IBN HALDUN UNIVERSITY
SCHOOL OF GRADUATE STUDIES
DEPARTMENT OF ECONOMICS

MASTER THESIS

LONG-RUN AND SHORT-RUN DETERMINANTS OF THE PRIVATE PENSION CONTRIBUTIONS IN TURKEY

MOHAMMAD ISMAYL AL MASUD

THESIS ADVISOR: ASST. PROF. ŞERİFE GENÇ İLERİ

AUGUST 2019

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by
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A thesis submitted to the School of Graduate Studies in partial fulfillment of the requirements for the degree of Master of Arts in Economics

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APPROVAL PAGE

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of master in Economics.

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MOHAMMAD ISMAYL AL MASUD

ABSTRACT

LONG-RUN AND SHORT-RUN DETERMINANTS OF PRIVATE PENSION CONTRIBUTIONS IN TURKEY.

Mohammad Ismayl Al Masud
MA in Economics
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August 2019, 80 Pages

An efficient private pension system can play a significant role in maintaining stable economic growth primarily through a higher savings rate, capital stock, and social welfare. Turkey is one of the relatively new countries to adopt a private pension scheme to promote higher household savings. In this study, we explore the determinants that affect a household's contribution to the private pension system. Using time-series monthly data from 2004 to 2018, we examine the long-run and short-run relationship amongst variables via the Vector Error Correction Model (VECM). We also conduct Impulse Response analysis to examine the response of variables to economic shocks. We find that the real exchange rate, deposit interest rate, change in the gross domestic product are negatively associated with per contribution in the system. Moreover, the gold price index and the BIST 100 index are positively related to per contribution level. However, we do not find any significant relationship between per contribution and changes in the inflation rate. The government incentive shows no real additional movement in the system.

Keywords: Cointegration, Private Pension Accounts, Vecm, Turkey.

ÖZ

TÜRKİYE'DE ÖZEL EMEKLİLİK KATKILARININ UZUN RUN VE KISA RUN AYARLARI.

Mohammad Ismayl Al Masud
İktisat Bilimi Yüksek Lisans
Tez Danışmanı: Dr. Şerife GENÇ İLERİ
Eş Danışman: Dr. Rasim ÖZCAN
Ağustos 2019, 80 sayfa

Verimli bir bireysel emeklilik sistemi, daha yüksek tasarruf oranı, sermaye stoku ve sosyal refah ile istikrarlı ekonomik büyümenin korunmasında önemli bir rol oynayabilir. Türkiye, daha yüksek hanehalkı tasarruflarını teşvik etmek için özel bir emeklilik planı benimseyen nispeten yeni ülkelerden biridir. Bu çalışmada, bir ailenin bireysel emeklilik sistemine katkısını etkileyen belirleyicileri araştırıyoruz. 2004'ten 2018'e kadar olan zaman serileri aylık verilerini kullanarak, Vektör Hata Düzeltme Modeli (VECM) aracılığıyla değişkenler arasındaki uzun ve kısa süreli ilişkiyi inceliyoruz. Değişkenlerin ekonomik şoklara tepkisini incelemek için Impulse Response analizi de yapıyoruz. Reel kur, mevduat faiz oranı, gayri safi yurtiçi hasıladaki değişimin sisteme yapılan katkılar ile negatif olarak ilişkili olduğunu tespit ediyoruz. Ayrıca, altın fiyat endeksi ve BIST 100 endeksi, katkı payları düzeyinde pozitif olarak ilişkilidir. Ancak, katkı payları ile enflasyon oranındaki değişiklikler arasında anlamlı bir ilişki bulamıyoruz. Hükümet teşviki, sistemde gerçek bir ek hareket olmadığını göstermektedir.

Anahtar Kelimeler: Eşbütünleşme, Bireysel Emeklilik Hesapları, VECM, Türkiye.

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MOHAMMAD ISMAYL AL MASUD

ISTANBUL, 2019

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LIST OF SYMBOLS AND ABBREVIATIONS

ADF	Augmented Dicky-Fuller test
AIC	Akaike Information Criterion
CBRT	Central Bank of Republic of Turkey
CPI	Consumer Price Index
DIR	Deposit Interest Rate
ECM	Error Correction modeling
GDP	Gross Domestic Product
HQC	Hannan–Quinn information criterion
IMF	International Monetary Fund
INF	Impulse Response Function
IPS	Individual Pension System
IRA	Individual Retirement Accounts
KPSS	Kwiatkowski, Phillips, Schmidt, Shin test
LPC	Per Contribution
OLS	Ordinary Least Squares
PMC	Pension Monitoring Center
PP	Phillps-Peron test
REX	Real Effective Exchange Rate
SBIC	Schwartz, Bayesian Criterion
TurkStat	Turkish Statistical Institute
VAR	Vector Autoregressive Model
VD	Variance decomposition
VECM	Vector Error Correction Model
WDI	World Development Indicators
Δ	First Difference of variables
$\prod$	Product of series
$\sum$	Summation of series

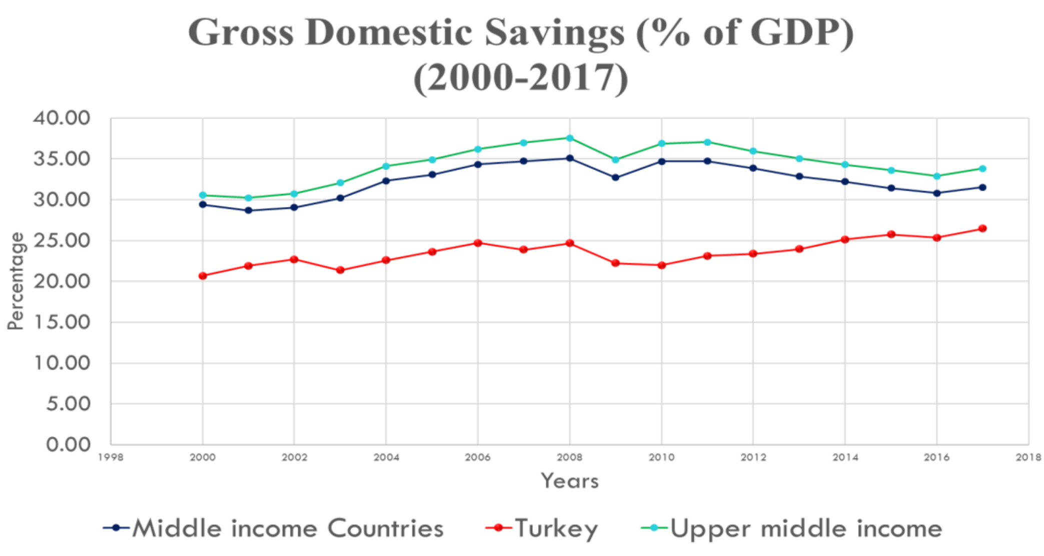
CHAPTER 1

INTRODUCTION

Economists and policymakers prioritize maintaining an adequate savings rate to sustain economic growth. There are numerous studies (Kelley and Williamson, 1968; Gupta, 1970a, b; and Gupta 1971, Leff, 1969, 1971, Ouliaris, 1981, Koskela and Viren, 1982, Edwards, 1996; Muradoglu and Taskin, 1996, Metin-Ozcan and Ozcan, 2000) that demonstrate the significance of healthy savings rate on an economy.

Although Turkey is an emerging country, where the savings rate is consistently lower compared to similar and more developed countries (see Figure 1.1). Perpetuating a higher and stable savings rate over a longer period, Turkey has the potential to grow as an even larger economy in the world. The Turkish government has initiated programs to serve as incentives to increase this rate to a higher level, and the Private Pension Scheme is among one of them. Private Pension funds can act as a crucial intermediary for the procurement of individual savings, which is a key problem for Turkey.

Figure 1.1: Gross Domestic Savings Rate as a Percentage of GDP



Source: The World Bank Indicator.

Turkey's implementation of the private pension scheme, to promote higher household savings, is relatively new compared to many other developed (such as the United States of America, United Kingdom, Denmark) and developing countries (such as Argentina, Brazil, Malaysia).

The goal of this study is to investigate the long-run and short-run relationship between contributions per participant and fundamental macro variables (like Consumer Price Index (CPI), Real effective exchange rate (REX), Gross Domestic Product (GDP), BIST100 Index, Gold Price, Deposit Interest Rate). We use monthly data from 2004 to 2018 that gathered from reliable sources (such as World Development Indicators (WDI) Turkish Statistical Institute (TurkStat), Central Bank of Republic of Turkey (CBRT), and Pension Monitoring Center (PMC)) for this study. Finally, we implement the Vector error correction model (VECM) to examine the long-run and short-run relationship.

The new paradigm is not a substitution to the existing unfunded social security system. Materially, it has been initiated to promote higher household savings. Along with the goal of accumulation of long-term savings, it can even ease the government burden that arises through maintaining financial support during retired age. Barr and Diamond (2006) argue excessive pressure from public pension endanger growth performance via higher tax rate, where the private pension scheme might be an auxiliary source for transferring the risk to the individual level. Hence, that would alleviate the public budget stress. To stimulate participation in the private pension system, many OECD (The Organization for Economic Cooperation and Development) countries have already introduced several economic incentives. In the case of Turkey, the private pension mechanism encompasses not only tax advantages, but also direct government contribution to the individual retirement accounts (IRAs).

However, across countries, the practice of private pension differs in heterogeneous dimensions. In Turkey, both private and public pension system operate together, and the entry into the private pension system is voluntary. But, for some other countries, it is mandatory to participate in the system. Moreover, in some countries, assets that are accumulated over a certain period in the system, are the only source of earnings during retirement years. Government offers varieties of incentives to elevate savings rate, and the tax-favored scheme is one of them. In a tax-favored scheme, the government alleviates taxes either by the lump-sum amount of reduction or pays back the tax on the accumulated funds on the IRA.

Matching pension contributions by the government is quite homogeneous among numerous developed and developing countries. Countries such as Germany, New Zealand, adopt the scheme to encourage participation in the system, where New Zealand's matching system is universal, and Germany's Riester Plan us means-tested. Mexico practices the matching contributions for the low wage and civil servants, whereas, in Peru, the small and micro enterprises get benefit from the system. Besides, a certain group of disadvantaged workers can also get benefit from the scheme in developing countries. For example in Thailand and India, the informal sector workers benefit from the matched defined contribution system. [1] For Turkey, the government matched contributions are universal, and one gets to benefit depending on participants' age and the tenure in the system.

[1] For more details, please see Hinz et al. (2013).

CHAPTER 2

LITERATURE REVIEW

Although private pension incentives theoretically should boost national savings, the empirical literature presents an inconclusive overview. There is evidence on both sides of the coin, which makes it even more arduous to conclude on the impact of private pension on domestic savings. For instance, Attanasio, Banks, and Wakefield (2004) analyze IRA's characteristics in the United States America (USA) and the United Kingdom (UK) and find that tax incentives not only act as an ineffective instrument but also as an additional burden on government budgets. In addition to the UK study, Guariglia, Markose (2000), and Rossi (2009) conclude no association of pension plans with an increase in the savings rate. Adopting a fixed-effects method for a longitudinal dataset for Spain, Anton, Bustillo, and Macias (2014) find no relation between tax-favored pension plans and raising national savings. For Italy, Marino, Pericoli, and Ventura (2011) conclude no contribution from pension funds with raising deductibility to raise the savings level. A careful study of Germany's Riester reform, Börsch-Supan, Reil-Held, and Schunk (2007), and Corneo, Keese, and Schröder (2010) find no significant impact on aggregate savings. Moreover, based on a study on Germany's Riester plans (2001 and 2004), Börsch-Supan asserts there should be much more than just tax relief to attract retirement savings.

On the other hand, in the presence of substitution and income effects, Bosworth and Burtless's (2004) overall findings on pension funds are quite ambiguous. With a stochastic life-cycle saving model, Engen, Gale, and Scholz (1994) find an increase in savings, but to a limited extent. Hubbard and Skinner (1996) state similar findings, where the increase in savings is limited.

The empirical literature on Turkeys' pension scheme is even exceptionally scarce. Employing savings functions and panel data techniques, Özel and Yalçın (2013) proclaim that Turkey has a chance of lifting up the domestic savings rate. They also argue the potentiality is being constrained due to the voluntary participation nature in the system, and high management fees. Hence they recommend reducing high management fees to promote national savings. Atasoy, Ertuğrul, and Gebeşoğlu (2017) found a positive association between the government contribution to the private pension (which is 25%) and the number of participants. But, analyzing dynamic time-varying interaction, they also show the positive effect tends to decline over time. They recommend improving management efficiency to maximize government incentives.

Inflation theoretically and empirically is one of the key determinants for savings behavior. The contingency motive regarding savings decisions is empirically supported, where there is a positive influence of inflation on private saving in Turkey (Ozcan, Gunay, and Ertac, 2003).

However, literature regarding the relationship between inflation and savings decisions varies significantly across countries. After studying a group of industrial countries, Koskela and Viren (1985) figure out a positive association between savings and inflation rate. In addition to the previous study, Gupta (1987) analyzes a group of Asian countries, and report that expected and unexpected components of inflation are positively associated with savings. Bayoumi, Masson, and Samiei (1998) also find a positive coefficient on inflation. Davidson and Mackinnon (1983) estimate Canada and United States quarterly time series data and report a positive interrelation between inflation and savings rate for both countries.

On the other hand, Adelakun and Johnson (2015) find a negative association of inflation to savings for Nigeria. For Pakistan, Ahmad and Mahmood (2013) also find a reversal impact of inflation on the saving rate. Also, Jilani et. al. (2013) have identical findings for Pakistan. Samantaraya and Patra (2014) argue high inflation is negatively associated with the savings rate in India both in the short-run and long run.

This study contributes to the literature by investigating the long-run and short-run determinants of private pension contributions in Turkey between 2003-2018. Different from the existing studies, this study covers the relatively the largest data set on private pension studies for Turkey. Moreover, we are the pioneer in implementing the Vector Error Correction Modeling (in Turkey’s pension literature) that captures both long-run, and short-run cointegrating relationships. Additionally, we also include an additional dummy variable to test government incentive effectivity.

In this study, we find that the real exchange rate, deposit interest rate, change in the gross domestic product are negatively associated with per contribution in the system. Moreover, the gold price index and the BIST 100 index are positively related to per contribution level. However, we do not find any significant relationship between per contribution and changes in the inflation rate. The government incentive shows no real additional movement in the system.

The rest of the paper is organized as follows: Section 3 offers an overview of the Turkish private pension scheme. Section 4 illustrates the implemented data and methodologies for this study. In section 5, we present the VECM results with several diagnosis residuals. Lastly, in section 6, we conclude and additionally, one of the appendix sections illustrates a robust section to justify the robustness of our estimations.

CHAPTER 3

OVERVIEW OF THE PRIVATE PENSION SCHEME IN TURKEY

The Individual Pension System (IPS) refers to a private pension system that is designed to generate additional income through long-term and promising investments. It aims to maintain higher living standards throughout retirement. Along with the regular pension (or benefits) provided by the social security system, people can benefit from the IPS through voluntary participation.

According to the PMC, the primary goals of the IPS are the following:

- Augmentation of well-being by providing an added income through precise long-term investment.
- Encouraging employment.
- It generate an enduring source for the economy.
- Supportive role in economic development.

The core of the IPS is based on the collection of the contributions, and efficiently investing, and providing a regular or a lump-sum payment after fulfilling the required conditions (Individual Pension Savings and Investment System Law number 4632). However, it is intended to be a supplementary program rather than an alternative to the regular social security system.

One of the most advantageous sides of the IPS is its flexible nature for participants. One can simply accept a suitable program according to his or her expectations, income level, and age. Moreover, a participant can even make the investment decision of his or her fund according to own preferred risk levels. But if one does not make any investment decision, the contributions are invested in a standard fund. One can also alter the contribution amount anytime depending on the financial situation including stop contributing or resuming on a any given period. Istanbul Settlement and Custody

Bank Inc. track all the decisions regarding participants' portfolios, and participants' can also keep track of their system (from Pension Monitoring Center e-State service). For retirement, one must stay in the system minimum of 10 years from enrolment day and be the age on minimum 56.

Another significance of Turkey's IPS is to offer no-interest funding. The majority of locals are Muslim in Turkey, and interest-free investment has become quite popular recently The pension funds provide an option, where the contributions are invested and managed according to the Islamic Law. Interest-free pension funds can be explained briefly as follows:

1. Accounts regardless of currencies (Turkish Lira (TL), US dollar or Euro) are opened in participation banks.
2. Funds are invested in ''No-interest'' based market instruments (precious metals such as Gold, Silver).

Table 3.1: Summary of the Aggregated Statistical Value of IPS (until April 2019).

Variables	**Aggregated Value**
Number of Participants	6,811,450
Participant´s Contribution	59,987.6 billion TL
State's Contribution	11,771.4 billion TL
Participant's Funds	82,105.7 billion TL
Invested Amount	59,024.2 billion TL

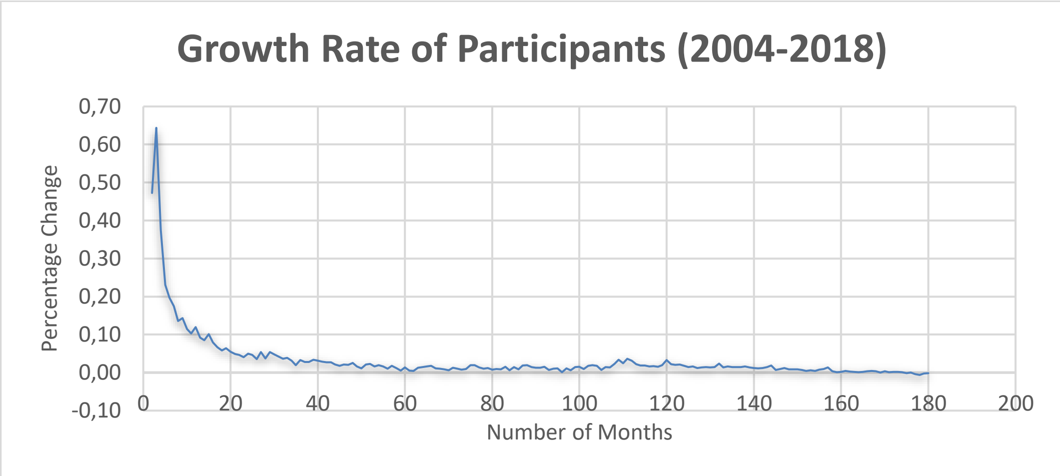
Source: The Pension Monitoring Center.

The PMC statistics report that the number of participants was 16, 268 at the beginning of 2004 and become 6.8 million at the end of 2018. From Table 3.1, the average per contribution (government contribution included) is around 11,000 Turkish Lira.

According to the PMC report in April 2019, there are around 7 million people are registered in the system. Compared to the total population (around 80 million), the number of participants is reasonably small. Since 2013, the government payment as 25% contribution reached almost 12 billion Turkish Lira.

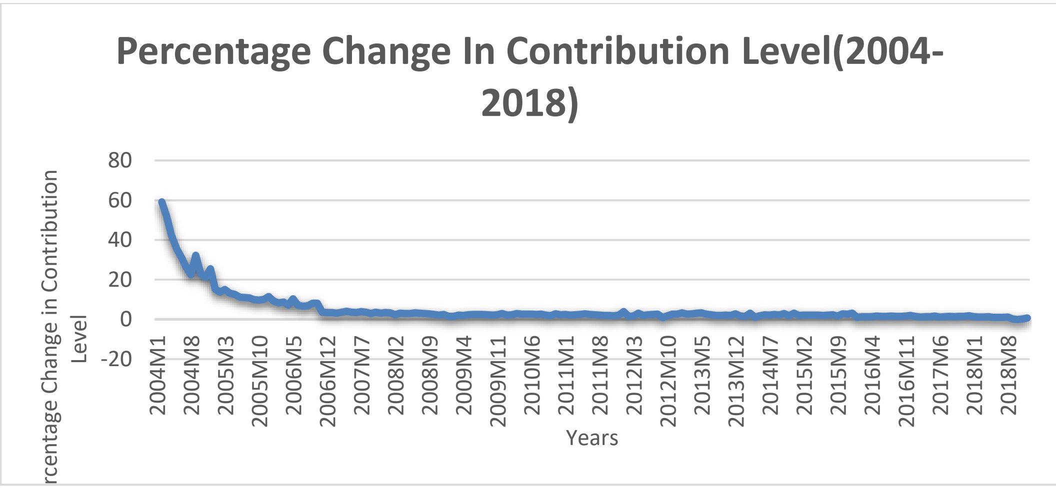
In 2003, Turkey introduced its first private pension system along with the existing unfunded social security system. After its introduction, there was a structural change in the system, and direct government contribution was initiated to attract more people in 2013. Before 2013, tax reduction was the only incentive, and one could deduct his or her total contribution from an annual taxable income.

Figure 3.1: Percentage Change in Growth Rate of Participants



Source: The Pension Monitoring Center.

Figure 3.2: Percentage Change in Contribution Level



Source: The Pension Monitoring Center.

Due to quite modest growth of the scheme and to enhance the participation (See figures 3.1, and 3.2), and contribution level, there is an introduction of direct government contribution of 25% of the savings added to the IRAs. Under the current version, regardless of the employment status, anyone who is older than 18 years old can participate, and accumulate assets in the system. Moreover, the capital income tax incentive is also provided in the updated system. For contributors, the tax rate is 15% if the tenure is less than 10 years, and if the tenure is 10 years or more, the contributor is subject to a 10% tax rate. If the contributor if at least 56 years old, 5% is his or her tax rate upon retirement.

Regarding withdrawing money from the IRAs, and getting government contributions, they are dependent on the tenure of the participation. Contributing 3 years or less, an individual is not allowed to withdraw an asset from the government account but at the end of 3 years, the individual is eligible to withdraw 15% of total assets in IRA. The percentage increases to 35 when the tenure gets 6 years and 60 when the contribution years reach 10 years if he/she is not 56 years of age. Finally, the contribution tenure at least 10 years and the contributor is at least 56 years old, he/she has the right to withdraw all the assets in IRA including government contributions.

Like many other funds, the savings in IRAs are also diversely invested among various types of funds with a calculated amount of risk. Financial firms generally operate with these funds, and the foundation of fund investment and operations are strictly restricted by law. There are different types of fees (such as management fee, maximum annual fee) that financial firms charge regarding the operating and managing the funds. Firms efficiency, especially operational fees, and investment decision, are being questioned recently, and it must improve to match the IPS goals (Özel and Yalçın, 2013, Atasoy, Ertuğrul and Gebeşoğlu, 2017).

Potential Determinants of the Contributions in the System

It is a fact that our savings decision generally correlated with its own lagged value (inertia). This condition remains identical throughout the heterogeneous set of controlled variables. Hence, the lagged value of the private pension contributions is a potential determinant of per contribution.

The growth literature that examines the relationship between savings and growth the rate is an unsettled topic. So, we may face a scenario completely no relationship at all, or they are positively correlated, or even inverse association.

The relationship between the per contributions and BIST 100 index can go any static direction. It is possible that an individual already an active investor, and an increase in the index will make the investor better off and depending on the domination of income or substitution effect, contribution in the system can be quite unpredictable arise from a change in BIST index.

The deposit interest rate should act as an alternative to contribute to the system. Because, keeping everything else constant, it is more lucrative to keep money on Bank rather than in IPS if the real interest rate is higher than IPS benefit. So, there should be an inverse relationship between the deposit interest rate and per contributions.

The real effective exchange rate shows the purchasing power of domestic currency to its most-traded currencies. So, an appreciation or depreciation generally affects people's financial decisions.

Gold is one of the popular investment options in Turkey and it is closely related to other financial instruments (Gülseven & Ekici, 2016, Omag, 2012, Akar, 2011). There might be two ways of relationship between the gold price and per contributions. Identical to the BIST index, depending on the domination of income or substitution effect, the relationship between the gold price and per contribution may vary across situations. Hence, it can be a potential determinant of per contribution.

Whether inflation rate affects savings decision or not, even if it affects, in which direction is ambiguous in the literature. Moreover, it is also a common proxy to measure financial stability and the Turkish economy is recently quite volatile. So, it is worth to examine its impact on our study.

CHAPTER 4

DATA AND METHODOLOGY

The data of the variables are collected consistently basis from 2004 to 2018, and the below table presents an overview of our data set.

Table 4.1: Variables Descriptions and Sources.

