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The impact of dividend payout policies on real estate market diversification

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ABSTRACT

An asymmetric DCC - GJR - GARCH model is applied to the Turkish and US REIT markets in order to estimate the time-varying correlations between the REIT and stock markets. Using these estimated correlations, we investigate the impact of dividend payouts on the diversification potential of REITs for stock market investors. Our choice of the Turkish REIT market is based on its unique REIT dividend policy, while US data provides a benchmark for comparison. This study has a number of motivations and contributions that make it a worthwhile undertaking. First, we document that REIT dividend policy is related to the correlation between REIT and stock markets. Dividend paying REITs have lower correlations with stock markets, which makes the REIT market a viable portfolio diversifier. Second, we confirm that REITs and stock prices cointegrated more closely due to the 2008 global financial crisis. We additionally document that a similar effect was also present in the correlation during the global Covid-19 pandemic crisis. It appears that REITs and stock markets become more correlated during times of financial turmoil and diversification opportunities are diminished. Finally, we document that there is a long-term trend in the time-varying correlations between REITs and stock markets. Türkiye has been experiencing a negative trend in this regard, while the US has been experiencing a positive trend.

Keywords: Turkish REITs, Correlations, Diversification, DCC-GARCH, Structural Break, Trend, Dividend Policy

Conflict of Interest Statement

The authors declare no conflict of interest.

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Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request. The data employed in this study can be obtained from the Refinitiv Eikon database.

Ethical Approval

Ethics approval was not required for this study.

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I. Introduction

It is well known that real estate securities are a major investment instrument that provides diversification benefits to both equity and fixed income investors, and its relationship with and its diversification benefits to risky income securities have been widely investigated in the literature.¹ Researchers have found that the real estate market offers diversification benefits to investors in equity portfolios. It is therefore imperative for stock market investors to keep an eye on the extent to which REIT firms are able to diversify their holdings.

Whether firm dividend policy has any relationship with stock market prices is an ongoing debate in the literature. Both theoretical and empirical support from the literature suggests a connection (Allen & Rachim, 1996; Hussainey *et al.* , 2011). We take this debate one step further. In the event that changes in the dividend policies of stocks result in changes in stock prices, we should expect to see a change in the correlation between these stocks and the overall market. In this regard, this study intends to investigate the relationship between REIT dividend policies and their diversification benefits for stock market investors. In particular, the study exploits the unique regulatory setting of the Turkish REIT market which we will explain in more detail below. Additionally, very limited information is known about how REITs' time-varying correlations with stocks changed during the global financial crisis (GFC) and the global Covid-19 pandemic crisis (GCPC). Another issue that this study considers is whether there is a deterministic trend in the correlations between stock and REIT markets. The association between dividend policy and correlations, the effect of financial crises on correlations, and a possible long-term trend in correlation would have some implications for the diversification benefits of REITs for stock market investors. An increase in correlations indicates a decrease in the diversification benefits of the REIT market. Therefore, portfolio managers and asset allocators seeking to diversify their portfolios should closely monitor how these factors affect the REIT market's diversification potential.

The present study aims to accomplish multiple objectives. First, the study explores to what ex-

¹Lu *et al.* (2013); Yang *et al.* (2012); Case *et al.* (2012b); Fugazza *et al.* (2007); Clayton & MacKinnon (2001); Bley & Olson (2005); Cotter & Stevenson (2006); Chong *et al.* (2009); Liow *et al.* (2009); Niskanen & Falkenbach (2010); Yang *et al.* (2012); Akinlana *et al.* (2019)

tent the diversification benefits offered by the REIT market can be affected by the dividend policies of REITs. Our study extends this question by looking at how the effect of REIT's dividend policy on their diversification potential changes with their dividend levels. Second, the study investigates whether changes in the correlations between REITs and stocks when there is financial stress in the market can lead to significant variations in the diversification potential of REITs. Finally, we test whether there is a deterministic time trend in the correlation process, which will have long-term implications for REIT market participants.

A number of contributions are made to the literature on REITs and their dividend policy. First, we document time-varying correlations between the stock and REIT markets at both the index and firm levels and analyze these correlations with respect to the dividend policies of REITs. To our knowledge, this study is the first attempt to examine the effects of REITs' dividend policy on their diversification potentials. Second, our analysis contributes to the literature of a relatively small number of studies that examine the diversification potential of REITs during periods of market instability (Abuzayed *et al.* , 2020; Hui & Chan, 2014, 2013; Huang & Zhong, 2013; Sing & Tan, 2013; Niskanen & Falkenbach, 2010). We are specifically interested in knowing the diversification benefits of REITs during the GFC and GCPC periods. To the best of our knowledge, there has not been a study investigating the diversification benefits of REITs during the GCPC period. Third, we consider a deterministic time trend in the correlation process. Finally, the findings of our study have implications for academics, practitioners, investors, portfolio managers, regulators, and policymakers whose goal is to assess common market risks during periods of financial instability. In this way, they will be able to take proactive measures to ensure the financial stability of the economy and diversify or hedge their portfolios in a better way. For instance, Turkish REIT regulators granted REITs the freedom to choose dividend payout policies most likely to enable the market to grow. By doing so, they also allowed the REIT market to have higher correlations with the stock market. In a sense, Turkish REITs may become less representative of the real estate market over time. Giving these REITs dividend freedom did not serve Turkish regulators' intent to make REITs a security class representing the real estate market. As a result, the Turkish REIT

market has decreased its diversification potential. A high correlation between REITs and the stock market would also limit the REIT market's ability to reflect the real estate market in terms of risk and return. The results also provide implications for portfolio managers in terms of whether REITs should be hedged or diversified in equity portfolios in turbulent market conditions.

Our sample includes daily, weekly, and monthly returns on the stock market and REIT index for Türkiye and the US from January 4, 2000 through December 31, 2021. The Turkish REIT market was selected primarily because of its unique dividend regulations. The US data provide a benchmark for comparison with Turkish REITs. They share the characteristics of REIT markets around the world. In order to qualify as a REIT and benefit from tax advantages, most countries, including the US, require the firm to generate a large portion of its income from real estate investments and to distribute most of that income to shareholders for the current year, typically 90-95 percent, which makes REITs an investment channel with an elevated level of security and income while providing exposure to real estate market risks. Türkiye stands out as an exception in this regard. While Turkish REITs are not required to distribute earnings, they still benefit from the tax advantages offered to REITs.

The approach taken to estimate the conditional correlation is based on Cappiello *et al.* (2006) framework. First, we examine the characteristics of conditional correlations between indices of the two fundamental markets in Türkiye and the US using a multivariate asymmetric DCC-GARCH model. Our sample period encompasses two global recession sub-periods. We next test whether the conditional correlations between the two markets exhibit structural breaks at both the index and firm level, using three unit root tests. In the last section, we test whether REIT market dividend policies affect their time-varying correlations with stock prices using a regression approach borrowed from the literature. The dividend policy of the REIT market is measured by the dividend payout ratio, which is calculated as dividends per share divided by earnings per share expressed as a percentage.² Typically, US REITs do not report taxable income, so their dividend policy is explained by Funds From Operations (FFO). It is reasonable to assume that FFO can substitute

²Datatype WC09504 from the Worldscope database

REIT dividend policy as long as REITs are required to distribute the majority of their income as dividends, like the minimum 90 percent distribution requirement in the US. The FFO, however, will only measure REITs' ability to pay dividends, not their actual dividend policy, if they have complete discretion over dividend policies, such as Turkish REITs. US REITs have a discretion of only 10 percent over dividend payout decisions, while Turkish REITs have a discretion of 100 percent. Our model requires a measure of dividend policy that reflects the firm's discretion. Therefore, we choose dividend payout ratios as a measure of REIT dividend policy. Further, our regression model also tests for potential changes in the estimated correlations during the GFC and GCPC periods and for a deterministic trend capturing long-term changes in the correlation process.

Our results indicate that REIT dividend policy is significantly and negatively associated with the correlation process. That is, dividend payments from REITs increase their diversification benefits for stock market investors in both countries. On the other hand, the results also indicate that the magnitude of this influence is lower in the Turkish market. Turkish REITs are able to make dividend decisions in a similar manner to general stocks as they have complete flexibility in their dividend payout decision. To put it simply, Turkish REITs are subject to the usual dividend theories. In turn, this limits the diversification benefits that Turkish REITs can provide to stock market investors. In addition, we provide evidence to support the literature that suggests that REITs have a higher correlation with the stock market during periods of economic depression. In both countries, financial downturns are positively associated with correlation levels. However, the results suggest that this relationship is not as strong on the Turkish market. In our opinion, this is due to the flexibility of Turkish REITs when it comes to determining dividends. As Turkish REITs have been able to accumulate cash over the years prior to the GFC, they use the excess cash to distribute dividends in times of financial distress in the market. Lastly, we observe that Turkish REITs demonstrate a negative long-run time trend in their correlation with the stock market, while US REITs show a positive deterministic time trend. Based on this finding, we conclude that US REIT diversification potential diminishes over time, while Turkish REIT diversification potential increases.

The remainder of this paper is organized as follows. A brief discussion of Turkish REITs is pro-

vided below as well as the effect dividend policies might have on REIT - stock market correlations. Section II provides a review of the literature. Section III and IV describe data and methodology, respectively. Section V presents the results and finally Section VI gives the overall remarks and concludes.

The Turkish REIT market and its correlation with stocks

As a capital market instrument, REITs invest in real estate, capital market instruments based on real estate, real estate projects, and real estate rights. REITs were introduced to the Turkish market in 1995. Since then, Turkish REITs have proven their ability to perform impressively over the past few years as they continue their rapid growth. The Istanbul Stock Exchange (ISE) listed 35 Turkish REITs as of June 30, 2022. These REITs have a market capitalization of around 7,167 million USD. In the global REIT index, Turkish REITs account for 0.05 percent of the whole. As an advantageous vehicle for accessing the profits of extensive real estate portfolios, REITs have gained a considerable amount of traction in the Turkish real estate market. Thus, both domestic and foreign investors have expressed an interest in REITs. By the end of 2021, the listed REITs had accumulated assets totalling approximately 9,433 million USD.

Global REIT markets are characterized by regular dividend payments ranging from 90 percent to 100 percent of taxable income, as well as tax advantages. Many countries, including the US, UK, Japan, and Canada, require firms to generate a large portion of their income from real estate investments. In this way, REITs offer a steady and secure income, but also expose investors to real estate market risks. The case of Türkiye is an exception.

Turkish REITs are distinguished from their counterparts in other countries by their total flexibility in dividend distribution choices and yet maintaining their non-taxable corporate status. A no-minimum dividend requirement may have a significant impact on the time-varying correlation between the Turkish REIT market and the stock market.

Firstly, a big advantage of REITs in Türkiye is that they're flexible like general stocks, so they can take advantage of alternative sources of financing, including their own. The Turkish REIT

market is likely to behave in a way consistent with the pecking order theory by Myers & Majluf (1984); this will likely increase the Turkish REIT market's overall time-varying correlation with the stock market, as general stocks will also make financing decisions along the same lines.³

Secondly, stock returns fluctuate partly due to the anticipation of discounted future cash flows when dividend discount models are used to price REIT stocks. In the dividend discount model, it is implied that non-dividend paying stocks' present value would be more affected by random shocks to the overall market than dividend bearing stocks. Therefore, dividend stocks and non-dividend stocks would have different return fluctuations, and their correlations with the overall stock market would be different.

Last, Turkish REITs are not required to distribute any portion of their income, and they do not have to pay taxes on their taxable earnings. So, they are often considered to be cash-rich firms. In the event of financial difficulty, this accumulated income may be used as a source of inexpensive financing when it is most needed. Due to the ability to accumulate their earnings and the ability to access these internal financing sources, non-dividend Turkish REITs are more flexible and have the ability to diminish the effects of external market shocks more easily or absorb them more quickly than dividend REITs, which in turn may lead to a different correlation of the stock market with dividend and non-dividend REITs.

Türkiye has a unique regulatory structure for REIT dividend payments. We believe it is imperative to examine the evolution of correlations between the stock and REIT markets over time, and how they relate to dividend policies. It is necessary to compare our Turkish market results with a reference point in order to make sense of them. In this case, we will use the US market as a reference since it is the most developed in the world.

³The pecking order theory proposes that the cost of financing increases in the presence of asymmetric information. Using internally generated funds is prioritized over external funds since asymmetric information is lower. Debt and equity issuance is considered after internal sources are depleted.

II. Literature Review

Portfolio diversification needs of investors have highlighted the relationship between various asset classes and markets. The subject has received extensive attention. A number of studies have shown that integration exists between stock and real estate markets and this integration is time-varying. As a result, the diversification potential of the real estate market varies over time.

