DYNAMIC RELATIONSHIP BETWEEN MACROECONOMIC VARIABLES AND RETURNS ON TURKISH REAL ESTATE INVESTMENT TRUSTS

A Master's Thesis

by

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Ankara
August 2012

To My Loving Family

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Graduate School of Economics and Social Sciences
of
İhsan Doğramacı Bilkent University

by

FETHİYE EZGİ KIRDÖK

In Partial Fulfilment of the Requirements for the Degree of
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in

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August 2012

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Science in Management.

Assoc. Prof. Zeynep Önder
Supervisor

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Science in Management.

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ABSTRACT

DYNAMIC RELATIONSHIP BETWEEN MACROECONOMIC VARIABLES AND RETURNS ON TURKISH REAL ESTATE INVESTMENT TRUSTS

Kırdök, Fethiye Ezgi

M.S., Department of Management

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August 2012

The purpose of this thesis is to examine the dynamic relationship between the returns on Turkish real estate investment trusts (REITs) and macroeconomic variables for the period between 2000 and 2011. Market returns, industrial production, inflation, unexpected inflation, overnight interest rate, term premium, and default risk premium are used as macroeconomic variables in the analysis. The models are estimated for the whole period, January 2000 – December 2011 as well as for the subperiod excluding the 2000-2001 crisis. Unrestricted vector autoregressive model, variance decomposition and generalized impulse response techniques are employed to capture the feedback mechanism between macroeconomic variables and REIT returns. The results of the variance decomposition analysis show that macroeconomic variables explain almost half of the total variation in REIT returns for the whole sample period. This proportion increases to 63% when the crisis period is eliminated. Although there is not a dominant factor, industrial production, inflation, market returns and term structure are found to be important variables to explain the variability of REIT returns. Generalized impulse response analysis shows that unexpected shocks in the stock market and default risk premium have positive impact on Turkish REIT returns whereas unexpected shocks on overnight interest rate and term premium have negative effect. However, shocks to inflation and industrial production are not found to have significant impact on REIT returns. Some differences among REITs are observed depending on whether the major shareholder of the REIT is a bank or a construction company.

Keywords: REIT return, macroeconomic variables, VAR model, variance decomposition, impulse response

ÖZET

TÜRKİYE'DEKİ GAYRİMENKUL YATIRIM ORTAKLIKLARI GETİRİLERİ VE MAKROEKONOMİK FAKTÖRLER ARASINDAKİ DİNAMİK İLİŞKİLER

Kırdök, Fethiye Ezgi

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Tez Yöneticisi: Doç. Dr. Zeynep Önder

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Bu tezde Türkiye'deki gayrimenkul yatırım ortaklıklarının (GMYO) getirileri ve makroekonomik faktörler arasındaki dinamik ilişki Ocak 2000 – Aralık 2011 dönemi için araştırılmıştır. Piyasa getirisi, sanayi üretimi, enflasyon, beklenmedik enflasyon, gecelik faiz oranı, vade primi ve iflas risk primi, makroekonomik faktörler olarak kullanılmıştır. GMYO getirileri ve makroekonomik faktörler arasındaki geri bildirimli ilişkiyi yakalayabilmek için, sınırlandırılmamış vektör otoregresif model, varyans dağılımı ve genelleştirilmiş etki-tepki fonksiyonları kullanılmıştır. Varyans dağılımı analizlerinin sonuçları makroekonomik faktörlerin GMYO getirilerinin varyansının yaklaşık olarak yarısını açıkladığı bulunmuştur. Kriz dönemini içermeyen Aralık 2002 – Aralık 2011 zaman aralığında ise, bu oran %63'e yükselmektedir. GMYO getirilerindeki değişkenliği açıklayan tek başına baskın bir faktör görülmemekle birlikte, sanayi üretimi, enflasyon, piyasa getirileri ve faiz oranlarının vade priminin önemli rol oynadığı bulunmuştur. Etki-tepki analizi sonuçlarına göre, GMYO getirileri, piyasa getirileri ve iflas risk primindeki beklenmedik şoklara pozitif, gecelik faiz oranları ve vade primindeki şoklara ise negatif yönde tepki vermektedir. Bununla birlikte, enflasyon, beklenmedik enflasyon ve sanayi üretimi değişkenlerine uygulanan şokların GMYO getirileri üzerinde anlamlı bir etkisi gözlenmemiştir. GMYO'ların ana hissedarlarının içinde bulundukları sektörün, bankacılık veya inşaat, GMYO getirileri ve makroekonomik faktörler arasındaki ilişkiyi etkilediği görülmüştür.

Keywords: GMYO getirileri, makroekonomik faktörler, vektör otoregresiv model, varyans dağılımı, etki-tepki analizi

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Analyzing the factors that affect stock returns has been a popular and interesting research area. First, Sharpe (1964), Lintner (1965) and Mossin (1966) develop Capital Asset Pricing Theory (CAPM). They explain excess return of individual stocks by a market sensitivity factor, namely beta. Later, relaxing the assumptions of CAPM, Ross (1976) develops Arbitrage Pricing Theory (APT). APT explains expected returns of a stock as a linear function of various macroeconomic factors or theoretical market indices. Chen, Roll and Ross (1986) examine the forces that determine stock market returns and observe that term structure of interest rates, expected and unexpected inflation, industrial production and risk premium are significantly priced. Fama & French (1993, 1995, 1996) analyze returns of stocks and bonds empirically. They find market premium, firm size, and book-to-market ratio

(B/M) are three common factors for stocks; and term structure of interest rates and default premiums are two common factors for bonds.

In analyzing stock returns, most of the empirical studies exclude Real Estate Investments Trusts (REITs) from their sample. The reason behind this exclusion is that they are considered as financial firms, they are highly tied to real estate market and they do not act like stocks. For example, Clayton and Mackinnon (2003) show that characteristics of the US REITs for the time period 1978 – 1998 are similar to the characteristics of real estate market rather than those of stocks.

Since the early 1990s, real estate market and real estate investment trusts (REITs) have become very popular. This popularity can be explained by the growth in the issuance of REITs and increases in property prices. However, several real estate bubbles the world experienced and the recent "sub-prime mortgage crisis" indicated that this growth also came with its own drawbacks. These events increased the academic interest on examining how macroeconomic variables affect the real estate market and how the existence of a real estate bubble is determined before it causes another crisis.

Many researchers have investigated the relationship between macroeconomic variables and real estate market returns, particularly returns of REITs, (for example

Ling and Naranjo (1997), Peterson and Hsieh (1997), Liziert and Satchell (1997), Glascock et al. (2000), Ewning and Payne (2005), Chen et al. (2011)). In earlier studies, such as Gyourko and Keim (1992), Chen et al. (1997), Ling and Naranjo (1997), Chen et al. (1998), simple regression is used. These studies only examine the simple relationship between variables without concentrating on shock effects or examining the variation of returns. Later studies, such as Liziert et al. (1997), Glascoock et al. (2000), Ewning and Payne (2005), Chen et al (2011), use Vector Auto Regressive Method (VAR) and co-integration analysis and examine short-term and long-term effect of macroeconomic variables on REIT returns.

All of these papers examine the dynamic linkage between the real estate market and macroeconomy using the US or the UK data. Although Hamelink and Hoesli (2004) analyze the impact of property type and country effect on REIT returns in ten countries for the period February 1990 - April 2003, they are all developed countries. In their study, they observe that there is significant country factor that affects the real estate markets. Hence, the impact of macroeconomic variables on REIT returns might be different in other countries. Moreover, to my knowledge, there are few studies that examine this relationship for emerging markets where mortgage system is not well-developed. Motivated by the findings of Hamelink and Hoesli (2004), I argue that Turkish real estate market has its unique characteristics which make examining this market interesting. Turkey is an emerging market. Analyzing Turkish real estate

market will help us to understand the characteristics of real estate return in emerging markets. Furthermore, mortgage market is not well developed in Turkey. Mortgage law enacted in February 2007 but there is not a secondary market for mortgage loans. Moreover, Turkey experienced high inflation which is not observed in the US or in the UK. Therefore, understanding the dynamic relationship between Turkish real estate market and macroeconomic variables will also reveal the effect and importance of market conditions on real estate returns. Finally, for Turkish investors real estate is an alternative investment tool for bonds and stocks. Therefore, investors' motivations and preferences are also different from US investors. Although Turkish real estate market is interesting to examine and is also experiencing a huge growth (the share of housing loans in total loans was 4.06% in January 2000 and it reached to 23% in December 2011), the data unavailability restricts the appropriate analysis. Nevertheless, the number of REITs traded in the Istanbul Stock Exchange (ISE) increased six fold over the last ten years, from four REITs in January 2002 to twentythree REITs in December 2011. This increase enables the researchers to use their returns as a proxy for the returns on real estate market in Turkey.

In this thesis, I analyze the dynamic relationship between the returns in the Turkish real estate market and macroeconomic variables including market returns, industrial production, inflation, unexpected inflation, overnight interest rate, term structure, default risk premium. In the analyses, the return on the Turkish real estate market is

proxied with returns on REITs traded in the ISE. The study covers the period between 2000 and 2011. Data unavailability before 2000 dictates the time period of the study. Turkey had experienced financial crisis in 2000 and 2001. The financial meltdown of 2001 increased the volatility of some of macroeconomic variables, such as inflation and interest rate. This volatility might affect the results of my analysis. Therefore, the models are estimated for the whole period, January 2000 – December 2011 as well as for the sub-period between December 2002 and December 2011.

In the analysis, I employ unrestricted vector autoregressive model (VAR). The major benefit of this methodology is that it has the ability to model the long lags inherent in real estate market (McCue and Kling, 1994). Moreover, variance decomposition analysis is used to determine the proportion of the variability of REIT returns that are explained by macroeconomic variables. I use generalized impulse response function to identify the sign and the duration of the impact of macroeconomic shocks on REIT returns.

I find that macroeconomic variables explain 48% of variation in REIT returns for the sample period. Although none of the variables explain more than 15% of real estate market returns, industrial production, inflation and market returns are relatively more important factors, each explaining around 10% of variability in real estate returns. Macroeconomic variables are able to explain 62.74% of the total variation in REIT returns for the subperiod (December 2002 – December 2011). These results suggest

that when the period where volatility of macroeconomic variables is high is eliminated, the role of macroeconomic variables in REIT returns becomes clearer. Moreover, industrial production, inflation, market returns, and term structure of interest rates are relatively more important variables to explain the variability of real estate market returns in this subpeirod.

When I perform the analysis for REITs with different ownership structure, I observe that REITs whose major owner is a bank (BREITs) are more sensitive to the changes in ISE-100 index compared to REITs whose major owners is a construction firm (CREITs) for both full sample period and subperiod. For full sample period CREITs are found to be more sensitive to shocks in industrial production than BREITs. Industrial production explains 7.58% of the total variation of BREIT returns, whereas it accounts for 10.58% of the total variation in CREIT returns. This difference vanishes for the subperiod. The effect of overnight interest rate on BREITs is found to be approximately three times larger than its effect on CREITs. This means that BREIT returns are more sensitive to the changes at monetary policy for the subperiod.

The remainder of the thesis is organized as follows. Chapter 2 provides a summary of real estate investment trusts in Turkey. Chapter 3 reviews the literature about the relationship between real estate market returns and macroeconomic variables. In

Chapter 4, data and empirical model are presented. I discuss empirical results in Chapter 5. Finally, I conclude in Chapter 6.

CHAPTER 2

REAL ESTATE INVESTMENT TRUSTS IN TURKEY

In this chapter, the characteristics of Turkish REITs are discussed. Although it is common to use REIT returns as a proxy for the return in the real estate market in the literature, the regulations and the characteristics of REITs change from country to country. These differences might affect the returns on REITs.

"REITs are closed-end investment companies managing portfolios composed of real estates, real estate based projects and capital market instruments based on real estates" (SPK, 2011). They are legally introduced to the Turkish capital market on 8 November 1998 by Communiqué on Principles Regarding Real Estate Investment Trusts. REITs are regulated by Capital Markets Board of Turkey and traded in the ISE.

According to the 1998 Communiqué, REITs are allowed to 1) purchase and sell real estate, 2) rent real estate to generate rental income or lease them, 3) take positions in capital markets, 4) buy land to be used in real estate development projects, and 5) purchase foreign real estate to obtain ownership or to invest in real estate backed foreign marketable securities. At least 50% of REITs portfolios must be invested in real estate and real estate backed securities. Total value of money market accounts cannot exceed 10% of the portfolio value and the total value of foreign investment cannot exceed 49% of their portfolios.

REITs can be founded to 1) realize a specific real estate project within a certain period of time, 2) invest in a specific area for a specific or unlimited period or 3) realize any project without any limitation of objective for a specific or unlimited period.

REITs are important institutions for the development of the economy. Firstly, REITs supply financing for huge real estate projects like shopping malls, offices etc. Financing these huge projects with their internal equity is generally not possible or very costly for firms. However, by selling their stocks to the public and by collecting funds from investors, REITs can finance large projects and overcome the high financing cost. For individual investors, REITs provide opportunities to invest in large scaled projects which they cannot afford individually. Moreover, investing in

real estate market through REITs allows investors to benefit from professionally managed real estate portfolios. In addition to these, REITs increase the liquidity of real estate market. "Turkish investors consider real estate as another investment alternative. Real estate is estimated to compose 40% of the total capital investment in Turkey" (Teker 2000). Therefore, liquidity provided by REITs is valuable to Turkish investors. They can rapidly gain from movements in real estate market by buying and selling highly liquid REITs shares. Finally, there are huge amount of unrecorded activities in the real estate market in Turkey. Since REITs are traded in the ISE, they provide transparency to the real estate market and act as a buffer against unrecorded activities.

Considering all these benefits of REITs to the real estate market, the government provided several incentives for the development of REITs in Turkey. One of them is tax exemptions. The income tax rate of REITs is zero. So, they are exempted from corporate tax. They do not pay any income tax from their portfolio management profits. On the other hand, REITs are obligated to pay value added tax for their real estate transactions. Value added tax rate is 18% and declines to 1% for residential units with the size less than 150 square meters.

One important distinction of Turkish REITs from the REITs in the US is their dividend payment obligations. The US REITs are required to pay out at least 90

percent of their taxable income to their shareholders as dividends. However, Turkish REITs are not required to distribute any dividend. Therefore, REITs stockholders earn profits mainly from capital gains and dividends if the company distributes.

REITs in Turkey have been growing since their first establishment in 1996. This can be observed from the increase in their number and market values. Table 1 shows that in December 2011 there were 23 REITs traded in the ISE. The number of REITs in the ISE was only 5 in 1998 and 10 in 2005. Similarly, total market capitalization of REITs corresponded to 10,612 million TL in 1998 and that was 0.35% of the total market capitalization. In 2005, the share of REITs in the market capitalization increased to 1.14%. By December 2011, total market value of REITs reached to 18,742 million TL and 4.92% of the market capitalization (SPK, 2011).

Table 1: The Number and Market Capitalization of REITs Trading in the ISE

Year	Number of REITs	Total Market Capitalization of ISE (Thousand TL)	Market capitalization of REITs (Thousand TL)	REITs Cap. / Total Market Cap.
1998	5	10,611,820	37,519	0.35%
1999	8	61,137,073	421,028	0.69%
2000	8	46,692,373	313,307	0.67%
2001	8	68,603,041	475,975	0.69%
2002	9	56,370,247	338,714	0.60%
2003	9	96,072,774	543,092	0.57%
2004	9	132,555,528	1,445,753	1.09%
2005	11	218,317,837	2,489,225	1.14%
2006	11	230,037,678	2,081,671	0.90%
2007	13	335,948,412	3,189,974	0.95%
2008	14	182,024,740	3,045,946	1.67%
2009	14	350,761,077	2,853,765	0.81%
2010	21	472,552,583	11,062,318	2.34%
2011	23	381,262,499	18,742,054	4.92%

Source: Capital Markets Board of Turkey

Starting from January 2000, the ISE formed a value-weighted Real Estate Investment Trust Index (ISE-REIT). The weight of each REIT in the index is determined by its publicly floating market value. Figure 1 presents the levels of ISE-REIT, ISE-100 and ISE-30 indexes and how these three indexes changed over time. Although ISE-REIT returns are highly correlated with market indices (0.8642 between ISE-100 and ISE-REITs and 0.8629 between ISE-30 and ISE-REITs), since January 2006, there is a clear differentiation in their performances. After the global crisis in 2008, the REIT index did not increase as much as the other indices.

Figure 1: The Levels of ISE-100, ISE-30, ISE-REIT Indexes

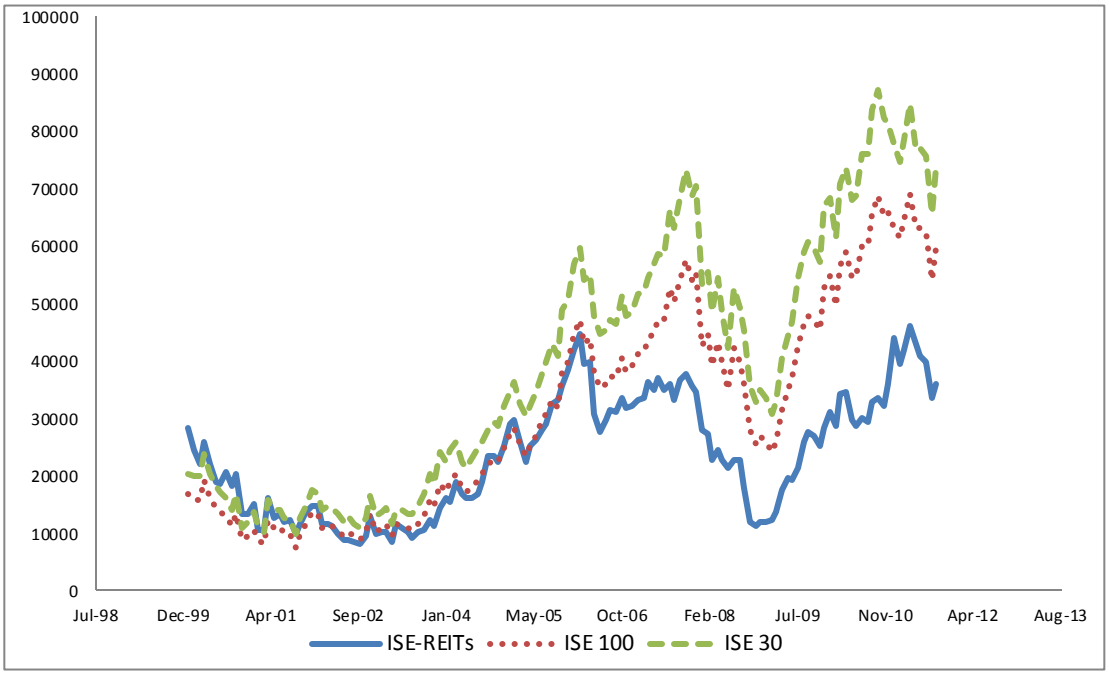


Table 2 presents the portfolio composition of REITs in June 2011. On average 85% of the REITs portfolios are invested in real estate. Buildings are the most common real estate type in REITs portfolio. Furthermore, relatively newly established REITs such as Emlak-Konut, Martı, Ozderici, Simpas, Torunlar, whose owners are mainly construction firms, invest more in real estate projects.