Variable	**Abbreviation**	**Frequency**	**Source**
Per Contribution	PC	Monthly	PMC
Real Effective Exchange Rate	REX	Monthly	CBRT
BIST100 Price Index	BIST100	Monthly	BORSA Istanbul
Change in GDP Growth Rate	GRR	Quarterly	TurkStat
Deposit Interest Rate	DIR	Monthly	CBRT
Change in Inflation Rate	CINF	Monthly	CBRT
Gold Price Index	GOLD	Monthly	CBRT
Number of Participants	PPL	Monthly	PMC
Contribution Level	CONT	Monthly	PMC

Note: Some of the variables are converted into log form: log(Variable)=lVariable.

Due to the nature of time-series data, we adopt the Augmented Dicky-Fuller (ADF) unit root test to test stationarity. We run a Johansen cointegration technique-based vector autoregressive model (VAR), and vector error correction model (VECM) to explore the long-run and short-run relationship. Turkey's private pension scheme has undergone a structural change in 2003, where the government starts contributing 25% on individual funds in the system. This study also aims to capture the effectiveness of the structural change and to capture that, a dummy variable is assimilated in both cointegration and vector error correction model (VECM).

We first conduct an ADF test to check the stationarity of the variables. After confirming all the variables are stationary at their first difference, the Johansen maximum eigenvalue and trace tests are conducted to identify cointegration relationship among the variables. We must have a minimum of one cointegration relationship among variables to adopt the VECM methodology. Once the number of cointegrating vectors is recognized, we can assert that variables have a long-run relationship. In other words, they never drift from each other in the long run.

Augmented Dickey-Fuller Unit Root Test

Generally, economic time series tend to be non-stationary, and their mean and variance depend on time variable. Hence, the variables being stationary is the first and inevitable condition to implement time series techniques. A variable is called covariance stationary, if it has finite mean and autocorrelation that do not change over time (Wooldridge, 2009, pp. 345-346). In other words, a series being stationary refers to having a constant value of mean, variance, and autocovariance at a given lag.

For cointegration analysis, we need to examine the stationarity properties. If the variables are stationary at level, they are referred to as a covariance-stationary process or I (0). If they become stationary after taking their first difference, then it is called I (1) processes or integrated at order 1 (Wooldridge, 2009, pp. 345-346). So, in general, a variable is an integrated order of q or I (q), if it gets stationary at the q^{th} difference.

As a first step, we need to examine the stationarity of all the variables. There are numerous tests for performing stationarity, and among them, the most common and popular methods are the Augmented Dicky-Fuller (ADF, 1979) unit root test, Kwiatkowski, Phillips, Schmidt, Shin (KPSS, 1992) test and Phillps-Peron (PP, 1988) test. It is often a regular dilemma for a researcher to pick out one or multiple tests among them, because of having heterogeneous limitations. For instance, the ADF often gets criticized for having low power, whereas the PP is criticized for having impecunious size parameters (Schwert, 1989). For this study, the Augmented Dicky-Fuller (ADF) is applied to identify the stationary property of the data.

The Augmented Dicky-Fuller (ADF) test was developed by Dickey and Fuller (1976, 1979) to detect a unit root in a time series that has predominantly three versions, and they are discussed below.

$$\Delta y = \alpha y_t - 1 + \sum_{i=1}^{q-1} \alpha_i y_t - i + \varepsilon_t$$

$$\Delta y = \gamma_0 + \gamma_{1t} + \alpha y_t - 1 + \sum_{i=1}^{q-1} \alpha_i y_t - i + \varepsilon_t$$

Where γ_0 is a constant term, t is a time trend, ε_t refers to an error term, y_t indicates the value of a variable at period t and $\Delta y = y_t - y_{t-1}$. Our goal is to investigate the null and alternative hypothesis stated below.

H_0: $\alpha = 0$; Series carries a unit root

H_1: $\alpha < 0$; Series is stationary.

Additionally, for testing the stationarity, we are required to calculate the t- statistics that can be found by applying the following; $\tau = \frac{\alpha}{\sqrt{var(\alpha)}}$ and after finding the t value, we need to compare it with the critical value according to different significant levels and confirm rejection or acceptance of the null hypothesis. If we fail to accept the null hypothesis or reject the null hypothesis, we can confirm the stationarity of the series.

Furthermore, if we adopt the Augmented Dicky-Fuller (ADF) methodology, we have to deal with two inexorable problems. The first one is selecting one of the three versions (None; Constant; Constant, and deterministic trend). The other is associated with deciding the dependent variable's optimal lag length. One of the solutions to the first dilemma can be choosing the ADF with a constant and deterministic trend. The argument for choosing the ADF with a constant and deterministic trend is that the other two versions of the ADF are special cases of the constant and deterministic trend. Additionally, according to Verbeek (2004), we can plot the time series initially and if it has a clear upward or downward trend, it would be optimal to test with a time trend.

Moving to the second problem regarding the optimal lag length, there are some information criteria like the Schwartz, Bayesian Criterion (SBIC), Akaike Information Criterion (AIC), Hannan–Quinn information criterion (HQC), and we can pick the lowest value of any of them. According to Enders (2003), adopting the SBIC and the AIC conforms to the residuals are white noise in the equation *I (1)*. But, there might a case where the AIC and SBIC might provide contradictive results, and to tackle that, SBIC is preferable due to its nature of selecting the appropriate model with fewer lags than AIC. Moreover, Schwert (1989) studies the identical issues and suggests the following equation to determine the number of lags:

$$q_{max} = 12\left(\sqrt[4]{\frac{n}{100}}\right)$$

where q refers to the number of optimal lags and n is the population size of the study. Furthermore, Said and Dickey (1984) assert a different approach for optimal lag selection found in their survey study and their justified equation is; $T^{(1/3)}$ where T refers to the number of observations + 1 was adequate. Sınce there is no universal threshold for determining the optimal lag order and this study is going to follow the AIC methodology for lag selection.

The Vector Autoregressive (VAR) Model

Sims (1980) proposed the vector autoregressive (VAR) model that is considered as an extension to the multivariate time series from the univariate autoregressive model. It is quite convenient for a time series to capture the dynamic behavior.

One of the simplest ways to demonstrate VAR modeling is through bivariate VAR (1), where we have only two variables that depend on their own previous and error terms. We can unravel it as follows:

$$\begin{pmatrix} y_{1t} \\ y_{2t} \end{pmatrix} = \begin{pmatrix} \alpha_{10} \\ \alpha_{20} \end{pmatrix} + \begin{pmatrix} \alpha_{11} & \theta_{11} \\ \theta_{21} & \alpha_{21} \end{pmatrix} \begin{pmatrix} y_{1t-1} \\ y_{2t-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{pmatrix}$$

where ε_{1t} is the error term and $E(\varepsilon_{1t}) = 0$ and $E(\varepsilon_{1t}, \varepsilon_{2t}) = 0$. Besides, the model can be extended to *n* variables $y_{1t}, y_{2t}, y_{3t}, \ldots\ldots y_{nt}$, and for a given value depends on its certain combinations of previous *p* values of *n* variables, and error terms.

The best segment of the VAR modeling is that it is not necessary to identify the endogeneity and exogeneity of the variables since all the variables in the model are considered endogenous, and that is ascertained to be successful and flexible for the multivariate time analysis. Now, we must deal with determining the optimal lag length and there are two common processes to determine. One of them is to use the information criteria (such as the Schwartz Bayesian Criterion (SBIC), Akaike Information Criterion (AIC), Hannan–Quinn information criterion (HQC), and we can choose the lowest value of any of them. However, there might a case where the AIC and SBIC might provide contradictive results, and tackle that SBIC is preferable due to its nature of selecting the appropriate model with fewer lags than AIC) and the other is the likelihood ratio test. For this study, the information criterion method (AIC) is used for identifying the optimal number of lags.

Cointegration Test

Times series data is generally quite dynamic, and tend to be non-stationary where a "spurious regression'' case might arise. Spurious regression refers to a group of variables being non-stationary, not having any meaningful economic relationship, but still regressing them might produce a statistically significant relationship among them. However, if the variables are non-stationary, and a linear combination makes them stationary, then they can be identified as cointegrated. So, the cointegration technique is used to scrutinize any correlation among non-stationary time series variables. Mostly in financial time series, there have been many time series variables that are non-stationary on their own but linear combination makes them stationary, and even if any of them drift away from equilibrium, the variable eventually comes back to the previous trend in long-run.

When there is a bivariate analysis, the series will be cointegrated, if all two of them are in *I(1)* process, but will be *I(0)* after a linear combination. Cointegration prescribes a situation where a group of non-stationary time series of identical order *(I(q))* indicates a long-run relationship. Moreover, the cointegrated variables share uniform stochastic trends that do not drift away over time. The existence of a cointegration relationship among variables will ameliorate forecasting both the short-run and long-run relationship. So, after confirming to the integration order of the variables, we can perform the cointegration tests to explore any presence of the cointegration relationship in the model.

The Engle & Granger (1987) test and the Johansen test (1988, 1991, and 1995) are two renowned cointegration tests in the literature. Due to its relative superior competence over the Engle & Granger, the Johansen test has been adopted for analyzing the macro determinants of the private pension scheme in Turkey (Enders, 2003, pp. 347-348). Researchers do not have to bother assuming the endogeneity or exogeneity of the variables, and it is one of the most expeditious points of implementing the Johansen test. The Johansen test can mathematically be expressed as follows:

$$y_t = \mu + \beta_1 y_{t-1} + \cdots \ldots . + \beta_p y_{t-p} + \vartheta_t$$

where y_t refers to the k×1 vector of endogenous variables, ϑ_t is the k×1 vector of error terms (Indecently and normally distributed), μ is k×1 is a constant vector and finally, A_1-A_p are the k×k matrices of parameters. We can restate the equation in a VECM form that follows:

$$\Delta y_t = \mu + \coprod y_{t-1} + \sum_{i=1}^{q-1} \omega_i \, \Delta y_{t-i} + \vartheta_t$$

Where μ and ϑ_t are same with the pre-VECM version, $\coprod = \sum_{j=1}^{j=q} A_i - I_k$ (here I_k refers to the k×k matrix) and $\omega_i = \sum_{j=i+1}^{j=q} A_j$.

If there is a cointegration relationship among variables, the direction of the relationship also should be detected: either a unidirectional or bidirectional Granger causality (Engle & Granger, 1987). The cointegration test is unable to detect the direction of the relationship. The Error Correction modeling (ECM) is extremely efficient in this case. Additionally, to examine the causality, the VECM explains both the short-run and long-run causality and eventually, the ECM indicates the adjustment process from the short-run disequilibrium to a long-run relationship. The ECM of the following time series can be shown as follows:

$$\Delta y_t = \alpha_0 + \sum_{i-1}^{n} \alpha_1 \Delta y_{t-1} + \sum_{i=1}^{m} \alpha_2 \Delta x_{t-1} + \emptyset ECT_{t-1} + \varepsilon_{1t}$$

(1)

$$\Delta x_t = \theta_0 + \sum_{i=1}^{n} \theta_1 x_{t-1} + \sum_{i=1}^{n} \theta_2 \Delta y_{t-1} + \delta ECT_{t-1} + \varepsilon_{2t}$$

(2)

where y_t is the per contribution level, and x_t are the selected macroeconomic variables, and ε_{it} refers to white noise with $E(\varepsilon_{it}$=0; i=1,2), n and m are the optimal lags of the variables, Δ refers to the first difference, θ and δ explain the speed of adjustment from short-run disequilibrium to the long-run equilibrium and finally, ECT_{t-1} represents the residuals from the equation. Here, Equation (1) explains the causality from x_t to y_t. On the other hand, Equation (2) explains the causality from y_t to x_t.

Johansen and Juselius (1990) propose trace and maximum eigenvalue t-statistics for conjecturing the number of cointegration vectors that can be formulated as follows:

$$Trace\ Test, \delta\ \max(r) = -T \sum_{j=r=1}^{n} \ln(1 - \hat{\delta})$$

$$Maximum\ Eigenvalue\ Test, \delta\ \max(r, r+1) = -T \ln(\ln(1 - \widehat{\delta r + 1}))$$

where r refers to the number of cointegration vectors with sample size T and eigenvalues δ. The null hypothesis of maximum r cointegration vectors with the alternative hypothesis of having more than r cointegration vectors is investigated by the trace test. Similarly, the null hypothesis of having r cointegration vectors with the alternative hypothesis of having r+1 cointegration vectors is examined by the maximum Eigenvalue test.

The Johansen Cointegration Test with Dummy Variable

While analyzing a time-series analysis, we often envisage structural breaks. Likewise, there is an identical situation in our data where we have government intervention in 2013. So, in this study, a drift dummy variable is included as an exogenous variable. There is no systematic difference here with the modeling based on VAR. However, there would be some modification in the standard test and the test statistics would change accordingly. So, there will be only changed in critical values after we include a dummy variable (Giles and Godwin, 2012).

The Error Correction Model (VECM)

We rule out Ordinary Least Squares (OLS) due to the non-stationarity of the variables. But if the non-stationary variables are cointegrated at order 1 (*I (1)*), the VECM can capture the short-run and long-run relationship. The VECM is formulated as follows:

$$\Delta y_t = \varphi_0 + \beta y_{t-1} + \varphi_1 \Delta y_{t-1} + \cdots .. + \varphi_p \Delta y_{t-p} + \cdots .. + \omega_0 x_t + \cdots . + \omega_p x_{t-p} + \gamma D_t + \epsilon_t$$

where φ_0 is ($n\times1$) intercept vectors, β refers to ($n\times n$) structural matrix, φ_i presents ($n\times n$) short-run coefficient matrixes, ϵ_t is ($n\times1$) the white noise. Additionally, x_t alludes to exogenous variable and D_t refers to a dummy variable. Now, all the variables in the model are cointegrated at order 1 (*I (1)*), and β has reduced rank. Then, we can express it as, $\beta = \theta\emptyset'$, where θ is an ($n\times n$) coefficient adjustment matrix and $\emptyset$ prescribes an ($n\times n$) cointegrating coefficient matrix.

Variance Decompositions and Impulse Response Function Analysis

One of the limitations of implementing the VECM is that it only explains the sample period. That is why the usages of variance decomposition have become quite efficacious. The variance decomposition illustrates the range of variance of an endogenous variable that can be elucidated through a shock on itself and other endogenous variables. If these do not unravel any of the forecast error variances of a certain variable, then we can conclude that variable as an exogenous variable. On the other hand, if the shocks explicate all the error variance of the variable, then we can identify it as a completely endogenous variable (Enders, 2003, pp. 278-280).

The Impulse response function is also applied to get even further dynamics of the variables. It explains how a dependent variable responds after having a shock from itself and a shock in other endogenous variables. Additionally, plotting the impulse response functions is a persuasive way to visualize the shocks and the response of the dependent variable with impulse response function one can measure the magnitude, length and direction of the variable after having a shock on either itself or from other endogenous variables within the system, ceteris paribus (Lutkepohl, 2005, pp. 51-63).

CHAPTER 5

RESULTS

Stationarity Test

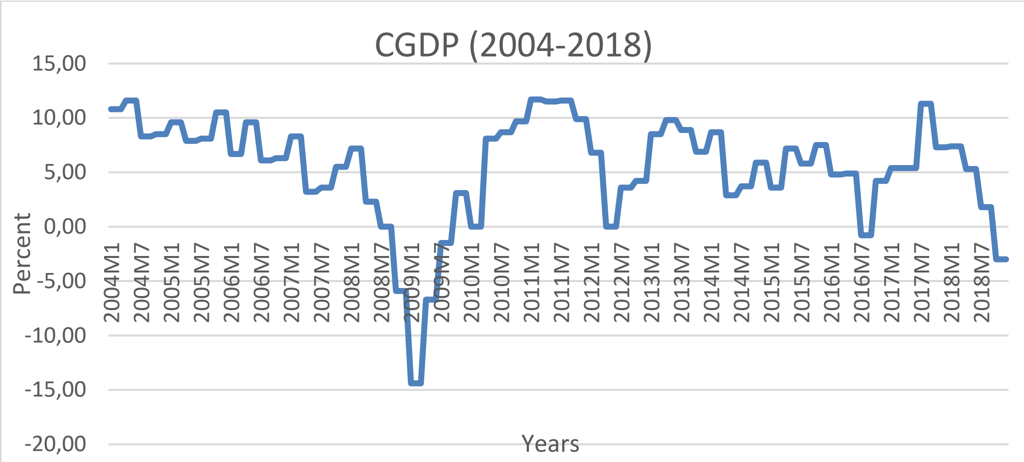
Keeping aside the fact that two-time series leading over time might lead us to misinterpret a causal relationship, a significant number of variables tend to have either positive or negative trend over time and it is imperative to identify those before we draw any statistical inferences on them (Wooldridge, 2009, pp. 329-332).

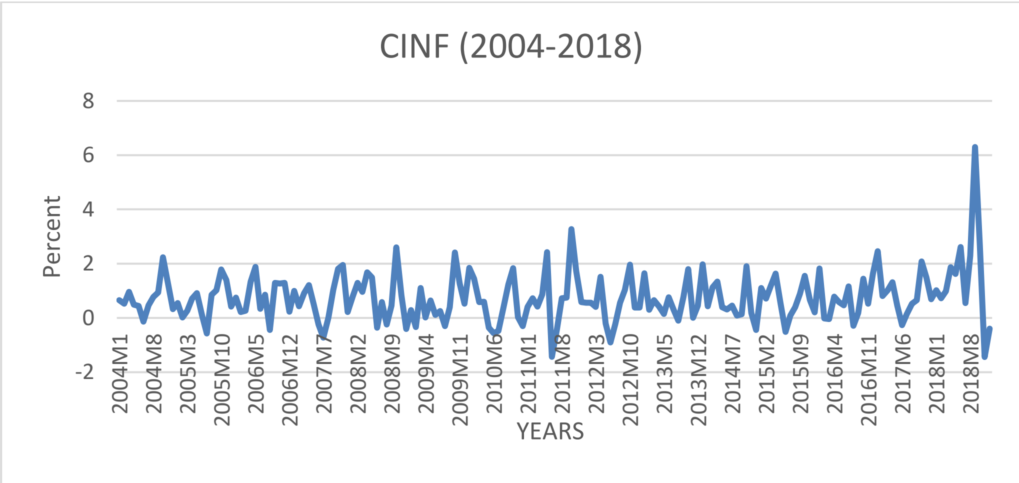
We informally check the stationarity of the variables by simply observing their time-series graphical plots (See Figure 5.1). From the figure, it is quite diaphanous of having a deterministic movement among variables in the long run.

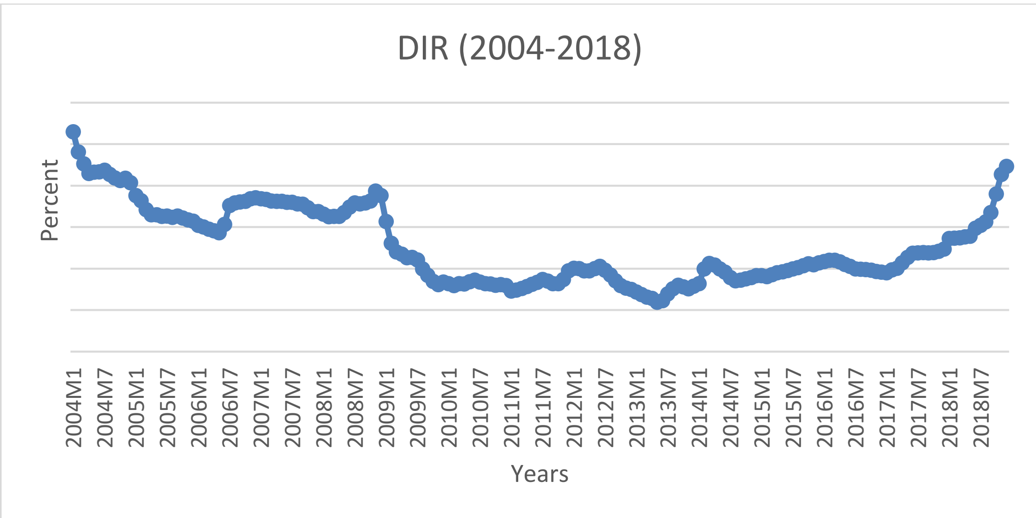
However, to avoid ambiguity, we have several dependable statistical methods to measure stationary property. For this study, the Augmented Dicky Fuller (ADF) test is implemented. Furthermore, to check the stationarity of variables in a model, we must specify the model of unit root test to adopt, i.e. either to have a constant, or a constant, and a linear trend or none of the linear and constant trend in the test. In addition, there will be an increase in critical values if we include a time trend in the test (Wooldridge, 2009, pp. 574-578).

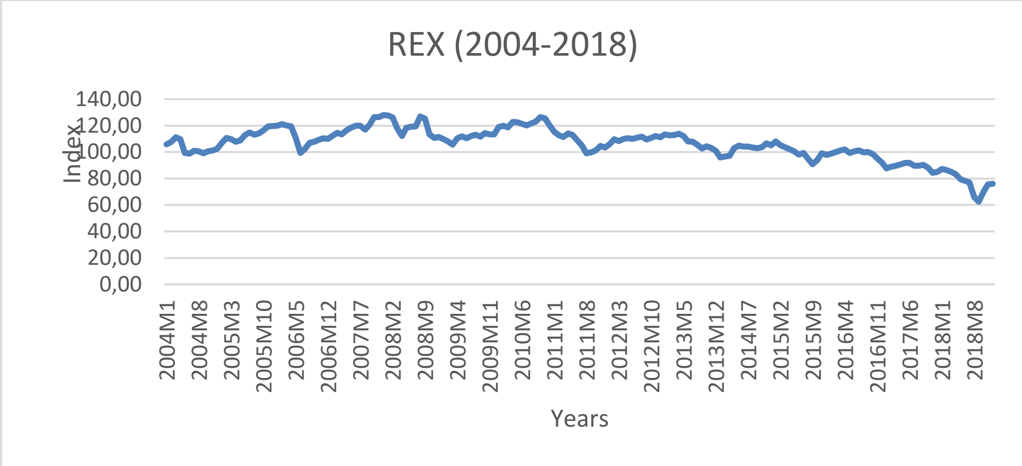
Variables that covers January 2004 to December 2018, mostly they display a deterministic trend an evident in Fıgure 5.1 So, a trend and a constant are appended during the stationary test. For the rest of the variables where the trend is opaque, we experiment them with both a constant and neither trend and constant and eventually, they have become stationary at the level I(1) with neither a trend nor a constant. The summary of the ADF test is presented below.

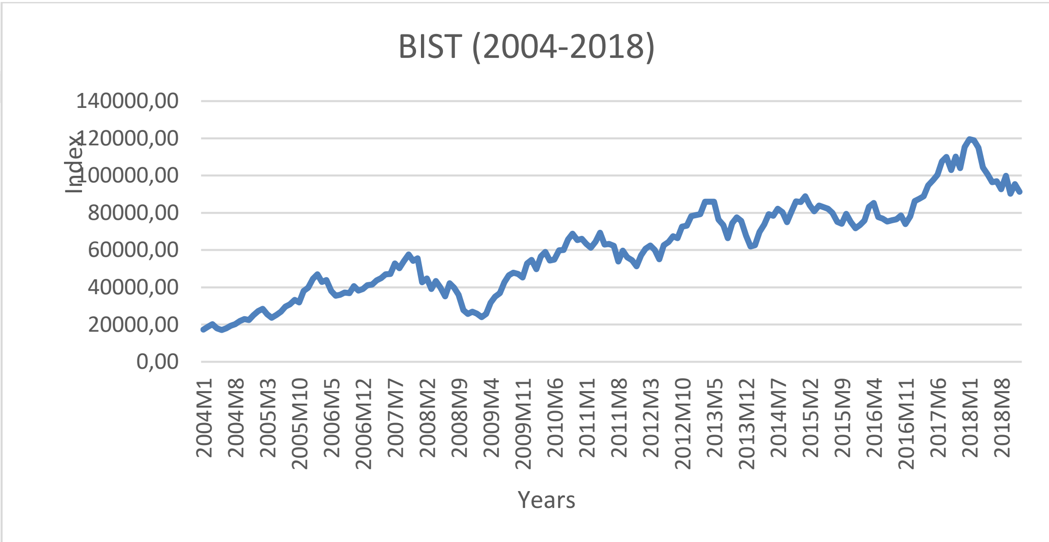
Figure 5.1: Progression of the macroeconomic variables during the sample period.

