A THESIS ON EXCHANGE RATES, FUNDAMENTALS AND TRADE

A Ph.D. Dissertation

by

SEDA MEYVECİ DOĞANAY

Department of
Economics
İhsan Doğramacı Bilkent University
Ankara
August 2014

To My Beloved Family and Son

A THESIS ON EXCHANGE RATES, FUNDAMENTALS AND TRADE

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

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SEDA MEYVECİ DOĞANAY

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August 2014

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

Assoc. Prof. Dr. Selin Sayek Böke
Supervisor

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

Assoc. Prof. Dr. Fatma Taşkın
Examining Committee Member

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

Assoc. Prof. Dr. Elif Akbostancı
Examining Committee Member

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

Prof. Dr Hakan Berument
Examining Committee Member

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

Assoc. Prof. Dr. Süheyla Özyıldırım
Examining Committee Member

Approval of the Graduate School of Economics and Social Sciences

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Prof. Dr. Erdal Erel
Director

ABSTRACT

A THESIS ON EXCHANGE RATES, FUNDAMENTALS AND TRADE

Meyveci Doğanay, Seda

Ph.D., Department of Economics

Supervisor: Assoc. Prof. Selin Sayek Böke

August 2014

This dissertation is made up of three essays on understanding the exchange rate movements and the link between the exchange rate and the real economy. In the first essay, exchange rate movements are decomposed into two components that are driven by the observable fundamentals and the unobservable factors in the economy with different statistical methods. Then, these methods results are compared in a reduce form equation in a panel setting that enables us to understand the economic sense behind these decomposition techniques. From this analysis, Christiano and Fitzgerald Filter (C-F Filter) (2003) is selected as the method that decomposes real exchange rate into permanent and temporary components which are respectively components that capture the fundamentals and unobservables.

In the second essay the Meese and Rogoff puzzle is analyzed through testing the scapegoat theory of exchange rate. Scapegoat theory of exchange rate claims that when exchange rate changes due to an unobserved factor, to rationalize this movement, agents give more weight to a fundamental that reveals a large variation from its mean which creates an exchange rate movement in the expected direction.

This part presents an empirical test of the scapegoat theory of exchange rate using Turkish data. It is found that there exists a strong and robust empirical support for the scapegoat theory of exchange rate. Of all the fundamentals, between 2003-2013 market participants have viewed the current account as the scapegoat; the current account variable and its scapegoat incidences have the statistically significant and theoretically expected effect on nominal spot exchange rate return.

Finally in the last essay making use of the decomposed exchange rate series the impact of exchange rate on bilateral trade flows is empirically analyzed using the Gravity Model in a panel setting. The estimation is done for using aggregate bilateral trade data. From this analysis we conclude that the impact of currency depreciation on trade flows depends on whether that change in the exchange rate reflects a shift in trend or is just a transitory movement.

Keywords: Exchange Rate Decomposition, Scapegoat Theory, Gravity Model

ÖZET

KURLAR, MAKROEKONOMİK TEMEL GÖSTERGELER VE DIŞ TİCARET ÜZERİNE BİR TEZ

Meyveci Doğanay, Seda

Doktora, İktisat Bölümü

Tez Danışmanı: Doç. Dr. Selin Sayek Böke

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Bu doktora tezi kurlardaki hareketi ve bu hareketlerin reel ekonomi ile ilişkisini daha iyi anlamayı amaçlayan üç makaleden oluşmaktadır. İlk makalede, kurlardaki hareketler farklı istatistiksel yöntemlerle gözlemlenen makroekonomik göstergeler ve gözlemlenemeyen sebeplerden kaynaklanan iki kısma ayrıştırılmıştır. Ardından bu methodların sonuçları panel bir analizle karşılaştırılarak söz konusu istatistiksel yöntemlerin arkasında yatan ekonomik anlamlar araştırılmıştır. Bu analiz sonucunda, Christiano and Fitzgerald Filtresi (C-F Filter) (2003) reel kurun temel makroekonomik göstergeler ve gözlemlenemeyen nedenlerden kaynaklanan kalıcı ve geçici kısımlara ayrıştırmak için kullanılması gereken yöntem olarak belirlenmiştir.

İkinci makalede Meese ve Rogoff bulmacası kurlardaki günah keçisi teorisi ile analiz edilmiştir. Günah keçisi teorisi kurdaki hareketlerin gözlemlenemeyen nedenleden kaynaklandığı durumlarda bireylerin bu hareketi rasyonelleştirmek için ortalamasının üzerinde değişiklik gösteren göstergelere daha fazla ağırlık vereceğini iddia etmektedir. Bu bölümde günah keçisi teorisi Türkiye datası ile ampirik olarak test edilmiştir. Sonuçlar günah keçisi teorisine güçlü ve sağlam bir ampirik destek vermektedir. 2003-2013 yıllarını kapsayan analiz çerçevesinde, piyasa oyuncularının çari işlemler açığını diğer makroekonomik göstergeler arasından günah keçisi olarak seçtiği: cari açık değişkeninin ve günah keçisi karşılığının nominal kur getirisi üzerine istatistiksel olarak anlamlı, beklenen yönlü bir etkisi tespit edilmiştir.

Son olarak son makalede ayrıştırılan kur hareketleri kullanılarak kurların ikili ticaret üzerindeki etkisi ampirik olarak panel Çekim Modeli çerçevesinden incelenmiştir. Bu analiz sonucunda para birimlerinde yaşanan değer kayıplarının ticaret üzerindeki etkisi bu hareketlerin trendden kaynaklanan bir hareket ya da geçici bir hareket olup olmadığına bağlı olarak değiştiği sonucuna ulaşılmıştır.

Anahtar Kelimeler: Kur Ayrıştırması, Günah Keçisi Teorisi, Çekim Modeli

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CHAPTER I

INTRODUCTION

Do we really understand the movements in the exchange rates? Upon the collapse of the Bretton Woods system of fixed exchange rates in 1973, exchange rates became endogenous variables that result from the complex interaction with observable macroeconomic fundamentals and unobservable factors such as speculative trades in the money market. This feature of the exchange rates renders the task of explaining exchange rate movements very difficult. However, understanding the factors governing exchange rate movements is of great importance given the significant role played by exchange rates in affecting the real economy. This thesis contributes to better understanding the exchange rate movements and to makes use of this new information to study the link between the real economy and exchange rates.

Exchange rates are nothing but asset prices, which in conventional models are determined as the expected present discounted value of a linear combination of fundamentals which are observable and shocks that are unobservable. Such an asset pricing framework has been used for exchange rates since the work by Engel and West (2005). This economic modeling corresponds econometrically to the time series decomposition of the series into a trend and a cycle component. The trend component should be linked to the observable fundamentals, whereas the cyclical component should be linked to the unobservable shocks. The thesis is built on the premise that such decomposition provides valuable information on the exchange rate and its link with fundamentals. While several papers have used such econometric decomposition techniques for this purpose, none of them have explicitly tested for the economic validity of these alternative decomposition techniques and whether the decomposed components actually do show the expected relationship with fundamentals. In chapter 2 of this thesis the exchange rates are decomposed making use of seven alternative decomposition methods that have been used in the literature, followed by an explicit test of whether the exercise is really effective in decomposing the exchange rate into a part that evolves with fundamentals in the long-run and a part that has no such long-run relationship. This is of importance if one is to interpret these econometric decompositions economically and make use of them to further understand exchange rate theories.

The seven methods used are the Blanchard-Quah decomposition (B-Q), Beveridge-Nelson decomposition (B-N), Hodrick-Prescott filter (H-P), Butterworth filter (B-W), Baxter and King filter (B–K), Christiano and Fitzgerald filter (C-F) and the unobserved component model (UCM). Using panel cointegration tests the long-run relationship between these alternative trend and cycle components with economic fundamentals is sought. These cointegration tests robustly suggest that among all the alternative decompositions the C-F Filter is the only one which shows a long-run relationship between observable macro fundamentals and the trend (permanent) component, while finding no such relationship of the same fundamentals with the cyclical (temporary) component. In other words, the C-F filter is the only econometric model that matches our ex ante economic expectation that the trend component reflects observable fundamentals whereas the cyclical component reflects unobservable shocks.

The discussion up to this point is one about the long-run relationship between fundamentals and the exchange rate. There are also ample studies on the short and medium run dynamics of the exchange rates. Following early studies based on linear relationships, empirical evidence has reached a consensus that there exists an unstable relationship between fundamental variables in the economy and the exchange rate in the short and medium run. The presence of time varying parameters is found to be an explanation of this instability by Meese and Rogoff (1983a, b). A more recent explanation proposed by Bacchetta and van Wincoop (2004, 2011) is the scapegoat theory of exchange rate.

As its name suggests the scapegoat theory basically relies on the fact that financial market participants search for a fundamental to explain exchange rate movements which may change for reasons that are not related with this observed macro fundamental. In other words, when unobservable factors such as speculative trades are responsible for an exchange rate movement, agents do not know what this movement is driven by and therefore blame an individual observed fundamental for this unexplained movement in the exchange rate, thus making the fundamental a scapegoat for the observed exchange rate changes. To select a fundamental as a scapegoat investors search the one with large changes which is in a consistent direction with the exchange rate movements. Once a fundamental becomes a scapegoat it has a larger impact on the exchange rate.

Empirical tests of the scapegoat have been limited to the study by Fratzscher, Sarno and Zinna (2012), given the difficulty in empirically identifying the scapegoat factor. However, it is important for market participants and policy makers to determine these scapegoats to understand the exchange rate movements thus in this third part of the thesis I seek to propose a measure to test the scapegoat theory. The decomposition conducted in chapter 2 provides a measure of exchange rate that moves with observable fundamentals, the trend or permanent component, and a measure of exchange rate that is on account of unobservable factors, the cyclical or temporary component. The contribution of this part of the thesis is through interpretation of this latter component as the unobservable factor that could lead for the investors to seek for a scapegoat factor. This interpretation suggests that the exchange rate decomposition into its permanent and temporary components would lend itself appropriate to test the scapegoat theory. In chapter 3 this alternative measure is used to test the scapegoat theory of exchange rate empirically using Turkey as a case study. The conclusions are strongly supportive of the scapegoat theory and suggest that policymakers should take into account the scapegoat structure of the exchange rate in the exchange rate modeling.

As for the Turkey specific findings, results suggest that the main scapegoat variable for market participants in Turkey is the current account and it has a statistically significant and theoretically expected impact on the nominal spot exchange rate return. This result reflects the fragile structure of the sustainable current account deficit in Turkey, as current account is found to be selected as the most internalized scapegoat among many macro fundamentals.

These results prove the decomposition exercise very valuable. An economically meaningful decomposition allows testing of alternative exchange rate theories providing important guidance to exchange rate modeling exercises. A further valuable venue would be to study what this decomposition implies about the link between real economic activities and exchange rate. A review of the literature that analyzes the relationship between exchange rate and trade flow suggests role for such an inquisition. According to any text-book open economy macroeconomic model depreciation is typically expected to improve the trade balance. However, upon the inception of the floating exchange rate regime, numerous studies have analyzed the impact of currency depreciation on the trade balance mostly finding conflicting results[1]. On the hypothesis that these conflicting results are on account of the mis-measurement of the exchange rate, in chapter 4 I test the trade effects of the permanent and temporary exchange rates. This is another novelty of this thesis.

The impact of the decomposed exchange rate on bilateral trade flows is empirically analyzed through the Gravity Model in a panel setting that is estimated using different model specifications. This part of the thesis claims that the exchange rate impact on trade balance depends on the sources of exchange rate movements. In the empirical analysis, I find that there is no statistically significant relation between temporary components whereas there is a strong and robust negative relationship with the permanent component of the real exchange rate and the bilateral exports. The results indicate that the reason behind the inconclusive results in trade and exchange rate relationship is the mismeasurement of the real exchange rate and if we take out the speculative movements/unobservable shock-driven real exchange rate, the correct relationship between these variables can be identified. Therefore, the effect of a change in real exchange rate on trade volume depends on whether that change reflects a shift in trend or is just a transitory movement.

To sum up, this thesis yields three important results:

i) First, among alternative decomposition techniques, I try determine which methodology should be used to decompose exchange rate

[1] See Chapter 4 for a detailed literature survey.

movements that enable us to understand the exchange rate movements and the economic sense behind these methodologies better.

ii) Secondly, making use of the decomposition I am able to test the scapegoat theory of exchange rate empirically by proposing a measure to identify the scapegoats with a publicly available data. With this analysis it is seen that the scapegoat nature of the fundamentals should be taken into account in exchange rate modeling and policy.

iii) Finally, the thesis shows that the impact of currency depreciation on trade flows depends on whether the change in the exchange rate is a shift in trend or is just a transitory movement. This result is also important since by decomposition I can explain the reason behind the inconclusive result in the literature that seeks to explain the link between exchange rate and trade. Moreover, for a policy recommendation in case of a currency movement, it is important to identify the reason behind these movements to determine whether this change in the currency would affect the trade volume or not.

While this thesis reaches several conclusions several further analyses remains. For example, how does trade in different sectors react to the change in the exchange rate? Ex ante one could expect that there may exist sectors that are affected by a permanent change in the exchange rate while others are affected by the temporary shifts in the exchange rate. Since determining these sectoral differences is important for policy recommendations, in future work I will also test the effect of the permanent and temporary component of the exchange rate on bilateral sectoral export volumes. In the concluding chapter of this thesis some preliminary results for this future work is provided, providing preliminary evidence supporting the ex ante hypothesis of sectoral differences.

CHAPTER II

EXCHANGE RATE DECOMPOSITION AND FUNDAMENTALS

How do macroeconomic fundamentals affect exchange rate? This has been the subject of several studies in the literature. As an endogenous variable, exchange rate has a complex interaction with remaining observable macroeconomic fundamentals and it is also affected by the unobservable factors in the money market. Engel and West (2005) define this feature of the exchange rate where they model the exchange rate as an asset price and define it as a linear combination of observable fundamentals and unobservable shocks.

Following their definition, in this part of the thesis I basically derive these components of exchange rate movements that are specific to the fundamentals and the unobservable speculative trades. To derive these components seven different statistical methods are utilized in this part of the thesis. Thus, the main argument of this chapter is that the exchange rate can be decomposed econometrically to differentiate between the role of fundamentals and unobservables.

The exchange rate has been decomposed in a number of studies for different purposes in the literature. Much of the studies focuses on the determination of the equilibrium exchange rate and uses the theoretical concept of the equilibrium exchange rate.[2] Another approach to decompose exchange rate used in the literature is the permanent equilibrium approach. This approach uses the model based methods to derive the permanent component used as a measure of the equilibrium exchange rate and is the approach this chapter is based on. Although these models are used to determine the permanent component of the exchange rate in the literature, this study is the first one that uses these techniques to decompose exchange rate and then test the economic meaning of these decomposed series in a reduced form equation.

In order to decompose exchange rate movements Blanchard-Quah decomposition (B-Q), Beveridge-Nelson decomposition (B-N), Hodrick-Prescott filter (H-P), Butterworth filter (B-W), Baxter and King filter (B–K), Christiano and Fitzgerald filter (C-F) and the unobserved component model (UCM) are modeled and explained in detail in section 2.2 All these seven different methods used to decompose real exchange rate are model based statistical methodologies, therefore it is important to test these methods' results in a reduced form model of the real exchange rate empirically. From this perspective, in this chapter of the thesis the study of MacDonald (1998) which presents the key determinants of the equilibrium exchange rate are used to test all the methodologies' results applied to decompose exchange rate. Using MacDonald (1998) model, all statistical methodologies results are tested in a reduced form equation through panel cointegration analysis in Section-2.3 to derive the economic sense behind these econometric techniques.

These results shows that the C-F Filter can decompose exchange rates into two economically meaningful components where the permanent component reveals a significant long run relationship with the fundamentals, while the temporary component is found to have no such relationship with the same observable macro

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[2] For a survey of literature, see Mac Donald (2000) and Driver and Westaway (2004).

fundamentals. Thus, the C-F filter matches the ex ante economic expectation that the trend component reflects observable fundamentals whereas the cyclical component reflects unobservable shocks.

2.1 Exchange Rate Decomposition

There are several tools developed in the literature to extract the permanent component of a macroeconomic time series. In this study alternative non-structural (statistical) model based methods are employed to decompose exchange rates into permanent and temporary components. Different methods are used to assess the robustness of our result. In this section all these methodologies are summarized and their results for some countries are reported.

2.1.1 Data

Monthly effective real and nominal exchange rates taken from BIS database comprising 60 economies beginning from January 1994 are used to decompose real and nominal exchange rate movements[3]. In this part only decomposed series for the real effective exchange rate is reported but depending on the question in the following chapters I also make use of the nominal series. Country choice and the time span are limited by data availability.

[3] The countries are Algeria, Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, China, Colombia, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Euro Area, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Malaysia, Malta, Mexico, Netherlands, New Zealand, Norway, Peru, Philippines, Poland, Portugal, Romania, Russia, Saudi Arabia, Singapore, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, United Arab Emirates, United Kingdom, United States, Venezuela.

2.2. Models

2.2.1 Blanchard Quah Decomposition

First of all, in order to decompose real exchange rate movements a structural vector autoregression (VAR) analysis in the tradition of Blanchard and Quah (B-Q Decomposition) (1989), the simplest version of a structural VAR model of this sort, is modeled. In this context, a two-dimensional system with the nominal and real exchange rates as the endogenous variables is used. The real shocks inducing a permanent shift of the real exchange rate and the nominal shocks leading to a temporary shift of the nominal exchange rates are identified by imposing the restriction that the nominal shocks have no long-run or permanent effect on the real exchange rates as shared with the other studies in the literature.

The literature that decomposes exchange rate movements using the Blanchard-Quah framework starts with Lastrapes (1992) and Evans and Lothian (1993). This methodology is widely used in the literature of decomposing the exchange rates and some of these studies are Enders and Lee (1997) for the U.S., Ghosh (1991) and Chadha and Prasad (1997) for Japan, MacDonald and Swagel (1998) for Germany and UK, Fisher (1996) for New Zealand and Australia, Chen and Wu (1997) for four Pacific Basin countries, Erlat (1998) for Turkey[4].

[4] Clarida and Gali (1994) extents the Blanchard and Quah methodology in a three dimensional version of the VAR by incorporating relative output levels as a third endogenous variable into the system. Modeling a higher-dimensional structural VAR system in the spirit of Clarida and Gali has been studied in the literature by other researchers. Rogers (1995) expands the the model by including the change in the ratio of government spending to output, Weber (1997) also extends the Clarida and Gali model by specifying a richer menu of shocks i.e. he splits supply shocks into labour supply and productivity components and segments monetary shocks into both money demand and money supply. Additionally, he also includes a relative aggregate demand shock. More recently, Kempa (2005) provides an alternative route to a VAR decomposition of exchange rate fluctuations by starting with a simple model of exchange rate determination; he extends the model to be triangularized and resembles the identification procedure of the VAR methodology. Finally, Ganguly and Breuer (2010) explore nominal exchange rate and relative price volatility with the inclusion of several nominal factors for both developed and developing countries' exchange rates. In this thesis the study is limited to two dimensional system since the definition of decomposed series in this system does not fit into the trend and cycle decomposition exactly.

The model explained below is based on Lastrapes (1992) study which is similar in spirit to Blanchard and Quah (1989) in order to understand the VAR mechanism to decompose exchange rate movements.

Let $\Delta y_t = \begin{bmatrix} \Delta r_t \\ \Delta n_t \end{bmatrix}$ where $\Delta = (1 - L)$ represents the first difference, r_t is the log of real exchange rate and n_t is nominal exchange rate. Assume that Δy_t follows a linear dynamic structural model:

$$\Delta y_t = A_0 \Delta y_t + A_1 \Delta y_{t-1} + \cdots + A_q \Delta y_{t-q} + u_t \qquad (1)$$

where $A_0 = \begin{bmatrix} 0 & a_{02} \\ a_{03} & 0 \end{bmatrix}$, $Eu_t u'_t = \Omega = \begin{bmatrix} w_{11} & 0 \\ 0 & w_{22} \end{bmatrix}$, $A_1, \ldots., A_q$ are unrestricted parameter matrices and u_t is white noise and contains two fundamental structural shocks. The zero restrictions in A_0 and Ω are normalizations.

The structural model (1) can be transformed into reduced form;

$$\Delta y_t = (I - A_0)^{-1} A_1 \Delta y_{t-1} + \cdots + (I - A_0)^{-1} A_q \Delta y_{t-q} + (I - A_0)^{-1} u_t \quad (2)$$

$$\Delta y_t = \pi_1 \Delta y_{t-1} + \cdots + \pi_q \Delta y_{t-q} + \epsilon_t \; where \; \pi_i = (I - A_0)^{-1} A_i$$

and $E(\epsilon_t \epsilon_t') = \sum = \begin{bmatrix} \sigma_{11} & \sigma_{12} \\ \sigma_{12} & \sigma_{22} \end{bmatrix} = (I - A_0)^{-1} \Omega (I - A_0)^{-1}$

Then, from reduced form equation we can obtain $\pi_1, \ldots., \pi_q$, Σ and ϵ_t. However, the effects of the structural shocks u_t on Δy_t can not be determined since A_0 and Ω are unknown. In other words, through reduced form equations we have three nonlinear equations $(\sigma_{11}, \sigma_{12}, \sigma_{22})$ from which four unknown parameters $(a_{02}, a_{03}, w_{11}, w_{22})$ can not be identified. Therefore, additional restrictions on A_0 and Ω are needed for identification.

The identifying restriction can be setting a_{02} and a_{03} equal to zero which is the Choleski Decomposition. However, here long run neutrality of nominal shocks on real exchange rate is imposed. Assume u_{1t} is the real exogenous shock and u_{2t} is the nominal shock and from (2), in vector moving average (VMA) equation form;

$$\Delta y_t = (I - \pi_1 L - \cdots - \pi_1 L^q)^{-1}\epsilon_t' = \begin{bmatrix} C_1(L) & C_3(L) \\ C_2(L) & C_4(L) \end{bmatrix} \begin{bmatrix} \epsilon_{1t} \\ \epsilon_{2t} \end{bmatrix} = C(L)\epsilon_t \quad (3)$$

where $C_i(L)$is an infinite lag polynomial.

Then,

$$y_t = (1 - L)^{-1} C(L)'(I - A_0)^{-1} u_t \quad (4)$$

and long run effect of the structural shocks on y_t is;

$$\lim_{k\to\infty} \left(\frac{\partial y_t}{\partial y_{t-k}}\right) = C(L)'(I - A_0)^{-1}$$

where the long run restriction implies that $a_{02} = C_2(1)/C_1(1)$ and given a_{02} the system can be solved. Then, the historical decompositions will be obtained by setting in (4) all e_{2t} to zero to obtain the permanent component and all e_{1t} to zero to obtain the transitory component.

In Blanchard Quah Decomposition, before the analysis as a necessary condition both real and nominal exchange rate should be integrated of order one (I(1)) and not cointegrated. Therefore, according to Augmented Dickey Fulley and Johansen cointegration tests, 35 countries[5] having both real and nominal exchange rates I(1) but not cointegrated are selected.

The results found in this study for some countries can be seen in Figure 2.1. Studies that use B-Q to decompose exchange rate mostly have found the dominance of permanent component in exchange rate movements. This result is parallel to what our results suggest.

[5] The selected countries based on unit root and cointegration test results are Argentina, Australia, Austria, China, Colombia, Croatia, Czech Republic, Denmark, Euro Area, France, Greece, Iceland, India, Indonesia, Ireland, Japan, Korea, Latvia, Malta, Netherlands, New Zealand, Norway, Peru, Philippines, Portugal, Singapore, Slovakia, South Africa, Sweden, Switzerland, Thailand, Turkey, United Arab Emirates, United Kingdom, United States.

2.2.2 Beveridge Nelson Decomposition

Beveridge Nelson Decomposition (B-N Decomposition) (1981) which calculates trend and cycle for an integrated time series is applied to decompose exchange rate movements[6]. The model summarized below is taken from Beveridge and Nelson (1981) in which the trend component of the time series is identified by imposing the restriction that it is random walk with drift and the cycle component is defined as the stationary part with mean zero[7]. The interpretation of the trend component corresponds to an estimate of the permanent component of the integrated time series by Watson (1986) and Morley et al. (2003)[8].

In the literature a number of studies have used B-N decomposition to decompose exchange rate into permanent and transitory components. Huizinga (1987) was the first study that extracts the trend component by the Beveridge-Nelson decomposition. Cumby and Huizinga (1990), Baxter (1994) and recently Wada (2012) use B-N decomposition to extract the permanent component of exchange rate for different currencies.

Let the non-stationary time series observations are denoted by z_t and its first difference by $w_t = z_t - z_{t-1}$. Then, according to Wold (1938) the differences can be represented by the model:

$$\varphi(L)(w_t - \mu) = \lambda(L)\varepsilon_t \quad (5)$$

where μ is the long-run mean of the w series and the ε's are uncorrelated random disturbances with zero mean and constant variance.

[6] The algorithm used is from Newbold (1990).
[7] See Beveridge and Nelson (1981) for further explanations.
[8] In the original paper by Beveridge and Nelson (1981), the trend component provides a definition of the permanent component of an integrated time series.

B-N Decomposition of z_t is motivated by considering the relation of the current value z_t to the forecast profile for future z's. Then, standing at time t, we can define the optimal linear predictor of z_{t+k} is

$$\widehat{z_t}(k) = z_t + \sum_{j=1}^{k} \widehat{w_t}\,(j) \tag{6}$$

From (5) it is seen that the forecast of w_{t+i} at time t is

$$\widehat{w_t}(i) = \mu + \lambda_i \varepsilon_t + \lambda_{i+1}\varepsilon_{t-1} + \cdots \tag{7}$$

with ε_{t+1} have with zero mean, the convergence of the summation of λ_i can be assured by the stationarity of w[9].

Then, substituting (7) into (6), we have;

$$\widehat{z_t}(k) = k\mu + z_t + \left(\sum_{i=1}^{k} \lambda_i\right)\varepsilon_t + \left(\sum_{i=2}^{k+1} \lambda_i\right)\varepsilon_{t-1} + \cdots$$

For very long horizons;

$$\widehat{z_t}(k) = k\mu + z_t + (\sum_{i=1}^{\infty} \lambda_i)\varepsilon_t + (\sum_{i=2}^{\infty} \lambda_i)\varepsilon_{t-1} + \cdots$$

Denoting the permanent or trend component by $\bar{z}$, we have;

$$\overline{z_t}(k) = z_t + (\sum_{i=1}^{\infty} \lambda_i)\varepsilon_t + (\sum_{i=2}^{\infty} \lambda_i)\varepsilon_{t-1} + \cdots$$

The permanent component as we have defined can be interpreted as the current observed value of z plus all forecastable future changes in the series beyond the mean rate of drift:

$$\overline{z_t}(k) = z_t + [\lim_{k\to\infty}\{\sum_{j=1}^{k} \widehat{w_t}\,(j)\} - k\mu]$$

Then the transitory or cyclical component c_t is;

$$c_t = z_t - \overline{z_t} = [\lim_{k\to\infty}\{\sum_{j=1}^{k} \widehat{w_t}\,(j)\} - k\mu]$$

$$= \left(\sum_{i=1}^{\infty} \lambda_i\right)\varepsilon_t + \left(\sum_{i=2}^{\infty} \lambda_i\right)\varepsilon_{t-1} + \cdots$$

[9] See Box and Jenkins (1976).

