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(Executive Master in Business Administration – EMBA)

Thesis Title :

"An empirical examination of the Trade Balance in Sweden"

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To my Parents, Georgios & Dimitria
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And Panagiotis, for their support

During the past two years
Thank you all

Abstract

This study examines the determinants of trade balance in Sweden in the context of a traditional model which includes the real effective exchange rate and domestic and foreign income levels. The econometric analysis indicates that the trade balance is found to be cointegrated with the other two variables and their relationship appears to be robust. A Vector Error Correction Model (VECM) analysis describes how the short term dynamics are linked to the long term relations, leading the cointegrating relationship to equilibrium. Finally, the study proves that there is no significant bilateral causality between the trade balance of Sweden and the real effective exchange rate.

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1. Introduction

Sweden is a Scandinavian country on the northern flank of Europe and the third-largest country in the European Union by area. With its population of over 9.5 million, is today one of the most wealthy nations in the world, having the world's eighth highest per capita income and the world's ninth highest GDP per hour worked.

The past year, *The Economist* declared that the Nordic countries "*are probably the best governed in the world*", with Sweden in the first place. Moreover in 2013, it ranked second in the world on the Democracy Index, second on the OECD Better Life Index, fourth on the Legatum Prosperity Index and seventh on the United Nations' Human Development Index. According to the United Nations, it has the third lowest infant mortality rate in the world. A few years earlier, in 2010, it also had one of the lowest Gini coefficients of all developed countries (0.25), making Sweden one of the world's most equal countries in terms of income.

Today, Sweden, officially the Kingdom of Sweden, is a constitutional monarchy with a parliamentary democracy form of government and a highly developed economy. It must been taken into consideration that since the early 19th century Sweden has generally been at peace and has largely avoided war. Therefore GDP growth has been fast since reforms in the early 1990s, especially in manufacturing. Almost half of the residents, about 4.5 million, are working and the GDP per hour worked is growing 2.5 per cent per year for the economy as a whole and 2 per cent for the trade terms balanced productivity growth. According to OECD globalization and technology sector growth have been key productivity drivers.

1.1 The characteristics of the Swedish Economy

Sweden is an export oriented mixed economy with a very high standard of living. The country is richly endowed with natural resources such as timber, hydropower and iron ore and ranks among the highest in telephone and internet access penetration. Sweden's engineering sector accounts for 50 per cent of output and exports, whilst agriculture accounts for only 2 per cent of GDP and employment. Telecommunications, along with the automotive industry and the pharmaceutical industries are also of great importance. The combination of the above with a skilled labor force, about 1.5 million has tertiary education, made Sweden a prosperous country and constitutes the base of an economy heavily oriented toward foreign trade.

Large organizations both in manufacturing and services dominate the Swedish economy. High and medium high technology manufacturing accounts for nearly 10 per cent of GDP. Amongst the 15 largest Nordic companies both by revenue and profits in billion of USD as published by *The Forbes Global 2000* on April 2012 are Volvo, Ericsson, Nordea and Hennes & Mauritz. Sweden's industry is overwhelmingly in private control, unlike many other industrialised Western countries and publicly owned enterprises have always been of minor importance.

In terms of structure, the Swedish economy is characterised by a large, knowledge intensive and export oriented manufacturing sector, an increasing but comparatively small, business service sector and by international standards, a large public service sector. According to the IMD World Competitiveness Yearbook 2013 Sweden is ranked fourth most competitive economy in the world leaving behind other European countries such as Norway at sixth place and Germany at ninth place.