Our literature review shows both increasing and decreasing relationships between the two asset classes. For instance, Chong *et al.* (2009), utilizing a DCC-GARCH model, examine the temporal variations in the conditional correlations of REIT returns with equity, bond and commodity returns, using daily US REIT index returns and equity index returns from US and global markets, from 1990 to 2005. The authors find an increased correlation between REITs and equity market returns during the period of analysis. It can be interpreted as a loss of diversification potential for equity market investors in the real estate market. Furthermore, the authors conclude that correlation tends to rise during periods of high volatility. In another study by Huang & Zhong (2013), the diversification benefits of REITs were examined for a period of time between 1970 and 2010, using a DCC model with monthly data as well as a 100-day rolling window correlation model with daily data. According to the authors, the correlation between REITs and equity markets increased around the global financial crisis.⁴ Using data from the European REIT market, Niskanen & Falkenbach (2010) investigate whether the market is integrated with the general European stock market, and if volatility affects correlation patterns. Results indicate a significant positive correlation between REITs and equities, especially small-caps and value stocks. The study also finds that REITs' diversification qualities are diminished during times of extreme equity market volatility, which is also supported by Chong *et al.* (2009). The increase in the correlation process has also been observed by Cotter & Stevenson (2006), Yang *et al.* (2012), and Liow (2012). Most studies citing an increasing conditional correlation use a DCC-GARCH type model, sample time periods post-late 1990s, and have a daily or weekly data frequency.

Bley & Olson (2005), Conover *et al.* (2002), Clayton & MacKinnon (2001), and Liow (2006)

⁴100-day rolling window correlations with daily data are given in Panel A of Figure 5 in Huang & Zhong (2013).

are all studies who find a decrease in the correlation, however the frequency of their data is either monthly or quarterly. In addition, the sample time periods date back as far back as the 1970s. It must also be noted that in these studies, non-DCC-GARCH models were applied, such as rolling correlations, factor sensitivity tests, and cointegration tests. Case *et al.* (2012b) use a DCC-GARCH model with monthly data to analyze dynamics in the correlation of returns between publicly traded REITs and non-REITs. It was reported that the relationship between the real estate and stock markets varies over time, which could have implications for optimal portfolio allocations in the future. Additionally, the researchers separated the sample into three subperiods, and they found that there was no trend in the first subperiod between July 1978 and September 1991, a decrease in the second subperiod ending in September 2001, thus allowing higher portfolio returns without additional portfolio volatility, and then a steady increase in the correlation in the third subperiod ending in September 2008. Fei *et al.* (2010) undertaken a similar study within the context of an asymmetric generalized dynamic conditional correlation model with monthly data, in which Panel B of their Exhibit 4 confirmed the direction in which the correlation was observed in subperiods by Case *et al.* (2012b).

Several trends have been observed in the literature regarding the direction of correlation, as illustrated in Table I. There may have been a structural break in the correlation, which may have contributed to the mixed results. In this case, the direction of the correlation would be dependent on the period of time in which the sample was taken. It appears from our literature review that there may have been a structural change in the correlation in the 1990s.⁵ Case *et al.* (2012b) found that the correlation process between REITs and non-REITs reversed direction from downward in 1991 to upward in 2001. However, our sample period covers the period after 2001. In light of this, we compare our findings with those of studies that cover a similar time period, such as Fei *et al.* (2010). Studies with similar sample periods have shown an upward trend in the dynamic conditional correlation between the stock and real estate markets.

⁵ Glascock *et al.* (2000) examines the integration of REITs and stock returns using co-integration and vector autoregressive models taking the long-run economic effects into account. They confirm the literature findings of structural changes in the correlation in early 1990s and they conclude that benefit of diversification from including REITs in a general portfolio may be diminished after these breaks.

Table I: The Literature on the Direction of Conditional Correlations

This table lists the studies on the time-varying correlation between stock and real estate markets and reports the direction of the correlation. *Frequency* reports the data frequency of the sample and *Time Period* is the years the sample covers. *Methodology* gives the main method used to estimate the correlation.

	Direction of Correlations	Frequency	Time Period	Methodology
Abuzayed <i>et al.</i> (2020)	Upwards	Daily	2003 to 2007	cDCC - GARCH
Abuzayed <i>et al.</i> (2020)	Downwards	Daily	2010 to 2018	cDCC - GARCH
Chong <i>et al.</i> (2009)	Upwards	Daily	1990 to 2005	DCC - GARCH
Chong <i>et al.</i> (2012)	Upwards	Daily	1990 to 2008	DCC - GARCH
Cotter & Stevenson (2006)	Upwards	Daily	1999 to 2003	BEKK - GARCH - VAR
Niskanen & Falkenbach (2010)	Upwards	Daily	2006 to 2009	50-day Rolling Corr & Vol
Yang <i>et al.</i> (2012)	Upwards	Daily	1999 to 2008	AG-DCC-GJR-GARCH-VAR
Huang & Zhong (2013)	Upwards	Daily	1999 to 2010	DCC & 100-Day Rolling Corr
Liow (2012)	Upwards	Weekly	1995 to 2009	ADCC - GJR - GARCH
Huang & Zhong (2013)	Upwards	Monthly	1970 to 2010	DCC & 100-Day Rolling Corr
Case <i>et al.</i> (2012b)	Downwards	Monthly	1991 to 2001	DCC - GARCH - VAR
Case <i>et al.</i> (2012b)	Upwards	Monthly	2001 to 2008	DCC - GARCH - VAR
Fei <i>et al.</i> (2010)	Downwards	Monthly	1988 to 2001	AG-DCC - GJR - GARCH
Fei <i>et al.</i> (2010)	Upwards	Monthly	2001 to 2008	AG-DCC - GJR - GARCH
Bley & Olson (2005)	Downwards	Monthly	1993 to 2001	24-month Rolling Corr
Conover <i>et al.</i> (2002)	Not Reported	Monthly	1986 to 1995	12-month Rolling Corr
Liang & McIntosh (1998)	Downwards	Monthly	1989 to 1997	5-year Trailing Rolling Corr
Chandrashekar (1999)	Upwards	Monthly	1975 to 1979	ARDL Cointegration
Chandrashekar (1999)	Downwards	Monthly	1980 to 1996	ARDL Cointegration
Clayton & MacKinnon (2001)	Downwards	Quarterly	1979 to 1998	Factor Sensitivity - Regr.

Findings in the literature regarding the direction of correlations between the real estate market and the stock market are not robust. And, the papers listed in the table mention that they have found an increasing or decreasing correlation. Yet, the majority of them do not formally test for a time trend in the correlation process, except for Chong *et al.* (2009) and Yang *et al.* (2012), who regress the estimated correlation on a time trend after controlling for the appropriate number of lags.

A common finding in the literature is that REITs correlate more strongly with stock market indexes during times of financial distress. The limited diversification properties of REITs are a result of increased correlations. A number of studies, including Liow (2012); Yang *et al.* (2012); Sing & Tan (2013); Hui & Chan (2014); Chen *et al.* (2015); Huang *et al.* (2016); Miles (2017); Yunus (2018), and Abuzayed *et al.* (2020), confirm that the 2008 global financial crisis is positively related to stock and real estate market cointegration. A change in market contagion can have a series of consequences for a portfolio on the stock market. These studies suggest portfolio managers should incorporate these linkages into their portfolio construction to maximize returns.

There is an extensive literature on the decision of corporate dividend policy. The role of dividend policy in affecting stock prices throughout the world remains a controversial topic. The dividend policy of firms has no relationship with the firm's value according to Miller & Modigliani (1961). However, during the past few decades many researchers have demonstrated the effect of dividends on the price of a stock, such as Gordon (1963), Lintner (1956), Black & Scholes (1974), Baskin (1989), Jensen *et al.* (1992), and Allen & Rachim (1996). The dividends a company pays out to its shareholders have both a positive and a negative impact on the stock price. These studies are based on the assumption that shareholders consider dividends when making investment decisions about other companies. Management of a company may then be able to manipulate stock prices through the use of dividends. Further, Lintner (1956) considers dividends to be sticky and tend to be smoothed over time, since investors prefer a stable dividend payout. Signalling or information asymmetry theory is another popular dividend theory (Bhattacharya, 1979; Miller & Rock, 1985), which suggests that dividend distribution conveys information on company's future prospects when managers have inside information on its future performance. The principle-agent problem theory (Jensen, 1986) states that dividend policy is relevant because firms can pay out excess cash flow in the form of dividends to mitigate agency problems. Apart of these classic dividend theories, there are other more contemporary hypotheses proposed, among which the dividend catering theory by Baker & Wurgler (2004) is the most relevant. According to dividend catering theory, the investor's demand drives / affects the firm's dividend distribution policy. They mentioned that during liquidity crisis, investors are more focused on the going-concern risk rather than dividend payout.

There are a number of studies conducted on determinants of REIT dividend policy (Bradley *et al.* , 1998; Ghosh & Sirmans, 2006; Hardin III & Hill, 2008; Case *et al.* , 2012a) and there is no definite conclusion on the optimal dividend policy. Bradley *et al.* (1998) investigate the announcement effect and REIT dividend policy, and find significant negative response to dividend reduction. Hardin III & Hill (2008) examine the determinants of excess dividend payout above the mandatory requirements for REITs, and find them mainly consistent with the agency-cost theory.

Boudry (2011) decomposes REIT dividends into discretionary and non-discretionary components and finds that the dividend smoothing is a major concern. Case *et al.* (2012a) examine the dividend policy during the 2008 liquidity crisis, and find that mitigating going-concern risk is the main motivation for REITs adjusting dividend policies during crisis since the access to external capital is limited, and their findings support the dividend catering theory.

III. Data

We use daily, weekly, and monthly data on REIT and stock market returns in Türkiye and the US from January 4, 2000 to December 31, 2021. In spite of this, it may be worthwhile to focus on high frequency data. Due to technological advancements allowing for rapid exchange of information between market participants and asset classes, daily frequency may be a more appropriate method of capturing high-frequency dynamic linkages between the two markets. We therefore emphasize results based on daily frequency data as our main focus. However, as suggested by Yunus (2009), daily return cointegration test results may reflect global reaction to major news/business shocks. For this reason, weekly and monthly data are also analyzed for robustness.

Dynamic processes in financial systems can occur at many different scales and over a wide range of time periods. Accordingly, it is imperative to examine these dynamics at different time scales. In order to avoid the results being dependent on data frequency and to offer insight into the issue presented in Table I, we use three data frequencies. For all three frequencies, we estimate the correlation between the two variables and carry out the rest of the analysis. All data are collected from the DataStream.

We acknowledge that both high frequency and low frequency data may be subject to certain limitations. According to one viewpoint, daily data is noisier, and the increasing correlation characteristics found in the literature may be due to some unobservable variables driving noise in daily data. In contrast, it is quite common in the literature to assume that index volatility measures exhibit additive measurement error. Lower frequency data, such as monthly data, highlight this error

more prominently. An increase in correlation at lower frequency would result from an increasing additive measurement error in variance-covariance estimates in such a situation.⁶ It should be noted, however, that no theory suggests that correlations would differ according to data frequency. Nevertheless, the data in this study are collected at multiple frequencies in order to avoid any possible bias caused by data frequency. We do not make any predictions regarding a differential trend based on the frequency of data.

A descriptive statistic for daily, weekly, and monthly returns on the stock market and REITs indices is presented in panel A of Table II. The risk-return relationships in both countries differ when the standard deviation is used as a proxy for risk. It is true that both the US REIT index and Turkish REIT index are riskier than respective stock market indices. However, while the US REIT index has achieved higher average returns than the corresponding stock market index, the Turkish REIT index has managed to achieve less than half the average returns of the stock market. Table II also reports the Augmented Dickey-Fuller and Ljung-Box (LB) tests. According to the ADF test, it is hypothesized that the return series during the sample period are all stationary. In the LB test, it is hypothesized that there is autocorrelation both in returns and in squared returns up to the lag of 20. For detecting autocorrelation in time series, the LB test is applied to the residuals, while for detecting volatility clustering, the LB test is applied to the squared residuals. It can be concluded from these results that there is some indication that volatility clustering occurs within the return series, an indication that the GARCH model may be appropriate to describe time-varying volatility processes. In addition to the test statistics reported in Table II, Figure 1 also depicts volatility clustering, which confirms the appropriateness of the GARCH model.

Figure 1 shows that in the US, REITs have performed better than the stock market, whereas in Türkiye the opposite is true. Idzorek *et al.* (2007) argues that securitizing direct real estate investment in the US increased market scrutiny, which led to gradual efficiency gains, which ultimately led to outperformance of real estate returns. In light of the fact that Türkiye is an emerging economy, its REIT market is far from being developed. Therefore, one may conclude that inefficiencies

⁶In the presence of a measurement error, both GARCH and DCC coefficient estimates are biased, and the degree of bias is directly proportional to the measurement error.