Before applying the B-N decomposition, I verify the existence of unit root in the real exchange rate. By conducting the Augmented Dickey Fuller, 58 numbers of countries[10] are selected to decompose real effective exchange rate. The results of this study for some countries can be seen in the Figure 2.2. This historical decomposition result of the B-N decomposition is different from B-Q especially in terms of the shape of permanent component. The result of previous literature using B-N decomposition to derive the components of exchange rate concludes that exchange rate movements consist of both permanent and temporary component with the dominance of permanent component. This findings are parallel to what I have found using B-N decomposition.

2.2.3 Hodrick and Prescott Filter

A popular filter used in the literature to extract the cycles from the time series is the Hodrick and Prescott Filter (H-P Filter). It is an easy to apply procedure but has recently been criticized by Harvey and Jaeger (1993), King and Rebelo (1993) and Cogley and Nason (1995) for generating cycles even if there is none in the original data, if it is applied to an integrated series. In addition to the spurious results, there are big revisions in H-P filter when a new data becomes available. It is included in this study for the comparison and robustness of the result with the knowledge of its drawbacks. Agenor et. at. (1997), Harris et. al. (2011), and recently Djennas (2013) and Jammazi and Aloui (2014) use H-P filter to decompose exchange rates.

[10] The selected countries are Argentina, Australia, Austria, Brazil, Bulgaria, Canada, Chile, China, Colombia, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Euro Area, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Korea, Latvia , Lithuania, Luxembourg, Malaysia, Malta, Mexico, Netherlands, New Zealand, Norway, Peru, Philippines, Poland, Portugal, Romania, Russia, Saudi Arabia, Singapore, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, United Arab Emirates, United Kingdom, United States, Venezuela.

The model summarized below is taken from Hodrick and Prescott (1997), who propose a procedure to extract a stochastic trend that moves smoothly over time and is uncorrelated with the cycle.

H-P Filter of series y_t is motivated by considering the following programming problem for determining the trend component g_t;

$$Min_{\{g_t\}_{t=1}^{T}} \{\sum_{t=1}^{T}(y_t - g_t)^2 + \lambda \sum_{t=1}^{T}[(g_t - g_{t-1}) - (g_{t-1} - g_{t-2})]^2\} \qquad (8)$$

where λ is the smoothing parameter. Here the first term is a measure of goodness of fit and the second term is a measure of degree of smoothness which penalizes the variation in the trend component. These two terms are contradicting to each other thus a weight λ is selected for the filter. As λ goes to infinity, we get smoother solution for the trend component. Hodrick and Prescott suggest that λ = 1600 is a reasonable choice for quarterly data, then I set λ= 129600 for the monthly data since the decomposition is sensible to the value λ[11].

The results of H-P filter for some countries can be seen in the Figure 2.3. Results corresponding H-P filter is different from B-N and B-Q decompositions. However, studies that apply H-P filter have found similar shapes for the historical decomposition results found in this chapter.

2.2.4 Butterworth Filter

Butterworth filter (B-W Filter) was first described by the British engineer and physicist Stephen Butterworth in 1930 and used as the digital translation of an analogue design by electrical engineers. Then Pollock (2000) derived the B-W filter for econometric time series from some axioms that we would like a filter to have.

[11] The solution to (4) as $T \to \infty$ is equivalent to a high pass filter (see King and Rebelo (1993)) in the frequency domain.

Unlike H-P filter that uses single parameter λ, B-W filter is more flexible in approximating the phase-neutral square wave filter. The model summarized below is taken from Pollock (2000), which proposes a smoothing operation applied both forwards and backwards of the time series with a recursive filtering. The B-W filter is characterized by a gain function that isolates the trend component which would possess a passband and a stopband which impedes all other frequencies less that the cut-off value. Pollock (2000) derives the finite–sample version of the B-W filter on the basis of signal extraction theory. The model;

$$y_t = s_t + c_t$$

where s_t is the trend component and c_t is the cycle component of the time series y_t. They are extracted by defining the following rational polynomial expressions as the high pass cut-off point:

$$\psi_H(z) = \frac{\lambda(1-z)^n(1-z^{-1})^n}{(1-z)^n(1-z^{-1})^n + \lambda(1-z)^n(1-z^{-1})^n}$$

where the parameter λ determines the cutoff frequency w_c that;

$$\lambda = \left[\frac{1}{tan\frac{w_c}{2}}\right]^{2n} \; and$$

$$\psi_H\left(e^{-iw}\right)|_{n\to\infty} = \begin{Bmatrix} 1 \; if \; w > w_c \\ \\ 0 \; otherwise \end{Bmatrix}$$

As implemented by Pollock at the end of the sample, the filter approximation to the asymptotic filter is not perfect but in the middle of the sample the deviations are small. The results of B-W filter can be seen in the following Figure 2.4. Results derived from B-W filter are quite similar to H-P filter.

2.2.5 Baxter and King Band Bass Filter

Next, in the spirit of Spectral Analysis, Baxter and King (B-K Filter) (1999) methodology is applied to decompose exchange rate movements. The model explained below is taken from their study which constructs Band Pass Filter methodology by specifying a particular quadratic loss function for discrepancies between the exact and approximate filter and design a filter that eliminates very slow-moving ("trend") components and very high-frequency ("cycle") components. Jammazi and Aloui (2014) has applied B-K filter to separate the Tunisian exchange rate into different periodic components.

It is well known that according to "Spectral Representation Theorem" any time series within a broad class can be decomposed into different frequency components[12]. The tool for extracting these components is the "Ideal Band Pass Filter" which is a linear transformation of the data that leaves intact the components of the data within a specified band of frequencies and eliminates all other components. On the other hand, the application of ideal band bass filter requires infinite data.

Consider the decomposition of x_t .i.e.;

$$x_t = y_t + \widetilde{x_t}$$

It is well known[13];

$$y_t = B(L)x_t$$

where

$$B(L) = \sum_{j=-\infty}^{\infty} B_j L_J,\ L^1 x_t = x_{t-1}$$

and

[12] See Cramer and Leadbetter (1967) and Lippi (2001) for a formal analysis.
[13] See Sergent (1987).

$$B_j = \frac{\sin(jb) - \sin(ja)}{\pi j}, j \geq 1$$

$$B_0 = \frac{b-a}{\pi}, a = \frac{2\pi}{p_u}, b = \frac{2\pi}{p_l}$$

and we want to isolate the component of x_t with a period of oscillation between $p_l$and p_u, where $2 \leq p_l \leq p_u < \infty$

For finite set, in Baxter and King Filter, we can solve the following minimization problem in which we can estimate fixed-lag, symmetric filter by choosing the filter weights $\hat{B}_j^{\pi}$ [14].

$$\hat{y}_t = \sum_{j=-\pi}^{\pi} \hat{B}_j^{\ \pi} x_{t-j}$$

$$min_{\hat{B}_j^{\pi}} \frac{1}{2\pi} \int_{-\pi}^{\pi} |\hat{B}^{p,p}(e^{-iw}) - B(e^{-iw})\,|^2 dw$$

subject to $\hat{B}^{p,p}(1) = 0$

The results for some countries can be seen in the Figure 2.5. It is known that the B-K filter does poor job for monthly data. It works better if π is increased but this requires throwing away more data at the beginning and the end of the series. Moreover the criterion for choosing π is not clear and it is always symmetric and stationary that increase error we want to minimize. Therefore, a generalized version of B-K filter is also applied in the next subsection.

2.2.6 Christiano and Fitzgerald Band Bass Filter

A generalized version of the Baxter-King Bandpass Filter is Christiano and Fitzgerald Filter (C-F Filter) (2003) which is applied in order to decompose

[14] See Baxter and King (1999) for the solution of this minimization problem and further details.

exchange rate movements. Harris et. al. (2011) extract the cyclical components of the different exchange rate by C-F Filter.

In this model for finite set we solve the following minimization problem and estimate $\hat{B}^{p,f}$[15].

$$\hat{y}_t = \sum_{j=-p}^{f} \hat{B}_J^{p,f} x_{t-j}$$

$$min_{\hat{B}_J^{p,f}} E[(y_t - \hat{y}_t)^2 | x]$$

We can express this problem in the frequency domain by exploiting the standard frequency domain representation for a variance[16],

Here, f_x(w) is the spectral density of x_t and

$$\hat{B}_J^{p,f}(L) = \sum_{j=-p}^{f} \hat{B}_J^{p,f} L^j$$

The C-F filter differs from the B-K Filter in three aspects. First, in the C-F Filter the presence of f_x indicates that the solution to the minimization problem depends on the properties of the time series represenatation of x_t. Second, $\hat{B}_J^{p,f}(1) = 0$ is never imposed as a constraint. Third, C-F Filter uses all the data for each *t*, and *p* and *f* vary with *t* and different from each other.

The results of this study for some countries can be seen in the Figure 2.6. As expected the result of B-K and C-F are quite similar.

2.2.7 Unobserved Component Model

Another model that is used to decompose exchange rate movements is the Unobserved Component Model (UCM) in the literature. UCMs[17] decompose a time

[15] See Christiano and Fitzgerald (2003) for the solution and further details.
[16] See Sims (1972) for details.
[17] A deteailed explanation for the UCMs is given in Harvey (1990) and Harvey (2006).

series by treating the trend and cycle as unobservable and attempt to capture the features of the time series in the state space form. The unobservable components are estimated in a linear state space model by maximum likelihood and the estimates are based on the current and past observations. In UCMs, there are different models for identification and here we choose random walk with drift specification similar to the Beveridge Nelson Decomposition.

UCM is frequently used in the literature to decompose exchange rates. Campbell and Clarida (1987), Kleijn and van Dijk (2001), Elkhoury (2004), Chen and Macdonald (2010) and Berger and Kempa (2014) apply UCM to exchange rate with different model specifications to extract its permanent and transitory component.

With this model, we follow Harvey (1985) where the trend component is defined to be a random walk with drift and cyclical component follows an AR(1) process. Moreover, trend and cyclical innovations are uncorrelated.

Then the random walk with drift model can be expressed as;

$$y_t = \tau_t + c_t$$

$$\tau_t = \tau_{t-1} + \beta + \eta_t,\ \eta_t \sim NID(0, \sigma_\eta^2)$$

$$c_t = \lambda c_{t-1} + \epsilon_t, \epsilon_t \sim NID(0, \sigma_\epsilon^2)$$

Here, σ_η^2 and σ_ϵ^2 represents the variance of innovations to trend and cycle respectively where the covariance of these shocks is set to be equal to 0. Through this model specification, with Kalman Filter a set of one-step ahead prediction errors is produced and they are used to construct the likelihood function that we maximized with respect to unobserved parameters in the system.

The result of this study can be seen in the Figure 2.7.

2.3 Comparison of the Results

In order to decompose exchange rate, different methodologies are modeled and their results for some countries are reported in the previous section. To compare these methods and understand their differences in detail, in Table 2.1 I summarize all these methodologies, alongside their advantages and disadvantages of them.

Figure 2.8, all methods' result for US can be seen. Although this graph tells us the shape of the components, it presents no evidence as to how well they perform in estimating these components. Thus, I also report the periodogram of the spectral density function of the temporary component which displays the results in natural frequencies in the Figure 2.9 through Figure 2.12. The periodogram for the models that are grouped into frequency domain analysis indicates that the C-F Filter works well since we expect to see a flat line above and below the critical region which means I can filter the series that passes the corresponding high and low bands.

Moreover, to get further information, their correlations for both temporary and permanent components are given in Table 2.2. It is clearly seen that for permanent component all methods results are highly correlated with each other except B-Q Decomposition. On the other hand, their results are different for temporary component. Frequency domain methods have similar results for temporary component but the correlation is low for B-N and B-Q decomposition which are resulted in highly correlated temporary component. Moreover, the correlations between the UCM model and the frequency domain analysis methods are also rather weak.

2.4 A test for The Economic Interpretation of the Components

All these different methods used to decompose real exchange rates are model based methodologies; therefore it is important to empirically test these methods' results in a reduced form model of the real exchange rate in order to test the economic meaning of these technical methodologies. From this perspective, in this section of the thesis the framework of MacDonald (1998) which presents a reduced form model of the real exchange rate is detailed, then used to test all seven decomposition methodologies applied in the previous section. Moreover, this is an important exercise to determine which methods' results gives an economic sense and also to determine which methodologies' result should be used to analyze the future questions asked in this thesis.

2.4.1 Model

Modeling the long run behavior of exchange rate using fundamentals is a long lasting question in the literature that includes numerous studies explaining this link[18]. Mac Donald (1998) re-examines the determinants of real exchange rate and discusses the sources of trends in behavior equilibrium exchange rate.[19] Although there has been a number of different studies that attempt to model exchange rate behavior in the long run, these models have failed to establish a long run link between exchange rate and fundamentals. In contrast Mac Donald's (1998) model finds evidence of a significant long run relationship between exchange rate and the determined fundamentals that is why I select to use this model in order to test the link between the components of real exchange rate and the fundamentals.

[18] See the surveys of Breuer (1994), Froot and Rogoff (1995) and MacDonald (1995).
[19] Here his model is summarized, for further information see Mac Donald (1998).

In this model the real exchange rate is defined as;

$$q_t \equiv s_t - p_t^* + p_t \quad (1)$$

where q_t denotes the real exchange rate, s_t denotes the nominal spot exchange rate (defined as the foreign currency price of a unit of home currency), p_t denotes the price level and an asterik denotes the foreign magnitude.

This relationship can be defined for the prices of traded goods as;

$$q_t^T \equiv s_t - p_t^{T*} + p_t^T \quad (2)$$

where T denotes the traded goods.

The price level may also be decomposed into traded and non-traded components;

$$p_t = (1 - \alpha_t)p_t^T + \alpha_t p_t^{NT} \quad (3)$$

$$p_t^* = (1 - \alpha_t^*)p_t^{T*} + \alpha_t^* p_t^{NT*} \quad (4)$$

where α denotes the share of non-tradable goods sectors in the economy and it is time varying, NT indicates the variable is defined for non-traded good.

By substituting equation (2), (3) and (4) into (1), we can obtain a general form for the long run equilibrium exchange rate;

$$\bar{q}_t = q_t^T + \alpha_t^*(p_t^{T*} - p_t^{NT*}) - \alpha_t(p_t^T - p_t^{NT}) \quad (5)$$

Equation (5) highlights three potential important sources of long-run variability in real exchange rates: non-constancy of the real exchange rate for traded goods, movements in the relative prices of traded to non-traded goods between home and foreign country, differing time variability of weights used to construct the overall prices in the home and foreign country[20].

For traded and non-traded price ratio changes Balasso-Samuelson effect is a known source. Balasso-Samuelson effect is based on the divergence of productivity

[20] The last source is ignored in this study since the empirical evidence of the effect of this part is unclear.

levels in traded and non-traded goods and the relative price of traded goods rising less rapidly over time for a country with relatively high productivity in tradable sector. Thus the real exchange rate appreciates for fast growing countries.

The other explanation for the long run variability in real exchange rates is a demand side bias with the existence of non-traded goods.[21] The systematic variability in real exchange rate for traded goods can be explained by national saving and investment decisions and since one key component of national saving is the fiscal balance it should be added among the determinants of real exchange rate[22]. Changes in the real price of oil can also have an effect on the equilibrium real exchange rate, usually through their effect on the terms of trade.

Then I can summarize the key variables that affect equilibrium real exchange rate using the following relationship;

$$\overline{q_t} = h(PROD, DEM, FISC, PS, ROIL) \quad (6)$$

where PROD is a measure of productivity, DEM is demand side bias, FISC represents relative fiscal balance, PS is private sector savings and ROIL is the real price of oil.

Moreover, to tie up the actual exchange rate and the long run equilibrium exchange rate uncovered interest parity (UIP) condition is introduced;

$$E_t(\Delta s_{t+k}) = (i_t^* - i_t) \quad (7)$$

where i_t denotes a nominal interest rate, Δ is the first difference operator, E_t is the conditional expectations operator, t+k defines the maturity horizon of the bonds.

[21] Genberg (1978) has demonstrated that if the income elasticity of demand for non-traded goods is greater than unity, the relative price of non-traded goods will rise as income rises, assuming unbiased productivity growth.
[22] The analysis of national savings and investment and their effects on the real exchange rate has been central to the IMF's analysis of real exchange rates; see Clark et al. (1994).

Then, by subtracting the expected inflation differentials form both side, the real relationship can be formed after some arrangements as the following equation;

$$q_t = E_t(\Delta q_{t+k}) + (r_t - r_t^*) \tag{8}$$

where $r_t = i_t - E_t(\Delta p_{t+k})$ is the ex ante real interest rate. It is assumed that the unobservable expectation of the exchange rate $E_t(\Delta q_{t+k})$ is equal to the equilibrium exchange rate $\overline{q_t}$;

$$q_t = \overline{q_t} + (r_t - r_t^*) \tag{9}$$

Therefore, the actual equilibrium exchange rate has two components; one part that is driven by the fundamentals exclusive of the real interest rate differentials and the other part driven by real interest differentials[23].

Since, the variables used to explain the real exchange rate are potential I(1) processes, and since there may exist cointegrating relationship amongst these variables, I propose a panel cointegrating framework to analyze the long-run relationship in the tradition of Pedroni (1995,1999). Since panel cointegration techniques are intended to allow researchers to selectively pool information regarding common long-run relationships from across the panel while allowing the associated short-run dynamics and fixed effects to be heterogenous across different members of the panel, this methodology is selected to compare the alternative decomposition techniques' results.

[23] All of these variables are viewed as fundamentals in this thesis. Other variables used in the literature in other studies like capital account, risk premium... etc. are ignored. I just follow Mac Donald's (1998) model that also found evidence of a significant long run relationship between exchange rate and these fundamentals. Thus I select to use this model in order to test the link between the components of real exchange rate and the fundamentals.

2.4.2 Data

The sample period is 1995, quarter 1 to 2010, quarter 1[24], with data from 1994, quarters 1 to 4 used to construct lags. The sample consists of 14 countries that have available data set[25].

LREER, denotes the multilateral CPI-based real effective exchange rate for the domestic country relative to its partner countries, expressed in logarithms. To compute LREER nominal spot rates are taken from Bloomberg. The real exchange rate is calculated using the consumer prices indices ratio taken from International Monetary Fund's International Financial Statistics (IFS). To calculate the real effective exchange rate weighted geometric average is used with time varying weights taken from BIS. Then, all these seven methods are applied to decompose LREER into permanent and temporary components.

To capture the effects of fundamentals three variables are used. Firstly, to proxy for PROD, the ratio of the domestic consumer price index to the producer price index taken from IFS relative to the equivalent foreign (trade weighted) ratio where the weights are those used to construct the effective exchange rates), expressed in logarithms is used. Then the effect of fiscal deficits is captured by using the term FISC, which is the domestic fiscal balance as a proportion of GDP and taken from Bloomberg. Finally, CAD which is the ratio of the domestic country's current account balance to GDP is taken from Bloomberg and Global Financial Data (GFD).

[24] Due to the limited data availability, especially fiscal balance, GDP and current accout we have to change the frequency of the data set from monthly to quarterly for this part of the analysis.
[25] The countries are Australia, Austria, France, Greece, Ireland, Italy, Korea, New Zealand, Norway, South Africa, Switzerland, UK and USA.

Two variables are used to capture the effect of commodity shocks. The terms of trade, LTOT, are constructed as the ratio of domestic export unit value to import unit value taken from IFS and GFD as a proportion of the equivalent effective foreign ratio, expressed in logarithms. ROIL is the real price of oil defined as the ratio of the nominal price of oil taken from World Development Indicators (WDI) to the domestic country's consumer price index, again expressed in logarithms. Finally, I use (IR) long-term real interest differential constructed using the domestic nominal bond yield which is taken from IFS, minus a centered 12 quarter moving average of the consumer price inflation rate minus the equivalent foreign effective.

The effect of all of these variables on permanent and temporary components of real exchange rate is summarized by the following equation which is driven by MacDonald (1998) and estimated with the available data;

$$\log(per\ or\ temp) = f(LPROD, FISC, CAD, LTOT, LROIL, IR) \qquad (10)$$

From the estimation of this equation I exante expect to find a significant long run relationship between the fundamentals and the permanent component while for the temporary component I expect to find not such long run relationship between these fundamentals.

2.4.3. Empirical Results

2.4.3.1 Test of Unit Roots

Before testing the hypothesis of no cointegration, it is important to determine the order of integration of the variables. Panel unit root tests that allow for heterogeneous intercepts and trends across individual members in tradition of Levin-Lin (1993) and Im, Pesaran and Shin (IPS) (1997) are used to test the null of non-stationarity. Different models are used to test this hypothesis; in the first model includes heterogeneous member specific trends and subtracts out common time effects, second model includes heterogeneous member specific trends and common time effects and third model excludes heterogeneous member specific trends and subtract out common time effects. The left tail of the normal distribution is used to reject the null hypothesis, thus the positive values and small negative values reported in Table 2 consistently fail to reject the null of unit root. On the other hand, the large negative values for the statistics indicate rejection of the null of non-stationarity.

There are four different statistics where the first two statistics are non-parametric rho-statistic; the last two are parametric ADF t-statistics that are used for robust estimation. Levin-Lin (LL) process tests the common unit root process under the null of non-stationarity. IPS test has the same null hypothesis of having unit roots as LL test. However, it assumes individual unit root processes. There are two major shortcomings of the LL test. Firstly, it relies on the assumption of the independence across units of the panel where a cross sectional correlation may be present (Barbieri, 2004). Secondly, autoregressive parameters are considered to be identical across the panel in this model. The IPS test which is a generalization of the LL test combines the evidence on the unit root hypothesis from the N unit root tests performed on the N cross-section units. As reported in Table 2.3, with different models and test statistics, the presence of unit root could not be rejected for some variables. Nevertheless, when the first difference of the variables is taken, it can be noted that all explanatory variables (LPROD, FISC, CAD, LTOT, LROIL, IR) and the permanent components of the decomposed exchange rates in all methods (PERBQ, PERBN, PERBK, PERCF, PERRWD) except for Hodrick Prescott and Butterworth

Filter, are found to have unit root, in all models and for all test results[26]. On the other hand, PERHP and PERBW are found to be unit root at both level and first difference. Thus, one cannot test the existence of their long run relationship with fundamentals. As expected temporary components of all decomposed series are found to be I(0)[27].

2.4.3.2 Test for Panel Cointegration

Prompted by the existence of unit roots, it is possible to continue with cointegration tests developed by Pedroni (1995, 1999). This technique improves other cointegration tests applied to a single country by allowing for heterogenous fixed effects and deterministic trends while pooling data to determine the common long run relationship. With a null of no cointegration, the panel cointegration test is essentially a test of unit roots in the estimated residuals of the panel. Pedroni (1999) developed seven test statistics to test the null of no cointegration between two variables. Of these seven statistics, the four are known as panel cointegration statistics; the three are group mean panel cointegration statistics. Based on Pedroni (1995) Monte Carlo results, Group-Rho statistics is used since it is the most conservative test for small panels. Large negative values for the statistics suggest rejection of the null of no cointegration. These statistics under different model specifications are reported in Table 2.4 for the permanent components of the models. The statistics for Model-1 and Model-3 suggest rejection of the null at 1% level only for the C-F Filter permanent component[28].

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[26] PERBQ is stationary when we include heterogeneous member specific trends and PERBK is found to be I(1) in the third model with IPS test statistic.
[27] TEMPCF is I(1) if we use Levin-Lin t-rho-stat in the first model. Thus we can also analyze the long run relationship between the fundamentals and temporary component of CF Filter.
[28] Model-2 does not subtract out common time effects; therefore, it rejects the null at 20% significance level.

Results suggest that the permanent component derived by C-F Filter is cointegrated in the long run with the fundamental determinants of the real exchange rate. On the other hand, there is not a strong cointegration between these fundamentals and other decomposed series of permanent components using different methods. Therefore, I conclude that for an economically meaningful decomposition of the exchange rate movements the C-F Filter should be used. The decomposition of exchange rate movements into two where the first component can be labeled as permanent are the movements generated by the fundamentals and the second component labeled as temporary are the movements specified to the speculative changes[29].

2.5 Conclusion

This chapter of the thesis investigates the link between macroeconomic fundamentals and the components of real exchange rate movements in order to determine the economically meaningful econometric method to decompose exchange rate. To test this relationship the first objective of this study is to empirically determine the sources of fluctuations in the exchange rates. In order to decompose the exchange rate movement seven different methods are explored: Blanchard and Quah, Beveridge Nelson, Hodrick-Prescott filter, Butterworth filter, Baxter and King, Christiano and Fitzgerald Filter and Unobserved Component Model in spirit of state space models.

The alternative decomposition results are compared through panel cointegration technique and it is concluded that the C-F Filter methodology should

[29] Based on LL test results for TEMPCF to be I(1), we investigate the co-integration relationship between the temporary component and fundamental determinants of the real exchange rate. From Table-3, it is seen that there is not a strong long-run relationship between temporary component of real exchange rate decomposed by C-F Filter and the fundamentals.

be used to decompose exchange rate movements into two economically meaningful components. Of these components the first is labeled the permanent component and is reflective of fundamentals and the second component is labeled the temporary component which is reflective of the unobservable factors. Thus we can identify the economic sense behind these econometric techniques and the C-F filter is the only econometric model that matches our ex ante economic expectation that the trend component reflects observable fundamentals whereas the cyclical component reflects unobservable shocks.

After determining the technique to use in order to decompose exchange rate, in the following chapter the link between the fundamentals and the components of the exchange rate in the short run is tested using the “Scapegoat Theory” of exchange rate. How the decomposition provides information that is suitable for the scapegoat theory is discussed in the next chapter.