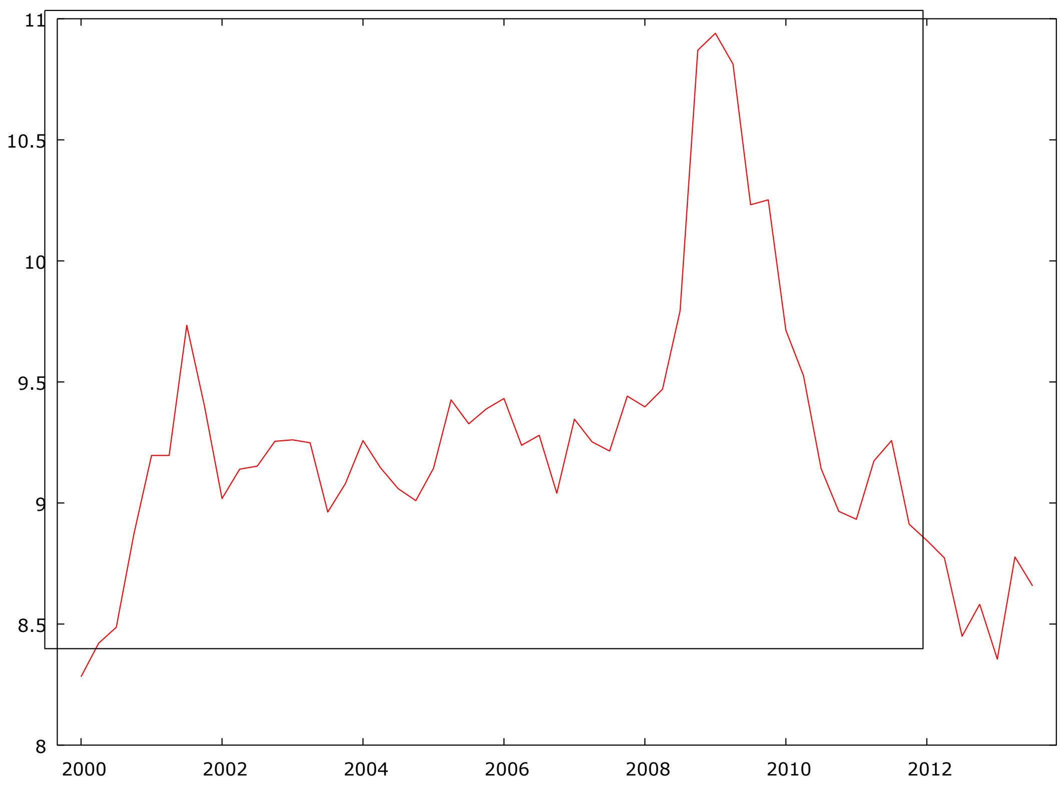
1.2 Exchange Rate policy of Sweden

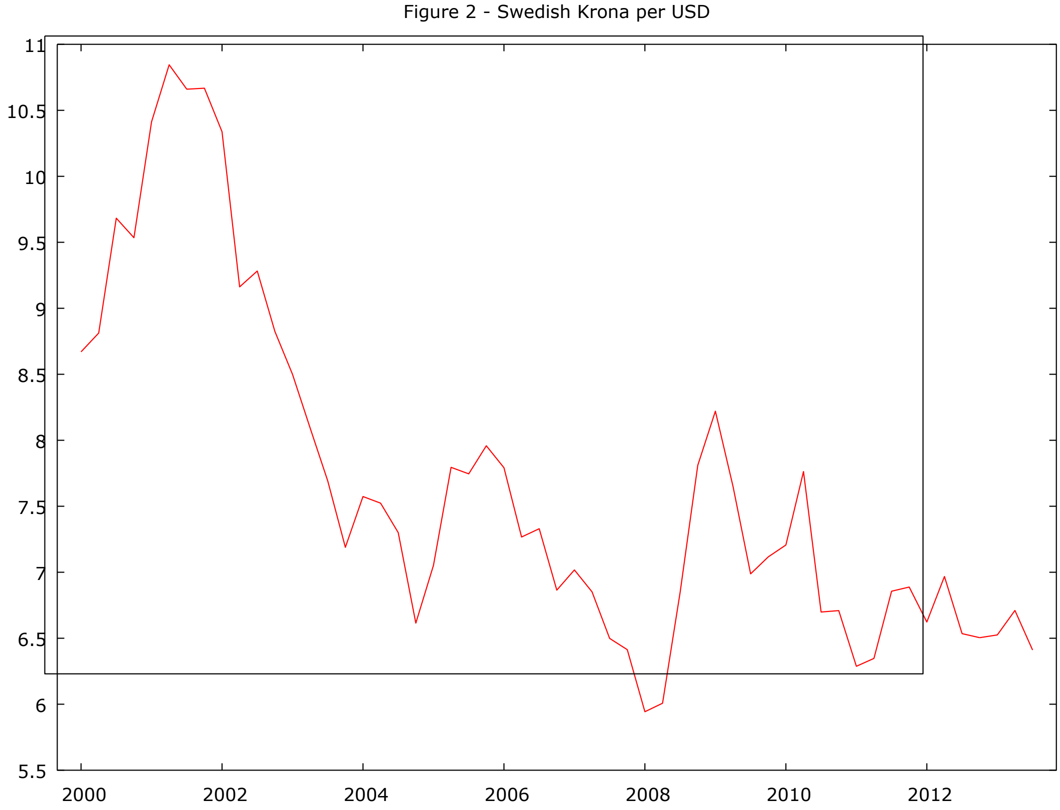
Sweden is a member of the European Union, but not a member of the European Monetary Union. Having rejected the adoption of euro currency in the referendum of 14th September 2003 with 55.9 per cent of the votes, Swedes maintained their own currency, the Swedish krona (SEK). This essay seeks to examine and find the relationship between the exchange rate of the Swedish krona and the trade balance of Sweden.