Table II: Descriptive Statistics

Data are index returns for the period from December 2001 to December 2016 and obtained from *DataStream*. *Equity* is percentage return on BIST National All Price Index (TKNATA(PI)) and S&P 500 Composite Price Index (S&PCOMP(PI)) in Türkiye and in the U.S., respectively. *REITs* is the percentage return on BIST REAL ESTATE Price Index (TKRLEST(PI)) and FTSE/NAREIT Equity REITs Price Index (NAREQR\$(PI)) in Türkiye and in the U.S., respectively. Mean, median, maximum, minimum, standard deviation, skewness, excess kurtosis, Jarque-Berra test of normality, and unconditional correlation of index returns are reported. ADF indicates the Augmented Dickey-Fuller, LB20 stands for Ljung-Box Test on returns with lag 20, and LB^2_{20} represents Ljung-Box Test on squared returns with lag 20.

	Daily		Weekly		Monthly	
	Equity	REITS	Equity	REITS	Equity	REITS
Panel A: Descriptive Statistics - Türkiye						
Panel A: Descriptive Statistics - Türkiye						
Mean (%)	0.0412	0.0193	0.2147	0.0942	0.9157	0.3528
Median (%)	0.0265	0.0208	0.5464	0.2384	1.3604	0.9040
Maximum (%)	17.7649	18.0183	25.7829	34.5811	43.2719	41.1410
Minimum (%)	-19.9784	-19.1011	-30.3691	-26.8807	-43.6675	-41.9402
Std. Dev. (%)	1.9923	2.0662	4.4504	4.6976	9.7303	10.7789
Skewness	-0.1595	-0.349	-0.3321	-0.3693	-0.1874	-0.3084
Excess Kurtosis	11.5689	11.0264	8.4137	10.6932	5.6005	5.1255
Jarque-Bera Test Statistic	17579***	15519***	1421***	2854***	75***	53***
N	5738	5738	1147	1147	263	263
$CORR_{equity}$		0.8208		0.8265		0.8538
ADF	-16.78***	-16.08***	-11.49***	-10.81***	-5.92***	-5.91
LB20	62.93***	73.59***	44.87***	38.03***	23.60	14.40
LB^2_{20}	2924.91***	3207.81***	306.41***	95.23***	126.69***	69.76***
Panel B: Descriptive Statistics - US						
Mean (%)	0.0214	0.0242	0.1043	0.1173	0.4673	0.5203
Median (%)	0.0323	0.0359	0.2406	0.2782	1.0618	1.2223
Maximum (%)	10.9572	16.8755	11.4237	21.6023	11.9421	26.6235
Minimum (%)	-12.7652	-21.5324	-20.0837	-29.8618	-18.5636	-38.4337
Std. Dev. (%)	1.2158	1.7658	2.5035	3.4474	4.3753	6.1820
Skewness	-0.4022	-0.5539	-0.9706	-0.7601	-0.7317	-1.6774
Kurtosis	14.6038	26.3453	10.918	16.1828	4.4968	12.3518
Jarque-Bera Test Statistic	32347***	130594***	3176***	8416***	48***	1081***
N	5738	5738	1147	1147	263	263
$CORR_{equity}$		0.7098		0.6834		0.6486
ADF	-17.94***	-17.28***	-11.00***	-11.99***	-5.78***	-6.36***
LB20	132.05***	253.20***	34.31***	64.81***	22.01	64.01***
LB^2_{20}	8013.34***	10705.46***	370.12***	1081.93***	66.63***	96.69***

***, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively.

in the Turkish REIT market may be a consequence of insufficient scrutiny.

IV. Methodology

We model dynamic conditional correlations between daily stock and REIT returns utilizing the Asymmetric DCC (ADCC) process of Cappiello *et al.* (2006), which is derived from Engle (2002)'s DCC process.

The ADCC process is estimated in two steps. As a first step, each return series is used to estimate univariate asymmetric GARCH models following the Glosten *et al.* (1993) approach. A conditional correlation dynamic is calculated in the next step (Chong *et al.*, 2009; Cappiello *et al.*, 2006; Yang *et al.*, 2012).

Our AR(1)-GJR(1)-GARHC(1,1) model is defined in Equation 2:

$$r_{i,t} = \delta_{i,0} + \delta_{i,1}r_{i,t-1} + \varepsilon_{i,t}, \quad \varepsilon_{i,t} \sim N(0, h_{i,t}) \quad (1)$$

$$h_{i,t} = \omega_i + \alpha_i \varepsilon_{i,t-1}^2 + \gamma_i I_{i,t-1} \varepsilon_{i,t-1}^2 + \beta_i h_{i-1} \quad (2)$$

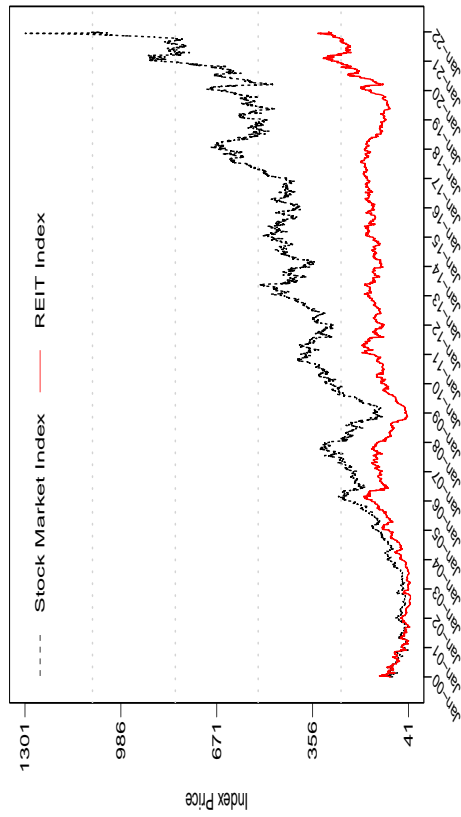
where $h_{i,t}$ is the conditional variance of the standardized disturbances, $\varepsilon_{i,t}$ is the innovation of asset i at time t , and $r_t = \log(\text{return}_{i,t}) - \log(\text{return}_{i,t-1})$ are the excess return rates.⁷ i is the stock market index, the REIT index or a REIT firm. The parameter γ_i captures the asymmetric effect of negative shocks. $I_{i,t-1}$ is an indicator function that takes value of 1 when residuals are negative and 0 otherwise.⁸

As demonstrated in Case *et al.* (2012b), using a DCC model for large and time-varying covariance matrices of multiple assets can produce a dynamic correlation path while maintaining consistency. A dynamic correlation between two markets is obtained through Equation 3 based on

⁷In this study, return and excess return terms are used interchangeably.

⁸To ensure a non-negative volatility process from GARCH(1,1) model, coefficients are restricted with non-negativity; the intercept, the coefficient of past shocks α and that of past conditional variance β . Also, $\alpha_i + \beta_i < 1$ ensures that the process is stationary.

(a) Turkey



(b) US

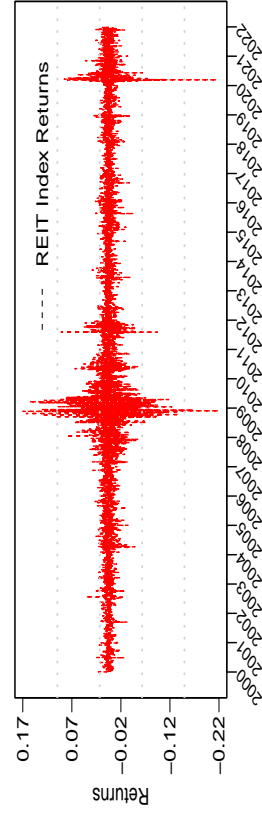
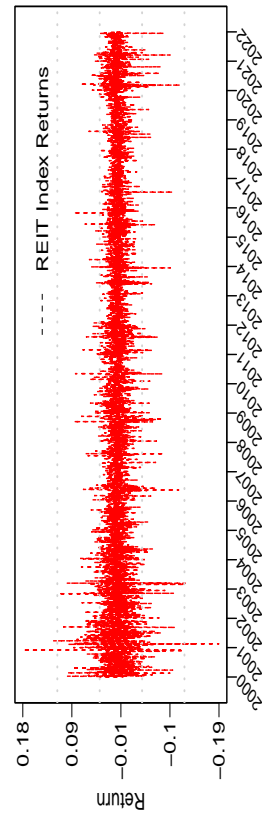
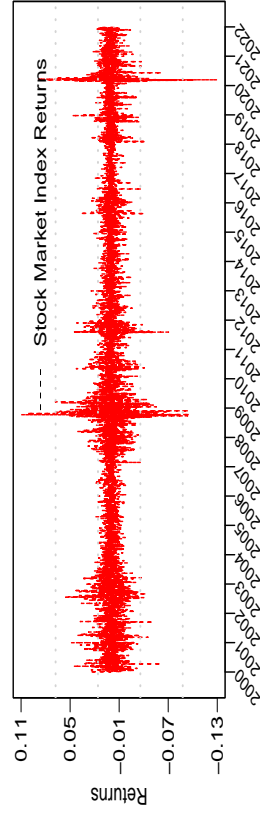
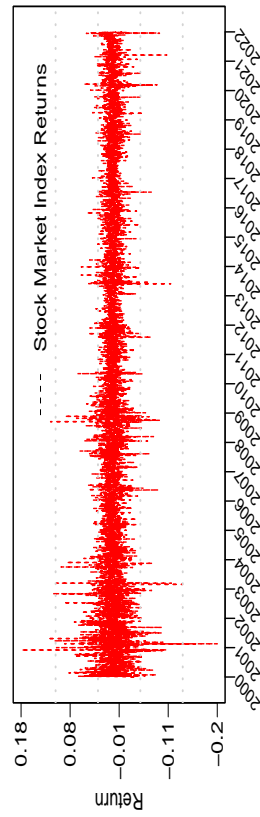
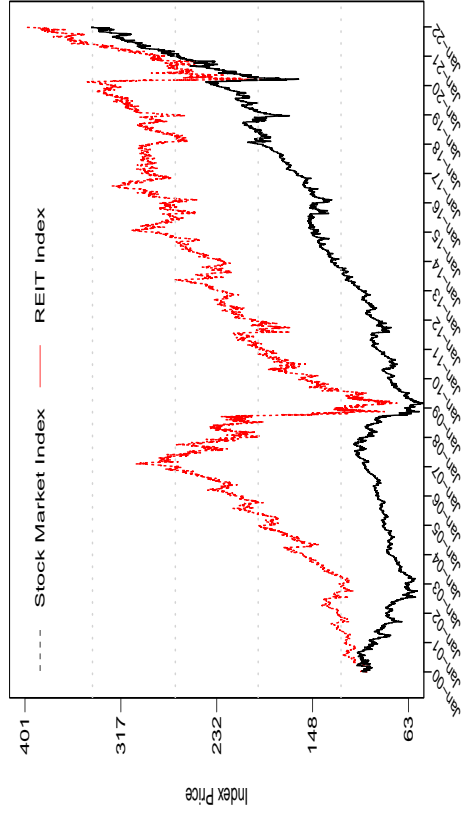


Figure 1. Performance of Stock Market and REIT Indices

Data are index prices and returns for the period from January 2000 to December 2021 obtained from *DataStream*, in TR and USD. For the data from Turkey, *Equity* and *REITs* are percentage returns on BIST National All Price Index and BIST REAL ESTATE Price Index. For the data from the U.S., *Equity* and *REITs* are percentage returns on S&P 500 Composite Price Index and FTSE/NAREIT Equity REITs Price Index.

the conditional variance calculated in the first step.

$$q_{ij,t} = (1 - a - g - b)\overline{\rho_{ij}} + a\eta_{i,t-1}\eta_{j,t-1} + gI_{ij,t-1}\eta_{i,t-1}\eta_{j,t-1} + bq_{ij,t-1} \quad (3)$$

$$\eta_{i,t} = \varepsilon_{i,t}D_{i,t}^{-1} = \frac{\varepsilon_{i,t}}{\sqrt{h_{i,t}}} \quad (4)$$

where $q_{ij,t}$ is conditional-covariance, $\overline{\rho_{ij}}$ is unconditional correlation between residuals of time series i and j , and standardized disturbances, $\eta_{i,t}$, are derived from the first step estimation of conditional volatility. The subscript i is the stock market index and j is either the REIT index or an individual REIT firm. a and b are parameters representing the effect of past shocks and past conditional covariance on current covariance, g is the asymmetric effect parameter and represents the impact of negative news on conditional correlations.⁹ The conditional correlations are obtained using the conditional variances from the first stage via the GARCH model run for each time series separately and conditional covariance from the second stage via the ADCC model run for all-time series at once: $\rho_{ij,t} = \frac{q_{ij,t}}{\sqrt{q_{ij,t}}\sqrt{q_{ij,t}}}$, where $\rho_{ij,t}$ represents conditional correlations.¹⁰

In the next step, we perform a time series analysis. Based on the estimated dynamic correlation between the REIT and stock markets, we examine a number of research questions. The first question relates to the REIT market's dividend policy and how it affects its correlation with the stock market. Moreover, the study examines whether the relationship between dividend policies and the

⁹The reverting process implies $a + b < 1$ and the non-negativity of coefficients a and b . The persistence of the correlation gets stronger as the sum of the two coefficients gets closer to 1.