CHAPTER III

A TEST OF THE SCAPEGOAT THEORY OF EXCHAGE RATE

The classical exchange rate theory tells us that the exchange rate is determined linearly by a set of fundamentals[30]. Contrary to this idea that there is linear and stable relationship between the exchange rate and a set of fundamentals, recent empirical evidence reaches a consensus that the relationship between fundamental variables in the economy and the exchange rate in the short and medium run is unstable. The presence of time varying parameters is found to be an explanation of this instability by Meese and Rogoff (1983a,b). Another explanation proposed by Bacchetta and van Wincoop (2004, 2011) is the scapegoat theory of exchange rate.

The name of the theory is reflective of the fact that financial market participants pick a single fundamental as the scapegoat that drives the exchange rate movements during period of significant liquidity movements that are caused by unobserved speculative trades. This scapegoat fundamental that is singled out is usually the fundamental that significantly diverges from its long-run behavior. Once market participants identify a fundamental as the scapegoat this leads to a change in the relationship between this fundamental and the exchange rate, breaking the stable

[30] See Taylor (1995) for a detailed discussion of the underlying theories and empirical tests of this argument.

and linear relationship between all fundamentals and the exchange rate. Empirical tests of the scapegoat theory are very scarce in the literature, given the difficulty in empirically identifying of the scapegoat factor.

In the only full-fledge empirical testing of the scapegoat theory, making use of survey of financial market participants as well as order flow data, Fratzscher, Sarno and Zinna (2012) are able to identify the two foundations of the scapegoat theory: the survey provides information on the variables that the markets view as diverging significantly from their long-run behavior, while the order flow data provides information on the unobserved speculative trade flows. In this seminal paper, they find supporting evidence for the scapegoat exchange rate theory that points to the importance of policy-makers taking into account the non-linear nature of the exchange rate. Such non-linear relationship between fundamentals and the exchange rate makes policy-making processes more difficult. Hence, further finding empirical tests of for the scapegoat theory, which is one possible contributor to the non-linear relationship between fundamentals and the exchange rate is of importance.

Given the difficulty of public access to such survey data and the order flow data, it is difficult for a wide range of market participants and policy-makers to identify scapegoat factors in a similar fashion. It is therefore of interest to find alternative indicators/measures that would allow capturing both of these factors that underlie the scapegoat theory that finds strong support in the analysis of Fratzscher et al (2012). The main idea is to seek alternative factors that would be easily accessible by analysts as well as market participants that are not large institutional investors, as well as policy-makers whose mandate is not to manage the exchange rate but is heavily affected by the evolution of the exchange rate and would be interested in better understanding the exchange rate market. In this chapter I seek to propose such measures, and using these measures further test the scapegoat theory.

To do so I go to the core of the scapegoat theory as defined by Bacchetta and van Wincoop (2004). While the exchange rate might move on account of changes in observed macro fundamentals, it can also move due to changes in unobservables. In the latter case, the market participants seek for an observable explanation to this movement, and usually attribute this change to the observed variable that have changed in large amounts and in the expected direction. This definition is consistent with the econometric decomposition of the exchange rate into two parts: one that moves with macro fundamentals, and one that does not move with fundamentals, or in others words moves due to unobservable factors. Such a decomposition of the exchange rate is carried out in the first chapter of the thesis using alternative econometric decomposition methods. The decomposition into a permanent and a temporary component where the former is found to have a relationship with observable macro fundamentals, while the latter is found to have no such relationship with the same observable macro fundamentals is the basis that renders this decomposition suitable for testing of the scapegoat theory.

The contribution of this part of the thesis is that such a decomposition is a tool that could easily be implemented by wide audiences, and makes use of publicly available data. Moreover, this alternative measure is also thought to be an encompassing one that could capture multiple dimensions of unobservable factors. Fratzscher et al (2012) use order flows data as a proxy for these unobservable factors. Given the possibility that the unobservable factors could include many more alternative items, testing for the validity of the scapegoat theory using a broader measure capturing these unobservable factors would reinforce the support for the theory. In short, making use of alternative indicators the validity of the scapegoat theory and its contributions to the performance of the econometric model is tested.

To analyze the scapegoat theory, a preliminary result for a set of countries suggests the scapegoat nature of the fundamentals should be taken into account since I have determined 65% of the countries' exchange rates are significantly affected by the scapegoat factors. Based on these individual country results that signal the existence of the scapegoat nature of the fundamentals, I further analyze this theory for Turkey in detail in this chapter. As a developing country with flexible exchange rate Turkey is an interesting country to analyze this theory. Specific to the Turkish case study, the findings of the analysis point to a strong and robust empirical support that when current account becomes a scapegoat, it has a statistically significant and theoretically expected impact on both nominal spot exchange rate return and permanent component of the exchange rate return.

The plan of this chapter is as follows: Section 3.1 discusses the scapegoat theory and the model; section 3.2 presents the data and the identified scapegoats, section 3.3 presents the model results and finally section 3.4 concludes.

3.1. Scapegoat Theory and the Empirical Model

The literature on the exchange rate has evolved in two stages. The first generation theoretical models namely the monetary model with flexible prices[31], the monetary model with sticky prices originally by Dornbusch (1976), the equilibrium model by Stockman (1980) and Lucas (1982), the portfolio balance model by Branson and Dale Henderson (1985), all explain changes in the exchange rate by the different sets of economic fundamentals (money stocks, inflation, interest rate, real

[31] See Frenkel and Johnson (1978) for the review of the monetary model studies with flexible prices.

GDP, etc.) linearly. While early empirical studies tended to be supportive of the first generation model, later studies rejected the linear relationship[32].

Recent empirical evidence reaches a consensus that there exists an unstable relationship between fundamental variables in the economy and the exchange rate in the short and medium run. The presence of time varying parameters is found to be an explanation of this instability by Meese and Rogoff (1983a,b) and subsequent literature by Meese and Rogoff (1988), Cheung and Chin (2001), Cheung et. al. (2005), Rossi (2006) and Sarno and Valente (2009).

Another explanation proposed by Bacchetta and van Wincoop (2004, 2011) is the scapegoat theory of exchange rate. Bacchetta and van Wincoop analyze scapegoat theory in a series of papers (2004, 2006, 2009 and 2011). These studies are different with respect to model assumptions but the main results are the same. Their results state that, under heterogeneous information, dynamic model, time varying or constant structural parameter model, when exchange rate changes due to an unobserved factor, to rationalize these movement agents give more weight to a fundamental that reveals a large variation from its mean which has theoretically expected direction with the exchange rate movement. Thus, this macro fundamental becomes a scapegoat for the exchange rate movement which is actually driven by the unobservable. This scapegoat effect reflects the unstable relationship between exchange rate and macro fundamentals.

In other words, when unobserved speculative trades are responsible for an exchange rate movement, agents do not know this movement is driven by unobserved factors and therefore blame an individual observed fundamental for this unexplained movement in exchange rate, thus making the fundamental a scapegoat

[32] See Taylor (1995) for a literature review about the theory behind the first generation models in detail and the empirical studies testing these models.

for the observed exchange rate changes. To select a fundamental as a scapegoat investors search the one with large changes that is in a consistent direction with the exchange rate movements. Once a fundamental becomes a scapegoat it has a larger impact on the exchange rate.

To test for the validity of the scapegoat theory I follow in the steps of Fratzscher et al's (2012) empirical analysis that makes use of both constant and time varying unknown parameter models. Parallel to earlier studies of Engel and West (2005), Bacchetta and van Wincoop (2011) derive the following first difference equation from standard formulation of the exchange rate as the present value of the future fundamentals, under the assumption of constant structural parameters:

$$\Delta s_t \cong \Delta f_t'((1-\alpha)\beta + \alpha E_t\beta) + (1-\alpha)b_t \qquad (1)$$

where s_t is the log nominal exchange rate, f_t is a vector of observed macro fundamentals, β is the vector of structural parameters, $E_t\beta$ is the vector of expected structural parameters, b_t is the unobserved fundamental and α is the discount factor.[33] This key equation reflects the main premise of the scapegoat theory, where the effects of a change in the observable macro fundamentals, Δf_t, on the exchange rate depend on both the structural parameters and the expected values of these parameters. This latter part regarding the expected values of the parameters is what captures the scapegoat effect of the fundamentals.[34]

The first derivative of the exchange rate with respect to the fundamentals allows examining this relationship:

[33] Equation (1) is derived in levels in Bacchetta and van Wincoop (2011), but in Bacchetta and van Wincoop (2009) they drive the equation (1) with first differences and state that both exchange rate and fundamentals are typically nonstationary in the data, so it is usual to consider the first difference. Thus, like Fratzscher, Sarno, Zinna (2012), we take the first difference of both sides. Thus, instead of levels we analyze the impact of the changes in the fundamentals on the changes in the exchange rate. By taking the first difference of the log of nominal exchange rate, the independent variable is the return of exchange rates.

[34] Depending on Engel and West(2005), since exchange rate is forward looking, α tends to equal to 1, therefore the effect of fundamentals on exchange rate almost depends on the expectations of the parameters.

$$\frac{\partial \Delta s_t}{\partial \Delta f_t} \cong (1-\alpha)\beta + \alpha E_t\beta) + \Delta f_t'\alpha \frac{\partial E_t\beta}{\partial \Delta f_t}$$

where the derivative depends on both the expectation of the structural parameters and the change in the expectations of the structural parameters in case of a change in the fundamentals. This states that the uncertainty of the parameters is effective in exchange rate modeling and some macro fundamentals may be attached additional weights at some time that makes the fundamental a scapegoat and influence the relationship between exchange rate and fundamentals.[35]

The contribution of the following analysis is actually in the proxy that is used for the unobservable fundamentals, b_t. In the first chapter, I use alternative time series tools to decompose the real exchange rate into a trend and a cycle component, finding that the trend component (which is labeled as the *permanent* exchange rate) is mainly related to the economic fundamentals whereas the cyclical component (which is labelled as the *temporary* exchange rate) is mostly unrelated with economic fundamentals, except for those asset prices which bear within them both information on other economic fundamentals as well as unobservable. An interpretation for the temporary exchange rate is that its main drivers are speculative factors. This identity reflecting this decomposition can be written as follows:

$$\Delta s_t = \Delta per_t + \Delta temp_t \qquad (2)$$

where s_t is the log nominal exchange rate, per_t is the permanent component of the exchange rate return driven from a fundamental change in the economy and $temp_t$ is the temporary component of the exchange rate return which is driven from speculative changes that cannot be explained by the fundamentals. Following the first chapter of the thesis the exchange rate movements are decomposed into its

[35] In this model the structural parameters are constant but agents can learn the true parameter over time. A more realistic assumption with time varying structural parameter is also analyzed by Bacchetta and van Wincoop (2009) study in which they can also derive the scapegoat effect.

permanent and temporary components using the Christiano-Fitzgerald (C-F) Filter, which specifies a particular quadratic loss function for discrepancies between the exact and approximate filter and a filter that eliminates very slow-moving (trend) components and very high-frequency (cycle) components is modeled. The results of the decomposition of the Turkish Lira are presented in Figure 3.1[36].

The following analysis is carried out using monthly Turkish data for 2003:M1 to 2013:M6. The starting date of the dataset is determined based on the fact that the Turkish economy stabilized in 2003, following the aftermath of consecutive economic crises, the latest having been experienced in 2001. The same period coincides with the changing of the exchange rate regime to one of floating, which has continued to be the case till today.

The empirical specifications to be estimated are formulated rewriting equations (1) and (2) making use of the decomposition of the exchange rate and the proxying of the unobservable by the temporary exchange rate, as follows[37]:

$$\Delta s_t = \beta \Delta \mathrm{f_t} + (\gamma_t \Delta \mathrm{f_t})\theta + \Delta \mathrm{temp_t} \rho + \mathrm{u_t} \qquad (3a)$$

$$\Delta \mathrm{per_t} = \beta \Delta \mathrm{f_t} + (\gamma_t \Delta \mathrm{f_t})\theta + \mathrm{u_t} \qquad (3b)$$

In these specifications γ_t is the scapegoat parameter that is formalized following the definition of Bacchetta and van Wincoop (2011). Furthermore, as a robustness check since I proxy the unobserved fundamental by the temporary component of the exchange rate, the difference between nominal exchange rate and temporary component gives us the permanent component as the dependent variable. Thus, I estimate the second equation taken the permanent component as a dependent variable.

[36] The fundamentals and the permanent component of the exchange rate derived from C-F filter has a long run relationship for Turkey.

[37] ρ coincides with the weight calculated to decompose exchange rate movements that we can derive the equation (3b).

In order to estimate the equation I have to determine the scapegoat parameter. In measuring the scapegoat parameter I follow the proposed definition by Bacchetta and van Wincoop (2004, 2011) that is empirically tested by Fratzscher et al (2012). A fundamental becomes a scapegoat when it deviates from its mean by a large amount and at the same time there is a large change in the unobservables, which in the following analysis is proxied by a large change in the temporary exchange rate. To scale, each fundamental is standardized to have a zero mean and unit variance. Thus, the deviation from its mean is actually equal to the standardized value of each fundamental.

For the first condition, I measure the observed fundamental change from its mean and I propose the following weight of each fundamental which considers as a share of this deviation of each fundamental from its mean in total deviations of the fundamental:

$$\omega_{it} = \frac{|(\Delta \mathrm{f}_{\mathrm{it}} - \bar{\mathrm{f}})|}{\sum_{\mathrm{i}=1}^{\mathrm{N}}(|\mathrm{f}_{\mathrm{it}} - \bar{\mathrm{f}}|)} \quad (4)$$

where $i = 1..N$ is the number of observed macro fundamental

For the second condition that states there will be large unobservable shock, I measure the share of temporary component change in the total change in nominal exchange rate.

$$\varphi_t = \frac{|\Delta \mathrm{temp}_{\mathrm{t}}|}{\Delta s_t} \quad (5)$$

To satisfy these two conditions I match each fundamental large change with the large change in the temporary component. I formalize this condition by generating the following identification function that takes 1 if both ω_{it} and φ_t are in the top 20, 30 or 40 quartile.

$$\gamma_{\mathrm{t}} = I_{\{w_{it}^q, \varphi_t^q\}} = \begin{Bmatrix} 1\ both\ \omega_{it}\ and\ \varphi_t\ are\ in\ their\ top\ q\ percent\ of\ the\ observation \\ 0\ otherwise \end{Bmatrix}$$

Therefore, by the identification function I can determine which fundamental at which point in time satisfies the necessary properties of becoming a scapegoat condition. For the sufficient condition the movements must be parallel to the theoretically expected sign that I analyze in the fourth section of the chapter.

3.2. Data and Potential Scapegoats

3.2.1. Data

Turkey as a developing country with floating exchange rate regime is used to test the scapegoat effect on USD/TRY. Monthly data starting from 2003M01 to 2013M06 are selected as the sample period. USD/TRY is the nominal spot monthly exchange rate which is taken from the Central Bank of Turkish Republic. I study the same fundamental variables in Fratzscher, Sarno, Zinna (2012) namely growth, inflation, interest rate, current account and equity flow are taken as the fundamental variables. Each of the macro fundamentals except for the current account and equity flow are measured as the difference with respect to US[38].

To obtain monthly data instead of growth rate of GDP I use industrial production yearly growth rate taken from OECD database. Inflation is yearly change in the consumer price index. Both data are obtained from the OECD database. Interest rate is 2 year fixed coupon payment benchmark bond yield. Data for Turkey is obtained from the Republic of Turkey Prime Ministry Undersecretariat of Treasury, while the US interest rate with the same maturity is obtained from Data Stream. Equity flow is the total of net portfolio and other investment in the balance

[38] For current account and equity flow, the difference with respect to US is not considered since the size of this difference is huge and break the relationship between these fundamentals and the USD/TRY.

of payment statistics. Both the equity flow and current account data are obtained from Central Bank of Turkish Republic[39]. The descriptive statistics for each variable can be seen in Table 3.1 and further description can be found in Appendix-C.

3.2.2. Potential Scapegoats

This section summarizes the potential scapegoats. Figure 3.2 shows each observed macro fundamental that satisfies the necessary condition for being scapegoat variable for different quartiles. For the sufficient condition, in the following section, I will test their relationship with the nominal exchange rate return.

The periods that current account carries the characteristics of becoming a scapegoat variable can be seen in the first row of Figure 3.2. Current account shows the potential of becoming a scapegoat in two different periods. Its evolution suggests that the 2002-2004 period and recent period after 2010 are periods during which the current account could become a scapegoat.

Industrial production growth with different quartiles is shown in the second row of Figure 3.2. It shows the potential of becoming a scapegoat when the difference between the growth rates of US and Turkey's industrial production both increases or decreases by large amounts. The periods that the industrial production could become a scapegoat do not display a specific pattern like the current account deficit. However, Turkey's experience of high economic growth between 2005 and 2008 renders industrial production movements a potential scapegoat.

[39] Both equity flow and current account is the yearly change of the twelve month sum of each variable. I adjust the sign of each growth rate i.e. the positive sign for the current account growth rate means that the growth rate of the current account *deficit* is increasing; the positive sign for the equity flow growth rate means, the growth rate of *inflow* to Turkey is increasing.

The periods that inflation has the potential of becoming a scapegoat can be seen in the third row of Figure 3.2. Inflation becomes a scapegoat mostly in 2003 and 2004. Inflation is selected as a scapegoat less frequently than the current account deficit and industry production. In the fourth row, it is seen that before 2008 interest rate has a potential of becoming a scapegoat when it decreases, after 2008 it has a potential if it increases and as a whole it is selected as a scapegoat mostly if the difference between the interest rate in Turkey and US decreases. Finally, the potential scapegoats of the equity flow are revealed in the last row of the Figure 3.2. Equity flow has the potential of becoming a scapegoat least frequently than the other variables for the top 20th and 30th quartile. However, for the top 40th quartile its potential as a scapegoat is frequent. Its potential as a scapegoat is frequent between 2002-2009.

Moreover, Table 3.2 reports the frequency of the identified fundamentals that satisfies the necessary condition for becoming scapegoat. This table shows us industrial production becomes a scapegoat more frequently than other macro fundamentals for each quartile. It is followed by current account at 30-quartile but the sequence changes in the 40 quartile that inflation has the second high frequency as a scapegoat. As we saw in Figure 3.2, current account has the potential of becoming a scapegoat in 2003, 2004, 2005, 2009, 2010, 2011 and 2012 in the top 40 quartile. It has not the potential of becoming as a scapegoat in 2006, 2007, 2008 and the first half of 2013. Industry never has the potential of becoming a scapegoat in 2003 and 2004 but after 2004 it has always the potential of becoming as a scapegoat. It has the potential of becoming mostly in 2005, 2006 and 2012 that we witnessed high growth performance of Turkey. Inflation has the potential of becoming a scapegoat in all years expect 20007 and 2011. 2003 and 2008 are the years when inflation has the potential of becoming as a scapegoat most frequently. Interest rate never has the potential of becoming a scapegoat in 2006, 2010 and 2011. Among the other years, it has the potential of becoming a scapegoat in 2003, 2005 and 2008. Equity flow is rarely has the potential of becoming for the top 20 and 30 quartiles but for the top 40 quartile it has the potential of becoming a scapegoat in all years expect 2009 and 2012. As a total of each fundamental, 2003 was the year that has lots of potential scapegoats at the top-20 and top-30 quartile and 2005 was the year that had lots of potential scapegoats at the top 40-quartile.

3.3. Empirical Results

In the first hypothesis of the study I claim that there exists a link between scapegoat parameters and the return of exchange rate. To test this hypothesis I estimate equations 3(a) and 3(b) with the constant parameter model assumption. The model results are reported in Table-3.3 and Table-3.4 respectively. Moreover, in Table-3.5 and Table-3.6 Bayesian estimation results are reported[40]. The dependent variable is the spot nominal exchange rate return in the Table-3.3 and Table-3.5 and the permanent component of the nominal exchange rate return in the Table-3.4 and Table-3.6. The reason why I estimate the equation 3(b) is simply because I also want to identify the individual impact of the scapegoat on exchange rate return. With this equation, I not only control for the temporary component's impact which is taken as an independent variable in the Table-3.3 but also prevent the omitted variable bias. This latter issue is raised by Fratzscher, Sarno, Zinna (2012), who state the importence of inclusion of the unobserved component in estimating the scapegoat theory. Results are robust to the dependent variable considered.

[40] See Appendix-D for further details of Bayesian estimation.

First of all, all the models with the OLS estimation support the scapegoat theory, as I find all the coefficient signs of the scapegoat parameters are theoretically consistent. The findings of the analysis point to a strong and robust empirical support that when current account, industrial production and inflation has the potential of becoming a scapegoat they actually become one at the top 20^{th} quartile since they have a statistically significant and theoretically expected effect on both the nominal spot exchange rate return and its permanent component. The sign of the coefficients β and θ are parallel in current account deficit and inflation. As we expect, an increase in current account deficit is associated with a depreciation of TRY. Like current account deficit, an increase inflation rate in Turkey would lead to a depreciation of TRY as suggested by the purchasing power parity. For industrial production, an expected sign was detected in the scapegoat parameter coefficient θ since we expect a decrease in USD/TRY if the growth rate in Turkey rises relative to US.

Although interest rate[41] and equity flow are found to have an insignificant impact, the sign of the coefficients are parallel to what we expect theoretically. Like industrial production the sign of the coefficient β and θ are different in interest rate. Interest rate coefficient as a whole has a positive impact on USD/TRY reflecting the forward premium puzzle but the scapegoat impact is negative parallel to the interest rate parity. This reflects that agents select the interest rate as a scapegoat if USD/TRY depreciates due to a speculative movement and at that time interest rate increases in Turkey relative to US. A negative sign for the equity flow reflects that an increase in the net equity inflow to Turkey is associated with a buying pressure of TRY thus the exchange rate depreciates. Although the scapegoat coefficients are

[41] Interest rate is found to have a significant effect at top 10th quartile that we do not report this result because the data at the top 10th quartile is scarce. However, this signals that interest rate impact as a scapegoat has a significant impact on exchange rate return if it changes by very large amounts.

insignificant for equity inflow and interest rate, the structural coefficients are found to be statistically significant.

Growth and current account as a scapegoat at the top 30^{th} quartile are found to have statistically significant impact on both nominal and permanent component of exchange rate return. The significance of inflation rate is lost in top 30^{th} quartile this reflects that inflation becomes a scapegoat and this has a significant impact on exchange rate if it deviates at a larger amount from its mean than the current account and industrial production. Finally, current account is also found to have a statistically significant impact on the nominal and permanent component of exchange rate return at the top 30^{th} quartile. This time industrial production as a scapegoat becomes insignificant. Like inflation the large variation of the growth rate from its mean should be higher than current account variation.

Thus, I conclude that even if current account deviates from its mean by smaller amounts than other macro fundamentals it is selected as a scapegoat by investors frequently. This reflects the fragile structure of the current account deficit in Turkey, as current account is found to be selected as the most internalized scapegoat among the other macro fundamentals.

The significance of the current account at the top 20 quartile is robust to the Bayesian estimation although the significance of the other variables is lost. Moreover the significance of current account is also not preserved in the top 30 and top 40 quartile for the Bayesian Results. Thus, based on the Bayesian estimation the results related to the importance of the current account as a scapegoat factor in Turkey is still valid. The difference is that Bayesian results conclude uniqueness in the scapegoat factor of the current account that also deviates by large amount from its mean.

I further analyze the model performance of the scapegoat theory and test the hypothesis that the inclusion of the scapegoat parameters improves the model performance. To test this hypothesis, I calculate the rolling adjusted R^2 statistics of the model with time varying coefficients in Figure 3.3. In the first left graph, I compare the rolling adjusted R^2 statistics of the model that incorporates both the temporary component and scapegoat parameters with the model that just includes the macro fundamentals. It is clearly seen that the scapegoat model including the temporary component strongly performs better than the other model. However, there are two reasons behind this huge discrepancy as I add two things i.e. the scapegoat parameters and the temporary component of exchange rate return. To identify the individualized scapegoat impact I only add the scapegoat parameters into the model and determine a strong impact of the scapegoats on model performance as reported in the first row right graph.

In the second column, I compare the scapegoat impact on model performance for the model that includes the temporary component. In this case the model with scapegoat parameters at the 20^{th} quartile do a similar job as the model without scapegoats but for the other quartiles the performance of the model is less than the model that takes into account only the temporary component impact. This reflects that once I incorporate the temporary component, the marginal impact of scapegoats will become smaller.

To investigate the scapegoat parameter effect on the model performance by controlling the unobservable component, in the second column right graph, I further estimate the model with permanent component as a dependent variable. This time scapegoat model with 20^{th} quartile performs better than the other model. For the other quartiles the performance decreases as they converge to the model without scapegoats with an inclusion of five additional explanatory variables. Therefore, similar to Fratzscher, Sarno, Zinna (2012), I conclude that models with scapegoat parameters perform better than the model that excludes the scapegoat impact. I conclude that the scapegoat structure of the exchange rate should be taken into account in exchange rate modeling and policy.

3.4. Conclusion

Bacchetta and van Wincoop propose the “scapegoat theory” of exchange rate in a series of papers (2004, 2006, 2009 and 2011). This theory states that when exchange rate changes due to an unobservable factor, since investors do not observe the reason behind this movement they blame an individual observed macro fundamental that deviates from its mean by a large amount and has a theoretically consistent direction of the movement with the change in the nominal exchange rate. This part of the thesis empirically tests this theory for Turkey by decomposing the exchange rate return into two components using the C-F filter. I proxy the unobservable factor with the temporary component and match the large variations in the temporary component with the large variations in the observed macro fundamentals. I select growth, inflation, interest rate, current account and equity flow as the observed macro fundamental variables in the economy. Thus, I can determine which macro fundamental becomes a scapegoat at each point in time.

After determining the scapegoats, I analyze their relationship with the exchange rate return. I find strong empirical support for the scapegoat theory. The results of the empirical model suggest that once current account deficit has the potential of becoming a scapegoat it actually does. Under these circumstances it has a significant impact on both the nominal and permanent component of nominal exchange rate return. This result is robust to the quartile selection. Moreover, inflation is found to have a significant impact at top 20^{th} quartile and growth is found to have a significant impact at 30^{th} quartile.

Thus, I conclude that during the 2000's current account is the most regarded scapegoat in Turkey especially when there is an unobservable movement in the exchange rate. This result is not surprising since the sustainability of the current account deficit is an important vulnerability in Turkey noted by analyst and market participants[42]. I further test the model performance of the scapegoat theory, and conclude that models with scapegoat parameters perform strongly better than the models that exclude the scapegoat impact. Therefore, I conclude that the scapegoat structure of the exchange rate has strong implication on in exchange rate modeling.

