, there are three measures that are mostly used to assess the risk-adjusted performance of a portfolio: Sharpe ratio [8], Treynor ratio [9] and [10], and Jensen's alpha. Sharpe ratio is defined as follows:

$$Sj = \frac{\overline{Rj} - \overline{R_f}}{\vartheta j} \qquad (1)$$

where $(\overline{Rj} - \overline{R_f})$ is the average excess return of REIT over risk-free rate, ϑj is the standard deviation of the same REIT. Thus, Sharpe ratio shows the average excess return per unit of risk. The higher the ratio, the better the performance is.

Treynor ratio is the ratio of average excess return of REIT to its systematic risk, that is, beta (β);

$$Tj = \frac{\overline{Rj} - \overline{R_f}}{\beta j} \qquad (2)$$

where β is the beta coefficient of each REIT portfolio. It is calculated by using the following relationship:

$$R_{jt} - R_{ft} = \alpha_j + \beta_j(R_{mt} - R_{ft}) + \varepsilon_{jt} \qquad (3)$$

where $R_{jt} - R_{ft}$ is the excess return of REIT portfolio over risk-free rate, $R_{mt} - R_{ft}$ is the excess return of market portfolio over risk-free rate, β_j is the regression coefficient standing for the systematic risk, α_j is Jensen's alpha for each REIT portfolio. As can be seen from this specific regression, the calculation of Treynor ratio and Jensen's alpha requires the selection of a reference market portfolio. In this study, BIST 100 is going to be employed as the reference portfolio. The main purpose of the study is to observe the performance stability of REIT portfolios over a relatively long period, that is, the trend of the risk and return performances of the portfolios is more important than the actual level of the performances. Thus, the selection of the reference portfolio is not critical for the present study. Indeed, study by Myer and Webb [11] shows that the performances of the real estate funds are not very much affected by the choice of real estate benchmarks employed. Whether the employed benchmark portfolio is satisfactory or not is decided by looking at the explanatory power of the regression measured by R-squared values.

As in the case of Sharpe ratio, the higher the positive ratio, the better the performance of REIT index is. A positive and significant alpha indicates a superior performance of the REIT index relative to reference portfolio, while a negative alpha indicates the fund's inferior performance.

3. Results

Table 2 presents the statistical summary between BIST REIT Index return and some important financial indicators for four different periods, namely 2001m5–2005m12, 2006m1–2009m1, 2009m1–2013m12 and 2014m1–2017m7. The indicators that are compared with BIST REIT index are BIST 100, 10-year Treasury bond, gold prices in USD, consumer price index and USD/TRY currency. It is clearly observed that REIT index is closely linked to BIST index both in terms of returns and volatilities for all periods. In the first period, that is high-growth period, average returns of BIST 100, REIT index and CPI have their highest values. But for the second period, that is low-growth period, index returns become negative and BIST 100 is

	BIST REIT	BIST 100	10Y T-Bond	GOLD/OUNCE (USD)	CPI	USD/TRY Currency
A. 2001m5–2005m12						
Mean	2.36	2.02	NA	1.15	1.48	0.26
Median	4.27	2.16	NA	0.81	0.98	−0.32
Maximum	26.03	32.03	NA	8.10	5.92	11.55
Minimum	−25.89	−26.98	NA	−6.09	−0.58	−9.67
Std. Dev.	11.95	12.92	NA	3.00	1.43	4.87
B. 2006m1–2009m1						
Mean	−1.16	−3.16	NA	1.44	0.73	0.53
Median	1.72	−0.31	NA	0.89	0.80	−0.49
Maximum	18.45	10.53	NA	10.33	2.57	19.47
Minimum	−26.29	−38.16	NA	−12.26	−0.73	−7.61
Std. Dev.	9.82	10.87	NA	5.53	0.76	5.55
C. 2009m1–2013m12						
Mean	1.54	1.58	0.75	0.72	0.69	0.59
Median	0.78	1.97	0.76	0.70	0.58	0.49
Maximum	20.58	23.90	0.91	1.22	11.40	3.22
Minimum	−14.39	−18.35	0.51	0.42	−6.88	−1.44
Std. Dev.	7.58	9.10	0.10	0.16	3.96	0.84
D. 2014m1–2017m7						
Mean	0.94	0.97	0.80	0.08	0.72	1.18
Median	1.24	1.10	0.80	0.16	0.57	0.84
Maximum	10.87	13.91	0.92	9.61	2.43	10.53
Minimum	−9.23	−10.76	0.58	−7.13	−0.52	−5.13
Std. Dev.	5.13	4.91	0.08	3.37	0.70	3.23