The Swedish krona was the ninth most traded currency in the world by value in April 2010 according to the *Bank for International Settlements* report on global foreign exchange market activity. The exchange rate has been relatively stable against the euro since its introduction (about 9 to 9.5 SEK per EUR), but from the second half of 2008, the value of the krona has declined by around 20 per cent and had been oscillating between 10.4 to 11 SEK per EUR into the first half of 2009. The primary reason for its declining value lies with the Swedish National Bank, which has significantly lowered the interest rate. The Swedish Riksbank was founded in 1668 and is focusing on price stability with an inflation target of 2 per cent.

In the second half of 2009 and the start of 2010, the krona started to appreciate, during late 2010 and early 2011 it continued to appreciate at a quicker rate. The exchange rate is currently between 8.5 and 9.0 SEK per EUR. In July 2012, due to crisis in Greece and fear of further spreading to Italy and Spain, the euro continued to decline making the Swedish krona stronger, reaching as low as 8.17 SEK per EUR. In Figure 1 we plot the SEK per EUR from the beginning of 2000 until the first quarter of 2013 and in the Figure 2 we plot the SEK per USD for the same period.

Figure 1 - Swedish Krona per EUR





2. Literature Review

Forecasting exchange rate movements is an attractive subject in international finance literature since the collapse of Bretton Woods system at early 1970s and the advent of floating exchange rates. The impact of the exchange rate volatility or exchange rate uncertainty on the trade flows has gained momentum and many studies have investigated whether or not exchange rate fluctuations have negative or positive effects on international trade both in theoretical and empirical terms.

Generally, the majority of the studies have pointed out that the increase of the exchange rate fluctuations impacts negatively on international trade. Ethier (1973), Cushman (1983, 1986), Kenen and Rodrik (1986), Thursby and Thursby (1987), Peree and Steinherr (1989), Caporale and Doroodian (1994), Arize (1998) provide evidence that the increase of the exchange rate volatility dampens international trade, especially exports. Moreover, Arize et al. (2000), Saucer and Bohara (2001), Grier and Smallwood (2007), Baum and Caglayan (2009) and Caglayan and Di (2010) have indicated that there is a negative relationship between international trade and exchange rate fluctuations and pinpointed heterogeneous negative effects on countries.

On the other hand, some studies have demonstrated a positive relationship between exchange rate fluctuation and international trade. Hooper and Kohlhagen (1978) investigated the effects of exchange rate volatility on imports of five industrialized countries and found that exchange rate fluctuation measured by the standard error of the nominal exchange rate positively impacts imports. De Grauwe (1988) found a positive relationship between the exchange rate fluctuation and international trade when the income effect has a substitution effect. Klein (1990), Franke (1991), Sercu and Vanhulle (1992), Kroner and Lastrapes (1993), Baum et al. (2004) and Baum and Caglayan (2010) showed that exchange rate volatility has a positive impact on international trade in some cases. (Kurihara (2013, page 794))

Kenen and Rodrik (1986) have investigated the effects of short term volatility of real exchange rates on the volume of imports of eleven countries. In the case of Sweden, they have not found any significant relationship between the two variables. Thursby and Thursby (1987) have investigated the effects of exchange rate volatility on export value of sixteen countries. In the case of Sweden, the results have not indicated any significant relationship.

Sweden, a relatively less studied country when it comes to her exchange rate and trade balance issues, was one of the six countries examined by Qian and Varangis (1994) along with Australia, Canada, Japan, Netherlands and United Kingdom. The examination turns out to reveal, in contrast to Thursby and Thursby (1987), that the exchange rate volatility had significantly positive effects on Swedish real exports. More specifically, a 10 per cent increase in the volatility of exchange rates will increase the volume of trade by 5 per cent and the export prices by 0.6 per cent in Sweden. Furthermore, Bahmani - Oskooee and Niroomand (1998), estimated the Marshall – Lerner (ML) condition for many countries, including Sweden, found that the ML condition was met for the Scandinavian country, implying that devaluation of the krona has a long run favorable impact on the Swedish trade balance. In addition, Bahmani – Oskooee and Ratha (2007) found that between Sweden and her major seventeen trading partners, real depreciation of the krona has short run effects on the bilateral trade balance between Sweden and fourteen of her trading partners. However, in most cases, the short run effects did not last into the long run. In another paper, Bahmani – Oskooee and Hajilee (2009) have investigated the short run and the long run effects of real depreciation of krona, using disaggregating the data by industry on each of the eighty seven industries that trade. They have found short run significant effects in the majority of the industries, but the short run effects last into the long run favorable effects only in twenty three of the industries. Real depreciation of Swedish krona had adverse effects on the trade balance of three industries and no effects in the results of sixty one industries.