[42] See http://www.bbc.com/news/business-26610958, http://www.markit.com/assets/en/docs/commentary/markit-economics/2014/apr/EM_PMIs_03_04_2014.pdf

CHAPTER IV

IDENTIFYING THE RELATIONSHIP BETWEEN TRADE AND PERMANENT VS TRANSITORY COMPONENTS OF REAL EXCHANGE RATE

The relationship between exchange rate and trade balance has been an important issue in international economics since the adoption of the floating regime in 1973. After the beginning of floating exchange rate regime, numerous studies have analyzed the impact of currency depreciation on the trade balance. However, these studies find conflicting results.

The early studies that analyze the effect of exchange rate on trade flows focus on the impact of exchange rate volatility on the trade flow since the end of fixed exchange rate regime meant an increase of the volatility in the exchange rate markets. In both theoretical and empirical literature, numerous studies analyze this effect but the question of the effect of exchange rate variability on trade is still ambiguous. This point is underlined in a series of overviews of the literature; see McKenzie (1999), Taglioni(2002), Bahmani-Oskooee and Hegerty (2009), Ozturk (2006), Corig and Pugh (2010) and Auboin and Ruta (2013), among others.

After 2000, the focus has shifted towards the relationship between the level of the exchange rate (exchange rate appreciation/depreciation and currency misalignment) and trade flow. Depreciation is typically assumed to improve the trade account in the short run since, by allowing its own currency to lose value relative to those of other countries, a nation's exports which are now cheaper to foreigners increase; while at the same time imports from abroad which are now more expensive in the domestic market reduce. Therefore, the country's balance of trade increases due to the depreciation. There are two immediate effects of currency depreciation; namely the nominal depreciation results in a real depreciation and the rise in relative prices affects the volume of exports and imports. However, empirical findings on these text book effects suggest that these immediate effects depend on the specific characteristic of the economy.

When we look at the studies analyzing the relationship between exchange rate and trade balance, the twin concepts of the Marshall-Lerner (ML) condition and the J-S Curve phenomenon are compelled. According to the ML condition, the improvement in trade balance due to depreciation depends on whether the sum of import and export demand elasticities exceed unity. There are lots of studies empirically analyzing the ML condition and Bahmani-Oskooee and Niroomand (1998) and Bahmani-Oskooee and Kara (2005) are the most recent studies that provide an estimate of the ML condition using recent advances in time-series econometrics and reveal that the ML condition is not met. In other words, it is found that trade balance continues to deteriorate even if the sum of import and export demand elasticities exceed unity.

Next, since the impact of depreciation on the trade balance is not instantaneous, the studies' focus has shifted to the J-Curve phenomenon, the short run dynamics. The main contributing factors to this phenomenon can be explained by the lag structure in the time of consumers and producers response for the changes in exchange rates. Thus, devaluation creates a short-run deterioration in the trade balance, which will improve in the long run it will improve. Recent review articles by Bahmani-Oskooee and Ratha (2004) and Bahmani-Oskooee and Hegerty (2010) summarizes the main features of these studies and reveal that empirical support for the J-Curve theory is rather weak.

Furthermore, there are recent studies that analyze the impact of currency changes on export growth[43]. These studies differ with respect to countries they select. Fang et. al. (2006) analyses the impact of exchange rate depreciation on exports for Asian countries, Bernard and Jensen (2004) study the US, Arslan and van Wijnbergen (1993) focused on Turkish lira depreciation role on exports.

Some recent studies analyze the exchange rate misalignments namely the exchange rate that is above or below the equilibrium exchange rate. To measure the misalignment, studies use different approaches ranging from internal-external balance approach, to the behavior approach and permanent equilibrium approach. From the theoretical concept of the equilibrium exchange rate, some studies (Razin and Collins, 1997; Lee et al., 2008) use the definition of the equilibrium exchange rate. They measure the misalignment as the deviation from equilibrium exchange rate which is the level that both external (asset markets) and internal (productivity hypothesis advanced by Balassa-Samuelson (1964)) markets are balanced in the economy. Moreover, some studies (Rodrik, 2008; Freund and Pierola, 2012; Nicita, 2012) basically regress the real exchange rate on per capita income and the misalignment is simply the difference between the actual and fitted values.

A number of the studies have looked at the empirical relationship between exchange rate misalignment and exports. Some recent studies are Freund and Pierola

[43] See Auboin and Ruta(2013) for a detailed survey of literature.

(2012), Haddad and Pancaro (2010), Nicita (2012). These studies mainly have found that a currency undervaluation has a positive short term impact on exports, but the results are depending on the country characteristics.

Moreover, studies that analyze the relationship between exchange rate and growth have also underlined the trade impacts of currency undervaluation (Rodrik, 2008; Di Nino et al., 2011). These studies find that the undervaluation improves growth through expanding the exports.

Recent studies also looked at the exchange rate impact on disaggregated data by analyzing firm’s behavior to a currency appreciation or depreciation. Berman et. al. (2012), Chatterjee et al. (2012), Tang and Zhang (2012) examined how firms react to currency changes for French, China and Brazil respectively. These studies find that large and small firms react differently to the exchange rate changes i.e. the impact of a deprecation on large firms make them increase the mark up, on the other hand small firms change their import prices in case of a currency depreciation. Moreover, large exporters have higher shares in the total exports, thus these firm level studies reflect that the impact of depreciation on total trade flow will be rather weak.

Although there have been numerous papers examining the long run and the short-run relationships between the exchange rate and the trade balance, it is clearly concluded that the empirical evidence has been rather mixed, or inconclusive. This study on the other hand aims to bridge the gap by looking the components of exchange rate movements and claims that whether exchange rate impact on trade balance depends on the sources of exchange rate movements. In other words, measuring the effects of permanent and temporary movements on exchange rate may become an important issue in determining the relationship between the exchange rate and trade flows.

To decompose exchange rate movements from the analysis in the first chapter C-F Filter is used and the decomposed permanent and temporary components are derived. After decomposing exchange rate movements, their relationship with trade is analyzed through Gravity Model. By using the Gravity Model of trade, the effect of decomposed exchange rate movements on bilateral exports is examined by adding the permanent and temporary components into Gravity Model as new variables in a panel data analysis. Here the aim of the study is to test the significance of these variables, exante I expect to find a significant impact of the permanent component and an insignificant impact for the temporary component on exports.

The reason behind this expectation can be explained by the definition of these decomposed series. Since temporary component is the cyclical part of the exchange rate and they reflect the transitory changes in the exchange rate, the impact of these movements on real economy i.e. the international trade flows will be limited. In other words, these temporary movements in the real exchange rate will not be reflected to the trade contracts since these movements are quickly die without affecting the price levels in the long run thus they also will not influence the consumer and producer response to these changes in the exchange rate. However, if the change in the exchange rate corresponds to a change in the trend these movements affect the price level and will probably change the consumer and producer decisions.

To test this hypothesis, first, pooled Ordinary Least Squares (OLS) estimators are utilized to expose the relationship between the components of real exchange rate and bilateral exports. Then, different fixed effects are added into the model to account for the multilateral resistance terms. Silva and Tenreyro (2006) criticize the log-linearization of the empirical model in the presence of heteroskedasticity leading to inconsistent estimates and they show that in the presence of heteroskedasticity the standard methods are biased. They propose a simple Poisson pseudo-maximum-likelihood method (PPML) to overcome this problem. The PPML method provides a robust solution to different patterns of heteroskedasticity and they deal with the zeros that prevail in the trade data. As such, the fixed effects Poisson models with different specifications are estimated to test the relationship between the permanent and the temporary component of the real exchange rate.

Moreover, due to the possible simultaneity bias between bilateral exports, output and also the component of the real exchange rate, I instrument countries income levels and the component of the real exchange rate by their lagged values where I employ different models to solve the endogenity bias. The inertia in bilateral trade flows that is the countries that trade each other at time t-1 will tend to keep on trading at time t is also considered through Dynamic Gravity Model. The introduction of dynamics into the panel data analysis is modeled by using System Generalized Method of Moments as in Arellano-Bond (1991) and Arellano-Bover (1995) methodologies. Finally, IV-Poisson model that deals with both the zero trade problem and endogenity is estimated to have robust results.

In the empirical analysis, I find that there is no significant relation between temporary component whereas there is a strong and robust negative relationship with the permanent component of the real exchange rate and the bilateral exports. The results indicate that the reason behind the inconclusive results in trade and exchange rate relationship is the mis-measurement of the real exchange rate and if we take out the speculative movements in real exchange rate, the correct relationship between these variables can be easily identified. Therefore, the effect of a change in real exchange rate on trade volume depends on whether that change reflects a shift in trend or is just a transitory movement.

The plan of this chapter is as follows: the first objective is to explain the logical foundations of the gravity model, and then with its theoretical success I model our question through the use of gravity model and explain the data. Then the decomposed components of real exchange rate relationship between bilateral trade flows are analyzed in Section 4.2 with different estimation techniques. Finally, Section 4.3 concludes.

4.1. Gravity Model

In studying the empirical association between the permanent and the temporary component of real effective exchange rate and the international trade the following analysis will make use of the gravity model. The simply gravity model, which introduced into the field of international economics by Tinbergen (1962), is based on the Physics Gravity Law of Newton. The theory states that bilateral trade flows are positively related to the economic sizes of the two trading countries (measured by their respective GDPs) and negatively to the distance between these countries:

$$TradeFlow_{ij} = aGDP_i.GDP_j / D_{ij}$$

where $TradeFlow_{ij}$ is the bilateral trade flow from country i to j, GDP_i and GDP_j are the gross domestic products of country i and j, D_{ij} is the distance between the two countries and a is a gravitational constant depending on the units of measurement for mass and force.

The gravity models have now become the standard methodology in empirically studying the bilateral international trade patterns, especially given the increasing emphasis on its strong theoretical basis. Formal theoretical foundations of gravity models have been first provided by Anderson (1979). Bergstrand (1985, 1989) derives the model in reference to monopolistic competition; Deardorff (1998) derives it within a classical Heckscher–Ohlin framework with identical or CES preferences; Eaton and Kortum (2002) develop a Ricardian model of trade in homogenous goods; Haveman and Hummels (2004) have found that gravity model is consistent with incomplete specialization models; and recently Helpman et. al. (2008) develop a theory that predicts positive, as well as zero, trade flows between countries and accounts for firm heterogeneity, trade asymmetries and fixed trade costs. Anderson (2011) and Head and Mayer (2013) provide a detailed survey of the theoretical developments underpinning the gravity methodology.

The literature that makes use of the gravity model in empirical studying is surveyed in Anderson and van Wincoop (2004) and Bergstrand and Egger (2011). While many of these studies rely on the simple gravity framework a significant share of these studies further extend the model to include variables such as population (or income per capita), adjacency, common language and colonial links, remoteness, border effects, among others, in the regression analysis. The following analysis is based on such an extended version of the gravity model. In the next sub-section I discuss the data that is used in the analysis, for which the details are provided in Appendix C.

4.1.1. Data and Measurement

The bilateral trade flows data are obtained from the IMF, Direction of Trade Statistics. The income, population and land data are obtained from WDI, and variables including the distance among countries, the contiguity, common language and common colony are taken from the CEPII Mayer and Zignago (2011) dataset.

The most important independent variable in the following analysis is the decomposed series of real effective exchange rate. The technical details of the methodology to construct the permanent and temporary component used in this chapter is provided in Chapter 2 and following the findings, the real effective exchange rate is decomposed into permanent and temporary component by C-F Filter.

4.1.2 Model

The general form of the estimation specification is as follows[44];

$$lnX_{ijt} = \beta_0 + \beta_1 lnGDP_{it} + \beta_2 lnGDP_{jt} + \beta_3 lnDist_{ijt} + \beta_4 \ln \frac{PER_{it}}{PER_{jt}} + \beta_5 \ln \frac{TEMP_{it}}{TEMP_{jt}}$$
$$+\beta_6 lnPop_{it} + \beta_7 lnPop_{jt} + \beta_8 lnLand_{it} + \beta_9 lnLand_{jt} + \beta_{10} Contig_{ijt}$$
$$+ \beta_{11} ComLang_{ijt} + \beta_{12} ComCol_{ijt} + u_{ijt} \qquad \textbf{(4.1)}$$

where i denotes the exporting country and j denotes the importing country, X_{ijt} measures the total exports of country i to country j in millions of US dollars, GDP measures the respective country's Gross Domestic Product in millions of US dollars, $Dist_{ijt}$ measures the distance between country i and j in nautical miles, $\frac{PER_{it}}{PER_{jt}}$ is the ratio of the permanent component of real effective exchange rate and $\frac{TEMP_{it}}{TEMP_{jt}}$ is the temporary component of the real effective exchange rate that is decomposed by C-F Filter. The ratio of these components of real effective exchange rate that measures

[44] Anderson and van Wincoop (2003) show that bilateral trade is determined by relative trade costs and it is crucial to control these multilateral resistance terms in estimating gravity model. Therefore, following the literature, given the difficulty of obtaining the relevant price indices that would allow calculating such trade resistances, I include different cases of fixed effects. This inclusion is standard procedure in the literature; Feenstra (2004) and Baldwin and Taglioni (2006) have shown that including such fixed effects provides similar results to those of Anderson and van Wincoop (2003). The inclusion of these fixed effects results in the dropping some variables from equation 4.1.

the bilateral value of the currency in exporting country *i* relative to the importing country *j* is added into the model. *Pop* is the population, *Land* stands for land area, $Contig_{ijt}$ is the dummy that takes the value 1 if exporter *i* and importer *j* are contiguous and zero otherwise, *ComLangijt* is the dummy with value 1 if exporter *i* and importer *j* share a common language and zero otherwise, and finally $ComCol_{ijt}$ is the dummy with value 1 if both have had a common colonizer after 1945 and zero otherwise.[45] u_{ijt} is the log-normally distributed disturbance term.

Based on the gravity model ex ante I expect to find the coefficient of the exporting and importing countries' income to be positive and that of the distance between these two countries measure to be negative. The sign for the permanent and temporary component will be negative as we expect a depreciation of a currency increases the exports of that country. These variables are used to test the hypothesis whether exchange rate movements as movements driven by the fundamentals and movements driven by the unobservables have an effect on trade. Here, our claim is movements that are specific to fundamentals may have a significant effect on bilateral trade volumes, whereas speculative movements, which have a transitory effect on the exchange rates, may have an insignificant effect on bilateral trade volumes.

The population variable is expected to represent the country's potential supply and demand for exports and imports respectively. A country with a large population can much easily specialize in a wide range of commodities and, consequently, may be less dependent on foreign trade leading to a negative coefficient. Alternatively, if the demand factors are dominant the variable might result in a positive effect on exports.

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[45] See Mayer and Zignago (2011) for further details.

Land variables are assumed to have negative influence on trade. The larger a countries' total area, smaller the fraction of its economic activity that is expected to cross borders and higher the probability of it becoming a relatively closed economy. Finally, three dummy variables that shed light on the circumstance of being a neighbor, sharing a common language or having been colonized by a common country are respectively included in the model. The coefficients of all three dummy variables are expected to be positive as their existence will increase the level of bilateral trade.

Table 4.1 summarizes the expected signs of the coefficients in light of alternative theories.

4.2. Empirical Results

4.2.1. Static Panel Gravity Equation

First of all, in testing for the presence of permanent and temporary components of real exchange rate effect on bilateral trade, equation (4.1) is estimated by OLS in different model specifications. The results are reported in Table 4.2 where the dependent variable which is the total exports of country *i* to *j* is estimated for 1994M01-2012M12 period. Firstly, pooled Gravity Model with the components of real exchange rate is reported in column (1) of the Table 4.2. As theoretically expected, income of these two countries and the distance between them show statistically significant and theoretically expected signs. The coefficients of the population of both countries are found to be positive and significant. Land variables have significant coefficients with expected negative signs. All three factors capturing the contiguity of the two countries, as well as common cultural features such as a shared history or shared language, are found to positively and significantly explain bilateral export patterns.

The main question of interest in this analysis is to test the association between the bilateral trade and the permanent - temporary components of the exchange rate. With this first specification, it is found that there is not a statistically significant relationship between neither the permanent nor the temporary components of the real effective exchange rate and the bilateral exports[46]. The model is improved through the addition of time dummies in the second column but the results change only slightly[47]. The sign of the coefficient of the temporary component becomes negative but it has still insignificant impact.

Up to now, as Anderson and van Wincoop (2003) found all the coefficients are biased due to the omission of the multilateral resistance terms but I take this into account in the following columns through considering different country fixed effects (Feenstra, 2004 and Baldwin and Taglioni, 2006). In the third column, the model with both exporter and importer fixed effects in addition to time fixed effect is reported. With the inclusion of these fixed effects the coefficient of the permanent component becomes significant. On the other hand, the impact of the temporary component is still found to have an insignificant impact. In the fourth column, including pair dummies along with the time dummies does not change the result of the previous model.

Finally, in the last column time varying exporter and importer fixed effects[48] with pair fixed effect are included into the model. With this model specification, all of the variables are dropped from the model since they are perfectly collinear with

[46] The Variance Inflation Factor (VIF) scores, which test multicollinearity, are lower than 10 (with an average of 2.09) supporting that there is no multicollineraity problem.
[47] Including time fixed effect, we can prevent the bronze medal mistake that Baldwin and Taglioni (2006) define as the inappropriate deflation of trade flows.
[48] In a panel setting, the theoretical specification maintains the inclusion of time varying exporter and importer fixed effects.

the included fixed effects. To determine the impact of the permanent and temporary component of the real effective exchange rate on trade flows I propose two new variables that are driven by the multiplication of the permanent component and the temporary component with the distance. With this parameter, I can generate a time varying dyadic variable that can be estimated with the inclusion of the time varying exporter and importer fixed effects along with the dyadic fixed effects. Here, I claim that the impact of currency movements on bilateral trade flows will be different in terms of the distance between the trading countries. In other words, the impact of currency depreciation will be much more on the exports to a country near the exporting country than a country which is remote from the exporting country. With this claim, I expect a negative sign for the coefficients and as I expect both permanent and the temporary component interacted with the distance are found to have a negative impact on exports. Moreover, the permanent component interacted with the distance has a significant impact on the exports.

While all results remain the same with the inclusion of different types of fixed effects, which possibly include trade resistances alongside many country- and pair-specific factors, it is seen that the permanent component of the real effective exchange rate has an influential factor in the country's export performance, however the temporary component does not affect the export performance. In short, these results show that appreciation in a country's currency that is driven by the fundamentals negatively contributes to that country's exports. However, if the appreciation is a result of a speculative currency trade, it does not affect the country's export performance.

4.2.2. Zero Trade

Silva and Tenreyro (2006) criticize the log-linearization of the gravity model in the presence of heteroskedasticity that leads to inconsistent estimates and they show that in the presence of heteroskedasticity the standard methods can severely bias the estimated coefficients. They propose a simple Poisson pseudo-maximum-likelihood method (PPML) to overcome this problem. The PPML method provides not only a robust solution to different patterns of heteroskedasticity but also a natural way to deal with the zeros that prevail in the trade data. In Table 4.3, models that consider the zero trade problems with different specifications are estimated.

Like in the previous table, as a preliminary step, I present the results with the estimation of the PPML and PPML with time dummies in the first and second column of the table respectively. Different from the previous table, the permanent component has a significant impact on the international trade. On the other hand, the temporary component is statistically insignificant. All other variables are found to be statistically significant.

To consider multilateral resistance terms, exporter and importer fixed effects with the time dummies are considered in Column (3) and paired fixed effects with time dummies are considered in Column (4). The significance of the permanent components remains same in these two models. However, different from the previous results, once the paired fixed effects are included into the model, the temporary component becomes a significant positive impact on bilateral exports. This result can be explained by the J-curve that the effect of a transitory change in exchange rate on the trade flow initially creates a short-run deterioration in the exports. Moreover the unobserved reasons behind the exchange rate depreciation may create uncertainty in the economy that affects the export performance negatively.

Instead of the Poisson specification, in the fifth column negative binomial model with paired and time fixed effects is presented. Although it is known that other count data models like negative binomial are not adequate to estimate gravity model, i.e. negative binomial regression models are not invariant to the scale of the dependent variable, I just report this model as a robustness check and it is seen that our result are still valid even if I consider the negative binomial regression models.

Finally, in the last column I report another specification proposed by Helpman et. al. (2008) taking into account the selection bias and firm heterogeneity. Only the second step estimation results are reported. In the first step, a panel probit model with importer and exporter fixed effects along with time dummies is estimated[49]. From this step I obtain the predictions of firm heterogeneity (ZHAT) and selection bias (INVMILLS) that I use in the second step estimation that includes importer and exporter fixed effects. The important result of this model confirms the Helpman et. al (2008) results that firm heterogeneity (ZHAT) and selection bias (INVMILLS) have a significant impact on the export performance. The coefficient of the permanent component has also a significant negative impact on export. Different from previous findings, here temporary component is also found to have a significant negative impact on trade flows. An important drawback of this model is that through the estimation of the nonlinear system, time fixed effects are not incorporated into the second step estimations, thus this will be the reason why the temporary component is found to have a negative significant impact.

[49] This model proposed by Helpman, et. al (2008) is applied on a crossection and confirms the importance of firm heterogenity and selection in analyzing the international trade. To take into account these features we apply their framework on a panel setting. However, adapting the approach in Helpman et.al. (2008) to a panel setup is not obvious. Here, we follow Whitten(2012) study to estimate the model.

4.2.3. Endogeneity

Since international trade flows form a significant part of GDP, which is one of the regressor of the equation, there may be a causality problem in the estimation of the gravity model leading to the previous model's coefficients to be inconsistent. Moreover, it is also possible that international trade flows and these components of the exchange rate have reverse causality. To control for such problems, in columns (1) and (4) of Table 4.4, I use the instrumental variable technique with different specifications in estimating the gravity equation. I select lagged GDP variables and lagged permanent and temporary components as possible instruments, according to Hansen's J-statistics. The first-stage regressions F-statistics are quite high, signaling that the instruments are highly correlated with the independent variable GDP and these components, and that they support the validity of instrument choices.

In the first column, OLS results of the IV estimation with paired and time fixed effects are reported. The main results of the analysis also prevail when overcoming the endogeneity biases, where a country's exports are negatively associated with the permanent component of the exchange rate however the temporary component has not a significant impact on the bilateral trade between these two countries. In the second column, GMM results for the two step IV estimation having similar results with the OLS are presented.

Moreover, the inertia in bilateral trade flows that is the countries that trade each other at time *t-1* will tend to keep on trading at time *t* is considered through Dynamic Gravity Model in the third column of the table. Since the regressors are not strictly exogenous that are correlated with past and possibly current realizations of the disturbance term, Ordinary Least Squares (OLS) estimations would create biased estimates (Bond, 2002). Therefore, the introduction of dynamics into the panel data analysis is modeled by using System Generalized Method of Moments (SGMM) as in Arellano-Bover (1995) and Blundell-Bond (1998) methodologies.

In practice, very remote lags are unlikely to be informative instruments and to check the validity of instruments; I use the Hansen's J test of over identifying restrictions[50]. I estimate system GMM including country and time dummies and in all GMM estimations, two-step procedure is applied.[51] I estimate the gravity equations with GMM using optimal weighting matrix. This optimal weighting matrix makes two-step GMM asymptotically efficient. In order to verify that the error term is not serially correlated, m_1 and m_2 statistics are included as tests for first and second order serial correlation.

In the third column, parameter estimates for the Dynamic Gravity equation are presented. Before concentrating on the economic implications of the estimation results two specification tests should be checked in order to make sure GMM results consistency. The first one is that the idiosyncratic error of the estimators be serially uncorrelated. In other words, the null of no autocorrelation at order one should be rejected but for higher orders of the residuals it should not be rejected. The test for the System GMM estimator is presented as statistics *m1* and *m2* in Table 4.4, showing the required results. Moreover, it should be noted the Hansen's J statistics should accept validity of the instrument set. In this System GMM estimation, the instruments for the level equations are specified in addition to the instruments for the first differenced equations.

The results of this model is parallel to our previous results that can be summarized as follows: the permanent component of the real exchange rate has a

[50] Different from Sargan, Hansen tests are robust to heteroscedasticity, albeit they are vulnerable to instrument proliferation (Roodman, 2006, 2008).
[51] For comparison, one step procedure is also applied. The results give consistent results, thus they are not tabulated in the study.

significant negative effect on this country's export on the other hand, the impact of temporary component of the real exchange rate on the bilateral exports is statistically insignificant.

Finally, in the last column both endogenity bias and the zero trade problems are taken into account with the estimation of the Gravity Model through IV-Poisson regression model. Overall, regardless of the estimation technique, the permanent component of the real exchange rate is shown to contribute negatively to the extent of bilateral trade between two countries. In other words, all these regressions results point to a very robust negative relationship among the permanent component and the exports. On the other hand, the impact of temporary component of the real exchange rate on the bilateral exports is statistically insignificant. Therefore, it can be concluded that the effect of a change in real exchange rate on trade volume depends on whether that change is driven by a shift in fundamentals or is just driven by a transitory movement.

4.3. Conclusion

When we look at the literature that analyzes the relationship between exchange rate and trade flow, it is seen that there exist a gap to uncover a link between the exchange rate and trade flow. However, after the beginning of floating exchange rate regime, numerous studies have analyzed the impact of currency depreciation on the trade balance and in the literature of exchange rate and trade relationship, these studies find conflicting results.

Thus, following the first chapter, C-F filter decomposed exchange rate movements are added into Gravity Model and it is found that the permanent component of real exchange rate is effective on trade. On the other hand, the temporary component of the real exchange rate is found to be insignificant. Therefore, it can be concluded that the effect of a change in real exchange rate on trade volume depends on the sources of this change and identifying these sources of variation in exchange rate is important in determining this relationship.

CHAPTER V

CONCLUSION

This thesis aims to understand the movements of exchange rate movements. Following Engel and West (2005) definition of exchange rates that they work with an asset pricing model in which exchange rate is defined as a linear combination of observable fundamentals and unobservable shocks I decompose exchange rate with alternative methodologies and I am able to determine the part of the exchange rate named as the permanent component that is driven from the fundamental changes in the economy and the temporary component that is driven by the speculative trades. From this decomposition the relationship between the fundamentals and the decomposed series in the long and short run is analyzed. Furthermore, the impact of these decomposed series on international trade tested with Gravity Model. From this analyzed there important conclusions are achieved.

i) with different decomposition techniques and the corresponding test to compare their results, we can understand the exchange rate movements better and the economic sense behind these methodologies.

i) the decomposition has enabled us to test the scapegoat theory of exchange rate empirically by proposing a measure to identify the scapegoats with a publicly available data.

ii) the impact of a currency depreciation on trade flows depends on whether the change in the exchange rate is driven by the fundamentals or is just a transitory movement.