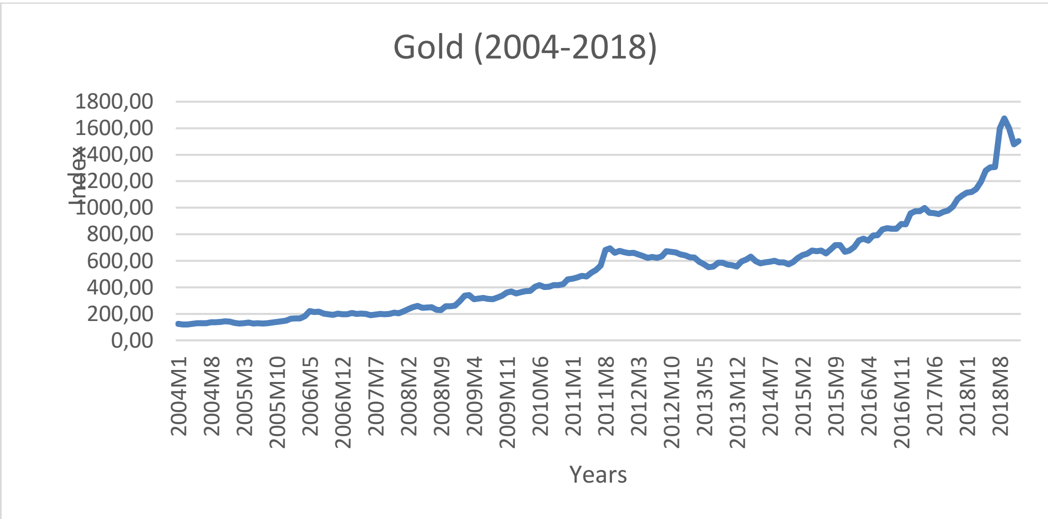







REX (2004-2018)
Index
140,00
120,00
100,00
80,00
60,00
40,00
20,00
0,00
2004M1
2004M8
2005M3
2005M10
2006M5
2006M12
2007M7
2008M2
2008M9
2009M4
2009M11
2010M6
2011M1
2011M8
2012M3
2012M10
2013M5
2013M12
2014M7
2015M2
2015M9
2016M4
2016M11
2017M6
2018M1
2018M8
Years


BIST (2004-2018)
Index
140000,00
120000,00
100000,00
80000,00
60000,00
40000,00
20000,00
0,00
2004M1
2004M8
2005M3
2005M10
2006M5
2006M12
2007M7
2008M2
2008M9
2009M4
2009M11
2010M6
2011M1
2011M8
2012M3
2012M10
2013M5
2013M12
2014M7
2015M2
2015M9
2016M4
2016M11
2017M6
2018M1
2018M8
Years


Gold (2004-2018)
Index
1800,00
1600,00
1400,00
1200,00
1000,00
800,00
600,00
400,00
200,00
0,00
2004M1
2004M8
2005M3
2005M10
2006M5
2006M12
2007M7
2008M2
2008M9
2009M4
2009M11
2010M6
2011M1
2011M8
2012M3
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2015M9
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2017M6
2018M1
2018M8
Years

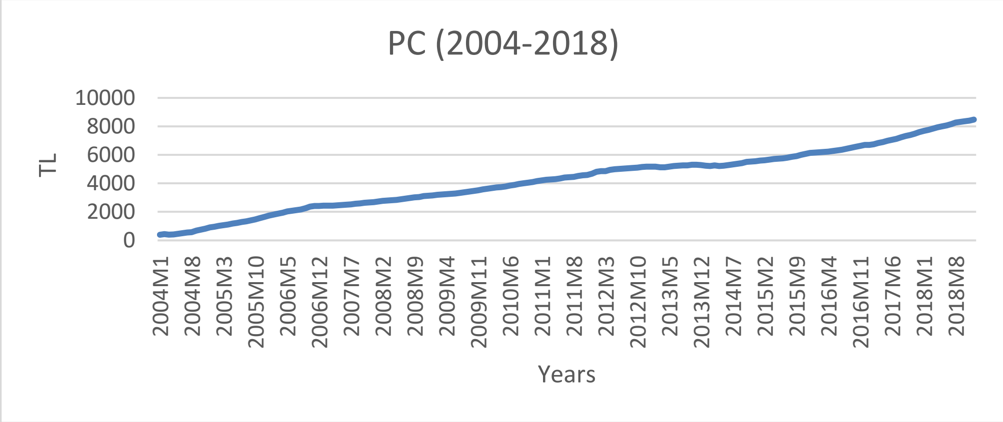


Table 5.1: Unit Root Test Results; Augmented Dickey-Fuller test (ADF), H_0: Non-Stationary

Variable	Deterministic Terms	Lags	Test Value	Critical Levels 1%	5%	10%
lpc	None	2	1.05	-2.58	-1.94	-1.62
Δlpc		2	-3.30***	-2.58	-1.94	-1.62
CINF	None	2	-1.68	-4.01	-3.44	-3.14
ΔCINF		2	-8.94***	-4.01	-3.44	-3.14
Lgold	Trend and	2	-2.27	-4.01	-3.44	-3.14
Δlgold	Intercept	2	-11.11***	-4.01	-3.44	-3.14
Lrex	Trend and	2	-1.68	-4.01	-3.44	-3.14
Δlrex	Intercept	2	-11.42***	-4.01	-3.44	-3.14
lbist	Trend and	2	-2.94	-4.01	-3.44	-3.14
Δlbist	Intercept	2	-12.88***	-4.01	-3.44	-3.14
CGDP	Trend and	2	-2.53	-4.01	-3.44	-3.14
ΔCGDP	Intercept	2	-13.26***	-4.01	-3.44	-3.14
DIR	Trend and	2	0.14	-4.01	-3.44	-3.14
ΔDIR	Intercept	2	-7.87***	-4.01	-3.44	-3.14

Note: Asterisks refer significance at the 1% (***), 5% (**), and 10% (*) levels.

So, from the ADF output, it is perspicuous that all the variables are non-stationary at level but become stationary at their first difference. Except for Per Contribution (LPC) and Change in Inflation Rate (CINF), variables have become stationary at I(1) with a trend and a constant (intercept). The LPC and CINF have also become stationary at I(1) but with neither a constant nor a trend.

Optimal Lag Length Criteria

Determining an appropriate lag order is a prerequisite for the cointegration application. If we fail to do so (whether it is below or above optimal lag order), there will be misspecification with the model (Wooldridge, 2009, pp. 576). Regarding the optimal lag length criteria, there are two conventional approaches: one is based on Likelihood ratio (LogL), and the other is based information criteria like the Schwartz Bayesian Criterion (SBIC), Akaike Information Criterion (AIC), Hannan–Quinn information criterion (HQC) and we pick the lowest value of any of them. According to Enders (2003), adopting the SBIC and the AIC confirms to the residuals are white noise in the equation *I (1)*. However, there might a case, where the AIC and SBIC might provide contradictive results and to tackle that, SBIC is preferable due to its nature of selecting the appropriate model with fewer lags than AIC.

Since we do not have a universal threshold for determining the optimal lag order, and this study is going to follow the AIC methodology for lag selection. The summary of statistical output regarding the lag length is exhibited below.

Table 5.2: Lag length criteria according to various information criterion.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-867.36	NA	6.1e-05	10.17	10.30	10.22
1	889.11	3349.54	1.5e-13	-9.69	-8.66*	-9.27
2	984.33	173.83	8.6e-14*	-10.23*	-8.30	-9.45*
3	1013.78	51.37	1.1e-13	-9.99	-7.18	-8.85
4	1054.31	67.39	1.2e-13	-9.90	-6.18	-8.39
5	1105.23	80.53	1.2e-13	-9.92	-5.31	-8.05
6	1147.88	63.96	1.3e-13	-9.85	-4.34	-7.61
7	1206.05	82.53	1.3e-13	-9.95	-3.55	-7.36
8	1267.78	82.54*	1.2e-13	-10.10	-2.80	-7.14

Note: Asterisk (*) implies the optimal lag order according to different information criterion. *(LR- Sequentially modified LR test statistic (each test at 5% level), FPE- Final prediction error, AIC- Akaike information criterion, SC- Schwarz information criterion, HQ- Hannan-Quinn information criterion)*

So, according to the results, both the AIC and the HQ indicate two optimal lag order whereas the SC is one. As we stated before it is one of the unavoidable dilemmas researchers face determining the optimal lag length for their model. The AIC methodology is decided for this study and according to Table 5.2, our optimal lag order is two for further cointegration analysis.

Cointegration Test

After confirming the stationarity of the variables at I(1), we can run a cointegration test. Keeping in mind the possibility of a ''spurious regression'' that arises from non-stationary variables, the cointegration technique is used to scrutinize any correlation among non-stationary time series variables. As our model is having multivariate time series, the Johansens cointegration test (proposed by Johansen in 1988, and Johansen, and Juselius in 1990) results are presented in Table 5.3, where there is strong evidence of the presence of cointegrating vectors in our model. So, the variables adjust in the model to annihilate the short-run divergence from long-run equilibrium.

Table 5.3: Cointegration Test.

Panel 1: Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CEs	Eigenvalue	Trace Statistics	Critical Value (0.05)
r=0*	0.59	314.48	125.62
r=1*	0.32	158.03	95.75
r=2*	0.20	90.34	69.82
r=3*	0.12	51.43	47.86
r=4	0.11	28.24	29.80
r=5	0.04	7.86	15.49
r=6	0.01	0.43	3.84

Asterisk (*) implies a rejection of H_0; H_0=No cointegration equation at the 0.05 level.

Panel 2: Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CEs	Eigenvalue	Max-Eigen Statistics	Prob.
r=0*	0.59	156.45	46.23
r=1*	0.32	67.69	40.08
r=2*	0.20	38.88	33.88
r=3	0.12	23.19	27.58
r=4	0.11	20.38	21.13
r=5	0.04	14.26	14.26
r=6	0.01	0.43	3.84

Note: Asterisk (*) rejection of H_0; H_0= at most one cointegration equation at the 0.05 level.

From the table, the Trace test indicates 4 cointegration equations, whereas 3 cointegration equation according to the Max-Eigenvalue test at 0.05 level. This is a decent result, considering that at least one cointegration relationship would have been good enough to continue with the VECM. Moreover, both the Trace and the Max-Eigenvalue tests are based on LR ratio. All in all, our results are all set for the VECM analysis.

Vector Error Correction Model (VECM) Analysis

As the theoretical background of the VECM has already elucidated before, we can illustrate our mathematical representation as follows.

$$\Delta LPC = \varphi_0 + \sum_{i=1}^{2} \Delta\varphi_1 LREX_{t-i} + \sum_{i=1}^{2} \varphi_2 \Delta LGOLD_{t-i} + \sum_{i=1}^{2} \varphi_3 \Delta DIR_{t-i} + \sum_{i=1}^{2} \varphi_4 \Delta CINF_{t-i} + \sum_{i=1}^{2} \varphi_5 \Delta CGDP_{t-i} + \sum_{i=1}^{2} \varphi_6 \Delta LBIST_{t-i} + \beta ECT_{t-1} + \gamma GC + \epsilon_t$$

From our final equation stated above, β implies the speed of adjustment from an economic shock to the long-run equilibrium and $\varphi_1, \dots \dots, \varphi_6$ refer to the lagged short-run coefficients with an error term (ϵ_t) in the VECM. Moreover, we can illustrate our error correction term as follows.

$$\beta ECT_t = \beta(\theta_1 LPC_t + \theta_2 LREX_t + \theta_3 LGOLD_t + \theta_4 DIR_t + \theta_5 CINF_t + \theta_6 CGDP_t + \theta_7 LBIST_t)$$

Finally, with the VECM output we get from Eviews, it can be illustrated in a short-run and a long-run equation. The long-run relationship is as following:

$$ECT_{t-1} = 1.00LPC_{t-1} - 0.1506LREX_{t-1} + 0.4067LGOLD_{t-1} - 0.0065DIR_{t-1} + 0.0125CINF_{t-1} - 0.0075CGDP_{t-1} + 0.2460LBIST_{t-1} + 3.8932$$

And the short-run equation can be drawn as follows:

$$\Delta LPC_{t-1} = -0.0493ect_{t-1} + 0.4000\Delta LPC_{t-1} - 0.0171\Delta LPC_{t-2} + 0.0298\Delta LREX_{t-1} + 0.0566\Delta LREX_{t-2} + 0.0147\Delta LGOLD_{t-1} + 0.0126\Delta LGOLD_{t-2} - 0.0001\Delta DIR_{t-1} + 0.0030\Delta DIR_{t-2} + 0.0011\Delta CINF_{t-1} + 0.010\Delta CINF_{t-2} - 0.0108\Delta LBIST_{t-1} - 0.0096\Delta LBIST_{t-2} + 0.0003\Delta CGDP_{t-1} - 0.0001\Delta CGDP_{t-2} + 0.0069 - 0.0012GC$$

Long-run Cointegration Relationship

As all the preconditions are satisfied; variables are stationary at level 1, cointegration relationship among variables and finding optimal lag length criteria, we are all set to analyze the VECM output. Most importantly, we are predominantly interested in the long-run relationships. From the VECM output (variables have an inverse coefficient sign due to normalization), the long-run relationship can be computed as follows:

Table 5.4: Long-run Dynamics.

Dependent variable: ΔLPC_{t-1}	Coefficients	
$\Delta LREX_{t-1}$	-0.1506	(0.449)
$\Delta LGOLD_{t-1}$	0.4067***	(-4.611)
ΔDIR_{t-1}	-0.0065	(0.856)
$\Delta CINF_{t-1}$	-0.0125	(0.457)
$\Delta CGDP_{t-1}$	-0.0075*	(2.000)
$\Delta LBIST_{t-1}$	0.2460***	(-2.629)
Dependent variable: : ΔLPC_{t-1}		
Constant	-3.8932	(0.001)

Notes: t-statistics are placed inside parentheses and asterisks refer significance at the 1% (***), 5% (**), and 10% (*) levels.

From Table 5.4, the coefficient of the cointegration equation refers to the speed of adjustment in the long run. In other words, if there is a shock to the equilibrium, according to our model, it will be adjusted back to equilibrium at 4.94% rate. The constant term is insignificant in our study. After running the VECM, we run the Wald test to confirm the significance of the variables in the long run.

Real effective exchange rate (LREX) is insignificant in our long-run analysis. However, in an identical study, Korkmaz, Uygurtürk, and Çevik (2010) which find a statistically positive relationship between Euro value and the contribution level for Turkey.

Gold is one of the popular investment options in Turkey and it is closely related to other financial instruments (Gülseven & Ekici, 2016, Omag, 2012, Akar, 2011). In our study, the Gold price index shows a positive association with the dependent variable. In fact, 1% increase in the gold price index will positively affect per contribution level by 40.67%. There might be two-sided explanations. People may already have an investment in gold and they are richer due to the positive income effect and save more. On the other hand, our findings here might be unorthodox, because if people find the gold price rising, rationally behaved, it wiser to invest in gold as an expected potential source of a higher return.

Depositing one's savings in banks is a substitute to contribution in a private pension scheme. So, we anticipate the deposit interest rate to have a negative correlation with the per contribution. But, the deposit interest rate shows no significant relationship with the per contribution.

Whether inflation rate affects savings decision or not, even if it affects, in which direction is ambiguous in the literature. In this study, we did not find any significant relationship between the change in inflation rate and per contribution. Ozcan, Gunayand Ertac (2003) find a supportive argument for the Precautionary motive for savings for Turkey where private saving is positively affected by inflation. Additionally, Masson, Bayoumi, and Samiei (1998) also detect a positive direction on savings from inflation. Martin (1980) argues that the nature of private pension funds changes due if there is a regular change in inflation. Turkey's economy has been volatile especially in recent years and people might have their strategies to act accordingly.

A positive impact on gross domestic product (CGDP) might lead to higher spending or savings depending on one's income and substitution effect. In our study, change in the gross domestic product is negatively associated with per contribution but at a quite low margin. So, 1% decrease in gross domestic product is found to positively affect the per contribution by 0.75%. Our findings support the literature as well. Haque, Pesaran, and Sharma (1999) have a similar finding that supports our estimation. However, Ozcan, Gunay, and Ertac (2003) assert that even though there is a positive relationship between income and private savings, but the growth rate does not have a statistically significant relationship with private savings for Turkey. Additionally, following the Neoclassical investment theory, there is a positive correlation between real GDP growth and private investment (Fielding, 1997; Greene and Villanueva, 1991). Moreover, Greene and Villanueva assert that as people have higher income with GDP growth, they tend to save more that may become useful in finance investment. Ouattara (2004) finds also a positive relationship between real income and private investment for Senegal. Several panel studies including IMF (2005) have found a statistically positive relationship between real per capita GDP and Savings.

Investing in stocks is a common preference among Turkish households and we can roughly measure the stock market performance by BIST 100 index. BIST 100 positively affects per contribution. So, 1% increase in the BIST 100 index raises per contribution level up by 24.60%. This finding is also consistent with the existing literature. Adopting OLS estimation Korkmaz, Uygurtürk, and Çevik (2010) find a statistically positive impact on the private pension contribution.

Short-run Dynamics

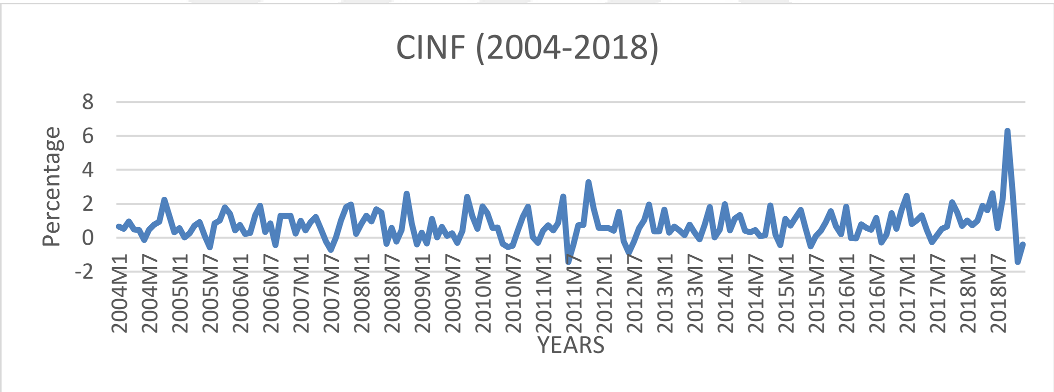
Table 5.5: Short-run Relationship and Summary Statistics.

Dependent variable: ΔLPC_{t-1}	Coefficients
Constant	0.0104*** (0.001)
ect_{t-1}	−0.0494*** (0.003)
ΔLPC_{t-1}	0.4000*** (0.042)
ΔLPC_{t-2}	−0.0171 (0.042)
$\Delta LREX_{t-1}$	0.0298 (0.030)
$\Delta LREX_{t-2}$	0.0566 (0.028)
$\Delta LGOLD_{t-1}$	0.0147 (0.019)
$\Delta LGOLD_{t-2}$	0.0126 (0.019)
ΔDIR_{t-1}	−0.0001 (0.002)
ΔDIR_{t-2}	0.0030 (0.002)
$\Delta CINF_{t-1}$	0.0011 (0.001)
$\Delta CINF_{t-2}$	0.0010 (0.001)
$\Delta CGDP_{t-1}$	0.0003 (0.001)
$\Delta CGDP_{t-2}$	−0.0001 (0.000)
$\Delta LBIST_{t-1}$	−0.0108 (0.010)
$\Delta LBIST_{t-2}$	−0.0010 (0.010)
$GC\ (DUMMY)$	0.0012 (0.002)
Dependent variable: : ΔLPC_{t-1}	
Constant	0.0104*** (0.001)
Dependent variable: ΔLPC_{t-1}	
R-squared	0.8670
Adjusted R-squared	0.8537
S.E. of regression	0.0085
Sum squared resid	0.0117
F-statistic	65.2099
Prob (F-statistic)	0.0000
Mean dependent var	0.0172
S.D. dependent var	0.0224
Log-likelihood	600.2099
Akaike info criterion	-6.5903
Schwarz criterion	-6.2852
Hannan-Quinn criterion	-6.4665
Durbin-Watson stat	2.1175
Number of observations	180

Notes: t-statistics are placed inside parentheses and asterisks refer significance at the 1% (***), 5% (**), and 10% (*) levels.

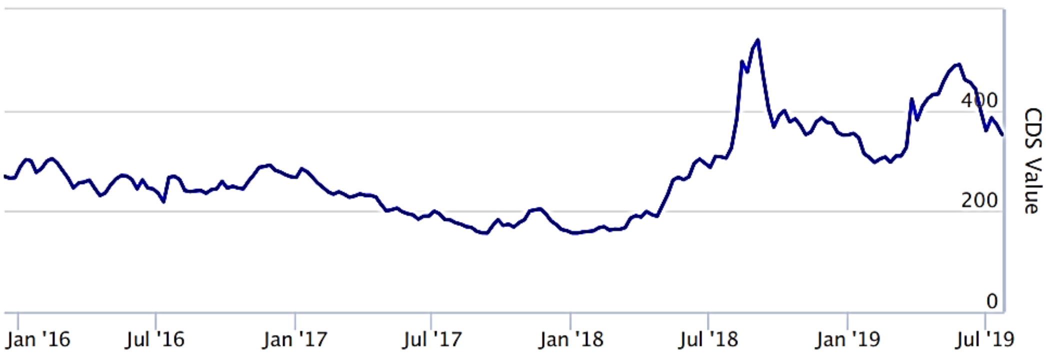
From the VECM short-run output above, previous periods deviation from long-run equilibrium is corrected in the current period as an adjustment speed of almost 5%. The adjusted R-squared indicates that our model accounts for 85.37% variance of the response data. One percentage change in the first lag of LPC is associated with a 4.6% increase in LPC on average in the short run ceteris paribus. The rest of the variables are insignificant in the short run. One explanation might be that due to the volatile character of the Turkish economy (see Figure 5.2 and Figure 5.3), people adjust accordingly. Looking closely at Figure 5.2, the Turkish economy is continuously volatile and especially it has even risen in recent years. If we observe the change in credit default swap (CDS) data, the volatility is much clearer. From Figure 5.3, until mid-2018, there was a consistent trend in the CDS but from July 2018, there is an increase in the credit default swap. But, it is hard to holistically explain the possible reasons in this study. One possible explanation is might be a political crisis in both international and domestic level. But, it is worth to explore these reasons in another study. Perhaps, some other factors play an even a bigger role in participation and contributing decision in private pension.

Figure 5.2: Change in Inflation Rate for Turkey.



Source: The World Bank Indicator.

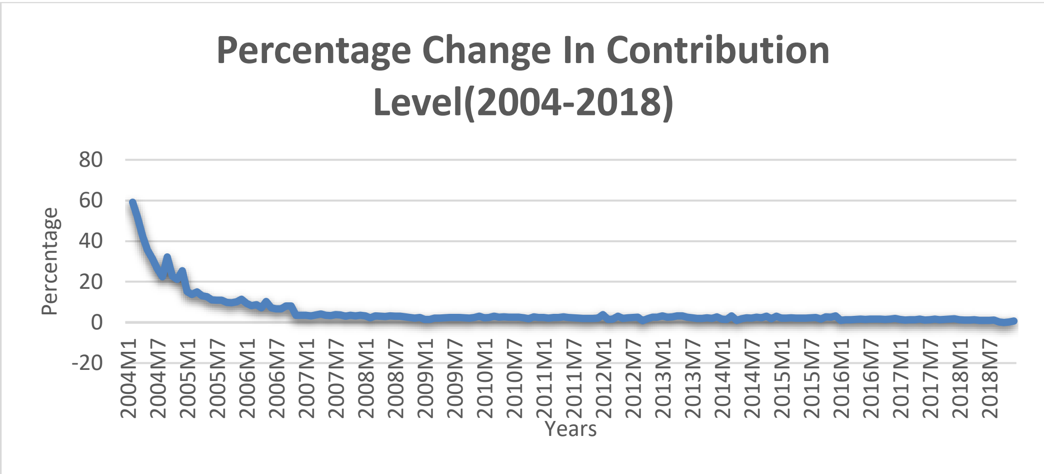
Figure 5.3: Change in Credit Default Swap (CDS) for Turkey.



Source: The World Government Bonds.