¹⁰The two-step estimation of the ADCC-GARCH model by Engle (2002) is as follows. Assuming normality, the log-likelihood function can be decomposed into two components that can be maximized separately, which is equivalent to maximizing it at once: $L(\theta, \phi) = L_v(\theta) + L_c(\theta, \phi)$.

$$L = -\frac{1}{2} \sum_{t=1}^T \begin{bmatrix} n \log(2\pi) + 2 \log(|D_t|) + r_t' D_t^{-1} R_t^{-1} D_t^{-1} r_t \\ -\eta_t' \eta_t + \log(|R_t|) + \eta_t' R_t^{-1} \eta_t \end{bmatrix} = \begin{bmatrix} L_v(\theta) \\ L_c(\theta, \phi) \end{bmatrix}$$

In this specification, the log-likelihood function to be maximized is given in two parts. In the two-step estimation process, the conditional volatility part of the function is maximized and the parameters estimated in that first step are used to compute standardized residuals to be then used in the second step, the maximization of the log-likelihood function for the conditional covariance. Engle & Sheppard (2001) suggest a first stage estimation stage where the correlation matrix R_t is replaced by an identity matrix; $L_v(\theta) = -\frac{1}{2} \sum_{t=1}^T (n \log(2\pi) + 2 \log(|D_t|) + r_t' D_t^{-1} I_t^{-1} D_t^{-1} r_t)$, which is equivalent to the univariate estimation of GARCH models. In this representation, the first stage of likelihood does not depend on the correlation parameters, therefore maximizing this part is equivalent to maximizing the univariate GARCH models. In the second step, the estimation is conditional on the parameters estimated in the first stage; $L_c(\theta, \phi) = -\frac{1}{2} \sum_{t=1}^T (-\eta_t' \eta_t + \log(|R_t|) + \eta_t' R_t^{-1} \eta_t)$. The second part of likelihood is maximized only with respect to components directly affecting the correlation parameters. The maximum derived from the second step is a function of the first step parameter estimates, therefore consistency of second step ensures consistency of the first step.

time-varying correlations of REITs with the stock market varies between our samples, which have differing REIT regularities with respect to dividend distributions. In addition, we aim to provide an answer to a question that is frequently raised by market participants and academics. That is, how financial outbreaks affect the correlation process. The rise in correlations during these outbreaks would indicate that REITs are less able to diversify stock market portfolios at a time when they are required most. The final step involves examining whether the correlation series shows any long-term trends.

To answer these research questions, we consider a modified version of a commonly used model (Liow & Addae-Dapaah, 2010; Chong *et al.* , 2009, 2012; Dua & Tuteja, 2016; Abuzayed *et al.* , 2020):

$$\begin{aligned} Model1 : \widehat{CORR}_t = & \alpha + \sum_{p=1}^P \beta_p \widehat{CORR}_{t-p} + \lambda_1 GFC + \lambda_2 GCPC + \lambda_3 DivInd_t \\ & + \lambda_4 Trend_t + \lambda_5 MktCap_t + \varepsilon_{i,t} \end{aligned} \quad (5)$$

$$\begin{aligned} Model2 : \widehat{CORR}_t = & \omega + \theta_1 GFC + \theta_2 GCPC + \theta_3 DivInd_t + \theta_4 Trend_t \\ & + \theta_5 MktCap_t + \xi_{i,t} \end{aligned} \quad (6)$$

$$\begin{aligned} Model3 : \widehat{CORR}_t = & \psi + \sum_{p=1}^P \Omega_p \widehat{CORR}_{t-p} + \delta_1 GFC + \delta_2 GCPC + \delta_3 DivInd_t \\ & + \delta_4 Trend_t + \delta_5 MktCap_t + \delta_6 Turkiye_t + \delta_7 Turkiye_t DivInd_t \\ & + \epsilon_{i,t} \end{aligned} \quad (7)$$

$$\begin{aligned} Model4 : \widehat{CORR}_t = & \mu + \kappa_1 GFC + \kappa_2 GCPC + \kappa_3 DivInd_t + \theta_4 Trend_t \\ & + \theta_5 MktCap_t + \kappa_6 Turkiye_t + \kappa_7 Turkiye_t DivInd_t + \zeta_{i,t} \end{aligned} \quad (8)$$

where \widehat{CORR}_t refers to the conditional correlation at time t between the two market indices estimated from the Asymmetric DCC-GARCH framework. GFC_t and $GCPC_t$ are dummy variables that take the value of one in the 2008 global financial crisis period and the global Covid-19 pan-

demic period, respectively. $Turkiye_t$ is another dummy variable that equals to one Türkiye and zero otherwise. $DivInd_t$ is a dividend payout index created using all dividend payouts of individual REIT firms. $Trend_t$ is a linear time trend variable. $MktCap_t$ is the sum market capitalization of all REITs, serving as a control variable.^{11 12} There is no assumption of a *reverse relationship* between the dependent variable and the regressor variables. We therefore have contemporaneous variables. Our research design of not considering lagged control variables would also be supported by the presence of significant lagged dependent variables. We collect all data from the *Refinitiv Eikon* database.

We consider two regression models. One of them includes the lag dependent variable (LDV), while the other excludes it. An LDV may suppress the effects of other explanatory variables when it is included in a regression as an independent factor. Consequently, coefficient estimates for exogenous variables will be biased. The use of a lag dependent variable in the presence of serial correlation could potentially undermine the significance of other explanatory variables. However, without the LDV, the regression model may suffer from the omitted variable problem, and coefficient estimates for explanatory variables may become biased, simply reflecting persistence in

¹¹The literature finds that Funds from Operations (FFO) can explain dividend policy of REITs (Ben-Shahar *et al.* , 2011; Hayunga & Stephens, 2009). However, the usefulness and the reliability of FFO is often questioned since this measure is voluntarily reported and hence un-audited. Additionally, FFO is not prepared according to Generally Accepted Accounting Principles (GAAP). Several studies in the literature find that FFO is closely associated with stock returns (Gore & Stott, 1998; Vincent, 1999). Although this feature of FFO gives the ability to forecast dividends, FFO is more of a performance measure and contains information about a firm's dividend-paying ability. Our dependent variable in Equations IV and IV is not a REIT firm's performance, but its correlation with the stock market. Assuming market's expectations on the dividend policy is related to a firm's dividend-paying ability, FFO measure in the equations above would capture how market expectations on the dividend payout policy affect the firm's correlations with the market. Hence, we do not consider FFO to measure the dividend payout policy of REITs and use the dividend payout ratios. Our study examines whether a firm's actual dividend payouts (not expectations) are related to its correlation with the market.

¹²Miller & Modigliani (1961) show that the market price of firms depends on all dividend and non-dividend cash flows such as stock repurchases. Stock repurchases have become an increasingly important method of distributing cash payments to shareholders. Recent literature has documented that the cash-flow measures that include repurchases, in contrast to conventional dividend yield measures, has strong predictive power for returns (Robertson & Wright, 2006; Haw *et al.* , 2011; Boudoukh *et al.* , 2007; Andriosopoulos & Lasfer, 2015). This line of literature argues that managers who take repurchase decisions are motivated by several reasons including information signaling (Chan *et al.* , 2004; Dittmar, 2000). Hardin III & Hill (2008) conclude that REITs use dividends or stock repurchases to reduce their cost of capital. However, another line of literature argues that the information content of repurchases depend on investor protection level of the environment. And in a weak investor protection environment, stock repurchases may be used to mislead investors or extract private benefits ((Chan *et al.* , 2010; Gong *et al.* , 2008; Hribar *et al.* , 2006).

correlation.¹³

Figure 2 compares the average dividend payout ratio of REITs and the stock market in Türkiye and the US. The average dividend payment of Turkish REITs was lower than that of other firms before the 2008 global financial crisis. Following the crisis, Turkish REITs abandoned their low- or zero-dividend payout policies and increased their dividend payments. The opposite is true in the US. It is our hypothesis that REITs' correlation with stock markets will change if dividend payout ratios increase or decrease. We expect dividend payout ratios to be negatively correlated with correlation processes. Increasing (decreasing) dividend payouts were observed in REITs in Türkiye (the US) during the financial crisis. Our hypothesis is that dividend changes by these REITs during the crisis would result in a decrease in the correlation if dividend changes are large enough. This would imply a negative coefficient estimate for dividend payout policy. Moreover, the dividend response of Turkish REITs to the 2008 financial crisis was fast and drastical. A similar response is not present during Covid-19.

First, Equations 5 and 6 are run separately for each country. We also combine our two samples into one and run equations 7 and 8 with this combined sample. Developed from the first two equations, these equations include a country dummy variable and an interaction term between the country dummy variable and the dividend payout variable. This model specification interprets the *DivInd* coefficient differently than the previous specification. The *DivInd* coefficient in Equations 5 and 6 is calculated separately for each country and measures the association between the dividend policy of the REIT market and the correlation process. In spite of the fact that we can compare the sign and significance of the coefficient in Equations 5 and 6 across countries, we cannot determine whether its magnitude varies from country to country. The coefficient of the interaction term in equations 7 and 8 allows for a magnitude comparison of countries. If, for example, coefficient estimates on *DivInd* and *TurkiyeDivInd* variables are both significant and have different signs, we would conclude that the magnitude of the relationship between dividend

¹³ There is a possibility that the coefficient estimates in both regression models are biased. In Monte Carlo analyses, Achen (2001); Keele & Kelly (2006) demonstrate that the inclusion and exclusion of a lag dependent variable may bias coefficient estimates.

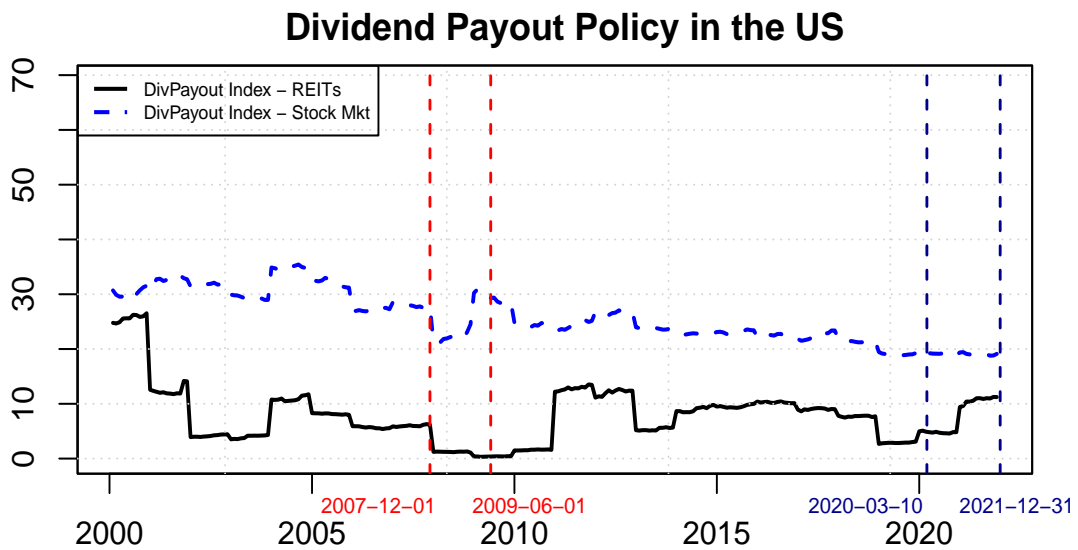
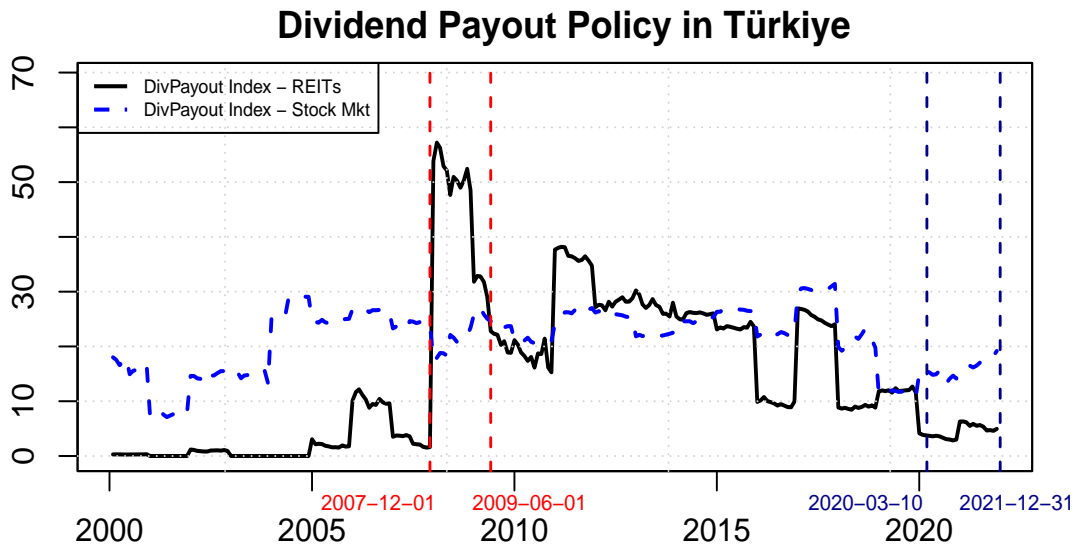


Figure 2. Average of Dividend Payout Ratios

This figure presents average dividend payout ratios of stock and REIT markets in Turkey and in the US. The vertical dashed red lines mark December 2007 and June 2009, which represent the beginning and the end of the 2008 global financial crisis, respectively, according to the National Bureau of Economic Research. The vertical dashed blue lines mark the beginning of the global Covid-19 pandemic crisis period.

policy and correlations differs by country.

