Hacettepe University Graduate School Of Social Sciences

Department of Economics

DETERMINANTS OF THE DYNAMIC CORRELATION PATTERNS BETWEEN STOCK PRICES AND EXCHANGE RATES

Ahmet Sacit Seyid ÖZDEM

Master's Thesis

Ankara, 2019

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- Tezimle ilgili gizlilik kararı verilmiştir. [3]

13/09/2019

Ahmet Sacit Seyid ÖZDEM

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ETİK BEYAN

Bu çalışmadaki bütün bilgi ve belgeleri akademik kurallar çerçevesinde elde ettiğimi, görsel, işitsel ve yazılı tüm bilgi ve sonuçları bilimsel ahlak kurallarına uygun olarak sunduğumu, kullandığım verilerde herhangi bir tahrifat yapmadığımı, yararlandığım kaynaklara bilimsel normlara uygun olarak atıfta bulunduğumu, tezimin kaynak gösterilen durumlar dışında özgün olduğunu, **Doç. Dr. Nasip BOLATOĞLU** danışmanlığında tarafımdan üretildiğini ve Hacettepe Üniversitesi Sosyal Bilimler Enstitüsü Tez Yazım Yönergesine göre yazıldığını beyan ederim.

Ahmet Sacit Seyid ÖZDEM

ABSTRACT

ÖZDEM, Ahmet Sacit Seyid*. Determinants of the dynamic Correlation Patterns between Stock Prices and Exchange Rates*, Master's Thesis, Ankara, 2019.

The foreign exchange market and the stock market are two of the most important markets in which investors and traders participate. The first is the largest market in terms of transaction volume.

The question of whether there is a relationship between the two markets is of interest to investors, traders, firms' decision-makers and policymakers of financial institutions.

In this study, we investigated the relationship between ER and SPI variables in terms of dynamic causality with the VAR model, in terms of long-term equilibrium relationship with cointegration technique, and analyzed whether the results support the posits and implications of traditional and stock-oriented models. IR functions analysis, FEVD analysis tools were also used for further inference. Data is from selected emerging countries including BRICS countries. In order to examine the impact of the crisis period, time series were examined as three periods.

The results indicate that there is no L-R equilibrium relationship between SPI and ER variables. Granger causality results are mixed. Before-crises period results indicate there is no causal relationship between ER and SPI variables. Brazil and South Africa during the crisis and Turkey and South Korea post-crisis period SPI leads to ER. This result supports the proposal of portfolio balance models. After-crises period in China, India, and Russia, ER leads to SPI. This result supports the proposal of flow models. No two-way Granger causality was found in any case.

Variance decomposition analysis and correlation coefficients indicate that the association between SPI and ER variables increased during the 2008 banking crisis.

Keywords

Exchange Rates, Stock Prices, Cointegration, Granger non-causality, VAR Model, Variance Decomposition Analysis, Impulse Response Function Analysis

ÖZET

Döviz kuru ve hisse senedi piyasaları tacirlerin ve yatırımcıların yoğun işlem yaptığı, iki önemli piyasadır. İlki hacim olarak en büyük piyasadır. Bu iki piyasa arasında ilişki olup olmadığı varsa nasıl bir ilişki olduğu yatırımcıların, firmaların ve finansal kurumların karar alıcılarının ilgilendiği bir konudur.

Bu konu araştırmacıların da ilgisini çeken bir sorunsaldır. Literatürde bu ilişkinin teorik altyapısı genel olarak döviz kuru belirleme modellerinden, hisse senedinin açıklayıcı değişken olarak ele alındığı, akış odaklı geleneksel ve stok odaklı portföy dengesi modelleridir. Çoğu ampirik çalışmada bu modellerin öngörüleri değerlendirilmiştir.

Bu çalışmada ER ve SPI değişkenleri arasındaki ilişkiye, VAR modeli ile dinamik nedensellik açısından, eşbütünleşim tekniği ile uzun dönemli denge ilişkisi açısından bakılmış ve sonuçların geleneksel ve stok odaklı modellerin öngörülerini destekleyip desteklemediği analiz edilmiştir.

Sonuç olarak iki değişken arasında uzun dönemli ilişki bulunmamıştır. Kriz öncesi dönemde Granger nedenselliği bulgusuna rastlanmamıştır. Kriz öncesi dönem Brezilya ve Güney Afrika serilerinde ve kriz sonrası dönem Türkiye ve Güney Kore serilerinde hisse senedi fiyatlarının döviz kurunun Granger nedeni olduğu sonucuna varılmıştır. Bu bulgu portföy dengesi modellerinin öngörüsüyle uyumludur. Kriz sonrası dönem Çin, Hindistan ve Rusya serileri nde ise döviz kurunun hisse senedi fiyatlarının Granger nedeni olduğu sonucuna varılmış ve bu sonuçta akış odaklı geleneksel modelleri desteklemiştir. Varyans ayrıştırması analizi ve kolerasyon değerleri, iki değişken arasındaki ilişkinin kriz döneminde arttığını göstermektedir. Bu sonuç literatürdeki kriz dönemi ile ilgili çalışmaların sonuçlarıyla örtüşmektedir.

Anahtar Kelimeler

Döviz Kuru, Hisse Senedi, Eşbütünleşim, Granger Nedenselliği, VAR Modeli, Varyans Ayrıştırması Analizi, Etki Tepki Fonksiyonu Analizi

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ABBREVİATIONS

ADF : Augmented Dickey-Fuller (Test)

AIC : Akaike Information Criterion

AR : Autoregressive (Model)

BRICS: Brazil, Russia, India, China, South Africa

ER : (The) Exchange Rate

DF(df): Degree of Freedom

FEVD : Forecast Error Variance Decomposition

IR : Impulse Response (Function)

L-R : Long-Run

OLS : Ordinary Least Square (Regression)

SPI : (The) Stock Prices Index

S-R : Short-Run

VAR : Vector Autoregressive (Model)

VECM: Vector Error Correction Model

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INTRODUCTION

Foreign exchange markets and stock markets are two of the most important markets in which traders and investors participate. According to the volume of transactions, foreign exchange markets called forex are the largest markets in the world. International trade in assets, goods, and services requires exchanges of currencies.

The question of whether there is a relationship between the two markets is of interest to investors, traders, decision-makers of firms and policymakers of financial institutions. Firm decision-makers should take into account foreign exchange risk. Policymakers should consider the impact of the relative value of the domestic currency on the fundamental variables of the domestic economy and follow stock prices (SPIs), which are viewed as barometers of the economy.

Exchange rate markets affect the stock markets and other asset markets by affecting the value of foreign assets. On the other hand, asset markets affect exchange rates (ER) through international trading transactions. This is because foreign exchange transactions take place in international trade of goods and assets. (Thompson, 2011: 338)

In empirical studies on the relationship between ER and SPI variables in the literature, the theoretical background of the relationship between the two variables generally taken from the fundamental models of the exchange rate determination in which stock prices can be interpreted as one of the determinants. Mostly these models are flow-oriented traditional models and stock oriented portfolio balance models.

There is no consensus on the explanation of the exchange rate in the economic literature. Over the years, exchange rate determination research has diversified as researchers used some new approaches, such as news hypothesis, rational bubbles, cointegration technique,chaos, behaviors, and rational expectations.

Some other economists felt that the explanation of the fundamental macro variables was insufficient, and tried to explain the exchange rate with non-fundamental movements. We will talk about this incompleteness of exchange rate determination models, in Chapter 1. However, the focus in this study is the models of exchange rate determination in which SPI can be thought of as an explanatory variable, specifically flow-oriented traditional models and stock oriented portfolio balance models.

The aims of this study are: first we used VAR(p) methodology, IR functions, and FEVD analysis to investigate causality and S-R dynamic behavior between ER and SPI variables, secondly we used Engle and Granger two step cointegration test methodology to investigate L-R behavior of the two variables, thirdly We examined the concordance of the findings with the propositions of flow and stock oriented models.

We used the data from, some of the largest developing countries from four continents including BRICS that have not been examined together before, for the first-moment (or mean) causality. We aimed to select countries that are not fully developed but as large as possible. We analyzed the data in three periods to see the impact of the crisis period. Mortgage and international banking crises in the 2007-2008 period, the period before and after the crisis. We used the latest data as the after-crisis period and in this respect this study is different.

It should be noticed that in this study we did not intend to fully explain the exchange rate with an empirical econometric model and did not search to add any other endogenous or exogenous variables other than ER and SPI and their lags. We intended to focus on the mutual dynamic effects between ER and SPI variables by modeling them and their lags in a VAR methodology.

The organization of the study is as follows: We have introduced the study in the current chapter. In Chapter 1, we have described flow-oriented and stock-oriented models and their implications in the context of ER and SPI relationship.

A fundamental model of stock price determination has been described. We have also placed a discussion about ER and SPI determination. We have introduced the data in Chapter 3. In Chapter 4, we have explained the empirical techniques used in this study theoretically and defined the estimated empirical model. In Chapter 5, we have explained our results and findings. We have summarized our findings in the last Chapter.

Throughout this study, we used the ‘Granger non-causality test’, instead of the ‘Granger causality test’ because the null hypothesis is ‘there is no causality’. Although the term ‘Granger causality test’ may be preferred in practical considerations, the correct formal usage is ‘Granger non-causality test’. (Koop, 2005: 188)

CHAPTER 1

THEORETICAL BACKGROUND

1.1 THE EXCHANGE RATE DETERMINATION

After 1973, the Bretton Woods system was collapsed and floating exchange rate era in which the exchange rate was determined by the market's demand and supply forces, started again. First the United States introduced. Thereupon, other developed countries, one by one switched their regimes to the floating exchange rate regime. In this new era the exchange rate volatilities were more than expected. In addition, trade barriers had been disappeared and capital flows had been increased. In these circumstances, the subject of ER determination had attracted the attention of researchers both theoretically and empirically. (Krueger, 1983: 7)

Before introducing the exchange rate determination models, it is useful to understand the stock and flow terms. The next paragraphs shed light on this point.

The term used to name a country’s net stock of foreign assets at a point in time is Net International Position; the flow of a countries asset is recording at the capital account, which is a part of the balance of payments. These holdings of assets or flow of them belong to all the sectors in a country as private sector firms, individuals and government (Van den Berg, 20017: 343)

In the literature, the models of the exchange rate determination use fundamental macroeconomic variables. These models are mainly categorizing as stock approach models, flow approach models, and the later approaches. Stock refers to the level of the money or the asset. Flow is the change of these stocks by transactions or movements. Therefore, while stock models using stock of assets or money as explanatory variables, flow models use movements or transactions

of them. Flow models also naming as traditional models because they are earlier historically. The asset market approach refers to stock approach models.

Flow oriented traditional approach and stock oriented asset market approach such as monetary approach and portfolio balance approach were approaches to balance of payments determination when exchange rates were fixed in the years the 1950s and 1960s. The Balance of payments determination in the fixed ER system is equivalent to ER determination under the floating ER system.

1.1.1 Traditional Approach (Flow Oriented)

Instead of a formal definition of the flow-oriented ER determination models, we will explain the causation mechanism and mention its implications in the context of ER and SPI relationship.

The traditional approach in the literature focuses on the current account imbalance. Change in the exchange rate causes changes in the profits of the firms. If the firm has international operations, it will be affected directly. The net effect depends on the firm's net profit from its exports and imports. The change in the exchange rate affects a domestic firm, which uses imported inputs too. The total effect of ER on SPI in a country depends on whether the country is export weighted or import weighted. Using the index of share prices calculated by the weighted sum of individual firms as a proxy of SPI is a common practice. Therefore the figure of firms in the country and their weights on the calculation of the proxy index also affects the sign of affection.

At the micro-level, a traditional ER model says that ER leads a firm's share price positively if the firm is an export weighted firm and negatively if the firm is import weighted firm.

At aggregated level (index proxy) a traditional (flow-oriented) approach ER determination model says that the change in ER affects (leads) SPI, but does not suggest an exact proposition about the sign of the relationship. (Granger, Huangb, and Yang 2002).

In addition, it should be noted that the causality of this channel does not occur in the S-R. The market participants will know the information about firms' gain or loss after the announcement of the balance-sheet of the firm. So there will be lags in causality.

1.1.2 Monetary Approach (Stock Oriented)

One of the main assumptions of the monetary model is the existence of the PPP condition. Another assumption is that home and foreign country bonds are perfect substitutes of each other. Therefore the primary emphasis of the monetary approach models is the home country residents' demand for domestic money. (Krueger, 1983:81)

A simple two-country monetary model of ER can be written as the system below.

Assuming PPP condition holds we can write:

$$S = P/P^* \qquad (1.1)$$

Where S is spot ER, P is the price level of the home country, the * token indicates the foreign country or the rest of the world.

The quantity theory of money can be written as:

$$MV = PY,\ M^*V^* = P^*Y^* \qquad (1.2)$$

Where M is money supply, P is price level, Y is real income, V is velocity and the * token denotes the other country or the rest of the world.

From equation (1.2)

$$P = MV/Y \qquad (1.3)$$

$$P^* = M^*V^*/Y^* \qquad (1.4)$$

Dividing eq.(1.3) by eq(1.4) side by side:

$$P/P^* = S = (V/V^*)\,(M/M^*)\,(Y^*/Y) \qquad (1.5)$$

Which is the exchange rate (ER), S derived from PPP

A more sophisticated monetary model takes into account the interest rate. Takeing the money demand function as:

$$M = kY\, i^{-\lambda} \qquad (1.6)$$

Then we can derive the equation for ER (S) as:

$$S = (k^*/k)\,(M/M^*)\,(Y^*/Y)\,(i/i^*)^{\lambda} \qquad (1.7)$$

The model's implications except for constant proportion k*/k are as follows:

First, the exchange rate is positively related to the money supply of a country relative to the foreign country. So relatively increasing money supply increases domestic price level relatively which is the increase of ER (S) means that depreciation of domestic currency relative to foreign currency. Second, relative

income growth negatively affects ER (S) and increasing relative income of a country causes, to decrease ER (S) and therefore appreciation of home currency. Third, a relative increase of domestic country interest rate positively affects ER (S) and an increase of domestic interest rate increases ER (S) and causes to depreciation of the domestic currency.