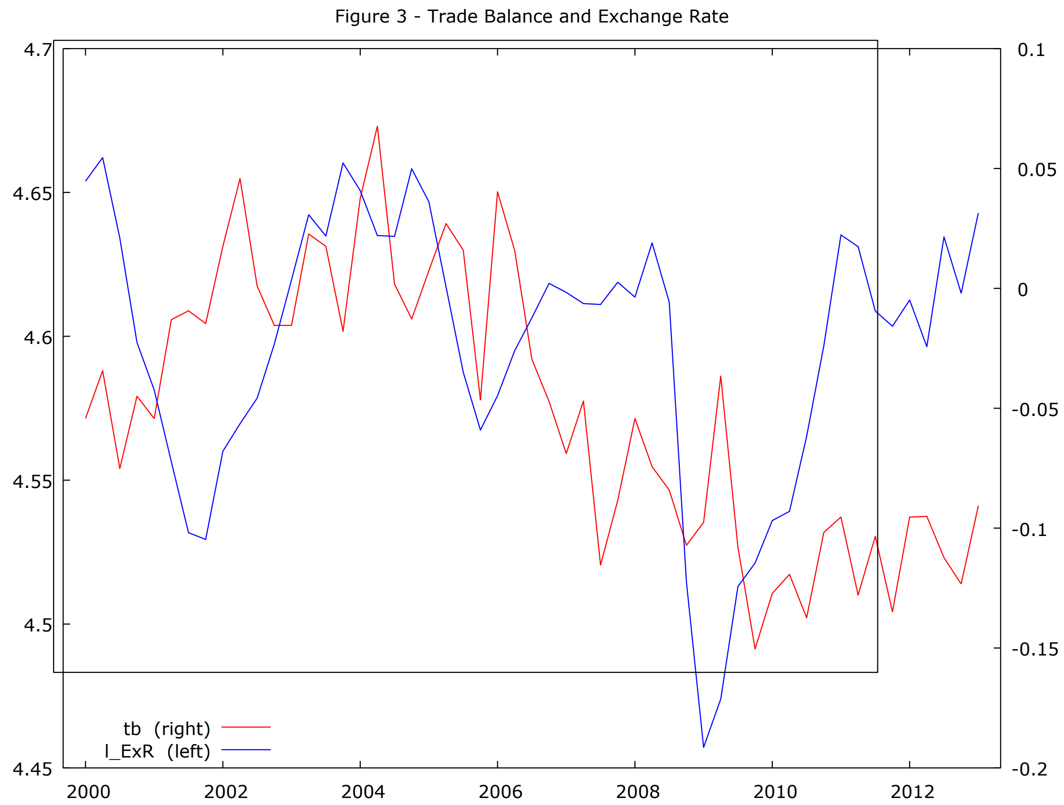
3. Empirical Analysis

3.1 Data

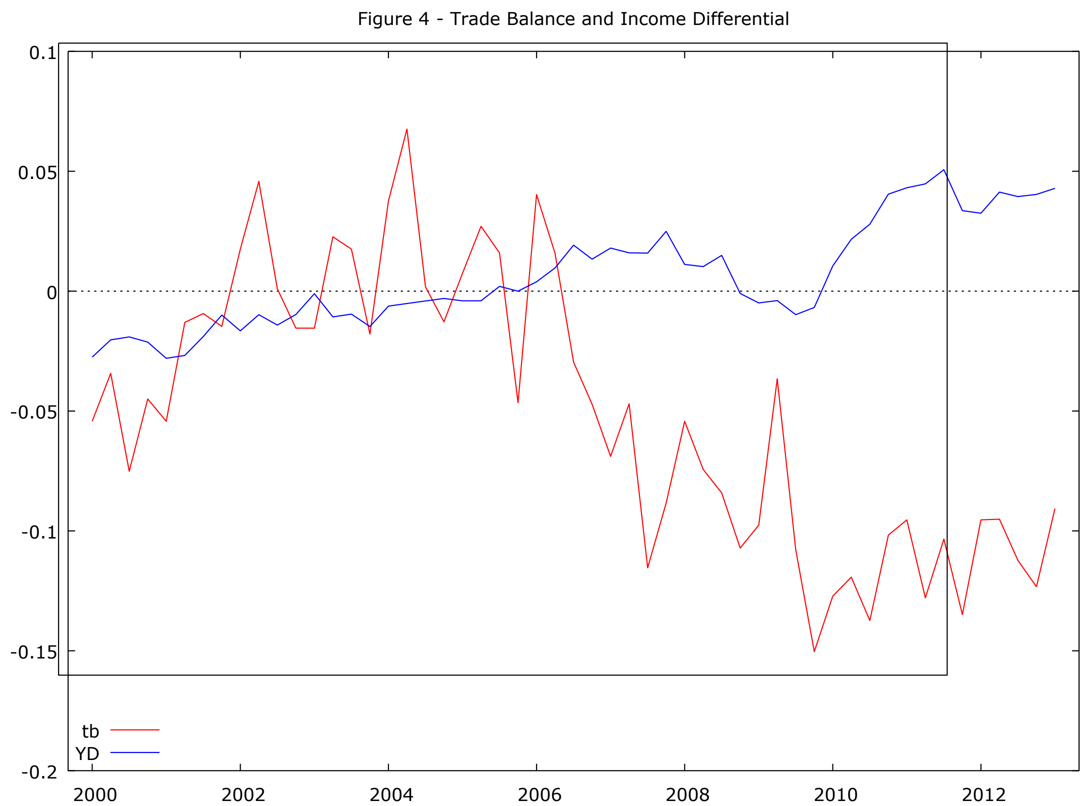
In the present thesis we study the relationship among the Swedish trade balance, the real effective exchange rate of Swedish krona and the difference between Swedish GDP and World GDP from the first quarter of 2000 to the first quarter of 2013. The exchange rate and the volume of exports and imports have been collected from International Monetary Fund (IMF) data base. Whilst the two income variables have been obtained from the Organisation for Economic Co – operation and Development (OECD).