Table 2. Statistical summary for BIST 100 and REIT index returns and some important financial indicators.

affected more harshly than REIT index. On the other hand, apparently as alternative investments gold and USD/TRY currency seem to be positively affected from this state change. In the third period, post-financial crisis, while changes in CPI and USD/TRY currency are relatively stable and returns on gold price decreases compared to the previous period, index returns become positive and looks like catching up with the pre-crisis levels. This expectation, however, is not realised since the last period is also a low-growth period and what happens to index returns is only a dramatic fall again. Meanwhile, gold returns for final period also dramatically decreased. When a similar statistical analysis is done for individual REITs for the same periods, more or less, we observe similar changes. These results are not

presented here for the sake of brevity. However, we present **Table 3**, where the statistical summary between BIST 100 and BIST REIT index and individual REITs are presented for the whole period. There are three REITs that perform better than BIST 100. Two of them are Vakıf GYO (VKGYO) with an average of 1.67 and Nurol GYO (NUGYO) with an average of 1.18 and they both have much higher volatilities compared to BIST 100. The third one is AKIŞ GYO (AKSGYO) with an average of 1.17 and a lower volatility than that of BIST 100. All other individual REITs and REIT index perform worse than BIST 100 and they also have high volatilities for the period.

The correlations between BIST 100 and REIT indices are shown in **Table 4**. The strongest relation is between BIST 100 and BIST REIT index. For all of the individual REITs except two, the correlation with BIST 100 is larger than 40%. For Akiş GYO (AKSGYO), the correlation is only 3% and for Yeni Gimat GYO (YGGYO), the correlation is even a negative number, −7%.

Table 5 reports the risk-adjusted performance results of Sharpe, Treynor and Jensen alpha measures alongside their respective performance rankings for different periods. However, as shown in all periods, there are some negative Sharpe ratio and Treynor ratio values. As the study by Israelsen [12] shows, these negative ratios can lead to incorrect rankings by making you choose the worse portfolio due to larger volatility. Craig Israelsen [12] has created modified Sharpe ratio where the denominator is adjusted as follows:

$$S_j = \frac{\overline{Rj} - \overline{R}_f}{\vartheta j^{ER/|ER|}} \tag{4}$$

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Obser.
BIST 100	1.15	2.23	26.03	−26.29	9.11	−0.25	3.83	193
BIST REIT	0.67	1.11	32	−38.2	10.2	−0.27	4.57	194
AKMGY	0.27	0	45.4	−31.3	10.5	0.62	6.6	147
AKSGYO	1.17	0.46	31.4	−12	8.1	1.76	7.52	54
ALGYO	1.08	1.6	41.2	−48.8	12.5	−0.07	4.34	195
EKGYO	0.6	0	36.1	−22.9	8.7	0.51	5.27	79
HLGYO	0.04	0	12.8	−10.6	5.5	0.01	2.44	53
ISGYO	0.53	0.9	36	−42	11.4	−0.13	4.52	195
KLGYO	0.01	0.56	39	−29	11.9	0.45	4.76	75
NUGYO	1.18	−1.06	59	−46	15.4	0.44	5.01	195
SNGYO	−0.59	0	45.2	−43.4	13	−0.17	4.99	121
TRGYO	0.69	0	25.2	−29.3	10.2	−0.11	3.05	81
VKGYO	1.67	0.7	50.2	−45	15	0.3	4.43	195
YGGYO	1.11	0	20.9	−12.8	6.5	0.9	4.93	47
PEGYO	−0.22	−0.9	85.3	−74.8	18.1	0.24	7.05	195

Table 3. Statistical summary for REIT index and indıvıdual REIT portfolio returns (2001m5–2017m7).