The rational expectation of inflation added simple monetary model of (Humphrey, Lawler, 1977) can be written as follow:

$$M^r = M/P,\ M^{r*} = M^*/P^* \qquad (1.8)$$

$$M^r = K(Y)\ a\ i,\ M^{r*} = K(Y^*)\ a\ i^* \qquad (1.9)$$

$$P = SP^* \qquad (1.10)$$

$$i = r + \pi,\ i^* = r + \pi^* \qquad (1.11)$$

$$\pi = m\ \pi^* = m^* \qquad (1.12)$$

M^r is real money supply, r is real interest rate, π is expected inflation and it is nominal interest rate, m is relative (to real money demand) growth of money supply. The other variables are as before.

As can be seen, equation (1.12) can be calculated from equation (1.8). The reason for this is that rational agents constitute their expectations using all available information and this model and do not make systematic errors. (Humphrey, Lawler, 1977).

The monetary approach to ER determination is a system that incorporates the PPP component and is structured with a monetarist worldview. In the monetarist macro model, relative price levels are determined in the goods and services markets and this price level ratio determines the ER. (Harvey, 1996)

In the monetary approach models, interest rates differential affects price levels proportion by the quantity of money component of the system by affecting money demand function negatively. A negative change in domestic interest rates relative to foreign one causes positive change in money demand value and negative change in money supply and negative change in inside prices in the quantity component of the system of monetary model and proportionate decrease in domestic prices against foreign prices causes to appreciation of domestic currency by reduction in exchange rate determined by purchasing power parity component of the monetary model.

1.1.3 Portfolio Balance Approach (Stock Oriented)

Unlike monetary models, portfolio balance models place emphasis on financial markets, capital account and portfolio decisions of domestic agents. They also assume that foreign and domestic bonds are imperfect substitutes, ie returns from foreign and domestic bonds may be different. (Harvey, 1996)

There are some variations in portfolio approach models that differ according to the assumptions about which assets local agents may own or to what extent different assets will replace each other. (Krueger, 1983:81)

A simple system of portfolio balance model can be written as follows:

$$M = mf(r, r^*) \qquad (1.13)$$

$$B = b(r, r^*) \qquad (1.14)$$

$$F = f(r, r^*) \quad (1.15)$$

$$W = M + B + SF \quad (1.16)$$

Where M is domestic money supply, B is domestic bonds, F is foreign bonds of domestic residents, W is domestic wealth, S is spot ER, r is the interest rate and the "*" token denotes foreign variables.

While interest rates affect exchange rates through asset markets in portfolio balance models, in monetary models this happens through goods and services markets. An exogenous contraction in the money supply made by the monetary authorities causes interest rates to rise, which leads to an increase in local bonds, a fall in foreign bonds in the portfolios of domestic market agents, which leads to a fall in the exchange rate. This is because the foreign currency obtained from the sale of foreign bonds is converted to the local currency in local bond purchases. (Harvey, 1996)

The reasoning for the chain of causation of the current account imbalance effect in this model is as follows: If current account deficit occurs in the home country causes reduction in the wealthy of domestic residents. Then domestic resident agents will increase foreign bonds in their portfolio and foreign currency appreciates and this causes to remove the current account deficit gradually. This is the reverse causation of traditional flow models.

Portfolio balance models are missing because real income and wealth are not included in the system as endogenous variables and expectations are not treated. (Krueger, 1983:89)

Despite the emphasis on capital markets, there is no direct channel in portfolio balance models where capital markets and exchange rates affect each other. This effect indirectly occurs through goods and services markets. This is because

portfolio diversification of the domestic agents changes with the monetary policy action of the monetary authority or with a change in the domestic country's current account. This means that portfolio models also do not take capital account as the primary channel where the exchange rate will be affected. (Harvey, 1996)

A typical portfolio may also include an equity (stock) as an asset. Thus, we can examine the effect of changes in SPI on ER on the model. As the domestic stock markets become attractive, they are attracting more and more investors from around the world and increasing the share of domestic countries in their portfolios, causes the domestic SPI changes positively. This change in the world portfolios causes the appreciation of the domestic currency against the foreign currency directly or indirectly. Therefore, this approach posits and implies that, the direction of causality is from SPI to ER and the correlation is negative.

Note that a positive change (appreciation) in domestic currency means a negative change (depreciation) in the exchange rate (ER).

1.1.4 News Hypothesis

One of the important component that foreign exchange markets players takes into account is news. Economic calendar and announcements are related with news. In addition to technical analysis and fundamental variables, news also affects exchange rates either directly, or by influencing expectations of financial market players.

Stock and flow approaches were not alone in the research of exchange rate determination. The economists who thought the flow and stock approaches of exchange rate determination were weak to explain S-R and even L-R behavior of exchange rates and searched some new approaches. The impact of the news was one of these new strands.

With the assumption of an efficient market involving rational agents, the news hypothesis posits that only unanticipated surprise changes will be effective.

(Frenkel, 1981) studied effect of news by using the model below:

$$\ln (S_t) = \beta_0 + \beta_1 \ln (F_{t-1}) + news + \varepsilon_t \qquad (1.17)$$

Where S is spot exchange rate, F is forward exchange rate. The term, "$\beta_0 + \beta_1 \ln (F_{t-1})$" is expected component of the equation and news is unexpected innovations.

The news is not an observable variable, so he used unanticipated change in interest rates as a proxy which is defined as the difference between the value of the difference between domestic and foreign interest rates at time t and its expectation at time t-1.

$$news = \lambda [(i-i^*)_t - E_{t-1}(i-i^*)_t] \qquad (1.18)$$

(Frenkel, 1981) From this study, she claimed that the news that was interpreted as an unexpected change in interest rates was an important determinant of exchange rates and that the expected change in interest rates was not taken as news and was not effective

1.2 STOCK PRICES DETERMINATION

The stock market, which involves more or less risk, is a kind of asset market in the financial sector. Other names are equity market and share market.

An investor holding a stock has two possibilities of winning, first is the capital gain, which is the profit or loss arising from the price difference of the share. The

second is the firm's payment to the shareholders from the profit, if any, called the dividend.

The discounted dividends model is the basic financial model for determining stock prices. The logic of the model is that the value of a firm is sum of the discounted values of expected dividend payments of the firm in the future to shareholders.

$$SP(0) = \sum_{i}^{\infty} \frac{D(t)}{(1+rr)^{t}} \qquad (1.19)$$

$$r = [SP(1)/SP(0) - 1] + D(1)/SP(0) \qquad (1.20)$$

T is the period. SP is the stock price. D (t) is the investor's expectation of dividend in period t. SP (0) is current stock price. SP (1) is expected stock price of period 1. D (1) is expected dividend of period 1. D (1) / SP (0) ratio is expected dividend yield. The r is the required return rate, which is the sum of the expected capital gain and expected dividend return, which is the investor's expected return for such a stock. If we imagine to that the expected growth of the expected dividends is a constant g, after calculations we get the expected dividend yield as: D (1)/SP (0) = r-g. (Miles, Scott and Breedon, 2012: 518)

This equation says that the current price of the stock is the discounted sum of the rationally expected dividends in the future. Discounts for later periods are greater and have less impact on the current price. In addition, this model states that the current price of a stock depends on the market participants' expectations of the firm's future performance and payments, based on all available information currently. (All participants are rational and behave alike)

In this model stock prices depends on investors' expectations about the future and the news that contains information affects these expectations. (Miles, Scott and Breedon, 2012: 395-412)

1.3 A DISCUSSION ABOUT ER and SPI DETERMINATION

Some economists argue that the empirical studies about ER and SPI determination are not proven any model that suggests an explanation by using macroeconomic fundamentals.

Purchasing Power Parity hypothesis has explanatory power only for very L-R but this has not been proven empirically. Despite the exchange rate determination is one of the best-studied topics in the economics literature, macroeconomic models to explain exchange rate behavior has not achieved much success empirically, especially in the S-R. The macroeconomic theories e.g: PPP, monetary models, could not get empirical evidence from cointegration test investigations that examine the L-R equilibrium relationship between ER and SPI variables.This means that the exchange rates may not be entirely determined by macroeconomic fundamentals. (Miles, Scott and Breedon, 2012: 518) (Harvey, 1996)

Failure of macroeconomic models to explain S-R behavior of ER , and profitability of technical analysis supports the thought of some non-fundamental behavior of ER especially in the S-R. But some economists think that this S-R considerations are not in the context of economic analysis. (Harvey, 1996)

As in the case of the exchange rate determination, stock prices also fluctuate substantially and go away from their fundamentally determined L-R behavior proposed by any economic model. Research continues to explain this S-R and L-R behavior of SPI variable. Some of them are rational expectations and efficient market hypothesis, speculative bubbles, chaos theories and studies in behavioral economics such as psychological bias and the herding behavior. (Miles, Scott and Breedon, 2012: 395-412)

Unpredictability and fluctuations of prices does not require being irrationality, including chaos or bubble in the market. If the market is full of, before trading,

fundamental calculating rational agents, the prices would be unpredictable. Because even if the prices are determining by expectations of fundamental variables and change of prices occurs by changing expectations, the rational agent does not know, how does she change her expectations before. Indeed the price unpredictability is an implication of rational expectations and of an efficient market. But this is necessary but not sufficient condition. Unpredictability does not require the market to be efficient. (Miles, Scott and Breedon, 2012: 404-405)

The expectations do not have to be rational that constituted in a logically coherent way. If all the market participants would be rational, outcome of this would be random behavior of stock prices and there would not be a profitable way that smart people can gain. Some phenomena in the stock market price movements appear to contradict with discounted sum of expectations and rational behavior (Miles, Scott, and Breedon, 2012: 404)

The expectations of forex market(stock markets) participants may not be rational and the forex market(stock markets) may not be efficient, because maybe that at least some of the market participants can not achieve at least some information about the macroeconomic determinants of ER (SPI). In addition, the rational agent should know the correct fundamental model that explains the stock price behavior, make calculations and constitute her decisions.

The efficient market hypothesis strongly criticized in the last three decades. One implication of the efficient market hypothesis is the unpredictability of stock prices. Evidence indicates that stock price movements have some momentum behavior and this momentum affects prices to go in a direction for some periods. Mean reversion behavior is another mechanism that can be effective and after deviating along some periods, the stock prices begin to go to reverse direction. This predictable pattern allows the technical analysts or a smart agent (human, algorithm or un-algorithmic machine) to search the historical data and try to find momentum or mean reversion movement to make profit. An efficient market supporter may explain this by risk premium. Behavioral finance may explain it by

the psychological biases, herding behavior and tendency to make common mistakes. (Miles, Scott and Breedon, 2012: 410-411)

The change in expectations of dividends occurs less than actual change in dividends. Therefore the volatility of stock prices calculated using actual paid dividends should be more volatile than expected. If actual stock price change occurs though rationally expected dividends, then it should also less volatile than stock prices calculated using actual dividend payments. (Shiller, R.J. 1981) found that actual prices are more volatile and concluded that expectations are not the driving force behind the stock price change. This means that the driving force is irrational sense. Whether this is true or not has not been replied yet. (Miles, Scott and Breedon, 2012: 408-410)

The prediction of price change is a different issue from to model the price with the fundamental variables. Even if the perfect model that explains the current ER (SPI) movement with current and lagged values of the fundamental variables, is found and known by rational agents, this is about the occurrence of the current price, not the future price. Therefore this study is about to examine the relationship between ER and SPI with a VAR model and to interpret the results' consistency with traditional and stock oriented portfolio balance models of ER determination.

CHAPTER 2

LİTERATURE REVİEW

The literature of ER and SPI relationship has evolved by decades with developing econometric methods, early studies examined the sign of the correlation to check which models proposition holds. Later by the developing of cointegration techniques and causality techniques, investigators examined the L-R behavior of the relationship and the direction of the causality, to check again the propositions of the models. While earlier first-moment relationship examined, later second-moment relationship and volatility spillover also examined. Studying with real variables, logarithmic and/or difference transformation of variables, including other endogenous or exogenous variables, handling SPI as the sectoral basis, including lags of variable to look for dynamics of relationship, examining crisis periods can also be mentioned as some of other variants of studies.

Another issue that should be mentioned, some of the studies criticized by other researchers about not handling the issue correctly. For example, (Bahmani-Oskoee 1992) criticized some of the early studies not taking into account bidirectional effects and only regressing SPI on ER that could be biased results. For them, besides traditional flow approach portfolio balance approach also should be noted and take into account the mutual effects.

As a literature review, we firstly put forth a summary of some of the studies and then give some remarks about them.

Studies in developed countries are:

(Ma and Kao, 1990) studied the United Kingdom, Canada, Germany, Italy, France, Japan, and reference country the United States. They analyzed monthly series between January 1973 and December 1983. Their conclusion was that, if the country is trade surplus country then ER and SPI positively related because

ER depreciation reduces the competitiveness of the country and this causes to decline in SPI. For trade deficit countries there is negative relationship between SPI and ER of the home country because depreciation of ER decreases the import costs and increases SPI.

(Oskooee and Sohrabian, 1992) found no significant L-R comovement in the US using monthly data for the period between 1973 and 1988 using SP500 as a Proxy for SPI and effective dollar index as ER. (Nieh and Lee, 2001) found the same result in G7 countries including the US for the period between 1993 and 1996.

(Nieh and Lee, 2001) studied G7 countries handling daily series for the period between 1993 and 1996. They applied two stage methodology of Engle and Granger 1987, and they concluded that there is no significant L-R equilibrium comovement between SPI and ER variables, from their results. They also applied Johansen maximum likelihood cointegration methodology and the same result achieved. On the other hand, they found one-day significant S-R dynamic interaction only for some countries.