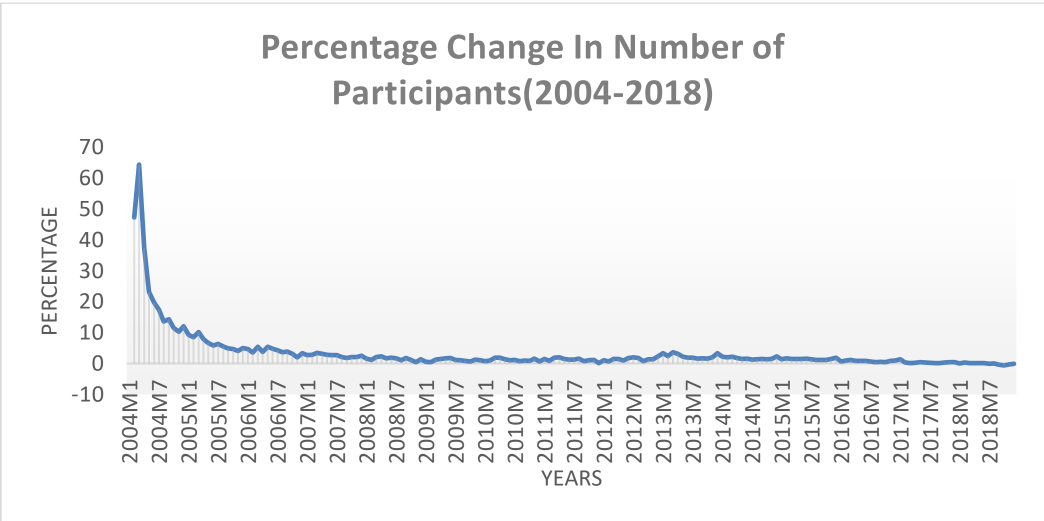
Noticeably, our dummy variable (Government Contribution) is also insignificant that contradicts some relevant literature (Ertugrul, H.M., et al, 2017). Looking at Figure 5.4 and 5.5, which show that there has not been any noticeable change in the Turkish private pension scheme, our results can be justified. Additionally, Engen, Gale, and Scholz (1996) advocate that incentives for saving may elevate savings rate but just for a while For Turkey, Ozel and Yalcin (2013) asserts a positive influence on the private pension system from the initiation of government incentive but can be threatened with inefficient fund management performance.

Figure 5.4: Percentage Change in Contribution Level



Source: The Pension Monitoring Center.

Figure 5.5: Percentage Change in Number of Participants



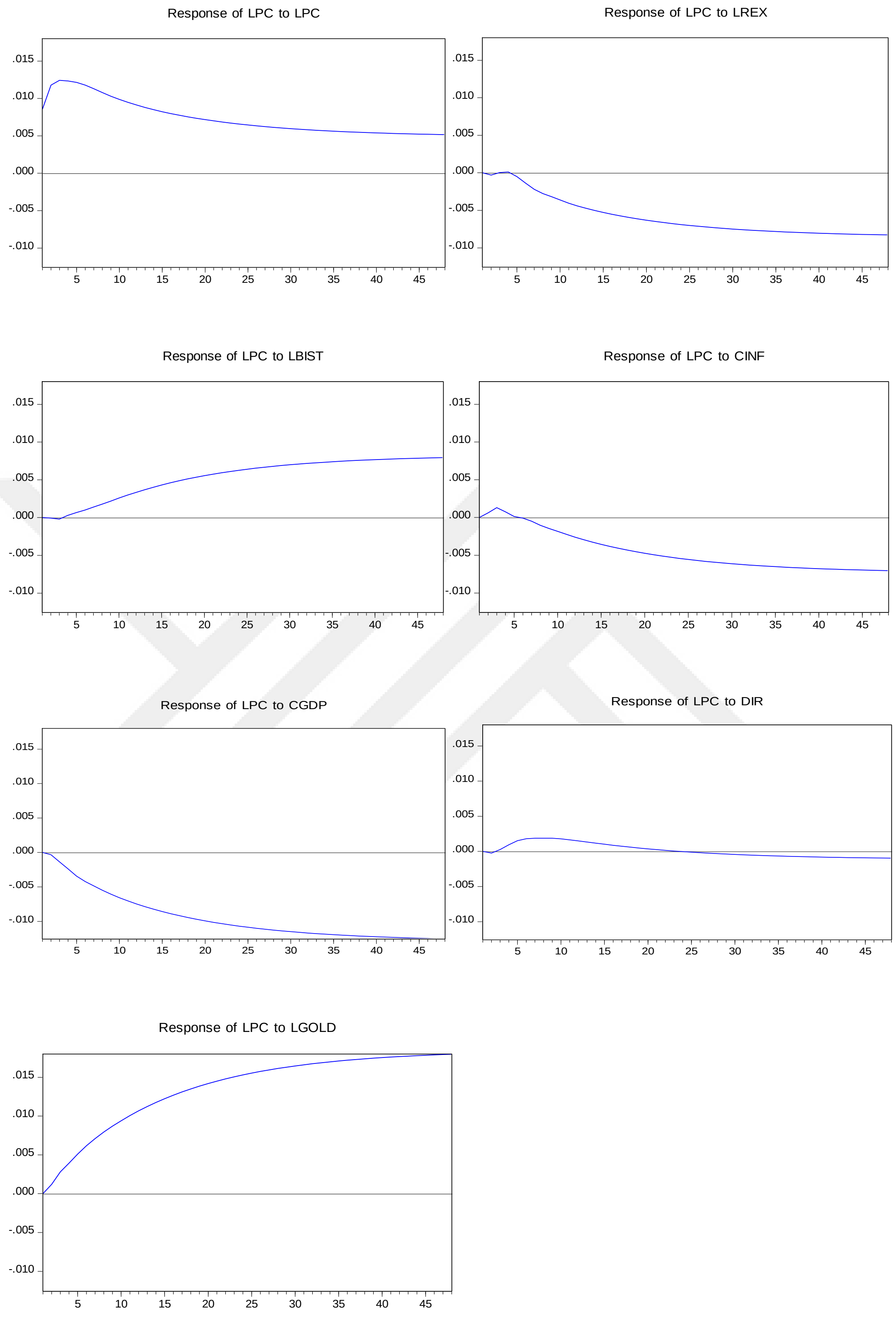
Source: The Pension Monitoring Center.

Impulse Response Function (INF)

Along with the cointegration test, the analysis of impulse response function is an additional check for the cointegration relationship. Impulse response function traces out impacts of any shocks among variables or any shocks to the error term. Precisely, we can identify the responsiveness of our dependent variables to the shocks not only from other variables but also from itself. One standard deviation or a unit shock is applied to all the variables and the impacts are both illustrated and explained in the following paragraphs.

According to Figure 5.5, a one-unit shock to LPC has a positive impact for at least 5 periods and dies out slowly after that. The initial response of LPC to a one standard deviation LREX shock has a quite small negative effect. In the following periods, its impact turns positive and finally we observe a negative in the long run. A one-unit shock to LBIST generates just the opposite impact on LPC compare to an LREX shock. It has almost no impact for a moment (roughly for 4 periods), which turned positive in the long-run. But, a one-unit inflation shock has a positive influence for the first 2 periods on per contributions and negative impact in the long run. Moving to a one standard deviation shock from CGDP, impacts LPC negatively both in the short and the long-run. As for DIR, LPC reacts quite in an ambiguous manner but moderately where it affects negatively on impact for the first 2 periods and positively after that until 24th periods and negatively again. Lastly, one standard deviation shock to LGOLD impacts positively LPC in the long-run.

Figure 5.6: Impulse Responses of LPC on shocks from all the variables.



Variance Decomposition

Table 5.6 illustrates the results of variance decomposition that covers 48 periods (Each period is a month).

From variance decomposition (VD) Table 5.6, 100% LPC variance can be explained by current LPC in the first period and the explanation power diminishes significantly after some periods (which is around 13% at the end of 48th periods). On the other hand, among the rest of the variables, DIR has almost no significant power to explain any variance in LPC throughout the given period. LGOLD, LREX, CINF, LBIST, and CGDP initially do not contribute much for explaining variance in LPC, but in the 48th period, they account for 44%, 9%, 6%, 7% and 21% of the variation in contribution amounts respectively.

In this study, we are more interested in examining the variation of per contribution in the system. From the VD table presented here, CGDP and GOLD become gradually more important for explaining the variation of our dependent variable. After the 48^{th} period, GOLD accounts for almost 44% variation and the rest of the variables remain ignorable throughout our VD period. It is reasonable that gold accounts for more variation because gold is one of the popular investment options in Turkey and it is closely related to other financial instruments (Gülseven & Ekici, 2016, Omag, 2012, Akar, 2011).

The VD of LREX indicates that around 100% the variance in LREX can be illustrated with its value during the first periods which diminishes to 92% at the end of 48 periods. However, except LBIST, the rest of the variables have no significant relationship with LREX. LBIST and CINF account for 6% of the variance in LREX at the end of the period.

The variance of LBIST implies that 79% of its variance can be explained by itself during the first periods while 21% of the variations are due to LREX's. At the end of 48 periods, the ability of LBIST to explain its variance drops to 75% and that of LREX to 14%. Even though LPC and DIR have almost no significant relationship in the initial few periods, their impact just increases by a margin at the end of the 48th period.

For DIR, presumably 96% of its variance can be elucidated through DIR in the first periods where it drops down to 87% at the end of 48 periods. LBIST and CINF are accounts of 6% and 4% of the variation respectably of DIR at the 48th period where LREX is 3% and LPC, CGDP, and LGOLD have no significant contribution.

The VD of CINF exhibits that 97% of its variance is explained by its first period's value where the remaining 3% is through LREX. Moving to the end of our 48th period, 97% abates to 80% but 9% from 3% respectively for CINF and DIR. Additionally, DIR accounts for 98% variance in the 48th period from almost no significant relationship initially. LGOLD, LBIST, and LPC do not have any significant effect throughout the period.

Approximately 97% of CGDP's variance stems from its commencing value which has diminished to 64% at the end of the 48th period. The variance accountability of DIR rises from 0% to 20% where 9 percentage points are due to LBIST, 5 percentage points is due to LREX and the rest of the variables have an ignorable impact on CGDP.

Finally, the variance of LGOLD can be explained only 61% from its first period's value which eventually drops to 53% at the end of the 48th period. LREX has quite a significant impact throughout the period (32% in the begging and 36% in the end). LBIST has just the opposite of CINF regarding variance in LGOLD where LBIST has no impact initially but finishes with 8%. Additionally, LPC and CGDP have no significant relationship at the end of the 48th period.

Table 5.6: Decomposition of Variance.

Relative Variance in ΔLPC								
	S.E.	ΔLPC	$\Delta LREX$	$\Delta LBIST$	ΔDIR	$\Delta CINF$	$\Delta CGDP$	$\Delta GOLD$
1	0.0085	100.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
6	0.0307	85.2437	0.2385	0.1675	0.6964	0.2812	3.9441	9.4283
12	0.0494	58.3751	3.0245	1.5580	1.0334	0.8670	11.3135	23.8281
24	0.0861	28.4821	6.8025	4.8654	0.4253	3.4194	18.3372	37.6677
48	0.1496	12.8520	8.7948	7.4623	0.1926	5.6682	21.3095	43.7203
Relative Variance in $\Delta LREX$								
	S.E.	ΔLPC	$\Delta LREX$	$\Delta LBIST$	ΔDIR	$\Delta CINF$	$\Delta CGDP$	$\Delta GOLD$

1	0.0274	0.2749	99.7251	0.0000	0.0000	0.0000	0.0000	0.0000
6	0.0783	0.5750	93.0876	4.4011	0.7055	0.2250	0.6128	0.3926
12	0.1094	0.7229	92.7831	4.9041	0.4548	0.2049	0.7242	0.2056
24	0.1531	0.7396	92.3738	5.4127	0.3067	0.1621	0.8940	0.1108
48	0.2150	0.6948	91.9193	5.8929	0.2156	0.1173	1.0782	0.0815
Relative Variance in $\Delta LBIST$								
	S.E.	ΔLPC	$\Delta LREX$	$\Delta LBIST$	ΔDIR	$\Delta CINF$	$\Delta CGDP$	$\Delta GOLD$
1	0.0754	0.0743	21.1773	78.7483	0.0000	0.0000	0.0000	0.0000
6	0.2025	2.1377	16.3423	77.4948	1.3722	0.9207	0.3687	1.3632
12	0.2996	2.6156	15.9916	75.8120	2.3629	0.9919	0.3510	1.8748
24	0.4369	2.5938	15.0608	75.3235	3.0135	1.2064	0.2425	2.5591
48	0.6912	2.3675	14.0134	75.3494	3.4177	1.45557	0.1428	3.2532
Relative Variance in $\Delta CINF$								
	S.E.	ΔLPC	$\Delta LREX$	$\Delta LBIST$	ΔDIR	$\Delta CINF$	$\Delta CGDP$	$\Delta GOLD$
1	0.9079	0.1223	2.8885	0.0046	0.0000	96.9845	0.0000	0.0000
6	1.5761	0.3904	10.9607	1.5134	6.1163	79.6968	1.0334	0.2886
12	2.0637	0.5905	9.5869	1.4923	6.8990	80.2432	1.0090	0.1788
24	2.7893	0.6995	8.8273	1.5710	7.3958	80.4571	0.9448	0.1041
48	3.8474	0.7377	8.4841	1.6621	7.7416	80.4288	0.8768	0.6861
Relative Variance in $\Delta\Delta CGDP$								
	S.E.	ΔLPC	$\Delta LREX$	$\Delta LBIST$	ΔDIR	$\Delta CINF$	$\Delta CGDP$	$\Delta GOLD$
1	1.9057	0.0031	0.0602	2.4286	0.0000	0.0184	97.4894	0.0000
6	4.7581	0.0182	2.2713	8.4218	8.7747	0.2226	80.2471	0.0440
12	7.1887	0.0522	3.7474	9.9706	14.8405	0.3722	70.9923	0.0245
24	10.5557	0.0954	4.5149	10.7474	18.0308	0.4581	66.1286	0.0245
48	15.1904	0.1084	4.8189	11.1991	19.5582	0.5163	63.7665	0.0322
Relative Variance in ΔDIR								
	S.E.	ΔLPC	$\Delta LREX$	$\Delta LBIST$	ΔDIR	$\Delta CINF$	$\Delta CGDP$	$\Delta GOLD$
1	0.3477	0.3896	0.3878	0.1544	96.0212	1.2460	1.8007	0.0000
6	1.7640	0.0930	2.3670	3.1916	90.7226	2.6929	0.9052	0.0274
12	2.9635	0.2531	3.2006	4.2081	88.6497	2.9114	0.7397	0.0461
24	4.5740	0.2586	3.2164	5.0227	87.5160	3.2887	0.4930	0.2042
48	6.7738	0.1922	2.9260	5.6964	86.7134	3.7174	0.3018	0.4524
Relative Variance in $\Delta GOLD$								
	S.E.	ΔLPC	$\Delta LREX$	$\Delta LBIST$	ΔDIR	$\Delta CINF$	$\Delta CGDP$	$\Delta GOLD$
1	0.0442	2.0669	32.3202	0.7816	0.6629	1.7241	1.5733	60.8707
6	0.1179	1.8701	35.0602	5.2040	0.7398	0.8133	0.3226	55.9897
12	0.1663	1.9539	35.5606	6.3573	0.3775	0.8040	0.2203	54.7262
24	0.2341	2.0374	35.9164	7.2015	0.1916	0.8762	0.1509	53.6256
48	0.3292	2.1544	36.0634	7.8270	0.0996	0.9687	0.1017	52.7848

Residual Diagnosis

In this section, we further run residual test, heteroskedastic test, serial autocorrelation test, and coefficient stability test to confirm the soundness of our VECM output.

Firstly the normality condition of the data is tested by using Jarque-Bera statistics. The hypothesis of normality test as follows:

H_0: Residuals are normally distributed.

H_1: Residuals are not normally distributed.

Table 5.7: Normality Test

Component	Jarque-Bera	df	Prob.
1	922.2008	2	0.0000
2	192.7716	2	0.0000
3	10.59127	2	0.0050
4	28.94838	2	0.0000
5	167.0877	2	0.0000
6	116.2575	2	0.0000
7	17.54588	2	0.0002
Joint	1455.403	14	0.0000

*Approximate p-values do not account for coefficient estimation

According to the table above, the probability value is below 5%. So, our residuals are both individually and jointly not normally distributed at 5% significance level.

Then, the Breusch-Godfrey serial correlation LM test is run to detect the existence of serial autocorrelation in our data. The hypothesis of serial correlation test as follows:

H_0: No serial correlation exists.

H_1: Serial correlation exists.

Table 5.8: Breusch-Godfrey Serial Correlation Test

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	63.29505	49	0.0824	1.305151	(49, 750.7)	0.0827
2	96.54474	49	0.0001	2.034725	(49, 750.7)	0.0001

Null hypothesis: No serial correlation at lags 1 to h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	63.29505	49	0.0824	1.305151	(49, 750.7)	0.0827
2	141.5028	98	0.0027	1.478594	(98, 894.4)	0.0027

*Edgeworth expansion corrected likelihood ratio statistic.

So, from the table above, we can conclude that we do not have serial correlation at lag 1, but there is a serial autocorrelation at the second lag. This is quite normal in time series data and our estimation considers of existing autocorrelation in our data.

The assumption of heteroskedasticity is enormously important to test the robustness of our model. The Breusch-Pagan-Godfrey test is run to check for heteroskedasticity.

Table 5.9: Breusch-Pagan-Godfrey Heteroskedasticity Test.

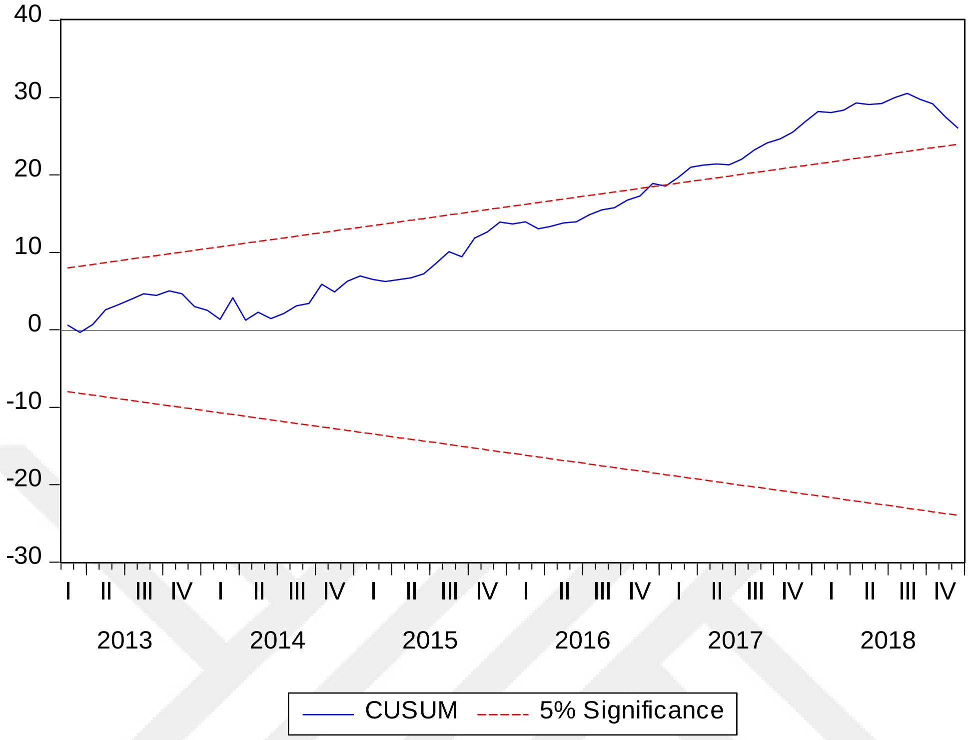
Joint test:

Chi-sq	df	Prob.
1076.376	868	0.0000

So, the probability value is bellow 5% level, and we can conclude that there is heteroskedasticity in the data and the VECM also estimates accordingly.

Finally, we run a stability test to inspect the soundness of our coefficient estimation.

Figure 5.7: Stability Test.



At 5% level, the stability test suggests that our coefficient estimations are quite reliable until mid-2016 but afterward the outlook changes. This change can be attributed to the Turkish economy's recent volatile nature since the occurrence of a military coup in July 2016. Additionally, the Turkish economy has faced several international diplomatic tensions (mostly from the United States of America and Russia) which are significantly responsible for contemporary economic instability.

Robustness Checks

We run several VECM tests on both real and nominal values of some key variables to check the robustness of our findings. The robust test includes shuffling nominal to real values or vice versa, inclusion or exclusion of variables. One important thing to be noted here that we run numerous VECM tests with different forms of the variables, but only statistically significant outputs are discussed bellow.

In our very first trial, we exclude the CINF and run the VECM test. In this case, our long-run cointegration relationship is still significant. The short-run output is identical with the original form and in long-run output, only LGOLD, CGDP, and LBIST are significant. Adjusted-R squared is almost the same here. Additionally, keeping the CINF out, this time we run the test without the dummy variable (government contribution). But, there are no noticeable changes in output.

Then, we run the test with the nominal exchange rate rather than the real effective exchange rate (REX). Here, our long-run cointegration dynamics is still significant and the short-run results are homogenous with the original results. But, in the long-run, only LBIST, DIR, CGDP, and LGOLD are significant. Moreover, we have inconsistency issues regarding maintaining an identical form of the variables on both sides of our equation.

Furthermore, keeping the nominal exchange rate in the system, we take in the expected inflation rate substituted with the change in the inflation rate. The long-run cointegration relationship, adjusted-r squared and the short-run dynamics are similar to before. However, in the long-run, only LGOLD, LBIST, DIR and CGDP are proved to be significant.

Finally, we check the VECM output with the real deposit interest rate (1-year base). Alike previous results, the cointegration dynamics, adjusted r squared, and the short-run outputs are identical. But, surprisingly, only LGOLD is significant in the long-run. All in all, we conclude that our original specification is a robust one.

CHAPTER 6

CONCLUSION

The objective of our study is to investigate the long-run and short-run determinants of the private pension contributions in Turkey. According to the pension literature for Turkey, this study covers the relatively the largest data period taking into account a structural break which is due to the initiation of the government contribution in 2013 We adopt the Vector Error Correction Model (VECM) to capture long-run and short-run determinants of the private pension contributions in Turkey for our chosen time period. In our study, the monthly data covers from 2004 to 2018 and we use government contribution as a dummy. The unit root test (Augmented Dickey-Fuller test) justifies that all the variables are stationary at level one (I (1)). The Johansen cointegration test illustratesenough cointegration relationship (4 cointegration relationship according to Trace test and 3 according to Maximum Eigenvalue test) evidence among variables.

Then finally the VECM model is run to capture the short-run and long-run relationship. Firstly, the negative sign of the error correction model confirms the long-run convergence in equilibrium and the adjustment rate is 4.94% to go back to the equilibrium after a deviation from equilibrium.

Real effective exchange rate (LREX) is negatively related to the per contribution (LPC). An appreciation in Turkish lira would lead to more contribution to the system. Gold price index shows a positive association with the dependent variable and the deposit interest rate is inversely related to the per contribution. Whether inflation rate affects savings decision or not, even if it affects, in which direction has an ambiguous finding in the literature. In this study, we do not find any significant relationship between the change in inflation rate and per contribution. A positive impact on gross domestic product (CGDP) might lead to higher spending or savings depending on the income and substitution effects. Change in the gross domestic product is negatively associated with per contribution but at a quite low margin. Finally, investing in stocks is a common preference in Turkey and BIST 100 positively affects per contribution. However, all the variables including the dummy (government contribution) are insignificant in short-run dynamics.

Furthermore, it should be noted that our estimations do not perform admirably in the adopted parameter stability test in this study. This parameter instability is especially noticeable in recent years. So, there could be better estimation with alternative models taking this issue into account.

So, all in all, the unrestricted VECM estimation suggests that five out of six variables in our study have a statistically long-run relationship with the per contribution in the private pension scheme. Impulse response and variance decomposition analysis are also made to explore further characteristics of our variables. Finally, various residuals diagnoses are run to justify our findings.

Additionally, we run several VECM tests on both real and nominal values of some key variables to check the robustness of our findings. The robust test includes shuffling nominal to real values or vice versa, inclusion or exclusion of variables. Even though we have consistency issues in the parameter stability test, but comparing the cointegration results and coefficient estimates, our estimation still provides relatively better results.

Despite some significant findings, a micro-level study would fit better in the scope of this study. Because we believe differences in demographics and income characteristics such as financial background, religion, demographics, etc. people act in a heterogeneous manner on an identical issue. Furthermore, fund management cost is proved to have a significant impact on contributions level but the data for Turkey has not been available during our working period. To maintain consistency across all the variables, we could not include some key variables like employment rate, life expectancy rate, number of housing loans. We keep a detailed micro-level study for further research.

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APPENDIXES

APPENDIX A

Table A.1. Stationarity Test Output.