Although some REITs (Akfen, Alarko, Atakule, and Sağlam) invest more than 20% of their portfolios to money market and capital market instruments, on average the total share of money market and capital market instruments investments is only 12%.

Table 2: Portfolio Composition and Leverage Ratios of REITs

	Construction Related REITs											
	Akfen	Akmerkez	Alarko	Emlak Konut	Kiler	Nurol	Sağlam	Sinpaş	Özderici	Torunlar	Yesil	**Average**
IPO Date	May 2011	May 2005	Aug 1996	Dec 2010	May 2011	Sep 1997	Mar 2007	Jul 2007	Nov 2010	Jan 2008	Dec 1997	
Total Debt/TA	30%	3%	29%	48%	41%	65%	37%	47%	36%	10%	81%	39%
Short-Term Debt/TA	11%	3%	25%	33%	36%	14%	36%	28%	10%	1%	81%	25%
Total Real Estate	**50.0**	**100.0**	**58.7**	**88.0**	**94.0**	**82.6**	**68.0**	**90.7**	**82.0**	**69.0**	**100.0**	80.3
-Land	0.0	0.0	16.2	52.0	6.0	49.0	0.0	32.8	0.0	7.0	30.0	17.5
-Building	45.0	100.0	16.2	4.0	85.0	34.0	68.0	20.8	3.0	39.0	0.0	37.7
*Office	0.0	0.0	16.2	0.0	5.0	15.0	68.0	0.4	3.0	1.0	0.0	9.9
*Hotel	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1
*Shopping Moll	0.0	100.0	0.0	0.0	41.0	3.0	0.0	0.0	0.0	37.0	0.0	16.5
*Housing	0.0	0.0	0.0	4.0	39.0	16.0	0.0	20.4	0.0	1.0	0.0	7.3
-Real estate projects	3.0	0.0	6.1	32.0	3.0	0.0	0.0	37.1	79.0	23.0	70.0	23.0
*Office	0.0	0.0	0.0	0.0	1.5	0.0	0.0	1.8	0.0	0.0	9.0	1.1
*Hotel	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
*Shopping Moll	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	21.0	1.0	2.1
*Housing	0.0	0.0	6.1	32.0	0.0	0.0	0.0	35.3	79.0	2.0	60.0	19.5
-Real estate rights	2.0	0.0	20.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
-Other real estates	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Affiliates	**6.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**4.0**	**6.9**	**0.0**	**11.0**	**0.0**	2.5
Money and Capital Market Instruments	**44.0**	**0.0**	**41.3**	**12.0**	**6.0**	**17.4**	**28.0**	**2.4**	**18.0**	**20.0**	**0.0**	17.2

Table 2: Continued

	Bank Related REITs								Other REITs					
	Atakule	Doğuş	EGS	İş	TSKB	Vakıf	Yapı K.	**Average**	Avrasya	İdealist	Martı	Pera	Reysaş	**Average**
IPO Date	Jan 2000	Jul 1997	Jun 1996	Aug 1999	Apr 2010	Jan 1996	Dec 1996		Nov 2010	Jul 2010	Oct 2010	Jan 2001	Aug 2010	
Total Debt/TA	0%	1%	205%	11%	36%	40%	2%	42%	0.18%	0.23%	30.35%	26.52%	16.31%	14.72%
Short-Term Debt/TA	0%	1%	205%	1%	3%	40%	0%	36%	0.17%	0.20%	21.04%	16.18%	5.24%	8.57%
Total Real Estate	**61.1**	**89.0**	**99.9**	**94.0**	**94.0**	**90.8**	**53.0**	**83.1**	**98.4**	**95.3**	**100.0**	**94.0**	**98.1**	**97.2**
-Land	0.3	0.0	1.9	12.0	4.0	77.0	8.0	14.7	15.8	0.0	11.0	0.0	16.2	8.6
-Building	60.4	3.0	0.0	82.0	90.0	12.2	15.0	37.5	82.6	95.3	5.0	82.0	74.3	67.8
*Office	17.8	0.0	0.0	45.0	27.0	12.2	10.0	16.0	0.0	0.0	0.0	0.0	74.3	14.9
*Hotel	9.6	0.0	0.0	8.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0
*Shopping Moll	33.0	3.0	0.0	29.0	63.0	0.0	0.0	18.3	30.0	0.0	0.0	82.0	0.0	22.4
*Housing	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.7	0.0	95.3	0.0	0.0	0.0	19.1
-Real estate projects	0.5	0.0	98.0	0.0	0.0	0.0	20.0	16.9	0.0	0.0	21.0	10.0	7.6	7.7
*Office	0.0	0.0	98.0	0.0	0.0	0.0	10.0	15.4	0.0	0.0	6.0	0.0	0.0	1.2
*Hotel	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
*Housing	0.0	0.0	0.0	0.0	0.0	0.0	10.0	1.4	0.0	0.0	15.0	10.0	0.0	5.0
-Real estate rights	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.2	0.0	0.0	63.0	2.0	0.0	13.0
-Other real estates	0.0	86.0	0.0	0.0	0.0	0.0	10.0	13.7	0.0	0.0	0.0	0.0	0.0	0.0
Affiliates	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**47.0**	**6.7**	**0.0**	**0.0**	**0.0**	**2.0**	**1.4**	**0.7**
Money and Capital Market Instruments	**38.9**	**11.0**	**0.1**	**6.0**	**6.0**	**9.2**	**0.0**	**10.2**	**1.6**	**4.7**	**0.0**	**4.0**	**0.5**	**2.2**

Source: Public Disclosure Platform (http://www.kap.gov.tr/yay/English/ek/index.aspx), Portfolio composition reflects the composition for June 2011 and leverage ratios are calculated for December 2011.

CHAPTER 3

LITERATURE REVIEW

In this chapter, first, the findings of the studies that examine the relationship between macroeconomic factors and return in real estate market are summarized. Then, the results of the studies analyzing Turkish REITs are presented.

3.1 Macroeconomic Factors

The first paper that aims to determine the macroeconomic factors that affect the stock market returns is Chen et al. (1986). They analyze the US stock market returns for January 1953 – November 1983, using the Fama & MacBeth (1973) methodology. They use term structure of interest rate, default risk premium, unexpected inflation, change in expected inflation, industrial production as macroeconomic variables in their model. They define default risk premium as the difference between "Baa and under" bond portfolio return and long-term government bond return. They find positive premium for the default risk, which is

explained by investors demand to be hedged against increase in aggregate risk level in the US stock market for January 1953 – November 1983. Moreover, to capture the influence of the shape of term structure of interest rates, they include term structure as another variable. It is defined as the difference between the interest rate on long-term government bond and T-bill. They find negative risk premium for the term structure of interest rates in the US stock market. This can be interpreted as investors prefer stocks whose return increases when long term rates decrease. They find a positive risk premium for the monthly growth in industrial production and interpret this finding as an incentive to be hedged from systematic production risk. Finally, they measure unexpected inflation using Fama and Gibbons (1984) methodology and find that both expected and unexpected inflation priced significantly in the US stock market.

Many studies use REIT returns as a proxy for real estate market returns to examine the relationship between macroeconomic factors and return in real estate market. Although using these returns as a proxy is criticized because REIT returns and stock market returns are highly correlated (Mengden and Hartzell, 1986; McCue and Kling, 1994; Barkham and Geltner 1995), Gyourko and Keim (1992) show that "Important information about changing market fundamentals incorporated into equity REIT returns before appraisers impound this information into property prices" in the US real estate market. Moreover, Ling and Naranjo (1997) analyze REIT returns and appraisal-based returns separately and they

observe that the impacts of macroeconomic factors are same for these two different proxies for the US real estate market.

Inflation rate, interest rate, stock market index and industrial production are the main macroeconomic factors that are used in the literature to explain REIT returns and returns in real estate market.

3.1.1 Inflation

Inflation is one of the most important macroeconomic variables that influences financial markets since it affects the real cost of borrowing and real rate of return. Feldstein (1992) and Kearl (1979) examine the effect of inflation on housing demand and they observe high inflation decreases housing demand through higher real cost of mortgage payments.

Furthermore, to understand the hedging role of real estate investments against inflation, Rubens et al. (1989) examine the inflation-hedging effectiveness of residential real estate in the US market, for the period 1960 – 1986. They conclude that residential real estate investment has a hedging role. On the other hand, several studies find the opposite. For example, Quan and Titman (1999) use a panel dataset which includes 17 countries and 14 years period. From the cross sectional analysis they observe that real estate is a good long term hedging tool against inflation. However, when they conduct their study with time series

methodology, they observe increasing inflation decreases rental income. Therefore, they conclude that real estate is not a good hedging vehicle for short term. Önder (2000) studies the return on house values in Ankara, between 1977 and 1996, and observes that real estate is not providing hedge against inflation in Turkey. The author argues that the main reasons of this finding are continuously observed high inflation and increasing interest rates on housing loans with inflation. Similarly, Steveson and Murray (1999) investigate the dynamics of Irish real estate market and observe real estate investment is not providing hedge against inflation. They argue that small size of the Irish market detains the response of real estate market to inflation and that result with positive real rate of returns with inflation risk.

Ling and Naranjo (1997) analyze US real estate market for the period 1978 – 1994 using quarterly data to determine economic factors that are priced in the real estate market. They form real estate market portfolios using REIT returns and NCREIF returns to get rid of portfolio selection bias in their analyses. Growth rate of per capita consumption, real T-bill rate, term structure of interest rate, and unexpected inflation are included in the models as macroeconomic variables. They use nonlinear multivariate regression technique and two different models. One of the models allows for fixed risk premium and uses nonlinear seemingly unrelated regression technique. The other one allows for time varying risk premium and uses Fama and MacBeth (1973) methodology. In that model they first regress real estate market returns on macroeconomic variables and determine

the betas for the variables. Then, they regress real estate market returns against the estimated betas for each quarter to determine the time series of risk premium for each variable. They apply two different models to show that the results are depending on the model specification. They find positive risk premium for unexpected inflation only for time varying risk premium model, but not for fixed risk premium model. They estimate that a REITs portfolio with a beta of 1 gains 2.17% unexpected inflation premium per year. They conclude that this difference is explained by the fact that constant coefficient model is too restrictive to capture the market dynamics.

Chen et al. (1997) conduct five factor model on the US equity REITs (EREITs), between January 1974 and December 1991. The macroeconomic variables in the model are unanticipated inflation, change in expected inflation, unanticipated change in term structure, unanticipated change in risk premium, and market index. Using excess equity REIT returns as the proxy of real estate market in the US, they observe a significant and negative risk premium for unexpected inflation. In other words, assets whose sensitivities to unexpected inflation are positive are perceived as a hedging tool against inflation.

In a different study, Chen et al. (1998) analyze the US EREITs for the period 1978 – 1994. The study employs a single pooled cross-sectional time-series regression. They test whether macroeconomic factors are important controlling for firm specific effects such as size and book-to-market ratio using two models: The

first model includes only macroeconomic variables. The second one includes macroeconomic variables and firm specific variables. Contradicting to their previous study, they find that both unexpected inflation and change in expected inflation do not have significant effect on the pricing of equity REITs.

Ewing and Payne (2005) analyze the feedback mechanism between industrial production, inflation, default risk premium and the stance of monetary policy for US EREITs for the time period January 1980 – September 2000. They measure inflation with consumer price index for all urban customers. They use generalized impulse response analysis. Impulse response function of inflation shows that inflation shocks result in lower REIT returns.

All these mixed findings can be explained by the differences in model construction or by the different time periods analyzed in each study. Moreover, mixed empirical findings about the relationship between inflation and real estate market return suggest that the effect of inflation on real estate market is still worth studying.

3.1.2 Interest Rate

Nominal interest rates are an important macroeconomic factor that affects the price of financial assets because the basic rational of asset pricing is based on the discounted cash flows. Holding everything else constant, an increase in interest

rates will decrease the present value of REITs future cash flows or vice versa. Moreover, increasing interest rates decreases the demand for housing and real estate market returns. Motivated by this fact, many studies use interest rates or interest rate related variables (term structure of interest rates and default risk premium) to explain stock and REIT returns.

Analyzing US REIT returns for the period 1978 – 1994, Ling and Naranjo (1997) measure term structure premium as the difference between the annualized yield of a 10-year Treasury bond and a 3-month Treasury bill. They observe that term structure of interest rates is significantly priced in real estate market with positive risk premium when they allow for time varying risk premiums. Applying the model that only allows for constant risk premiums, they observe positive risk premium for short-term real interest rates, which is measured as the end of quarter difference between the annualized yield on a three-month T-bill and the general inflation rate.

Chen et al. (1998) measure term premium as the difference between long-term government bond rate and T-bill rate, and they detect significant term structure factor for the model which includes only macroeconomic variables. However, when firm specific factors are included to the model, the significance of the term premium disappears. They explain the difference in the significance of term structure premium with the correlation between term structure and size. In other

words, the size effect dominates the effect of term structure because of multicollinearity.

In real estate literature, it is shown that REIT return performance differs across different REIT types since their investment portfolios include different type of assets. Equity REITs (EREITs) invest at least 75% of their total assets in income producing real estate projects. Mortgage REITs (MREITs) invest at least 75% of their total assets in residential mortgages, short and long-term construction loans and mortgages on commercial properties. Peterson and Hsieh (1997) analyze the effect of macroeconomic variables on EREITs and MREITs in the US market for the period July 1976 and December 1992. They measure term structure premium as the difference between the holding period return on a long-term government bond and risk-free rate. Default risk premium is measured as the difference between the return on long-term corporate bonds and the long-term government bond. They find that term structure and default risk premium affect only MREIT returns. In the absence of a market factor, term structure and default risk premium are significantly related to both types of REITs. However, when market factor is included into the model, significant effect vanishes for EREITs. It seems that market factor masks the effect of interest rate related variables on EREIT returns.

In addition to default and term premium, nominal interest rate is also examined as another macroeconomic factor. Lizieri et al. (1997) analyze the effect of interest rate on the return performance of the UK commercial real estate for 1975 – 1995,

using a regime switching model. There are two different regimes in their model: regime one represents high interest rate periods and regime two represents low interest rate periods. They use short-term interest rate, namely 3-month T-bill rates, in non-linear threshold autoregressive model. They conclude that property prices are sensitive to interest rates and the impact of interest rate is non-linear. The effect of relatively high interest rates is much sharper than those of lower interest rate. In other words, when interest rates are high, property market experiences sharp declines with little volatility.

McCue and Kling (1994) analyze the relationship between REIT returns and inflation, industrial production, investment, and nominal interest rates. They apply unrestricted vector autoregressive model, and variance decomposition analysis. They measure short-term nominal interest rate with three-month T-bill rate. They find that the macroeconomic variables explain approximately 60% of the variation in real estate returns. Furthermore, nominal interest rates explain the greatest percentage of the variation, 36.2%, in the real estate returns. They argue that this could be the effect of interest rate declines or the effect due to predictive power of interest rates on future output.

Some researchers use interest rate as a measure of monetary policy and examine its impact on real estate market or REIT returns using generalized impulse response function. For example, Ewing and Payne (2005) measure monetary policy with 3-month Fed fund rates. It is found that the response of REIT returns

to Fed fund rates is negative, i.e. a monetary policy shock corresponds to lower real estate investment returns. They argue that sudden monetary tightening increases interest rates and thus adversely affect real estate market activity.

Chang et al. (2011) measure the monitory policy through two channels. The first one is the direct channel and it is measured with three month Fed fund rate. The second one is the indirect channel, namely spread, and it is measured as the difference between long-term interest rates and short-term interest rates. They measure housing market returns with the return on equity REITs and Office of Federal Housing Enterprise Oversight housing price index. They argue that a decrease in interest rates will increase inflation expectations and therefore increase the long term interest rates. Therefore, change in monetary policy will indirectly change the spread. Using Two State Markov Process VAR, they conclude that housing market returns react to Fed fund rate innovations less significantly but more persistently than REIT returns. Furthermore, adding interest rate spread increases the effect of fed fund rates on REIT returns but decreases the effect on housing market returns in response to an innovation of Fed fun rates. They argue that this is a result of the difference in financing of the housing and REIT market. Many households in US finance their housing with a 30-year fixed rate mortgage. Therefore, decreasing interest rates increases long run inflation expectation and therefore increases the interest rate spread. This increase in long-term interest rates and spread suppress housing prices. On the other hand, underlying assets of US equity REITs are generally commercial real

estate and potential renters of commercial real estate are heavily prefers short-term rolling-over loan for finance. When interest rates decrease they may also become more motivated to switch to a higher proportion of short-term financing.

Chen et al. (forthcoming) analyze how the effect of monetary policy on the returns of the US equity REITs changes during bull, bear, and volatile markets for the period between January 1972 and December 2008. They use ordinary least squares and quantile regressions and they control for inflation, industrial production, default risk premium, and dividend yield. They measure monetary policy as the change in Fed fund rates. They find that the effect of the monetary policy depends on the state of market. More specifically, the change in Fed fund rates are found to affect equity REIT returns significantly and negatively in bull markets when investors have lower expectations of real estate price increases. However, they find that in bear markets, monetary policy changes do not affect equity REIT returns.

3.1.3 Industrial Production

The stability of the economy, its growth potential, and changes in production and output levels naturally affect the income levels and assets prices. With this motivation, industrial production has become a frequently used variable in empirical studies that analyze the REIT returns.

McCue and Kling (1994) measure industrial production with Federal Reserve's industrial production index. Variance decomposition results of their study show that industrial production explains only 9.3% of the variation in the US REIT returns, for the time period 1972 – 1991.