(Caporale et, al., 2014) found some significant relationship between ER and SPI variables. They studied the period between 2003 and 2011 using week frequency data in the US, UK, Canada, Euro Area, Switzerland, and Japan. As the mean causality they found causality in the direction from SPI to ER in the US and UK. ER leads SPI in Canada and feedback relationships found in Euro Area and Switzerland. They also studied variance causality and found causality in the direction from SPI to ER in US. In the Euro Area and Japan causality is in opposite direction and they found bidirectional spillovers in Canada and Switzerland.

Caparole et al found for mean and variance SPI granger cause ER for US.

Studies for developing countries are:

(Abdalla and Murinde, 1997) studied The Philippines, India, South Korea, and Pakistan for the period between 1985 and 1993 using monthly series. Their cointegration test result was nonexistence of stationary L-R comovement between the two series for Pakistan and Korea and existence of L-R equilibrium relationship for India and the Philippines. Their Granger non-causality test results indicated that there is unidirectional granger causality from ER to SPI in Korea, Pakistan and India for the period analyzed.

(Erbaykal, 2001) studied 13 developing countries handling monthly data for the period between 1990s and 2005 and 2007 around depending on country. They applied Toda Yamamoto (1995) test causality and found bidirectional causality in Brazil, Malaysia, South Korea, causality in the direction from SPI to ER in Thailand, The Philippines, Hungary, Indonesia, Mexico and ER leads to SPI in Turkey, India, China, Czech Republic and Chile.

(Granger, Huangb, and Yang, 2002) studied S-R dynamics of SPI and ER variables by using daily series between the period 1986 and 1998 from developing Asian countries. Their results did not indicate any uniform pattern for all the countries. They applied Granger causality based IR functions and found significant feedback causal interaction for Malaysia, Taiwan, Thailand, Singapore, Hong Kong. For South Korea they found Granger causality in the direction from ER to SPI that supporting Traditional Flow approach proposition. For the Philippines they found causality the direction from SPI to ER in accordance with the implication of Portfolio Balance approach. They did not detect any significant causal interaction between SPI and ER series for Japan and Indonesia. Their conclusion mainly supports portfolio balance approach although this is not exact result. Because for 5 countries ER also effected SPI.

(Caporale, Pittis and Spagnolo, 2002) studied Japan, South Korea, Indonesia, Thailand for the period 1987 and 2000, used log difference transformation and looked at second moment causality. They found causality from SPI to ER with negative correlation for Japan and South Korea for before-crisis and post crisis

periods. For Indonesia and Thailand their results were unidirectional causality in the direction from SPI to ER with positive correlation for before-crisis and whole period but unidirectional causality for after-crisis period.

(Hussain, Liew, 2004) studied Thailand and Malaysia and handled daily time series beginning from July 2, 1997 to August 31, 1998 which comprises 1997 Asian flu crisis. They applied Granger, Sim and Geweke causality tests. The result of causality from any one of the tests was enough as an argument. They found bidirectional causality in Malaysia and unidirectional causality from ER to SPI in Thailand.

(Rim, 2005) studied Malaysia for the period between June 1996 and August 1998 by separating before-crisis and crisis period by using daily frequency series of ER and sector based stock indexes. They found cointegration that the two series had L-R equilibrium relationship. They found bidirectional causality for entire period and the effect of change in ER changes by sector of industry that was negative effect on some sector but positive effect on some other sectors.

(Phylaktis and Ravazzolo, 2005) examined the period 1980-1998 monthly data from Malaysia, Thailand, The Philippines, Singapore and Hong Kong by including US equity markets, representing The World market in their model. They found L-R comovement between SPI and ER variables with positive sign correlation. US stock market found as main channel though which the interaction of SPI and ER variables occurs.

(Wafa et al., 2009) studied Thailand and Malaysian daily log transformed data between November 1, 1993 and August 31, 2003 period. They used THB/MYR and MYR/THB as ER and analyzed the series in two part, before-crisis and after-crisis periods. They found L-R equilibrium relationship between SPI and ER variables.

(Uddin, 2009) studied Bangladesh, Pakistan and Indian series from January 2003 to June 2008 period handling monthly frequency. As a result of cointegration test, they found no L-R equilibrium relationship between SPI and ER for all the studied countries. They also found no granger causality in any of the directions for all the studied countries.

(Kumar, 2009) studied Indian daily time series data beginning from January 4, 1999 to August 31, 2009. Log difference transformation applied to series and continuously compounded return series achieved. Their result of Engle and Granger cointegration test indicated nonexistence of L-R equilibrium relationship between ER and SPI index for India. Their Granger non-causality test result indicated bidirectional causality between ER and SPI index for India. They also applied volatility filtered nonlinear Mackey-Glass model to test causality and results was the same as Granger non causality test results which is bidirectional causality exist between SPI and ER variables in conditions of India for the sample period.

(Zhao, 2010) studied January 1991 and June 2009 period monthly time series data from China. They found the result of no L-R equilibrium relationship between ER and SPI in China. Their result also indicated that there is not first moment spillover but they found bidirectional second moment spillover between ER and SPI in China.

(Lean, 2011) studied six emerging countries, namely Egypt, Saudi Arabia, Iran, Kuwait, Jordan, Oman which are from Middle East, handling monthly series from January 2004 to September 2010 period. They found bidirectional causality in Egypt, Oman and Iran in the L-R and S-R for before-crisis period. They found unidirectional granger causality from ER to SPI in Kuwait and no causality in any direction in Jordan and Saudi Arabia in the S-R. They could not found granger causality in any direction between SPI and ER variables in Iran but found bidirectional granger causality in the other studied countries for crisis period.

(Lee, Doong, and Chou, 2011) studied six emerging countries namely South Korea, The Philippines, Indonesia, Thailand, Malaysia, Taiwan, from Asia for the period 2000-2008 weekly data applying STCC-EGARCH model. They found negative correlation for all the countries that posited by Portfolio Balance Models. They found mean spillover from SPI to ER for all but the countries they study except for The Philippines. They also found the correlation between SPI and ER series increasing by increased SPI volatility in all the countries except for The Philippines.

(Ülkü and Demirci, 2012) studied nine emerging European countries namely Turkey, Hungary, Poland, Czech Republic, Russia, Ukraine, Romania, Croatia for the period from 2003 to 2010 handling monthly and daily series. They included to the analysis effect the global developed and emerging SPI indexes. Their result indicated that this effect bears main part of interaction between SPI and ER. They also found that depth of the home equity markets increases the interaction between SPI and ER and decreases delay of response. Foreign capital dependency also affects the strength of the interaction of the two markets and the sign of relationship is positive for countries of balance of payments deficit.

(Andreou, Matsi, and Savvides, 2013) studied 1989 2008 period weekly series from six South American and six developing countries from Asia namely The Philippines, India, Thailand, Pakistan, Malaysia, South Korea, Argentina, Brazil, Mexico, Chile, Colombia, Venezuela applying Var-Garch models. They found bidirectional causality in variance in all the countries except for Colombia. They also found increasing flexibility of ER regime increases volatility spillover between SPI and ER variables.

(Alam, Rahim, 2013) studied 30 April 2012-02 December 2012 period Bangladesh, Dhaka exchange and BDT/USD daily return data and they applied OLS regression to return series and found positive relationship.

(Akdogu and Birkan, 2016) studied 21 emerging countries for the period between 2003 and 2013 handling monthly data. They applied Hacker and Hatemi-J (2010) causality test and found bidirectional causality for South Africa and Egypt, SPI leads ER in Peru, Hungary, Czech Republic, Brazil, Indonesia, Malaysia, Korea, Thailand and causality in reverse direction in Colombia. The other countries results were no significant causality in any direction.

Studies that examined Turkey data are:

(Erbaykal, 2001) found unidirectional causality in Turkey in which ER causes SPI.

(Rjoub, 2012) studied between August 2001 and August 2009 period monthly data in Turkey. Their comovement test result indicated that there is negative L-R equilibrium relationship between SPI and ER variables. They also found bidirectional Granger causality between SPI and ER variables.

(Ülkü and Demirci, 2012) found a positive relationship between home SPI and ER. They interpreted this result as Turkey's being dependent on foreign capital and depth of Borsa İstanbul.

Studies that examined crisis periods are:

(Granger, Huangb, and Yang, 2002) found increasing SPI effect on ER for developing Asian countries for the Asian flu period.

(Caporale, Pittis and Spagnolo, 2002) found that after the 1997 crisis second moment causality changed from unidirectional to bidirectional for Indonesia and Thailand but no change occurred for Japan and South Korea.

(Phylaktis and Ravazzolo, 2005) found crisis increases interaction between SPI and ER variables but returns to the before-crises conditions, a short time later.

(Rim, 2005) found evidence that there is a strong relationship between SPI and ER variables in 1997 Asian crisis period.

(Wafa et al., 2009) found that SPI granger cause ER in Thailand but no causality in both directions in Malaysia for before-crisis period. For after-crisis period their results indicated unidirectional causality that SPI granger cause ER in both Thailand and Malaysia.

(Lean, 2011) found that the 2008 crisis increased the interaction between SPI and exchange rates for Egypt, Saudi Arabia, Kuwait, Jordan, Oman.

(Andreou, Matsi, and Savvides, 2013) found that, the Asian flu crisis, affected the volatility spillover between SPI and ER variables in both of the directions.

(Caporale, Hunter, and Menla Ali, 2014) The result of time varying correlations indicated increased dependence between SPI and ER for 2007 banking crisis.

As can be seen most of the studies are conducted with developing countries, especially Asian emerging countries data. A considerable number of them examined the 1997 Asian flu crisis.

Cointegration test results are mixed. (Oskooee and Sohrabian, 1992), (Nieh and Lee, 2001) found no cointegration for US and the other developed countries that studied, (Abdalla and Murinde, 1997) found existence of cointegration for two of the countries and non-existence of cointegration for other two of the countries they studied. (Rim, 2005), (Phylaktis and Ravazzolo, 2005), (Wafa el al., 2009) found L-R comovement for developing countries that they study. (Uddin, 2009),

(Kumar, 2009), (Zhao, 2010), (Lean, 2011), (Rjoub, 2012) found no L-R comovement for developing countries that they study.

Some studies investigated mean and/or variance causality and there are mixed results also, for both developed and developing countries, (Caporale et, al., 2014) found mixed results for 6 developed countries for both first and second moment causality. (Abdalla and Murinde, 1997), (Erbaykal, 2001), (Granger, Huangb, and Yang, 2002),

(Caporale, Pittis and Spagnolo, 2002), (Hussain, Liew, 2004), (Rim, 2005), (Uddin, 2009), (Kumar, 2009), (Zhao, 2010), (Lean, 2011), (Lee, Doong, and Chou, 2011),

(Andreou, Matsi, and Savvides, 2013), (Akdogu and Birkan, 2016), (Rjoub, 2012) studied mean and/or variance causality in developing countries and their results also were mixed.

The results of all of the studies that examined 1997 Asian flu crisis and 2008 banking crisis reveals that the correlation and interaction between ER and SPI increases.

CHAPTER 3

DATA

Using the lunar frequency could be insufficient to capture some important information, and using daily data could cause noise. (Granger, Huangb, and Yang 2002).

All ER series are nominal spot ERs, which are the exchange rates in USD. " USD/TRY" means the amount of Turkish Lira required to purchase a US Dollar. Brazilian Real per USD is “USD/BRL”. Chinese Yuans per USD is “USD/CNY”. Indian Rupee per USD is “USD/INR”. South Korean Won per USD is “USD/KRW”. South African Rand per USD is USD/ZAR. Russian Ruble per USD is USD/RUB.

For SPI index variable we have used, Borsa Istanbul bist100 index for Turkey, Bovespa BVSP for Brazil, Shanghai Composite index SSEC for China, NSE (National Stock Exchange) Nifty50 for India, Moscow Exchange MOEX for Russia, KOSPI composite index KS11 for South Korea, FTSE/JSE(JALSH) for South Africa.

We planned to study time series in three periods as before-crisis, during crisis, and after-crisis periods. The beginning of year 2003 and the end of year 2006 is selected as the before-crisis period. Due to data availability, the series ended in 2004 for Russia. The date between 30.11.2003 and 01.01.2006 was taken for Turkey. As China's pre-crisis data is corrupted (incomplete data), we did not analyze for the pre-crisis period.

For the crisis period, the date between 19.08.2007 and the last week of 2009 was chosen. For data availability reasons, the period between the first and last week of 2008 was taken for Russia. As China's crisis data was also corrupted (missing data), we did not analyze for the crisis period too.

In the after-crisis period, the period from the beginning of 2010 to 21.04.2019 was chosen, but for some countries this was not achieved due to missing data. The period between 17.02.2013 and 31.01.2016 was used for China. For Russia 06.01.2013 was used as the beginning date. For South Korea 24.09.2017 is used as the ending date. The time series of other countries are between 03.01.2010 and 21.04.2019. All series were downloaded from investing.com.

The level and return time series of ER and SPI are shown in Figure 1.