	BIST 100	XGMYO	AKMGY	AKSGYO	ALGYO	EKGYO	HLGYO	ISGYO	KLGYO	NUGYO	SNGYO	TRGYO	VKGYO	YGGYO
BIST 100	1.00	0.86	0.50	0.03	0.63	0.65	0.53	0.77	0.44	0.57	0.76	0.66	0.45	−0.07
XGMYO	0.86	1.00	0.60	−0.06	0.73	0.95	0.53	0.88	0.53	0.60	0.81	0.75	0.51	0.10
AKMGY	0.50	0.60	1.00	0.00	0.48	0.42	0.22	0.36	0.33	0.37	0.45	0.36	0.19	0.28
AKSGYO	0.03	−0.06	0.00	1.00	−0.13	−0.10	0.14	0.01	−0.17	−0.03	0.04	−0.03	0.17	−0.08
ALGYO	0.63	0.73	0.48	−0.13	1.00	0.48	0.41	0.63	0.38	0.49	0.57	0.56	0.43	0.14
EKGYO	0.65	0.95	0.42	−0.10	0.48	1.00	0.47	0.63	0.44	0.37	0.61	0.67	0.16	0.00
HLGYO	0.53	0.53	0.22	0.14	0.41	0.47	1.00	0.55	0.40	0.35	0.48	0.36	0.31	−0.19
ISGYO	0.77	0.88	0.36	0.01	0.63	0.63	0.55	1.0	0.36	0.46	0.60	0.52	0.44	0.04
KLGYO	0.44	0.53	0.33	−0.17	0.38	0.44	0.40	0.36	1.00	0.49	0.54	0.58	0.18	−0.08
NUGYO	0.57	0.60	0.37	−0.03	0.49	0.37	0.35	0.46	0.49	1.00	0.49	0.50	0.45	0.09
SNGYO	0.76	0.81	0.45	0.04	0.57	0.61	0.48	0.6	0.54	0.49	1.00	0.66	0.25	−0.11
TRGYO	0.66	0.75	0.36	−0.03	0.56	0.67	0.36	0.52	0.58	0.50	0.66	1.00	0.19	−0.07
VKGYO	0.45	0.51	0.19	0.17	0.43	0.16	0.31	0.44	0.18	0.45	0.25	0.19	1.00	0.01
YGGYO	−0.07	0.10	0.28	−0.08	0.14	0.00	−0.19	0.04	−0.08	0.09	−0.11	−0.07	0.01	1.00
PEGYO	0.61	0.61	0.33	−0.04	0.47	0.39	0.34	0.5	0.46	0.38	0.50	0.47	0.33	−0.03

Table 4. Correlation matrix between REIT index and individual REIT portfolio returns (2001m5–2017m7).

	BIST REIT	AKMGY	AKSGYO	ALGYO	EKGYO	HLGYO	ISGYO	KLGYO	NUGYO	SNGYO	TRGYO	VKGYO	YGGYO	PEGYO
A. 2001m5–2005m12														
Sharpe ratio	−0.11			−0.05			−0.15		−0.10			0.00		−0.13
Modified Sharpe	−18.18			−11.80			−32.05		−26.16			0.00		−75.04
Ranking	3			2			5		4			1		6
Treynor ratio	−1.44			−0.99			−2.09		−1.67			0.07		−2.52
Modified Treynor	−1.38			−0.64			−2.24		−1.52			0.07		−3.81
Ranking	3			2			5		4			1		6
Jensen's alpha	−0.42			0.06			−0.86		−0.55			1.49		−0.63
Prob value (alpha)	0.63			0.97			0.46		0.72			0.40		0.82
Ranking	3			2			6		4			1		5
Obs.	55			56			56		56			56		56
B. 2006m1–2009m1														
Sharpe ratio	−0.43	−0.39		−0.43			−0.31		−0.36			−0.31		−0.26
Modified Sharpe ratio	−51.16	−29.46		−69.45			−56.56		−79.86			−53.93		−131.70
Ranking	2	1		5			4		6			3		7
Treynor ratio	−4.86	−5.62		−6.57			−3.84		−6.34			−5.05		−5.22
Modified Treynor	−4.56	−2.04		−4.55			−4.54		−4.57			−3.26		−6.46
Ranking	5	1		4			3		6			2		7
Jensen's alpha	−2.09	−1.76		−3.22			−1.24		−3.09			−1.89		−2.80
Prob value (alpha)	0.03	0.12		0.06			0.40		0.16			0.32		0.42
Ranking	4	2		7			1		6			3		5
Obser.	37	37		37			37		37			37		37