It is necessary to ascertain the univariate properties of the correlation time series before proceeding with time series analysis. Statistical tests must be performed to determine whether the data are non-stationary and to determine whether structural breaks exist in the correlation process. For this purpose, three unit root tests are used in this study. Literature provides methodologies for determining the timing of possible breaks in the correlation process, either unknown (endogenous) or known (exogenous). This study used endogenous break unit root tests. We assume that the break will take place during the period of time assumed to be known, but the exact date is unknown.

It has been documented that structural breaks can have a profound impact on global markets when they occur in correlations. The financial crisis in 2007 caused a structural break in the correlation between the US real estate and stock markets, as documented by Yang *et al.* (2012). This is consistent with the dates announced by the National Bureau of Economic Research (NBER) in its report on the 2008 Global Financial Crisis: December 2007 and June 2009. We also use NBER's announced dates to determine the time period during which the global financial crisis occurred. As a precaution, we allow for a 6-month lag and lead period for breaks to occur in the event that some REIT firms experience a break in their return correlations with the stock market index 6 months prior to or after the crisis period. We call this period *the extended crisis period*. In our sample, the global Covid-19 pandemic period starts in March 2020 and the period is not extended since any potential structural break in the correlation process cannot be attributed to the Covid-19 pandemic.

Taking into account the effects of the crisis on the correlations between the stock and REIT markets, we allow for a structural break in the correlation process and explore the timing of a possible structural break during the extended crisis period using unit root tests for structural breaks by Zivot & Andrews (2002) (ZA, henceforth), Perron (1997) (PA, henceforth) and Lee & Strazicich (2003) (LS, henceforth).

ZA is a test for endogenous sequential ADF to determine a possible gap between two dates. The break point is set at the point where the test statistic from the ADF test is minimum or most

negative. A break point is defined as the point at which the evidence is least favorable to the null hypothesis of a unit root. The PP test is another extension of the ADF test. This test uses dummy variables in the regression and identifies a break point by investigating the significance of these dummy variables. Additionally, a recently developed LS test is conducted to ensure robustness. The LS test is a Lagrange Multiplier-based structural break test that has been developed as a means of circumventing the difficulties associated with the ZA and PP tests.

V. Empirical Results

We present empirical results of AR(1), GJR(1) - GARCH(1,1), and ADCC(1,1) models along with visual evidence on the conditional correlation of stock market index with REIT index in the first part of this section. Time series analysis is discussed in the second part.

AR(1)-GJR(1)-GARCH(1,1), and the ADCC(1,1) Results

Panel 1 of Table III reports parameter estimates for both countries using the GJR-GARCH process between January 2000 and December 2021. At daily frequency, all parameters are statistically significant, indicating that the GJR-GARCH(1,1) model is able to capture the temporal dependence and asymmetry in the volatility process of REITs and stock markets. Accordingly, the common assumption of constant variance cannot be supported empirically.

The α parameter represents the effect of past shocks on volatility (ARCH parameter). For both equity and REIT indices in Türkiye, this parameter is significant only at daily frequencies. Equity index α parameter estimates in the US are significant on a daily basis, while REIT index α parameter estimates are significant on a daily and weekly basis. The β parameter measures how persistent the volatility process is (GARCH parameter). Turkish market-level estimates range from 0.8878 to 0.9230 for equity and from 0.8217 to 0.9643 for REITs. β parameter estimates for the US equity index range from 0.7042 to 0.8990, and for REIT indexes from 0.7070 to 0.8699. Each daily β estimate is statistically significant at 1 percent in both countries. In both countries,

the persistence parameter of REIT index volatility is lower than stock index volatility. Daily data in Türkiye and monthly data in the US show the lowest persistence parameter among all three frequencies.

As the asymmetry parameter γ has no restrictions on its sign, the parameter estimate can be either positive or negative. Both countries' empirical results demonstrate that the asymmetry parameter γ is positive at the market level and is statistically significant at the 1 percent significance level. Negative shocks to both markets increase the market level volatility of returns in both countries. The results of this study are in agreement with the literature. Stock market returns appear more vulnerable to negative shocks in both countries due to the larger asymmetry parameter. Using a DCC(1,1) - GARCH(1,1) model, Case *et al.* (2012b) estimate statistically significant ARCH and GARCH parameters that are similar to those estimated in this study.

Asymmetric Dynamic Conditional Correlation (ADCC) estimation results are presented in Panel 2 of Table III. The parameter a indicates how past shocks affect correlations. Both countries show statistically significant impacts of past shocks, as shown in the table. As a measure of the persistence of the correlation process, parameter b represents the effect of the lag one variance-covariance on the current variance-covariance. A statistically significant and highly persistent parameter is present in the variance-covariance process. g represents the leverage effect, which shows how the variance-covariance process or, equivalently, the correlation process behaves during an economic downturn. Considering daily data, the table indicates that the asymmetry effect in the correlations is significant and positive in both countries. Asymmetric effects are not robust in weekly and monthly correlations, suggesting that negative shocks are absorbed over time. Additionally, the table shows that shocks in Türkiye have a larger asymmetric effect than those in the US.

In Figures 3 and 4, we illustrate the evolution of the conditional correlation between the stock market and the REIT indices as well as the time-varying volatility of the stock market index at daily, weekly, and monthly data frequencies for Türkiye and the US, respectively. The daily conditional correlation processes in Türkiye are generally high, which is also evident in the weekly and monthly correlation processes. Additionally, a slightly downward trend is present in the daily correlation. Weekly and monthly conditional correlations exhibit a stronger downward trend.^{14 15} In general, high correlations with a negative slope in the Turkish market suggest that REITs offer only a low degree of diversification for stock market investors, but this has been increasing over time. Another observation is the obvious relationship between variance and correlation: at times of high variance, the correlation is greater. Both the GFC and the GCPC periods demonstrate this phenomenon.

In the US, however, the situation is quite different. There is a lower correlation between stock indices and REIT indices in the US than in Türkiye. Unlike the negative trend in Türkiye, the correlation between stock indices and REIT indices in the US is positive. However, the correlation process between the GFC and the GCPC periods shows a declining trend. Regarding the relationship between variance and correlation, while it is less apparent in US data, the correlation increases when volatility spikes. The same phenomenon occurred during the GFC and the GCPC periods in the US as well. In times of high market volatility, an increase in correlation reduces the diversification potential of REITs. The correlation between the stock market index and the REIT index in the US appears to be positively related to stock market volatility, which is also supported by the literature (Chong *et al.*, 2009).

Despite a downward slope in Turkish correlations, as well as an upward slope in US correlations, a formal investigation is needed to determine if there is a deterministic trend and its sign, which we will undertake in the next section. The downward slope of the correlation is an intriguing

¹⁴There are several possible explanations for the high correlation between the stock market and the real estate market. It is possible that the correlation has an upward bias as a result of REITs appearing in both the stock market index and the real estate market index.

¹⁵The trend coefficient in the figures is calculated as follows: $Corr_{i,t} = \alpha + \beta Trend_t + \epsilon_{it}$ where $Trend$ is a deterministic time trend variable that increases by 1 every day, week, or month.

Table III: GJR - GARCH(1,1) and ADCC(1,1) Models Coefficients Estimates

The table presents the parameter estimates of GARCH(1,1)^a, and ADCC(1,1)^b models for the Turkish and the U.S. markets. Data are index returns for the period from December 2001 to December 2016 and collected from *DataStream* in local currencies. *Equity* and *REITs* are percentage returns on BIST 100 Equity Price Index and BIST REIT Price Index in Türkiye and percentage returns on S&P Composite Price Index and FTSE/NAREIT Equity REITs Price Index in the U.S. GARCH(1,1) model estimates are reported in Panel 1; A-DCC(1,1) model estimates are given in Panel 2.

	Daily		Weekly		Monthly	
	Equity	REITs	Equity	REITs	Equity	REITs
Panel 1: GARCH(1,1) Model Coefficient Estimates						
Panel 1-A: Türkiye						
α_i	0.0625	0.1107	0.0561	0.0293	0.0202	0.0183
<i>p-value</i>	0.0008	0.0001	0.1034	0.1965	0.6864	0.5852
β_i	0.8878	0.8217	0.923	0.9643	0.9000	0.9069
<i>p-value</i>	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
γ_i	0.0646	0.0596	0.0136	-0.0032	0.0982	0.1091
<i>p-value</i>	0.0187	0.0652	0.5697	0.8642	0.0679	0.0628
Panel 1-B: US						
α_i	0.0003	0.0710	0.0442	0.1606	0.0001	0.0001
<i>p-value</i>	0.9673	0.0000	0.2856	0.0089	0.9999	0.9999
β_i	0.8990	0.8699	0.7042	0.7070	0.7264	0.6870
<i>p-value</i>	0.0000	0.0000	0.0000	0.0000	0.0001	0.1261
γ_i	0.1605	0.0880	0.3795	0.1157	0.3301	0.3514
<i>p-value</i>	0.0000	0.0000	0.0002	0.274	0.0188	0.1690
	$\widehat{CORR}_{Equity,REITs}$		$\widehat{CORR}_{Equity,REITs}$		$\widehat{CORR}_{Equity,REITs}$	
Panel 2: ADCC(1,1) Model Coefficient Estimates						
Panel 2-A: Türkiye						
a	0.0282		0.0264		0.0001	
<i>p-value</i>	0.0001		0.0022		0.9999	
b	0.9326		0.9547		0.9319	
<i>p-value</i>	0.0000		0.0000		0.0000	
g	0.0292		0.0001		0.0498	
<i>p-value</i>	0.0032		0.9999		0.2038	
Panel 2-B: US						
a	0.0302		0.0431		0.0812	
<i>p-value</i>	0.0000		0.1754		0.0918	
b	0.0984		0.8663		0.8483	
<i>p-value</i>	0.0000		0.0000		0.0000	
g	0.0161		0.0379		0.0492	
<i>p-value</i>	0.0242		0.2826		0.4768	

^a $h_{i,t} = \omega_i + \alpha_i \varepsilon_{i,t-1}^2 + \gamma_i I_{i,t-1} \varepsilon_{i,t-1}^2 + \beta_i h_{i,t-1}$

^b $q_{ij,t} = (1 - a - g - b) \overline{p_{ij}} + a \eta_{i,t-1} \eta_{i,t-1} + g I_{ij,t-1} \eta_{i,t-1} \eta_{i,t-1} + b q_{ij,t-1}$

P-values are estimated with robust standard errors and *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ indicate significance levels.

ing finding in this paper that distinguishes it from other studies in the field. The literature does not agree on the direction of the conditional correlation between equity and real estate markets when using DCC - GJR - GARCH family methods, rolling correlations, or other co-integration tests on daily, weekly, monthly, or quarterly data.

To the best of our knowledge, this is the first study to report on a time-varying correlation in daily frequency with the support of weekly and monthly frequencies. We use this approach to determine if the direction of the correlation between the stock market and the real estate market is time- or sample-specific, or in other words, whether it depends on the frequency of data or the sample period of the study. The results indicate that the direction of the correlation does not depend on the frequency of the data. Rather, the time period of the study and the market investigated play an influential role in determining the direction of the correlation.

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Unit-root Test Results

The purpose of this section is to present empirical results from our time series analysis. The correlation series must be stationary before time series analysis can be conducted. We first perform the ZA, PP, and LS unit root tests. Specifically, the correlation between the stock market index and REITs is tested for stationarity and the existence of a break. We conduct these tests both at the firm

¹⁶At a daily level, there is a 0.83 correlation between the stock market and REIT indices in Türkiye. High correlations may be indicative of immaturity in the Turkish REIT market. As a mature securities market, the U.S. REIT market has an unconditional correlation of 0.71 between its stock and REIT markets. Increasing maturity of the Turkish REIT market and a greater exposure to Turkish real estate over time may explain the decreasing daily time-varying correlation in Türkiye.