Null Hypothesis: LREX has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.679349	0.7565
Test critical values:	1% level	-4.010740	
	5% level	-3.435413	
	10% level	-3.141734	

Null Hypothesis: D(LREX) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.41983	0.0000
Test critical values:	1% level	-4.010740	
	5% level	-3.435413	
	10% level	-3.141734	

Null Hypothesis: LPC has a unit root
Exogenous: None
Lag Length: 3 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.046057	0.9224
Test critical values:	1% level	-2.578167	
	5% level	-1.942645	
	10% level	-1.615502	

Null Hypothesis: D(LPC) has a unit root
Exogenous: None
Lag Length: 4 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.295722	0.0011
Test critical values:	1% level	-2.578320	
	5% level	-1.942666	
	10% level	-1.615488	

Null Hypothesis: LGOLD has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.268070	0.4487
Test critical values:	1% level	-4.010440	
	5% level	-3.435269	
	10% level	-3.141649	

Null Hypothesis: D(LGOLD) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.11127	0.0000
Test critical values:	1% level	-4.010440	
	5% level	-3.435269	
	10% level	-3.141649	

Null Hypothesis: CINF has a unit root
Exogenous: None
Lag Length: 5 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.678847	0.0881
Test critical values:	1% level	-2.578320	
	5% level	-1.942666	
	10% level	-1.615488	

Null Hypothesis: D(CINF) has a unit root
Exogenous: None
Lag Length: 10 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.954105	0.0000
Test critical values:	1% level	-2.578799	
	5% level	-1.942733	
	10% level	-1.615446	

Null Hypothesis: CGDP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.529231	0.3138
Test critical values:	1% level	-4.010143	
	5% level	-3.435125	
	10% level	-3.141565	

Null Hypothesis: D(CGDP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-13.25555	0.0000
Test critical values:	1% level	-4.010440	
	5% level	-3.435269	
	10% level	-3.141649	

Null Hypothesis: DIR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.068775	0.9968
Test critical values:	1% level	-4.010440	
	5% level	-3.435269	
	10% level	-3.141649	

Null Hypothesis: D(DIR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.670597	0.0000
Test critical values:	1% level	-4.010440	
	5% level	-3.435269	
	10% level	-3.141649	

Null Hypothesis: LBIST has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.947311	0.1504
Test critical values:	1% level	-4.010143	
	5% level	-3.435125	
	10% level	-3.141565	

Null Hypothesis: D(LBIST) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.87774	0.0000
Test critical values:	1% level	-4.010440	
	5% level	-3.435269	
	10% level	-3.141649	

APPENDIX B

Table B.1. Lag Length Criteria Output.

VAR Lag Order Selection Criteria
Endogenous variables: LPC LREX LGOLD LBIST CGDP CINF DIR
Exogenous variables: C
Date: 04/20/19 Time: 16:19
Sample: 2004M01 2018M12
Included observations: 172

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-867.3592	NA	6.14e-05	10.16697	10.29506	10.21894
1	889.1084	3349.543	1.46e-13	-9.687307	-8.662541*	-9.271533
2	984.3272	173.8297	8.58e-14*	-10.22473*	-8.303299	-9.445159*
3	1013.782	51.37383	1.08e-13	-9.997460	-7.179354	-8.854081
4	1054.312	67.39336	1.21e-13	-9.898974	-6.184199	-8.391794
5	1105.237	80.53240	1.21e-13	-9.921357	-5.309912	-8.050374
6	1147.877	63.96113	1.35e-13	-9.847412	-4.339297	-7.612627
7	1206.053	82.52740	1.27e-13	-9.954099	-3.549314	-7.355511
8	1267.778	82.53985*	1.16e-13	-10.10207	-2.800614	-7.139679

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

APPENDIX C

Table C.1. Cointegration Test Output.

Date: 04/20/19 Time: 16:23
Sample (adjusted): 2004M04 2018M12
Included observations: 177 after adjustments
Trend assumption: Linear deterministic trend
Series: LPC LREX LGOLD LBIST CGDP CINF DIR
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.586827	314.4783	125.6154	0.0000
At most 1 *	0.317788	158.0298	95.75366	0.0000
At most 2 *	0.197370	90.34238	69.81889	0.0005
At most 3 *	0.122784	51.42695	47.85613	0.0222
At most 4	0.108764	28.23964	29.79707	0.0748
At most 5	0.041091	7.858812	15.49471	0.4806
At most 6	0.002438	0.432130	3.841466	0.5109

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.586827	156.4485	46.23142	0.0000
At most 1 *	0.317788	67.68741	40.07757	0.0000
At most 2 *	0.197370	38.91543	33.87687	0.0115
At most 3	0.122784	23.18731	27.58434	0.1656
At most 4	0.108764	20.38082	21.13162	0.0634
At most 5	0.041091	7.426682	14.26460	0.4400
At most 6	0.002438	0.432130	3.841466	0.5109

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

APPENDIX D

Table D.1. VECM Long-run Estimation

Vector Error Correction Estimates
Date: 04/20/19 Time: 16:33
Sample (adjusted): 2004M04 2018M12
Included observations: 177 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LPC(-1)	1.000000
LREX(-1)	0.150622
	(0.33570)
	[0.44868]
LGOLD(-1)	-0.406654
	(0.08820)
	[-4.61077]
LBIST(-1)	-0.246041
	(0.09360)
	[-2.62859]
CGDP(-1)	0.007459
	(0.00373)
	[1.99958]
CINF(-1)	0.012531
	(0.02741)
	[0.45711]
DIR(-1)	0.006530
	(0.00763)
	[0.85630]
C	-3.893157

APPENDIX E

Table E.1. VECM Short-run Estimation.

Error Correction:	D(LPC)	D(LREX)	D(LGOLD)	D(LBIST)	D(CGDP)	D(CINF)	D(DIR)
CointEq1	-0.049355	0.015359	0.012677	0.034054	0.061998	0.264616	0.158143
	(0.00344)	(0.01102)	(0.01776)	(0.03027)	(0.76418)	(0.36410)	(0.13946)
	[-14.3643]	[1.39365]	[0.71367]	[1.12489]	[0.08113]	[0.72677]	[1.13395]
D(LPC(-1))	0.399545	0.058849	-0.141116	0.582694	-4.814144	-1.352624	5.520768
	(0.04193)	(0.13448)	(0.21675)	(0.36940)	(9.32476)	(4.44286)	(1.70176)
	[9.52956]	[0.43761]	[-0.65106]	[1.57742]	[-0.51628]	[-0.30445]	[3.24416]
D(LPC(-2))	-0.017142	0.144870	0.265019	0.153997	-3.592262	3.930014	-4.916436
	(0.04211)	(0.13506)	(0.21768)	(0.37099)	(9.36490)	(4.46198)	(1.70908)
	[-0.40710]	[1.07264]	[1.21746]	[0.41510]	[-0.38359]	[0.88078]	[-2.87665]
D(LREX(-1))	0.029875	0.150334	-0.033005	-0.145366	3.555574	-12.92424	0.404159
	(0.03021)	(0.09691)	(0.15619)	(0.26620)	(6.71967)	(3.20164)	(1.22633)
	[0.98881]	[1.55128]	[-0.21131]	[-0.54609]	[0.52913]	[-4.03675]	[0.32957]
D(LREX(-2))	0.056609	-0.209983	0.032042	0.043248	1.846018	5.267779	-2.683346
	(0.02842)	(0.09115)	(0.14690)	(0.25036)	(6.31997)	(3.01120)	(1.15339)
	[1.99213]	[-2.30383]	[0.21812]	[0.17274]	[0.29209]	[1.74939]	[-2.32649]
D(LGOLD(-1))	0.014721	-0.112828	0.149367	0.184474	2.656605	-1.592324	0.575730
	(0.01895)	(0.06079)	(0.09798)	(0.16698)	(4.21514)	(2.00834)	(0.76926)
	[0.77672]	[-1.85603]	[1.52449]	[1.10476]	[0.63025]	[-0.79286]	[0.74842]
D(LGOLD(-2))	0.012683	0.065264	-0.083033	0.078186	-1.685072	1.193462	-0.471444
	(0.01940)	(0.06222)	(0.10028)	(0.17091)	(4.31424)	(2.05556)	(0.78734)
	[0.65381]	[1.04894]	[-0.82800]	[0.45748]	[-0.39058]	[0.58060]	[-0.59878]
D(LBIST(-1))	-0.010819	0.107980	-0.098640	0.055183	2.979966	1.631599	-0.715568
	(0.01007)	(0.03231)	(0.05208)	(0.08876)	(2.24057)	(1.06754)	(0.40890)
	[-1.07397]	[3.34169]	[-1.89398]	[0.62172]	[1.33000]	[1.52837]	[-1.74998]
D(LBIST(-2))	-0.009580	0.013411	-0.012509	0.087248	0.996307	-0.264073	0.067027
	(0.01045)	(0.03352)	(0.05402)	(0.09207)	(2.32420)	(1.10738)	(0.42416)
	[-0.91673]	[0.40009]	[-0.23154]	[0.94761]	[0.42867]	[-0.23847]	[0.15802]
D(CGDP(-1))	0.000289	-0.001153	0.001744	0.001254	-0.077804	0.040782	0.014654
	(0.00037)	(0.00117)	(0.00189)	(0.00322)	(0.08126)	(0.03872)	(0.01483)
	[0.78977]	[-0.98368]	[0.92314]	[0.38945]	[-0.95749]	[1.05336]	[0.98814]
D(CGDP(-2))	-3.41E-05	-0.001149	0.001000	0.001775	-0.080085	-0.020985	-0.009730
	(0.00037)	(0.00118)	(0.00190)	(0.00324)	(0.08186)	(0.03900)	(0.01494)
	[-0.09260]	[-0.97302]	[0.52565]	[0.54738]	[-0.97827]	[-0.53802]	[-0.65125]

D(CINF(-1))	0.001106	0.002560	-0.001106	-0.014210	-0.034648	-0.341055	-0.007848
	(0.00070)	(0.00224)	(0.00361)	(0.00615)	(0.15524)	(0.07397)	(0.02833)
	[1.58421]	[1.14328]	[-0.30636]	[-2.31068]	[-0.22319]	[-4.61091]	[-0.27700]
D(CINF(-2))	0.000978	0.000430	-0.006187	-0.000138	0.035409	-0.376159	0.042277
	(0.00070)	(0.00224)	(0.00362)	(0.00616)	(0.15558)	(0.07413)	(0.02839)
	[1.39826]	[0.19147]	[-1.71067]	[-0.02244]	[0.22759]	[-5.07434]	[1.48893]
D(DIR(-1))	-9.95E-06	0.013731	-0.010244	-0.009630	-0.310557	-0.686350	0.607079
	(0.00189)	(0.00607)	(0.00978)	(0.01666)	(0.42058)	(0.20039)	(0.07675)
	[-0.00526]	[2.26376]	[-1.04787]	[-0.57798]	[-0.73841]	[-3.42513]	[7.90935]
D(DIR(-2))	0.002980	-0.013089	0.013282	-0.007645	-0.880092	0.446816	0.024044
	(0.00206)	(0.00659)	(0.01063)	(0.01811)	(0.45716)	(0.21782)	(0.08343)
	[1.44980]	[-1.98522]	[1.24990]	[-0.42214]	[-1.92513]	[2.05133]	[0.28818]
C	0.010474	-0.004092	0.015375	-0.009799	-0.135835	-0.082262	-0.051546
	(0.00129)	(0.00413)	(0.00666)	(0.01135)	(0.28649)	(0.13650)	(0.05228)
	[8.13117]	[-0.99043]	[2.30883]	[-0.86339]	[-0.47413]	[-0.60264]	[-0.98586]
GC	0.001217	-0.006129	-0.006439	0.000290	0.238229	0.027534	0.094730
	(0.00155)	(0.00498)	(0.00802)	(0.01367)	(0.34511)	(0.16443)	(0.06298)
	[0.78406]	[-1.23136]	[-0.80267]	[0.02124]	[0.69029]	[0.16745]	[1.50405]
R-squared	0.867039	0.315735	0.112411	0.089959	0.081085	0.377439	0.557586
Adj. R-squared	0.853743	0.247308	0.023653	-0.001045	-0.010807	0.315183	0.513345
Sum sq. resids	0.011747	0.120856	0.313955	0.911880	581.0707	131.9103	19.35304
S.E. equation	0.008569	0.027484	0.044297	0.075493	1.905700	0.907986	0.347788
F-statistic	65.20993	4.614218	1.266481	0.988520	0.882394	6.062683	12.60328
Log likelihood	600.2427	393.9517	309.4649	215.1010	-356.3541	-225.1307	-55.27505
Akaike AIC	-6.590313	-4.259341	-3.304688	-2.238429	4.218690	2.735940	0.816667
Schwarz SC	-6.285259	-3.954287	-2.999634	-1.933375	4.523744	3.040994	1.121721
Mean dependent	0.017200	-0.002132	0.014249	0.008523	-0.077966	-0.007684	-0.023898
S.D. dependent	0.022405	0.031679	0.044830	0.075454	1.895485	1.097216	0.498545

Determinant resid covariance (dof adj.)	9.75E-14
Determinant resid covariance	4.81E-14
Log likelihood	955.8739
Akaike information criterion	-9.377106
Schwarz criterion	-7.116118
Number of coefficients	126

APPENDIX F

Table F.1. Coefficient Significance Test.

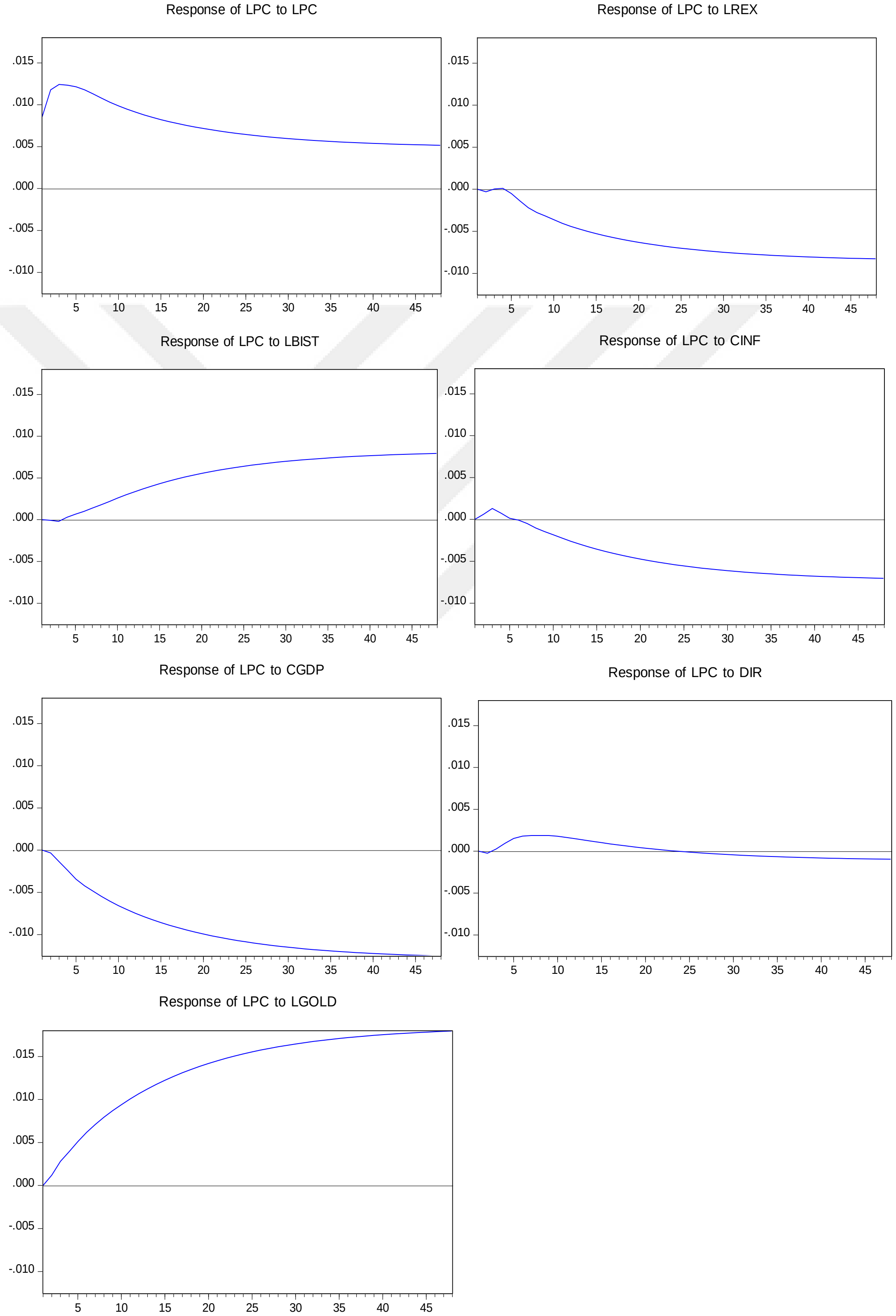
Dependent Variable: D(LPC)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 04/20/19 Time: 16:48
Sample (adjusted): 2004M04 2018M12
Included observations: 177 after adjustments
D(LPC) = C(1)*(LPC(-1) + 0.150621956182*LREX(-1) - 0.406653832875 *LGOLD(-1) - 0.2460409415*LBIST(-1) + 0.00745865180816*CGDP(-1) + 0.0125309683599*CINF(-1) + 0.00652962148665*DIR(-1) - 3.89315663682) + C(2)*D(LPC(-1)) + C(3)*D(LPC(-2)) + C(4)*D(LREX(-1)) + C(5)*D(LREX(-2)) + C(6)*D(LGOLD(-1)) + C(7)*D(LGOLD(-2)) + C(8)*D(LBIST(-1)) + C(9)*D(LBIST(-2)) + C(10)*D(CGDP(-1)) + C(11) *D(CGDP(-2)) + C(12)*D(CINF(-1)) + C(13)*D(CINF(-2)) + C(14) *D(DIR(-1)) + C(15)*D(DIR(-2)) + C(16) + C(17)*GC

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.049355	0.003436	-14.36430	0.0000
C(2)	0.399545	0.041927	9.529560	0.0000
C(3)	-0.017142	0.042107	-0.407103	0.6845
C(4)	0.029875	0.030214	0.988809	0.3242
C(5)	0.056609	0.028416	1.992133	0.0481
C(6)	0.014721	0.018953	0.776724	0.4385
C(7)	0.012683	0.019398	0.653815	0.5142
C(8)	-0.010819	0.010074	-1.073971	0.2845
C(9)	-0.009580	0.010450	-0.916729	0.3607
C(10)	0.000289	0.000365	0.789772	0.4308
C(11)	-3.41E-05	0.000368	-0.092595	0.9263
C(12)	0.001106	0.000698	1.584208	0.1151
C(13)	0.000978	0.000700	1.398256	0.1640
C(14)	-9.95E-06	0.001891	-0.005260	0.9958
C(15)	0.002980	0.002056	1.449802	0.1491
C(16)	0.010474	0.001288	8.131174	0.0000
C(17)	0.001217	0.001552	0.784058	0.4342

R-squared	0.867039	Mean dependent var	0.017200
Adjusted R-squared	0.853743	S.D. dependent var	0.022405
S.E. of regression	0.008569	Akaike info criterion	-6.590313
Sum squared resid	0.011747	Schwarz criterion	-6.285259
Log likelihood	600.2427	Hannan-Quinn criter.	-6.466595
F-statistic	65.20993	Durbin-Watson stat	2.117562
Prob(F-statistic)	0.000000		

APPENDIX G

Table G.1. Impulse Response Diagrams.



APPENDIX H

Table H.1. Variance Decomposition Output.

Variance Decomposition of LPC:

Period	S.E.	LPC	LREX	LBIST	CINF	CGDP	DIR	LGOLD
1	0.008569	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.014641	99.02374	0.042088	0.001889	0.181172	0.050046	0.026582	0.674485
3	0.019497	96.41857	0.024032	0.011554	0.546994	0.518426	0.033794	2.446631
4	0.023560	93.45825	0.018416	0.023418	0.474183	1.375858	0.182104	4.467771
5	0.027265	89.61375	0.048642	0.077751	0.356553	2.615206	0.446560	6.841542
6	0.030731	85.24379	0.238578	0.167516	0.281258	3.944104	0.696420	9.428336
7	0.034007	80.64967	0.610037	0.305332	0.249897	5.258088	0.871865	12.05511
8	0.037167	75.93903	1.063902	0.482397	0.286810	6.575301	0.985414	14.66715
9	0.040253	71.28451	1.530283	0.700104	0.374331	7.868569	1.055984	17.18621
10	0.043305	66.77841	2.018457	0.962111	0.501202	9.100189	1.083375	19.55625
11	0.046356	62.45620	2.526759	1.252899	0.669397	10.25183	1.071376	21.77154
12	0.049413	58.37511	3.024599	1.558032	0.867052	11.31352	1.033497	23.82819
13	0.052473	54.57216	3.493969	1.873267	1.082329	12.28278	0.981085	25.71441
14	0.055540	51.04929	3.933386	2.193201	1.310043	13.16327	0.920706	27.43010
15	0.058617	47.80026	4.342680	2.510688	1.544010	13.95953	0.857038	28.98580
16	0.061698	44.81636	4.720949	2.821298	1.778441	14.67653	0.793592	30.39284
17	0.064782	42.08296	5.068598	3.122354	2.010231	15.32090	0.732608	31.66235
18	0.067864	39.58250	5.387017	3.411712	2.236972	15.89983	0.675376	32.80659
19	0.070940	37.29688	5.678243	3.688093	2.456509	16.41998	0.622556	33.83774
20	0.074007	35.20788	5.944617	3.950880	2.667648	16.88743	0.574374	34.76717
21	0.077062	33.29783	6.188292	4.199799	2.869780	17.30792	0.530796	35.60558
22	0.080101	31.55023	6.411235	4.434942	3.062502	17.68669	0.491628	36.36277
23	0.083122	29.94972	6.615382	4.656679	3.245688	18.02841	0.456586	37.04754
24	0.086123	28.48217	6.802560	4.865496	3.419451	18.33723	0.425336	37.66775
25	0.089101	27.13475	6.974406	5.061964	3.584014	18.61685	0.397534	38.23049
26	0.092055	25.89583	7.132396	5.246724	3.739684	18.87051	0.372839	38.74201
27	0.094983	24.75497	7.277866	5.420440	3.886837	19.10109	0.350930	39.20787
28	0.097883	23.70275	7.412022	5.583776	4.025878	19.31112	0.331505	39.63295
29	0.100756	22.73073	7.535940	5.737384	4.157227	19.50284	0.314289	40.02159
30	0.103600	21.83136	7.650588	5.881895	4.281306	19.67819	0.299033	40.37763
31	0.106414	20.99788	7.756831	6.017912	4.398537	19.83890	0.285514	40.70443
32	0.109198	20.22423	7.855441	6.146004	4.509326	19.98649	0.273532	41.00498
33	0.111952	19.50497	7.947112	6.266710	4.614065	20.12231	0.262909	41.28192
34	0.114675	18.83526	8.032465	6.380533	4.713127	20.24753	0.253487	41.53760
35	0.117368	18.21072	8.112057	6.487941	4.806869	20.36321	0.245128	41.77407
36	0.120030	17.62744	8.186388	6.589373	4.895624	20.47028	0.237708	41.99319
37	0.122662	17.08190	8.255906	6.685235	4.979706	20.56955	0.231119	42.19659
38	0.125263	16.57094	8.321017	6.775903	5.059412	20.66175	0.225264	42.38571
39	0.127834	16.09170	8.382084	6.861727	5.135016	20.74755	0.220059	42.56187
40	0.130376	15.64160	8.439435	6.943030	5.206778	20.82751	0.215430	42.72621
41	0.132888	15.21833	8.493367	7.020110	5.274936	20.90217	0.211312	42.87978
42	0.135371	14.81977	8.544149	7.093246	5.339717	20.97197	0.207645	43.02350
43	0.137826	14.44403	8.592024	7.162693	5.401328	21.03734	0.204380	43.15820
44	0.140252	14.08936	8.637212	7.228688	5.459964	21.09866	0.201471	43.28465
45	0.142650	13.75420	8.679914	7.291452	5.515807	21.15625	0.198878	43.40351
46	0.145022	13.43711	8.720312	7.351188	5.569025	21.21041	0.196566	43.51538
47	0.147366	13.13680	8.758573	7.408085	5.619775	21.26143	0.194504	43.62083
48	0.149684	12.85207	8.794848	7.462316	5.668203	21.30955	0.192665	43.72035

Variance Decomposition of LREX:

Period	S.E.	LPC	LREX	LBIST	CINF	CGDP	DIR	LGOLD
1	0.027484	0.274903	99.72510	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.048058	0.229082	95.40357	2.101495	0.224771	0.162526	1.145296	0.733265
3	0.058729	0.267112	93.53808	3.667392	0.197329	0.482241	1.160067	0.687774
4	0.065415	0.469635	92.95993	4.200566	0.213246	0.637019	0.964156	0.555452
5	0.071738	0.549834	92.99156	4.319603	0.238449	0.628958	0.809725	0.461866
6	0.078311	0.575061	93.08762	4.401140	0.225053	0.612897	0.705551	0.392680
7	0.084559	0.607223	93.06001	4.503461	0.215297	0.630645	0.641482	0.341881
8	0.090180	0.646608	92.96971	4.617138	0.218719	0.655129	0.590160	0.302532
9	0.095327	0.679058	92.89876	4.713920	0.217782	0.674425	0.544891	0.271170
10	0.100235	0.699693	92.86067	4.782704	0.212531	0.691215	0.507840	0.245345
11	0.104968	0.712649	92.82655	4.842328	0.208452	0.707395	0.478853	0.223768
12	0.109487	0.722945	92.78314	4.904190	0.204949	0.724246	0.454843	0.205688
13	0.113796	0.731468	92.73895	4.962982	0.200933	0.741533	0.433703	0.190427
14	0.117937	0.737410	92.69952	5.015677	0.196914	0.758005	0.415074	0.177400
15	0.121939	0.741120	92.66264	5.064762	0.193007	0.773567	0.398764	0.166137
16	0.125812	0.743485	92.62635	5.111634	0.189098	0.788770	0.384319	0.156349
17	0.129564	0.744923	92.59083	5.156151	0.185295	0.803638	0.371332	0.147829
18	0.133205	0.745557	92.55653	5.198368	0.181638	0.817975	0.359553	0.140378
19	0.136746	0.745524	92.52348	5.238478	0.178079	0.831784	0.348820	0.133833
20	0.140196	0.744973	92.49158	5.276630	0.174629	0.845122	0.339003	0.128061
21	0.143560	0.744033	92.46068	5.313026	0.171314	0.858005	0.329981	0.122958
22	0.146845	0.742795	92.43075	5.347806	0.168125	0.870438	0.321648	0.118435
23	0.150056	0.741323	92.40181	5.381034	0.165055	0.882437	0.313923	0.114420
24	0.153197	0.739665	92.37384	5.412797	0.162105	0.894010	0.306740	0.110845
25	0.156274	0.737868	92.34678	5.443202	0.159273	0.905174	0.300044	0.107657
26	0.159291	0.735970	92.32061	5.472328	0.156553	0.915945	0.293782	0.104809
27	0.162249	0.733998	92.29531	5.500241	0.153942	0.926337	0.287913	0.102261
28	0.165154	0.731975	92.27084	5.527009	0.151436	0.936362	0.282400	0.099978
29	0.168007	0.729919	92.24718	5.552694	0.149029	0.946034	0.277211	0.097930
30	0.170812	0.727848	92.22431	5.577353	0.146719	0.955368	0.272317	0.096089
31	0.173570	0.725772	92.20219	5.601038	0.144500	0.964375	0.267694	0.094433
32	0.176285	0.723702	92.18080	5.623801	0.142369	0.973068	0.263319	0.092942
33	0.178957	0.721647	92.16011	5.645686	0.140322	0.981460	0.259173	0.091597
34	0.181590	0.719612	92.14011	5.666738	0.138354	0.989561	0.255239	0.090384
35	0.184184	0.717604	92.12077	5.686997	0.136462	0.997384	0.251499	0.089287
36	0.186742	0.715626	92.10206	5.706501	0.134642	1.004939	0.247941	0.088295
37	0.189265	0.713681	92.08396	5.725287	0.132891	1.012238	0.244551	0.087397
38	0.191754	0.711772	92.06644	5.743388	0.131206	1.019289	0.241318	0.086583
39	0.194210	0.709902	92.04950	5.760836	0.129583	1.026103	0.238231	0.085844
40	0.196636	0.708070	92.03310	5.777662	0.128020	1.032690	0.235281	0.085174
41	0.199032	0.706279	92.01723	5.793894	0.126514	1.039058	0.232458	0.084565
42	0.201399	0.704529	92.00187	5.809559	0.125062	1.045216	0.229755	0.084010
43	0.203738	0.702819	91.98699	5.824683	0.123662	1.051173	0.227165	0.083505
44	0.206050	0.701151	91.97259	5.839289	0.122311	1.056936	0.224681	0.083046
45	0.208336	0.699524	91.95863	5.853402	0.121007	1.062514	0.222296	0.082626
46	0.210598	0.697937	91.94511	5.867041	0.119748	1.067913	0.220005	0.082243
47	0.212835	0.696390	91.93201	5.880229	0.118532	1.073140	0.217802	0.081893
48	0.215048	0.694883	91.91932	5.892984	0.117357	1.078203	0.215682	0.081573

Variance Decomposition of LBIST:

Period	S.E.	LPC	LREX	LBIST	CINF	CGDP	DIR	LGOLD
1	0.075493	0.074363	21.17730	78.74834	0.000000	0.000000	0.000000	0.000000
2	0.108483	0.651519	18.01327	79.71458	1.155032	0.046044	0.124086	0.295474
3	0.136124	1.280153	17.17721	79.10363	1.029280	0.162128	0.365181	0.882417
4	0.160344	1.653761	16.71615	78.70250	0.846282	0.295337	0.697501	1.088468
5	0.182425	1.933574	16.35486	78.17541	0.884528	0.353371	1.074533	1.223728
6	0.202547	2.137741	16.34235	77.49487	0.920783	0.368785	1.372253	1.363214
7	0.221281	2.281970	16.38214	76.98898	0.905980	0.379317	1.600949	1.460663
8	0.238802	2.395972	16.30097	76.65315	0.915857	0.381165	1.806633	1.546259
9	0.255209	2.483326	16.20911	76.36585	0.939542	0.375909	1.987074	1.639187
10	0.270732	2.543360	16.14602	76.12821	0.954960	0.369165	2.133813	1.724473
11	0.285526	2.585350	16.07466	75.95048	0.971540	0.360937	2.256394	1.800634
12	0.299653	2.615622	15.99167	75.81202	0.991914	0.351036	2.362915	1.874818
13	0.313188	2.635716	15.90851	75.70165	1.011251	0.340731	2.455455	1.946684
14	0.326212	2.647641	15.82501	75.61586	1.030079	0.330486	2.536267	2.014656
15	0.338779	2.653712	15.74082	75.54816	1.049579	0.320241	2.607793	2.079697
16	0.350931	2.655302	15.65789	75.49408	1.068789	0.310163	2.671533	2.142245
17	0.362710	2.653392	15.57634	75.45155	1.087423	0.300410	2.728772	2.202113
18	0.374149	2.648867	15.49608	75.41807	1.105809	0.291005	2.780651	2.259523
19	0.385275	2.642358	15.41783	75.39140	1.123827	0.281969	2.827922	2.314686
20	0.396113	2.634335	15.34189	75.37034	1.141320	0.273326	2.871175	2.367622
21	0.406686	2.625200	15.26814	75.35386	1.158336	0.265074	2.910968	2.418425
22	0.417011	2.615265	15.19667	75.34099	1.174882	0.257205	2.947747	2.467232
23	0.427106	2.604757	15.12758	75.33106	1.190916	0.249711	2.981855	2.514121
24	0.436986	2.593861	15.06084	75.32353	1.206444	0.242580	3.013588	2.559164
25	0.446662	2.582727	14.99640	75.31794	1.221479	0.235794	3.043203	2.602450
26	0.456148	2.571471	14.93425	75.31395	1.236021	0.229338	3.070915	2.644056
27	0.465454	2.560182	14.87432	75.31126	1.250076	0.223196	3.096907	2.684053
28	0.474590	2.548933	14.81656	75.30965	1.263659	0.217351	3.121341	2.722511
29	0.483564	2.537780	14.76090	75.30890	1.276779	0.211787	3.144356	2.759499
30	0.492385	2.526766	14.70727	75.30887	1.289449	0.206488	3.166073	2.795079
31	0.501061	2.515924	14.65561	75.30943	1.301683	0.201440	3.186600	2.829313
32	0.509597	2.505281	14.60583	75.31047	1.313494	0.196628	3.206034	2.862259
33	0.518000	2.494855	14.55788	75.31190	1.324896	0.192039	3.224459	2.893974
34	0.526277	2.484661	14.51167	75.31364	1.335902	0.187659	3.241951	2.924510
35	0.534432	2.474707	14.46715	75.31564	1.346528	0.183478	3.258579	2.953920
36	0.542470	2.465000	14.42424	75.31784	1.356786	0.179482	3.274404	2.982253
37	0.550397	2.455545	14.38288	75.32019	1.366689	0.175663	3.289481	3.009554
38	0.558216	2.446341	14.34300	75.32267	1.376252	0.172010	3.303862	3.035869
39	0.565932	2.437388	14.30455	75.32523	1.385488	0.168513	3.317592	3.061240
40	0.573548	2.428685	14.26745	75.32787	1.394407	0.165163	3.330712	3.085708
41	0.581068	2.420229	14.23167	75.33055	1.403024	0.161954	3.343263	3.109313
42	0.588496	2.412015	14.19714	75.33326	1.411349	0.158875	3.355278	3.132090
43	0.595835	2.404039	14.16380	75.33598	1.419394	0.155922	3.366789	3.154076
44	0.603087	2.396296	14.13162	75.33870	1.427171	0.153086	3.377828	3.175305
45	0.610257	2.388781	14.10053	75.34141	1.434689	0.150362	3.388420	3.195808
46	0.617345	2.381486	14.07050	75.34410	1.441959	0.147744	3.398592	3.215617
47	0.624355	2.374407	14.04148	75.34677	1.448991	0.145226	3.408366	3.234760
48	0.631290	2.367538	14.01343	75.34940	1.455795	0.142802	3.417766	3.253266

Variance Decomposition of CINF:

Period	S.E.	LPC	LREX	LBIST	CINF	CGDP	DIR	LGOLD
1	0.907986	0.122316	2.888510	0.004625	96.98455	0.000000	0.000000	0.000000
2	1.167381	0.179908	11.87015	1.395124	81.42467	1.089450	3.787419	0.253276
3	1.248563	0.232425	14.09931	1.259611	76.83065	1.037131	6.201488	0.339391
4	1.359631	0.217802	11.96106	1.083437	79.49926	1.017316	5.928017	0.293105
5	1.482239	0.256338	10.58130	1.396935	80.72199	1.077020	5.640009	0.326405
6	1.576164	0.390466	10.96077	1.513437	79.69681	1.033467	6.116384	0.288668
7	1.666652	0.452877	10.78897	1.439694	79.59757	1.010677	6.438551	0.271659
8	1.756235	0.473622	10.30104	1.432843	79.99782	1.035088	6.514797	0.244798
9	1.836769	0.509206	10.04957	1.474101	80.08288	1.034153	6.625815	0.224274
10	1.914213	0.546115	9.889912	1.480838	80.11665	1.018236	6.741080	0.207172
11	1.990870	0.570485	9.719634	1.482100	80.20246	1.012184	6.821138	0.191999
12	2.063736	0.590563	9.586938	1.492377	80.24320	1.009018	6.899010	0.178893
13	2.133331	0.608789	9.474706	1.499931	80.27588	1.002355	6.970452	0.167883
14	2.201225	0.623678	9.366836	1.506166	80.32316	0.995862	7.026116	0.158184
15	2.267176	0.636507	9.278182	1.514241	80.35411	0.990246	7.077147	0.149569
16	2.331026	0.647918	9.205454	1.521537	80.37183	0.984413	7.126775	0.142073
17	2.393177	0.657578	9.137916	1.527873	80.39168	0.978774	7.170747	0.135437
18	2.453779	0.665898	9.076755	1.534595	80.40974	0.973502	7.210048	0.129458
19	2.512863	0.673338	9.023742	1.541324	80.42228	0.968293	7.246913	0.124107
20	2.570572	0.679911	8.976383	1.547604	80.43241	0.963210	7.281176	0.119310
21	2.627013	0.685677	8.933330	1.553703	80.44115	0.958377	7.312791	0.114966
22	2.682242	0.690813	8.894532	1.559703	80.44789	0.953724	7.342313	0.111021
23	2.736339	0.695412	8.859404	1.565492	80.45309	0.949213	7.369952	0.107435
24	2.789379	0.699525	8.827361	1.571084	80.45719	0.944872	7.395811	0.104161
25	2.841418	0.703220	8.798126	1.576513	80.46016	0.940698	7.420118	0.101161
26	2.892508	0.706554	8.771367	1.581763	80.46221	0.936674	7.443027	0.098407
27	2.942702	0.709567	8.746754	1.586837	80.46355	0.932798	7.464627	0.095872
28	2.992047	0.712298	8.724073	1.591747	80.46425	0.929066	7.485037	0.093531
29	3.040582	0.714782	8.703134	1.596496	80.46439	0.925470	7.504366	0.091366
30	3.088348	0.717045	8.683740	1.601085	80.46407	0.922004	7.522693	0.089358
31	3.135380	0.719113	8.665733	1.605521	80.46338	0.918666	7.540093	0.087492
32	3.181710	0.721006	8.648982	1.609810	80.46236	0.915448	7.556637	0.085755
33	3.227370	0.722744	8.633365	1.613956	80.46107	0.912345	7.572387	0.084133
34	3.272388	0.724342	8.618773	1.617963	80.45955	0.909353	7.587399	0.082617
35	3.316791	0.725815	8.605114	1.621838	80.45785	0.906468	7.601722	0.081198
36	3.360603	0.727176	8.592304	1.625585	80.45598	0.903684	7.615403	0.079866
37	3.403847	0.728435	8.580268	1.629207	80.45399	0.900997	7.628483	0.078614
38	3.446545	0.729603	8.568941	1.632711	80.45190	0.898404	7.641001	0.077435
39	3.488717	0.730688	8.558262	1.636101	80.44973	0.895900	7.652991	0.076324
40	3.530383	0.731697	8.548180	1.639380	80.44750	0.893481	7.664486	0.075275
41	3.571560	0.732639	8.538646	1.642553	80.44522	0.891144	7.675515	0.074283
42	3.612265	0.733518	8.529617	1.645623	80.44291	0.888886	7.686104	0.073343
43	3.652514	0.734341	8.521054	1.648596	80.44057	0.886703	7.696279	0.072452
44	3.692323	0.735112	8.512923	1.651475	80.43823	0.884591	7.706063	0.071606
45	3.731705	0.735836	8.505192	1.654263	80.43588	0.882549	7.715478	0.070802
46	3.770674	0.736516	8.497832	1.656963	80.43354	0.880573	7.724543	0.070037
47	3.809243	0.737157	8.490816	1.659580	80.43120	0.878660	7.733277	0.069307
48	3.847424	0.737761	8.484122	1.662115	80.42888	0.876808	7.741698	0.068611

Variance Decomposition of CGDP:

Period	S.E.	LPC	LREX	LBIST	CINF	CGDP	DIR	LGOLD
1	1.905700	0.003124	0.060298	2.428693	0.018487	97.48940	0.000000	0.000000
2	2.629712	0.002456	0.480913	4.420487	0.009849	94.77483	0.191873	0.119595
3	3.200052	0.015613	1.101586	5.870061	0.022537	90.71942	2.180317	0.090466
4	3.746879	0.027341	1.472095	7.118972	0.076287	86.62076	4.618560	0.065990
5	4.266718	0.022552	1.829424	7.881865	0.170869	83.14047	6.901950	0.052872
6	4.758190	0.018252	2.271309	8.421855	0.222645	80.24713	8.774759	0.044049
7	5.222677	0.017903	2.658572	8.867930	0.257570	77.85066	10.31029	0.037071
8	5.659955	0.022333	2.955053	9.211391	0.293320	75.88611	11.59939	0.032406
9	6.072624	0.029217	3.203482	9.464104	0.320366	74.29142	12.66196	0.029448
10	6.463822	0.036827	3.417969	9.665623	0.340020	72.98464	13.52770	0.027225
11	6.835243	0.044666	3.597466	9.832701	0.357440	71.89946	14.24267	0.025592
12	7.188746	0.052202	3.747484	9.970654	0.372205	70.99236	14.84059	0.024510
13	7.526493	0.059030	3.873692	10.08691	0.384207	70.22769	15.34469	0.023779
14	7.850198	0.065075	3.980250	10.18694	0.394769	69.57540	15.77428	0.023299
15	8.161252	0.070363	4.071385	10.27373	0.404237	69.01337	16.14388	0.023028
16	8.460950	0.074947	4.150051	10.35010	0.412564	68.52494	16.46450	0.022906
17	8.750410	0.078916	4.218078	10.41816	0.420045	68.09664	16.74526	0.022895
18	9.030571	0.082356	4.277278	10.47919	0.426893	67.71802	16.99328	0.022978
19	9.302259	0.085337	4.329289	10.53428	0.433155	67.38095	17.21386	0.023132
20	9.566195	0.087926	4.375269	10.58441	0.438911	67.07886	17.41129	0.023340
21	9.822998	0.090187	4.416109	10.63028	0.444251	66.80645	17.58913	0.023589
22	10.07321	0.092168	4.452589	10.67244	0.449219	66.55951	17.75020	0.023872
23	10.31733	0.093909	4.485349	10.71137	0.453852	66.33455	17.89679	0.024180
24	10.55576	0.095447	4.514902	10.74745	0.458194	66.12868	18.03082	0.024507
25	10.78890	0.096810	4.541679	10.78101	0.462272	65.93954	18.15385	0.024847
26	11.01707	0.098023	4.566040	10.81231	0.466112	65.76511	18.26721	0.025198
27	11.24059	0.099106	4.588284	10.84160	0.469734	65.60371	18.37201	0.025555
28	11.45972	0.100076	4.608665	10.86906	0.473159	65.45391	18.46921	0.025916
29	11.67473	0.100948	4.627402	10.89488	0.476404	65.31447	18.55961	0.026278
30	11.88582	0.101735	4.644678	10.91920	0.479481	65.18434	18.64392	0.026641
31	12.09322	0.102446	4.660653	10.94215	0.482404	65.06261	18.72273	0.027001
32	12.29710	0.103091	4.675464	10.96385	0.485185	64.94847	18.79658	0.027358
33	12.49764	0.103677	4.689231	10.98440	0.487834	64.84122	18.86592	0.027711
34	12.69500	0.104211	4.702056	11.00389	0.490360	64.74026	18.93116	0.028060
35	12.88933	0.104700	4.714032	11.02240	0.492771	64.64504	18.99265	0.028403
36	13.08076	0.105147	4.725238	11.04001	0.495075	64.55508	19.05071	0.028739
37	13.26942	0.105558	4.735744	11.05677	0.497278	64.46996	19.10562	0.029070
38	13.45542	0.105936	4.745614	11.07275	0.499387	64.38929	19.15763	0.029394
39	13.63889	0.106284	4.754901	11.08800	0.501408	64.31273	19.20697	0.029711
40	13.81990	0.106606	4.763657	11.10257	0.503345	64.23998	19.25383	0.030020
41	13.99857	0.106904	4.771923	11.11650	0.505203	64.17075	19.29840	0.030323
42	14.17499	0.107181	4.779741	11.12983	0.506988	64.10480	19.34085	0.030619
43	14.34923	0.107438	4.787145	11.14260	0.508703	64.04189	19.38131	0.030907
44	14.52137	0.107677	4.794167	11.15485	0.510352	63.98183	19.41994	0.031188
45	14.69149	0.107901	4.800835	11.16660	0.511938	63.92443	19.45684	0.031462
46	14.85966	0.108109	4.807177	11.17788	0.513465	63.86951	19.49213	0.031729
47	15.02594	0.108305	4.813215	11.18872	0.514935	63.81692	19.52592	0.031989
48	15.19040	0.108488	4.818970	11.19915	0.516353	63.76650	19.55829	0.032243

Variance Decomposition of DIR:

Period	S.E.	LPC	LREX	LBIST	CINF	CGDP	DIR	LGOLD
1	0.347788	0.389637	0.387801	0.154464	1.246098	1.800719	96.02128	0.000000
2	0.656329	0.160385	0.128244	1.176410	1.201605	1.042716	96.21812	0.072522
3	0.965410	0.085622	0.422839	1.699572	2.249500	0.994484	94.49077	0.057208
4	1.249539	0.051584	1.368733	2.248549	2.640258	0.964445	92.68095	0.045485
5	1.514031	0.057753	2.059233	2.786055	2.653616	0.937594	91.46886	0.036892
6	1.764029	0.093057	2.367053	3.191650	2.692902	0.905259	90.72267	0.027414
7	1.998337	0.132716	2.576967	3.445622	2.751044	0.873303	90.19737	0.022982
8	2.216392	0.166380	2.787405	3.642715	2.782753	0.846197	89.75209	0.022461
9	2.420158	0.195488	2.956425	3.819929	2.812268	0.817880	89.37369	0.024323
10	2.611651	0.220256	3.069515	3.970530	2.846667	0.787512	89.07624	0.029278
11	2.792344	0.239386	3.146160	4.096983	2.879032	0.758244	88.84330	0.036898
12	2.963582	0.253163	3.200636	4.208125	2.911409	0.730737	88.64978	0.046147
13	3.126534	0.262775	3.238796	4.308057	2.945615	0.704366	88.48373	0.056656
14	3.282177	0.269165	3.263908	4.398783	2.979740	0.679173	88.34100	0.068228
15	3.431385	0.273020	3.278395	4.482058	3.013284	0.655341	88.21730	0.080602
16	3.574898	0.274908	3.284836	4.558900	3.046736	0.632833	88.10819	0.093600
17	3.713307	0.275287	3.285643	4.630173	3.079802	0.611587	88.01046	0.107052
18	3.847116	0.274532	3.282287	4.696777	3.112133	0.591556	87.92193	0.120789
19	3.976767	0.272942	3.275641	4.759296	3.143722	0.572668	87.84103	0.134702
20	4.102632	0.270739	3.266507	4.818094	3.174525	0.554853	87.76657	0.148714
21	4.225029	0.268089	3.255588	4.873539	3.204446	0.538053	87.69755	0.162739
22	4.344233	0.265122	3.243381	4.925966	3.233462	0.522201	87.63316	0.176707
23	4.460487	0.261939	3.230250	4.975628	3.261570	0.507235	87.57281	0.190565
24	4.574000	0.258619	3.216485	5.022744	3.288755	0.493095	87.51603	0.204269
25	4.684959	0.255217	3.202316	5.067508	3.315021	0.479727	87.46243	0.217783
26	4.793529	0.251780	3.187921	5.110090	3.340385	0.467079	87.41167	0.231077
27	4.899859	0.248341	3.173440	5.150640	3.364860	0.455103	87.36349	0.244127
28	5.004080	0.244926	3.158980	5.189296	3.388468	0.443754	87.31766	0.256915
29	5.106312	0.241554	3.144623	5.226179	3.411231	0.432990	87.27400	0.269426
30	5.206664	0.238240	3.130434	5.261398	3.433176	0.422773	87.23233	0.281650
31	5.305233	0.234994	3.116463	5.295057	3.454327	0.413067	87.19251	0.293579
32	5.402111	0.231823	3.102748	5.327246	3.474711	0.403839	87.15442	0.305210
33	5.497378	0.228732	3.089315	5.358052	3.494357	0.395058	87.11795	0.316538
34	5.591112	0.225725	3.076185	5.387552	3.513291	0.386697	87.08299	0.327565
35	5.683382	0.222804	3.063372	5.415820	3.531539	0.378728	87.04945	0.338290
36	5.774253	0.219969	3.050884	5.442922	3.549128	0.371129	87.01725	0.348717
37	5.863785	0.217221	3.038727	5.468922	3.566084	0.363875	86.98632	0.358848
38	5.952033	0.214558	3.026902	5.493878	3.582433	0.356946	86.95660	0.368688
39	6.039049	0.211979	3.015409	5.517845	3.598198	0.350323	86.92800	0.378243
40	6.124883	0.209483	3.004245	5.540874	3.613403	0.343988	86.90049	0.387517
41	6.209579	0.207067	2.993407	5.563011	3.628071	0.337924	86.87400	0.396517
42	6.293180	0.204730	2.982888	5.584303	3.642224	0.332115	86.84849	0.405249
43	6.375726	0.202470	2.972682	5.604791	3.655884	0.326547	86.82390	0.413721
44	6.457254	0.200283	2.962783	5.624515	3.669070	0.321207	86.80020	0.421939
45	6.537801	0.198168	2.953182	5.643512	3.681803	0.316082	86.77734	0.429910
46	6.617399	0.196123	2.943872	5.661816	3.694101	0.311161	86.75529	0.437641
47	6.696080	0.194144	2.934844	5.679461	3.705982	0.306431	86.73400	0.445140
48	6.773875	0.192229	2.926091	5.696478	3.717463	0.301884	86.71344	0.452414

Variance Decomposition of LGOLD:

Period	S.E.	LPC	LREX	LBIST	CINF	CGDP	DIR	LGOLD
1	0.044297	2.066956	32.32023	0.781685	1.724132	1.573306	0.662932	60.87076
2	0.069804	1.629406	35.62536	2.629205	1.306572	0.754219	1.449184	56.60606
3	0.085466	1.581425	35.86228	3.703683	0.889230	0.507255	1.324970	56.13116
4	0.097248	1.687998	34.94341	4.539329	0.748400	0.412471	1.061702	56.60669
5	0.107776	1.797242	34.69456	4.951665	0.819246	0.360219	0.871841	56.50523
6	0.117975	1.870149	35.06026	5.204040	0.813311	0.322669	0.739851	55.98972
7	0.127539	1.901725	35.25502	5.490894	0.780933	0.295429	0.640823	55.63518
8	0.136204	1.913999	35.26897	5.748593	0.783790	0.273154	0.563016	55.44848
9	0.144269	1.926423	35.32639	5.934967	0.791767	0.255833	0.501921	55.26270
10	0.151988	1.938871	35.42117	6.089875	0.792718	0.242615	0.452295	55.06245
11	0.159357	1.947426	35.49849	6.232208	0.797385	0.230930	0.411450	54.88211
12	0.166365	1.953930	35.56061	6.357344	0.804079	0.220305	0.377516	54.72621
13	0.173070	1.960602	35.61457	6.467239	0.809479	0.211126	0.348858	54.58812
14	0.179519	1.967517	35.66090	6.566036	0.815418	0.203056	0.324296	54.46277
15	0.185737	1.974443	35.70277	6.655043	0.822085	0.195703	0.303014	54.34694
16	0.191746	1.981423	35.74046	6.735953	0.828422	0.188992	0.284400	54.24035
17	0.197564	1.988459	35.77269	6.810418	0.834619	0.182869	0.267991	54.14296
18	0.203207	1.995547	35.80062	6.879031	0.840947	0.177235	0.253423	54.05320
19	0.208690	2.002679	35.82573	6.942382	0.847181	0.172028	0.240398	53.96960
20	0.214028	2.009798	35.84819	7.001290	0.853247	0.167203	0.228681	53.89159
21	0.219231	2.016849	35.86810	7.056306	0.859213	0.162710	0.218087	53.81873
22	0.224307	2.023817	35.88592	7.107785	0.865057	0.158515	0.208465	53.75044
23	0.229267	2.030687	35.90198	7.156093	0.870744	0.154591	0.199684	53.68622
24	0.234118	2.037435	35.91648	7.201557	0.876286	0.150911	0.191641	53.62569
25	0.238867	2.044045	35.92963	7.244436	0.881681	0.147450	0.184246	53.56851
26	0.243519	2.050508	35.94159	7.284957	0.886921	0.144191	0.177425	53.51441
27	0.248082	2.056817	35.95249	7.323322	0.892007	0.141115	0.171112	53.46313
28	0.252559	2.062967	35.96247	7.359705	0.896943	0.138208	0.165254	53.41445
29	0.256956	2.068955	35.97164	7.394259	0.901729	0.135456	0.159804	53.36816
30	0.261276	2.074780	35.98007	7.427123	0.906368	0.132847	0.154719	53.32409
31	0.265524	2.080441	35.98785	7.458420	0.910862	0.130370	0.149965	53.28209
32	0.269703	2.085940	35.99505	7.488259	0.915215	0.128016	0.145511	53.24201
33	0.273817	2.091278	36.00172	7.516739	0.919430	0.125775	0.141329	53.20372
34	0.277868	2.096459	36.00793	7.543950	0.923511	0.123641	0.137394	53.16712
35	0.281860	2.101485	36.01370	7.569974	0.927462	0.121606	0.133686	53.13208
36	0.285794	2.106358	36.01909	7.594884	0.931288	0.119662	0.130186	53.09853
37	0.289674	2.111084	36.02413	7.618748	0.934990	0.117806	0.126876	53.06636
38	0.293502	2.115666	36.02886	7.641629	0.938575	0.116030	0.123741	53.03550
39	0.297279	2.120108	36.03329	7.663584	0.942045	0.114329	0.120768	53.00588
40	0.301008	2.124414	36.03745	7.684666	0.945405	0.112701	0.117945	52.97742
41	0.304690	2.128587	36.04138	7.704923	0.948658	0.111139	0.115260	52.95006
42	0.308328	2.132633	36.04508	7.724400	0.951809	0.109640	0.112704	52.92374
43	0.311922	2.136555	36.04857	7.743140	0.954860	0.108201	0.110267	52.89841
44	0.315475	2.140357	36.05188	7.761181	0.957815	0.106818	0.107941	52.87401
45	0.318988	2.144044	36.05501	7.778559	0.960679	0.105488	0.105719	52.85050
46	0.322461	2.147618	36.05798	7.795309	0.963453	0.104209	0.103594	52.82784
47	0.325898	2.151085	36.06080	7.811461	0.966141	0.102977	0.101560	52.80597
48	0.329298	2.154447	36.06349	7.827046	0.968748	0.101790	0.099611	52.78487

Cholesky Ordering: LPC LREX LBIST CINF CGDP DIR LGOLD

Variance Decomposition of LPC:

Period	S.E.	LPC	LREX	LBIST	CINF	CGDP	DIR	LGOLD
1	0.008569	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.014641	99.02374	0.042088	0.001889	0.181172	0.050046	0.026582	0.674485
3	0.019497	96.41857	0.024032	0.011554	0.546994	0.518426	0.033794	2.446631
4	0.023560	93.45825	0.018416	0.023418	0.474183	1.375858	0.182104	4.467771
5	0.027265	89.61375	0.048642	0.077751	0.356553	2.615206	0.446560	6.841542
6	0.030731	85.24379	0.238578	0.167516	0.281258	3.944104	0.696420	9.428336
7	0.034007	80.64967	0.610037	0.305332	0.249897	5.258088	0.871865	12.05511
8	0.037167	75.93903	1.063902	0.482397	0.286810	6.575301	0.985414	14.66715
9	0.040253	71.28451	1.530283	0.700104	0.374331	7.868569	1.055984	17.18621
10	0.043305	66.77841	2.018457	0.962111	0.501202	9.100189	1.083375	19.55625
11	0.046356	62.45620	2.526759	1.252899	0.669397	10.25183	1.071376	21.77154
12	0.049413	58.37511	3.024599	1.558032	0.867052	11.31352	1.033497	23.82819
13	0.052473	54.57216	3.493969	1.873267	1.082329	12.28278	0.981085	25.71441
14	0.055540	51.04929	3.933386	2.193201	1.310043	13.16327	0.920706	27.43010
15	0.058617	47.80026	4.342680	2.510688	1.544010	13.95953	0.857038	28.98580
16	0.061698	44.81636	4.720949	2.821298	1.778441	14.67653	0.793592	30.39284
17	0.064782	42.08296	5.068598	3.122354	2.010231	15.32090	0.732608	31.66235
18	0.067864	39.58250	5.387017	3.411712	2.236972	15.89983	0.675376	32.80659
19	0.070940	37.29688	5.678243	3.688093	2.456509	16.41998	0.622556	33.83774
20	0.074007	35.20788	5.944617	3.950880	2.667648	16.88743	0.574374	34.76717
21	0.077062	33.29783	6.188292	4.199799	2.869780	17.30792	0.530796	35.60558
22	0.080101	31.55023	6.411235	4.434942	3.062502	17.68669	0.491628	36.36277
23	0.083122	29.94972	6.615382	4.656679	3.245688	18.02841	0.456586	37.04754
24	0.086123	28.48217	6.802560	4.865496	3.419451	18.33723	0.425336	37.66775
25	0.089101	27.13475	6.974406	5.061964	3.584014	18.61685	0.397534	38.23049
26	0.092055	25.89583	7.132396	5.246724	3.739684	18.87051	0.372839	38.74201
27	0.094983	24.75497	7.277866	5.420440	3.886837	19.10109	0.350930	39.20787
28	0.097883	23.70275	7.412022	5.583776	4.025878	19.31112	0.331505	39.63295
29	0.100756	22.73073	7.535940	5.737384	4.157227	19.50284	0.314289	40.02159
30	0.103600	21.83136	7.650588	5.881895	4.281306	19.67819	0.299033	40.37763
31	0.106414	20.99788	7.756831	6.017912	4.398537	19.83890	0.285514	40.70443
32	0.109198	20.22423	7.855441	6.146004	4.509326	19.98649	0.273532	41.00498
33	0.111952	19.50497	7.947112	6.266710	4.614065	20.12231	0.262909	41.28192
34	0.114675	18.83526	8.032465	6.380533	4.713127	20.24753	0.253487	41.53760
35	0.117368	18.21072	8.112057	6.487941	4.806869	20.36321	0.245128	41.77407
36	0.120030	17.62744	8.186388	6.589373	4.895624	20.47028	0.237708	41.99319
37	0.122662	17.08190	8.255906	6.685235	4.979706	20.56955	0.231119	42.19659
38	0.125263	16.57094	8.321017	6.775903	5.059412	20.66175	0.225264	42.38571
39	0.127834	16.09170	8.382084	6.861727	5.135016	20.74755	0.220059	42.56187
40	0.130376	15.64160	8.439435	6.943030	5.206778	20.82751	0.215430	42.72621
41	0.132888	15.21833	8.493367	7.020110	5.274936	20.90217	0.211312	42.87978
42	0.135371	14.81977	8.544149	7.093246	5.339717	20.97197	0.207645	43.02350
43	0.137826	14.44403	8.592024	7.162693	5.401328	21.03734	0.204380	43.15820
44	0.140252	14.08936	8.637212	7.228688	5.459964	21.09866	0.201471	43.28465
45	0.142650	13.75420	8.679914	7.291452	5.515807	21.15625	0.198878	43.40351
46	0.145022	13.43711	8.720312	7.351188	5.569025	21.21041	0.196566	43.51538
47	0.147366	13.13680	8.758573	7.408085	5.619775	21.26143	0.194504	43.62083
48	0.149684	12.85207	8.794848	7.462316	5.668203	21.30955	0.192665	43.72035

APPENDIX İ

Table I.1. Residuals Normality Test.

VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: Residuals are multivariate normal
Date: 05/29/19 Time: 13:29
Sample: 2004M01 2018M12
Included observations: 177

Component	Skewness	Chi-sq	df	Prob.*
1	1.308773	50.53014	1	0.0000
2	-1.172877	40.58142	1	0.0000
3	-0.071617	0.151303	1	0.6973
4	-0.388129	4.443998	1	0.0350
5	0.421062	5.230153	1	0.0222
6	0.216865	1.387400	1	0.2388
7	-0.445920	5.865926	1	0.0154
Joint		108.1903	7	0.0000

Component	Kurtosis	Chi-sq	df	Prob.
1	13.87164	871.6707	1	0.0000
2	7.542682	152.1902	1	0.0000
3	4.189785	10.43996	1	0.0012
4	4.822808	24.50438	1	0.0000
5	7.684740	161.8576	1	0.0000
6	4.414116	14.74796	1	0.0001
7	6.898829	112.1064	1	0.0000
Joint		1347.517	7	0.0000

Component	Jarque-Bera	df	Prob.
1	922.2008	2	0.0000
2	192.7716	2	0.0000
3	10.59127	2	0.0050
4	28.94838	2	0.0000
5	167.0877	2	0.0000
6	16.13536	2	0.0003
7	117.9724	2	0.0000
Joint	1455.707	14	0.0000

*Approximate p-values do not account for coefficient estimation

Table I.2. Serial Correlation Test.

VEC Residual Serial Correlation LM Tests
Date: 05/29/19 Time: 13:30
Sample: 2004M01 2018M12
Included observations: 177

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	63.29505	49	0.0824	1.305151	(49, 750.7)	0.0827
2	96.54474	49	0.0001	2.034725	(49, 750.7)	0.0001

Null hypothesis: No serial correlation at lags 1 to h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	63.29505	49	0.0824	1.305151	(49, 750.7)	0.0827
2	141.5028	98	0.0027	1.478594	(98, 894.4)	0.0027

*Edgeworth expansion corrected likelihood ratio statistic.

Table I.3. Heteroskedasticity Test.

VEC Residual Heteroskedasticity Tests (Levels and Squares)
Date: 05/29/19 Time: 13:30
Sample: 2004M01 2018M12
Included observations: 177

Joint test:

Chi-sq	df	Prob.
1076.376	868	0.0000

Individual components:

Dependent	R-squared	F(31,145)	Prob.	Chi-sq(31)	Prob.
res1*res1	0.347421	2.490177	0.0001	61.49360	0.0009
res2*res2	0.155917	0.864004	0.6742	27.59738	0.6419
res3*res3	0.256020	1.609606	0.0328	45.31558	0.0467
res4*res4	0.196058	1.140684	0.2960	34.70222	0.2958
res5*res5	0.276867	1.790852	0.0118	49.00549	0.0210
res6*res6	0.197023	1.147678	0.2883	34.87306	0.2889
res7*res7	0.190567	1.101219	0.3419	33.73040	0.3368
res2*res1	0.153153	0.845915	0.7000	27.10806	0.6667
res3*res1	0.203973	1.198537	0.2364	36.10323	0.2422
res3*res2	0.168555	0.948230	0.5508	29.83419	0.5259
res4*res1	0.228372	1.384338	0.1041	40.42191	0.1198
res4*res2	0.291524	1.924663	0.0053	51.59967	0.0115
res4*res3	0.239862	1.475961	0.0663	42.45554	0.0824
res5*res1	0.124782	0.666872	0.9064	22.08644	0.8803
res5*res2	0.321691	2.218288	0.0009	56.93934	0.0030
res5*res3	0.335851	2.365309	0.0003	59.44566	0.0016
res5*res4	0.196638	1.144886	0.2914	34.80491	0.2916
res6*res1	0.117735	0.624187	0.9373	20.83917	0.9161
res6*res2	0.202794	1.189849	0.2448	35.89460	0.2497
res6*res3	0.102142	0.532113	0.9790	18.07916	0.9686
res6*res4	0.235506	1.440897	0.0790	41.68448	0.0953
res6*res5	0.479934	4.316479	0.0000	84.94835	0.0000
res7*res1	0.131152	0.706051	0.8712	23.21384	0.8413
res7*res2	0.154141	0.852366	0.6909	27.28293	0.6579
res7*res3	0.130929	0.704670	0.8726	23.17438	0.8427
res7*res4	0.199928	1.168829	0.2659	35.38727	0.2687
res7*res5	0.329554	2.299160	0.0005	58.33106	0.0021
res7*res6	0.178779	1.018270	0.4502	31.64390	0.4341

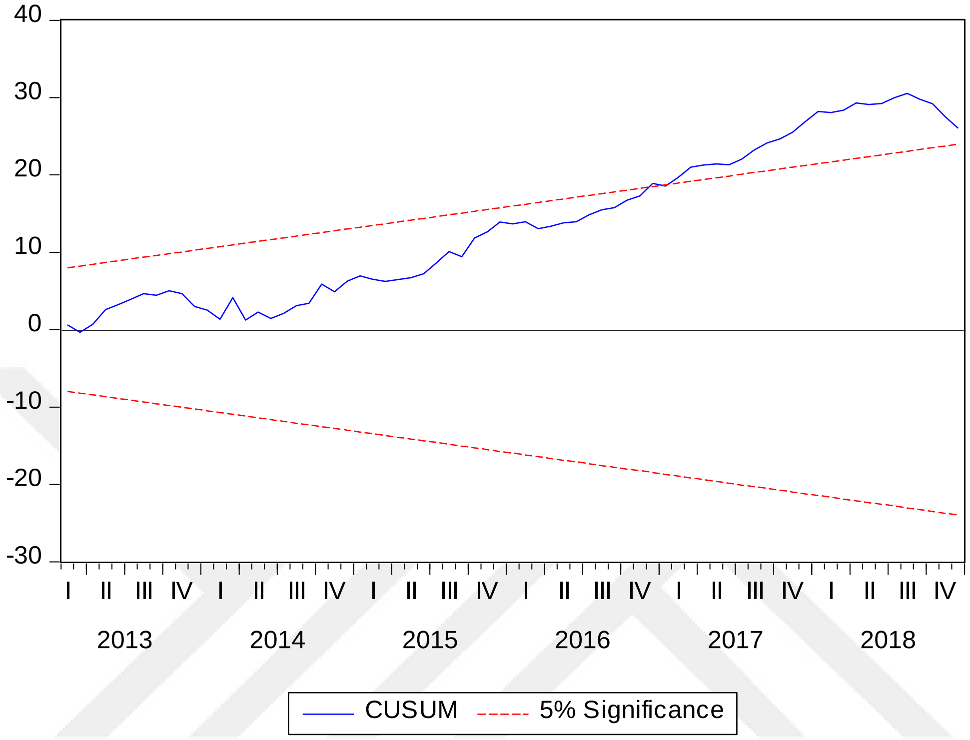
Table I.4. Granger-Causality Test.

Pairwise Granger Causality Tests
Date: 05/29/19 Time: 13:31
Sample: 2004M01 2018M12
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LREX does not Granger Cause LPC	178	4.43525	0.0132
LPC does not Granger Cause LREX		1.15714	0.3168
LGOLD does not Granger Cause LPC	178	4.53094	0.0121
LPC does not Granger Cause LGOLD		0.72564	0.4855
LBIST does not Granger Cause LPC	178	1.77357	0.1728
LPC does not Granger Cause LBIST		5.42373	0.0052
DIR does not Granger Cause LPC	178	0.05918	0.9426
LPC does not Granger Cause DIR		5.59610	0.0044
CINF does not Granger Cause LPC	178	0.48674	0.6155
LPC does not Granger Cause CINF		2.07720	0.1284
CGDP does not Granger Cause LPC	178	0.44636	0.6407
LPC does not Granger Cause CGDP		0.18419	0.8319
LGOLD does not Granger Cause LREX	178	4.26899	0.0155
LREX does not Granger Cause LGOLD		0.62998	0.5338
LBIST does not Granger Cause LREX	178	11.8108	2.E-05
LREX does not Granger Cause LBIST		1.59826	0.2052
DIR does not Granger Cause LREX	178	0.56479	0.5695
LREX does not Granger Cause DIR		7.66075	0.0006
CINF does not Granger Cause LREX	178	3.50912	0.0321
LREX does not Granger Cause CINF		13.9500	2.E-06
CGDP does not Granger Cause LREX	178	0.25707	0.7736
LREX does not Granger Cause CGDP		1.22638	0.2959
LBIST does not Granger Cause LGOLD	178	2.97049	0.0539
LGOLD does not Granger Cause LBIST		3.41540	0.0351
DIR does not Granger Cause LGOLD	178	0.00899	0.9911
LGOLD does not Granger Cause DIR		3.92366	0.0216
CINF does not Granger Cause LGOLD	178	2.07232	0.1290
LGOLD does not Granger Cause CINF		3.58950	0.0297
CGDP does not Granger Cause LGOLD	178	0.26360	0.7686
LGOLD does not Granger Cause CGDP		0.09349	0.9108
DIR does not Granger Cause LBIST	178	1.64587	0.1958
LBIST does not Granger Cause DIR		7.31149	0.0009
CINF does not Granger Cause LBIST	178	1.69299	0.1870
LBIST does not Granger Cause CINF		1.10762	0.3327
CGDP does not Granger Cause LBIST	178	0.91357	0.4030
LBIST does not Granger Cause CGDP		1.04213	0.3549
CINF does not Granger Cause DIR	178	8.06617	0.0004
DIR does not Granger Cause CINF		0.05560	0.9459
CGDP does not Granger Cause DIR	178	0.69471	0.5006
DIR does not Granger Cause CGDP		4.43631	0.0132
CGDP does not Granger Cause CINF	178	0.69593	0.5000
CINF does not Granger Cause CGDP		1.20829	0.3012

APPENDIX J

Figure J.1. Stability Test Diagram.



APPENDIX K

Table k.1: Robust Test.

Vector Error Correction Estimates
Date: 06/12/19 Time: 11:43
Sample (adjusted): 2004M04 2018M12
Included observations: 177 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LPC(-1)	1.000000
LREX(-1)	0.293758
	(0.26997)
	[1.08813]
LBIST(-1)	-0.297787
	(0.07727)
	[-3.85373]
DIR(-1)	0.009971
	(0.00721)
	[1.38375]
CGDP(-1)	0.008961
	(0.00355)
	[2.52364]
LGOLD(-1)	-0.364843
	(0.08129)
	[-4.48834]
C	-4.292484

Error Correction:	D(LPC)	D(LREX)	D(LBIST)	D(DIR)	D(CGDP)	D(LGOLD)
CointEq1	-0.050819	0.013796	0.031861	0.156327	0.043173	0.011771
	(0.00351)	(0.01130)	(0.03127)	(0.14423)	(0.77756)	(0.01824)
	[-14.4882]	[1.22095]	[1.01884]	[1.08390]	[0.05552]	[0.64545]
D(LPC(-1))	0.394953	0.060638	0.601338	5.291732	-5.414987	-0.131180
	(0.04178)	(0.13458)	(0.37247)	(1.71782)	(9.26118)	(0.21721)
	[9.45378]	[0.45057]	[1.61447]	[3.08049]	[-0.58470]	[-0.60393]
D(LPC(-2))	-0.017566	0.160580	0.132427	-5.377031	-4.700943	0.288090
	(0.04170)	(0.13432)	(0.37175)	(1.71453)	(9.24341)	(0.21679)
	[-0.42128]	[1.19548]	[0.35622]	[-3.13616]	[-0.50857]	[1.32886]
D(LREX(-1))	0.034349	0.156448	-0.053548	0.576189	3.366725	-0.071577
	(0.02854)	(0.09195)	(0.25448)	(1.17366)	(6.32747)	(0.14840)
	[1.20342]	[1.70146]	[-0.21042]	[0.49093]	[0.53208]	[-0.48232]
D(LREX(-2))	0.047129	-0.231650	0.206998	-3.103360	1.458235	0.093581
	(0.02613)	(0.08418)	(0.23297)	(1.07447)	(5.79272)	(0.13586)
	[1.80357]	[-2.75190]	[0.88851]	[-2.88827]	[0.25174]	[0.68880]
D(LBIST(-1))	-0.014573	0.109827	0.029956	-0.856695	2.854955	-0.078283
	(0.00965)	(0.03109)	(0.08605)	(0.39685)	(2.13953)	(0.05018)
	[-1.50994]	[3.53243]	[0.34813]	[-2.15872]	[1.33438]	[-1.56004]
D(LBIST(-2))	-0.009150	0.019849	0.043744	0.124529	1.023488	-0.021833
	(0.01010)	(0.03255)	(0.09009)	(0.41548)	(2.23994)	(0.05254)
	[-0.90553]	[0.60979]	[0.48558]	[0.29973]	[0.45693]	[-0.41558]
D(DIR(-1))	-0.000435	0.013250	-0.011332	0.621462	-0.271124	-0.010550
	(0.00185)	(0.00597)	(0.01652)	(0.07620)	(0.41083)	(0.00964)
	[-0.23468]	[2.21950]	[-0.68586]	[8.15538]	[-0.65995]	[-1.09495]
D(DIR(-2))	0.002808	-0.015057	-0.000667	0.041624	-0.828640	0.012854
	(0.00201)	(0.00648)	(0.01794)	(0.08276)	(0.44618)	(0.01046)
	[1.39539]	[-2.32233]	[-0.03714]	[0.50295]	[-1.85721]	[1.22832]
D(CGDP(-1))	0.000333	-0.001160	0.001200	0.016774	-0.074593	0.001512
	(0.00036)	(0.00117)	(0.00324)	(0.01494)	(0.08054)	(0.00189)
	[0.91531]	[-0.99135]	[0.37052]	[1.12281]	[-0.92616]	[0.80029]
D(CGDP(-2))	-6.21E-06	-0.001114	0.001765	-0.007908	-0.078189	0.000773
	(0.00037)	(0.00118)	(0.00326)	(0.01504)	(0.08108)	(0.00190)
	[-0.01699]	[-0.94573]	[0.54120]	[-0.52583]	[-0.96439]	[0.40670]
D(LGOLD(-1))	0.018722	-0.089641	0.110873	0.496941	2.224371	0.140477
	(0.01828)	(0.05890)	(0.16302)	(0.75184)	(4.05332)	(0.09507)
	[1.02394]	[-1.52188]	[0.68013]	[0.66097]	[0.54878]	[1.47768]
D(LGOLD(-2))	0.011481	0.064509	0.150741	-0.348940	-1.694001	-0.101804
	(0.01855)	(0.05975)	(0.16535)	(0.76262)	(4.11144)	(0.09643)
	[0.61902]	[1.07971]	[0.91163]	[-0.45756]	[-0.41202]	[-1.05573]
C	0.011014	-0.007447	-0.007997	0.000309	0.000793	0.012437
	(0.00102)	(0.00329)	(0.00910)	(0.04196)	(0.22620)	(0.00531)
	[10.7936]	[-2.26548]	[-0.87906]	[0.00738]	[0.00350]	[2.34433]
R-squared	0.865605	0.302341	0.058077	0.541063	0.077223	0.092548
Adj. R-squared	0.854886	0.246699	-0.017046	0.504461	0.003627	0.020174
Sum sq. resids	0.011874	0.123221	0.943827	20.07582	583.5129	0.320981
S.E. equation	0.008535	0.027495	0.076094	0.350948	1.892045	0.044376
F-statistic	80.75693	5.433725	0.773095	14.78221	1.049280	1.278753
Log likelihood	599.2933	392.2361	212.0535	-58.52006	-356.7253	307.5062
Akaike AIC	-6.613483	-4.273854	-2.237893	0.819436	4.188986	-3.316454
Schwarz SC	-6.362262	-4.022633	-1.986672	1.070657	4.440207	-3.065233
Mean dependent	0.017200	-0.002132	0.008523	-0.023898	-0.077966	0.014249
S.D. dependent	0.022405	0.031679	0.075454	0.498545	1.895485	0.044830