We have transformed all variables into natural logarithms. Thus, the logarithm of exports is denoted as l_X, the logarithm of imports is denoted as l_M, the logarithm of real effective exchange rate is denoted as l_ExR, the logarithm of domestic GDP is denoted by l_Y and the logarithm of foreign GDP is denoted as l_Y*. The trade balance (tb) has been constructed as the difference between l_X and l_M. Also, we have constructed the income differential (YD) as the l_Y minus l_Y*.

In Figure 3, we plot the variables tb and l_ExR. As we observe, the two variables seem to move together over the sample period.



In Figure 4, we plot the variables tb and YD. From the plot we cannot observe a clear-cut pattern between the two variables.



3.2 Methodology

We set up the following model :

$$tb_t=\alpha+\beta l\_ExR_t+\gamma YD_t+u_t \quad (1)$$

Where α is a constant, β is the elasticity of the trade balance with respect to exchange rate, γ is the elasticity of the trade balance with respect to income differential and u_t is an error term.

Firstly, we test whether the variables concerned are I(1) processes, that is they are contain unit roots in the autoregressive polynomials. This preliminary step is very important in order to avoid the spurious regression problem in econometrics. If the hypothesis of one unit root is not rejected for all variables, then equation 1 is tested for cointegration by testing the stationarity properly of the residuals $u_{t.}$

3.3 Stationarity tests

We perform Augmented Dickey – Fuller (ADF) test for the trade balance and the results are depicted in Table 1.

Table 1 – ADF test for the Trade Balance

```
Augmented Dickey-Fuller test for tb
including 2 lags of (1-L)tb (max was 2)
sample size 50
unit-root null hypothesis: a = 1

   test without constant
   model: (1-L)y = (a-1)*y(-1) + ... + e
   1st-order autocorrelation coeff. for e: -0.057
   lagged differences: F(2, 47) = 6.608 [0.0030]
   estimated value of (a - 1): -0.0245015
   test statistic: tau_nc(1) = -0.397057
   asymptotic p-value 0.5411

   with constant and trend
   model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e
   1st-order autocorrelation coeff. for e: -0.078
   lagged differences: F(2, 45) = 3.625 [0.0347]
   estimated value of (a - 1): -0.340394
   test statistic: tau_ct(1) = -2.72696
   asymptotic p-value 0.2255
```

It is clear that the unit root hypothesis cannot be rejected. This is derived by the fact that the asymptotic p – value of the tests, firstly the test without constant (0.5411) and secondly the test with constant and trend (0.2255), is higher than 0.05. Therefore, the trade balance is a non stationary time series.

Subsequently, we perform the same test for the first difference of the trade balance and results are given in Table 2.

Table 2 – ADF test for the first difference of the Trade Balance

```
Augmented Dickey-Fuller test for d_tb
including one lag of (1-L)d_tb (max was 2)
sample size 50
unit-root null hypothesis: a = 1

   test without constant
   model: (1-L)y = (a-1)*y(-1) + ... + e
   1st-order autocorrelation coeff. for e: -0.064
   estimated value of (a - 1): -1.82731
   test statistic: tau_nc(1) = -8.90054
   asymptotic p-value 1.869e-016

   with constant and trend
   model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e
   1st-order autocorrelation coeff. for e: -0.081
   estimated value of (a - 1): -1.85418
   test statistic: tau_ct(1) = -8.86747
   asymptotic p-value 1.874e-015
```

It is obvious that the unit root hypothesis is now rejected, the time series is stationary and therefore the trade balance variable is integrated of order one (I(1)).

By applying the Augmented Dickey – Fuller (ADF) test on the exchange rate and its first difference, we get the results depicted in Table 3 and Table 4 respectively.