Ewing and Payne (2005) find industrial production as an important factor in explaining the returns on real estate market. More specifically, when market experience unexpected changes in the economic production level, returns of REITs decreases significantly.

3.1.4 Stock Market Return

Since REITs are stocks that are traded in the stock markets, many researchers use stock market index as another variable to explain the REIT returns. However, conflicting results are obtained depending upon the time period studied and the methodology used.

Chen et al. (1997) measure the market return with the return on CRSP value-weighted index. Using Fama & MacBeth (1973) methodology, they observe negative risk premium for stock market index for the time period January 1974 – December 1979 for the US EREIT. Chen et al. (1998) pool the dataset and run a single regression and increase the number of observations, rather than Fama and MacBeth methodology. They show that stock market returns is not significantly

affecting US EREIT returns for the time period 1978 – 1994. One possible explanation for contradicting results of Chen et al. (1997) and Chen et al. (1998) is the difference of the applied methodology.

Peterson and Hsieh (1997) define market factor as the excess monthly return on NYSE/ AMEX / NASDAQ value-weighted index. They find that market index alone is not sufficient to explain returns in real estate market. However, in their five factor model they use size, book-to-market ratio, term structure of interest rate and default risk premium and market index as macroeconomic variables. They observe 0.3% average risk premium per month for market index.

In addition, Glascock et al. (2000) analyze how the 1993 tax reform act affected the relationship between stock market returns and REIT returns. This act changed the condition for pension funds to be considered as REIT and increased the institutional investment in the REIT market. According to this act, a domestic pension plan is qualified to be a REIT if more than 50 percent of the market value of its shares owned by at least five individuals during the last half of its taxable year. Glascock et al. (2000) discover that the cointegration between the return on S&P 500 and US REIT returns increases and becomes significant after 1993. They conclude that US REITs became more like stocks than real estate investments after 1993.

3.1.5 Other Variables

Fama & French three-factor model shows that size and B/M ratio are two significant factors that affect stock market returns. Motivated by this finding, several studies analyze the effects of size and B/M ratio on REIT returns. Chen et al. (1998) find that size is significantly priced in US REITs between the years 1978 and 1994, when all other macroeconomic variables (unanticipated inflation, market index, change in expected inflation, unanticipated change in term structure, unanticipated change in risk premium) are included in the model. Motivated by the fact that size of EREITs is larger than MREITs, Peterson and Hsieh (1997) analyze the size effect on these two groups of REITs and find that size is significantly priced in both types. Moreover, they also observe small firm effect is clearer for MREITs. Clayton and Mackinnon (2003) try to explain US REIT return for the 1978 – 1998 time period using variance decomposition methodology. They conduct their analysis for the whole sample period as well as, for the sub-periods of 1979 – 1984, 1985 – 1991, 1992 – 1998. They use Lehman Brothers indices returns on long-term government and corporate bonds, the return on S&P 500 index for large capitalization stocks, Russell 2000 index for small capitalization stocks as explanatory variables. They find that size is an important factor that affects the behavior of REIT returns. They observe small REIT returns are behaving more like real estate, however large ones' returns are highly tied to stocks. They argue that this could be a result of the institutionalization of the ownership of larger capitalization REITs that took place after 1990s.

Motivated by Fama-French (1993) study, Peterson and Hsieh (1997) also analyze the effect of B/M ratio of firms on the US REIT returns for the time period July 1976 – December 1992. They find an average risk premium of 0.1% per month for both equity and mortgage REITs and show that B/M factor in common stock returns is also important for pricing of REITs. Contradictory to this finding, Chen et al. (1998) show that B/M ratio is not significantly priced for the time period between 1978 and 1994 for the US REITs. They argue that the effect of B/M ratio is not observable since all the firms are in the same industry. More specifically, they interpret B/M ratio as a distress factor which can be, on average, at the same level for the firms operating in the same industry and hence this factor loses its explanatory power.

Jegadeesh and Titman (1993) show that strategies that buy well performed stocks and sell poorly performed stocks in the past realize significant abnormal returns for common stocks over the 1965 to 1989 period in NYSE and AMEX, called momentum effect. Motivated by that study, Chui et al. (2003) analyze momentum effect for US REITs traded on the NYSE, AMEX, and NASDAQ over the period from 1984 to 2000. In other words, they check empirically if there is a tendency for rising REITs prices to rise further and falling prices to keep falling. They conduct the analysis for pre-1990 and post-1990 periods, since the regulations for REITs changed around 1990s in the US. They form REIT specific momentum strategy, which buys REITS with highest past return and sells REITs with the lowest past return. In their model they control for size, B/M ratio, turnover ratio,

and analyst coverage. They show that in the pre-1990 sub-period momentum, size, turnover, and analyst coverage predict REIT returns. However, for post-1990 sub-period momentum is the dominant predictor for US REIT returns. Moreover, Derwall et al. (2009) cover all US equity REITs in the CRSP/Ziman Real Estate Data Series over the period January 1980 – September 2008. They use four- factor model which adds a momentum factor to Fama & French three-factor model. They show that momentum explains abnormal returns of actively managed REIT mutual funds.

Hamelink and Hoesli (2004) examine REITs from ten countries (United States, Germany, The United Kingdom, Australia, France, Switzerland, the Netherlands, Canada, Hong Kong and Japan). They analyze the impact of country effect on REIT returns controlling for property type, size and value ratio, for the period February 1990 - April 2003. They measure country effect by including country-dummy variable in the model and observe that there is a significant country factor that affects the real estate markets. Furthermore, they use value ratio (growth / value) of the Salomon Smith Barney (SSB) Developed World Equity Database, which mainly provides a growth weight and a value weight to each stock such that total weight sums to always one. Therefore, stocks are not classified as growth stocks or value stocks, but are some combination of both attributes. Growth to value ratio is obtained by dividing given growth weight to given value weight. They find that growth to value ratio is an important driver for real estate market returns.

Vishwakarma and French (2010) use VAR methodology to test the impact of macroeconomic and financial variables on Indian real estate market between the years 1996 and 2000. They use inflation, industrial production, term structure of premium and exchange rate (Rupee/USD) as explanatory variables in their model. For their whole sample period analysis variance decomposition results show that none of the variables explain real estate market. Furthermore, they also analyze the subperiod between 2000 and 2007 because Indian government relaxed restrictions on foreign direct investment in real estate sector in March 2000. They observe that for the subperiod exchange rate is able to explain 11% of the variation in REIT returns in India. They argue that depreciation in the Rupee negatively affects real estate market returns, because when Rupee depreciates foreign investors decreases their investments in India because of increased uncertainty.

Table 3 summarizes the studies that analyze the relationship between macroeconomic variables and real estate market returns.

The relationship between macroeconomic factors and real estate market has been deeply investigated for US market. However, this dynamic linkage has not been analyzed for emerging markets, which have their unique characteristics. This thesis aims to fill this gap in the real estate finance literature by analyzing the relationship for the Turkish market.

Table 3: Summary–of Literature Review

Paper	Data	Time period	Methodology	Explanatory Variables	Summary of Findings
Chen-Roll-Ross (1986)	US stock market	1958 - 1984	Fama-MacBeth (1973)	Term structure, expected inflation, unexpected inflation, industrial production, risk premium, oil prices, consumption	All of the variables are significantly priced in stock market, except oil prices and consumption. Significant market effect is observed only in time series analysis.
McCue – Kling (1994)	US equity REITs	1974 - 1991	VAR model and variance decomposition	Inflation, short-term nominal rates, industrial production, investment	Macroeconomic variables explain 60% of the variation in real estate returns. Nominal interest rates alone account for 36.2% of the variation.
Ling - Naranjo (1997)	4 different real estate portfolios for US (REITs, Appraised, Transaction, Combination)	1978 - 1994	Non-linear SUR and regression	Consumption, real T-bill rate, term structure premium, unexpected inflation	Consumption and interest rates are priced both in constant and time varying risk premiums. However, term structure of interest rates and unexpected inflation are priced only when time varying risk premiums are allowed.

Table 3: Continued

Paper	Data	Time period	Methodology	Explanatory Variables	Summary of Findings
Chen - Hsieh - Jordan (1997)	US equity REITs	1974 - 1991	Factor loading model and macro variable model	Term structure, risk premium, unexpected inflation, change in expected inflation, market index	The major pricing factors in real estate are inflation and interest rate related variables. Furthermore, market variable model is superior to Factor loading model.
Peterson - Hsieh (1997)	US equity and mortgage REITs	1976 - 1992	Multifactor model	Term structure, risk premium, market index, size, B/M	Market factor is not enough to explain REIT returns. Firm specific variables, size and B/M have explanatory power on returns. Small firm effect is clearer for MREITs. Term structure and risk premium explain only MREITS.
Liziert - Satchell (1997)	UK REITs	1975 - 1995	Threshold autoregressive (TAR) model	Inflation and interest rate	Finds interest rates play a significant role as an indicator of price changes. Because of the regime switching in the market, TAR is superior in forecasting than linear models.

Table 3: Continued

Chen - Hsieh - Vines - Chiou (1998)	US equity REITs	1978 - 1994	CAPM - Firm specific variable model - macroeconomic variable model	Term structure, risk premium, unexpected inflation, change in expected inflation, market index size, B/M	Rejects CAPM for equity REIT returns. Size is significantly priced in REITs but not B/M ratio. Furthermore, no correlation is observed between EREIT returns and inflation.
Glascock - Lu - So (2000)	US REITs	1992 - 1997	Cointegration test	Inflation, short and long term interest rates, market index	REITs are more like fixed-income securities before 1992 and they are like stocks after 1992. Moreover, REIT returns do not lead inflation and only MREITs adjust toward inflation. There is no co-integration between MREITs and EREITs after 1992.
Clayton - Mackinnon (2003)	US REITs	1978 - 1998	Variance decomposition	Long term interest rate, market index, real estate market index	REIT returns reflect nature of underlying better in time. This can be explained by more available information and more institutional investors in REIT market. Furthermore, small cap effect is increasing in REITs and small REITs are more correlated with real estate market.

Table 3: Continued

Paper	Data	Time period	Methodology	Explanatory Variables	Summary of Findings
Hamelink - Hoesli (2004)	REITs from 10 countries	1990 - 2003	Multifactor model	Size, property type, country, growth/value ratio	Country effect is the most important factor in real estate market. Second important factor is growth to value ratio and it is followed by size and property type.
Ewning – Payne (2005)	US equity REITs	1980 - 2000	VAR model and generalized impulse response functions	Output, inflation, default risk premium, Fed fund rates	Unexpected changes in all four factors affect REIT returns. Most importantly, a positive shock to Fed fund rates, affects real estate returns significantly and negatively. However, REITs persistently respond positively to default risk premium.
Chang – Chen – Leung (2011)	US REITs and US housing prices	1975 - 2008	Two state Markov process VAR	Fed fund rates, term structure of interest rate	Housing market returns react to Fed fund rate innovations less significantly but more persistently than REIT returns. Adding term structure increases the effect on REIT returns but decreases the effect on housing market returns in response to an innovation of Fed fun rates.

Table 3: Continued

Paper	Data	Time period	Methodology	Explanatory Variables	Summary of Findings
Chen – Peng – Shyu – Zeng (forthcoming)	US equity REITs	1972 - 2008	OLS and quantile regression	Fed fund rates, inflation, default risk premium, industrial production, dividend yield	The effect of monetary policy depends on the state of the market. Change in Fed fund rates affects equity REIT returns significantly and negatively in a bull market where investors have lower expectations. However, in bear markets, in volatile markets, and when investors have higher expectations of real estate prices in a bull market monetary policy changes do not affect equity REIT returns.

3.2 Studies on Turkish REITs

Although the dynamic linkage between Turkish real estate market and macroeconomic variables has not been investigated, Turkish REITs are analyzed for different aspects.

Aydınoglu (2004) tries to form an efficient frontier using Markowitz optimization with mean return indexes from several industries on different asset classes for the period between January 2000 and December 2003. These industries include REITs, telecommunication, banks, closed ended mutual funds, energy and utilities, tourism, chemicals, holding and investment companies, forestry and forest products, insurance, and food – beverage. He finds that REITs have the lowest inflation adjusted returns among all sectors. Moreover, he finds that efficient index portfolio does not include any REIT stocks because of their low expected return and high correlation of REIT returns with other stock indices.

Aktan and Ozturk (2009) test the validity of CAPM and single index model (SIM) for each Turkish REIT listed on the ISE over the time period January 2002 – June 2008. In their analysis, they rejected the linearity assumption of both CAPM and SIM. They conclude that their empirical specification is not sufficient to test the coefficients of regressions because of small number of observations and non-normally distributed residuals.

Hepsen (2012) use Ordinary least square model with standard errors computed using Newey – West (1987) autocorrelation and heteroscedasticy to investigate the calendar effects on Turkish REITs. He analyzes daily ISE-REIT index returns over the time period January 2000 - December 2010. He shows that average daily return in January is 0.1163 and statistically significant at the 1% level. He concludes that REITs behave different in January than the other months of the year, and this generates a premium over other months for investors. Moreover, ISE-REIT returns on Monday are lower than returns on other days of the week. His model includes dummy variables for Tuesday, Wednesday, Thursday, and Friday, whose coefficients are positive and significant at 1% level. These positive and significant coefficients imply that these returns are significantly higher than the returns on Monday. He argues that this is evidence of a day of week effect in Turkish REITs market.

Erol and Tırtıroglu (2011) empirically examine the capital structure of Turkish REITs over the time period 1998 – 2007. They use semi-annual data on Turkish REITs traded on the ISE. They use Tobit estimation procedure and the dependent variable is either total debt ratio or long-term debt to total assets ratio. The explanatory variables of the model can be grouped as firm characteristics, ownership characteristics and country specific characteristics. They find that Turkish REITs borrow substantially less than US REITs. This is a result of regulatory differences among two countries. Turkish REITs have valuable option to retain their inexpensive internal equity to

finance their new projects. However, leader owner is bank (owns a minimum of 25% of the REIT) is likely to deplete REITs' dividends and force them to seek long-term debt, because financial institutions do not pay tax from their dividend incomes. They also find that 2001 financial meltdown affects long-term debt ratio negatively in the short run. However, long-term effect of the crisis on long-term debt ratio is found to be positive.

Altınsoy et al. (2010) analyze the time varying behavior of beta for Turkish REITs listed on the ISE using daily data. The study analyzes the time period between February 2002 and June 2009. They use M-GARCH model and Kalman Filter algorithm with random walk parameterization. They find a declining trend in Turkish REIT betas, which shows the tendency of REITs to be less sensitive to the market. Furthermore, they investigate if Turkish REIT betas exhibit a diverse behavior under high and low growth periods. They determine two sub-periods (February 2002-December 2005 as high growth rate period and January 2006 – June 2009 as low growth rate period). They find that REIT returns more closely track stock market in high-growth economic states.

These studies show that Turkish REIT market has its unique characteristics. Furthermore, there is still more room to investigate their characteristics and the return structures of Turkish REITs and Turkish real estate market.

CHAPTER 4

DATA AND METHODOLOGY

In this chapter, I will discuss my data and methodology used to analyze the dynamic relationship between Turkish real estate market and macroeconomic forces.

Following the literature, I hypothesize that real estate market returns in Turkey are affected from macroeconomic factors, namely 1) term premium of interest rates, 2) the difference between corporate bond interest rates and short term interest rate, namely default premium, 3) short-term interest rates, 4) inflation, 5) unexpected inflation, and 6) industrial production. In addition to these macroeconomic forces following the three-factor model of Fama and French, I also hypothesize that 7) market returns, 8) size return series, i.e., the difference between in the return of small capitalization and large capitalization stocks and 9) B/M ratio return series, ie, the

difference between the return of value stocks and growth stocks, also affect the real estate market returns.

I use monthly data from January 2000 to December 2011. The data availability dictates this time interval.

At the beginning of the sample period, Turkey had experienced financial crisis in 2000 and 2001. According to Onis (2009), the crisis of 2001 was particularly far-reaching in terms of its impact, resulting in a major collapse of output and employment. The findings might be affected from financial meltdown of 2001 because of the volatility of some of macroeconomic variables, inflation and interest rate at the beginning of the sample. Therefore, the models are estimated for the subperiod between December 2002 and December 2011 as well as a robustness check.

4.1 Data

4.1.1 Returns on Real Estate Market

The appropriate proxy for real estate market return has always been an important topic in empirical real estate studies. It is difficult to find a market determined price

series for real estate because of infrequent trading and the absence of the data about exchange transactions. Some researchers use the returns from the appraisal-based index such as National Council of Real Estate Investment Fiduciaries (NCREIF) Property Index for the US market. However, this quarterly index is criticized because of its low volatility, which is not able to reflect true market condition. Some other researchers use the returns from the transaction-based indices. These indices are also criticized because of the illiquid nature of real estate market. The transactions are usually small in number which affects the representativeness of these indices.

In addition to appraisal-based and transaction-based price series, REIT returns are widely used as a proxy for real estate market. Since REITs generate their value mainly from real estate market, it is argued that using liquid assets returns overcomes the representativeness problem of transaction-based indices.

In my research, I use the returns on ISE-REIT index as a proxy for real estate market returns because of unavailability of the transaction-based and appraisal-based indices for the period time analyzed in this study. ISE-REIT index is a value-weighted index calculated using the market value of shares outstanding and the end of the month closing prices. I gather monthly ISE-REIT returns from DataStream.

However, using REIT return series directly is criticized since they are highly correlated with market returns. The correlation coefficient between ISE-100 and ISE-REIT is 0.8642 and it is 0.8629 between ISE30 and ISE-REITs. These correlations show that REIT returns are influenced by stock market movements. To overcome this problem and to generate a series that reflects the pure real estate market returns, I regress REIT returns against market returns and save the residuals as my proxy for real estate market return. This approach is parallel to the study by McCue and Kling (1994), in which they analyze the relationship between macroeconomic variables and US EREIT returns using vector autoregressive model. Table 4 shows the regression results for whole sample period.