Determinant resid covariance (dof adj.)	1.37E-13
Determinant resid covariance	8.38E-14
Log likelihood	1157.830
Akaike information criterion	-12.06588
Schwarz criterion	-10.45088
Number of coefficients	90

Vector Error Correction Estimates
Date: 06/12/19 Time: 22:04
Sample (adjusted): 2004M04 2018M12
Included observations: 177 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LPC(-1)	1.000000
LGOLD(-1)	-0.297025 (0.07847) [-3.78526]
LBIST(-1)	-0.249682 (0.08538) [-2.92421]
CGDP(-1)	0.009895 (0.00338) [2.92908]
NEXR(-1)	-0.091296 (0.05057) [-1.80547]
CINF(-1)	-0.011838 (0.02668) [-0.44368]
DIR(-1)	0.017588 (0.00827) [2.12729]
C	-3.766878

Error Correction:	D(LPC)	D(LGOLD)	D(LBIST)	D(CGDP)	D(NEXR)	D(CINF)	D(DIR)
CointEq1	-0.051989	0.009445	0.034749	-0.251364	0.004449	0.304786	0.152223
	(0.00360)	(0.01855)	(0.03174)	(0.78831)	(0.04311)	(0.37235)	(0.13856)
	[-14.4606]	[0.50907]	[1.09484]	[-0.31886]	[0.10319]	[0.81855]	[1.09864]
D(LPC(-1))	0.388081	-0.145631	0.606274	-6.402851	-0.004802	0.859755	5.267434
	(0.04194)	(0.21644)	(0.37028)	(9.19665)	(0.50298)	(4.34391)	(1.61642)
	[9.25259]	[-0.67284]	[1.63734]	[-0.69622]	[-0.00955]	[0.19792]	[3.25870]
D(LPC(-2))	-0.028227	0.238067	0.134537	-4.358744	0.017019	2.331353	-4.737606
	(0.04195)	(0.21648)	(0.37034)	(9.19821)	(0.50307)	(4.34465)	(1.61669)
	[-0.67287]	[1.09972]	[0.36328]	[-0.47387]	[0.03383]	[0.53660]	[-2.93043]
D(LGOLD(-1))	0.006130	0.120752	0.227873	3.130449	-0.000520	-0.908134	0.005778
	(0.01810)	(0.09339)	(0.15978)	(3.96834)	(0.21704)	(1.87439)	(0.69748)
	[0.33871]	[1.29292]	[1.42621]	[0.78886]	[-0.00240]	[-0.48450]	[0.00828]
D(LGOLD(-2))	-0.001061	-0.100434	0.054913	0.769334	-0.196381	2.765149	-0.982565
	(0.01804)	(0.09311)	(0.15929)	(3.95619)	(0.21637)	(1.86865)	(0.69535)
	[-0.05880]	[-1.07867]	[0.34474]	[0.19446]	[-0.90761]	[1.47976]	[-1.41306]
D(LBIST(-1))	-0.010708	-0.094690	0.040768	3.162572	-0.195210	0.864480	-0.627232
	(0.00957)	(0.04936)	(0.08445)	(2.09746)	(0.11471)	(0.99070)	(0.36865)
	[-1.11937]	[-1.91822]	[0.48275]	[1.50781]	[-1.70171]	[0.87259]	[-1.70142]
D(LBIST(-2))	-0.007362	-0.001147	0.082615	0.829139	-0.022694	-0.427026	0.061704
	(0.00973)	(0.05022)	(0.08591)	(2.13378)	(0.11670)	(1.00786)	(0.37504)
	[-0.75649]	[-0.02285]	[0.96164]	[0.38858]	[-0.19446]	[-0.42369]	[0.16453]
D(CGDP(-1))	0.000265	0.001698	0.001556	-0.084248	-0.005040	0.037923	0.015918
	(0.00036)	(0.00188)	(0.00322)	(0.07992)	(0.00437)	(0.03775)	(0.01405)
	[0.72771]	[0.90268]	[0.48357]	[-1.05416]	[-1.15317]	[1.00462]	[1.13318]
D(CGDP(-2))	-8.23E-05	0.001247	0.001833	-0.082726	0.002919	0.010782	-0.008968
	(0.00037)	(0.00190)	(0.00326)	(0.08085)	(0.00442)	(0.03819)	(0.01421)
	[-0.22309]	[0.65560]	[0.56313]	[-1.02324]	[0.66014]	[0.28235]	[-0.63112]
D(NEXR(-1))	-0.003321	0.042185	0.005536	-1.437855	0.568369	3.586455	0.302587
	(0.00738)	(0.03810)	(0.06518)	(1.61899)	(0.08855)	(0.76471)	(0.28456)
	[-0.44978]	[1.10713]	[0.08493]	[-0.88812]	[6.41893]	[4.68997]	[1.06336]
D(NEXR(-2))	-0.014152	-0.000347	0.028282	-2.995158	-0.386167	-2.745783	1.280135
	(0.00767)	(0.03960)	(0.06774)	(1.68254)	(0.09202)	(0.79472)	(0.29573)
	[-1.84420]	[-0.00876]	[0.41749]	[-1.78014]	[-4.19650]	[-3.45501]	[4.32878]
D(CINF(-1))	0.000319	-0.002729	-0.014586	0.066768	-0.019368	-0.421433	-0.025873
	(0.00071)	(0.00366)	(0.00627)	(0.15570)	(0.00852)	(0.07354)	(0.02737)
	[0.44872]	[-0.74463]	[-2.32673]	[0.42883]	[-2.27446]	[-5.73048]	[-0.94546]
D(CINF(-2))	0.000823	-0.006461	-0.001753	0.160390	-0.001602	-0.362029	0.009206
	(0.00073)	(0.00375)	(0.00642)	(0.15951)	(0.00872)	(0.07534)	(0.02804)
	[1.13125]	[-1.72100]	[-0.27292]	[1.00553]	[-0.18358]	[-4.80520]	[0.32836]
D(DIR(-1))	-0.000343	-0.009139	-0.010200	-0.170662	-0.045525	-0.529669	0.554313
	(0.00192)	(0.00991)	(0.01695)	(0.42094)	(0.02302)	(0.19883)	(0.07399)
	[-0.17870]	[-0.92248]	[-0.60181]	[-0.40543]	[-1.97746]	[-2.66398]	[7.49218]
D(DIR(-2))	0.003311	0.013845	-0.008797	-0.909909	0.038197	0.348551	0.064031
	(0.00204)	(0.01055)	(0.01805)	(0.44832)	(0.02452)	(0.21176)	(0.07880)
	[1.61950]	[1.31220]	[-0.48735]	[-2.02961]	[1.55782]	[1.64600]	[0.81261]
C	0.012266	0.016244	-0.011057	-0.116868	0.008324	-0.118023	-0.046631
	(0.00131)	(0.00674)	(0.01153)	(0.28640)	(0.01566)	(0.13528)	(0.05034)
	[9.39074]	[2.41001]	[-0.95885]	[-0.40806]	[0.53140]	[-0.87246]	[-0.92637]
GC	-0.000931	-0.008209	0.001278	0.430518	0.038608	0.040001	0.039323
	(0.00157)	(0.00809)	(0.01384)	(0.34366)	(0.01880)	(0.16232)	(0.06040)
	[-0.59429]	[-1.01500]	[0.09235]	[1.25275]	[2.05411]	[0.24643]	[0.65102]
R-squared	0.867365	0.117764	0.088543	0.109038	0.386223	0.406776	0.602130
Adj. R-squared	0.854102	0.029540	-0.002603	0.019942	0.324845	0.347454	0.562343
Sum sq. resids	0.011718	0.312062	0.913300	563.3944	1.685232	125.6942	17.40452
S.E. equation	0.008558	0.044163	0.075552	1.876490	0.102629	0.886335	0.329815
F-statistic	65.39498	1.334831	0.971443	1.223826	6.292565	6.857047	15.13383
Log likelihood	600.4602	310.0002	214.9633	-353.6201	160.7487	-220.8588	-45.88346
Akaike AIC	-6.592771	-3.310736	-2.236874	4.187798	-1.624279	2.687670	0.710548
Schwarz SC	-6.287717	-3.005682	-1.931820	4.492852	-1.319225	2.992724	1.015601
Mean dependent	0.017200	0.014249	0.008523	-0.077966	0.022528	-0.007684	-0.023898
S.D. dependent	0.022405	0.044830	0.075454	1.895485	0.124902	1.097216	0.498545

Determinant resid covariance (dof adj.)	1.37E-12
Determinant resid covariance	6.77E-13
Log likelihood	721.8492
Akaike information criterion	-6.732760
Schwarz criterion	-4.471772
Number of coefficients	126

Vector Error Correction Estimates
Date: 06/12/19 Time: 22:17
Sample (adjusted): 2004M04 2018M12
Included observations: 177 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LPC(-1)	1.000000
NEXR(-1)	-0.094766 (0.05039) [-1.88055]
EINF(-1)	-0.031868 (0.05104) [-0.62438]
LGOLD(-1)	-0.293904 (0.08013) [-3.66794]
LBIST(-1)	-0.231111 (0.08738) [-2.64491]
DIR(-1)	0.018044 (0.00851) [2.12150]
CGDP(-1)	0.008839 (0.00349) [2.53051]
C	-3.968394

Error Correction:	D(LPC)	D(NEXR)	D(EINF)	D(LGOLD)	D(LBIST)	D(DIR)	D(CGDP)
CointEq1	-0.050260	-0.000288	0.120755	0.011006	0.032113	0.133300	-0.209599
	(0.00354)	(0.04282)	(0.15690)	(0.01810)	(0.03135)	(0.13598)	(0.77115)
	[-14.1935]	[-0.00672]	[0.76965]	[0.60817]	[1.02423]	[0.98032]	[-0.27180]
D(LPC(-1))	0.384435	0.037076	-0.408166	-0.107968	0.674073	5.208402	-7.127343
	(0.04256)	(0.51463)	(1.88586)	(0.21752)	(0.37686)	(1.63441)	(9.26910)
	[9.03222]	[0.07204]	[-0.21644]	[-0.49636]	[1.78864]	[3.18673]	[-0.76894]
D(LPC(-2))	-0.023163	-0.040352	1.337966	0.236854	0.065353	-4.766780	-3.725325
	(0.04241)	(0.51275)	(1.87898)	(0.21673)	(0.37549)	(1.62844)	(9.23529)
	[-0.54619]	[-0.07870]	[0.71207]	[1.09288]	[0.17405]	[-2.92720]	[-0.40338]
D(NEXR(-1))	-0.004446	0.503931	0.602474	0.039152	-0.031390	0.173998	-1.485996
	(0.00702)	(0.08490)	(0.31111)	(0.03588)	(0.06217)	(0.26963)	(1.52913)
	[-0.63323]	[5.93569]	[1.93652]	[1.09106]	[-0.50490]	[0.64532]	[-0.97179]
D(NEXR(-2))	-0.009326	-0.399477	-0.424428	-0.014151	0.017999	1.287369	-2.582034
	(0.00723)	(0.08742)	(0.32033)	(0.03695)	(0.06401)	(0.27762)	(1.57447)
	[-1.28993]	[-4.56986]	[-1.32495]	[-0.38300]	[0.28117]	[4.63711]	[-1.63994]
D(EINF(-1))	0.000922	-0.009825	-0.148562	6.22E-05	-0.021724	0.019173	0.118100
	(0.00170)	(0.02053)	(0.07522)	(0.00868)	(0.01503)	(0.06519)	(0.36972)
	[0.54334]	[-0.47862]	[-1.97499]	[0.00717]	[-1.44520]	[0.29410]	[0.31943]
D(EINF(-2))	-0.000961	0.001614	-0.338705	-0.016749	0.000763	0.019690	0.334770
	(0.00170)	(0.02054)	(0.07525)	(0.00868)	(0.01504)	(0.06522)	(0.36987)
	[-0.56610]	[0.07862]	[-4.50098]	[-1.92969]	[0.05076]	[0.30191]	[0.90511]
D(LGOLD(-1))	0.009873	-0.046411	1.362125	0.111035	0.196324	-0.069409	3.345068
	(0.01814)	(0.21930)	(0.80361)	(0.09269)	(0.16059)	(0.69646)	(3.94981)
	[0.54436]	[-0.21164]	[1.69500]	[1.19790]	[1.22250]	[-0.09966]	[0.84689]
D(LGOLD(-2))	-0.001736	-0.155339	1.087410	-0.102659	0.103506	-0.946589	0.684160
	(0.01825)	(0.22064)	(0.80854)	(0.09326)	(0.16158)	(0.70073)	(3.97403)
	[-0.09514]	[-0.70403]	[1.34490]	[-1.10080]	[0.64060]	[-1.35085]	[0.17216]
D(LBIST(-1))	-0.012053	-0.220774	0.316954	-0.092638	0.027906	-0.700106	3.009929
	(0.00947)	(0.11456)	(0.41981)	(0.04842)	(0.08389)	(0.36383)	(2.06339)
	[-1.27208]	[-1.92713]	[0.75500]	[-1.91315]	[0.33264]	[-1.92425]	[1.45873]
D(LBIST(-2))	-0.004697	-0.063391	0.247046	-0.007402	0.061341	-0.017051	0.941826
	(0.00971)	(0.11735)	(0.43004)	(0.04960)	(0.08594)	(0.37270)	(2.11366)
	[-0.48393]	[-0.54018]	[0.57448]	[-0.14923]	[0.71378]	[-0.04575]	[0.44559]
D(DIR(-1))	-0.000563	-0.048068	-0.109565	-0.006475	-0.011831	0.546129	-0.238547
	(0.00192)	(0.02321)	(0.08504)	(0.00981)	(0.01699)	(0.07370)	(0.41797)
	[-0.29352]	[-2.07134]	[-1.28841]	[-0.66009]	[-0.69620]	[7.41009]	[-0.57072]
D(DIR(-2))	0.003091	0.045079	0.092062	0.013682	-0.004193	0.077252	-0.908414
	(0.00204)	(0.02471)	(0.09054)	(0.01044)	(0.01809)	(0.07847)	(0.44503)
	[1.51279]	[1.82447]	[1.01677]	[1.31011]	[-0.23175]	[0.98446]	[-2.04126]
D(CGDP(-1))	0.000232	-0.004797	-0.009026	0.001697	0.001950	0.016157	-0.085579
	(0.00037)	(0.00444)	(0.01629)	(0.00188)	(0.00325)	(0.01412)	(0.08006)
	[0.63023]	[-1.07912]	[-0.55414]	[0.90301]	[0.59903]	[1.14457]	[-1.06896]
D(CGDP(-2))	-4.57E-05	0.002044	0.015829	0.001409	0.001028	-0.009975	-0.084776
	(0.00037)	(0.00450)	(0.01648)	(0.00190)	(0.00329)	(0.01428)	(0.08098)
	[-0.12300]	[0.45470]	[0.96079]	[0.74145]	[0.31216]	[-0.69862]	[-1.04691]
C	0.011985	0.010335	-0.064695	0.016316	-0.010175	-0.041401	-0.126702
	(0.00131)	(0.01586)	(0.05812)	(0.00670)	(0.01162)	(0.05037)	(0.28568)
	[9.13668]	[0.65162]	[-1.11308]	[2.43375]	[-0.87598]	[-0.82189]	[-0.44352]
GC	-0.000700	0.041389	0.011212	-0.008098	0.002715	0.043321	0.425911
	(0.00158)	(0.01908)	(0.06994)	(0.00807)	(0.01398)	(0.06061)	(0.34374)
	[-0.44356]	[2.16872]	[0.16033]	[-1.00395]	[0.19430]	[0.71474]	[1.23907]
R-squared	0.865366	0.366641	0.215799	0.121685	0.069313	0.599031	0.107860
Adj. R-squared	0.851903	0.303305	0.137379	0.033854	-0.023756	0.558934	0.018646
Sum sq. resids	0.011895	1.738997	23.35225	0.310675	0.932569	17.54006	564.1397
S.E. equation	0.008622	0.104253	0.382036	0.044065	0.076345	0.331097	1.877731
F-statistic	64.27545	5.788837	2.751828	1.385441	0.744746	14.93960	1.208999
Log likelihood	599.1362	157.9693	-71.89924	310.3944	213.1155	-46.57000	-353.7371
Akaike AIC	-6.577810	-1.592874	1.004511	-3.315191	-2.215995	0.718305	4.189120
Schwarz SC	-6.272757	-1.287820	1.309565	-3.010138	-1.910941	1.023359	4.494174
Mean dependent	0.017200	0.022528	-0.003107	0.014249	0.008523	-0.023898	-0.077966
S.D. dependent	0.022405	0.124902	0.411334	0.044830	0.075454	0.498545	1.895485

Determinant resid covariance (dof adj.)	2.94E-13
Determinant resid covariance	1.45E-13
Log likelihood	858.1160
Akaike information criterion	-8.272497
Schwarz criterion	-6.011509
Number of coefficients	126

Vector Error Correction Estimates
Date: 06/19/19 Time: 22:44
Sample (adjusted): 2004M04 2018M12
Included observations: 177 after adjus...
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LPC(-1)	1.000000
LREX(-1)	0.094114
	(0.26401)
	[0.35647]
RDIR_F_(-1)	0.001592
	(0.00926)
	[0.17193]
LBIST(-1)	-0.194728
	(0.10039)
	[-1.93980]
CGDP(-1)	0.002518
	(0.00417)
	[0.60338]
LGOLD(-1)	-0.439468
	(0.09600)
	[-4.57777]
C	-3.874916

Error Correction:	D(LPC)	D(LREX)	D(RDIR_F_)	D(LBIST)	D(CGDP)	D(LGOLD)
CointEq1	-0.044293	0.015716	0.326783	0.028498	-0.147622	0.009988
	(0.00310)	(0.00984)	(0.28646)	(0.02736)	(0.70063)	(0.01591)
	[-14.2989]	[1.59753]	[1.14075]	[1.04165]	[-0.21070]	[0.62784]
D(LPC(-1))	0.395791	0.001613	7.176052	0.600340	-2.778542	-0.099623
	(0.04215)	(0.13387)	(3.89808)	(0.37228)	(9.53385)	(0.21648)
	[9.38971]	[0.01205]	[1.84092]	[1.61258]	[-0.29144]	[-0.46020]
D(LPC(-2))	-0.019438	0.213044	-2.938726	0.155948	-3.276858	0.182323
	(0.04209)	(0.13367)	(3.89235)	(0.37174)	(9.51985)	(0.21616)
	[-0.46182]	[1.59379]	[-0.75500]	[0.41951]	[-0.34421]	[0.84347]
D(LREX(-1))	0.035567	0.121962	7.262833	-0.056980	0.818248	-0.093211
	(0.02893)	(0.09189)	(2.67568)	(0.25554)	(6.54414)	(0.14859)
	[1.22927]	[1.32729]	[2.71439]	[-0.22298]	[0.12504]	[-0.62730]
D(LREX(-2))	0.046880	-0.200233	6.518945	0.275671	1.901486	0.028302
	(0.02718)	(0.08633)	(2.51396)	(0.24010)	(6.14861)	(0.13961)
	[1.72452]	[-2.31928]	[2.59309]	[1.14817]	[0.30925]	[0.20272]
D(RDIR_F_(-1))	-0.000544	-0.000684	0.167709	-0.006224	-0.020569	0.007728
	(0.00086)	(0.00272)	(0.07935)	(0.00758)	(0.19406)	(0.00441)
	[-0.63375]	[-0.25102]	[2.11365]	[-0.82138]	[-0.10599]	[1.75384]
D(RDIR_F_(-2))	-0.000216	-0.007374	-0.076269	-0.006886	0.069431	0.001061
	(0.00084)	(0.00267)	(0.07789)	(0.00744)	(0.19049)	(0.00433)
	[-0.25632]	[-2.75684]	[-0.97925]	[-0.92577]	[0.36448]	[0.24535]
D(LBIST(-1))	-0.008344	0.110690	-0.815520	0.040899	3.505537	-0.090667
	(0.00975)	(0.03097)	(0.90194)	(0.08614)	(2.20594)	(0.05009)
	[-0.85555]	[3.57362]	[-0.90419]	[0.47481]	[1.58914]	[-1.81014]
D(LBIST(-2))	-0.004173	0.018684	-3.113810	0.059907	1.712073	-0.010078
	(0.01008)	(0.03201)	(0.93220)	(0.08903)	(2.27997)	(0.05177)
	[-0.41400]	[0.58362]	[-3.34027]	[0.67288]	[0.75092]	[-0.19467]
D(CGDP(-1))	0.000127	-0.001207	0.018550	0.001586	-0.027680	0.002022
	(0.00036)	(0.00115)	(0.03336)	(0.00319)	(0.08160)	(0.00185)
	[0.35163]	[-1.05319]	[0.55601]	[0.49784]	[-0.33922]	[1.09130]
D(CGDP(-2))	-0.000212	-0.001066	-0.047068	0.001535	-0.022372	0.000263
	(0.00036)	(0.00114)	(0.03331)	(0.00318)	(0.08146)	(0.00185)
	[-0.58922]	[-0.93215]	[-1.41319]	[0.48258]	[-0.27464]	[0.14225]
D(LGOLD(-1))	0.023406	-0.091200	-3.472102	0.160149	2.366436	0.122992
	(0.01869)	(0.05935)	(1.72824)	(0.16505)	(4.22689)	(0.09598)
	[1.25245]	[-1.53662]	[-2.00904]	[0.97028]	[0.55985]	[1.28148]
D(LGOLD(-2))	0.009513	0.080848	0.693075	0.138375	-1.518093	-0.101471
	(0.01911)	(0.06068)	(1.76697)	(0.16875)	(4.32163)	(0.09813)
	[0.49790]	[1.33233]	[0.39224]	[0.81998]	[-0.35128]	[-1.03407]
C	0.009868	-0.005872	-0.075538	-0.009256	-0.017097	0.017216
	(0.00128)	(0.00406)	(0.11818)	(0.01129)	(0.28904)	(0.00656)
	[7.72227]	[-1.44686]	[-0.63918]	[-0.82006]	[-0.05915]	[2.62316]
GC	0.001957	-0.005585	0.098222	-0.001755	-0.025492	-0.006999
	(0.00152)	(0.00481)	(0.14014)	(0.01338)	(0.34275)	(0.00778)
	[1.29113]	[-1.16047]	[0.70088]	[-0.13110]	[-0.07437]	[-0.89934]

R-squared	0.864102	0.314342	0.268157	0.065298	0.028633	0.104700
Adj. R-squared	0.852358	0.255087	0.204911	-0.015479	-0.055313	0.027329
Sum sq. resids	0.012007	0.121102	102.6836	0.936591	614.2384	0.316683
S.E. equation	0.008609	0.027341	0.796147	0.076036	1.947202	0.044213
F-statistic	73.57641	5.304944	4.239918	0.808377	0.341087	1.353211
Log likelihood	598.3092	393.7716	-202.9641	212.7346	-361.2668	308.6993
Akaike AIC	-6.591064	-4.279906	2.462871	-2.234289	4.251602	-3.318637
Schwarz SC	-6.321899	-4.010740	2.732036	-1.965124	4.520767	-3.049471
Mean dependent	0.017200	-0.002132	-0.077345	0.008523	-0.077966	0.014249
S.D. dependent	0.022405	0.031679	0.892864	0.075454	1.895485	0.044830

Determinant resid covariance (dof adj.)	7.01E-13
Determinant resid covariance	4.12E-13
Log likelihood	1016.837
Akaike information criterion	-10.40494
Schwarz criterion	-8.682285
Number of coefficients	96

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Publications:

Mohammad I. Al Masud and Levent Kutlu, (2018). US Bank Efficiency and FED Activity. *Economics Bulletin, Vol. 38 No. 4 p. A188.*