Up to this point the thesis reaches these conclusions but several further analyses remains. For example, how does trade in different sectors react to the change in exchange rate? Investigating the sectoral differences in order to identify the aggregation bias is important. Moreover, to determine the differences in sector's reaction to a change in the exchange rate components rather than the exchange rate as a total will change the policy recommendations since the sectors sensitivity to these components will be different. Ex ante one could expect that there may exist sectors that are affected by a permanent change in the exchange rate while others are affected by the temporary shifts in the exchange rate.

Some preliminary results for this future work is provided in Table 5.1, these preliminary evidence supports the ex ante hypothesis of sectoral differences. In the following section the details of the study are summarized. Depending on these preliminary results, in the future, I also plan to calculate the sectoral real effective exchange rate to test their relationship between the trade flows. Furthermore, firm reactions to these changes in the exchange rates in Turkey have not been answered yet in the literature. The firm level data set in TurkStat can be used to test these further questions in the future work.

5.1. Sectoral Analysis

Until the mid-2000's studies mostly analyze the impact of exchange rate changes on aggregate imports and exports. However, recently studies looks more closely at how sectors react to a change in the exchange rate. At the bilateral level, we conclude that the impact of the currency depreciation on exports depends on whether this depreciation is a reason of a fundamental change in the economy or a reason of a transitory change in the exchange rate. Similar to the literature, at this stage I further analyze this question by investigating the sectoral differences in order to identify the aggregation bias.

To address this question I follow the same model in equation 4.1 with a sectoral level data set. The bilateral sectoral trade flows are obtained from the Trade Map database on HS-6 digit for 50 countries[52] between 2003-2012 periods. HS-6 digit data is summed to 44-GTAP sectors[53] according to the concordance tables. For the other variables the same data set in Chapter-4 [54] with a yearly frequency is used.

To determine the sectoral differences I analyze the association between the bilateral trade and the components of the exchange rate for each individual sector with paired fixed effect PPML method. To test the sectoral sensitivity, each sector dummy variable is interacted with the permanent and the temporary component and their sign and significance are reported in Table 5.1.

For the most of the sectors it is clearly seen that there exists a negative significant impact of the permanent component on bilateral exports with this disaggregation of the data. Only some industries that have inelastic demand like coal,

[52] Argentina, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, China, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Korea, Rep., Latvia, Lithuania, Malaysia, Mexico, Netherlands, Netherlands, New Zealand, Norway, Peru, Poland, Portugal, Romania, Russian Federation, Saudi Arabia, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, United Arab Emirates, United Kingdom, United States, Venezuela.

[53] The sectors are listed in Apendix-C

[54] For further details see Appendix-C.

other meat product, dairy products, oil seeds and processed rice show a significant positive sign. If we look at the magnitude of the coefficients, these permanent changes in the exchange rate are found to have changed the export performance by a large amount in forestry, raw milk, minerals and plant based-fibers.

For oil seeds, plant based fibers, fishing, coal, oil, other meat products, processed rice and ferrous metals industries temporary component is found to have a significant negative effect on exports however, other cereal grains, other crops, raw milk, beverage and tobacco, textile, leather products, paper product, chemical, other mineral products, metal products, motor vehicles, transport equipment, other machinery and equipment react to the transitory changes in the exchange rate with a positive significant sign. This positive sign can be explained by the J-curve phenomena that a transitory depreciation in exchange rate has worsened the exports. Moreover, the speculative changes in the exchange rate create uncertainty in the economy that affect the export performance negatively.

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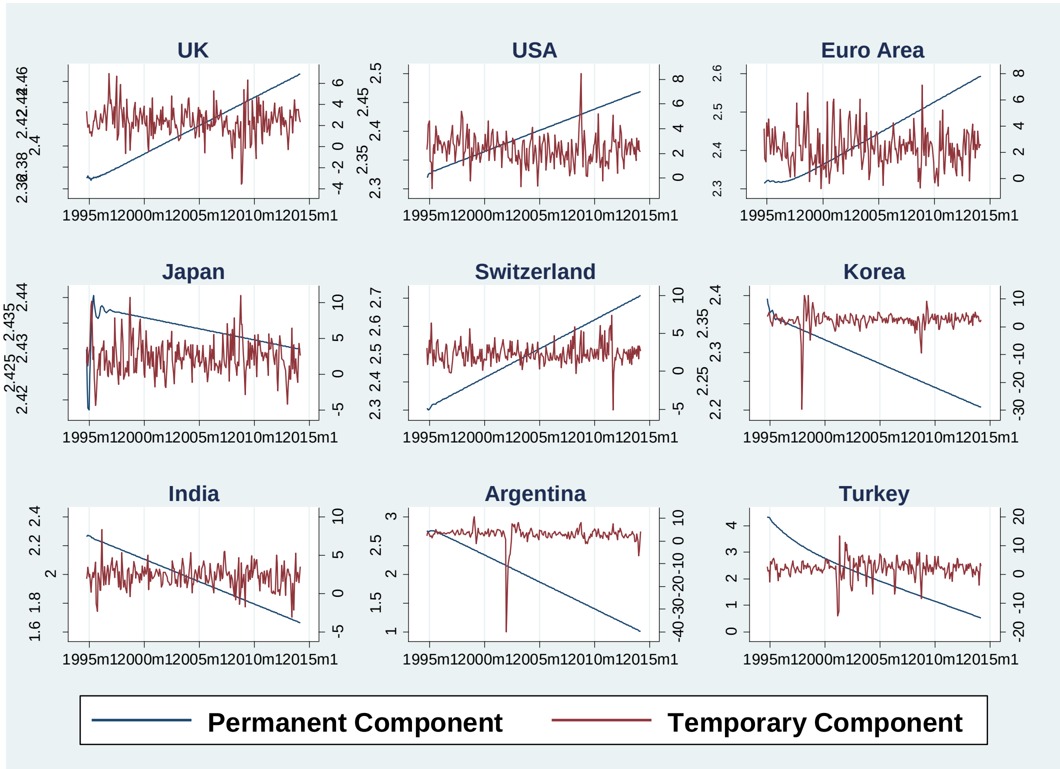
APPENDICES

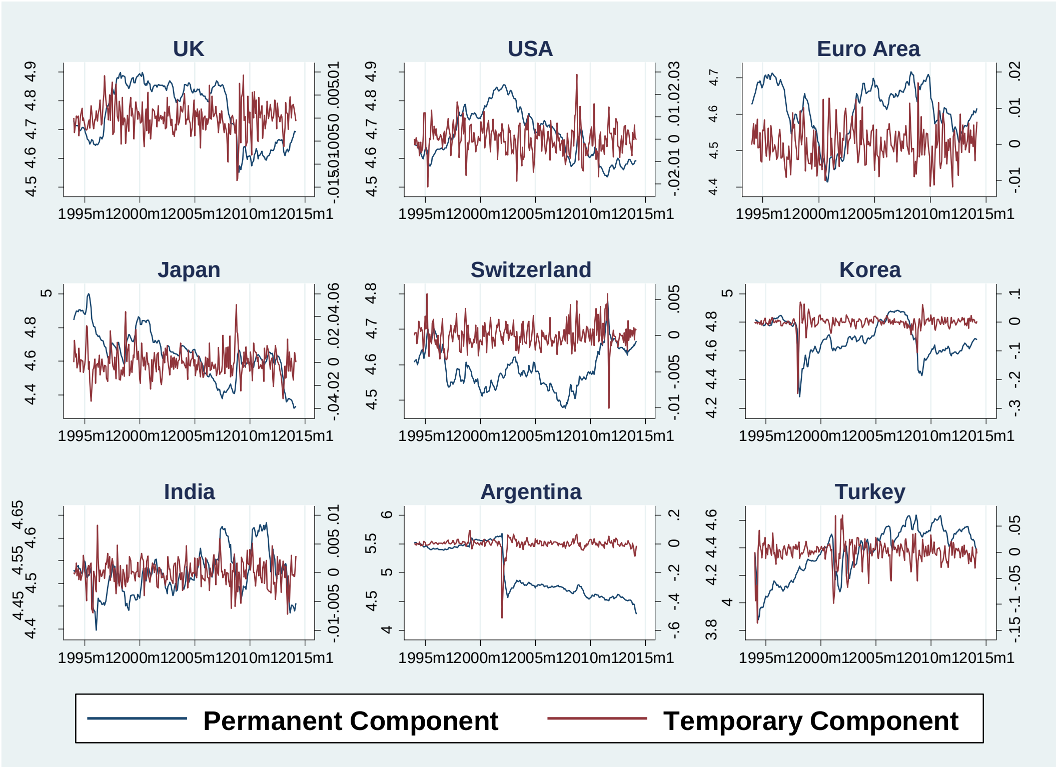
APPENDIX A

Figure-2.1: B-Q Result for Selected Currency Examples



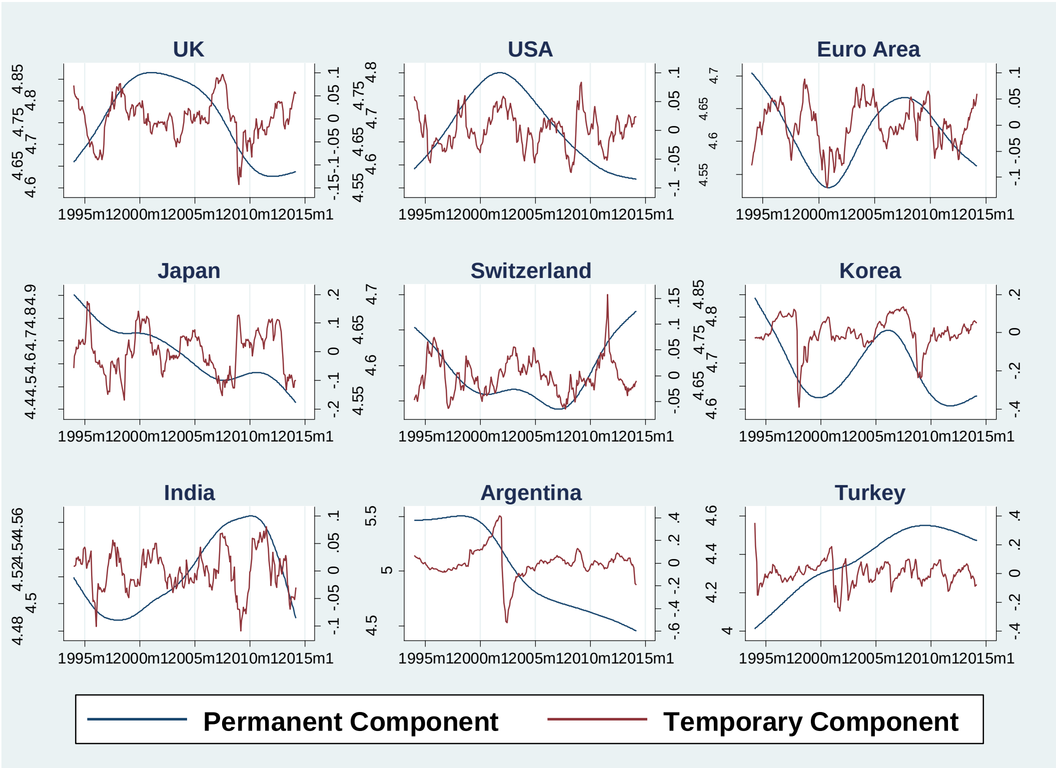
The figure shows the decomposed series using Blanchard Quah Decomposition summarized in the section 2.1. for nine currencies: UK, USA, Euro Area, Japan, Switzerland, Korea, India, Argentina and Turkey. The sample spans the period from January 1994 to December 2013.

Figure-2.2: B-N Result Country Examples



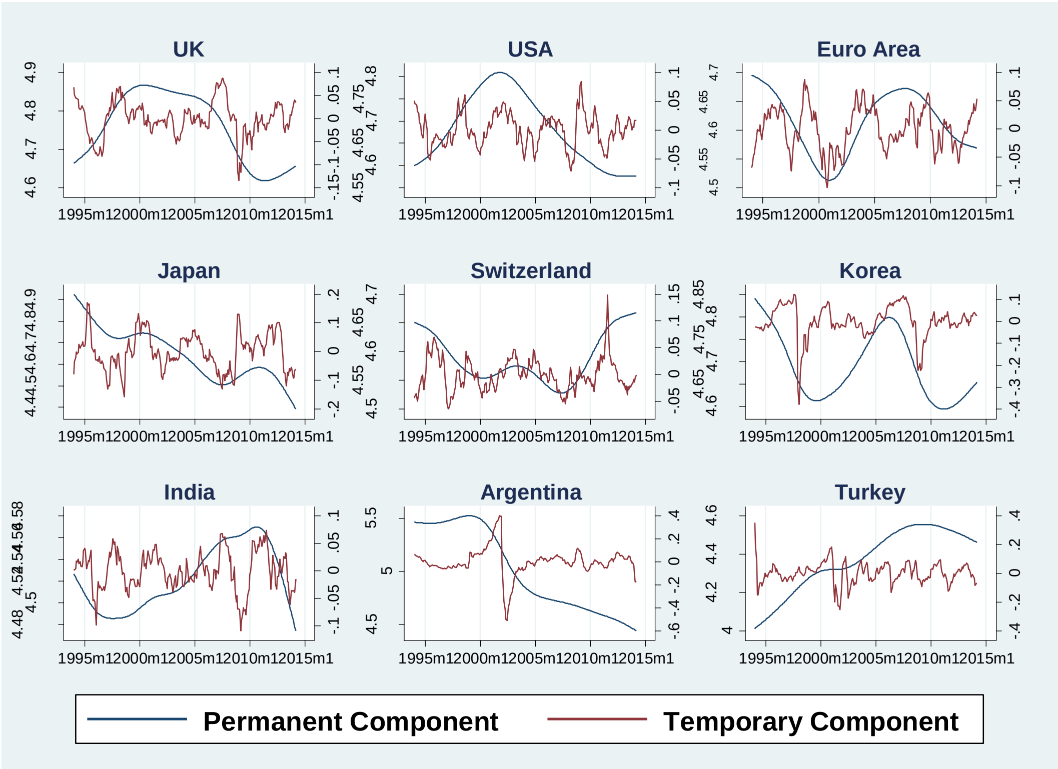
The figure shows the decomposed series using Beveridge Nelson Decomposition summarized in the section 2.2. for nine currencies: UK, USA, Euro Area, Japan, Switzerland, Korea, India, Argentina and Turkey. The sample spans the period from January 1994 to December 2013.

Figure-2.3: H-P Result Country Examples



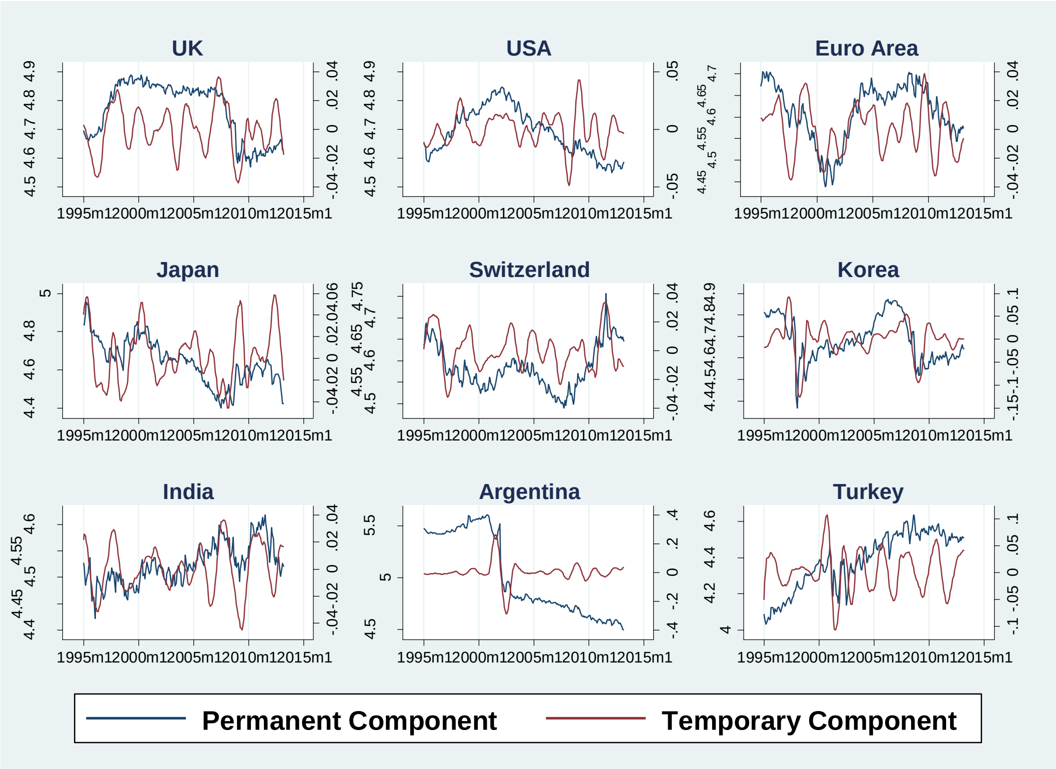
The figure shows the decomposed series using Hodrick Prescott Decomposition summarized in the section 2.3. for nine currencies: UK, USA, Euro Area, Japan, Switzerland, Korea, India, Argentina and Turkey. The sample spans the period from January 1994 to December 2013.

Figure-2.4: B-W Result Country Examples



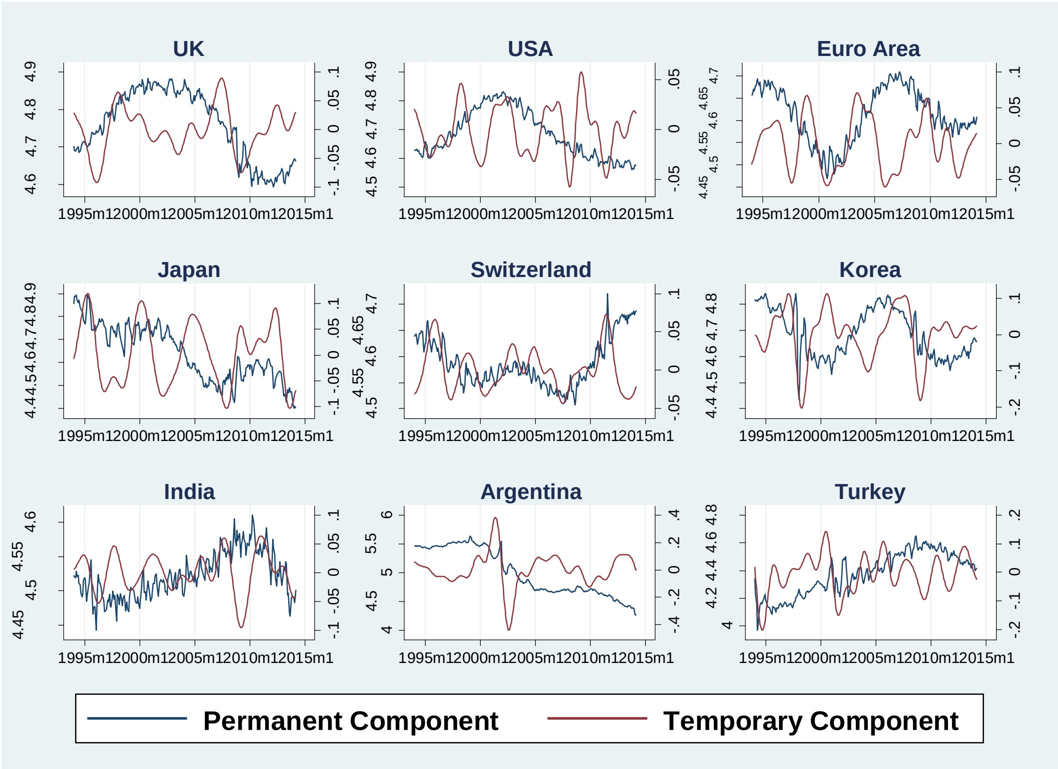
The figure shows the decomposed series using Butterworth Filter summarized in the section 2.4. for nine currencies: UK, USA, Euro Area, Japan, Switzerland, Korea, India, Argentina and Turkey. The sample spans the period from January 1994 to December 2013.

Figure-2.5: B-K Result Country Examples



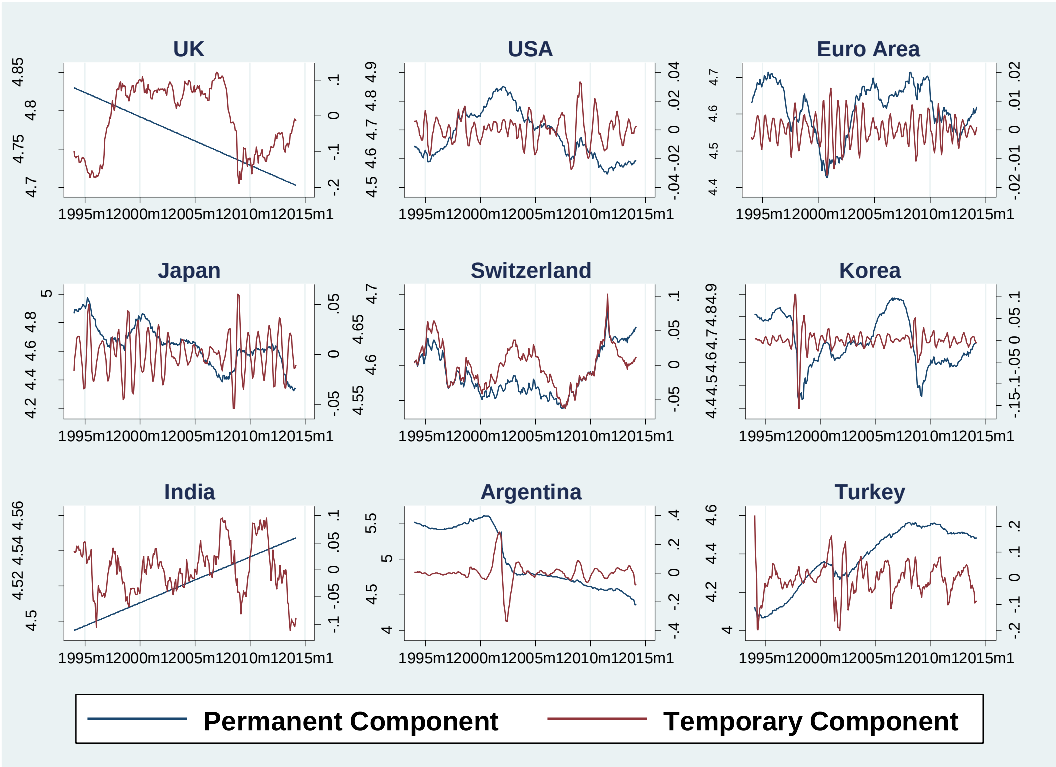
The figure shows the decomposed series using Baxter and King Decomposition summarized in the section 2.5. for nine currencies: UK, USA, Euro Area, Japan, Switzerland, Korea, India, Argentina and Turkey. The sample spans the period from January 1994 to December 2013.

Figure-2.6: C-F Result Country Examples



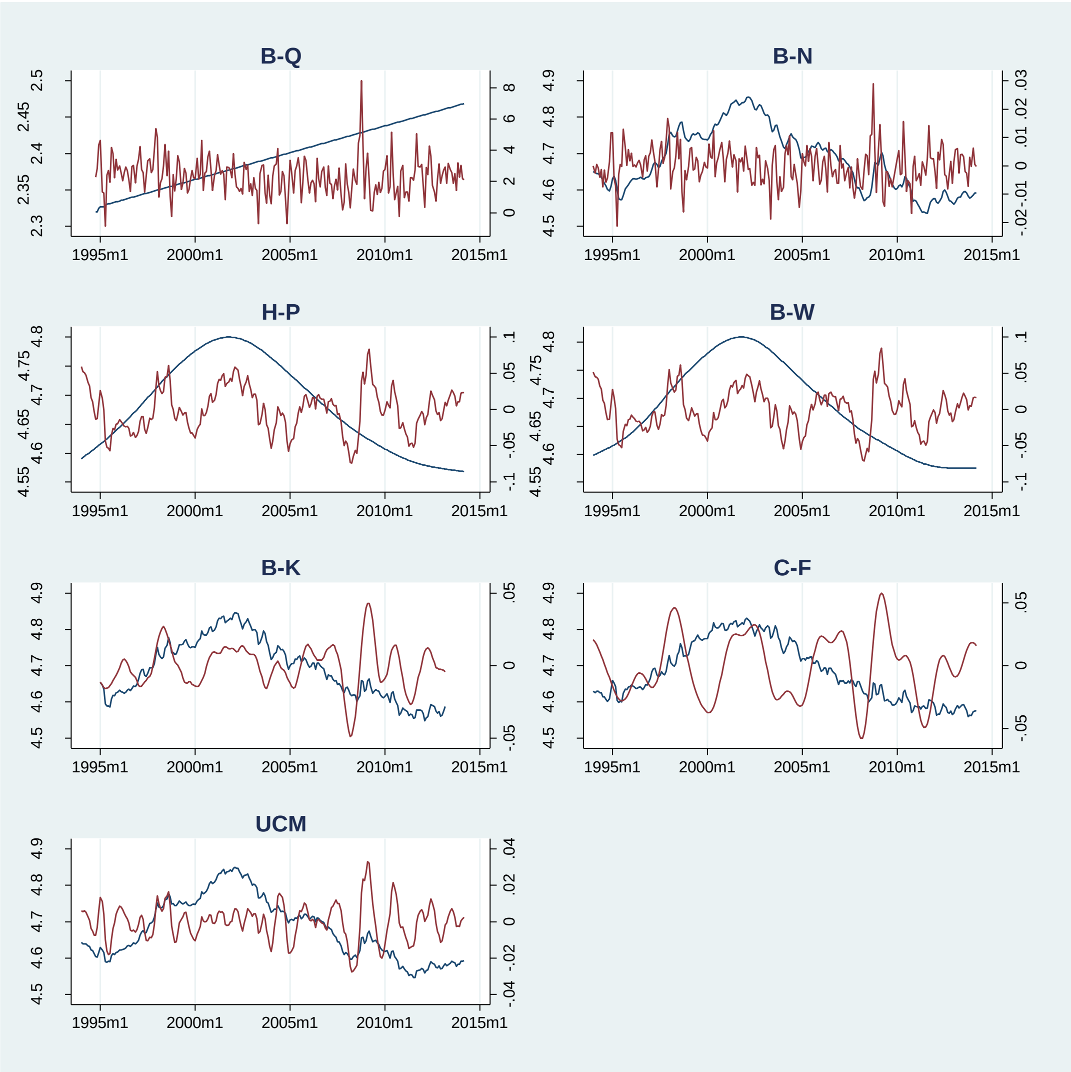
The figure shows the decomposed series using Christiano Fitzgerald Filter summarized in the section 2.6. for nine currencies: UK, USA, Euro Area, Japan, Switzerland, Korea, India, Argentina and Turkey. The sample spans the period from January 1994 to December 2013.