Table 4: Results for Regression Model: REIT return=α +β * ISE-100 return +Ɛ

Dependent Variable	Constant	ISE-100	
ISE-REITs	-0.005	0.961	**Adjusted R^2:** 0.770
p-values	(0.311)	(0.000)	N: 143
BREITs	0.001	0.937	**Adjusted R^2:** 0.704
p-values	(0.868)	(0.000)	N:144
CREITs	0.006	0.992	**Adjusted R^2:** 0.619
p-values	(0.448)	(0.000)	N: 144

Using REITs as the proxy of real estate market returns, I hypothesize that the explanatory power of macroeconomic factors varies depending on the ownership structure of REITs. Erol and Tirtiroglu (2011) document that there is a concentrated controlling mechanism for Turkish REITs, where the owner dictates its experience

and resources to the manager of REITs using its ownership power. Furthermore, owners of REITs are mainly banks or construction firms. These two groups of firms have experiences in different markets and in managing different risk structures. I argue that ownership structure might also affect the dynamic relationship between REIT returns and macroeconomic variables. Therefore, I divide REITs into three groups: 1) REITs whose major owners are banks (BREITs), 2) REITs whose major owners are construction firms (CREITs), and 3) others. Then, I generate value-weighted return series for these three groups. Return series of REITs that are in group "others" starts from January 2005 and have a limited number of observations. Therefore, I only analyze BREITs and CREITs.

Table 5 gives total number of REITs and total market value in each group at the end of each year, during the sample period. At the end of January 2000 BREITs accounted for 62% of the total market value of REITs whereas 38% of the total market value of REITs was owned by CREITs. Over time, the size and the number of REITs owned by construction firms have increased. At the end of the 2002, the number of BREITs increased to six. However, construction firms have continued to establish new REITs for the last four years. The number of CREITs almost doubled over the last four years. In December 2011, this type of REITs accounted for 85% of the total market value of REITs where the bank owned REITs accounted for 11%.

There were some changes in the ownership structure of some REITs. For example, Atakule REIT was owned by Vakıf Bank until October 2009 and then it was sold to a private investor. Therefore, Atakule REIT was included in BREITs before October 2010 and in Other REITs thereafter. Similarly, the major shareholder of EGS REIT was a construction firm before July 2001 and then Savings Deposit Insurance Fund took over the firm. Therefore, EGS REIT returns were classified as CREITs until July 2001 and as BREITs thereafter.

The huge increase in market value of CREITs in 2007 is explained the establishment of Simpaş. Similarly, the increase in 2010 is driven by the establishment of Emlak-Konut REIT in 2010. This REIT is owned by Toki, that is considered as an state-owned construction company.

Table 5- Distribution and Market Values of REITs by Ownership

	Number of REITs			Market Value of REITs (Million TL)		
	BREITs	CREITs	Other	BREITs	CREITs	Other
2000	4	4	0	226.23	89.18	0.00
2001	5	3	0	403.31	99.85	0.00
2002	6	3	0	277.78	74.94	0.00
2003	6	3	0	437.88	105.21	0.00
2004	6	3	0	866.20	142.95	0.00
2005	6	4	1	1531.55	967.47	43.20
2006	6	4	1	1371.14	724.94	25.28
2007	6	6	1	1245.64	2367.64	107.52
2008	6	7	1	487.79	674.36	24.00
2009	6	7	2	1032.58	1643.51	169.80
2010	6	9	6	1260.32	8967.02	503.40
2011	6	11	6	1158.58	9247.46	434.82

4.1.2 Macroeconomic Variables

4.1.2.1 Market Return

I use monthly ISE-100 index returns as the proxy for market portfolio returns. The index is used as the basic index for ISE. It consists of 100 stocks which are selected among the stocks of companies listed on the National Market and Corporate Products Market. There were three REITs in the ISE-100 in December 2000. The number of REITs in the ISE-100 index increased to four in December 2005 and five in December 2011. I calculate the percentage change in ISE-100 price index to obtain

return series. The end of month data for January 2000 – December 2011 period is gathered from DataStream.

4.1.2.2 Industrial Production

Industrial Production Index data are obtained from Central Bank of Republic of Turkey (CBRT). Turkish Statistics Institute (TSI) provides this series to measure short term positive or negative effects of economic policies and economic changes. There is not a single index that covers my sample period. Current industrial production index covers the period from 2005 to present and older industrial production index covers the period from 1997 to 2008. Therefore, to generate a series for the whole sample period, I adjust the older industrial production index with current industrial production index.

4.1.2.3 Inflation

Monthly inflation rate is calculated from Consumer Price Index (CPI). CPI is used to measure the change in price of product and services that are used by households. TSI prepares this data to measure the inflation rate in the market. The data are obtained from CBRT. Current CPI index takes 2003 as a base year and covers the period since 2003 to present. For 1994 – 2004 time period, another CPI index, whose base year is

1994, is available at archive. The CPI series is obtained for the whole period by adjusting the first sub-period with 2003 the CPI index as a base year.

4.1.2.4 Unexpected Inflation

I measure unexpected inflation in two different ways. In the first measure, UI-1, I use "Current Month CPI Expectation Survey" of CBRT as a proxy for expected inflation. This survey is conducted by CBRT two times in a month, at the beginning and in the middle of the month. Selected voluntary participants express their expectations about current month's inflation. These expectations are available from August 2001. I use the survey results on the 15^{th} of each month. The limitation of using the survey results on the 15^{th} of the month is that it might reduce the variability in the inflation expectations as well as unexpected inflation since individuals make their forecast after observing the first half of the month. UI-1 monthly unexpected inflation series is defined as the difference between actual inflation and expected inflation from CPI Expectation Survey. Since survey results are available since August 2001, UI-1 is obtained only for August 2001 to December 2002.

As an alternative way to measure unexpected inflation, UI-2, I model actual inflation using Box-Jenkins analysis and save residuals of the model as unexpected inflation. UI-2 is available for the whole sample period, January 2000 – December 2011. I use

monthly dummies to avoid seasonality problem in the model. Using AIC information criteria I observe that inflation can be represented as AR (5) process, and Adjusted R^2 of the AR (5) model is 0.6395. The result of this model is presented in the Appendix A. The correlation coefficient between two measures of unexpected inflation for the time period August 2001 – December 2011 is 0.72.

4.1.2.5 Overnight Interest Rate

Monetary policy is the process of controlling the availability and cost of money. CBRT maintains a monetary policy to promote national economic goals and stability. The most frequently used tool for monetary policy is targeting an interest rate. I measure monetary policy using overnight interest rates similar to Chen et al. (2012), Chang et al. (2011), and Ewning and Payne (2005). Daily data are available at the ISE. Since I use monthly frequency in my analysis, overnight interest rate at the last trading day of the month is used in the analysis. The main limitation of using overnight interest rate as a proxy for monetary policy is that banks might affect it. Therefore, this rate may not indicate only the changes in monetary policy; the power of banks may affect it.

4.1.2.6 Term Structure Premium

I define term structure premium as the monthly difference between long-term interest rates and short-term interest rates. Both short-term and long-term interest rates are obtained from ISE Government Debt Securities (GDS) Index. Two series are available at the ISE: GDS price index and GDS performance index. I use GDS price index because this index keeps the maturity of the assets constant to capture pure interest rate effect. In other words, the change in the GDS price index only results from the change in interest rates.

To obtain interest rates from GDS price index, I use "ISE GDS Indices Guide." Index values and price of GDS only at the base date are provided by the ISE for different maturities. Following the procedure in the guide, I first calculate the prices (P) using the price of the base year. For instance, 91 days GDS price index was 100 in January 2001, 105.51 in February 2001. The price at the base year was 85.471 for 91 days maturity GDS. Using this given data, I calculate the price for Febuary 2001 as 90.180 (85.471*105.51/100). Then, applying the formula ((100/P) – 1)*(365/maturity), I calculate annualized interest rates. I transform these annualized interest rates to monthly interest rates using simple compounding.

Daily data are available at the ISE. Since I use monthly frequency in my analysis, I form monthly short-term and long-term interest rate series by using end of month

values. If the end of a specific month is not a trading day, I use interest rate of the last trading day of that month.

I measure short-term interest rate using 91 days GDS price index. There are two indices. Current index covers the period 2001 to present. Older GDS price index covers the period between 1996 and 2000. To generate a series for whole sample period, I adjust the older GDS price index with current index. To measure long term interest rate, I use 186 Days GDS price index for 2000 and 365 Days GDS price index for 2001 and 2011. Although using 186 Days GDS price index is dictated by data availability, considering the market conditions in Turkey for 2000, it is reasonable to use 6-month interest rate as a proxy for long-term interest rates.

4.1.2.7 Default Risk Premium

In the literature, default premium is measured as the difference between the return on "Baa-rated corporate bond portfolio" and "Long term government bond portfolio". However, in Turkey corporate bond market is immature because of crowding out effect experienced in early 2000s, and start to be active only in recent years (Coskun, 2010). Turkish government extensively borrowed in the market to finance government expenses and high inflation rates resulted in an increase in interest rates. As a result, issuing corporate bonds became costly for corporations and they did not

finance their projects via corporate bonds. Therefore, it is not possible to use this definition of default risk premium for Turkish markets because of data unavailability.

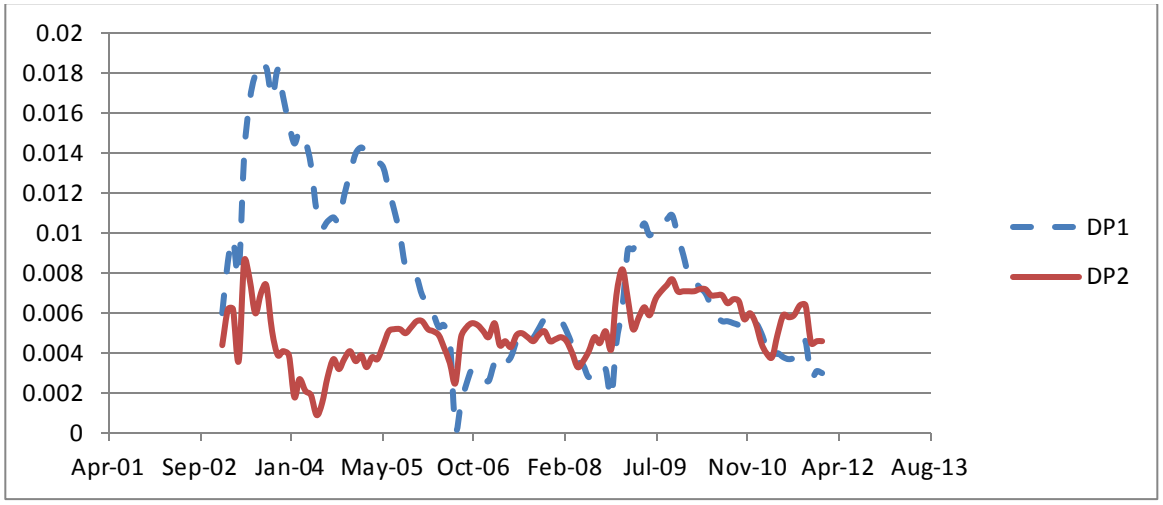
I use two proxies for default risk premium. In the first one (DP-1), default risk premium is the difference between "Is Bank average TL loan interest rate" and "91Days GDS interest rates". "Is Bank average TL loan interest rate" (IS rate) provides a single average interest rate for all given TL loan types: business loans and consumer loans. The limitation of using IS rate is that the duration of the loans are not known. Therefore, it is not possible to identify whether the changes in IS rate is because of changes in risk levels or because of the changes in loan durations. I obtain IS rate from footnotes of Is Bank quarterly reports for December 2002 and December 2005. These individual bank reports are available at The Banks Association of Turkey (BAT). For the period covering January 2006 and December 2011, I use BAT "Selected Tables for Individual Banks Report" which summarizes bank reports of banks quarterly. To convert this quarterly data to monthly data, I use linear interpolation. Finally, I transform these annualized interest rates to monthly interest rate using simple compounding.

The limitation of this proxy is that it is available only for December 2002 and December 2011 period. To obtain a default risk premium that covers all sample period, I define DP- 2. It is the difference between "12 month average TL deposit

rate" and "91Days GDS interest rates." I gather monthly "12 month average TL deposit rate" from CBRT database.

Figure 2 demonstrates two different proxies of default risk premium for December 2002 – December 2011 period, where both of the proxies are available. In this time period the correlation coefficient between IS rate and "12 month average TL deposit rate" was 0.89. The average annual interest rate is 0.254 for IS rate and 0.221 for "12 month average TL deposit rate". For January 2000 to December 2002, the time period included only in DP-2, average annual 12 month TL deposit rate is 0.514. The discrepancy between two measures of default risk premium is observed at the beginning of the sample period (2003-2005) and around the global crisis period.

Figure 2: Two Proxies for Default Risk Premium



4.1.2.8 Size and Book-to-Market Ratio

Fama & French (1993) construct six portfolios based on size and B/M ratio. They basically define two size levels (S - small and B - big) and three B/M levels (L - low, M - medium and H - high). Then, stocks are assigned to six portfolios depending on their size and B/M ratio. Fama & French define Small minus Big (SMB) as the difference between the simple average of the returns on the three small stock portfolios and the simple average of the returns on the three big stock portfolios. They define High minus Low (HML) as the difference between the simple average of the returns on the two high B/M ratio stock portfolios and the average of the returns on the two low B/M ratio stock portfolios. In my analysis, I follow the Fama & French (1993) procedure and form SMB and HML monthly return series for the ISE. SMB and HML are used as different measures of risk, to capture the risks that are not captured by market risk.

4.1.3 Descriptive Statistics

Table 6 presents descriptive statistics for the variables for the whole period and for the sub-period excluding 2000 – 2001 crisis. Like other stocks in the market, REITs performance increases in the subperiod, since mean return on REITs increases and corresponding standard deviation decreases. This performance improvement seems to be mainly driven from the performance of BREITs. The REITs which are not

classified as BREITs or CREITs seem to reduce the returns of the all REITs. Moreover, REITs are more volatile than the index. The variation in all variables, except industrial production, decreases when the crisis period excluded. This is an expected result since crisis periods damage the stability of the economies.

When descriptive statistics of interest rate related variables are investigated, it is observed that mean and standard deviation of term structure of interest rates decrease in the subperiod. In other words, decreasing uncertainty decreases the spread between long-term and short-term interest rates. Median of DP 2 is same for the whole period and the subperiod, but its standard deviation decreased from 0.66% to 0.15%. Furthermore, as a result of decreasing interest rates after the crisis, mean overnight interest rate decreased from 2.32% to 1.36%. Furthermore, for both periods, monthly mean of unexpected inflation is negative and its median is around -0.10%.

Table 6: Descriptive Statistics

PANEL A	***For Whole Sample Period : Jan 2000 - Dec2011***				
	Mean	Median	St. Dev.	Min	Max
Real Estate Market Returns					
REIT Return	0.88%	0.90%	13.12%	-34.25%	50.90%
BREIT Return (BREIT)	1.54%	0.88%	13.31%	-32.51%	50.23%
CREIT Return (CREIT)	2.12%	0.88%	15.02%	-40.58%	61.96%
Macroeconomic Variables					
ISE100 Return (MARKET)	1.54%	2.35%	11.93%	-35.39%	54.15%
Industrial Production (IP)	0.78%	-0.09%	8.00%	-25.07%	25.08%
Inflation (INF)	1.37%	0.93%	1.59%	-1.43%	10.33%
Unexpected Inflation -1 (UE 1)	-0.04%	-0.09%	0.68%	-2.05%	1.89%
Unexpected Inflation -2 (UE 2)	-0.03%	-0.09%	0.92%	-2.53%	5.13%
Overnight Interest Rate (OVERNIGHT)	2.32%	1.46%	2.16%	0.21%	12.84%
Term Structure Premium (TERM)	0.49%	0.17%	0.81%	-2.45%	3.60%
Default Risk Premium-2 (DP 2)	0.41%	0.50%	0.66%	-5.96%	1.52%
SMB	0.86%	0.68%	5.66%	-20.09%	18.09%
HML	0.67%	0.56%	5.85%	-12.98%	18.67%
PANEL B	***Subperiod: Dec 2002 - Dec 2011***				
	Mean	Median	St. Dev.	Min	Max
Real Estate Market Returns					
REIT Return	1.42%	1.64%	11.45%	-31.73%	36.06%
BREIT Return (BREIT)	2.14%	2.85%	12.14%	-32.51%	37.23%
CREIT Return (CREIT)	1.76%	1.27%	11.81%	-31.04%	40.74%
Macroeconomic Variables					
ISE100 Return (MARKET)	1.70%	3.03%	9.59%	-23.12%	27.42%
Industrial Production (IP)	0.92%	-0.09%	8.46%	-25.07%	25.08%
Inflation (INF)	0.78%	0.71%	0.87%	-1.43%	3.27%
Unexpected Inflation -1 (UE 1)	-0.03%	-0.09%	0.62%	-1.59%	1.89%
Unexpected Inflation -2 (UE 2)	-0.11%	-0.10%	0.63%	-1.87%	1.88%
Overnight Interest Rate (OVERNIGHT)	1.36%	1.30%	0.76%	0.21%	3.67%
Term Structure Premium (TERM)	0.27%	0.15%	0.36%	0.02%	1.92%
Default Risk Premium-1 (DP 1)	0.78%	0.60%	0.45%	0.02%	1.83%
Default Risk Premium-2 (DP 2)	0.51%	0.50%	0.15%	0.09%	0.86%
SMB	0.70%	0.50%	5.06%	-13.02%	11.64%
HML	0.44%	0.57%	4.83%	-12.98%	15.97%

Table 7: Correlation Coefficient Matrix of Variables

	REIT	CREIT	BREIT	ISE100	DP1	DP2	TERM	IP	UE1	UE2	INF	OVERNIGHT	SMB	HML
CREIT	0.9113 0.0000	1												
BREIT	0.9347 0.0000	0.7350 0.0000	1											
ISE100	0.8761 0.0000	0.7881 0.0000	0.840 0.0000	1										
DP1	0.2872 0.0025	0.2467 0.0097	0.2705 0.0044	0.2803 0.0032	1									
DP2	0.2209 0.0080	0.1738 0.0372	0.1964 0.0183	0.2012 0.0156	-0.0428 0.6585	1								
TERM	0.0143 0.8654	0.0760 0.3651	-0.0323 0.7007	0.0225 0.7893	0.4610 0.0000	0.1444 0.08343	1							
IP	-0.0185 0.8265	-0.0926 0.2695	-0.0229 0.7855	-0.0487 0.5623	0.0254 0.7934	0.0363 0.6654	0.0429 0.6099	1						
UE1	-0.1018 0.2588	-0.0900 0.3182	-0.0983 0.2755	-0.1004 0.2651	-0.1770 0.0656	-0.0787 0.3829	0.0086 0.9240	0.0730 0.4185	1					
UE2	0.0760 0.3667	0.1634 0.0503	0.0852 0.3098	0.0764 0.3631	-0.1145 0.2358	-0.1893 0.0231	0.0230 0.7842	0.0014 0.9866	0.7182 0.0000	1				
INF	0.0693 0.4108	0.1584 0.0580	0.0585 0.4858	0.1128 0.1784	-0.0052 0.9573	-0.2484 0.0027	0.4349 0.0000	-0.0068 0.9354	0.5954 0.0000	0.5521 0.0000	1			
OVERNIGHT	-0.1467 0.0804	-0.1031 0.2186	-0.1229 0.1421	-0.1066 0.2035	0.4501 0.0000	-0.5235 0.0000	0.2956 0.0003	-0.0747 0.3733	-0.1066 0.2367	0.1548 0.0639	0.5934 0.0000	1		
SMB	-0.2284 0.0061	-0.1160 0.1660	-0.2144 0.0099	-0.3819 0.0000	-0.0500 0.6055	-0.0349 0.6775	0.0237 0.7779	0.0138 0.8693	0.0290 0.7479	-0.0206 0.8061	0.0068 0.9357	0.0118 0.8884	1	
HML	0.3148 0.0001	0.3980 0.0000	0.2442 0.0031	0.2952 0.0003	0.3200 0.0007	0.0925 0.2704	0.0567 0.5000	0.1113 0.1840	-0.1357 0.1312	0.1309 0.1177	0.0963 0.2508	-0.0173 0.8366	-0.2235 0.0071	1

1) For each variable the second row represents p-values.