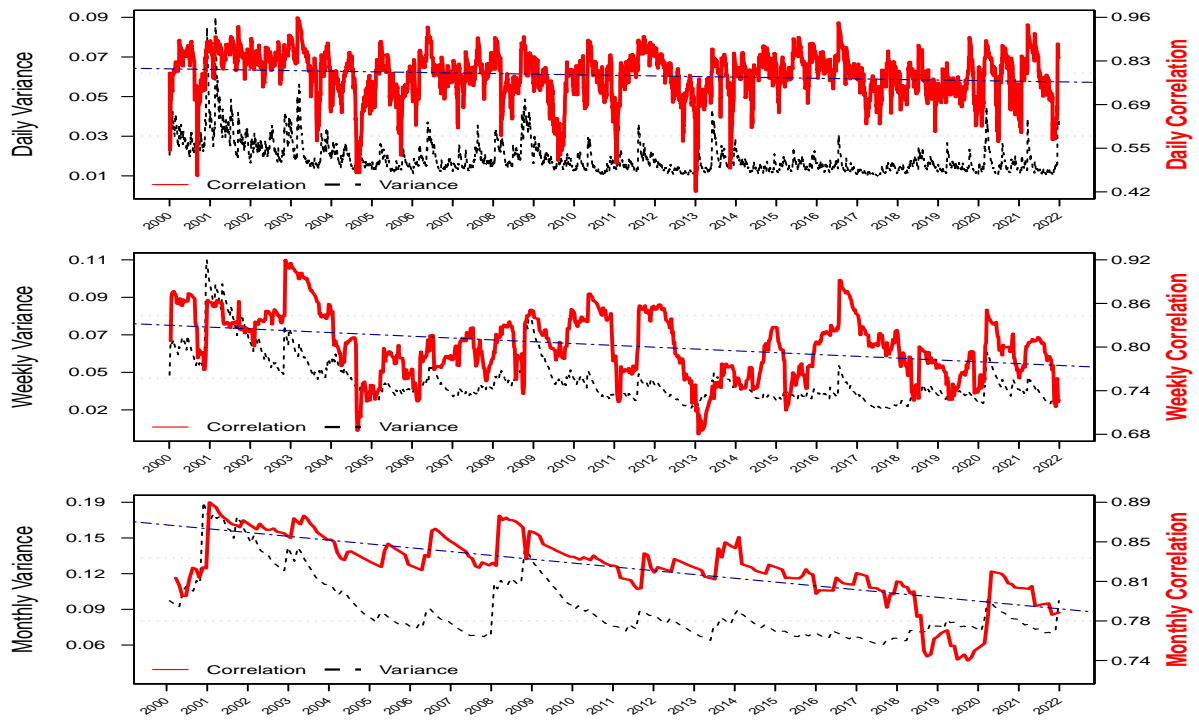


Figure 3. Turkish REITs & Stock Market Conditional Correlations and Volatilities - Daily, Weekly, and Monthly

This figure illustrates the evolution of the conditional correlation between the stock market and the REIT indices as well as the time-varying volatility of the stock market index at daily, weekly, and monthly data frequencies for Turkey.

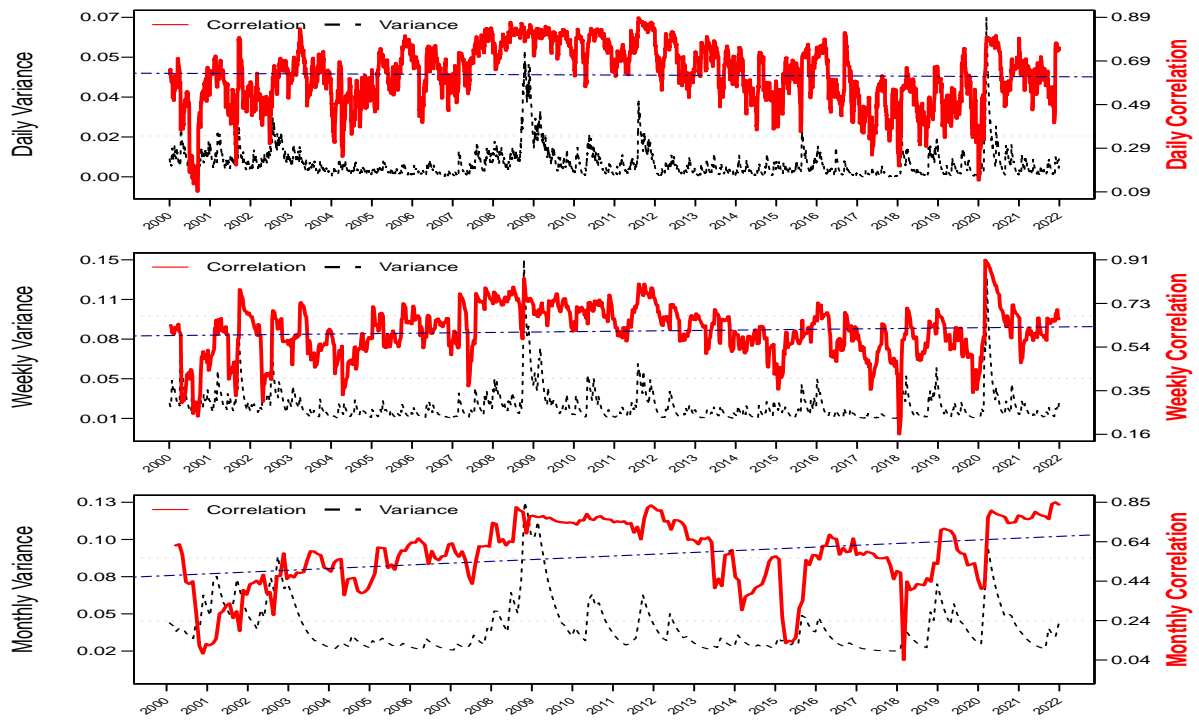


Figure 4. The US REITs & Stock Market Conditional Correlations and Volatilities - Daily, Weekly, and Monthly

This figure illustrates the evolution of the conditional correlation between the stock market and the REIT indices as well as the time-varying volatility of the stock market index at daily, weekly, and monthly data frequencies for the US.

and index levels.

The results of the unit root tests are presented in Table IV. The t-statistics and break dates at index level are presented in Panel A of the table. According to all three tests, the correlation between the stock and REIT indices is stationary with a structural break. There are inconsistencies in the timing of the break. First, there seems to be a break in the correlation process in Türkiye before the GCPC period. LS test results show that a break in correlation occurred in 2018 and 2019. ZA and BP results indicate a break between 2003 and 2004. This time period does not coincide with any of the crises discussed in this paper. As for the US markets, the ZA, BP, and LS unit root tests suggest a break in the correlation process in 2012, 2005, 2008, and 2013. Except for the first break date of the LS test, which coincides with the NBER dates for the GFC, these results are inconsistent with the timing of these crises.

The results of the unit root test at the firm level are reported in panel B of the table. A REIT firm must have 2 years of data before and after the crisis in order to be included in the test sample. Turkish test results indicate that 7-42 percent of firms that existed during the GFC period and 24-55 percent of firms that existed during the GCPC period experienced a break in their correlation with the stock market index. There were a large number of firm-level structural breaks during the GCPC period, in line with the index-level structural break just before that period. There are, however, no index-level breaks to support the firm-level breaks during the GFC. One third of US firms experienced structural breaks during the GFC period, according to ZA and BP structural break tests. The LS test suggests, however, that almost two-thirds of these firms had a break in their correlation with the stock market index. According to the ZA and LS tests, only a small percentage of US firms experienced a structural break during the GCPC period. The BP test indicates around one third did. Additionally, more than half of the breaks in correlations of US REIT firms occurred during the GFC.

Figures 5 and 6 present information from Panel B of Table IV, showing the dates of index level and firm level breaks in correlations between stock and REIT markets in Türkiye and the US. In Türkiye, the index level break was observed in 2003, 2004, and the 2018-2019 period, according to

Table IV: Unit Root Test

This table reports the results of unit root test with structural breaks. The first two columns show the results of the Zivot & Andrews (2002) test t-statistics and break. The remaining columns show the results of the Bai & Perron (1998) and Lee & Strazicich (2003) tests for structural breaks. While Panel A of the table reports the t-statistics and break dates at index level, Panel B reports firm level data analysis. "All breaks" represents the total number of breaks in the firm level correlations. "Crisis firms" is total number of existing firms during the *extended crisis period* and "Breaks" presents the number of breaks "Crisis firms" experienced. The Zivot-Andrews and Bai-Perron tests are performed on weekly data, whereas the Lee-Strazicich test is performed on monthly data to make computations easier.

	Zivot-Andrews	Zivot-Andrews Break	Bai-Perron	Bair-Perron Break	Lee-Strazicich	Lee-Strazicich Break 1	Lee-Strazicich Break 2
Panel A: Index Level Tests							
Türkiye	-5.11**	2003:12	465.92***	2004:01	-5.54***	2018:05	2019:08
US	-7.56***	2012:06	167.86***	2005:01	-5.59***	2008:07	2013:11
Panel B: Firm Level Tests							
Panel B1: Türkiye							
All breaks		11		30		22	23
GFC Perid							
Breaks		3		1		5	6
Crisis firms		14		14		14	14
GCPC Period							
Breaks		16		7		0	9
Crisis firms		29		29		27	27
Panel B2: US							
All breaks		54		128		107	101
GFC Perid							
Breaks		32		27		57	6
Crisis firms		93		93		91	91
GCPC Period							
Breaks		4		37		4	11
Crisis firms		112		112		78	78

The critical value for the Zivot & Andrews (2002) are -4.82, -5.08 and -5.57 at 10%, 5% and 1% level of significance, respectively.

The critical value for the Bai & Perron (1998) are 7.04, 8.58 and 12.29 at 10%, 5% and 1% level of significance, respectively.

The critical value for the Lee & Strazicich (2003) are -4.99, -5.29 and -5.82 at 10%, 5% and 1% level of significance, respectively.

***, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively.

the three models considered. The break dates at the firm level are dispersed throughout the sample period and do not cluster around the index-level break dates. When one examines the US data carefully, one will find that firm level breaks are clustered around and within the GFC period and before the GCPC. In spite of this, there is no consistent clustering behavior across the three unit root test models.

We conducted three different unit root tests as a means of examining whether a structural break occurs in the correlation process, especially when financial markets are unstable. The results of the structural break tests, however, were largely inconclusive. The correlations showed structural breaks, but the dates of the breaks were not synchronized with the two financial crises in our sample. While firm-level structural breaks are supportive of global crises, they are not sufficient for a conclusive assessment.

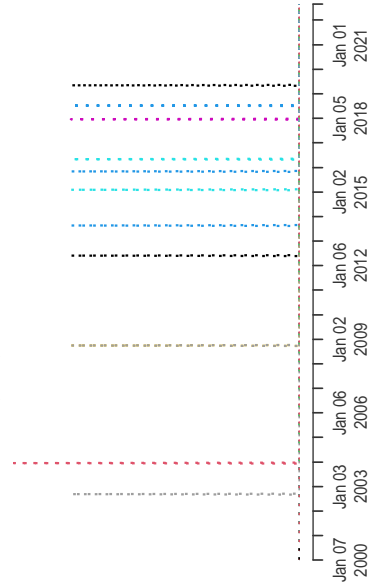
Regression Results

Table V presents the coefficient estimates of Equations 5 & 6 (Panels A1 & A2) and Equations 7 & 8 (Panel B) using index level data from Turkish and US markets. The first two columns report coefficient estimates using daily data. The most critical variable in our research is the *DivInd* variable. According to the coefficient estimates, the effect of dividend payout policy on the correlation process is negative and statistically significant. Panel A of the table shows that this result is consistent across countries and is supported by weekly and monthly data. In panel B, we combine the two samples and find that the *DivInd* variable is significantly negative, which indicates that the negative relationship between dividend payouts and correlations still holds true.