	BIST REIT	AKMGY	AKSGYO	ALGYO	EKGYO	HLGYO	ISGYO	KLGYO	NUGYO	SNGYO	TRGYO	VKGYO	YGGYO	PEGYO
C. 2009m1–2013m12														
Sharpe ratio	0.09	0.01		0.14	−0.05		0.11	−0.50	0.20	0.04	−0.09	0.28		−0.05
Modified Sharpe ratio	0.09	0.01		0.14	−5.98		0.11	−55.62	0.20	0.04	−10.64	0.28		−6.93
Ranking	**5**	**7**		**3**	**8**		**4**	**11**	**2**	**6**	**10**	**1**		**9**
Treynor ratio	0.90	0.18		2.06	−0.58		1.20	−5.04	3.16	0.31	−0.78	10.08		−0.55
Modified Treynor ratio	0.90	0.18		2.06	−0.53		1.20	−5.49	3.16	0.31	−1.18	10.08		−0.69
Ranking	**5**	**7**		**3**	**8**		**4**	**11**	**2**	**6**	**10**	**1**		**9**
Jensen's alpha	0.07	−0.62		1.02	0.06		0.31	−4.44	2.59	−0.79	−0.04	4.28		−1.54
Prob value (alpha)	0.92	0.70		0.45	0.96		0.72	0.00	0.21	0.40	0.98	0.05		0.12
Ranking	**5**	**8**		**3**	**6**		**4**	**11**	**2**	**9**	**7**	**1**		**10**
Obs.	60	60		60	36		60	32	60	60	38	60		60
D. 2014m1–2017m7														
Sharpe ratio	0.03	0.01	−0.05	0.13	0.02	−0.11	0.03	0.22	−0.01	−0.15	0.07	−0.25	0.08	0.12
Modified Sharpe ratio	0.03	0.01	−2.84	0.13	0.02	−3.16	0.03	0.22	−1.14	−5.97	0.07	−30.92	0.08	0.12
Ranking	**6**	**9**	**11**	**2**	**8**	**12**	**7**	**1**	**10**	**13**	**5**	**14**	**4**	**3**
Treynor ratio	0.24	0.17	64.65	1.86	0.17	−1.09	0.36	7.41	−1.72	−1.27	0.76	−18.55	−4.75	1.21
Modified Treynor ratio	0.24	0.17	0.002	1.86	0.17	−0.33	0.36	7.41	−0.01	−0.72	0.76	−0.42	−4.75	1.21
Ranking	**6**	**7**	**14**	**2**	**8**	**10**	**5**	**1**	**9**	**12**	**4**	**11**	**13**	**3**
Jensen's alpha	−0.05	−0.02	−0.46	1.08	−0.12	−0.86	0.11	1.83	−0.25	−1.28	0.45	−3.20	0.63	1.07
Prob value (alpha)	0.93	0.97	0.69	0.42	0.87	0.22	0.90	0.29	0.86	0.09	0.73	0.07	0.56	0.47
Ranking	**8**	**7**	**11**	**2**	**9**	**12**	**6**	**1**	**10**	**13**	**5**	**14**	**4**	**3**
Obser.	43	43	43	43	43	43	43	43	43	43	43	43	43	43

Table 5. Performance comparison of REITs with BIST 100 for different sub-periods.

The Sharpe ratio is adjusted by adding an exponent to the denominator, standard deviation of excess return. The exponent is excess return divided by the absolute value of excess return, $\overline{Rj} - \overline{R}_f$. This modification does not have any impact on positive ratios. But by modifying the negative ones, modified Sharpe ratio leads to correct rankings. Since the time period is quite a long one, negative Treynor ratios are also observed. By using the same logic, to prevent counterintuitive results, Treynor ratios are also modified in the same way:

$$T_j = \frac{\overline{Rj} - \overline{R}_f}{\beta j^{ER/|ER|}} \tag{5}$$

Table 5 reports both Sharpe and Treynor ratios and their modified versions.