Table 3 – ADF test for the Exchange Rate

```
Augmented Dickey-Fuller test for l_ExR
including one lag of (1-L)l_ExR (max was 2)
sample size 51
unit-root null hypothesis: a = 1

   test without constant
   model: (1-L)y = (a-1)*y(-1) + ... + e
   1st-order autocorrelation coeff. for e: 0.083
   estimated value of (a - 1): -3.95142e-005
   test statistic: tau_nc(1) = -0.0540181
   asymptotic p-value 0.6649

   with constant and trend
   model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e
   1st-order autocorrelation coeff. for e: 0.025
   estimated value of (a - 1): -0.218717
   test statistic: tau_ct(1) = -3.14987
   asymptotic p-value 0.09482
```

Table 4 – ADF test for the first difference of the Exchange Rate

```
Augmented Dickey-Fuller test for d_l_ExR
sample size 51
unit-root null hypothesis: a = 1

   test without constant
   model: (1-L)y = (a-1)*y(-1) + e
   1st-order autocorrelation coeff. for e: 0.083
   estimated value of (a - 1): -0.613454
   test statistic: tau_nc(1) = -4.64371
   p-value 1.492e-005

   with constant and trend
   model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + e
   1st-order autocorrelation coeff. for e: 0.089
   estimated value of (a - 1): -0.626042
   test statistic: tau_ct(1) = -4.65085
   p-value 0.002449
```

As we can see from the asymptotic p – values of the Table 3 and Table 4 the exchange rate is integrated of order one (I(1)).

Similar results, meaning that the time series of income differential is integrated of order one I(1), are given in Table 5 and Table 6.

Table 5 – ADF test for the Income Differential

```
Augmented Dickey-Fuller test for YD
sample size 52
unit-root null hypothesis: a = 1

   test without constant
   model: (1-L)y = (a-1)*y(-1) + e
   1st-order autocorrelation coeff. for e: 0.016
   estimated value of (a - 1): -0.0299362
   test statistic: tau_nc(1) = -0.665408
   p-value 0.4241

   with constant and trend
   model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + e
   1st-order autocorrelation coeff. for e: 0.063
   estimated value of (a - 1): -0.221453
   test statistic: tau_ct(1) = -2.45699
   p-value 0.3474
```

Table 6 – ADF test for the first difference of the Income Differential

```
Augmented Dickey-Fuller test for d_YD
including 2 lags of (1-L)d_YD (max was 2)
sample size 49
unit-root null hypothesis: a = 1

   test without constant
   model: (1-L)y = (a-1)*y(-1) + ... + e
   1st-order autocorrelation coeff. for e: 0.037
   lagged differences: F(2, 46) = 1.528 [0.2279]
   estimated value of (a - 1): -0.745917
```

```
   test statistic: tau_nc(1) = -3.0218
   asymptotic p-value 0.002453

   with constant and trend
   model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + e
   1st-order autocorrelation coeff. for e: -0.003
   estimated value of (a - 1): -1.04066
   test statistic: tau_ct(1) = -7.27356
   p-value 6.413e-007
```

Eventually, from the analysis above, we conclude that the examined time series are non stationary.

3.4 Cointegration analysis

The estimation results of equation 1 are reported in Table 7. Furthermore, for the purpose of the estimation it is useful to point out that the second quarter of the year 2006 includes a dummy variable, which cause no structural break. However, the facts that took place the specific period and lead us to the use of the dummy variable is not a subject of investigation in this paper, since there is no structural break.

Table 7 – Cointegration test

```
Step 1: cointegrating regression

Cointegrating regression -
OLS, using observations 2000:1-2013:1 (T = 53)
Dependent variable: tb

             coefficient   std. error   t-ratio   p-value
  ---------------------------------------------------------
  const      -1.83074      0.581784     -3.147    0.0028   ***
  l_ExR       0.389236     0.126622      3.074    0.0034   ***
  YD         -1.68441      0.277021     -6.080    1.76e-07 ***
  DUM3        0.0742453    0.0430050     1.726    0.0906   *


Mean dependent var  -0.050249   S.D. dependent var   0.056860
Sum squared resid    0.088855   S.E. of regression   0.042584
R-squared            0.471483   Adjusted R-squared   0.439125
Log-likelihood       94.15897   Akaike criterion    -180.3179
Schwarz criterion   -172.4368   Hannan-Quinn        -177.2872
rho                  0.465764   Durbin-Watson        0.993901

Step 2: testing for a unit root in uhat

Dickey-Fuller test for uhat
sample size 52
unit-root null hypothesis: a = 1
```