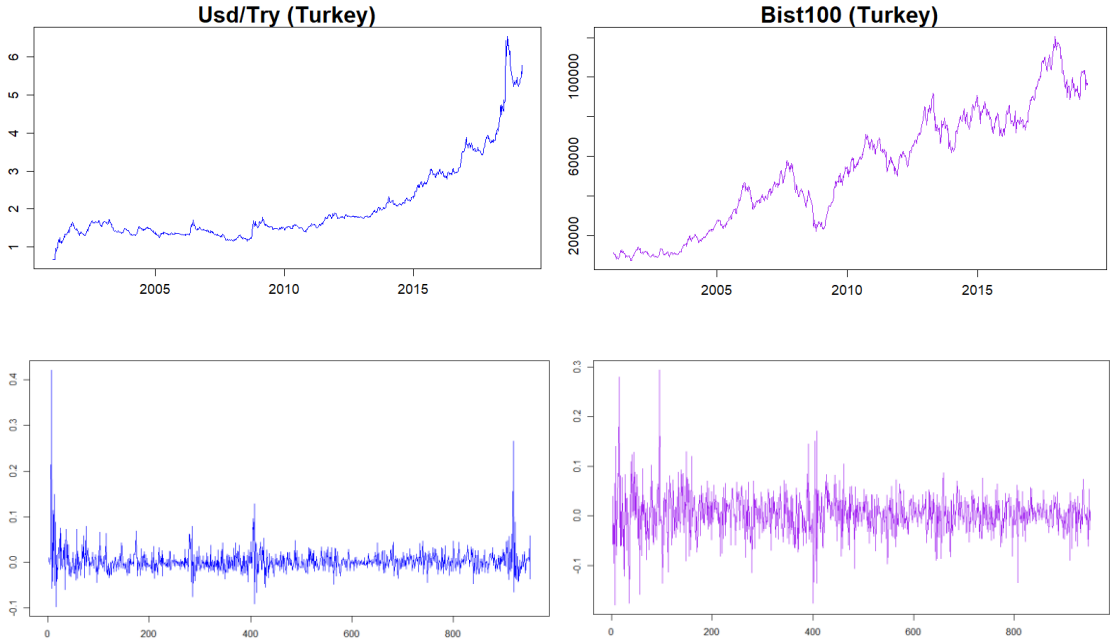


Figure1-(Turkey): Time series plot of usd/try and bist100 (level and return).

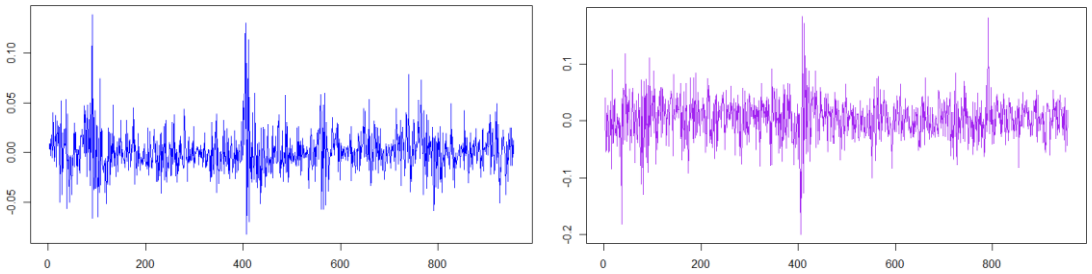


Figure1-(Brasil): Time series plot of usd/brl and bvsp (level and return).

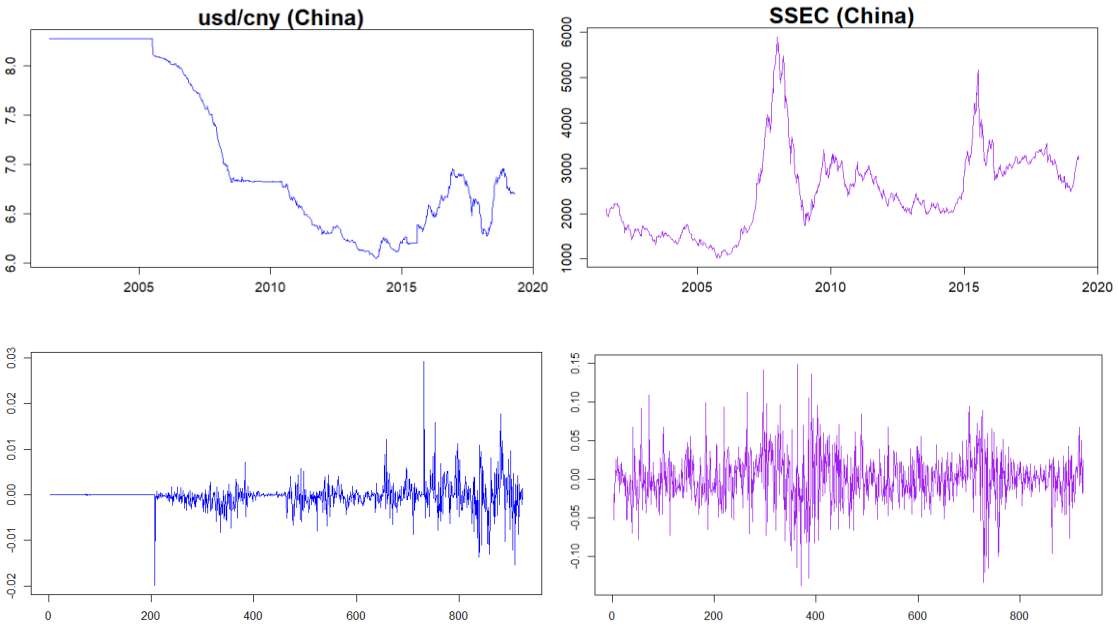


Figure1-(China): Time series plot of usd/cny and ssec (level and return).

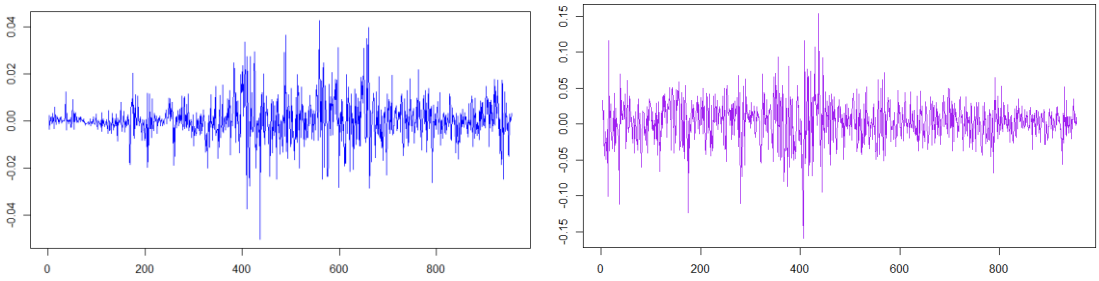


Figure1-(India): Time series plot of usd/inr and nifty50 (level and return).

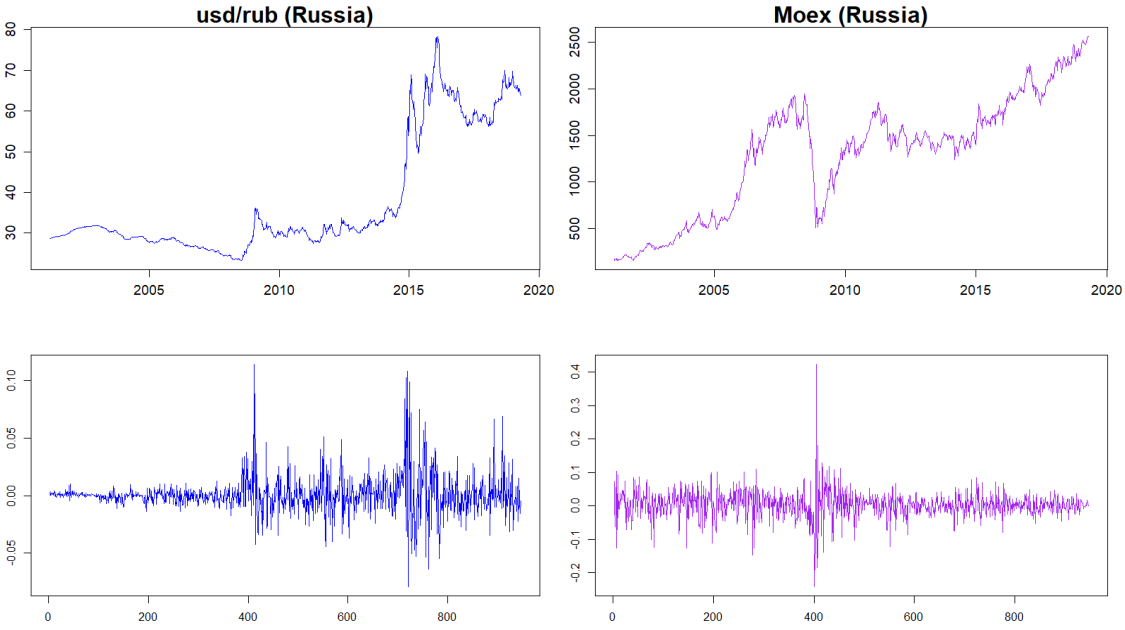
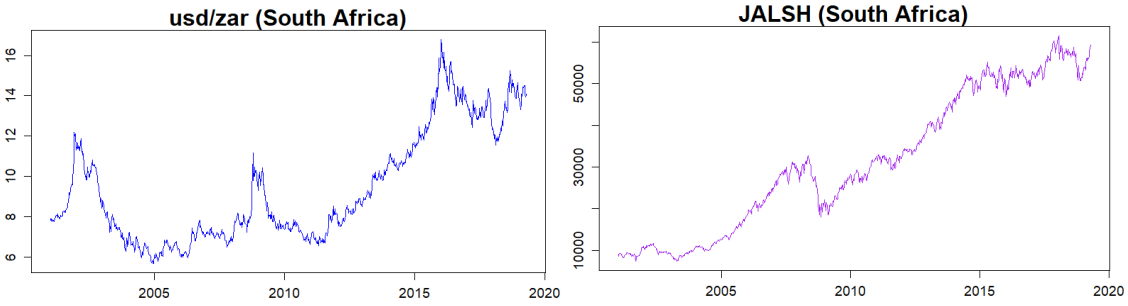


Figure1-(Russia): Time series plot of usd/rub and moex (level and return).



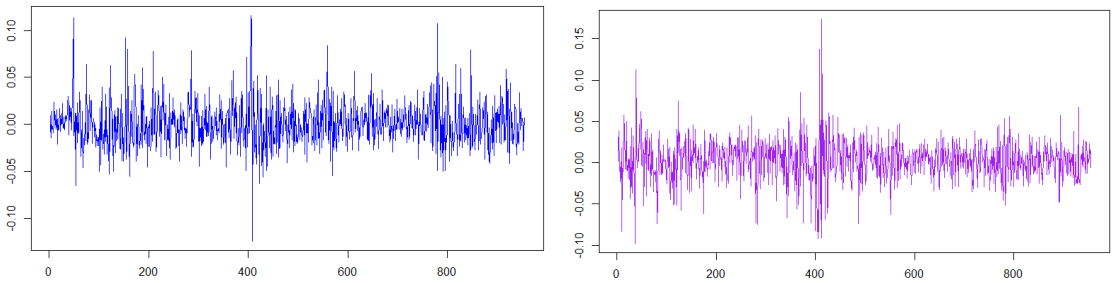


Figure1-(South Africa): Time series plot of usd/zar and jalsh(ftse/jse) (level and return).

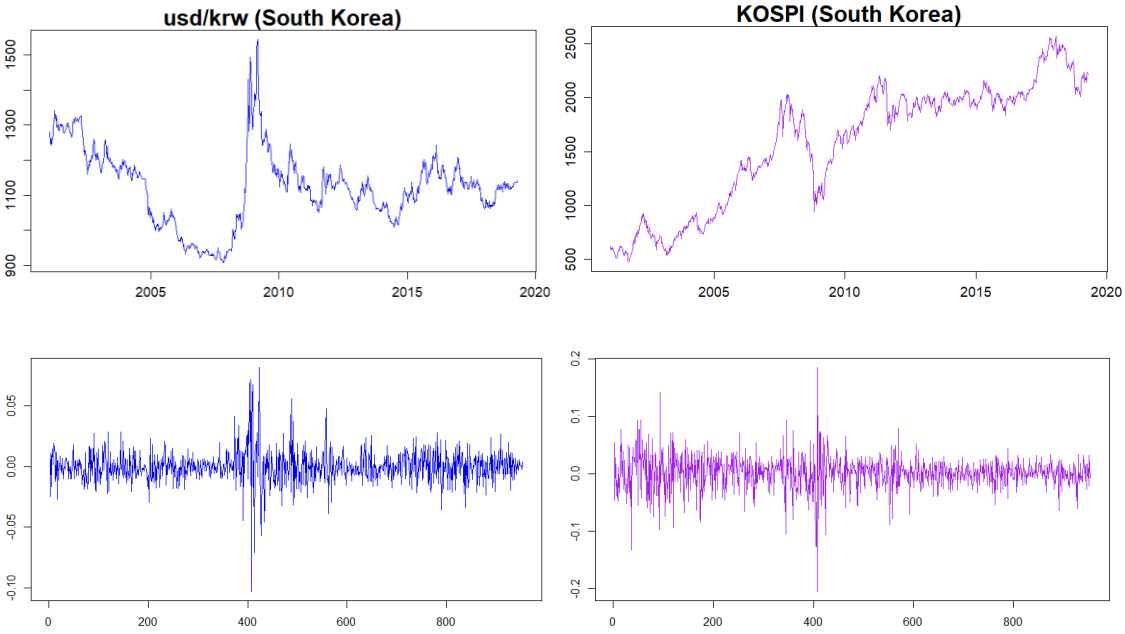


Figure1-(South Korea): Time series plot of usd/krw and kospi/(k11)(level and return).

CHAPTER 4

METHODOLOGY

In this study, we used the VAR methodology to analyze the S-R relationship between ER and SPI, we conducted the Granger non-causality test, the impulse response function analysis, and the variance decomposition analysis of the VAR estimation results.

We used Engle and Granger's two-step cointegration methodology, for the analysis of the L-R relationship between ER and SPI. We used the cointegration test methodology, also for deciding which of the VAR and VECM methodology is appropriate.

To apply the VAR estimation methodology, all the variables included in the model except for exogenous variables must be stationary. If the series are not stationary but integrated of equal order then there is a possibility that the series are in cointegrated. In this case we sould add ERror correction term to the model. The name of the model in this case is vector error correction model (VECM). VECM model should be used for the levels of the series. For this reason, we have to check on whether the series are stationary or include unit root, and determine the degree of integration of the series. If the series are integrated of equal order then we conduct the cointegration test.

4.1 UNIT ROOT and COINTEGRATION TEST

We use the unit root test to determine a series is stationary or not. We can write an AR (1) process as follows:

$$x_t = \rho x_{t-1} + \varepsilon_t \qquad (4.1)$$

If xt process is stationary then it should be that $-1 < \rho < 1$. If $\rho = 1$ then we say that x_t process includes unit root.