The performance rankings by Sharpe ratio (whether modified or not) theoretically can differ from those of Treynor ratio and Jensen's alpha since Sharpe ratio depends on volatility of return, while Treynor ratio and Jensen's alpha depend on systematic risk, beta, as the relevant risk factor. For the first period (Panel A of **Table 5**), there is no significant difference in the ranking orders of REIT performances. Even though none of the Jensen's alpha values are significant (probability values are quite large), the rankings for all of three measures are almost the same. Similarly, the observed rankings by Treynor ratio and Sharpe ratio are fairly consistent with each other in Panel C, for the second high-growth period. Jensen performance measures, though not significant, are not really far away from those rankings, either. Some minor differences can be observed in the rankings in Panel B between Treynor and Sharpe ratios. However, the last period, presented in Panel D of the **Table 5** has some real contrasts in ranking orders of Treynor and Sharpe. The most important one is the Yeni Gimat REIT (YGGYO). While it is ranked as fourth by Sharpe ratio, it is only the second from the last (13th) in ranking by Treynor. Such differences of course can be attributed to the differences in risk measure employed, that is, standard deviation of return versus beta. Given that the reported R-squared values for REITs are high (see **Table 6**), it can be assumed that beta coefficients are quite reliable and thus, Treynor ratios that uses beta can be thought to be giving more convincing performance rankings than Sharpe.

When the performance ratings are compared over the periods, between first and second periods, there is not much difference. In the third period for AKMGY, VKGYO and NUGYO some changes are observed. AKMGY ranking as first before the crisis (Panel B) becomes only the seventh after the crisis period (Panel C). On the other hand, NUGYO improves by four rankings (from six to two) and VKGYO improves by at least one ranking for the same periods. However, the last period is witness to much more important changes in the rankings for most of the REITs, namely, for KLGYO, NUGYO, SNGYO, TRGYO, VKGYO, YGGYO and PEGYO. It can be even stated that the rankings are shuffled around for the last period so that VKGYO, which has the first ranking in the third period becomes the last one in the last period. In contrast, KLGYO, which has the 11th ranking in the high-growth period, becomes first one in the last period for all of the performance measures. The others also experience radical changes in their rankings. These results basically show us that regulatory changes almost have no impact on the performances of the REITs. Otherwise, we would observe stable improvements in the performances of the REITs throughout the

REIT	BIST REIT	AKMGY	AKSGYO	ALGYO	EKGYO	HLGYO	ISGYO	KLGYO	NUGYO	SNGYO	TRGYO	VKGYO	YGGYO	PEGYO
A. 2001m5–2017m7														
Beta	0.97***	0.70***	0.04	0.83***	0.93***	0.49***	0.98***	0.81***	0.94***	1.25***	1.12***	0.70***	−0.08	1.18***
R-squared	0.73	0.26	0.00	0.38	0.42	0.28	0.61	0.19	0.31	0.58	0.43	0.18	0.01	0.35
Prob value (beta)	0.00	0.00	0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.64	0.00
B. 2001m5–2005m12														
Beta	0.98***			0.80***			1.04***		0.95***			0.78***		1.23***
R-squared	0.79			0.49			0.70		0.52			0.36		0.38
Prob value (beta)	0.00			0.00			0.00		0.00			0.00		0.00
C. 2006m1–2009m1														
Beta	0.97***	0.60***		0.83***			1.09***		0.85***			0.80***		1.11***
R-squared	0.77	0.46		0.41			0.62		0.32			0.35		0.23
Prob value (beta)	0.00	0.00		0.00			0.00		0.00			0.00		0.00
D. 2009m1–2013m12														
Beta	0.96***	0.96***		0.83***	0.96***		0.83***	1.04***	1.11***	1.56***	1.23***	0.46*		1.12***
R-squared	0.64	0.26		0.28	0.40		0.49	0.52	0.23	0.73	0.60	0.05		0.57
Prob value (beta)	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.10		0.00
E. 2014m1–2017m7														
Beta	0.68***	0.32**	−0.01	0.62**	0.90***	0.55***	0.50***	0.35	0.07	0.75***	0.91***	0.15	−0.12	1.05***
R-squared	0.50	0.12	0.00	0.12	0.47	0.29	0.18	0.03	0.00	0.40	0.24	0.00	0.01	0.25
Prob value (beta)	0.00	0.03	0.98	0.02	0.00	0.00	0.01	0.30	0.79	0.00	0.00	0.66	0.57	0.00

***Shows that beta coefficient is significant at 1% level, **shows beta coefficient is significant at 5% level, *shows the significance at 10% level.