Figure-2.7: UCM Result Country Examples



The figure shows the decomposed series using Unobserved Component Model with random walk with drift specification summarized in the section 2.7. for nine currencies: UK, USA, Euro Area, Japan, Switzerland, Korea, India, Argentina and Turkey. The sample spans the period from January 1994 to December 2013.

Figure-2.8: Comparison of Results: US Case

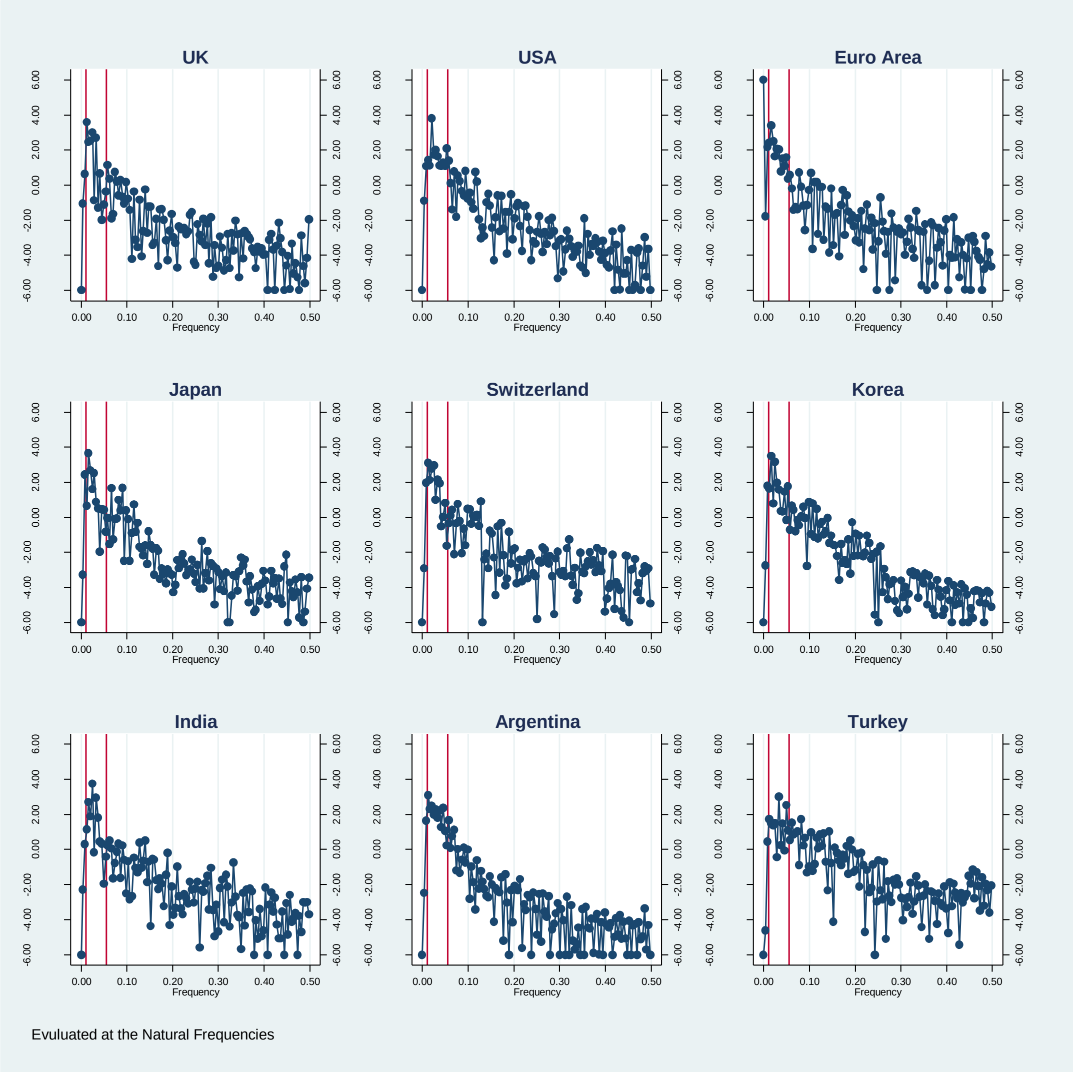


The figure shows the decomposed series using B-Q, B-N, H-P, B-W, B-K, C-F and UCM filters for US. The sample spans the period from January 1994 to December 2013.

Figure-2.9: H-P Periodogram Country Examples-Temporary Component

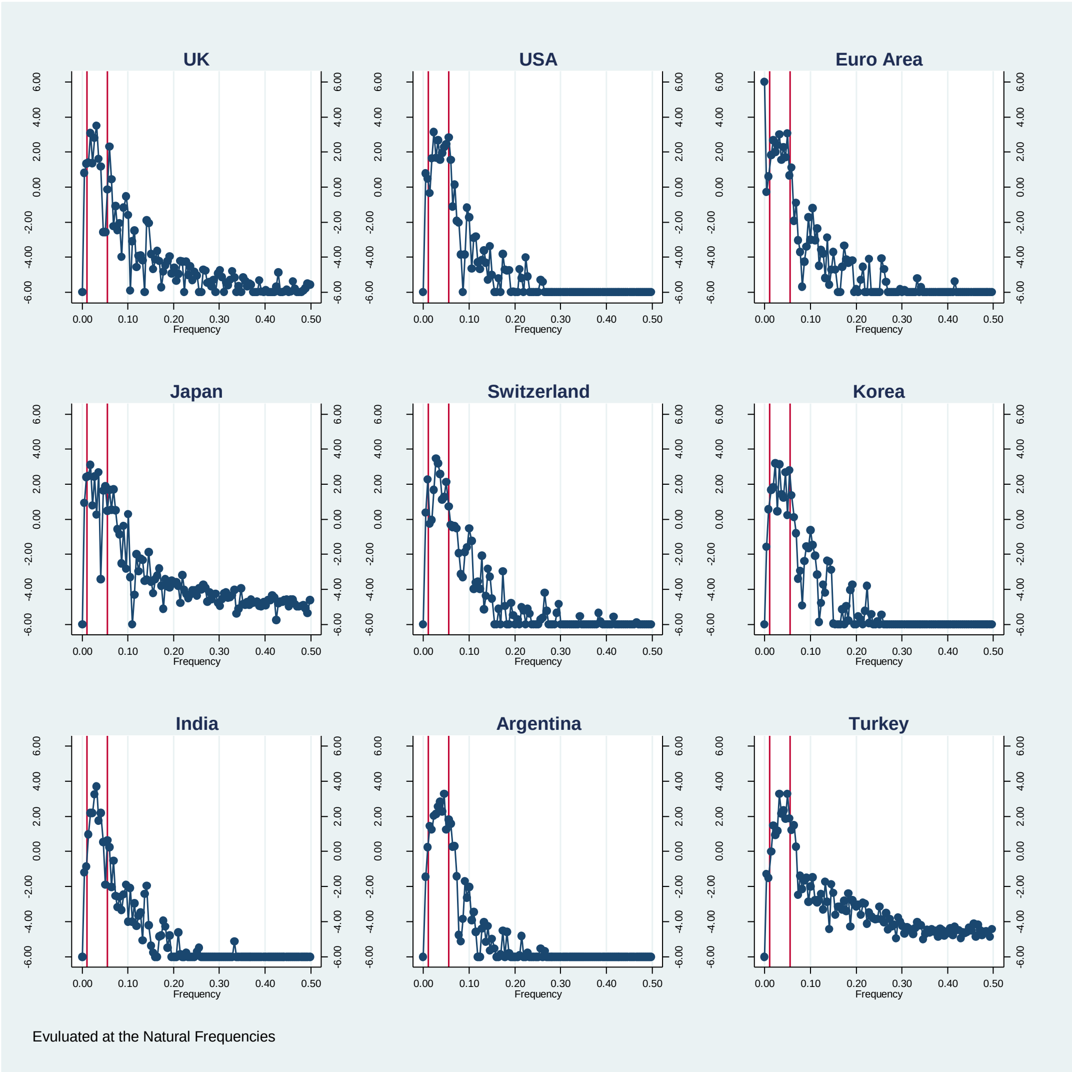
The figure shows the periodogram of the spectral density function of the decomposed temporary component of the nine different currencies using Hodrick Prescott Filter. The results are in natural frequencies.

Figure-2.10: B-W Periodogram Country Examples-Temporary Component



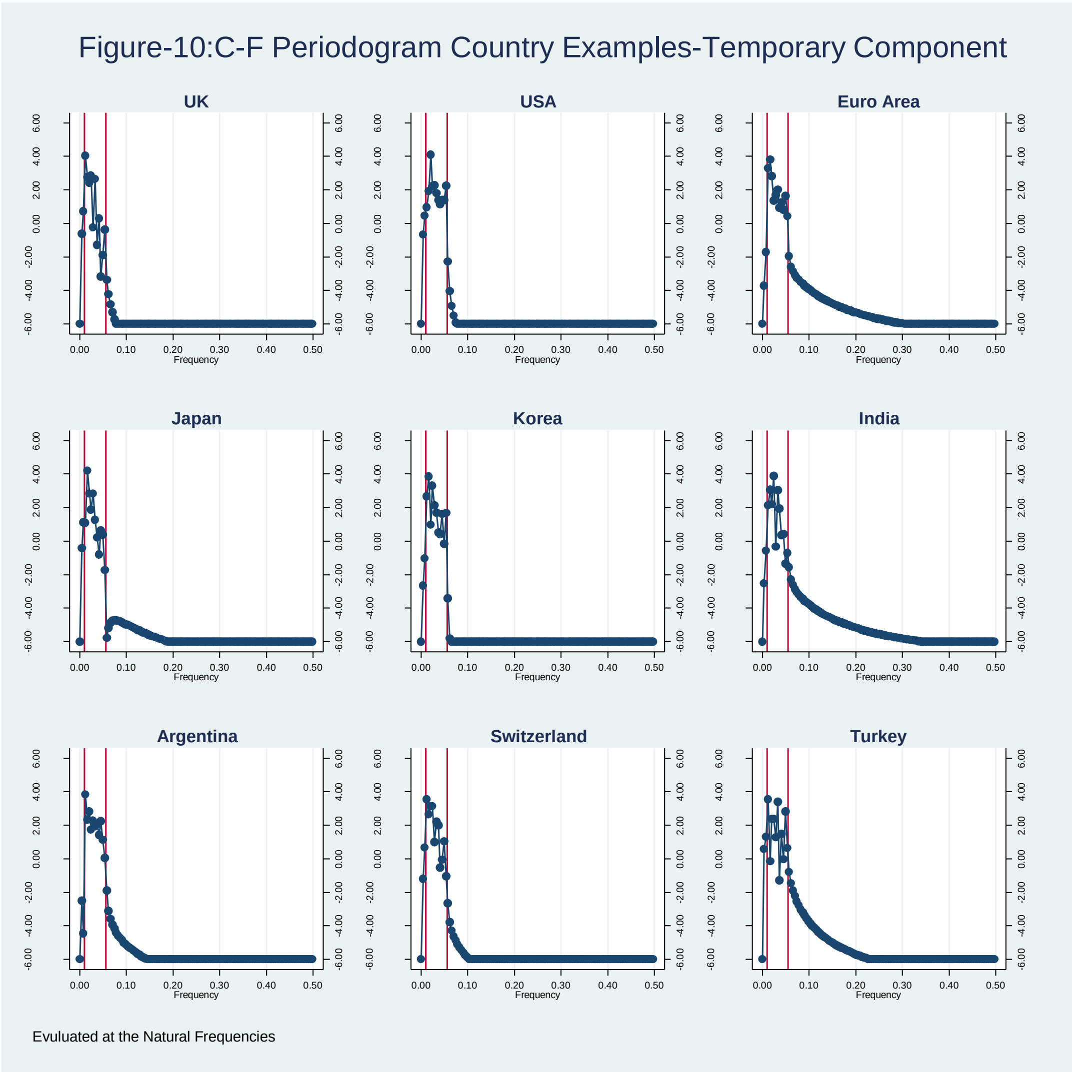
The figure shows the periodogram of the spectral density function of the decomposed temporary component of the nine different currencies using Butterworth Filter. The results are in natural frequencies.

Figure-2.11: B-K Periodogram Country Examples-Temporary Component



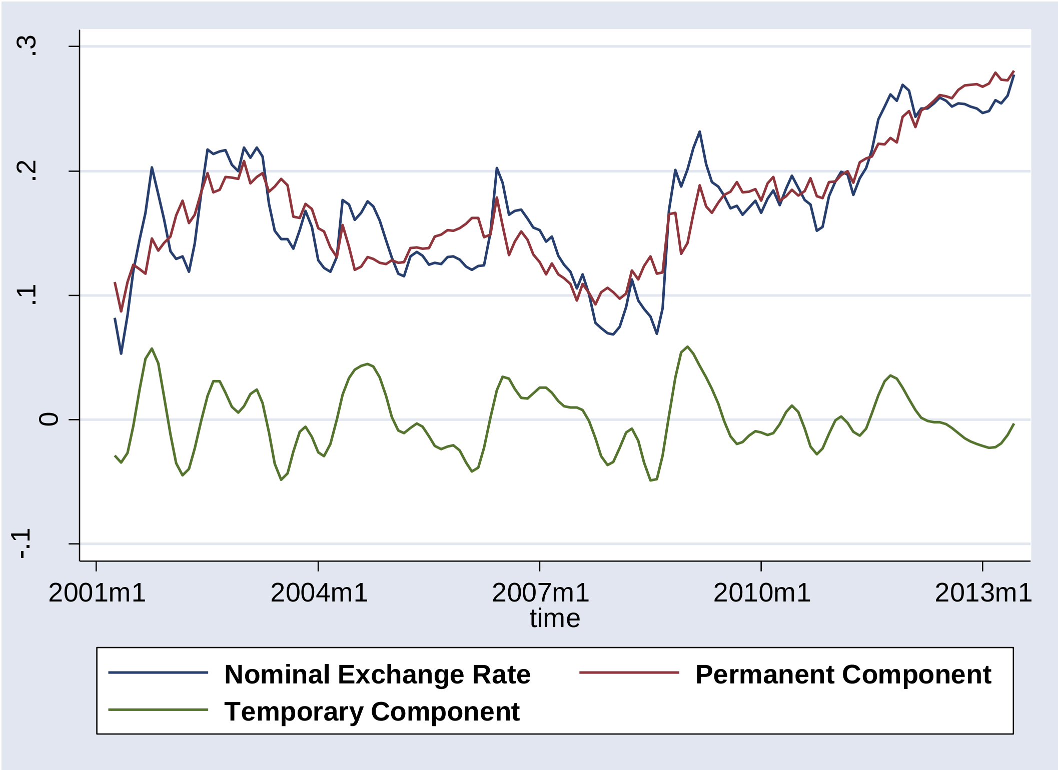
The figure shows the periodogram of the spectral density function of the decomposed temporary component of the nine different currencies using Baxter and King Filter. The results are in natural frequencies.

Figure-2.12: C-F Periodogram Country Examples-Temporary Component



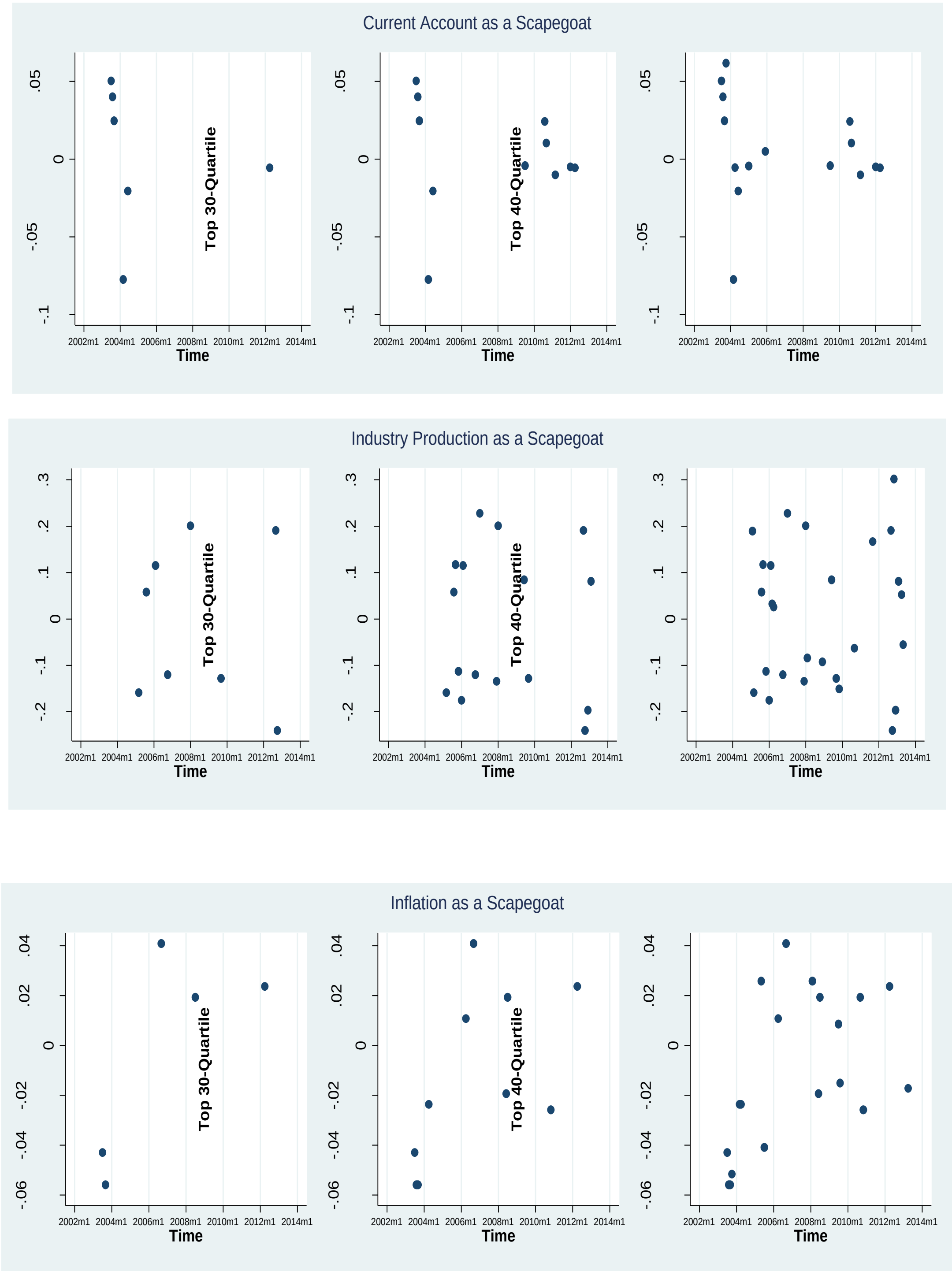
The figure shows the periodogram of the spectral density function of the decomposed temporary component of the nine different currencies using Christiano Fitzgerald Filter. The results are in natural frequencies.

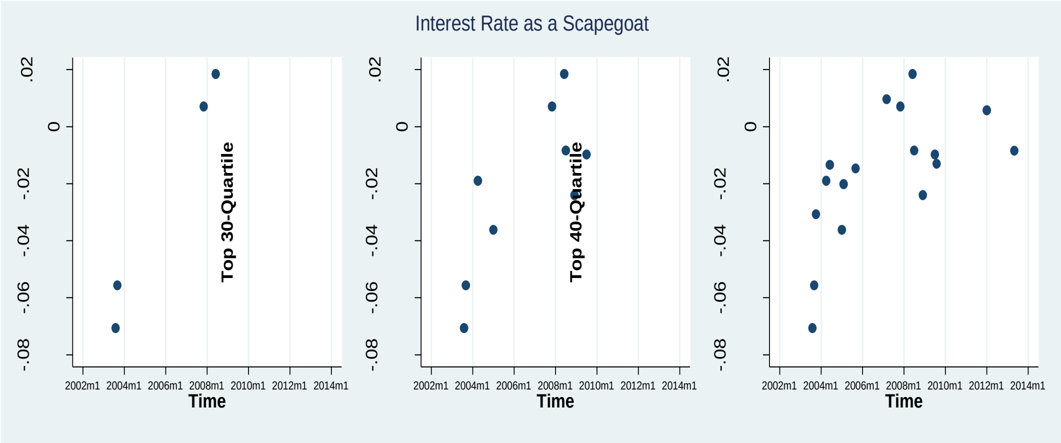
Figure 3.1: Exchange Rate Decomposition

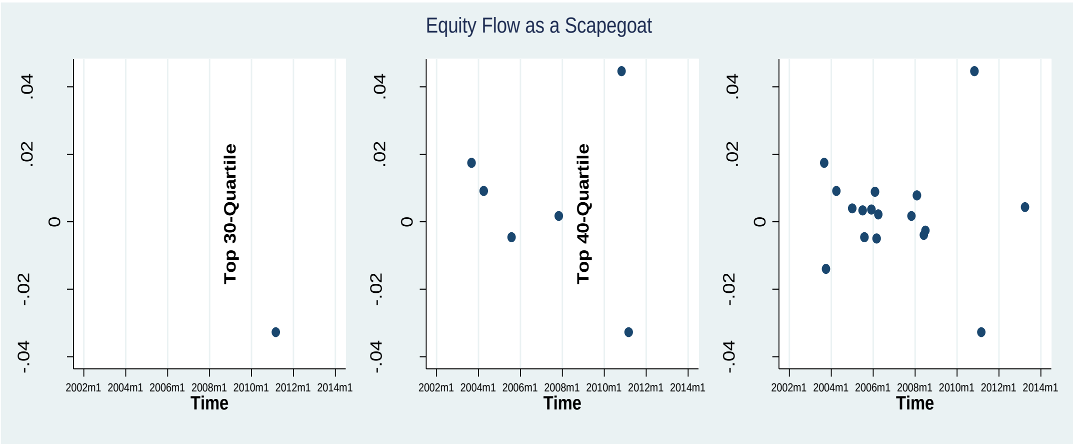


Following the second chapter, this graph shows the decomposed series of USD/TRY using C-F Filter. The series are in logarithm.

Figure 3.2: Potential Macro Fundamentals Satisfying the Necessary Conditions as a Scapegoat

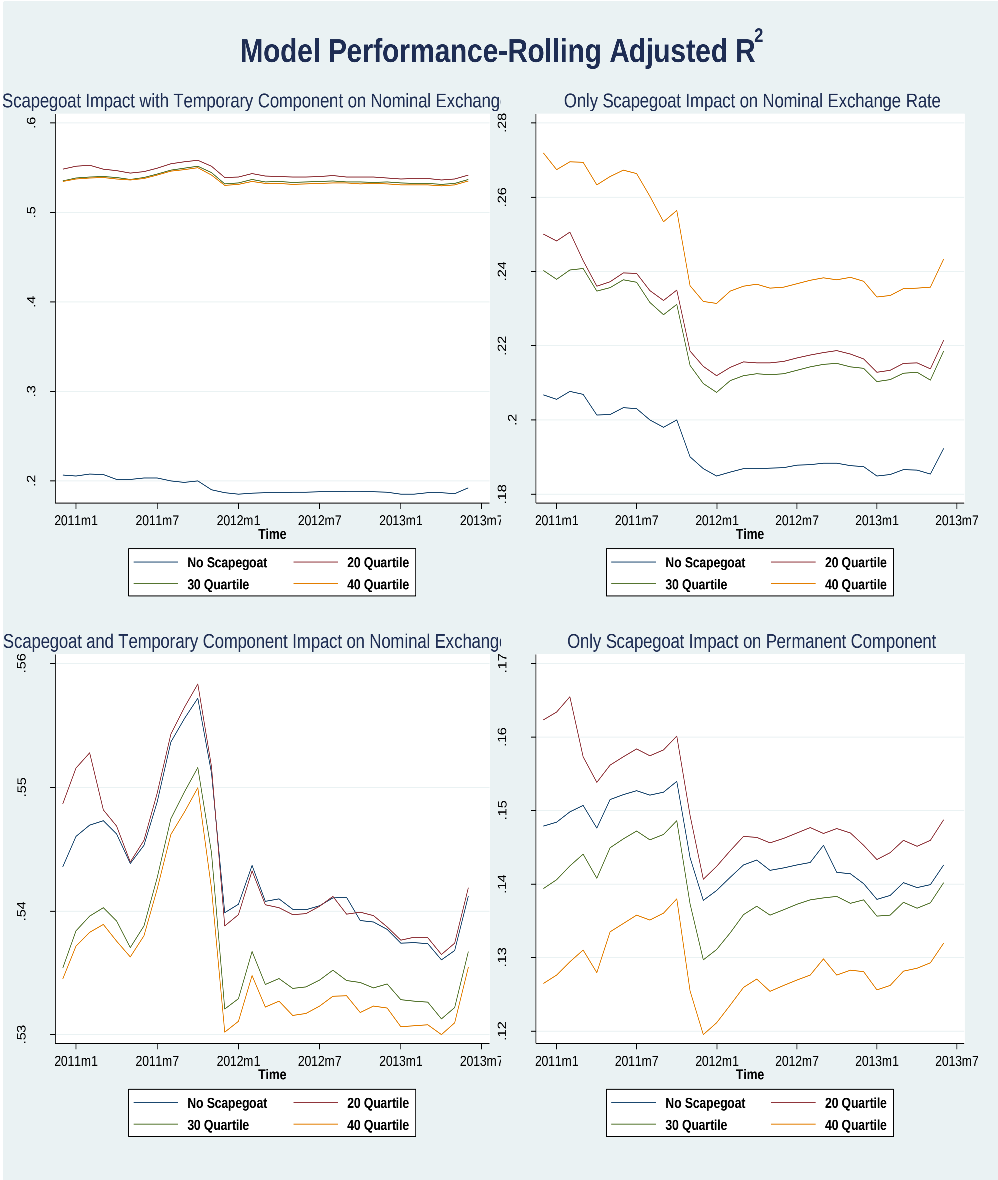






The figure presents the selected time periods for each macro fundamental that satisfies the necessary condition of being a scapegoat parameter and the corresponding value of these scapegoats at the determined time period. These specific time periods are determined by the identification function that we match each fundamental large change with the large change in the temporary component.

Figure 3.3: Model Performance of the Scapegoat Theory



The figure shows the rolling percentage adjusted R^2 for the model with time-varying parameters and four specifications of the scapegoat model: i. scapegoat impact with temporary component on nominal exchange rate, ii. sole scapegoat impact on nominal exchange rate, iii. scapegoat impact with temporary component on permanent exchange rate, iv. sole scapegoat impact on permanent exchange rate.