2) REIT= REIT returns, CREIT= REIT returns owned by construction firms, BREIT= REIT returns owned by banks, ISE100= ISE100 return, DP1 and DP2 = default risk premium, TERM=term structure of interest rate, IP=industrial production, UE1 and UE2= unexpected inflation, INF=inflation, OVERNIGHT=overnight interest rates, SMB=small minus big, HML=high minus low

Table 7 shows the Peasrson correlation coefficients between variables. It can be seen that both of default premium proxies are significantly and positively correlated with REIT, BREIT and CREIT returns. On the other hand, none of the other macroeconomic variables have significant correlation with REIT returns.

It is also interesting to note that there is significant correlation between inflation and CREIT returns, and unexpected inflation and CREIT returns. However, these variables do not have significant correlations with BREIT returns. This shows that CREIT returns are more sensitive to actual inflation and unexpected inflation movements.

In addition to SMB and HML have significant correlation with REIT returns at 1% level. It is interesting to note that size factor, SMB, is significantly and negatively correlated with BREIT returns but not CREIT returns. However, significant and positive correlation of HML is persistent for all REIT types.

4.2 Methodology

To capture the feedback mechanism between real estate market and macroeconomic variables, I apply a vector autoregressive model (VAR). This approach is consistent with existing literature on real estate markets of developed economies (see McCue

and Kling (1994), Lizieri and Satchell (1997), Brooks and Tsolacos (1999) and Joshi (2006)).

A VAR model is composed of a system of regressions in which the dependent variables are expressed as functions of their own and each other's lagged values (Enders 2004) and possibly some other control variables. Its estimation is done by running a separate regression for each variable, regressing it on lags of itself and all other variables. This methodology has proven especially useful for forecasting systems of interrelated time-series variables, when the exact theoretical nature of the relationship is obtuse.

One attractive feature of VAR analysis is the researcher does not need to specify which variables are endogenous or exogenous since it allows each variable in the system to be treated symmetrically. This overcomes the invalid identifying restrictions. Another attractive feature of VAR is that the structure of the system incorporates feedback because the variables in the system are allowed to affect each other (Enders, 2004).

I include two dummy variables as exogenous variables into my VAR model (dummy-crisis and dummy-mortgage). The values of the dummy variables are determined outside of the VAR system. In other words, there are no equations in the VAR in which dummy

variables are dependent variables. Claessens et al. (2010) show that Turkish market was affected from the 2008 global financial crisis. They find that Turkey experienced a recession period between April 2008 and December 2008 as a result of 2008 global financial crisis. Recession is identified by the negative real GDP growth rate. Therefore, I hypothesize that global financial crisis of 2008 influenced the returns of real estate market of Turkey negatively. I include an exogenous dummy variable (dummy-crisis) to VAR model to capture this effect. It takes a value of 1 for the months between April 2008 and December 2008.

Moreover, on 21.02.2007, the "Mortgage Law" (law number 5582) was enacted for the further development of housing market by facilitating housing finance in Turkey. This regulation is an important progress for the improvement of real estate market. Motivated by this signal of development in real estate market, I hypothesize that having active mortgage market has a positive effect on real estate market returns. Therefore, I include an exogenous dummy variable (dummy-mortgage) to VAR model. This variable takes a value of one after February 2007 and it is zero otherwise. The VAR model can be written as:

$$X_t = C + \sum_{i=1}^{k} Z_k X_{t-i} + \mathrm{B} * Dummy_{Crisis} + \mathrm{D} * Dummy_{Mortgage} + \mathrm{V}_t$$

Where X_t is the vector of variables at time t (REIT returns=REIT, stock market return=ISE100, default risk premium=DP, term structure of interest rates=Term, industrial production=IP, unexpected inflation=UE, inflation=INF, overnight interest rate=OVERNIGHT), C is the constant coefficient vector, Z is the coefficient matrix and V is the error term and k is the optimal lag determined for that VAR model. This model is also estimated by controlling for monthly seasonality and trend.

It is known that the interpretation of the coefficients is difficult in VAR models. Therefore, variance decomposition offers a method for examining VAR system dynamics. Variance decomposition gives the proportion of the movements in the dependent variables that are due to their own shocks, versus shocks to the other variables. If shocks to one variable explain none of the forecast error variance of a dependent variable at all forecast horizons, it is possible to say that the variable is exogenous. In practice, it is usually observed that own series shocks explain most of the forecast error variance of the series in VAR (Brooks, 2008). Hence, the contributions of each macroeconomic variable to the volatility of REIT returns are estimated with variance decomposition.

Impulse response function is also valuable to understand the dynamic effects of macroeconomic variables on real estate market returns. This analysis is used to assess the effect of a shock to macroeconomic variables on REIT returns. So, for each

macroeconomic variable, a unit shock is applied to the error, and their effect on REIT returns is examined over time. Therefore, impulse response function is used to analyze the dynamic response of the model. This method indicates whether the impact of one variable on other variable is positive or negative. Furthermore, it is also possible to analyze the duration of this impact.

Lutkenpohl (1991) criticize conventional impulse response method because results are subject to the orthogonality assumption and may differ depending on the ordering of the variables in VAR. To overcome this this problem, I use generalized impulse response function developed by Peseran and Shin (1998) and Koop et al. (1996).

The nature of the model necessitates that all the variables to be stationary. I applied Augmented Dickey-Fuller (ADF) unit root test to the variables, where null hypothesis is "the variable has a unit root." Therefore, rejecting the null means the variable is stationary. The lag length of the ADF is determined using Ng & Perron Information Criteria technique. Table 8 presents the unit root test results of the variables. It is observed that for whole sample period all of the variables are level stationary except TERM, INF, and OVERNIGHT. For the subperiod DP2 and IP are I (1) and other variables are I (0).

Table 8: Results of ADF Unit Root Test

Whole Sample Period January 2000 - December 2011			Sub-Period December2002 - December2011	
Variable	**Level**	**First Difference**	**Level**	**First Difference**
REIT Return	-12.616***	xxx	-10.793***	xxx
BREIT Return	-13.095***	xxx	-11.539***	xxx
CREIT Return	-13.770***	xxx	-10.475***	xxx
REIT Residual	-12.360***	xxx	-11.003***	xxx
BREIT Residual	-12.165***	xxx	-11.196***	xxx
CREIT Residual	-15.898***	xxx	-11.551***	xxx
ISE100	-14.066***	xxx	-12.285***	xxx
DP2	-3.922***	xxx	-2.843*	-6.406***
TERM	-2.666*	-5.525***	-3.667***	xxx
IP	-3.065**	xxx	-2.065	-9.634***
UE1	-10.487***	xxx	-9.950***	xxx
UE2	-12.583***	xxx	-14.640***	xxx
INF	-2.464	-10.925***	-7.324***	xxx
OVERNIGHT	-1.736	-5.252***	-3.630***	xxx
SMB	-14.130***	xxx	-11.600***	xxx
HML	-12.326***	xxx	-5.481***	xxx

Test Statistics values are presented in the table. *, **, *** denotes 10%, 5%, 1% significance respectively.

To overcome the non-stationarity in the data I apply Johansen co-integration test with TERM, INF, and OVERNIGHT for the whole sample period. For the subperiod I conduct Johansen co-integration test with DP and IP. Under the Johansen trace test, the null hypothesis that "there is at most one co-integrating vector" is rejected at the 5% significance level for both whole sample period and subperiod tests. Similarly, under the Johansen maximum eigenvalue test, the null hypothesis that "there is at most one co-integrating vector" is rejected at the 5% significance level for both whole sample period

and the subperiod tests. In other words, Table 9 shows that there are two co-integrating equations for both the whole sample period and the subperiod. Therefore, I conclude that there is a long run relationship between non-stationary variables and non-stationary variables are co-integrated. Following Sims et al. (1999) I use level data of these variables in the VAR analysis.

Table 9: Johansen Co-Integration Test

Whole Sample Period				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized Number of Cointegrating Equations	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.383	103.619	29.797	0.000
At most 1 *	0.211	36.451	15.495	0.000
At most 2	0.025	3.516	3.841	0.061
Trace test indicates two cointegrating equations at the 0.05 level, * denotes rejection of the hypothesis at the 0.05 level				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized Number of Cointegrating Equations	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.383	67.168	21.132	0.000
At most 1 *	0.211	32.935	14.265	0.000
Max-eigenvalue test indicates two cointegrating equations at the 0.05 level, * denotes rejection of the hypothesis at the 0.05 level				
Subperiod				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized Number of Cointegrating Equations	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.355	53.721	15.495	0.000
At most 1 *	0.053	5.899	3.841	0.015
Trace test indicates two cointegrating equations at the 0.05 level, * denotes rejection of the hypothesis at the 0.05 level				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized Number of Cointegrating Equations	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.355	47.822	14.265	0.000
At most 1 *	0.053	5.899	3.841	0.015
Max-eigenvalue test indicates two cointegrating equations at the 0.05 level, * denotes rejection of the hypothesis at the 0.05 level				

To determine the lag length of the VAR model I use Likelihood Ratio (LR) test and Akaike Information Criteria (AIC). LR test approach can be used when the errors from each equation are normally distributed. To overcome this normality assumption concerning the distribution of the errors I also check AIC. Both approaches suggest the same number of lags for every analysis.

Since variance decomposition uses Cholesky decomposition, ordering of the variables may affect the results of the analysis. Therefore, it is crucial to determine the order that is suggested by financial theory. Ordering a variable(Variable A) before another variable (Variable B) in the VAR model means implicitly assuming that "A" will effect "B" but not vice versa in the same month (Berument, 2006). In other words, variables should be ordered from the most exogenous variable to the most endogenous one. Therefore, I order the variables in the VAR as overnight interest rate, industrial production, inflation, unexpected inflation, term structure of interest rate, default risk premium, market returns, and REIT returns. Furthermore, the analysis repeated with different ordering of variables and the results do not change much.

CHAPTER 5

EMPIRICAL RESULTS

In this chapter I present and discuss the results of the estimated models. First, I estimate the ordinary least square (OLS) model in which REIT return series are dependent variables and macroeconomic factors are independent variables. I included crisis and mortgage dummy variables to the model and controled for monthly seasonality. Table 10 represents the results of the OLS regressions for both whole sample period and subperiod. All of the models are significant and their adjusted R^2 are higher than 0.55. However, this high explanatory power is driven by the stock market return series. Stock market returns are significant at 1% level for all REIT types and for all periods. All the coefficients of other macroeconomic variables and dummy variables are found to be insignificant, except industrial production. The

results show that there is a positive relationship between BREIT returns and industrial production for both whole sample period and subperiod.

Table 11 represents the results of the OLS regressions where market effect is eliminated and the residuals of REIT returns is used as a dependent variable. It is found that the significance of the models declines and except industrial production, all coefficients are insignificant. The positive relationship between BREIT returns and industrial production for the whole sample period and the subperiod is still observed. The insignificance of coefficients can be explained by multicollinarity among macroeconomic variables.

Table 10: OLS Regression Results for REIT Returns

	Explanatory Variables											
Dependent Variable	Constant	Overnight	Industrial Production	Inflation	Unexpected Inflation	Term	Default Risk	Market	Global Crisis Dummy	Mortgage Dummy		
	Whole Period: January 2000 – December 2011											
REIT Return	-0.006	0.082	0.097	-0.987	1.198	0.570	0.363	0.963***	-0.021	0.001	Adjusted R2:	0.785
	-0.24	0.19	1.12	-1.22	1.36	0.62	0.35	19.88	-0.92	0.11	Prob(F-statistic):	0.00
BREIT Return	0.011	0.218	0.216**	-1.154	1.254	-0.298	0.545	0.937***	0.011	-0.013	Adjusted R2:	0.715
	0.42	0.42	2.14	-1.22	1.24	-0.28	0.46	16.58	0.41	-0.84	Prob(F-statistic):	0.00
CREIT Return	0.016	-0.408	-0.090	0.050	1.424	1.729	-0.829	0.992***	-0.014	0.014	Adjusted R2:	0.659
	0.49	-0.64	-0.72	0.04	1.14	1.32	-0.57	14.22	-0.42	0.74	Prob(F-statistic):	0.00
	Subperiod: December 2002 – December 2011											
REIT Return	0.025	-1.415	0.165	0.173	-1.607	1.447	-2.231	0.998***	-0.014	-0.001	Adjusted R2:	0.703
	0.55	-0.61	1.47	0.09	-0.84	0.32	-0.42	13.59	-0.54	-0.07	Prob(F-statistic):	0.00
BREIT Return	0.006	0.126	0.336**	0.650	-1.767	-2.832	1.431	0.970***	0.019	-0.019	Adjusted R2:	0.621
	0.12	0.05	2.51	0.27	-0.77	-0.52	0.22	11.02	0.62	-0.87	Prob(F-statistic):	0.00
CREIT Return	0.045	-1.234	0.016	0.508	-1.947	0.878	-2.362	0.952***	-0.016	0.017	Adjusted R2:	0.566
	0.77	-0.43	0.11	0.20	-0.82	0.15	-0.35	10.39	-0.51	0.76	Prob(F-statistic):	0.00

T-values for each coefficient are presented in the second row of each dependent variable.
*, **, *** denotes 10%, 5%, and 1% significance levels respectively.

Table 11: OLS Regression Results for REIT Return Residuals

	Explanatory Variables											
Dependent Variable	Constant	Overnight	Industrial Production	Inflation	Unexpected Inflation	Term	Default Risk	Market	Global Crisis Dummy	Mortgage Dummy		
	Whole Period: January 2000 – December 2011											
REIT Residual	-0.010	0.180	0.099	-0.930	1.143	0.580	0.442	0.002	-0.020	-0.005	Adjusted R2:	0.069
	-0.25	0.33	1.13	-1.12	1.27	0.63	0.42	0.04	-0.86	-0.19	Prob(F-statistic):	0.089
BREIT Residual	-0.034	0.631	0.218**	-0.903	1.062	-0.289	0.918	0.004	0.016	-0.039	Adjusted R2:	0.035
	-0.71	1.00	2.16	-0.93	1.03	-0.27	0.75	0.07	0.60	-1.42	Prob(F-statistic):	0.223
CREIT Residual	0.101	-1.260	-0.094	-0.469	1.820	1.711	-1.600	-0.006	-0.025	0.067**	Adjusted R2:	0.122
	1.76	-1.64	-0.76	-0.40	1.45	1.32	-1.06	-0.09	-0.75	2.01	Prob(F-statistic):	0.013
	Subperiod: December 2002 – December 2011											
REIT Residual	0.021	-1.097	0.165	0.069	-1.527	1.275	-2.305	0.039	-0.014	-0.004	Adjusted R2:	0.049
	0.21	-0.31	1.47	0.03	-0.75	0.26	-0.43	0.51	-0.54	-0.14	Prob(F-statistic):	0.224
BREIT Residual	-0.104	3.575	0.335***	-0.474	-0.907	-4.697	0.626	0.059	0.019	-0.049	Adjusted R2:	0.010
	-0.89	0.84	2.50	-0.18	-0.37	-0.82	0.10	0.65	0.62	-1.38	Prob(F-statistic):	0.414
CREIT Residual	0.089	-2.817	0.016	1.024	-2.342	1.734	-1.993	-0.052	-0.016	0.031	Adjusted R2:	-0.003
	0.73	-0.63	0.11	0.37	-0.92	0.29	-0.30	-0.54	-0.51	0.84	Prob(F-statistic):	0.488

T-values for each coefficient are presented in the second row of each coefficient.
*, **, *** denotes 10%, 5%, and 1% significance levels respectively.

Although OLS results do not reveal a significant relationship between macroeconomic variables and REIT returns, futrher analysis is needed to examine the dynamic relationship.

5.1 Testing Fama & French Three – Factor Model

In order to identify whether macroeconomic factors are important for REIT returns, Fama & French three-factor model is estimated for Turkish REITs for the time period January 2000 – December 2011. Size factor (SMB) and value factor (HML) are included in the model in addition to the market factor in CAPM. The idea for including these two factors is to capture systematic risk that is coming from the macroeconomic factors.

Table 12 represents the results of three – factor model, for both REIT index returns and individual REIT returns. Number of observation changes across each REIT, because their IPO dates differ.