İf we subtract x_{t-1} from each side of the equation (4.1) we get

$$\Delta x_t = (\rho-1) x_{t-1} + \varepsilon_t \quad (4.2)$$

$$\Delta x_t = \gamma x_{t-1} + \varepsilon_t \quad (4.3)$$

Where $\gamma = 0$ is equivalent of $\rho = 1$. So if $\gamma = 0$ then we say that the x_t process has the unit root. The Augmented Dickey-Fuller test (ADF) uses this transformation (tests equation 4.3, instead of equation 4.1) . (Hill, Griffiths and Judge 2001: 343)

To determine a series includes the unit-root we apply the ADF test. The null hypothesis of the ADF test is:

H_0: $\gamma = 0$, the process is nonstationary

H_1: $\gamma \neq 0$, the process is stationary

The cointegration test should be applied to non-stationary and equal order integrated series.

The algorithm of determining the order of a series is as follows: We apply the ADF test to the series. If the series is not stationary, then we apply the ADF test to the first difference of the series. If the first difference of the series is stationary, then we say that the level series is I(1) or degree 1 integrated. If first difference series is not stationary then we continue to the difference operation and check whether the differenced series is stationary or not, until achieving stationary series. The number of the difference operation that has been applied, gives the order of the level series.

If the levels (series) of the two variables are integrated of equal order, we should apply cointegration test to determine if there exists comovement between the two variables. We used (Engle and Granger, 1987) two-stage cointegration test methodology. At first step we apply OLS regression of a variable on the second variable and save the residuals of the regression. At the second stage we apply the unit root test (ADF) to the residuals series of the first step. If the residuals series is stationary, then we say that the series is co trended or cointegrated, which indicates L-R equilibrium relationship. (Koop, 2005: 165)

To decide to reject or not a null hypothesis, we look at the p-value of the test. The p-value that less than 0.01 indicates that we should reject the null hypothesis with 99 % significance level. If the p-value of the test less than 0.05 indicates that we should reject the null hypothesis with 95 % significance level. If the p-value of the test less than 0.1 indicates that we should reject the null hypothesis with 90 % significance level.

4.2 THE VAR(p) MODEL

We have to use stationary series for the VAR model. If the series is not stationary, instead of using the difference series, using return series is more appropriate if it is stationary because the interpretation of the proportionate change is more meaningful in the aspect of economics.

P lag order VAR(p) model can be written as follows:

$$ER_t = \lambda_{er} + \alpha_{11}ER_{t-1} + \dots + \alpha_{1p}ER_{t-p} + \beta_{11}SPI_{t-1} + \dots + \beta_{1p}SPI_{t-p} + \varepsilon_{er} \quad (4.4)$$

$$SPI_t = \lambda_{spi} + \alpha_{21}ER_{t-1} + \dots + \alpha_{2p}ER_{t-p} + \beta_{21}SPI_{t-1} + \dots + \beta_{2p}SPI_{t-p} + \varepsilon_{spi} \quad (4.5)$$

We use akaike information criterion AIC to determine the model's lag order p.

4.3 GRANGER NON-CAUSALITY TEST

The Granger non-causality test can be applied to an estimation of a VAR model. In an equation (eq 4.4 or eq 4.5 in the section 4.2) in the VAR system, any significant coefficient of any lag of an explanatory variable means, that variable Granger causes the response variable, which is on the left-hand side.

To infer that, an explanatory variable does not granger cause the response variable, all the coefficients of all the lags of that variable in the equation have to be zero, or not to be significantly non zero.

The joined null hypothesis of Granger Non-Causality test of ER on SPI is as follow:

H_0: ER do not Granger Cause SPI

H_0: $\alpha_{21} = 0$ and … and $\alpha_{2p} = 0$

The alternative hypothesis is:

H_1: ER Granger Cause SPI

H_1: $\alpha_{21} \neq 0$ or $\alpha_{22} \neq 0$ or… or $\alpha_{2p} \neq 0$.

Joined null hypothesis of Granger Non-Causality test of SPI on ER is as:

H_0: SPI do not Granger Cause ER

H_0: $\beta_{11} = 0$ and … and $\beta_{1p} = 0$.

The alternative hypothesis is:

H_1: SPI Granger Cause ER

$H_{1:}\ \beta_{11} \neq 0$ or $\beta_{12} \neq 0$ or… or $\beta_{1p} \neq 0$.

4.4 THE IMPULSE RESPONSE FUNCTION

A var model can be represented as vma model which is the vector notation of the moving average, model. Hence a Var model can be represented as error terms. This representation is named as Wold representation, after Wold. Wold representation, can be written in matrix form as:

$$y_t = \psi_0\, e_t + \psi_1\, e_{t-1} + \psi_2\, e_{t-2} + \ldots \qquad (4.6)$$

Coefficients of these error terms constitute impulse response matrices that also takes into account error terms effect on later periods. Ψ_k coefficient matrix can be calculated recursively by summation beginning from $e_{0.}$

An element [a, b] in impulse response function matrix Ψ_k represents the response of $y_{a,\, t+k}$ to a unit shock on $y_{b,\, t.}$ Which is k period later response of variable y_a to a unit shock on variable $y_{b.}$

If the variables are not stationary, the impulse response function may not converges.

Because of covariance between errors in the ma representation, effects of a shock also include effects of other errors. To eliminate these other effects using Choleski decomposition which orthogonalises the coefficient matrix.

4.5 VARIANCE DECOMPOSITION

Writing n step ahead forecast error variance as sum of squares of orthogonalised impulse response coefficients of moving average representation of var as:

$$\sigma^2_{spi}(n) = \sum_{i=0}^{n-1} \phi^2_{er,spi,i} + \phi^2_{spi,spi,i} \quad (4.7)$$

$$\sigma^2_{er}(n) = \sum_{i=0}^{n-1} \phi^2_{spii\ er,i} + \phi^2_{er,er,I} \quad (4.8)$$

Can be written as orthogonalised impulse response function that

$$\sigma^2_{spi}(n) = [\ \phi^2_{er,spi,0} + \ldots + \phi^2_{er,spi,i-1}] + [\ \phi^2_{spi,spi,0} + \ldots + \phi^2_{spi,spi,i-1}] \quad (4.9)$$

$$\sigma^2_{er}(n) = [\ \phi^2_{spi,er,0} + \ldots + \phi^2_{spi,er,i-1}] + [\ \phi^2_{er,er,0} + \ldots + \phi^2_{er,er,i-1}] \quad (4.10)$$

Dividing each side by $\sigma^2_{spi}(n)$ in eq.3 and by $\sigma^2_{er}(n)$ in eq.4 we have

$$1 = [\ \phi^2_{er,spi,0} + \ldots + \phi^2_{er,spi,i-1}] / \sigma^2_{spi}(n) + [\ \phi^2_{spi,spi,0} + \ldots + \phi^2_{spi,spi,i-1}] / \sigma^2_{spi}(n) \quad (4.11)$$

$$1 = [\ \phi^2_{spi,er,0} + \ldots + \phi^2_{spi,er,i-1}] / \sigma^2_{er}(n) + [\ \phi^2_{er,er,0} + \ldots + \phi^2_{er,er,i-1}] / \sigma^2_{er}(n) \quad (4.12)$$

İn which we can see proportional weights of effect of ER and SPI separately on n step ahead forecast error variance of SPI in equation (4.11) and ER in equation (4.12).

CHAPTER 5

EMPIRICAL RESULTS

5.1 UNIT ROOT TEST RESULTS

First, we applied the ADF test to level and first differences of the series to determine integration orders of the series. The results are illustrated in Table 1.

P-values indicate that, null hypothesis of γ = 0 could not be rejected by 95 % significance level and AR process of before-crisis, crisis and after-crisis periods of Turkey, India, South Africa, South Korea and after-crisis period for China ER and SPI level series have unit roots and null hypothesis rejected by 95 % significance level for the first differences of all periods and we conclude that all the level series of these countries are integrated of order 1.

The Brazilian results are as follows: ADF test results indicate that the series are degree 1 integrated I(1) in the crisis and the after-crisis periods for ER and SPI series and before-crisis period SPI series. In the before-crisis period ER series, the null hypothesis is rejected by 95 % level but could not be rejected by 99 % significance level and we conclude that it is not clear whether the level ER series is integrated in 1 or zero degrees in the pre-crisis period.

The Russian results are as follows: For the before-crisis period level and first difference ER series are not stationary so the before-crisis period ER series is integrated of at least 2 orders. SPI series is nonstationary at level but stationary at first difference series. So before-crisis period SPI series is integrated of order 1. For crisis period level and first difference SPI series are not stationary at 95 % significance level so crisis period SPI series is integrated of at least two orders. ER series is nonstationary at level but stationary at first difference series. So crisis period ER series is integrated of order 1. For after-crisis period level of ER series is nonstationary but first difference of ER series is stationary, means that after-

crisis period ER series is integrated of order 1. Both Level and first difference of SPI series are stationary at 95 % significance level so the after-crisis period SPI level series is 0 degrees integrated.

P-values of ADF test results of ER and SPI for all periods return series in Turkey, Brazil, India, South Africa, South Korea and after-crisis period in China indicate that null hypothesis that series are nonstationary, γ = 0, rejected by 95 % significance and this indicates that return series of these periods in these countries are stationary.

Russian crisis and after-crisis period ER and SPI and before-crisis SPI return series are stationary at 95 % significance level but before-crisis ER return series is nonstationary even at 90 % significance level.

Country	Series	Dickey Fuller	Lag Order	P-Value
Turkey	ER	-2,4189	4	0,4028
	∆ER	-3,7413	4	0,02435
	SPI	-0,91712	4	0,9475
	∆SPI	-5,1196	4	< 0.01
	Residual	-1,5838	4	0,7493
	Return ER	-3,7571	4	0,02358
	Return SPI	-5,2931	4	< 0.01
Brazil	ER	-3,4717	5	0,04661
	∆ER	-6,4898	5	< 0.01
	SPI	-3,1375	5	0,09969
	∆SPI	-6,3108	5	< 0.01
	Residual	-3,4029	5	0,05545
	Return ER	-6,7959	5	< 0.01
	Return SPI	-6,3669	5	< 0.01
India	ER	-2,7496	5	0,2618
	∆ER	-5,1775	5	< 0.01
	SPI	-1,9851	5	0,5823
	∆SPI	-5,8422	5	< 0.01
	Residual	-2,3409	5	0,4331
	Return ER	-5,2003	5	< 0.01

	Return SPI	-5,4604	5	< 0.01
Russia	ER	-2,365	4	0,4253
	∆ER	-2,7108	4	0,282
	SPI	-2,292	4	0,4556
	∆SPI	-4,5467	4	< 0.01
	Residual	-2,1546	4	0,5126
	Return ER	-2,6608	4	0,3027
	Return SPI	-4,6723	4	< 0.01
South Africa	ER	-2,1924	5	0,4954
	∆ER	-6,9858	5	< 0.01
	SPI	-1,6991	5	0,7022
	∆SPI	-7,5325	5	< 0.01
	Residual	-3,3591	5	0,06275
	Return ER	-6,8147	5	< 0.01
	Return SPI	-6,8403	5	< 0.01
South Korea	ER	-3,1949	5	0,09012
	∆ER	-6,0449	5	< 0.01
	SPI	-2,4277	5	0,3967
	∆SPI	-6,1282	5	< 0.01
	Residual	-2,7095	5	0,2786
	Return ER	-5,9982	5	< 0.01
	Return SPI	-5,9094	5	< 0.01

Table 1a: (before-crisis period)

Adf tests of level, derivative and OLS residual series for Cointegration Test

Country	Series	Dickey Fuller	Lag Order	P-Value
Turkey	ER	-1,8931	4	0,621
	∆ER	-4,8209	4	< 0.01
	SPI	-0,69061	4	0,969
	∆SPI	-4,9704	4	< 0.01
	Residual	-0,99142	4	0,9361
	Return ER	-4,5934	4	< 0.01
	Return SPI	-4,5998	4	< 0.01
Brazil	ER	-1,3072	4	0,8644
	∆ER	-4,3493	4	< 0.01
	SPI	-0,97166	4	0,9392
	∆SPI	-4,3525	4	< 0.01
	Residual	-1,0069	4	0,9337

	Return ER	-3,9856	4	0.01229
	Return SPI	-4,4778	4	< 0.01
India	ER	-0,86636	4	0,9533
	ΔER	-4,6696	4	< 0.01
	SPI	-1,126	4	0,915
	ΔSPI	-4,4215	4	< 0.01
	Residual	-0,95884	4	0,9412
	Return ER	-4,5976	4	< 0.01
	Return SPI	-4,6104	4	< 0.01
Russia	ER	-0,59583	3	0,9737
	ΔER	-4,2164	3	< 0.01
	SPI	-1,6499	3	0,7153
	ΔSPI	-3,2992	3	0,08138
	Residual	-1,5987	3	0,7359
	Return ER	-4,0397	3	0,01473
	Return SPI	-3,5549	3	0,04543
South Africa	ER	-1,191	4	0,9048
	ΔER	-4,5092	4	< 0.01
	SPI	-1,0226	4	0,9312
	ΔSPI	-4,4528	4	< 0.01
	Residual	-0,96152	4	0,9408
	Return ER	-4,3264	4	< 0.01
	Return SPI	-4,7099	4	< 0.01
South Korea	ER	-0,86024	4	0,9538
	ΔER	-5,3485	4	< 0.01
	SPI	-0,9171	4	0,9478
	ΔSPI	-4,7438	4	< 0.01
	Residual	-0,71188	4	0,9671
	Return ER	-5,0317	4	< 0.01
	Return SPI	-5,1349	4	< 0.01

Table 1b: (crisis period)

Adf tests of level, derivative and OLS residual series for Cointegration Test

Country	Series	Dickey Fuller	Lag Order	P-Value
Turkey	ER	-1,3313	7	0,8611
	ΔER	-7,1142	7	< 0.01
	SPI	-3,0662	7	0,127
	ΔSPI	-7,9706	7	< 0.01