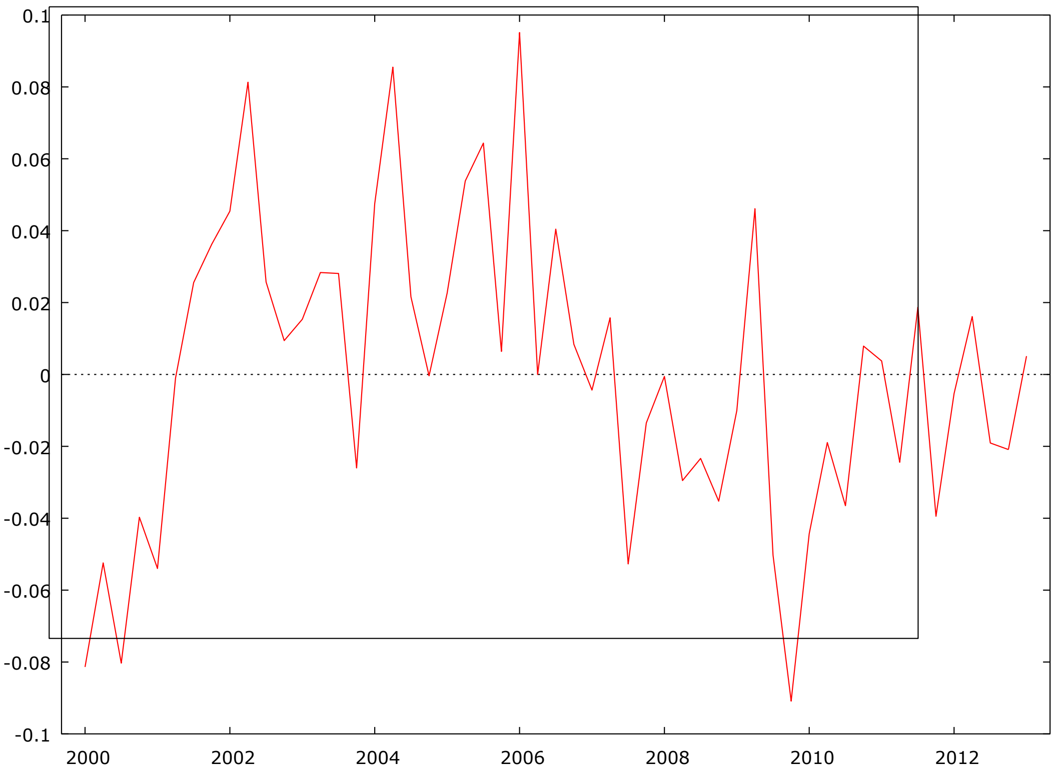
```
   model: (1-L)y = (a-1)*y(-1) + e
   1st-order autocorrelation coeff. for e: -0.111
   estimated value of (a - 1): -0.534236
   test statistic: tau_c(4) = -4.5317
   p-value 0.0311

There is evidence for a cointegrating relationship if:
(a) The unit-root hypothesis is not rejected for the individual variables.
(b) The unit-root hypothesis is rejected for the residuals (uhat) from the
    cointegrating regression.
```

In Figure 5, we plot the cointegrating residuals from equation 1. As we observe the series does not seem to exhibit systematic time trends, which is consistent with the stationarity hypothesis.

The Augmented Dickey – Fuller (ADF) test indicates that the residuals are I(0) and thus the variables are cointegrated. This implies that the trade balance and the two explanatory variables have moved together in a systematic way during the sample period, obeying an equilibrium constraint.

Figure 5 - Regression residuals (=observed - fitted tb)



3.5 Vector Error Correction Model (VECM)

According to Granger Representation Theorem, if variables are cointegrated, then there always exists an Error Correction Model (ECM). We have already shown that the variables under study are cointegrated and they have a long run equilibrium relationship.

In our case, we are dealing with more than one variable, that's why we should use the Vector Error Correction Model (VECM), counterpart of ECM, in order to take full account of the dynamic responses of all variables in the cointegrated system. Firstly, we determine the optimum lag order of the VECM by estimating a Vector Autoregression (VAR) Model and the results are given in the Table 8 below.

Table 8 – VAR lag selection

```
VAR system, maximum lag order 8

The asterisks below indicate the best (that is, minimized) values
of the respective information criteria, AIC = Akaike criterion,
BIC = Schwarz Bayesian criterion and HQC = Hannan-Quinn criterion.

lags        loglik    p(LR)       AIC          BIC          HQC

   1     360.99183           -15.510748   -15.028972*  -15.331147*
   2     370.35570  0.02761  -15.526920*  -14.683811   -15.212617
   3     375.98837  0.25796  -15.377261   -14.172819   -14.928257
   4     384.90222  0.03723  -15.373432   -13.807658   -14.789727
   5     387.92404  0.73554  -15.107735   -13.180628   -14.389329
   6     399.84811  0.00455  -15.237694   -12.949255   -14.384587
   7     407.85463  0.06661  -15.193539   -12.543768   -14.205731
   8     414.13375  0.18364  -15.072611   -12.061507   -13.950102
```

We note that the Schwarz Bayesian criterion (BIC) and the Hannan – Quinn criterion (HQC) indicate that the optimal lag is one (1), while the Akaike criterion (AIC) chooses two (2) lags.