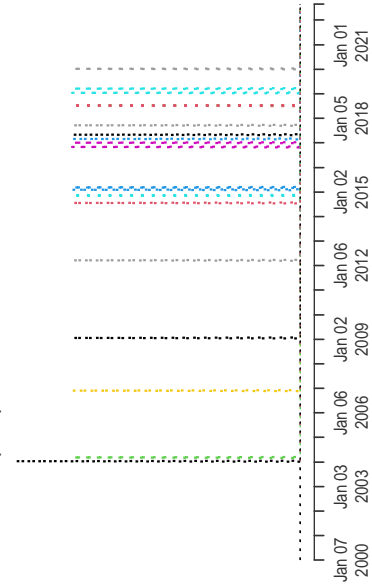
The interaction variable ($TRdummy * DivInd$) is also statistically significant and positive. That means that the negative relationship between dividend payout policy and correlations in Türkiye is less pronounced than that in the US. These coefficient estimates can be interpreted as follows. The mandatory dividend distribution requirement of 90 percent for US REITs alters their price-generating process from that of regular securities. As a result of high dividend payments, US REITs have a lower correlation with stock market indexes. This might be because regular stocks

(a) Turkey

Zivot and Andrew (1992) Structural Break

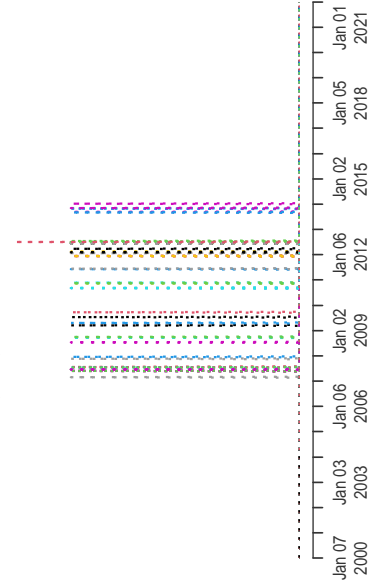


Bai-Perron (1998) Structural Break



(b) US

Zivot and Andrew (1992) Structural Break



Bai-Perron (1998) Structural Break

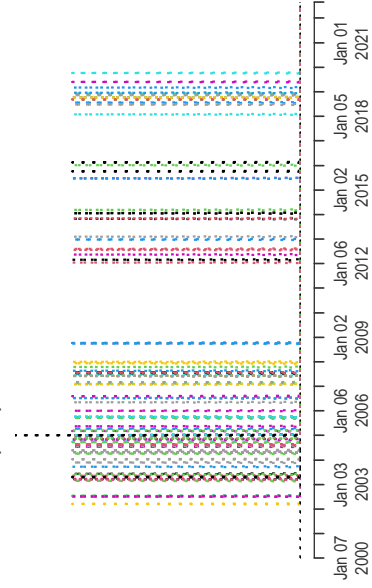
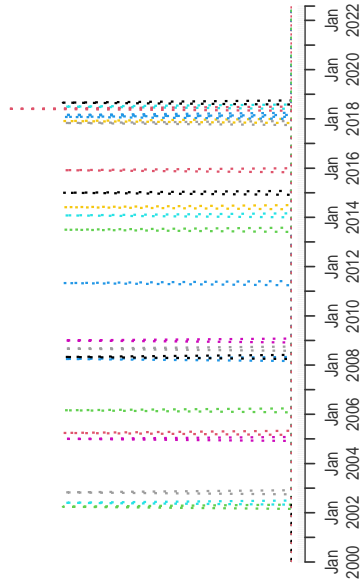


Figure 5. Dates of Structural Breaks

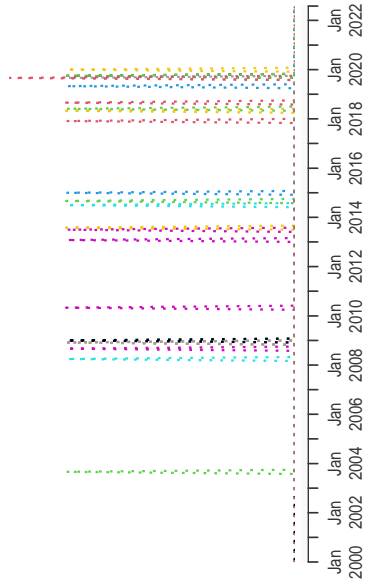
This figure reports the timing of all structural breaks at the correlations of REIT firms with stock market index. The taller line in each figure represents the timing of the structural break in the correlation process between the stock and REIT indices.

(a) Turkey

Lee and Strazizich (2003) First Structural Break

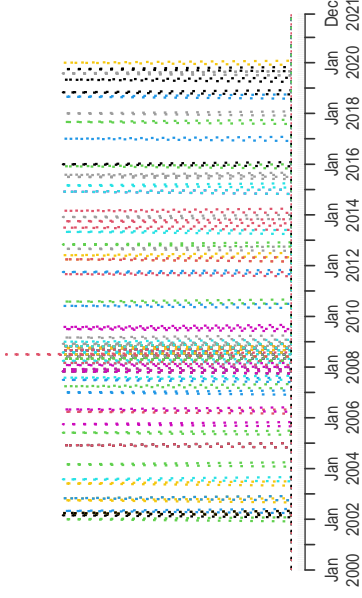


Lee and Strazizich (2003) Second Structural Break



(b) US

Lee and Strazizich (2003) First Structural Break



Lee and Strazizich (2003) Second Structural Break

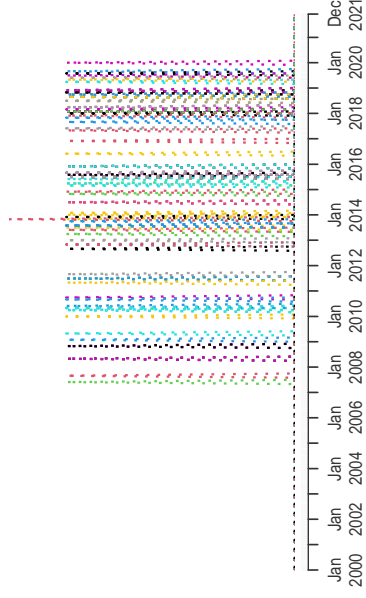


Figure 6. Dates of Structural Breaks

This figure reports the timing of all structural breaks at the correlations of REIT firms with stock market index. The taller line in each figure represents the timing of the structural break in the correlation process between the stock and REIT indices.

Table V: Time Trend Model Estimates

The table presents coefficient estimates of models investigating the relationship of dynamic correlations with two global crises, dividend policy of REITs, a time trend variable while controlling for market size of REITs. \widehat{CORR}_{t-1} refers to the conditional correlation at time $t - 1$ between the stock and REIT market indices estimated from the Asymmetric DCC-GARCH framework. $Trend_t$ is a linear time trend variable, $Div.Payout_t$ is the equally weighted average of dividend payout ratio of each REIT at time t . $MktCap_t$ is sum market capitalisation of all REITs. The constant and the control variables are not reported. The optimum number of lags based on the Bayesian Information Criterion (BIC) is one. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

	$CORR_{daily}$		$CORR_{weekly}$		$CORR_{monthly}$	
	<i>Model1</i>	<i>Model2</i>	<i>Model1</i>	<i>Model2</i>	<i>Model1</i>	<i>Model2</i>
Panel A1: Türkiye (Jan 2000 - Dec 2021)						
$Corr_{t-1}$	0.967*** (0.003)		0.964*** (0.008)		0.857*** (0.029)	
GFC	0.000 (0.001)	0.011** (0.005)	0.000 (0.002)	0.015*** (0.006)	0.001 (0.003)	0.011** (0.006)
GCPC	-0.001 (0.002)	0.007 (0.006)	0.002 (0.002)	0.032*** (0.007)	0.010*** (0.003)	0.025*** (0.007)
DivInd	-0.000 (0.000)	-0.002*** (0.000)	-0.000 (0.000)	-0.002*** (0.000)	0.000** (0.000)	0.002*** (0.000)
Trend	-0.000 (0.000)	-0.000*** (0.000)	-0.000 (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
Panel A2: US (Jan 2000 - Dec 2021)						
$Corr_{t-1}$	0.971*** (0.003)		0.892*** (0.014)		0.785*** (0.034)	
GFC	0.003** (0.001)	0.100*** (0.005)	0.011** (0.004)	0.086*** (0.009)	0.022 (0.016)	0.093*** (0.027)
GCPC	0.004*** (0.002)	0.143*** (0.006)	0.009 (0.005)	0.126*** (0.011)	0.071*** (0.020)	0.236*** (0.034)
DivInd	-0.000 (0.000)	-0.004*** (0.000)	-0.000 (0.000)	-0.004*** (0.001)	-0.004** (0.002)	-0.015*** (0.003)
Trend	0.000*** (0.000)	0.000*** (0.000)	0.000** (0.000)	0.000*** (0.000)	0.000** (0.000)	0.000*** (0.000)
Panel B: Türkiye & US (Jan 2000 - Dec 2021)						
$Corr_{t-1}$	0.975*** (0.002)		0.918*** (0.008)		0.833*** (0.022)	
GFC	0.002*** (0.001)	0.092*** (0.004)	0.007*** (0.002)	0.077*** (0.006)	0.016* (0.009)	0.083*** (0.017)
GCPC	0.000 (0.001)	0.025*** (0.004)	0.001 (0.003)	0.036*** (0.007)	0.025** (0.010)	0.087*** (0.019)
DivInd	-0.000*** (0.000)	-0.014*** (0.000)	-0.001*** (0.000)	-0.011*** (0.001)	-0.005*** (0.001)	-0.025*** (0.002)
Trend	0.000 (0.000)	0.000*** (0.000)	-0.000 (0.000)	-0.000** (0.000)	-0.000 (0.000)	-0.000*** (0.000)
TRdummy	0.001 (0.001)	0.047*** (0.005)	0.013*** (0.003)	0.149*** (0.008)	0.020* (0.012)	0.169*** (0.022)
TRdummy*DivInd	0.000 (0.000)	0.009*** (0.001)	0.001 (0.000)	0.008*** (0.001)	0.006*** (0.001)	0.025*** (0.003)

pay less dividends than REITs or do not pay them at all. Although dividends still have a negative impact on correlations in Türkiye, this relationship is not as significant as it is in the US. This is also related to the dividend payout policy in Türkiye. Generally speaking, Turkish REITs behave like general stocks due to the freedom they have on their dividend payout policy. Consequently, dividends have a relatively smaller impact on correlations. Data from weekly and monthly periods are further evidence of the negative correlation between dividend policy and correlations. The bottom line is that REITs paying higher dividends, whether they are based in Türkiye or the US, provide better portfolio diversification for stock market investors. By applying this to countries, we observe that US REITs have greater diversification opportunities due to their mandatory dividend payments.

As far as we are aware, this is the first study to examine the effects of REIT dividend policies on correlations between REIT and stock market indexes. It should be noted that the impact of dividend policies on stock prices has been well documented in the past. Despite this, there is considerable controversy surrounding the question of how dividend policy affects stock prices worldwide. Miller and Modigliani (1961) presented a theory that states that dividend policy does not have any relationship with firm value. In contrast, Gordon (1963), Lintner (1956), Black and Scholes (1974), Baskin (1989), Jensen et al. (1992), and Allen and Rachim (1996) have documented the effect of dividends on stock prices. Dividends have an effect on the stock price in both a positive and negative manner. The basic idea of these studies is that shareholders consider dividends when choosing whether to invest in other companies besides being a source of income for them. Dividends can therefore be used by managers to control stock prices.

Our study contributes to this line of literature by showing that the effects of dividend policies on stock price changes in REITs can be extended to more applications. We document that REIT dividend policy and REIT-stock market integration are related. High dividend paying REITs have more diversification benefits for stock market investors.

The next question of interest is whether financial stress has an impact on the correlations between stock and REIT markets. We examine this question by using coefficient estimates for GFC

and GCPC. Our findings reveal that the coefficient estimates for these two variables are statistically significant and positive. Therefore, the global financial crisis as well as the global Covid-19 pandemic crises both contributed positively to the correlations between REITs and stock markets in both countries, reducing the diversification potential of REITs for investors in stock markets. Based on the magnitude of the coefficient estimates, it appears that the Covid-19 pandemic period cointegrated the two markets more than the global financial crisis of 2008. Moreover, the coefficients for the weekly and monthly data are also in support of our results.

Stock market investors need investment products to diversify their portfolios during a financial crisis. The relationship between real estate securities and the stock market is therefore extremely relevant. Several studies have examined the link between a financial crisis and the integration of the stock and real estate markets. Studies documenting the integration of stock and real estate markets during the 2008 global financial crisis include Huang et al. (2016), Chen, Tsai, Sing, and Yang (2015), Luchtenberg and Seiler (2014), Hui and Chan (2013), Yang et al. (2012), and Liow (2012). Our study contributes to this literature by confirming that there was an increase in correlation during the GFC period. Additionally, we document for the first time in the literature a significant increase in the correlation during the period of the GCPC.

Regarding the deterministic trend in the correlation process, Panel A1 reports a negative deterministic long-term trend in the Turkish correlation process. Panel A2 presents a positive deterministic trend for US correlations.¹⁷ The negative time trend in Turkish correlations and the positive trend in US correlations are further supported by weekly and monthly data. As shown in Panel B, the coefficient estimates for the time variable remain positive when both Turkish and US samples are combined. However, when the data is aggregated over a period of time, namely a week and a month, it becomes negative.