	Residual	-2,2599	7	0,4682
	Return ER	-7,104	7	< 0.01
	Return SPI	-8,205	7	< 0.01
Brazil	ER	-2,2506	7	0,4721
	∆ER	-8,07	7	< 0.01
	SPI	-1,1245	7	0,9185
	∆SPI	-8,4768	7	< 0.01
	Residual	-1,6562	7	0,7236
	Return ER	-7,7969	7	< 0.01
	Return SPI	-8,257	7	< 0.01
China	ER	-1,8398	5	-0,6431
	∆ER	-4,1575	5	< 0.01
	SPI	-1,6324	5	0,7296
	∆SPI	-4,364	5	< 0.01
	Residual	-1,5189	5	0,7769
	Return ER	-4,1565	5	< 0.01
	Return SPI	-4,3741	5	< 0.01
India	ER	-2,0246	7	0,5678
	∆ER	-8,1549	7	< 0.01
	SPI	-2,0124	7	0,5729
	∆SPI	-9,5208	7	< 0.01
	Residual	-1,8386	7	0,6464
	Return ER	-7,9574	7	< 0.01
	Return SPI	-9,5033	7	< 0.01
Russia	ER	-2,1084	6	0,5309
	∆ER	-5,3711	6	< 0.01
	SPI	-3,6209	6	0,03134
	∆SPI	-8,4575	6	< 0.01
	Residual	-2,0591	6	0,5517
	Return ER	-5,0345	6	< 0.01
	Return SPI	-8,637	6	< 0.01
South Africa	ER	-2,1161	7	0,529
	∆ER	-8,3104	7	< 0.01
	SPI	-2,1397	7	0,519
	∆SPI	-8,975	7	< 0.01
	Residual	-2,9569	7	0,1733
	Return ER	-7,9955	7	< 0.01
	Return SPI	-8,825	7	< 0.01

South Korea	ER	-2,8231	7	0,2296
	∆ER	-7,3546	7	< 0.01
	SPI	-2,8887	7	0,2019
	∆SPI	-7,715	7	< 0.01
	Residual	-3,3067	7	0,06993
	Return ER	-7,2499	7	< 0.01
	Return SPI	-7,8	7	< 0.01

Table 1c: (after-crisis period)

Adf tests of level, derivative and OLS residual series for Cointegration Test

5.2 COINTEGRATION TEST RESULTS

The result of the ADF test, which is applied to the residuals of the OLS regression of ER on SPI is shown in Table 1 for three periods. P-value indicates that null hypothesis of residuals series is nonstationary could not be rejected at 95 % significance level and this indicated that the residuals series are nonstationary each period in Turkey, Brazil, India, South Africa, South Korea, for crisis period, after-crisis period in Brazil and for after-crisis period in China. We concluded from this result that all ER and SPI series pairs are not cointegrated for each period in Turkey, Brazil, India, South Africa, South Korea, for crisis and after-crisis period in Brazil and for after-crisis period in China. This means that there is no L-R equilibrium relationship between ER and SPI in these countries for mentioned periods.

As mentioned before, before-crisis period test results of Brazilian data is not clear, that before-crisis period ER series integrated of order 1 or zero and SPI series is integrated of order 1. If ER series is stationary then the series cannot be cointegrated, if ER series is also integrated of order 1, then we need to look at ADF test result of the residuals of the OLS regression of ER on SPI and null hypothesis of the test cannot be rejected at 95 % significance level and though this result we say that ER and SPI series are not cointegrated also for before-crisis period in Brazil.

Analyzing Russian data in respect to cointegration as follows: In all of the three-periods, ER and SPI series are integrated of different order as a result of ADF tests by 95 % significance level. In regard to this results we say that there is no cointegraton and no L-R equilibrium relationship between ER and SPI series for three periods we study. Even if ER and SPI series are equal order integrated, ADF tests of residuals of OLS regression of ER on SPI also say that the two series are not cointegrated.

After determining nonexistence of cointegration between ER and SPI series, for all the countries the VECM model usage is not appropriate for any country.

5.3 VAR MODEL ESTIMATION RESULTS

Before the use of return series, we applied ADF test and as seen in Table 1 p-values indicate that the null hypothesis rejected at 99 % significance level and this indicated that all the return series are stationary.

As a result of standard VAR model estimation, residuals of ER_t and SPI_t equations are normally distributed and stationary and serially uncorrelated. So they are White noises. This result supports the validity of the model.

Test	Turkey	Brazil	China	India	Russia	S. Africa	S. Korea
Before-crisis Box-Ljung ER	0,6025	0,1863		0,8922	0,287	0,6252	0,3808
Box-Ljung ER X-Squared	17,771	25,406		12,643	23,037	17,426	21,281
Before-crisis Box-Ljung SPI	0,9274	0,5474		0,2509	0,8917	0,4937	0,7265
Box-Ljung SPI X-Squared	11,656	18,608		23,808	12,654	19,435	15,839
Before-crisis ADF ER	<0,01	<0,01		<0,01	0,2455	<0,01	<0,01
Before-crisis ADF SPI	<0,01	<0,01		<0,01	<0,01	<0,01	<0,01
Crisis Box-Ljung ER	0,1389	0,6977		0,188	0,8019	0,908	0,06995
Box-Ljung ER X-Squared	26,874	16,303		25,359	14,544	12,229	29,994
Crisis Box-Ljung SPI	0,07011	0,6061		0,6863	0,0281	0,1932	0,8253
Box-Ljung SPI X-Squared	29,984	17,716		16,482	33,721	25,219	14,101
Crisis ADF ER	<0,01	<0,01		<0,01	0,0708	<0,01	<0,01

Crisis ADF SPI	<0,01	<0,01		<0,01	0,4689	<0,01	<0,01
After-crisis Box-Ljung ER	0,05265	0,3049	0,6264	0,5871	0,0799	0,3198	0,5242
Box-Ljung ER X-Squared	31,196	22,678	17,407	18,004	29,414	22,388	18,964
After-crisis Box-Ljung SPI	0,6014	0,58	0,7713	0,1875	0,735	0,1182	0,2719
Box-Ljung SPI X-Squared	17,788	18,112	15,088	25,373	15,7	27,64	23,35
After-crisis ADF ER	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
After-crisis ADF SPI	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01

Table 2 : ADF and Box Ljung Test(df=20) results(p-values) of standard Var estimation residuals(ER and SPI equations OLS)

ADF H0: Series is not stationary(Unit root exist)

Box-Ljung H0: There is no serial correlation in lag of 20

VAR estimation correlation coefficients are shown in Table 3.

Except for positive correlation for the before-crisis period South Africa series, and relatively weak negative correlation for after-crisis period China and Indian series there are negative correlations between ER and SPI variables for all countries.

Another noticeable point in table 3 is that correlations increased in crisis periods relative to the pre-crisis period and decreased again in after-crisis periods by absolute amounts. This result is consistent with the result of (Caporale, Hunter, and Menla Ali, 2014), (Phylaktis and Ravazzolo, 2005), (Wafa el al., 2009), (Lean, 2011) and (Rim, 2005) that found increased relationship between ER and SPI for the crisis periods.

COUNTRY	Pre Crisis	Crisis	Post Crisis
Turkey	-0,5389	-0,7181	-0.397
Brasil	-0,5636	-0,8026	-0,512
China			-0.002418
India	-0.3274	-0,6571	-0.01144
Russia	-0,2612	-0,4537	-0.2354
South Africa	0,2826	-0,5026	-0,2753
South Korea	-0,3426	-0,7338	-0.5019

Table 3 : Correlations between ER and SPI

5.4 GRANGER NON-CAUSALITY TEST RESULTS

Granger non-causality test statistics are illustrated in Table 2. Granger non-causality test results of before-crisis period indicate that both of the null hypothesis could not be rejected even by 90 % significance level in any of the country we analyzed. Therefore, for the before-crisis period, we could not find the Granger causality between ER and SPI variables in any direction and in any of the countries we analyzed.

Granger non-causality test result of the crisis period indicates that the null hypothesis of SPI does not granger cause ER, rejected by 95 % significance level in Brazil and South Africa but for other countries, this null hypothesis could not be rejected even by 90 % significance level. The null hypothesis of ER does not granger cause SPI, could not be rejected even by 90 % significance level. This result reveals that for crisis period there is unidirectional causality between ER and SPI, which is SPI granger cause ER, in Brazil and South Africa. There is no Granger causality between ER and SPI in any direction in any of the other countries we analyzed for the crisis period. This result is consistent with the proposition of the portfolio balance models.

P-values in the table for the after-crisis period indicate that the null hypothesis of ER does not granger cause SPI is rejected by 95 % significance level in China, India, and Russia. This means is that in these countries ER granger causes SPI by 95 % significance level for the after-crisis period's sample series. This result supports the proposition of the traditional flow-oriented models.

For the after-crisis period, the null hypothesis of SPI does not granger cause ER is rejected by 95 % significance level in Turkey and South Korea. This means is that in these countries, SPI granger cause ER by 95 % significance level for the after-crisis period's sample series. This result is consistent with the proposition of the portfolio balance models.

Both of the null hypothesis could not be rejected by 95 % significance level in Brazil and South Africa and this means that there is no Granger causality found in both directions by 95 % significance level for instances of after-crisis period sample series.

Feedback causality could not found in any of the countries that we examined for after-crisis period.

COUNTRY	df1	df2	F-Test	P-Value
Turkey (ER->SPI)	1	210	0,46761	0,4948
(SPI->ER)	1	210	1,665	0,1984
Brazil	1	408	0,42856	0,5131
	1	408	0,59411	0,4413
India	2	402	1,3326	0,265
	2	402	1,4316	0,2401
Russia	1	198	0,9791	0,3236
	1	198	0,3266	0,5683
South Africa	1	408	0,41	0,5223
	1	408	0,01707	0,8961
South Korea	1	408	0,0007299	0,9785
	1	408	1,6227	0,2034

Table 4a : (before-crisis period) Granger non-causality Test Results

First Line **Ho:** ER do not Granger Cause SPI

Second Line Ho: SPI do not Granger Cause ER

COUNTRY	df1	df2	F-Test	P-Value
Turkey (ER->SPI)	1	238	0,15291	0,6961
(SPI->ER)	1	238	0,39608	0,5297
Brazil	3	226	1,8738	0,1348
	3	226	2,8367	0,03892
India	2	232	0.25852	0,7724
	2	232	1,2504	0,2883
Russia	13	22	0,44479	0,9332
	13	22	1,7763	0,1135

South Africa	2	232	1,0032	0,3683
	2	232	4,4814	0,01231
South Korea	1	238	0,061949	0,8037
	1	238	0,41654	0,5193

Table 4b : (crisis period) Granger non-causality Test Results

First Line **Ho:** ER do not Granger Cause SPI

Second Line Ho: SPI do not Granger Cause ER

COUNTRY	df1	df2	F-Test	P-Value
Turkey (ER->SPI)	4	944	1,6379	0,1626
(SPI->ER)	4	944	3,0673	0,0159
Brazil	1	962	0,10402	0,7471
	1	962	0,034017	0,8537
China	1	300	10,947	0,001052
	1	300	0,57643	0,4483
India	1	962	179,2	< 2.2e-16
	1	962	0,62864	0,4281
Russia	1	648	7,52	0,00627
	1	648	0,66678	0,4145
South Africa	1	962	0,30176	0,5829
	1	962	0,20788	0,6485
South Korea	3	786	0,50504	0,6789
	3	786	3,5005	0,01518

Table 4c : (after-crisis period) Granger non-causality Test Results

First Line **Ho:** ER do not Granger Cause SPI

Second Line Ho: SPI do not Granger Cause ER

5.5 IMPULSE RESPONSE FUNCTION ANALYSIS

Impulse response function results are shown in Figure 2 for each country period combination separately. General findings are as follow:

Firstly, the effect of a one-unit shock to ER on ER is positive, on SPI is negative.

Secondly, the effect of a one-unit shock to SPI on ER is very weakly negative, on SPI is positive.

Thirdly, the impact of one-unit shock to each variable, on both of the variables decreases and disappears in one or two weeks. The impact of a one-unit shock to SPI on ER is not sharp at the beginning and later.

Fourthly, ER and SPI affect each other negatively. This result is consistent with the portfolio balance models' implications.

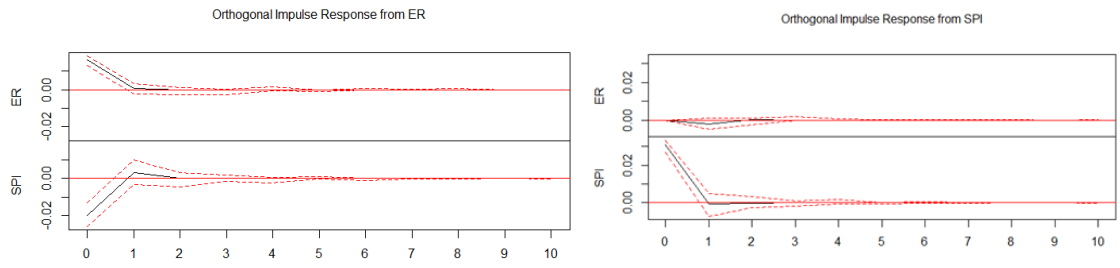


Figure 2a: (Turkey-before crises): Impulse Response function plot (95 % Bootstrap CI, 100 runs).

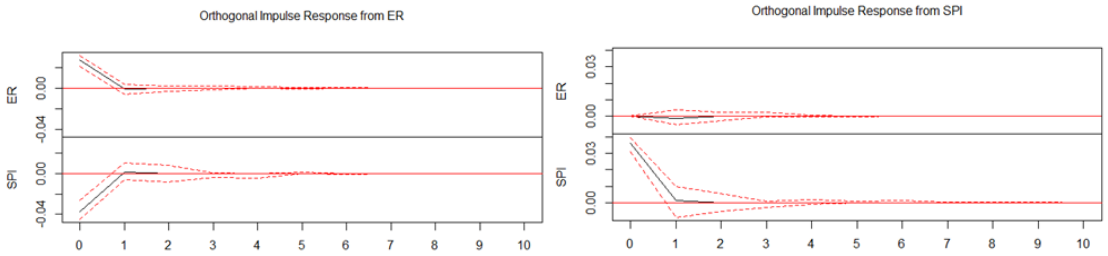


Figure 2b: (Turkey- crisis): Impulse Response function plot(95 % Bootstrap CI, 100 runs).