APPENDIX B

Table-2.1: Comparison of the Decomposition Techniques

	Method	Summary	Pros	Cons
1	**Blanchard Quah Decomposition**	the simplest version of a structural VAR model where a two-dimensional system with the nominal and real exchange rates as the endogenous variables is used. The real shocks inducing a permanent shift of the real exchange rate and nominal shocks leading a temporary shift of the nominal exchange rates are identified with imposing the restriction that the nominal shocks have no long-run or permanent effect on the real exchange rates.	can determine the number of shocks that are enough to account for the large variation in data	there are some model limitations that we have to eliminate some countries. The model results depend on the assumption that nominal shocks have no long-run effect on the real exchange rate.
2	**Beveridge Nelson Decomposition**	calculates trend and cycle for an integrated time series by imposing the restriction that the trend component of the time series is identified random walk with drift and cycle component is defined as the stationary part with mean zero. The interpretation of the trend component corresponds to an estimate of the permanent component of the integrated time series.	it produces a decomposition into permanent and temporary components with minimal assumptions about the structure of the components	there are some model limitations that we have to eliminate some countries. We lose the first observation due to differencing the data.
3	**Hodrick and Prescott Filter**	a procedure to extract a stochastic trend that moves smoothly over time and is uncorrelated with the cycle.	easy to use that it is frequently selected as a method to decompose time series.	the model can generate cycles even if there is no in the original data if it is applied to an integrated series. In addition to the spurious results, there are big revisions in H-P filter when a new data became available. The decomposition is sensible to the value of smoothing parameter.

4	**Butterworth Filter**	is characterized by a gain function that is isolate the trend component which would possess a passband and a stopband which impedes all other frequencies less that the cut-off value	is flexible in approximating the phase-neutral square wave filter	the filter approximation to the asymptotic filter is not perfect but in the middle of the sample the deviations are small.
5	**Baxter and King Band Bass Filter**	specify a particular quadratic loss function for discrepancies between the exact and approximate filter and design a filter that eliminates very slow-moving ("trend") components and very high-frequency ("cycle") components.	does not have any prerequest for the time series to apply the filter	does poor job for monthly data. It works better if π is increased but this requires throwing away more data at the beginning and end. Moreover the criterion for choosing π is not clear and it is always symmetric and stationary that increase error we want to minimize.
6	**Christiano and Fitzgerald Band Bass Filter**	a generalized version of the Baxter-King Bandpass Filter, in spirit of Christiano and Fitzgerald Filter (C-F Filter) (2003) is applied in order to decompose exchange rate movements.	does not have any prerequest for the time series to apply the filter uses all the data for each t, and p and f vary with t and different from each other.	determination of the low and high pass bands is unique to the frequency of the time series.
7	**Unobserved Component Model**	decompose a time series by treating the trend and cycle as unobservable and attempt to capture the features of the time series in the state space form. The unobservable components are estimated in a linear state space model by maximum likelihood and the estimates are based on the current and past observations. In UCMs, there are different models for identification and here we choose random walk with drift specification like Beveridge Nelson Decomposition	set up in a State Space context that takes advantage of the extraordinary flexibility of the recursive algorithms known as the Kalman Filter.	set up of the model can change results seriously.

Table-2.2: Cross Correlation Matrix

Permanent Component	***B-Q***	***B-N***	***H-P***	***B-W***	***B-K***	***C-F***	***UCM***
B-Q	1						
B-N	0.1638	1					
H-P	0.1799	0.9551	1				
B-W	0.1768	0.9623	0.9988	1			
B-K	0.1695	0.9885	0.9779	0.9837	1		
C-F	0.1762	0.9632	0.9872	0.9893	0.9858	1	
UCM	0.1758	0.9727	0.969	0.9734	0.9809	0.9666	1
Temporary Component	***B-Q***	***B-N***	***H-P***	***B-W***	***B-K***	***C-F***	***UCM***
B-Q	1						
B-N	0.8175	1					
H-P	0.1852	0.1592	1				
B-W	0.1986	0.1719	0.99	1			
B-K	0.0508	0.0517	0.8083	0.8379	1		
C-F	0.0393	0.0378	0.858	0.8649	0.8415	1	
UCM	0.1279	0.1128	0.6212	0.6286	0.5703	0.4943	1

This table shows the correlation between the permanent and temporary components of real effective exchange rate using seven different decomposition techniques. The sample spans the period from January 1994 to December 2013.

Table-2.3 Unit Root Test Results

Model-1: include heterogeneous member specific trends and subtract out common time effects

Variables	*Levin-Lin rho-stat*	*Levin-Lin t-rho-stat*	*Levin-Lin ADF-stat*	*IPS ADF-stat*
lrpod	0.69	0.06	0.24	-1.68
ir	-1.78	-0.38	-0.86	-1.57
fisc	-5.60	-1.31	-1.03	0.83
ltot	-9.24	-2.29	-2.80	-6.16
lroil	-1.18	-0.46	-0.36	0.42
cad	-10.16	-2.38	-2.09	-2.90
perbq	-58.74	-25.31	-6.88	-7.37
tempbq	-75.47	-17.47	-15.79	-23.06
perbn	-1.67	-0.87	-1.35	-2.30
tempbn	-80.07	-16.67	-15.84	-25.52
perhp	6.67	1.44	0.09	2.36
temphp	-13.57	-3.02	-4.50	-7.68
perbw	6.59	1.72	-2.41	-2.65
tempbw	-17.27	-3.77	-5.38	-9.20
perbk	6.68	1.45	-7.81	-9.52
tempbk	-20.64	-4.62	-4.98	-8.05
percf	1.01	-0.44	2.37	4.88
tempcf	-11.30	-2.43	-18.30	-28.43
perrwd	-0.62	-0.12	-1.47	-1.72
temprwd	-7.56	-2.73	-3.19	-10.79
Δlrpod	-75.41	-16.88	-15.09	-19.99
Δir	-44.85	-10.75	-11.42	-18.80
Δfisc	-76.91	-13.74	-13.13	-20.85
Δltot	-54.39	-12.42	-11.15	-18.57
Δlroil	-105.87	-24.82	-8.91	-9.46
Δcad	-67.78	-18.14	-8.46	-14.44
Δperbq	-14.61	-2.26	-3.10	-4.85
Δperbn	-85.35	-18.66	-16.68	-26.38
Δperhp	6.77	2.27	2.83	4.49
Δperbw	4.92	1.46	0.74	1.89
Δperbk	6.73	2.16	-2.19	-3.44
Δpercf	-100.03	-32.95	-18.55	-28.82
Δtempcf	-17.59	-3.56	-21.53	-39.52
Δperrwd	-44.98	-9.12	-8.98	-12.39

This table shows the panel unit root test result for the variables that are used to test the cointegration relationship between the fundamentals in the economy and the exchange rate components that are decomposed by seven different methods.

Model-2: include heterogeneous member specific trends and common time effects

Variables	*Levin-Lin rho-stat*	*Levin-Lin t-rho-stat*	*Levin-Lin ADF-stat*	*IPS ADF-stat*
lrpod	0.38	-0.04	0.01	-1.76
ir	-1.76	-0.38	-0.91	-2.64
fisc	-2.61	-0.13	0.02	2.35
ltot	-9.65	-2.35	-3.14	-5.33
lroil	-9.99	-2.51	-3.79	-5.23
cad	-9.07	-2.08	-2.08	-3.41
perbq	-59.73	-24.89	-9.52	-7.55
tempbq	-73.67	-16.96	-14.24	-19.89
perbn	-0.18	-0.82	-1.31	-1.06
tempbn	-79.92	-16.63	-14.08	-24.57
perhp	6.38	1.27	-0.22	1.24
temphp	-12.67	-2.84	-4.31	-5.98
perbw	6.36	1.59	-3.20	-4.15
tempbw	-16.54	-3.62	-5.37	-7.72
perbk	5.66	0.39	-11.48	-18.92
tempbk	-19.09	-4.40	-4.91	-6.89
percf	3.11	-0.13	0.62	3.00
tempcf	-11.70	-2.52	-18.94	-36.96
perrwd	-0.08	-0.03	-1.26	-1.66
temprwd	-6.38	-2.84	-2.04	-15.34
Δlrpod	-74.98	-17.21	-15.68	-20.47
Δir	-45.70	-10.98	-11.27	-15.68
Δfisc	-78.22	-13.82	-12.38	-14.07
Δltot	-52.00	-12.17	-11.08	-18.43
Δlroil	-46.97	-10.88	-12.66	-20.34
Δcad	-68.47	-18.90	-5.79	-10.19
Δperbq	-19.24	-3.24	-4.23	-6.71
Δperbn	-82.25	-17.89	-14.65	-24.64
Δperhp	6.90	2.29	2.70	6.18
Δperbw	5.11	1.51	0.37	2.98
Δperbk	8.01	2.91	-2.13	-3.24
Δpercf	-99.69	-28.79	-13.82	-26.40
Δtempcf	-18.27	-3.72	-21.60	-39.59
Δperrwd	-43.62	-8.85	-8.65	-23.10

This table shows the panel unit root test result for the variables that are used to test the cointegration relationship between the fundamentals in the economy and the exchange rate components that are decomposed by seven different methods.

Model-3: exclude heterogeneous member specific trends and subtract out common time effects

Variables	*Levin-Lin rho-stat*	*Levin-Lin t-rho-stat*	*Levin-Lin ADF-stat*	*IPS ADF-stat*
lrpod	0.23	1.51	1.89	0.80
ir	-2.98	-0.31	-0.82	-3.42
fisc	-3.81	-0.78	-0.79	-0.06
ltot	0.42	1.18	1.16	-1.89
lroil	2.09	2.05	2.47	1.30
cad	-3.84	-1.15	-0.87	-2.76
perbq	3.06	3.82	4.93	9.62
tempbq	-60.73	-20.33	-17.36	-20.29
perbn	-0.80	0.75	0.51	-0.85
tempbn	-66.89	-20.53	-18.08	-23.53
perhp	1.93	2.17	0.53	0.32
temphp	-14.54	-4.55	-6.22	-8.31
perbw	1.49	1.81	-1.44	-2.53
tempbw	-17.44	-5.44	-7.37	-9.76
perbk	3.11	4.33	1.77	-0.13
tempbk	-21.49	-6.87	-7.27	-9.78
percf	1.61	2.51	4.69	5.17
tempcf	-13.63	-4.11	-22.57	-28.17
perrwd	-2.76	-0.65	-1.68	-0.89
temprwd	-10.11	-4.88	-4.25	-25.24
Δlrpod	-62.46	-19.95	-17.94	-20.26
Δir	-38.56	-13.33	-15.15	-19.39
Δfisc	-63.16	-16.84	-15.71	-19.58
Δltot	-46.12	-15.43	-14.06	-20.60
Δlroil	-87.24	-27.67	-6.56	-8.59
Δcad	-55.84	-21.95	-10.68	-14.87
Δperbq	-14.54	-3.44	-4.34	-6.32
Δperbn	-69.61	-21.88	-19.30	-24.34
Δperhp	1.04	1.73	-0.16	-0.10
Δperbw	0.03	1.22	-0.86	-0.53
Δperbk	0.93	1.60	-2.04	-3.90
Δpercf	-83.30	-34.13	-17.01	-21.65
Δtempcf	-18.38	-5.38	-25.87	-38.48
Δperrwd	-37.45	-11.19	-11.36	-23.46

This table shows the panel unit root test result for the variables that are used to test the cointegration relationship between the fundamentals in the economy and the exchange rate components that are decomposed by seven different methods.

Table-2.4 Panel Cointegration - Group Rho Statistics

Model-1: include heterogeneous member specific trends and subtract out common time effects

	B-Q Decomposition	*B-N Decomposition*	*B-K Filter*	*C-F Filter*	*UCM*
Permanent	-	1.66	-	-3.57***	4.27
Temporary		-	-	4.26	-

This table shows the panel cointegration group rho statistics result to test the relationship between the fundamentals in the economy and the exchange rate components that are decomposed by five different methods. Other two methods cannot be tested due to their unit root test results.

Model-2: include heterogeneous member specific trends and common time effects

	B-Q Decomposition	*B-N Decomposition*	*B-K Filter*	*C-F Filter*	*UCM*
Permanent	-	2.20	-	-0.54	1.10
Temporary		-	-	4.48	-

This table shows the panel cointegration group rho statistics result to test the relationship between the fundamentals in the economy and the exchange rate components that are decomposed by five different methods. Other two methods cannot be tested due to their unit root test results.

Model-3: exclude heterogeneous member specific trends and subtract out common time effects

	B-Q Decomposition	*B-N Decomposition*	*B-K Filter*	*C-F Filter*	*UCM*
Permanent	1.45	0.97	4.51	-3.24***	3.90
Temporary	-	-	-	3.52	-

This table shows the panel cointegration group rho statistics result to test the relationship between the fundamentals in the economy and the exchange rate components that are decomposed by five different methods. Other two methods cannot be tested due to their unit root test results.

Table 3.1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Current Account	126.0	101.6	203.5	-76.5	1301.2
ΔIndustrial Production	126.0	4.3	6.2	-10.0	26.7
ΔInflation	126.0	7.2	4.6	1.1	24.1
ΔInterest Rate	126.0	15.2	10.8	5.4	58.4
Equity Flow	126.0	216.3	943.6	-136.3	9543.7

The data set starts from January 2003 and June 2013. Δ denotes the difference of each macro fundamental with respect to US i.e. $\Delta\text{Inflation}=\text{Inflation}^{TR}-\text{Inflation}^{US}$. Current account is the yearly change of moving sum of 12 months. A positive sign reflects an increase in the current account deficit. Industrial production is the yearly change in the total industry production. Inflation is the CPI based yearly inflation rate. Interest rate is the 2 year fixed coupon payment bond yield. Equity flow is the yearly change of 12 month moving sum of the portfolio and other investment. A positive sign means that the growth rate of inflow to Turkey is increasing.

Table 3.2: The Frequency of Fundamentals that Satisfies Necessary Conditions of Scapegoat

Year	*Quartile*	*Current Account*	*Industry*	*Inflation*	*Interest*	*Equity Flow*	*TOTAL*
2003	***Top 20***	3	0	2	2	0	7
	Top 30	3	0	3	2	1	9
	Top 40	4	0	4	3	2	13
2004	***Top 20***	2	0	0	0	0	2
	Top 30	2	0	1	1	1	5
	Top 40	3	0	2	2	1	8
2005	***Top 20***	0	2	0	0	0	2
	Top 30	0	4	0	1	1	6
	Top 40	2	5	2	3	4	16
2006	***Top 20***	0	2	1	0	0	3
	Top 30	0	3	2	0	0	5
	Top 40	0	5	2	0	3	10
2007	***Top 20***	0	0	0	1	0	1
	Top 30	0	2	0	1	1	4
	Top 40	0	2	0	2	1	5
2008	***Top 20***	0	1	1	1	0	3
	Top 30	0	1	2	3	0	6
	Top 40	0	3	3	3	3	12
2009	***Top 20***	0	1	0	0	0	1
	Top 30	1	2	0	1	0	4
	Top 40	1	3	2	2	0	8
2010	***Top 20***	0	0	0	0	0	0
	Top 30	2	0	1	0	1	4
	Top 40	2	1	2	0	1	6
2011	***Top 20***	0	0	0	0	1	1
	Top 30	1	0	0	0	1	2
	Top 40	1	1	0	0	1	3
2012	***Top 20***	1	2	1	0	0	4
	Top 30	2	3	1	0	0	6
	Top 40	2	4	1	1	0	8
2013IH	***Top 20***	0	0	0	0	0	0
	Top 30	0	1	0	0	0	1
	Top 40	0	3	1	1	1	6
TOTAL	***Top 20***	6	8	5	4	1	24
	Top 30	11	16	10	9	6	52
	Top 40	15	27	19	17	17	95

The table represents the frequency of selected macro fundamentals as a scapegoat for different quartiles in each year. The data set starts from January 2003 and June 2013.

Table-3.3: Empirical Results-Nominal Exchange Rate Return

VARIABLES	(1) dlnom	(2) dlnom	(3) dlnom	(4) dlnom
Current Account (β)	0.035**	0.026	0.026	0.024
	(0.015)	(0.016)	(0.016)	(0.017)
Top 20-Quartile (θ)		0.200***		
		(0.070)		
Top 30-Quartile (θ)			0.162***	
			(0.055)	
Top 40-Quartile (θ)				0.132***
				(0.040)
ΔIndustry (β)	0.008	0.011	0.014	0.014
	(0.006)	(0.007)	(0.009)	(0.010)
Top 20-Quartile (θ)		-0.022*		
		(0.013)		
Top 30-Quartile (θ)			-0.021*	
			(0.011)	
Top 40-Quartile (θ)				-0.012
				(0.013)
ΔInflation (β)	0.050	0.045	0.055	0.063
	(0.051)	(0.056)	(0.058)	(0.064)
Top 20-Quartile (θ)		0.187***		
		(0.067)		
Top 30-Quartile (θ)			0.020	
			(0.109)	
Top 40-Quartile (θ)				-0.009
				(0.080)
ΔInterest Rate (β)	0.278***	0.304***	0.297***	0.314***
	(0.078)	(0.095)	(0.091)	(0.101)
Top 20-Quartile (θ)		-0.069		
		(0.122)		
Top 30-Quartile (θ)			-0.030	
			(0.155)	
Top 40-Quartile (θ)				-0.048
				(0.146)
Equity Flow (β)	-0.008*	-0.009*	-0.008*	-0.009
	(0.005)	(0.005)	(0.005)	(0.005)
Top 20-Quartile (θ)		-0.007		
		(0.047)		
Top 30-Quartile (θ)			-0.091	
			(0.078)	
Top 40-Quartile (θ)				-0.093
				(0.069)
ρ	0.876***	0.893***	0.899***	0.865***
	(0.133)	(0.144)	(0.140)	(0.137)
Constant	0.002	0.002	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	125	125	125	125
Adjusted R^2	0.541	0.542	0.537	0.535

The dependent variable is the nominal exchange rate return. All independent variables are standardized that they have zero mean and unit variance. We take the first difference of each standardized variable. Δ denotes the difference of each macro fundamental with respect to US i.e. $\Delta Inflation = Inflation^{TR} - Inflation^{US}$. The data set starts from January 2003 to June 2013.

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Model-1: Model without Scapegoat Parameters

Model-2: Model with 20-Quartile Scapegoat Parameters

Model-3: Model with 30-Quartile Scapegoat Parameters

Model-4: Model with 40-Quartile Scapegoat Parameters

Table 3.4: Empirical Results- Permanent Component

VARIABLES	(1) dlper	(2) dlper	(3) dlper	(4) dlper
Current Account (β)	0.032**	0.023	0.022	0.020
	(0.014)	(0.014)	(0.014)	(0.015)
Top 20-Quartile (θ)		0.228***		
		(0.069)		
Top 30-Quartile (θ)			0.188***	
			(0.051)	
Top 40-Quartile (θ)				0.147***
				(0.042)
ΔIndustry (β)	0.009	0.012	0.015	0.014
	(0.007)	(0.008)	(0.009)	(0.011)
Top 20-Quartile (θ)		-0.022*		
		(0.013)		
Top 30-Quartile (θ)			-0.022*	
			(0.011)	
Top 40-Quartile (θ)				-0.012
				(0.013)
ΔInflation (β)	0.053	0.045	0.055	0.062
	(0.048)	(0.055)	(0.056)	(0.063)
Top 20-Quartile (θ)		0.205***		
		(0.072)		
Top 30-Quartile (θ)			0.031	
			(0.117)	
Top 40-Quartile (θ)				0.004
				(0.086)
ΔInterest Rate (β)	0.256***	0.274***	0.266***	0.266***
	(0.077)	(0.091)	(0.090)	(0.097)
Top 20-Quartile (θ)		-0.013		
		(0.112)		
Top 30-Quartile (θ)			0.015	
			(0.167)	
Top 40-Quartile (θ)				0.018
				(0.156)
Equity Flow (β)	-0.008*	-0.008*	-0.008*	-0.008*
	(0.004)	(0.005)	(0.005)	(0.005)
Top 20-Quartile (θ)		-0.031		
		(0.042)		
Top 30-Quartile (θ)			-0.114	
			(0.080)	
Top 40-Quartile (θ)				-0.111
				(0.073)
Constant	0.002	0.002	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	125	125	125	125
Adjusted R^2	0.143	0.149	0.140	0.132

The dependent variable is the permanent component of nominal exchange rate return. All independent variables are standardized that they have zero mean and unit variance. We take the first difference of each standardized variable. Δ denotes the difference of each macro fundamental with respect to US i.e. ΔInflation=Inflation^{TR}- Inflation^{US}. The data set starts from January 2003 to June 2013. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Model-1: Model without Scapegoat Parameters
Model-2: Model with 20-Quartile Scapegoat Parameters
Model-3: Model with 30-Quartile Scapegoat Parameters
Model-4: Model with 40-Quartile Scapegoat Parameters

Table 3.5: Bayesian Results- Nominal Exchange Rate Return

VARIABLES	(1) dlnom	(2) dlnom	(3) dlnom	(4) dlnom
Current Account (β)	0.035**	0.025	0.026	0.024
	(0.024)	(0.024)	(0.024)	(0.024)
Top 20-Quartile (θ)		0.200*		
		(0.114)		
Top 30-Quartile (θ)			0.162	
			(0.112)	
Top 40-Quartile (θ)				0.132
				(0.093)
ΔIndustry (β)	0.008	0.011	0.014	0.014
	(0.009)	(0.009)	(0.011)	(0.012)
Top 20-Quartile (θ)		-0.022		
		(0.024)		
Top 30-Quartile (θ)			-0.021	
			(0.019)	
Top 40-Quartile (θ)				-0.012
				(0.018)
ΔInflation (β)	0.050	0.045	0.055	0.063
	(0.042)	(0.043)	(0.045)	(0.048)
Top 20-Quartile (θ)		0.187		
		(0.135)		
Top 30-Quartile (θ)			0.020	
			(0.137)	
Top 40-Quartile (θ)				-0.009
				(0.101)
ΔInterest Rate (β)	0.277***	0.304***	0.297***	0.314***
	(0.063)	(0.073)	(0.077)	(0.082)
Top 20-Quartile (θ)		-0.069		
		(0.148)		
Top 30-Quartile (θ)			-0.030	
			(0.145)	
Top 40-Quartile (θ)				-0.048
				(0.137)
Equity Flow (β)	-0.008	-0.009	-0.008*	-0.009
	(0.007)	(0.007)	(0.007)	(0.007)
Top 20-Quartile (θ)		-0.007		
		(0.307)		
Top 30-Quartile (θ)			-0.091	
			(0.183)	
Top 40-Quartile (θ)				-0.093
				(0.164)
ρ	0.875***	0.893***	0.899***	0.865***
	(0.090)	(0.095)	(0.097)	(0.097)
Constant	0.002*	0.002*	0.002*	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)

The dependent variable is the nominal exchange rate return. All independent variables are standardized that they have zero mean and unit variance. We take the first difference of each standardized variable. Δ denotes the difference of each macro fundamental with respect to US i.e. ΔInflation=$Inflation^{TR}$- $Inflation^{US}$. The data set starts from January 2003 to June 2013.

*** p<0.01, ** p<0.05, * p<0.1.

Model-1: Model without Scapegoat Parameters

Model-2: Model with 20-Quartile Scapegoat Parameters

Model-3: Model with 30-Quartile Scapegoat Parameters

Model-4: Model with 40-Quartile Scapegoat Parameters

Table 3.6: Bayesian Results- Permanent Component

VARIABLES	(1) dlper	(2) dlper	(3) dlper	(4) dlper
Current Account (β)	0.032	0.023	0.022	0.020
	(0.024)	(0.024)	(0.024)	(0.025)
Top 20-Quartile (θ)		0.228**		
		(0.112)		
Top 30-Quartile (θ)			0.188*	
			(0.109)	
Top 40-Quartile (θ)				0.147
				(0.093)
ΔIndustry (β)	0.009	0.012	0.015	0.014
	(0.009)	(0.011)	(0.011)	(0.012)
Top 20-Quartile (θ)		-0.022		
		(0.024)		
Top 30-Quartile (θ)			-0.022	
			(0.019)	
Top 40-Quartile (θ)				-0.012
				(0.018)
ΔInflation (β)	0.050	0.045	0.055	0.062
	(0.042)	(0.044)	(0.046)	(0.048)
Top 20-Quartile (θ)		0.205		
		(0.135)		
Top 30-Quartile (θ)			0.031	
			(0.138)	
Top 40-Quartile (θ)				0.004
				(0.101)
ΔInterest Rate (β)	0.256***	0.274***	0.266***	0.266***
	(0.062)	(0.068)	(0.072)	(0.074)
Top 20-Quartile (θ)		-0.013		
		(0.14)		
Top 30-Quartile (θ)			0.015	
			(0.14)	
Top 40-Quartile (θ)				0.018
				(0.130)
Equity Flow (β)	-0.008	-0.008	-0.008*	-0.008*
	(0.007)	(0.007)	(0.007)	(0.007)
Top 20-Quartile (θ)		-0.031		
		(0.308)		
Top 30-Quartile (θ)			-0.114	
			(0.183)	
Top 40-Quartile (θ)				-0.111
				(0.165)
Constant	0.002*	0.002*	0.002*	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)

The dependent variable is the permanent component of nominal exchange rate return. All independent variables are standardized that they have zero mean and unit variance. We take the first difference of each standardized variable. Δ denotes the difference of each macro fundamental with respect to US i.e. $\Delta Inflation = Inflation^{TR} - Inflation^{US}$. The data set starts from January 2003 to June 2013. *** p<0.01, ** p<0.05, * p<0.1.

Model-1: Model without Scapegoat Parameters
Model-2: Model with 20-Quartile Scapegoat Parameters
Model-3: Model with 30-Quartile Scapegoat Parameters
Model-4: Model with 40-Quartile Scapegoat Parameters

Table 4.1: Expected Signs of Coefficients

Variable	Expected sign	Interpretation
Income of exporting country *i*	+	Increased mass, *à la* gravity model.
Income of importing country *j*	+	Increased mass, *à la* gravity model.
Distance between *i* and *j*	-	Increased cost-reducing trade, *à la* gravity model.
Permanent component of real effective exchange rate of exporting country i relative to importing country j	-	a depreciation of a currency increases the exports of that country
Temporary component of real effective exchanga rate of exporting country i relative to importing country j	-	a depreciation of a currency increases the exports of that country
Land of exporting country *i*	-	The larger a country's total area, the smaller the fraction of its economic activity that is expected to cross borders and the higher probability of a relatively closed economy.
Land of importing country *j*	-	The larger a country's total area, the smaller the fraction of its economic activity that is expected to cross borders and the higher probability of a relatively closed economy.
Population of exporting country *i*	+/-	Population is a good approximation for the effects of economies of scale. A country with a large population can more easily specialize in a wide range of commodities and, consequently, may be less dependent on foreign trade, which may lead to a negative coefficient. Alternatively, if the demand factors are dominant, the variable might result in a positive effect on exports.
Population of importing country *j*	+/-	Population is a good approximation for the effects of economies of scale. A country with a large population can more easily specialize in a wide range of commodities and, consequently, may be less dependent on foreign trade, which may lead to a negative coefficient. Alternatively, if the demand factors are dominant, the variable might result in a positive effect on exports.
Common language	+	Its existence will increase the level of bilateral trade.
Contiguity	+	Its existence will increase the level of bilateral trade.
Common colonization	+	Its existence will increase the level of bilateral trade.