Based on our literature review listed in Table I, the relationship between REITs and stock

¹⁷Portfolio managers might be interested in incorporating this trend into their trading strategies. Among all significant cases, the linear time trend coefficients are 0.000001 at the maximum. If we multiply this by the sample size of 5738, we can see that the conditional correlation decreases over time in a relatively small manner (around 0.57 percent). Consequently, it can be concluded that trending behavior does not constitute a significant factor in the conditional correlation movement.

markets has trended both upward and downward, primarily depending on the time period studied. In spite of the graphical evidence for a trend in these studies, only Fei et al. (2010) conduct a test to examine whether there is a time trend in the correlations. They do not, however, provide coefficient estimates for the time trend variable in their regression. A deterministic time trend among REITs is tested and reported by Liow and Addae-Dapaah (2010). In general, research on REIT-stock market correlations does not explicitly examine long-term trends in correlations. This gap in the literature is addressed in our study. In Türkiye and the US, we find decreasing and increasing correlations between REITs and stock markets, respectively. It appears that the direction of the long-term trend depends on the market of interest.

An imperative point to note here is that when an LDV is included in the regression as an explanatory factor, the autoregressive term may take on strong significance while suppressing the effects of other explanatory variables. There is a potential risk of squashing the significance of other exogenous explanatory variables when using a lag endogenous variable in the presence of serial correlation. Without the LDV, however, coefficient estimates may be biased due to omitted variables and may simply reflect persistence in the correlation process. Therefore, we run the model with and without the LDV.

We next turn our attention to firm level analysis and run Equations 7 and 8 using firm level data in panel model regression. We estimate the coefficients in OLS, fixed, and random effect models. Table VI reports the results of these regressions. The unreported F-test and Hausman test results indicate that the fixed effect model is a better choice among these three models. Thus, we focus on fixed effect model estimates.¹⁸

Regression coefficients at the firm-level are less conclusive than those at the index level. With Turkish data, the negative effect of dividends on the correlation process, measured by *DivInd*, is lost; however, with US data, it remains statistically significant. The relationship between the

¹⁸The GMM model would seem to be more appropriate here as an alternative since we have panel data and a dynamic model. A GMM estimator, however, can be unreliable when the number of observations over time (T) is large, but the number of observations across firms (N) is much smaller. Considering that our main sample consists of daily observations, with more than 5500 data points per firm, we do not consider GMM in our analysis. An analysis of large T overfitting bias can be found in Arellano (2003).

Table VI: Panel Model Regressions with Firm Level Data

The table presents coefficient estimates panel model regressions with firm level data. \widehat{CORR}_t refers to the conditional correlation at time t between the two market indices estimated from the Asymmetric DCC-GARCH framework. $Trend_t$ is a linear time trend variable, $Div.Payout$ is the weighted average of dividend payout ratio of each REIT at time t . $MktCap_t$ is sum market capitalisation of all REITs. The control and fixed effect constant variables are not reported. The optimum number of lags based on the Bayesian Information Criterion (BIC) is one. Panels A and B (Panel C) report coefficient estimates for Model 2 (Model 4).

	$CORR_{daily}$			$CORR_{weekly}$			$CORR_{monthly}$		
	OLS (1)	FIXED (2)	RANDOM (3)	OLS (4)	FIXED (5)	RANDOM (6)	OLS (7)	FIXED (8)	RANDOM (9)
Panel A1: Türkiye (Jan 2000 - Dec 2021)									
$Corr_{t-1}$	0.971*** (0.001)	0.956*** (0.001)	0.971*** (0.001)	0.969*** (0.002)	0.932*** (0.003)	0.969*** (0.002)	0.837*** (0.008)	0.577*** (0.012)	0.837*** (0.008)
GFC	0.001 (0.000)	0.001 (0.000)	0.001 (0.000)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.015*** (0.006)	0.024*** (0.005)	0.015*** (0.006)
GCPC	-0.000 (0.000)	0.001*** (0.000)	-0.000 (0.000)	-0.002* (0.001)	0.001 (0.001)	-0.002* (0.001)	0.002 (0.004)	0.013*** (0.005)	0.002 (0.004)
Trend	-0.000*** (0.000)	0.000 (0.000)	-0.000*** (0.000)	-0.000** (0.000)	-0.000* (0.000)	-0.000** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
DivInd	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	-0.002 (0.003)	-0.002 (0.003)	-0.002 (0.003)
Panel A2: US (Jan 2000 - Dec 2021)									
$Corr_{t-1}$	0.989*** (0.000)	0.967*** (0.001)	0.983*** (0.001)	0.948*** (0.003)	0.829*** (0.005)	0.948*** (0.003)	0.936*** (0.006)	0.814*** (0.009)	0.936*** (0.006)
GFC	0.002*** (0.000)	0.003*** (0.000)	0.002*** (0.000)	0.006*** (0.002)	0.014*** (0.002)	0.006*** (0.002)	0.011*** (0.003)	0.022*** (0.003)	0.011*** (0.003)
GCPC	-0.000 (0.000)	-0.001 (0.000)	-0.000 (0.000)	-0.004** (0.002)	-0.006*** (0.002)	-0.004** (0.002)	0.008** (0.003)	0.005 (0.004)	0.008** (0.003)
Trend	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000** (0.000)	0.000*** (0.000)	0.000** (0.000)
DivInd	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.003* (0.001)	-0.004** (0.001)	-0.003* (0.001)
Panel B: Türkiye & US (Jan 2000 - Dec 2021)									
$Corr_{t-1}$	0.9839*** (0.0004)	0.9653*** (0.0005)	0.9822*** (0.0004)	0.9631*** (0.0015)	0.9209*** (0.0022)	0.9631*** (0.0015)	0.8837*** (0.0051)	0.7016*** (0.0078)	0.8837*** (0.0051)
GFC	0.0015*** (0.0003)	0.0025*** (0.0003)	0.0017*** (0.0003)	0.0025*** (0.0010)	0.0042*** (0.0010)	0.0025*** (0.0010)	0.0151*** (0.0032)	0.0267*** (0.0032)	0.0151*** (0.0032)
GCPC	-0.0003 (0.0002)	0.0002 (0.0002)	-0.0003 (0.0002)	-0.0021*** (0.0007)	-0.0015** (0.0008)	-0.0021*** (0.0007)	-0.0002 (0.0028)	0.0009 (0.0027)	-0.0002 (0.0028)
Trend	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)
Div.Payout	-0.0000* (0.0000)	-0.0000 (0.0000)	-0.0000* (0.0000)	-0.0000 (0.0001)	-0.0000 (0.0001)	-0.0000 (0.0001)	-0.0034 (0.0021)	-0.0055** (0.0022)	-0.0034 (0.0021)
TRdummy	0.0018*** (0.0002)	0.0004 (0.0003)	0.0018*** (0.0002)	0.0040*** (0.0007)	0.0058*** (0.0013)	0.0040*** (0.0007)	0.0109*** (0.0028)	0.0487*** (0.0049)	0.0109*** (0.0028)
TRdummy*DivPayout	-0.0000 (0.0002)	0.0001 (0.0002)	0.0000 (0.0002)	0.0006 (0.0006)	0.0008 (0.0006)	0.0006 (0.0006)	0.0029 (0.0032)	0.0051 (0.0032)	0.0029 (0.0032)

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

two financial crisis periods and the level of correlations in Türkiye is still positive; but only the GCPC period has a statistically significant association with the correlations. In the US, we observe that the GCPC period is unrelated to correlations while the positive effect of the GFC period on correlations is statistically significant. Our results on the daily *DivInd*, *GFC*, and *GCPC* variables cannot be confirmed with weekly and monthly data. Finally, based on firm-level data, we find a statistically significant negative trend in Turkish daily correlations, and a positive trend in US daily correlations. These long-term trends are also supported by weekly and monthly analyses.

Global Minimum Portfolio Analysis

This study documents the association between dividend payout policy and REIT diversification. This section discusses the implications of this relationship for risk-averse investors. The section calculates the global minimum variance portfolios taking into account REIT dividend policies. In addition to the stock market index, there are two REIT-based indices in the portfolios. The REIT-based portfolios consist of the 10 REITs with the lowest (LowDiv) and highest (HigDiv) dividend payments. In light of the results in Tables 5 and 6, if dividend payments by the REIT market are positively associated with the diversification potential of the REIT market, then we should observe in the optimal portfolio that high dividend paying firms are allocated more wealth than low dividend paying firms.

Summary statistics for optimal portfolios are reported in Table 7. It is assumed in the table that there are three components that make up the market, each with its own index. These indices are the stock market index, an index of 10 REITs with the lowest dividend payments, and an index of 10 REITs with the highest dividend payments. An investor who is interested in investing in a portfolio with minimum variance allocates her wealth between these three indices. A short position on an index is permitted. According to the full sample results, the percentage of wealth allocated to REITs with high dividend payments is significantly greater than that allocated to REITs with low dividend payments. This is true in both countries. Regarding the subperiods in Türkiye, the weight of REITs with high dividend payments is always much larger than those with low dividend

payments. During the period of the GFC in Türkiye, dividend paying REITs became the most significant component of the Turkish market portfolio. In the US subperiods, REITs with high dividend payments also receive more wealth than low dividend paying REITs, with one exception, high dividend paying REITs were shorted during the 2008 financial crisis. When other subperiods are considered, high dividend paying REITs are always allocated more wealth than low dividend paying REITs during those subperiods. All in all, there are significant implications for investors arising from the results of this paper.

Table VII: Portfolio Descriptive Statistics

This table shows summary statistics for global minimum variance portfolios consisting of a stock market index, as well as two indices of REIT firms. 10 REITs with the lowest and highest dividend payments are indexed for this portfolio. The ER and SD represent the expected return of the portfolio and its standard deviation, expressed in annual terms. $wStock$, $wLowDiv$, and $wHighDiv$ represent the weights of indices of stock market, low, and high dividend paying REIT firms, respectively. A portfolio is constructed using the entire sample, pre-, peri-, and post-GFC periods, as well as the Covid19 period.

	Full Sample	Pre-GFC	Peri-GFC	Post-GFC	Covid-19
Panel A: Türkiye					
ER	0.0722	0.0788	-0.2880	0.0759	0.3300
SD	4.6587	6.1441	5.0384	3.1030	3.9900
wStock	0.3692	0.4376	-0.0811	0.2531	0.7607
wLowDiv	0.0408	0.0346	0.0594	0.0767	0.0171
wHighDiv	0.5900	0.5278	1.0216	0.6702	0.2222
Panel B: US					
ER	0.0557	0.0705	-0.2625	0.1014	0.3103
SD	3.0449	2.0042	5.4410	2.3703	3.7538
wStock	0.8822	0.2649	1.2618	0.8074	1.1176
wLowDiv	0.0012	0.0020	0.1120	0.0062	-0.2948
wHighDiv	0.1166	0.7330	-0.3738	0.1864	0.1772

VI. Conclusion

In this article, we provide a unique contribution to the literature on the dynamics of correlation between two major asset classes, REITs and stock markets. We examine two countries that have

unique dividend policy regulations for REITs, namely Türkiye and the US. To begin with, the study attempts to investigate to what extent the dividend policies of REITs may be able to influence the diversification benefits provided by the REIT market. As part of this study, we extend this question by looking at how the impact of REITs dividend policy on their diversification potential changes as their dividend levels increase and subsequently decrease. Furthermore, the study investigates whether changes in the correlation between REITs and stocks that may occur during times of financial stress can cause significant variations in the REIT market's potential to diversify during these times. As a final step, we test whether the correlation process is governed by a deterministic time trend, which will have long-term implications for market participants involved in REITs.

Our analysis shows that time-varying correlations between the stock and REIT markets, at both the index and firm levels, are related to REIT dividend policies. REITs that pay high dividends provide more diversification for stock market investors. Second, our analysis contributes to the literature of a relatively small number of studies that examine the diversification potential of REITs during periods of market instability. That is, our findings suggest that during the GFC and GCPC periods, there has been an increasing integration between the REIT and stock markets. As a result, the potential for diversification between these two markets has been reduced. There is also evidence in the study to indicate that Turkish REITs continued to provide diversification potential even during times of market crises. In contrast, US REITs lost the ability to diversify the stock market portfolio. We believe that this can be attributed to the absence of a mandatory dividend payment requirement in the Turkish REIT market. Moreover, we present a deterministic time trend in the correlation process, which will have long-term implications for market participants in the REIT market.

The findings of our study have implications for academics, practitioners, investors, portfolio managers, regulators, and policymakers who are concerned with assessing the risks associated with common market situations during periods of financial instability. Akinlana *et al.* (2019) conclude that REITs are useful in portfolios against the stock market risk. We take this argument a step forward and find that active portfolio managers not only need to take the trend and dividend payments

by REITs into account but also make their asset allocation updates based on their preferred trading time periods. For instance, consider a portfolio invested in stock market index and REIT indices. An investment strategy that updates the weights of REITs in the portfolio at a pre-determined frequency may need to increase or decrease the weight of a certain REIT index in her portfolio. The portfolio reallocations may also be due to the deterministic time-trend in the correlations since the trend in correlation turns to positive during extremely high volatility periods, such as a financial crisis in the market. Further, the findings of this paper may give regulators an insight on how the dynamics between the stock and REIT markets are and whether or not they need to update the current regulation in order make REITs a better representative of real estate market.

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