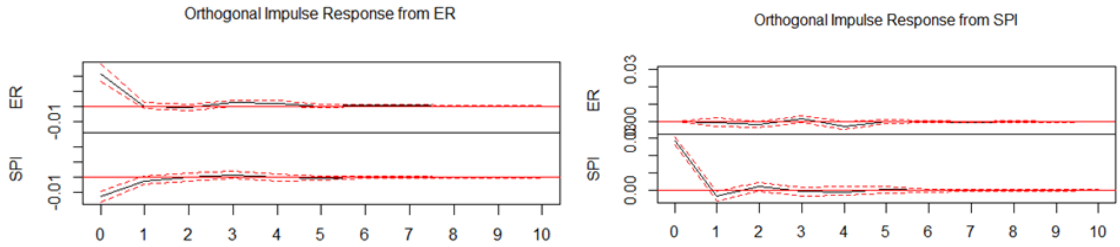


Figure 2c: (Turkey-after crises): Impulse Response function plot(95 % Bootstrap CI, 100 runs).

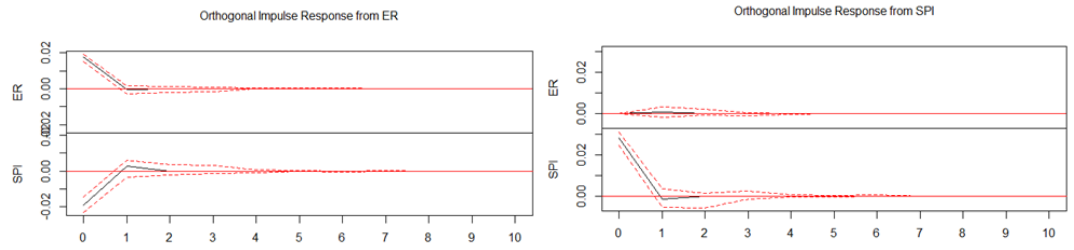


Figure 2a: (Brasil-before crises) Impulse Response function plot(95 % Bootstrap CI, 100 runs).

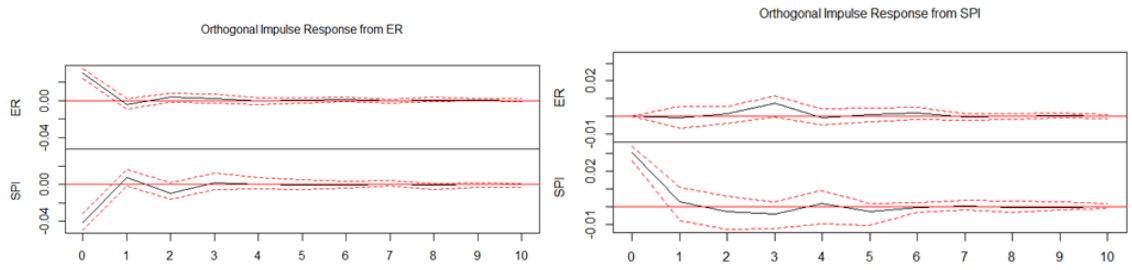


Figure 2b: (Brasil-crisis) Impulse Response function plot(95 % Bootstrap CI, 100 runs).

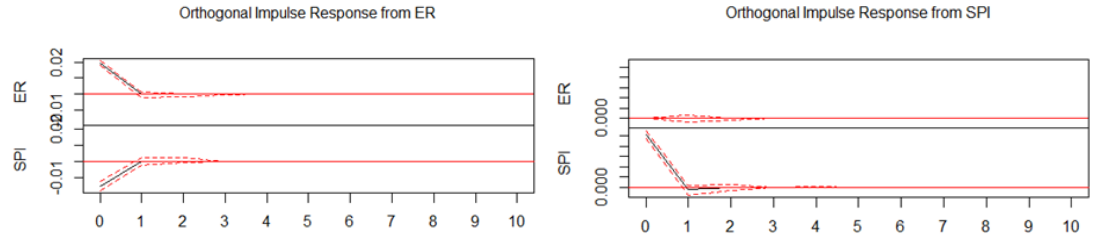


Figure 2c: (Brasil-after crises) Impulse Response function plot(95 % Bootstrap CI, 100 runs).

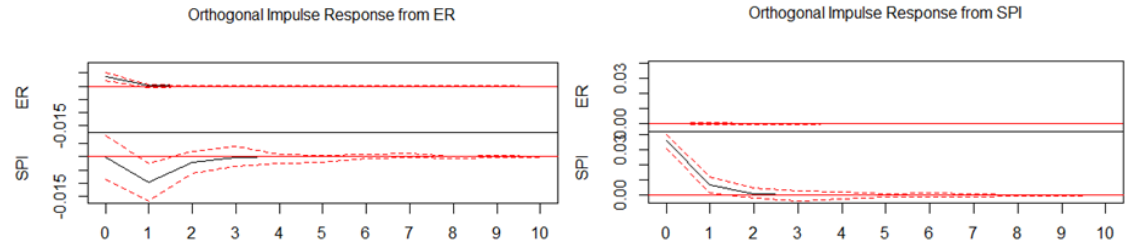


Figure 2c: (China-after crises) Impulse Response function plot(95 % Bootstrap CI, 100 runs).

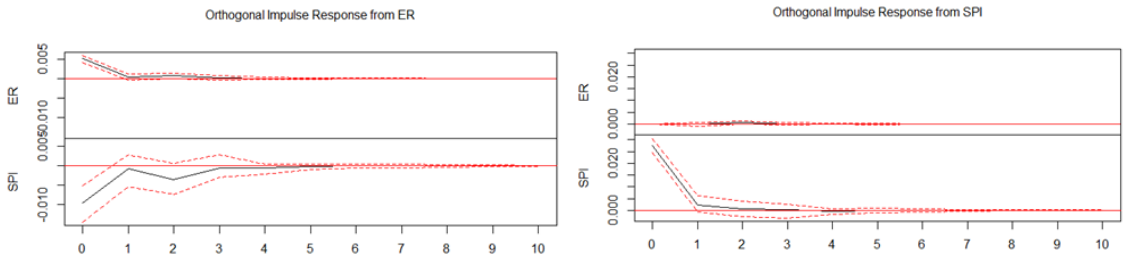


Figure 2a: (India-before crises) Impulse Response function plot(95 % Bootstrap CI, 100 runs).

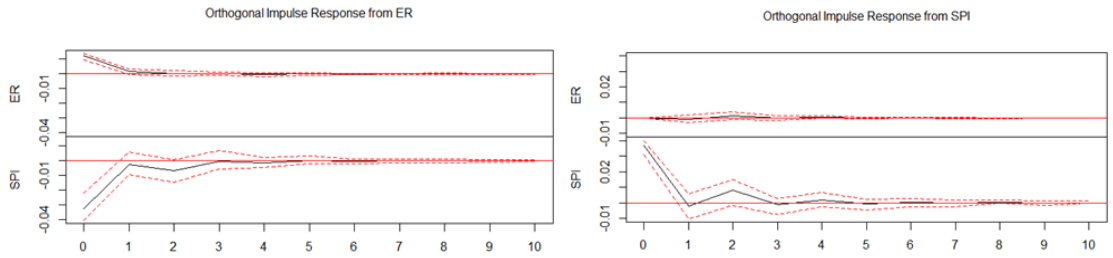


Figure 2b: (India-crisis) Impulse Response function plot(95 % Bootstrap CI, 100 runs).

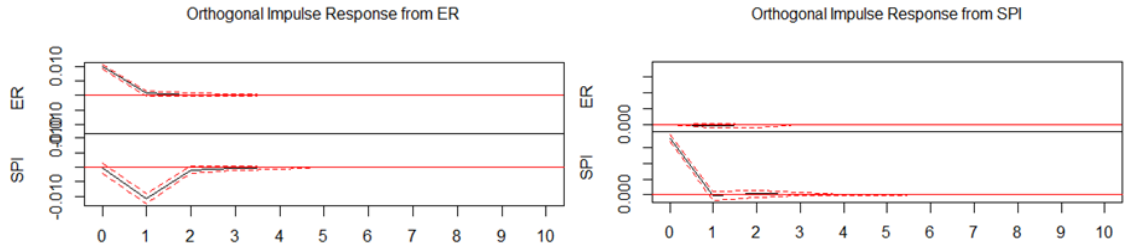


Figure 2c: (India-after crises) Impulse Response function plot(95 % Bootstrap CI, 100 runs).

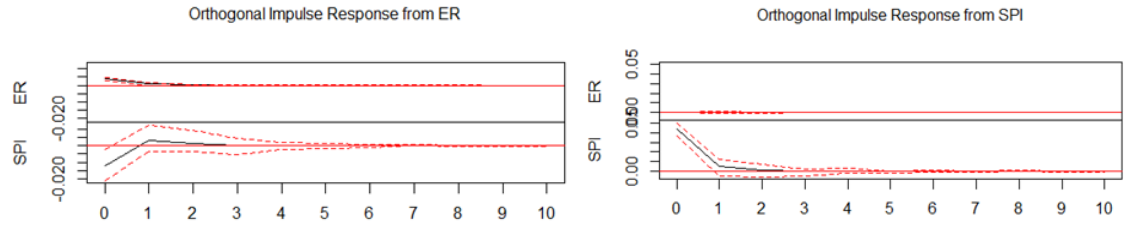


Figure 2a: (Russia - before crises) Impulse Response function plot(95 % Bootstrap CI, 100 runs).

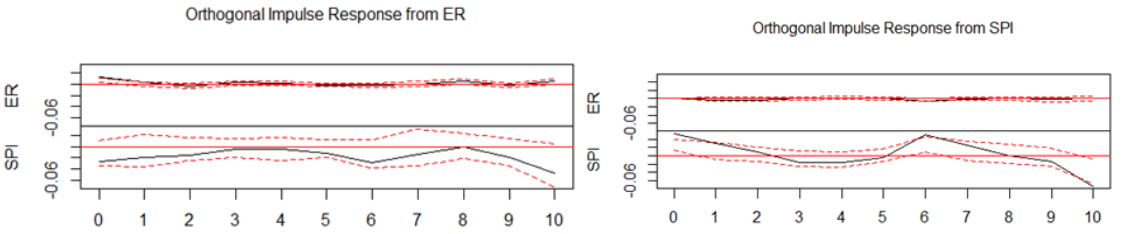


Figure 2b: (Russia - crisis) Impulse Response function plot(95 % Bootstrap CI, 100 runs).

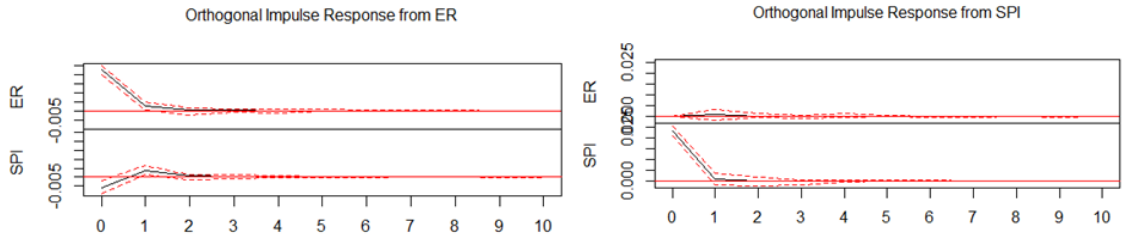


Figure 2c: (Russia-after crises) Impulse Response function plot(95 % Bootstrap CI, 100 runs).

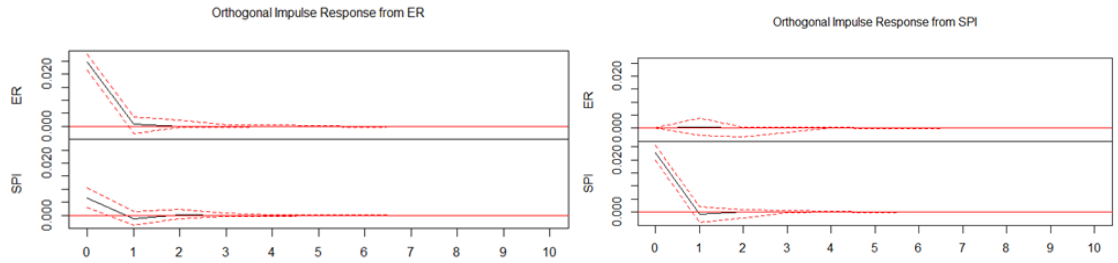


Figure 2a: (South Africa-before crises) Impulse Response function plot(95 % Bootstrap CI, 100 runs).

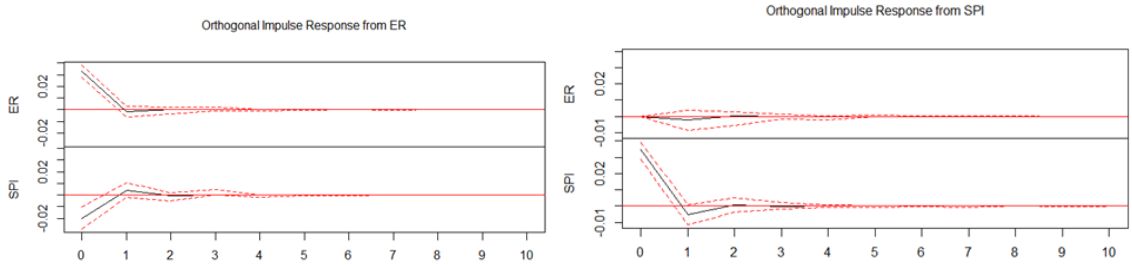


Figure 2b: (South Africa- crisis) Impulse Response function plot(95 % Bootstrap CI, 100 runs).