Table 12: Fama & French Three – Factor Model

	Constant	Market	SMB	HML	Adj. R^2	N
ISE - REIT	-0.010	1.022	0.435	0.219	0.802	143
	0.043	0.000	0.000	0.019		
Bank REITs	-0.003	0.998	0.304	0.020	0.725	144
	0.655	0.000	0.009	0.851		
Construction REITs	-0.003	1.029	0.647	0.542	0.701	144
	0.648	0.000	0.000	0.000		
BREITs						
Yapıkredi - Koray	-0.002	1.300	0.629	0.263	0.663	144
	0.811	0.000	0.000	0.108		
İş	-0.008	1.005	0.281	-0.042	0.657	144
	0.287	0.000	0.051	0.748		
Vakıf	0.002	0.882	0.703	0.410	0.363	144
	0.898	0.000	0.002	0.053		
EGS	-0.018	0.476	0.357	0.508	0.106	126
	0.223	0.001	0.227	0.074		
Atakule	-0.004	1.241	0.851	0.159	0.567	91
	0.722	0.000	0.000	0.492		
CREITs						
Ozderici	0.044	0.935	0.745	1.004	0.096	48
	0.267	0.039	0.396	0.274		
Yesil	-0.003	0.930	0.931	0.562	0.242	144
	0.869	0.000	0.004	0.062		
Sinpas	0.000	1.216	0.275	0.979	0.606	54
	0.978	0.000	0.429	0.006		
Saf	0.010	1.034	0.251	0.413	0.294	57
	0.612	0.000	0.572	0.380		
Nurol	-0.001	1.036	0.765	0.320	0.444	144
	0.909	0.000	0.001	0.117		
Alarko	-0.001	0.997	0.796	0.217	0.524	144
	0.930	0.000	0.000	0.189		
Akmerkez	-0.006	0.811	0.313	-0.206	0.235	80
	0.660	0.000	0.242	0.516		

*Table includes REITs that have at leats 30 observations.
*P-values are given in the second row for each REIT.
*All of the models are significant at 1% except Ozderici. Ozderici is significant at 10% level.

Table 12 shows that for ISE – REIT returns all of the explanatory variables are significant at 1% level and the adjusted R^2 of the model is high, 0.802. These results are parallel to the observations of Fama & French.

However, when I consider the ownership effect and analyze CREITs and BREITs separately, I observe that for BREITs the coefficient on HML is not found to be significant. BREIT returns can be explained by market index return movements and size factor. When I investigate BREITs individually I observe that HML is significant at 10% level for Vakıf and EGS, however, explanatory power of these two models is low. Their adjusted R^2 are 0.36 and 0.11 respectively. In addition, for CREITs, all of the three variables are significant. Therefore, it is possible to conclude that three-factor model holds for Turkish CREITs.

Adjusted R^2 is more than 70% for all and bank or construction related REITs. These results suggest that risks associated with macroeconomic factors are important to explain REIT returns. However, there are some differences among individual REITs.

5.2 Variance Decomposition Results for the Full Sample: January 2000 – December 2011

Table 13 shows the variance decomposition of REIT returns using three VAR models for whole sample period, from January 2000 to December 2011. There are three main groups of analysis. Group 1 covers all REIT returns. Group 2 includes REITs that are owned by banks and Group 3 includes REITs owned by construction firms. In all three groups, REIT returns exclude market effect, i.e., they are the residuals obtained from the regression of REIT returns on the returns of market index (Models are presented in Table 4).

For each group, three models are estimated. Model 1 includes industrial production, unexpected inflation, term structure premium, default risk premium as macroeconomic variables. Data availability dictates the choice of DP – 2 against DP-1 and UI – 2 against UI – 1 for the analysis covering the whole period. In Model 2, I add inflation and overnight interest rate as additional variables in the model. Model 3 has the same macroeconomic variables as Model 2 but I also control for monthly seasonality and trend in the model.

Table 13: Variance Decomposition of REIT Returns for Whole Sample Period

January 2000 – December 2011									
	Group 1			Group 2			Group 3		
	All REITs			Bank related REITs (BREITs)			Construction related REITS (CREITS)		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
REIT return	75.91	59.20	51.74	65.11	62.25	56.71	72.25	51.72	55.95
Overnight	x	2.29	5.75	x	2.24	3.40	x	6.19	5.35
IP	6.19	10.97	12.06	6.14	5.62	7.58	4.66	9.58	10.58
Inf	x	6.65	11.78	x	6.69	7.95	x	4.31	6.34
UE 2	2.42	9.17	1.17	5.42	5.58	4.91	3.53	10.14	3.33
Term	2.74	1.37	2.27	5.04	4.12	1.66	8.09	5.52	7.06
DP 2	3.95	3.72	5.74	7.50	3.51	4.97	5.44	5.08	4.77
Market	8.79	6.62	9.50	10.78	9.98	12.82	6.02	7.47	6.63
# of lags	6	8	8	8	8	8	4	8	8
SE	0.0939	0.0118	0.0119	0.1007	0.0124	0.0123	0.0878	0.0115	0.0113

Variance decomposition results show the proportion of movements in REIT returns that are due to its own shocks and shocks to other macroeconomic variables. If there is no interaction between real estate market returns and macroeconomic variables, the proportion of REIT returns to explain its variability should be 100%. It is observed that macroeconomic variables are able to explain more than 40% of the variation in REIT returns.

5.2.1 Effect of Macroeconomic Variables on ISE-REITs

In Model 3, macroeconomic variables explain the highest percentage of the variation in all REIT returns compared to other models. However, even in that model, none of the variables explain more than 15% of real estate market returns. It can be interpreted that there is not a dominant factor. However, industrial production, inflation and market returns seem to be more important than other factors.

Industrial production accounts for 12.06% of the variation in REIT returns. It seems that the stage of business cycle is important and affecting real estate market returns. Growing and robust economy accelerates the improvements in real estate sector but a sudden shock to the output level of the economy distresses real estate market. This finding is similar to the results for the US. McCue and Kling (1994) report that total variation of US REIT returns explained by industrial production is 9.3% for the time period 1972 – 1991. Furthermore, the effect of industrial production increases from 10.97% to 12.06% when monthly seasonality and trend are controlled.

Actual inflation accounts for 11.78% of the total variation in all REIT returns. The effect of inflation increases from 6.65% to 11.78% when monthly seasonality and trend are controlled. The finding can be explained with the effect of inflation on real cost of borrowing to finance investments in real estate. Therefore, returns on real estate are affected from the movements in actual inflation. In McCue and Kling

(1994) study, actual inflation explains 7.5% of the variation in US REIT returns. The effect of controlling monthly seasonality is clearer for the explanatory power of unexpected inflation. In Model 2, unexpected inflation explains 9.17% of the total variation but this proportion decreases to 1.17% in Model 3. In other words, total explanatory power of two inflation variables is close in Model 2 and Model 3, however, controlling monthly seasonality transfers the effect of unexpected inflation to actual inflation.

Market returns explain 9.50% of the total variation in all REIT returns. Moreover, comparing Model 1 and Model 2, I observe that the effect of market returns decreases as inflation and overnight interest rates are added to the model. This finding supports the arguments against CAPM, adding other related variables increases the explanatory power of the model. Although market returns has the third highest explanatory power on Turkish REIT returns, its explanatory power is low compared to the Clayton and Mackinnon (2003) results. They find that for 1978 – 1998 time period S&P 500 returns explain 21.4% and Russell 2000 index returns explain 18.4% of the NAREIT volatility. These different results can be interpreted as Turkish REIT are acting more like real estate compared to US REITs that act like stocks.

Monetary policy is measured with overnight interest rates. The contribution of overnight interest rates to the variability of REIT returns increased from 2.29% to

5.75% in model 3. One possible explanation for this result is a shock to the monetary policy, tightening for instance, affects returns on REITs through interest rates. This finding indicates that change in borrowing costs transmits the shock on the monetary policy to REIT market.

Two interest rate related variables default risk premium, DP-2, and term structure premium account for 5.74% and 2.27% of total variation respectively. The low explanatory power of term structure premium is persistent in all three models. On the other hand, the contribution of default risk premium is relatively higher than other macroeconomic variables. This observation can be explained by the fact that when default rate increases, investors might increase their demand for real estate.

5.2.2 Effect of Ownership Structure

The findings for the two group of REITs, i.e., BREITs and CREITs suggest that ownership structure of REITs is an important factor for understanding return structure of REITs.

Market returns explain 12.82% of the total variation in BREIT returns, whereas it explains only 6.63% of the total variation for CREITs. This result indicates that

REITs whose major owners are banks are more sensitive to the changes in ISE-100 index compared to REITs whose major owners are construction firms. This might be explained by the fact that the major owners of BREITs are banks and they are also traded in the ISE whereas none of the construction firms are traded publicly. This difference cannot be explained by the composition of their portfolios since CREITs hold more money and capital market instruments in their portfolio than BREITs do.

On the other hand, CREITs are more sensitive to shock to industrial production then BREITs. Industrial production is able to explain 7.58% of the total variation BREIT returns, whereas industrial production accounts for 10.58% of the total variation in CREIT returns (Model 3). This shows that the stage of business cycle and the general conditions of economy are relatively more important to explain the variability of returns of CREITs. Similarly, the effect of term structure of interest rates on CREITs is more pronounceable and term premium shocks explain 7.06% of the total variation in CREITs in model 3. When the results for BREITs are investigated, this proportion decreases to 1.66%. Term premium has predictive power about the economy and it reflects market participants' future expectations. Therefore, combining variance decomposition results of industrial production and term structure of interest rates, I conclude that general condition of the economy and the expectations about the economy are relatively more important to explain CREIT returns than BREIT returns.

Finally, it is interesting to observe that none of the coefficients on dummy-mortgage and dummy-crisis are significant. Furthermore, there is not any consistency in the sign of the coefficients. One possible explanation for not observing any effect of mortgage law is that there is not an active secondary market for mortgages. In other words, there is not securitization of loans and banks are not able to transfer their risks resulted from long - term mortgage loans. Although not having secondary market blocks the positive effect of mortgage law, it seems that it also protected the real estate market returns from the negative effect of global sub-prime mortgage crisis.

5.3 Variance Decomposition Results for the Subperiod: December 2002 – December 2011

Table 14 shows the variance decomposition of REIT returns for the subperiod, from December 2002 to December 2011. The structure of the table is exactly the same as the previous one. Moreover, variables included in the models 1- 3 are also same as the whole period.

Table 14: Variance Decomposition of REIT Returns for Subperiod

December 2002 - December 2011									
	Group1			Group 2			Group 3		
	All REITs			Bank related REITs (BREITs)			Construction related REITS (CREITS)		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
REIT Return	67.26	47.43	37.26	75.57	51.24	46.54	83.45	31.71	57.81
Overnight	x	5.79	4.85	x	6.47	6.95	x	9.47	2.84
IP	9.43	12.12	11.20	5.52	5.59	7.22	6.79	11.13	7.26
Inf	x	6.36	11.51	x	9.34	10.57	x	8.21	11.36
UE 2	7.18	8.14	2.59	5.73	7.04	1.57	0.84	11.11	2.31
Term	3.19	10.64	15.17	4.32	8.40	7.38	3.78	12.44	6.75
DP 2	1.66	3.90	3.70	0.42	2.09	3.87	1.46	9.58	6.32
Market	11.28	5.63	13.71	8.45	9.84	15.89	3.66	6.36	5.35
# of lags	4	6	5	2	6	5	2	8	5
SE	0.0954	0.0051	0.0061	0.0899	0.0046	0.0049	0.0897	0.0068	0.0065

5.3.1 Effect of Macroeconomic Variables on REIT Returns for the Sub-period

Macroeconomic variables explain most of the variation in all REIT returns (Group 1) when seasonality and trend are controlled for (Model 3). These variables are found to be explaining 62.74% of the variation in all REIT returns. The same model explains only 48.26% of the variation for the whole sample period. In other words, when the period covering "2001 Crisis" is eliminated, the contribution of macroeconomic variables on REIT returns becomes clearer. Moreover, industrial production,

inflation, market, and term structure of interest rates are found to be four relatively important variables to explain the variability of real estate market returns.

The explanatory power of industrial production and inflation is almost same as the results for the whole period. The persistence of these variables in two periods show that production level and actual inflation rate are two most important factors to consider when analyzing real estate market returns.

The influence of term structure of interest rate increases to 15.17% in the subperiod, from 2.27% in the whole period. This increase in the contribution of term structure can be partially explained by the availability of long-term interest rates with the decrease in the uncertainty in the economy. The maturity of bonds increased from 6-month to one year or longer. Furthermore, term structure of interest rates can be used as a proxy to understand the market participants' future expectations. As the expectations for future become more positive, the spread between long term and short term interest rates decreases. Therefore, Table 14 demonstrates that market participants' expectations about future conditions of the market affect real estate returns. The increase in explanatory power of this variable in the subperiod is intuitive since high uncertainty in the market at crisis period affects long – term interest rates. Examining the subperiod means decreasing long – term interest rates indirectly. Since lower the long – term interest rates results in higher demand for

housing and real estate market, explanatory power of term structure of interest rates increases in the subperiod.

In addition to term premium, explanatory power of market returns also increases to 13.71%. For whole sample period market explain 9.50% of the total variation in REIT returns (Model 3). This explained portion increase to 13.71% for subperiod analysis. This finding suggests that REITs are behaving more like common stocks instead of real estate market instruments for the sub-period.

Finally, explanatory power of default premium, overnight interest rates and unexpected inflation are close for two periods. Moreover, none of the variables are able to explain more than 5.75% of the total variation in REIT returns. Parallel to the whole period results, none of the dummy variables are found to be significant.

5.3.2 Effect of Ownership Structure for the Subperiod

Table 14 show that almost 70% of the variation in construction firm related REIT returns is explained with macroeconomic variables in model 2. This explainable portion decreases to 42.19% in model 3. This shows that construction related REIT returns are exposed to monthly seasonality. The reduction in explanatory power of

macroeconomic variables from model 2 to model 3 is resulted from the decrease in the explanatory power of unexpected inflation and term structure of interest rate.

Parallel to the whole period results, shocks to market return series explain 15.89% of the total variation in BREIT returns, whereas it explains only 5.35% of the total variation for CREITs. This result indicates that REITs whose major owners are banks are more sensitive to the changes in ISE-100 index compared to REITs whose major owners are construction firms.

Moreover, I observe that the effect of overnight interest rate on BREITs is approximately three times larger than its effect on CREITs. This means that BREIT returns are more sensitive to the changes at monetary policy. Therefore, when intervention to the market is low and interest rates are stable, the volatility of BREIT returns decreases. Monetary policy becomes one of the important factors explaining the variability of BREIT returns. The difference in findings can be explained by the decline in economically uncertain environment at the beginning of the sample period.

5.4 Generalized Impulse Responses

The generalized impulse response functions of REIT returns to macroeconomic shocks are obtained from the VAR model. In the estimations, monthly seasonality and trend are controlled. The impacts of the shocks to all macroeconomic variables in

Model 3 are analyzed. The actual returns on REITs are used instead of REIT residuals.

Panel A of Table 15 represents the expected sign of the shocks in macroeconomic variables on REIT returns. Panel B represents the observed sign of significant impulse responses for whole sample period and Panel C displays the observed significant results for the sub-period. To determine the significances, confidence intervals for two standard deviations are obtained. The plots of impulse response functions of REIT returns on macroeconomic shocks for 10 months are presented in Appendix B to Appendix G.

Table 15: Generalized Impulse Response Functions

	OVERNIGHT	TERM	DP	UE	INF	IP	MARKET
PANEL A - Expectations							
	negative	negative	positive	negative	negative	positive/negative	positive
PANEL B – Sample Period: January 2000 – December 2011							
All REITs	negative	negative	positive	x	x	x	positive
BREITs	x	negative	positive	x	x	x	positive
CREITs	negative	negative	positive	x	x	x	positive
PANEL C – Sample Period: December 2002 – December 2011							
All REITs	negative	negative	positive	x	x	x	positive
BREITs	negative	negative	positive	x	negative	x	positive
CREITs	x	negative	positive	x	x	x	positive

A unit shock to overnight interest rates may increase interest rates. This is expected to decrease the demand for real estate and real estate market returns. Therefore, I expect that the shocks on monetary policy variable will have negative effect on REIT returns. Table 15 shows that all of the significant impulse response functions indicate negative impact on REIT returns for the whole period and the sub-period (Panel B and Panel C). However, for CREIT returns, the significant negative impulse responses observed for the whole sample period disappear for the sub-period. The reverse is true for BREITs. This results show that after 2001 financial crisis, the impact of monetary policy on BREIT returns increased whereas its effect on CREIT returns decreased.

Since term structure of interest rates is a proxy for slope of yield curve, when a unit shock will increase it the difference between long-term interest rates and short-term interest rates increases. This increase in long-term interest rates increases the cost of borrowing for real estate and expected to decrease return on real estate. Therefore, I expect a negative effect of term structure premium and REIT returns. Table 15 shows that for all REIT types and for all periods, REIT returns react negatively and significantly to a unit shock on term structure of interest rates.

In addition to overnight interest rates and term structure of interest rates, default risk premium is another interest rate related factor examined in this study. When a unit

shock applied to default risk premium, it is expected that risk level in the market increases. This increased risk perception increases the demand for investment in real assets. Therefore, I expect a positive response of REIT returns to a unit shock of default risk premium. Table 15 shows that for all REIT types and for all periods REIT returns react positively and significantly to a shock on default risk premium.

For both of the inflation related factors, actual inflation and unexpected inflation, I expect negative response of REIT returns because an increase in inflation increases the real cost of borrowing, decreases households purchasing power and their demand for real estate investment, and lower REIT returns. The only significant response for the increase in inflation rate is observed for BREITs in the sub-period.

The response of REIT returns to a shock in industrial production can be either negative or positive. A shock to industrial production means an increase in output of industrial sector of economy. If the investors expect positive stock market returns following the increase in industrial production this may result in an increase in REIT returns. On the other hand, if the shock to the industrial production results in an increase in inflation, then REIT returns may respond negatively to the shock in industrial production. Table 15 shows that none of the impulse response functions of REITs are significant for industrial production shock. Since explanatory power of industrial production on the total variation of REIT returns is 12.06% for whole

sample period and 11.20% for the subperiod it would be misleading to conclude that industrial production does not affect real estate market returns. These insignificant impulse responses may be a result of positive and negative effects of industrial production on REIT returns neutralized each other.

Finally, I expect a positive response to market index returns shocks. Since REITs are traded in the ISE, increases in the index level result in increases in REIT price levels and returns. From Table 15, it is seen that for all REIT types and for all periods REIT returns react positively and significantly to a shock in market returns.

5.5 Robustness Check

I conduct further analyses to investigate whether my findings are robust to the proxies used for macroeconomic variables. Mainly, I examine whether proxies used for default risk premium and term structure of interest rates are affecting the results. Since all of the proxies are not available for whole sample period, the analyses are done for the subperiod (December 2002 and December 2011) and for all REITs.