Table 6. Comparison of beta values for different sub-periods.

years. In consistent with the previous literature, it is possible that state of the economy (whether it is a low-growth or high-growth state) is more important in terms of the performances of REITs.

So far, the risk-adjusted returns of the REITs have been analysed for different periods. It may be interesting to look at the systematic risk behaviour of REITs for the same sub-periods. Indeed, a study by Altınsoy et al. [1] shows systematic risks of REITs, betas, decline over time for the period of 2002–2009. They also show that REIT returns more closely track stock market in high-growth economic states than low-growth economic states, unlike to the findings from other countries. **Table 6** compares the beta values of REITs for the sub-periods of the study and aims to investigate whether we can observe similar facts of the mentioned study. Panel A of the **Table 6** shows the CAPM results for the whole period. Panels B, C, D and E show the regression results for periods of 2001–2005, 2006–2008, 2009–2013 and 2014–2017, respectively. Results show that except for five REITs in the last period, AKSGYO, KLGYO, NUGYO, VKGYO and YGGYO, all beta coefficients are significant and mostly at 1% significance level. Respectively, high R-squared values are observed for most of the REITs. On the other hand, the results with respect to beta behaviour over the sub-periods are different than the results of Altınsoy et al. [1][3]. The betas do not decrease from the high-growth (Panel B) to low-growth period (Panel C). For 2009–2013, which is also a high-growth period, different effects are observed, REIT index beta is relatively stable, some betas decrease and some increase. Finally, betas decrease in the last period (low-growth period) substantially. Thus, it is not possible to easily relate decreasing betas in total to economic states as it is done in the previous studies[4]. There may be other important reasons for time-varying betas. Another important thing to notice is the fact that most of the REITs have lower risks than the market portfolio, that is, beta values are lower than one. It shows that although REITs have lower risks, they do not perform better than market index (alphas are not significant but betas are significant).

4. Conclusions

The main purpose of the study is to analyse the performance stability of REIT index and individual REITs over different sub-periods. The sample for the study contains 12 individual REITs that have weights larger than 1% in the REIT index and the REIT index that survived for the whole REIT history in Turkish stock market, thus, in total, 13 individual REITs and REIT index itself. The performance of the REITs is compared to mainly that of BIST 100 Index which is

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[3]The present study differs at many aspects from the study by Altınsoy et al. [1]. This study uses monthly returns of both REIT index and individual REITs and uses simple CAPM over a longer period. The study carried out by Altınsoy et al. [1] uses weekly and daily returns for only REIT index for the period 2002–2009 and calculates time varying betas by using three different methods. It does not analyses the individual REITs.

[4]The author has also run regressions with several macroeconomic factors including GDP. Only for the second period, the financial crisis period, 50% of the REIT returns has significant negative relation with GDP. For all other periods, the relationship between REIT returns and GDP is not consistently significant. The best can be said about the relationship is being unclear. These multifactor regressions are also consistent with the declared conclusions on alpha and beta behaviour. The results are not presented here for the sake of brevity and integrity.

accepted to be the reference portfolio in the study. Data employed in this study is the monthly returns for a 14-year period and Treasury bill rates are used as a proxy for the risk-free rate.

For analysing the performance stability, three different risk-adjusted measures, namely, Sharpe ratio, Treynor ratio and Jensen's alpha, are employed for four different periods. These periods are determined with respect to important regulatory changes in the REIT market and also to economic states of the country. The results show that although Treynor and Sharpe ratios use different risk measures, volatility and beta, they rank the REITs consistently for the high-growth periods. However, the rankings are not that consistent in low-growth periods and even they may contrast significantly. In terms of stability, whether the performance of the REITs changes over time, it is observed that the rankings of the REITs in the last period virtually are shuffled up with respect to the previous period. These results basically show us that regulatory changes almost have no impact on the performances of the REITs. Otherwise, we would observe stable improvements in the performances of the REITs throughout the years. In consistent with the previous literature, it is possible that state of the economy (whether it is a low-growth or high-growth state) is more important in terms of the performances of REITs. However, time-varying behaviour of betas does not tell us the same story. The betas do not consistently decrease from the high-growth to low-growth period. Thus, it is not possible to easily relate decreasing betas to economic states as it is done in the previous studies. There may be other important reasons for time varying betas. As a future study, it looks important to analyse why the betas of REITs are decreasing over time.

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