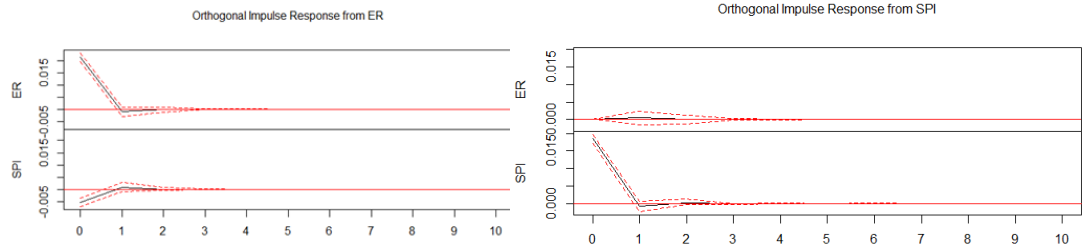


Figure 2c: (South Africa-after crises) Impulse Response function plot(95 % Bootstrap CI, 100 runs).

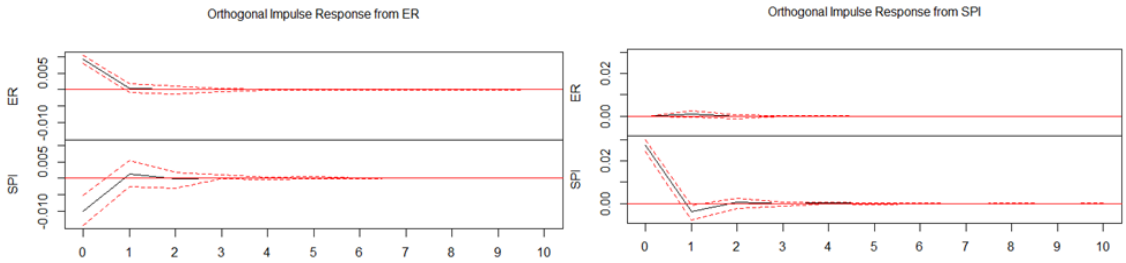


Figure 2a :(South Korea-before crises) Impulse Response function plot(95 % Bootstrap CI, 100 runs).

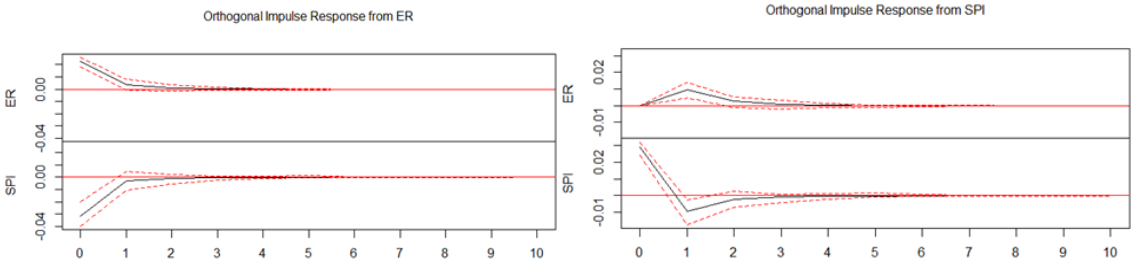


Figure 2b :(South Korea-crisis) Impulse Response function plot(95 % Bootstrap CI, 100 runs).

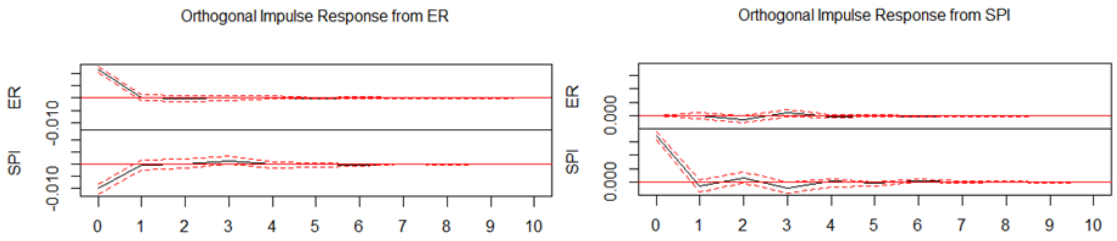


Figure 2c :(South Korea-after crises) Impulse Response function plot(95 % Bootstrap CI, 100 runs).

5.6 VARIANCE DECOMPOSITION ANALYSIS

The forecast error variance decomposition results for each country-period combination are illustrated in Figure 3. The general findings are as follow:

First, generally, the variance of ER mostly caused by ER itself.

Second, generally, the share of ER effect on the variance of SPI is relatively high.

Third, the general finding that can be clearly seen in figure 3 is that the effect of ER on the variance of SPI increases in the crisis period and decreases in the after-crisis period. This result is consistent with the result of (Caporale, Hunter, and Menla Ali, 2014), (Phylaktis and Ravazzolo, 2005), (Wafa el al., 2009), (Lean, 2011) and (Rim, 2005) that found increased relationship between ER and SPI for the crisis periods.

Fourth, the share of ER effect, in the variance of SPI is close to or higher than that of SPI in Brazil, Turkey, South Korea, and India.

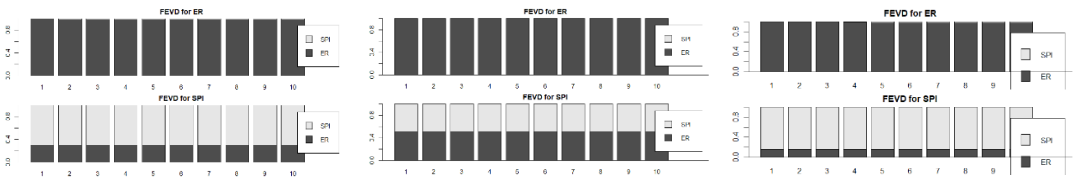


Figure 3: (Turkey) Forecast Error Variance Decomposition for ER and SPI returns. (Before-Crisis, In-Crisis and After-Crisis periods in sequence)

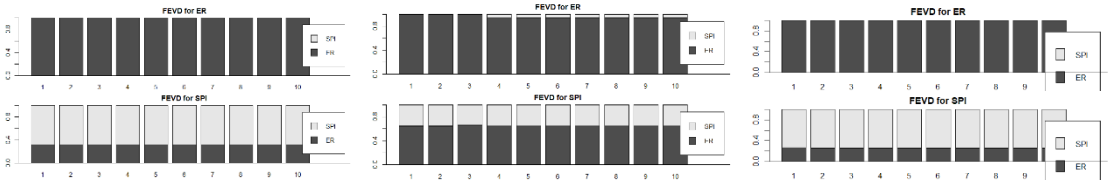


Figure 3: (Brasil) Forecast Error Variance Decomposition for ER and SPI returns. (Before-Crisis, In-Crisis and After-Crisis periods in sequence)

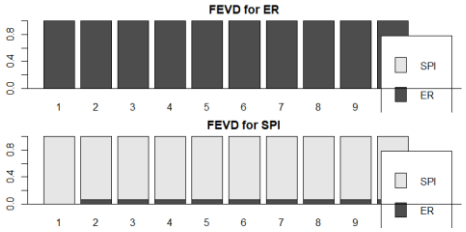


Figure 3: (China) Forecast Error Variance Decomposition for ER and SPI returns. (After-Crisis period)

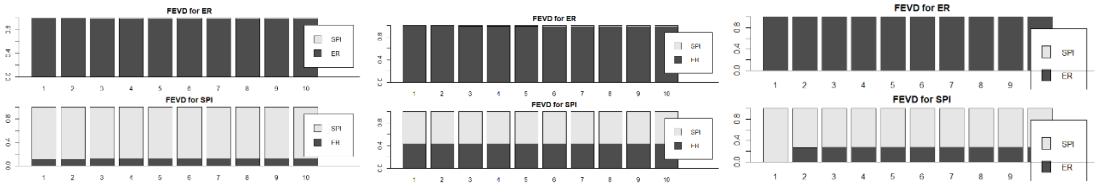


Figure 3: (India) Forecast Error Variance Decomposition for ER and SPI returns. (Before-Crisis, In-Crisis and After-Crisis periods in sequence)

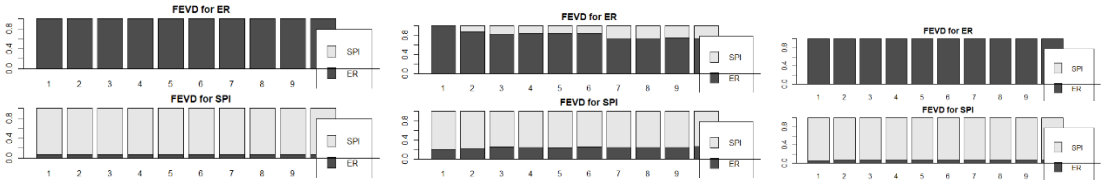


Figure 3: (Russia) Forecast Error Variance Decomposition for ER and SPI returns (Before-Crisis, In-Crisis and After-Crisis periods in sequence).

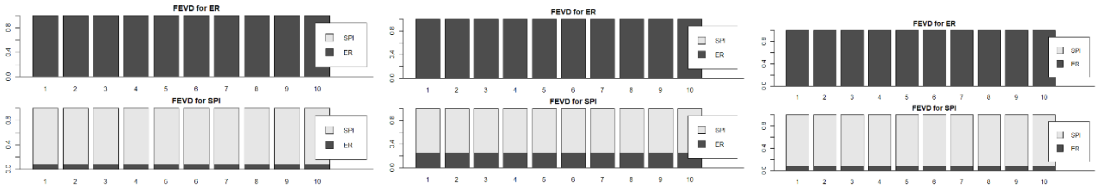


Figure 3: (South Africa) Forecast Error Variance Decomposition for ER and SPI returns (Before-Crisis, In-Crisis and After-Crisis periods in sequence)

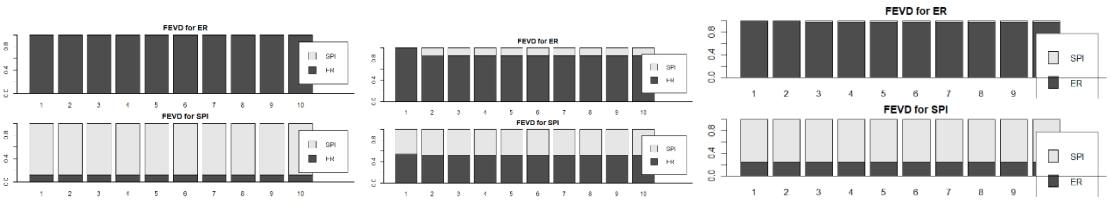


Figure 3: (South Korea) Forecast Error Variance Decomposition for ER and SPI returns (Before-Crisis, In-Crisis and After-Crisis periods in sequence)

CONCLUSION

In this study, we aimed to investigate the relationship between ER and SPI and to examine the results in terms of traditional flow models and stock-oriented portfolio balance models.

We have chosen some of the largest developing countries from four continents. To see the effect of the crisis period we have analyzed the data in three periods. The after-crisis period includes contemporary data and this property differentiates this study.

Some points and patterns obtained from our results are as follows: First, the cointegration test results of this study show that there is no L-R equilibrium relationship between ER and SPI for the countries and periods studied. This result is consistent with the results of (Nieh and Lee, 2001) and (Oskooee and Sohrabian, 1992) which did not find any L-R equilibrium relationship between ER and SPI.

Second, there is no Granger causality in any of the countries examined in the before-crisis period, SPI granger cause ER in Brazil and South Africa during crisis period, and Turkey and South Korea in the after-crisis period. This result supports the proposition of the portfolio balance models. ER granger causes SPI in China, India, and Russia in the after-crisis period. This result supports the proposition of the traditional flow-oriented models. We could not find the two-way causality in any of the country period combinations.

Third, the Var estimation results show that there is a negative correlation between the two variables in all countries examined, except for the pre-crisis period in South Africa. IR analysis shows that ER and SPI negatively affect each other. These results are consistent with the implications of portfolio balance models.

Fourth, FEVD analysis results and correlation coefficients of VAR estimation show that the relationship between ER and SPI increased during the crisis. This result is consistent with the result of (Caporale, Hunter, and Menla Ali, 2014), (Phylaktis and Ravazzolo, 2005), (Wafa el al., 2009), (Lean, 2011) and (Rim, 2005) that found increased relationship between ER and SPI for the crisis periods.

As stated in the discussion in Section 1.3, research to explain and determine exchange rates using macroeconomic fundamental variables has not been successful, especially in the S-R. Therefore, the mixed results of the causality direction, even for the same country in different periods, is consistent with this situation. The mechanisms proposed by different approaches, non fundamental based mechanisms and mechanisms that have not yet been proposed, all or some of them may be working together. For this reason, research should continue in all directions, fundamental and non-fundamental.

For these countries, other aspects of the relationship between ER and SPI can be examined. Including some other internal and external variables, using real variables, and examining the second moment (volatility) may be considered for further investigation.

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APPENDIX1. ETHİCS BOARD WAIVER FORM

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1. Does not perform experimentation on animals or people.
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13/09/2019

Name Surname:	Ahmet Sacit Seyid ÖZDEM
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Department:	Department of Economics
Program:	Economics
Status:	☒ MA ☐ Ph.D. ☐ Combined MA/ Ph.D.

ADVISER COMMENTS AND APPROVAL

Doç. Dr. Nasip BOLATOĞLU

APPENDIX2. ORIGINALITY REPORT

HACETTEPE UNIVERSITY
GRADUATE SCHOOL OF SOCIAL SCIENCES
MASTER'S THESIS ORIGINALITY REPORT

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Name Surname: Ahmet Sacit Seyid ÖZDEM
Student No: N11222563
Department: Economics
Program: Economics

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APPROVED.
Doç. Dr. Nasip Bolatoğlu

(Title, Name Surname, Signature)