Notes: The *ex ante* expectations of the sign of the coefficients are based on the detailed literature survey conducted by the authors.

Table 4.2: Static Panel Results

	(1)	(2)	(3)	(5)	(6)
	POOLED	**POOLED$_{time}$**	**FIXED$_{i,j,time}$**	**FIXED$_{ij,time}$**	**FIXED$_{it,jt,ij}$**
VARIABLES	lnX_{ij}	lnX_{ij}	lnX_{ij}	lnX_{ij}	lnX_{ij}
$lnGDP_i$	1.1739***	1.1380***	1.7405***	1.7858***	(omitted)
	(0.0227)	(0.0233)	(0.0661)	(0.0639)	.
$lnGDP_j$	1.0282***	0.9929***	1.6645***	1.7246***	(omitted)
	(0.0234)	(0.0239)	(0.0707)	(0.0693)	.
$lnDist_{ij}$	-0.8852***	-0.8954***	-1.4548***	(omitted)	(omitted)
	(0.0271)	(0.0272)	(0.0312)	.	.
$ln(PER_i/PER_j)$	-0.2779	-0.2271	-0.3955***	-0.4135***	(omitted)
	(0.2401)	(0.2399)	(0.1207)	(0.1166)	.
$ln(TEMP_i/TEMP_j)$	0.0010	-0.0025	-0.0507	-0.0088	(omitted)
	(0.0450)	(0.0397)	(0.0340)	(0.0220)	.
$lnPop_i$	0.1171***	0.1342***	-0.8222***	-0.7954***	(omitted)
	(0.0263)	(0.0265)	(0.1473)	(0.1429)	.
$lnPop_j$	0.0535*	0.0694**	-0.5351***	-0.5359***	(omitted)
	(0.0281)	(0.0283)	(0.1186)	(0.1174)	.
$Contig_{ij}$	0.8236***	0.8170***	0.0047	(omitted)	(omitted)
	(0.1345)	(0.1309)	(0.1312)	.	.
$ComLang_{ij}$	0.6962***	0.7150***	0.4133***	(omitted)	(omitted)
	(0.0926)	(0.0924)	(0.0864)	.	.
$ComCol_{ij}$	1.4887***	1.4612***	0.9772***	(omitted)	(omitted)
	(0.2812)	(0.2805)	(0.2517)	.	.
$lnLand_i$	-0.1684***	-0.1617***	(omitted)	(omitted)	(omitted)
	(0.0191)	(0.0194)	.	.	.
$lnLand_j$	-0.1244***	-0.1165***	(omitted)	(omitted)	(omitted)
	(0.0182)	(0.0184)	.	.	.
$lnDist_{ij}$* $ln(PER_i/PER_j)$	-	-	-	-	-0.2225**
	-	-	-	-	(0.1098)
$lnDist_{ij}$* $ln(TEMP_i/TEMP_j)$	-	-	-	-	-0.0009
	-	-	-	-	(0.0028)
Constant	-28.3429***	-27.7035***	-33.8976***	-48.4806***	-
	(0.6411)	(0.6449)	(3.6775)	(3.5192)	-
Observations	637,067	637,067	637,067	637,067	734128
R-squared	0.7115	0.7221	0.8125	0.4177	0.9225
Exporter	No	No	Yes	No	No
Importer	No	No	Yes	No	No
Paired Effect	No	No	No	Yes	Yes
Time Varying Exporter	No	No	No	No	Yes
Time Varying Importer	No	No	No	No	Yes
Time Effect	No	Yes	Yes	Yes	No

Notes: Robust, clustered standard errors are reported in parentheses. *** denotes p<0.01, ** denotes p<0.05, * denotes p<0.1. Trade is the bilateral exports from country *i* to country *j*. GDP_i and GDP_j are Gross Domestic Product of country *i* and *j* respectively. $Dist_{ij}$ is the distance between country *i* and *j*. Eff_i and Eff_j are the environmental efficiency index of country *i* and *j* respectively. Pop_i and Pop_j are the population of country *i* and *j* respectively. $Land_i$ and $Land_j$ are the land area of country *i* and *j* respectively. $Contig_{ij}$ is dummy with that takes 1 if both exporter *i* and importer *j* are contiguous and zero otherwise. $ComLang_{ij}$ dummy with value 1 if both exporter *i* and importer *j* share a common language and zero otherwise. $Comcol_{ij}$ is the dummy with value 1 if both have had a common colonizer after 1945 and zero otherwise. All variables that start with "l" denote the logaritic transformation of the variable.

Table 4.3: Zero Trade Problem

	(1)	(2)	(3)	(4)	(5)	(6)
	PPML	**$PPML_{time}$**	**$PPML_{i,j,time}$**	**$PPML_{ij,time}$**	**$NB_{ij,time}$**	**$HMR_{i,j}$**
VARIABLES	X_{ij}	X_{ij}	X_{ij}	X_{ij}	X_{ij}	lnX_{ij}
$lnGDP_i$	0.6817***	0.6556***	1.2885***	1.2910***	0.6252***	2.3042***
	(0.0033)	(0.0032)	(0.0237)	(0.0001)	(0.0017)	(0.0155)
$lnGDP_j$	0.7729***	0.7490***	1.2575***	1.2694***	0.4583***	2.1977***
	(0.0043)	(0.0039)	(0.0219)	(0.0001)	(0.0017)	(0.0158)
$lnDist_{ij}$	-0.5401***	-0.5517***	-0.7803***	(omitted)	(omitted)	-1.5927***
	(0.0037)	(0.0035)	(0.0031)	.	.	(0.0032)
$ln(PER_i/PER_j)$	-0.1796***	-0.2020***	-0.1505***	-0.1677***	-0.3789***	-0.5354***
	(0.0641)	(0.0706)	(0.0553)	(0.0003)	(0.0139)	(0.0386)
$ln(TEMP_i/TEMP_j)$	0.0275	0.0211	0.0146	0.0173***	0.0042	-0.0706*
	(0.0393)	(0.0386)	(0.0408)	(0.0003)	(0.0145)	(0.0000)
$lnPop_i$	0.1870***	0.1844***	-0.1762***	-0.2177***	-0.2775***	-0.9468***
	(0.0050)	(0.0047)	(0.0581)	(0.0002)	(0.0015)	(0.0308)
$lnPop_j$	0.0915***	0.0881***	-0.3391***	-0.3730***	-0.1335***	-0.5852***
	(0.0040)	(0.0038)	(0.0406)	(0.0002)	(0.0014)	(0.0217)
$lnLand_i$	-0.0816***	-0.0708***	(omitted)	(omitted)	(omitted)	(omitted)
	(0.0029)	(0.0026)	.	.	.	.
$lnLand_j$	-0.0460***	-0.0351***	(omitted)	(omitted)	(omitted)	(omitted)
	(0.0025)	(0.0024)	.	.	.	.
$Contig_{ij}$	0.7364***	0.7409***	0.4911***	(omitted)	(omitted)	-0.0726***
	(0.0133)	(0.0122)	(0.0087)	.	.	(0.0103)
$ComLang_{ij}$	0.2481***	0.2340***	0.1086***	(omitted)	(omitted)	(omitted)
	(0.0095)	(0.0087)	(0.0076)	.	.	.
$ComCol_{ij}$	1.6466***	1.5349***	0.1740***	(omitted)	(omitted)	0.7774***
	(0.0208)	(0.0190)	(0.0315)	.	.	(0.0100)
ZHAT	-	-	-	-	-	-0.6547***
	-	-	-	-	-	(0.0202)
INVMILLS	-	-	-	-	-	-2.2621***
	-	-	-	-	-	(0.3632)
Constant	-	-	-	-	-20.9285***	-55.3027
	-	-	-	-	(0.0482)	(0.0000)
Observations	665,260	665,260	665,260	661,495	661,495	637,067
R-squared	0.7051	0.7571	0.8623	-	-	0.8089
Exporter	No	No	Yes	No	No	Yes
Importer	No	No	Yes	No	No	Yes
Paired Effect	No	No	No	Yes	Yes	No
Time Effect	No	Yes	Yes	Yes	No	Yes

Notes: Robust standard errors are reported in parentheses. *** denotes p<0.01, ** denotes p<0.05, * denotes p<0.1. Trade is the bilateral exports from country *i* to country *j*. GDP_i and GDP_j are Gross Domestic Product of country *i* and *j* respectively. $Dist_{ij}$ is the distance between country *i* and *j*. Eff_i and Eff_j are the environmental efficiency index of country *i* and *j* respectively. Pop_i and Pop_j are the population of country *i* and *j* respectively. $Land_i$ and $Land_j$ are the land area of country *i* and *j* respectively. $Contig_{ij}$ is dummy with that takes 1 if both exporter *i* and importer *j* are contiguous and zero otherwise. $ComLang_{ij}$ dummy with value 1 if both exporter *i* and importer *j* share a common language and zero otherwise. $Comcol_{ij}$ is the dummy with value 1 if both have had a common colonizer after 1945 and zero otherwise. All variables that start with "l" denote the logaritic transformation of the variable.

Table 4.4: Endogenity Problem

	(1)	(2)	(3)	(4)
	IVOLS$_{ij,time}$	**IVGMM$_{ij,time}$**	**SGMM$_{i,j,time}$**	**IVPoisson$_{i,j,time}$**
VARIABLES	***lnX_{ij}***	***lnX_{ij}***	***lnX_{ij}***	***X_{ij}***
$lnGDP_i$	1.8041*** (0.0666)	1.8019*** (0.0665)	0.7857*** (0.2170)	1.9713*** (0.0735)
$lnGDP_j$	1.6621*** (0.0728)	1.6639*** (0.0728)	2.0210*** (0.3501)	1.4566*** (0.1052)
$lnDist_{ij}$	(omitted) .	(omitted) .	-0.6328*** (0.1175)	-1.3397*** (0.0041)
$ln(PER_i/PER_j)$	-0.4559** (0.2083)	-0.4564** (0.1869)	-0.3957*** (0.1386)	-0.5598*** (0.1573)
$ln(TEMP_i/TEMP_j)$	0.7735 (55.2736)	-0.7239 (39.1712)	-0.5294 (2.0297)	-1.5610 (18.9121)
$lnPop_i$	-0.7716*** (0.1459)	-0.7623*** (0.1455)	-0.3532*** (0.1025)	-0.6197*** (0.0562)
$lnPop_j$	-0.4388*** (0.1178)	-0.4370*** (0.1170)	-0.5220*** (0.1115)	-0.3333*** (0.0410)
$lnLand_i$	(omitted) .	(omitted) .	(omitted) .	(omitted) .
$lnLand_j$	(omitted) .	(omitted) .	(omitted) .	(omitted) .
$Contig_{ij}$	(omitted) .	(omitted) .	0.0181 (0.0574)	0.4303*** (0.0112)
$ComLang_{ij}$	(omitted) .	(omitted) .	0.1783*** (0.0492)	0.4566*** (0.0180)
$ComCol_{ij}$	(omitted) .	(omitted) .	0.4268*** (0.1370)	1.3020*** (0.0233)
m1 ***p-value***	- -	- -	-3.65 (0.000)	- -
m2 ***p-value***	- -	- -	1.65 (0.100)	- -
Hansen ***p-value***	2.092 (0.3513)	2.092 (0.3513)	7.3 (0.199)	- -
Observations ***R-squared***	607,845 0.3842	607,845 0.3863	614,975 -	600,957 -
Exporter	No	No	Yes	Yes
Importer	No	No	Yes	Yes
Paired Effect	Yes	Yes	No	No
Time Effect	Yes	Yes	Yes	Yes

Notes: Robust standard errors are reported in parentheses. *** denotes p<0.01, ** denotes p<0.05, * denotes p<0.1. Trade is the bilateral exports from country *i* to country *j*. GDP_i and GDP_j are Gross Domestic Product of country *i* and *j* respectively. $Dist_{ij}$ is the distance between country *i* and *j*. Eff_i and Eff_j are the environmental efficiency index of country *i* and *j* respectively. Pop_i and Pop_j are the population of country *i* and *j* respectively. $Land_i$ and $Land_j$ are the land area of country *i* and *j* respectively. $Contig_{ij}$ is dummy with that takes 1 if both exporter *i* and importer *j* are contiguous and zero otherwise. $ComLang_{ij}$ dummy with value 1 if both exporter *i* and importer *j* share a common language and zero otherwise. $Comcol_{ij}$ is the dummy with value 1 if both have had a common colonizer after 1945 and zero otherwise. All variables that start with "l" denote the logaritic transformation of the variable.

Table 5.1: Individual Sector Results

	Sector	Permanent Component	Temporary Component
1	Paddy rice	-0.7107	-0.0673
2	Wheat	-1.6556***	0.0225
3	Cereal grains nec	-2.0965***	0.3165***
4	Vegetables, fruit, nuts	-0.7638***	-0.0060
5	Oil seeds	1.6006***	-0.0315***
6	Sugar cane, sugar beet	14.5063	0.0507
7	Plant-based fibers	-3.3614***	-0.0775*
8	Crops nec	-0.2578*	0.0322***
9	Bovine cattle, sheep and goats, horses	0.6537	0.0682
10	Animal products nec	-1.8843***	0.0048
11	Raw milk	-3.3994**	0.2076***
12	Wool, silk-worm cocoons	-3.1416***	-0.0298
13	Forestry	-4.3676***	0.0058
14	Fishing	-0.2672	-0.0134**
15	Coal	0.3725***	-0.0616***
16	Oil	-0.7627***	-0.0378***
17	Gas	-0.4767***	-0.0039
18	Minerals nec	-3.8539***	0.0071
19	Bovine meat products	-0.8126***	0.0072
20	Meat products nec	0.3359**	-0.0098***
21	Vegetable oils and fats	-2.1522***	-0.0129
22	Dairy products	1.3254**	0.0120
23	Processed rice	3.1973***	-0.0840***
24	Sugar	-1.0588***	0.0059
25	Food products nec	-1.2155***	-0.0102
26	Beverages and tobacco products	-0.3898***	0.0383***
27	Textiles	-0.8346***	0.0293***
28	Wearing apparel	0.0545	-0.0048
29	Leather products	-2.7331***	0.0262***
30	Wood products	-0.9478***	0.0050
31	Paper products, publishing	-1.7566***	0.0437***
32	Petroleum, coal products	-0.3809***	0.0015
33	Chemical, rubber, plastic products	-0.3794***	0.0211*
34	Mineral products nec	-0.6529***	0.0316***
35	Ferrous metals	-0.8605***	-0.0466***
36	Metals nec	-0.5946***	0.0119
37	Metal products	-1.7095***	0.0166***
38	Motor vehicles and parts	1.4770***	0.0157***
39	Transport equipment nec	-0.9666***	0.0529***
40	Electronic equipment	-0.2745***	-0.0017
41	Machinery and equipment nec	-2.2256***	0.0249***
42	Manufactures nec	7.0058***	0.0006

Notes: These coefficients are driven from the estimation of equation 4.2 including each sector dummies interacted with the permanent and temporary component of real effective exchange rate and the paired fixed effects along with the time fixed effect. For further description of the sectors see Appendix C.

APPENDIX C

CHAPTER-3: DATA DESCRIPTION AND SOURCES

Nominal Exchange Rate (USD/TRY): Measures the value of TRY required to buy 1 USD. It is the monthly average of the nominal spot exchange rate in Turkey. ***Source:*** *Central Bank of the Republic of Turkey.*

Current Account Deficit (yoy-%): Measures the yearly % change in the 12 month moving total of the current account balance. The sign of the growth rate is corrected i.e. a positive sign reflects an increase in the current account deficit. ***Source:*** *Central Bank of the Republic of Turkey.*

Industry Production (yoy-%): Measures the yearly % change in the total industrial production. Both Turkey and US data are taken from OECD. ***Source:*** *OECD Database.*

Inflation Rate (yoy-%): Measures the yearly % change in the consumer price indices. Both Turkey and US data are taken from OECD. ***Source:*** *OECD Database.*

Interest Rate (%): is the 2 year fixed coupon payment benchmark bond yield for the Turkey and the same maturity bond yield is collected for US. ***Source:*** *Republic of Turkey Prime Ministry Undersecretariat of Treasury, Reuters-Datastream*

Equity Flow (yoy-%): Measures the yearly % change in the net equity flow to Turkey. The sign of the growth rate is corrected i.e. a positive sign reflects an increase in the inflows to Turkey. ***Source:*** *Central Bank of the Republic of Turkey*

CHAPTER-4: DATA DESCRIPTION AND SOURCES

Bilateral exports from country i to country j (X_{ij}): Measures the total exports from country *i* to country *j* in current period USD. The variable is converted into real terms by export price indices. ***Source:*** *Direction of Trade Statistics, IMF.*

Gross domestic product of country i and j (GDP_i and GDP_j): GDP at purchaser's prices in million USD. Data are in constant 2005 USD. ***Source****: World Development Indicators, World Bank.*

Distance between country i and j ($Dist_{ij}$): The simple distances calculated following the great circle formula, which uses the latitude and longitude of a country's most important city (in terms of population) or of its official capital in nautical miles. ***Source:*** *CEPII Mayer and Zignago (2011) dataset.*

Population of country i and j (Pop_i and Pop_j): Total population is based on the *de facto* definition of population, which counts all residents regardless of legal status or citizenship – except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of their country of origin. The values shown are midyear estimates. ***Source:*** *World Development Indicators, World Bank.*

Land area of country i and j ($Land_i$ and $Land_j$): Land area is a country's total area, excluding area under inland water bodies, national claims to a continental shelf and exclusive economic zones. In most cases, the definition of inland water bodies includes major rivers and lakes. ***Source:*** *World Development Indicators, World Bank.*

Common Language ($ComLang_{ij}$): A dummy variable indicating whether the two countries share a common official language. ***Source:*** *CEPII Mayer and Zignago (2011) dataset.*

Common Colonizer ($ComCol_{ij}$): A dummy variable indicating whether the two countries had a common colonizer after 1945. ***Source****: CEPII Mayer and Zignago (2011) dataset.*

Contiguity ($Contig_{ij}$): dummy variable indicating whether the two countries are contiguous. ***Source:*** *CEPII Mayer and Zignago (2011) dataset.*

SECTORAL DATA DESCRIPTION

Sector	Name	Description
1	Paddy rice	Paddy Rice: rice, husked and unhusked
2	Wheat	Wheat: wheat and meslin
3	Cereal grains nec	Other Grains: maize (corn), barley, rye, oats, other cereals
4	Vegetables, fruit, nuts	Veg & Fruit: vegetables, fruitvegetables, fruit and nuts, potatoes, cassava, truffles,
5	Oil seeds	Oil Seeds: oil seeds and oleaginous fruit; soy beans, copra
6	Sugar cane, sugar beet	Cane & Beet: sugar cane and sugar beet
7	Plant-based fibers	Plant Fibres: cotton, flax, hemp, sisal and other raw vegetable materials used in textiles
8	Crops nec	Other Crops: live plants; cut flowers and flower buds; flower seeds and fruit seeds; vegetable seeds, beverage and spice crops, unmanufactured tobacco, cereal straw and husks, unprepared, whether or not chopped, ground, pressed or in the form of pellets; swedes, mangolds, fodder roots, hay, lucerne (alfalfa), clover, sainfoin, forage kale, lupines, vetches and similar forage products, whether or not in the form of pellets, plants and parts of plants used primarily in perfumery, in pharmacy, or for insecticidal, fungicidal or similar purposes, sugar beet seed and seeds of forage plants, other raw vegetable materials
9	Bovine cattle, sheep and goats, horses	Cattle: cattle, sheep, goats, horses, asses, mules, and hinnies; and semen thereof
10	Animal products nec	Other Animal Products: swine, poultry and other live animals; eggs, in shell (fresh or cooked), natural honey, snails (fresh or preserved) except sea snails; frogs' legs, edible products of animal origin n.e.c., hides, skins and furskins, raw, insect waxes and spermaceti, whether or not refined or coloured
11	Raw milk	Raw milk
12	Wool, silk-worm cocoons	Wool: wool, silk, and other raw animal materials used in textile
13	Forestry	Forestry: forestry, logging and related service activities
14	Fishing	Fishing: hunting, trapping and game propagation including related service activities, fishing, fish farms; service activities incidental to fishing
15	Coal	Coal: mining and agglomeration of hard coal, lignite and peat
16	Oil	Oil: extraction of crude petroleum and natural gas (part), service activities incidental to oil and gas extraction excluding surveying (part)

17	Gas	Gas: extraction of crude petroleum and natural gas (part), service activities incidental to oil and gas extraction excluding surveying (part)
18	Minerals nec	Other Mining: mining of metal ores, uranium, gems. other mining and quarrying
19	Bovine meat products	Cattle Meat: fresh or chilled meat and edible offal of cattle, sheep, goats, horses, asses, mules, and hinnies. raw fats or grease from any animal or bird.
20	Meat products nec	Other Meat: pig meat and offal. preserves and preparations of meat, meat offal or blood, flours, meals and pellets of meat or inedible meat offal; greaves
21	Vegetable oils and fats	Vegetable Oils: crude and refined oils of soya-bean, maize (corn),olive, sesame, ground-nut, olive, sunflower-seed, safflower, cotton-seed, rape, colza and canola, mustard, coconut palm, palm kernel, castor, tung jojoba, babassu and linseed, perhaps partly or wholly hydrogenated,inter-esterified, re-esterified or elaidinised. Also margarine and similar preparations, animal or vegetable waxes, fats and oils and their fractions, cotton linters, oil-cake and other solid residues resulting from the extraction of vegetable fats or oils; flours and meals of oil seeds or oleaginous fruits, except those of mustard; degras and other residues resulting from the treatment of fatty substances or animal or vegetable waxes.
22	Dairy products	Milk: dairy products
23	Processed rice	Processed Rice: rice, semi- or wholly milled
24	Sugar	Sugar
25	Food products nec	Other Food: prepared and preserved fish or vegetables, fruit juices and vegetable juices, prepared and preserved fruit and nuts, all cereal flours, groats, meal and pellets of wheat, cereal groats, meal and pellets n.e.c., other cereal grain products (including corn flakes), other vegetable flours and meals, mixes and doughs for the preparation of bakers' wares, starches and starch products; sugars and sugar syrups n.e.c., preparations used in animal feeding, bakery products, cocoa, chocolate and sugar confectionery, macaroni, noodles, couscous and similar farinaceous products, food products n.e.c.
26	Beverages and tobacco products	Beverages and Tobacco products
27	Textiles	Textiles: textiles and man-made fibres
28	Wearing apparel	Wearing Apparel: Clothing, dressing and dyeing of fur
29	Leather products	Leather: tanning and dressing of leather; luggage, handbags, saddlery, harness and footwear

30	Wood products	Lumber: wood and products of wood and cork, except furniture; articles of straw and plaiting materials
31	Paper products, publishing	Paper & Paper Products: includes publishing, printing and reproduction of recorded media
32	Petroleum, coal products	Petroleum & Coke: coke oven products, refined petroleum products, processing of nuclear fuel
33	Chemical, rubber, plastic products	Chemical Rubber Products: basic chemicals, other chemical products, rubber and plastics products
34	Mineral products nec	Non-Metallic Minerals: cement, plaster, lime, gravel, concrete
35	Ferrous metals	Iron & Steel: basic production and casting
36	Metals nec	Non-Ferrous Metals: production and casting of copper, aluminium, zinc, lead, gold, and silver
37	Metal products	Fabricated Metal Products: Sheet metal products, but not machinery and equipment
38	Motor vehicles and parts	Motor Motor vehicles and parts: cars, lorries, trailers and semi-trailers
39	Transport equipment nec	Other Transport Equipment: Manufacture of other transport equipment
40	Electronic equipment	Electronic Equipment: office, accounting and computing machinery, radio, television and communication equipment and apparatus
41	Machinery and equipment nec	Other Machinery & Equipment: electrical machinery and apparatus n.e.c., medical, precision and optical instruments, watches and clocks
42	Manufactures nec	Other Manufacturing: includes recycling

Source: *https://www.gtap.agecon.purdue.edu/databases/v8/v8_sectors.asp*

APPENDIX D

Bayesian MCMC Estimation

The estimation of the constant parameter model with scapegoat parameters are also performed with Bayesian estimation. We use Markov Chain Monte Carlo (MCMC) to sample from the posterior distribution of normal linear regression model of dependent variables on both nominal exchange rate return and the permanent component of the nominal exchange rate return:

$$\Delta s_t = \beta \Delta \mathrm{f_t} + (\gamma_t \Delta \mathrm{f_t})\theta + \Delta \mathrm{temp_t} \rho + \mathrm{u_t}$$

$$\Delta \mathrm{per_t} = \beta \Delta \mathrm{f_t} + (\gamma_t \Delta \mathrm{f_t})\theta + \mathrm{u_t}$$

where s_t is the log of the nominal exchange rate and per_t is the permanent component of the nominal exchange rate, $\beta = (\beta_1, \beta_2, \beta_3, \ldots \beta_k), \theta = (\theta_1, \theta_2, \theta_3, \ldots \theta_k)$ and ρ are the coefficients, $\mathrm{f_t} = (\mathrm{f_{1t}}, \mathrm{f_{2t}}, \mathrm{f_{3t}}, \ldots \mathrm{f_{kt}})$ and $\mathrm{temp_t}$ are the regressors at time t. u_t is a disturbance term normally distributed with 0 mean and constant variance σ^2. We need to estimate the set of the conditional mean hyperparameters (β, θ, ρ) and the constant variance hyperparameter (σ^2).

To estimate the coefficients we use the Gibbs sampler, Chib (2001, algorithm 5). Standard uninformative conjugate priors are used: The prior for the regression coefficients is uninformative, while the prior for the error variance σ^2 is Inverse Gamma (1/2, d_0/2). The sampler is initialized with the OLS results of σ^2 and each posterior drawn from Inverse Gamma ((1+df)/2, (d_0+SSR)/2), where df is the number of observations.