I conduct four additional variance decomposition analyses to check the robustness of 1) the definition of default risk premium, 2) the definition of unexpected inflation rate, 3) the usage of real estate market returns as residuals where ISE-REITs index

returns is regressed on ISE-100 index returns, and 4) the usage of REIT returns as a proxy for real estate market returns.

Table 16 summarizes robustness checks. The first column gives the results of Model 3 reported in part 4.2.1 as a reference. The second column presents the results for the variance decomposition of REITs using DP 1 is used instead of DP 2. Therefore, by comparing the first and the second columns, the definition of DP is tested. Similarly, UE 1 is used instead of UE 2 in the model and the results are presented in the third column. Hence, by comparing the first and the third columns, the definition of UE is tested. The fourth column shows the variance decomposition of REIT returns without filtering the market effect. The comparison between the first and fourth column reveals the effect of using real estate market returns as residuals. Finally, I use changes in Building Construction Cost Index (BCCI) as an alternative to real estate market return proxy. This index measures the changes in the cost of inputs used in construction. I obtained the data from Turkish Statistical Institute. The current BCCI index uses 2005 as base year and covers the period 2005 to present. For 1991 – 2005 time period another BCCI index, whose base year is 1991, is available. The BCCI series is obtained for the whole period by adjusting the first sub-period with 2005 base year index.

Table 16: Variance Decomposition for Robustness Analyses

	(1) REIT Residuals	(2) REIT Residuals	(3) REIT Residuals	(4) REIT Return	(5) Building Const. Cost Index
Real Estate Market Proxy	37.26	42.54	64.79	11.04	74.00
Overnight	4.85	4.65	2.48	6.93	3.79
IP	11.20	9.57	12.06	9.86	4.70
Inf	11.51	15.96	5.28	15.16	1.04
UE 1	x	x	2.08	x	x
UE 2	2.59	2.23	x	2.05	1.20
Term	15.17	6.63	5.63	20.05	3.78
DP 1	x	7.99	x	x	x
DP 2	3.70	x	2.33	7.74	3.01
Market	13.71	11.42	5.36	27.18	8.50

From Table 16, I observe that using DP 1 instead of DP 2 as the proxy for default risk premium increases explanatory power of default risk premium from 3.70% to 7.99%. At the same time the variation explained by term structure of interest rates decreased from 15.17% to 6.63%. In other words, explanatory power of term structure of interest rates is transferred to default risk premium. This finding can be explained by the fact that both DP and Term are interest rate related variables and both of them have predictive power about the economy. Therefore, explanatory power of other macroeconomic variables on REIT returns does not alter more than 4.45%.

However, when I use UE 1 instead of UE 2 in the analysis, explainable part of the REIT returns decreased from 62.74% to 35.21%. Although explanatory power of

unexpected inflation does not changed; inflation, term structure of interest rates, and market returns lose their explanatory power.

When I use REIT returns without filtering the market index effect, I observe that 27.18% of the total variation on REIT returns explained by market index return. This increase in explanatory power is expected since the correlation coefficient between market returns and REIT returns is 0.828 between the time periods December 2002 – December 2011. Furthermore, industrial production, inflation, term structure of interest rates and market index returns are still have the highest explanatory power, parallel to the results in column one. Therefore, it is possible to conclude that using REIT returns directly in the analysis inflates the role of market returns, but does not change dominant macroeconomic variables that explain REIT returns.

Finally, when I use BCCI index returns as the proxy of real estate market returns, explanatory power of macroeconomic variables disappears. The macroeconomic variables explain only 26% of the total variation in BCCI index.

CHAPTER 6

CONCLUSION

This thesis examines the dynamic relationship between Turkish REIT returns and macroeconomic variables, including market return, industrial production, inflation, unexpected inflation, overnight interest rate, term structure premium, and default risk premium. The study covers the period between 2000 and 2011. The models are estimated for the whole period, January 2000 – December 2011 as well as for the subperiod between December 2002 and December 2011 which excludes the financial crisis observed in 2000 and 2001.

To capture the feedback mechanism between REIT returns and macroeconomic variables unrestricted vector autoregressive model (VAR) is employed. Moreover, variance decomposition analysis is conducted to determine the proportion of the

variability of REIT returns that are explained by macroeconomic variables. Generalized impulse response function is used to identify the sign and the duration of the impact of macroeconomic shocks on REIT returns.

The results can be summarized as follows. For the whole sample period analysis, macroeconomic variables are able to explain almost half of the total variation in REIT returns, 43% of the variability in BREIT returns and 44% of CREIT returns. Although none of the variables explain more than 15% of real estate market returns, industrial production, inflation and market returns are relatively more important factors affecting REIT returns in Turkey. Furthermore, when the period where volatility of macroeconomic variables is high is eliminated, the explainable part of the total variation of REIT returns by macroeconomic variables increases to 63%. Similar to the results for the full sample period, industrial production, inflation, market, and term structure of interest rates are four relatively important variables to explain the variability of real estate market returns in this subperiod. Moreover, I observe that for both full sample period and the subperiod, REITs whose major owners are banks are more sensitive to the changes in ISE-100 index compared to REITs whose major owners are construction firms. Shocks to overnight interest rate and term premium are found to have negative effect on Turkish REIT returns but shocks to market and default risk premium has positive effect.

Generalized impulse response analysis shows that unexpected shocks in the stock market and default risk premium have positive impact on Turkish REIT returns. Ewning and Payne (2005) observe the same effect of default risk premium for the time period 1980 – 2000 for US equity REITs. On the other hand, unexpected shocks on overnight interest rate and term premium have negative effect. Chang et al. (2011) also find that unexpected shocks in the Fed fund rates and term premium result in negative and significant impact for US REITs for the period between 1975 and 2008. However, shocks to inflation, unexpected inflation and industrial production are not found to have significant impact on REIT returns. These findings are contradiction to some studies in literature. McCue and Kling (1994) observe positive and significant impact on US equity REIT returns for unexpected shocks in the industrial production. Furthermore, Ewning and Payne (2005) observe negative and significant impact on US equity REIT returns for inflation.

The results of generalized impulse responses functions suggest that an investor can invest in real estate, when he expects a decrease in overnight interest rates, or term strucuture premium or long-term interest rates, and an increase in default risk premium, or an increase in the stock market.

Furthermore, I observe that Fama & French three factor model holds for Turkish REITs for the time period between January 2000 and December 2011. All of the

explanatory variables are found to be significant at 1% level and the adjusted R^2 of the model is high, 0.802. These results suggest that REITs are affected not only from market risk but also from the systematic risk that is created by macroeconomic variables.

There are some limitations in this study. First, using REIT returns may not be a good proxy for real estate market returns. Second, the use of inflation expectations in the middle of month might reduce the unexpected inflation and its variability since individuals form their forecasts for the month after some observations. Third, overnight interest rates may not be a good indicator of monetary policy since banks might affect this rate.

As a further study, it will be useful to repeat this analysis using transaction-based or appraisal-based indices as they become available. Moreover, Turkey experienced high inflation in early 2000s and Turkish economy become more stable in the second part of the sample period. As another study, the structural break in the economy could be tested and the whole sample period could be divided into less stable and more stable periods and the dynamic relationship between REIT returns and macroeconomic variables could be tested for these two subperiods.

Some differences between CREITs and BREITs are observed in the study. It can be argued that Emlak-Konut REIT, a state owned REIT, with a value of 4,950 million TL might be dominating the results of the CREITs. Another extension could be the estimation of CREIT returns without Emlak-Konut REIT although Emlak-Konut REIT is available only for last thirteen observations of the analyses.

BIBLIOGRAPHY

Aktan B., M. Oztürk. 2009. "Emprical examination of REITs in Turkey: an emerging market perspective", *Journal of Property Investment and Finance* 27(4): 373 – 403.

Altınsoy G., I. Erol and S.K. Yıldırak. 2010. "Time-Varying Beta Risk of Turkish REITs," *METU Studied in Development* 37(August): 83-114.

Aydınoğlu, Can. 1998. "Turkish REITs: An Overview of the Industry and its Performance." Unpublished master's thesis. İstanbul, Boğaziçi University.

Barkham, R. and D. Geltner. 1995. "Price Discovery in American and British Property Markets," *Real Estate Economics* 23(19): 21-44.

Berument, Hakan. 2007. "Measuring Monetary Policy For Small Open Economy: Turkey" *Journal of Macroeconomics* 29:411-430.

Brooks Chriss. 2008. "Introductory Economics for Finance," *Cambridge Press*.

Chang K., N. Chen, C. Leung. 2011. "Monetory Policy Term Structure and Asset Return: Comparing REIT, Housing and Stock," *Journal of Real Estate Finance and Economics* 43:221-257.

Chen, M., C. Peng, S. Shyu and J. Zeng. Forthcoming. "Market States and the Effect on Equity REIT Returns due to Changes in Monetary Policy Stance," *Journal of Real Estate Finance and Economics*

Chen, S., C. Hsieh, T. W. Vines and S. Chiou. 1998. "Macroeconomic Variables, Firm-Specific Variables and Returns to REITs," *Journal of Real Estate Research* 16(3): 269-278.

Chen, S., C.Hsieh and B.D. Jordan. 1997. "Real Estate and the Arbitrage Pricing Theory: Macrovariables vs. Derived Factors," *Real Estate Economics* 25(3): 506-523.

Chen, N., R. Roll and S. Ross. 1986. "Economic Forces and the Sock Market," *Journal of Business* 59(3): 383-403.

Chui A.C.W., S. Titman and K.C.J. Wei. 2003. "The Cross Section of Expected REIT Returns" *Journal of Real Estate Economics* 31(3): 451 – 479.

Claessens, S.,G. Dell'Ariccia, D. Igan and L. Laeven. 2010. "Cross-country Experiences and Policy Implications from the Global Financial Crisis" *Economic Policy*, 267-293.

Clayton, J. and G. Mackinnon. 2003. "The Relative Importance of stock, Bond, and Real Estate Factors in Explaining REIT Returns," *Journal of Real Estate Finance and Economics* 27(1): 39-60.

Coşkun Taner. 2010. "Özel Sektör Borçlanma Araçları Piyasasının Gelişmesinde Düzenlemelerin Etkisi," *Ankara Üniversitesi Siyasal Bilgiler Fakültesi Dergisi* 65(4): 2-40.

Demir, H., V. Kurt and V. Çağdaş. 2003. "Housing Financing in Turkey." Paper presented at the Conference on "2nd FIG Regional Conference," held in Marrakech, Morocco, December 2, 5.

Derwal J., J. Huij, D. Brounen and W. Marquering. 2009. "REIT Momentum and the Performance of Real Estate Mutual Funds," *Financial Analysts Journal* 65(5): 24 -34.

Doğan, Ela. 2006. "Türk Bankacılık Sisteminde Konut Kredilerinin Gelişimi," *BDDK SGD Çalışma Raporu*, 2006/1.

Dolun, Leyla. 2007. "İpoteğe Dayalı Konut Kredisi (Mortgage)," *Türkiye Kalkınma Bankası A.Ş.*, Ankara.

Erol, I. and D. Tırtıroğlu. 2011. "Concentrated Ownership, No Dividend Payout Requirement and Capital Structure of REITs: Evidence from Turkey," *Journal of Real Estate Finance and Economics* 43(1): 174-204.

Ewing, B. T. and J.E. Payne. 2005. "The response of real estate investment trust returns to macroeconomic shocks." *Journal of Business Research* 58(3): 293-300.

Fama, E. and K. French. 1996. "Multifactor Explanations of Asset Pricing Anomalies," *The Journal of Finance* 51(1): 55-84.

Fama, E. and K. French. 1993. "Common risk factors in the returns on stocks and bonds," *Journal of Financial Economics* 33(1): 3-56.

Feldstein, M. S. 1992. "Comment on James M. Poterba's paper, tax reform and the housing market in the late 1980s : who knew what, and when did they know it?," in L. Browne and E. S. Rosegren (eds.), *Real Estate and Credit Crunch*, Federal Reserve Bank of Boston Conference Series, 36: 252-257.

Glascock J L., C. Lu and R. W. So. 2000. "Further Evidence on the Integration of REIT, Bond, and Stock Returns," *The Journal of Real Estate finance and Economics* 20(2): 177-194.

Gyourko, J. and D. Keim. 1992. "What does the stock market tell us about real estate returns?," *Journal of the American Real Estate and Urban Economics Association* 20(3): 457-485.

Hamelink, F. and M. Hoesli. 2004 "What factors Determine International Real Estate Returns?," *Real Estate Economics* 32(3): 437-462.

Hepşen Ali. 2012. "Calendar Anomalies and Turkish Real Estate Investment Trusts," *International Journal of Economics and Finance* 4(3): 230-236.

Işık, Şevket. 2005. "Türkiye'de Kentleşme ve Kentleşme Modelleri," *Ege Coğrafya Dergisi* 14: 57-71.

Jegadeesh N. and S. Titman. 1993. "Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency" *Journal of Finance* 48(1): 65-91.

Kearl, J.R. 1979. "Inflation, Mortgage, and Housing," *Journal of Political Economy* 87(5): 1115-1138.

Koop, G.,M.H. Peresan, S.M. Potter. 1996. "Impulse Response Analysis in Nonlinear Multivariate Models," *Journal of Econometrics* 74:119-147.

Ling, D. and A. Naranjo. 1997. "Economic Risk Factors and Commercial Real Estate Returns," *Journal of Real Estate Finance and Economics* 15(3): 283-307.

Lintner, John. 1965. "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets," *The Review of Economics and Statistics,* 47(1): 13-37.

Lizieri, C. and S. Satchell. 1997. "Property company performance and real interest rates: a regime-switching approach," *Journal of Property Research* 14(2): 85-97.

Lutkenpohl Helmut. 1991. "Introduction to Multiple Time Series Analysis," *Springer*.

McCue, T.E and J.L. Kling. 1994. "Real Estate Returns and the Macroeconomy: Some Empirical Evidence from Real Estate Investment Trust Data, 1972-1991," *Journal of Real Estate Research* 9(3): 277-287.

Mossin, Jan. 1966. "Equilibrium in a Capital Asset Market," *Econometrica,* 34(4): 768-783.

Ng, S., and Perron, P., 2001. "Lag Length Selection and the Construction of Unit Root Tests with Good Size and Power", *Econometrica*, 69(6):1519-1554.

Önder, Zeynep. 2000. "High Inflation and Returns on Residential Real Estate: Evidence from Turkey," *Applied Economics* 32(7): 917-931.

Pesaran M.H., C. Hsieh. 1998. "Generalized Impulse Response Analysis in Linear Multivariate Models," *Economics Letter* 58:17-29.

Peterson J.D. and J. Hsieh. 1997. "Do Common Risk Factors in the Returns on Stocks and Bonds Explain Returns on REITs?," *Real Estate Economics* 25(2): 321-345.

Quan, D. C. and S. Titman. 1999. "Do Real Estate Prices and Stock Prices Move Together? An International Analysis" *Real Estate Economics,* 27(2): 183-207.

Ross, Stephen A. 1976. "The arbitrage theory of capital asset pricing," *Journal of Economic Theory* 13:341-60.

Rubens, J. H., M. Bond, J. Webb. 1989. "The Inflation Hedging Effectiveness of Real Estate," *Journal of Real Estate Research* 4(2): 45-55.

Sharpe, Wiliam F. 1964. "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk," *The Journal of Finance* 19(3): 425-442.

SPK. 2011. Available at: http://www.cmb.gov.tr/indexpage.aspx?pageid=5&submenuheader=5

SPK. 2011. "Aylık İstatistik Bülteni 2011 - 2," Available at: http://www.spk.gov.tr/apps/aylikbulten/index.aspx?submenuheader=-1

Stevenson, S. and L. Murray. 1999. "An Examination of the Inflation Hedging Ability of Irish Real Estate," *Journal of Real Estate Portfolio Management* 5(1): 59-69.

TBB. 2010. "Tüketici Kredileri ve Konut Kredileri," Available at: http://www.tbb.org.tr/tr/Banka_ve_Sektor_Bilgileri/Tum_Raporlar.aspx

Teker, Bahadır M. 2000. *Sermaye Piyasası Araçları Yoluyla Gayrimenkul Finansmanı ve Yatırımı*. Ankara: Sermaye Piyasası Kurulu.

TÜİK. 2010. "Adrese Dayalı Nüfus Kayıt Sistemi," Available at: http://tuikapp.tuik.gov.tr/adnksdagitapp/adnks.zul

Westerheide, Peter. 2006. "Cointegration of Real estate stocks and REITs with common stocks, bonds and consumer price inflation." Available at SSRN.

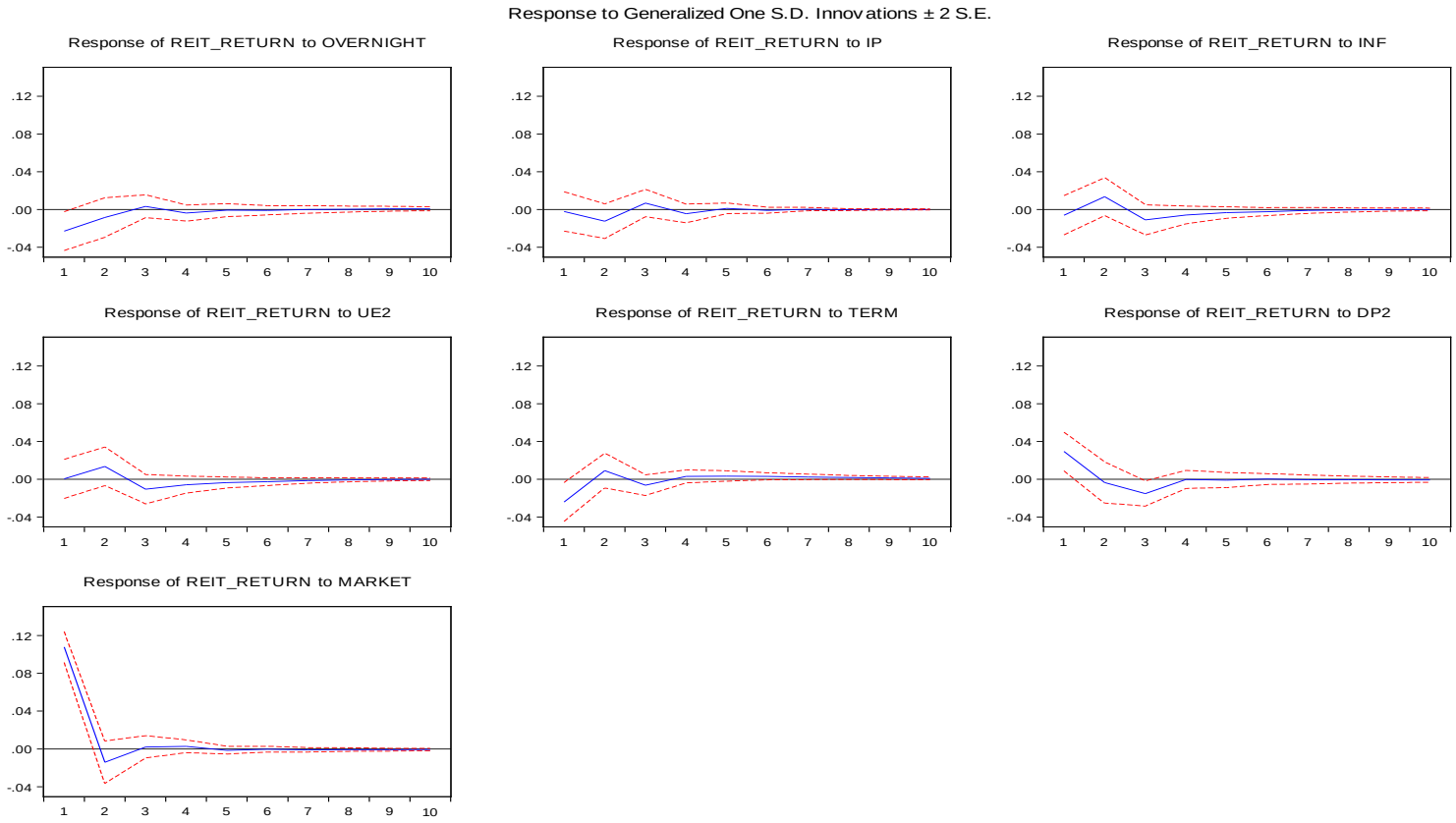
Wishwakarma,V.K. and J. French. 2010. "Dynamic Linkages among Macroeconomic Factors and Returns on the Indian Real Estate Sector," *International research Journal of Finance and Economics* 43:167 -182.

APPENDICES

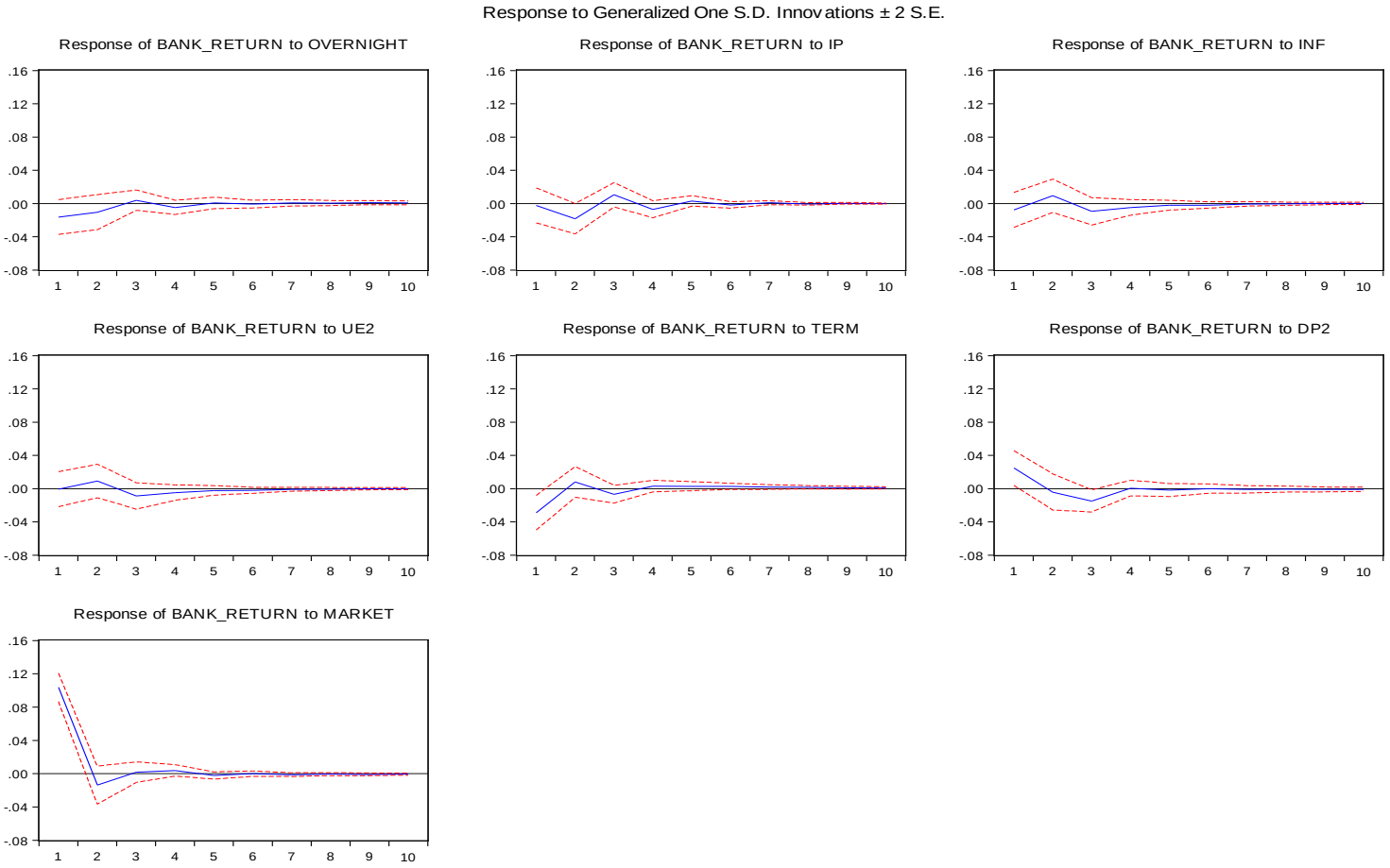
Appendix A: Information Criteria for Modeling Unexpected Inflation

Model	Information Criteria	
	AIC	BIC
AR(1)	-880.75	-839.56
AR(2)	-880.19	-836.07
AR(3)	-884.67	-837.61
AR(4)	-883.97	-833.97
AR(5)	**-887.84**	**-834.89**
AR(6)	-885.90	-830.01
AR(7)	-884.81	-825.97
MA(1)	-840.38	-799.20
MA(2)	-852.35	-808.29
MA(3)	-865.59	-818.10
MA(4)	-864.56	-814.65
MA(5)	-870.38	-817.87
MA(6)	-870.98	-814.62

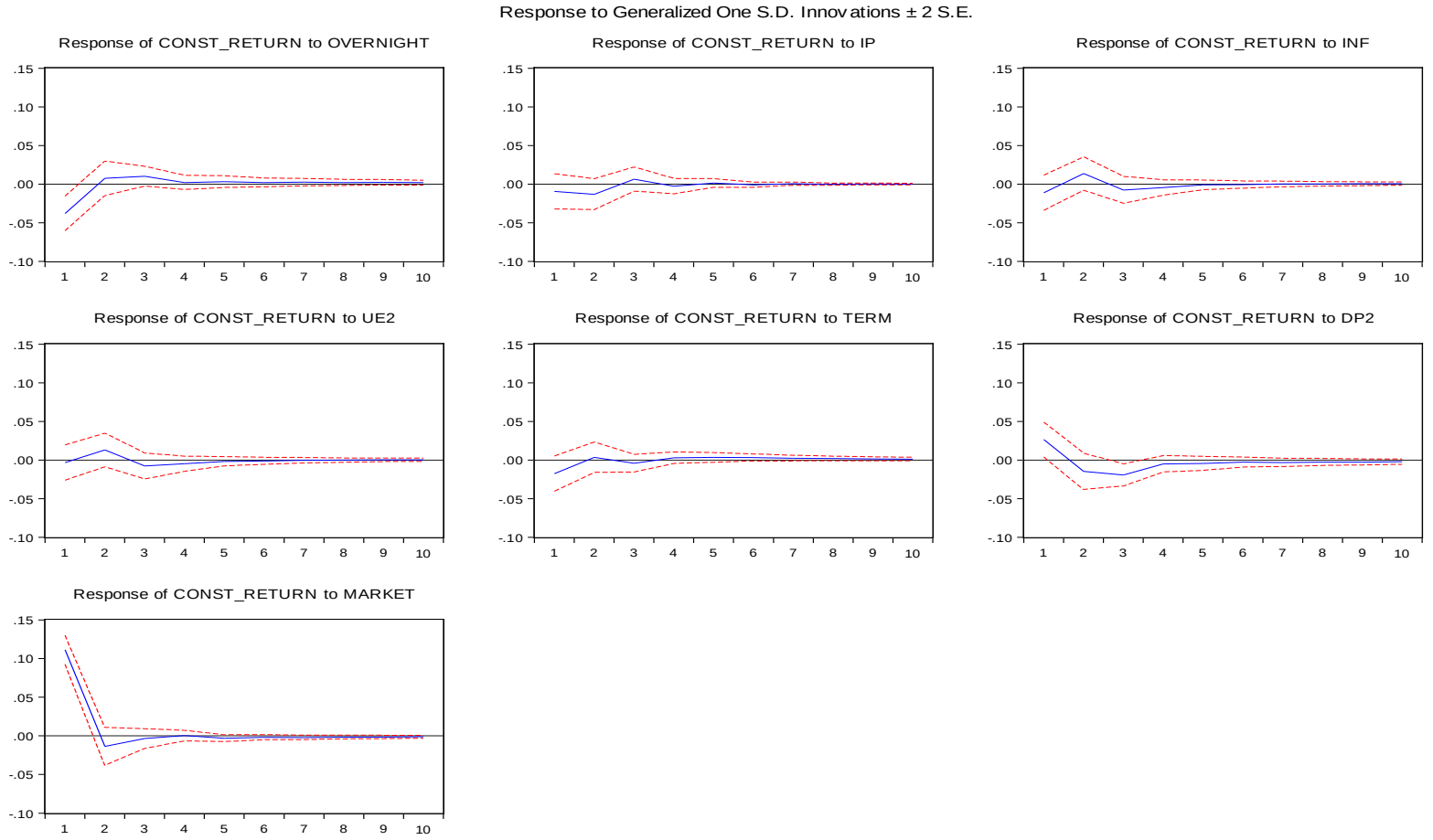
Appendix B: Generalized Impulse Response Graphs for All REIT – Whole Sample Period



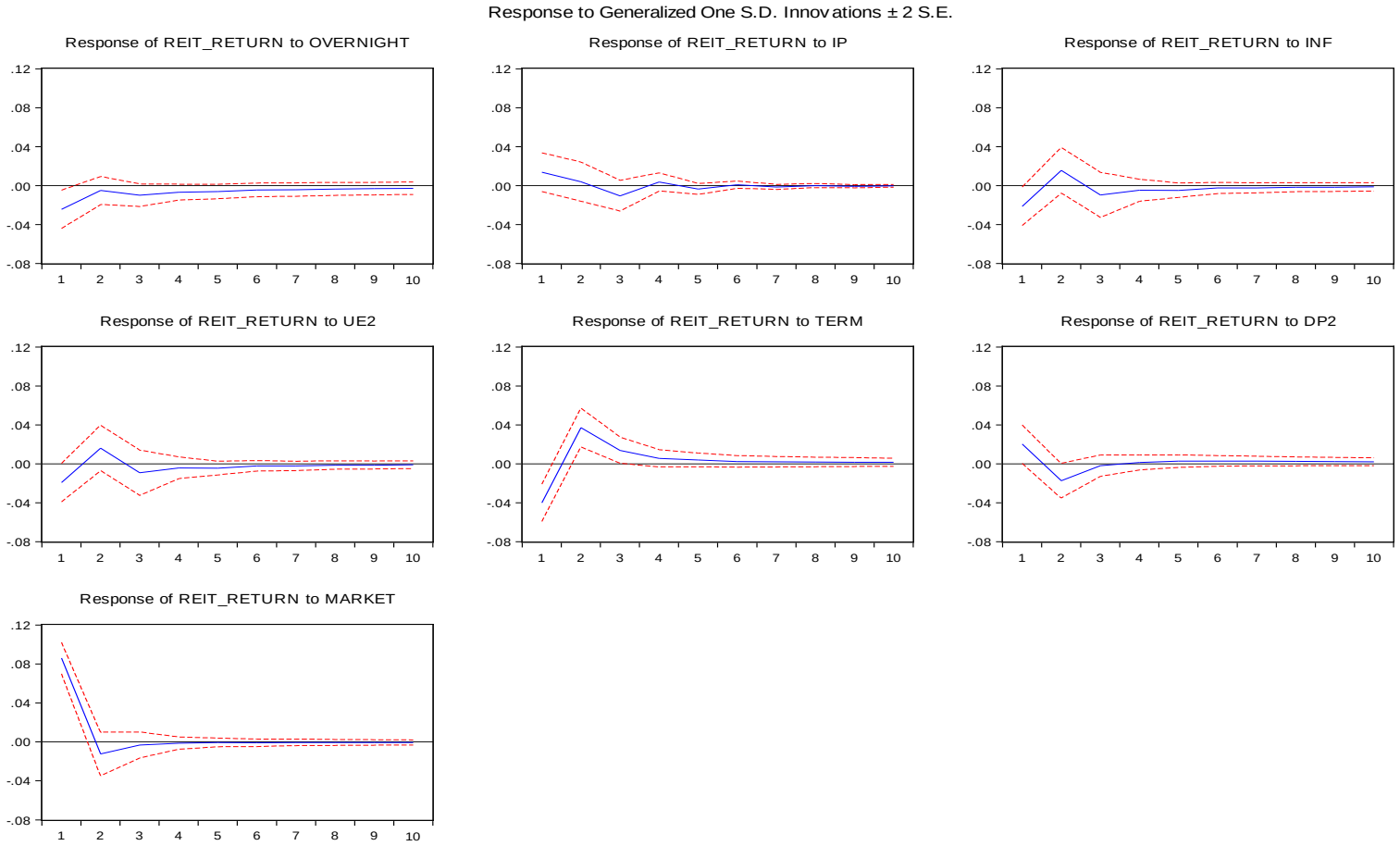
Appendix C: Generalized Impulse Response Graphs for BREIT – Whole Sample Period



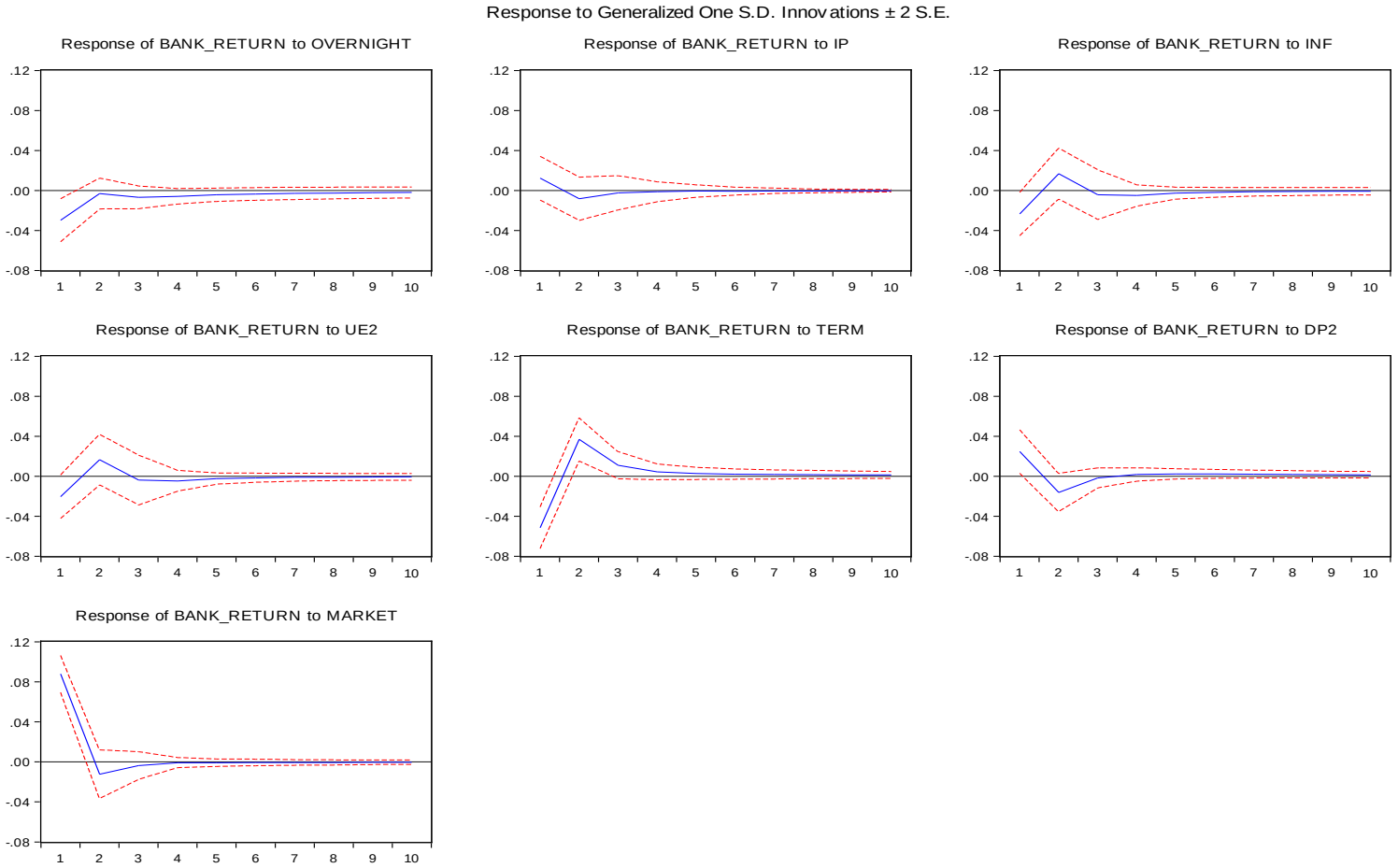
Appendix D: Generalized Impulse Response Graphs for CREIT – Whole Sample Period



Appendix E: Generalized Impulse Response Graphs for All REIT – Subperiod



Appendix F: Generalized Impulse Response Graphs for BREIT – Subperiod



Appendix G: Generalized Impulse Response Graphs for CREIT – Subperiod