Then we estimate the VECM and the results are presented in Table 9.

Table 9 - VECM estimation

```
VECM system, lag order 1
Maximum likelihood estimates, observations 2000:2-2013:1 (T = 52)
Cointegration rank = 1
Case 2: Restricted constant
```

```
beta (cointegrating vectors, standard errors in parentheses)

tb          1.0000
           (0.00000)
YD          2.5129
           (0.47405)
l_ExR     -0.66758
           (0.21248)
const       3.0984
           (0.97619)


alpha (adjustment vectors)

tb        -0.29420
YD       -0.030113
l_ExR      0.17258



Log-likelihood = 414.87186
Determinant of covariance matrix = 2.3588989e-011
AIC = -15.6105
BIC = -15.2727
HQC = -15.4810



Equation 1: d_tb

             coefficient   std. error   t-ratio   p-value
  -------------------------------------------------------
  EC1         -0.294197    0.0944302    -3.115    0.0030  ***

Mean dependent var  -0.000699   S.D. dependent var   0.035043
Sum squared resid    0.052470   S.E. of regression   0.032394
R-squared            0.162568   Adjusted R-squared   0.145819
rho                 -0.125957   Durbin-Watson        2.221755



Equation 2: d_YD

             coefficient   std. error   t-ratio   p-value
  -------------------------------------------------------
```

```
  EC1        -0.0301128    0.0203378    -1.481    0.1450

Mean dependent var   0.001354   S.D. dependent var   0.006924
Sum squared resid    0.002434   S.E. of regression   0.006977
R-squared            0.042004   Adjusted R-squared   0.022844
rho                  0.073434   Durbin-Watson        1.846843



Equation 3: d_l_ExR

             coefficient   std. error   t-ratio   p-value
  -------------------------------------------------------
  EC1         0.172575     0.0709293     2.433    0.0186  **

Mean dependent var  -0.000212   S.D. dependent var   0.025478
Sum squared resid    0.029603   S.E. of regression   0.024332
R-squared            0.105862   Adjusted R-squared   0.087979
rho                  0.328846   Durbin-Watson        1.300406


Cross-equation covariance matrix:

                 tb           YD         l_ExR
tb        0.0010090  2.1791e-005   0.00012361
YD      2.1791e-005  4.6805e-005  5.0613e-005
l_ExR    0.00012361  5.0613e-005   0.00056929


determinant = 2.3589e-011
```

The error correction coefficient of the trade balance is -0.29 (EC1=-0.294197) and suggests that about one third of the discrepancy between long term and short term is corrected within a quarter. This is the rate of adjustment to equilibrium. The error correction coefficient of the exchange rate is 0.17 (EC1=0.172575) and suggests that about seventeen per cent of the discrepancy between long term and short term is corrected within a quarter. This is also the rate of adjustment to equilibrium. By employing additional variables, we might have seen a different result.

Since we have discovered two EC models, it implies that both the trade balance and the exchange rate are adjusting to bring about equilibrium.

3.6 EC Analysis and Stability tests

In order to enrich the dynamics of the short run trade balance equation, we have also estimated an EC Model with two lags and the selective equation is reported in Table 10. The EC term is highly significant, indicating the existence of cointegration.

Table 10 – OLS regression model on the first difference of the Trade Balance

```
Model 2 : OLS, using observations 2000:4-2013:1 (T = 50)
Dependent variable: d_tb
HAC standard errors, bandwidth 2 (Bartlett kernel)

              coefficient   std. error   t-ratio   p-value
  --------------------------------------------------------
  d_l_ExR_2    -0.222166    0.131725     -1.687    0.0985  *
  uhat1_1      -0.269594    0.0982246    -2.745    0.0086  ***
  d_tb_1       -0.230453    0.135339     -1.703    0.0954  *
  d_tb_2       -0.377996    0.108405     -3.487    0.0011  ***

Mean dependent var  -0.000311   S.D. dependent var   0.035162
Sum squared resid    0.039736   S.E. of regression   0.029391
R-squared            0.344161   Adjusted R-squared   0.301388
F(4, 46)             11.15389   P-value(F)           2.08e-06
Log-likelihood       107.4910   Akaike criterion    -206.9820
Schwarz criterion   -199.3339   Hannan-Quinn        -204.0696
rho                 -0.036898   Durbin's h          -0.806801


  QLR test for structural break
  Null hypothesis: no structural break
  Test statistic: max F(5, 41) = 1.92855 at observation 2006:1
  (10 percent critical value = 3.26)
```

In Figure 6 we plot the actual and fitted values of the model and in Figure 7 we plot the estimated residuals.

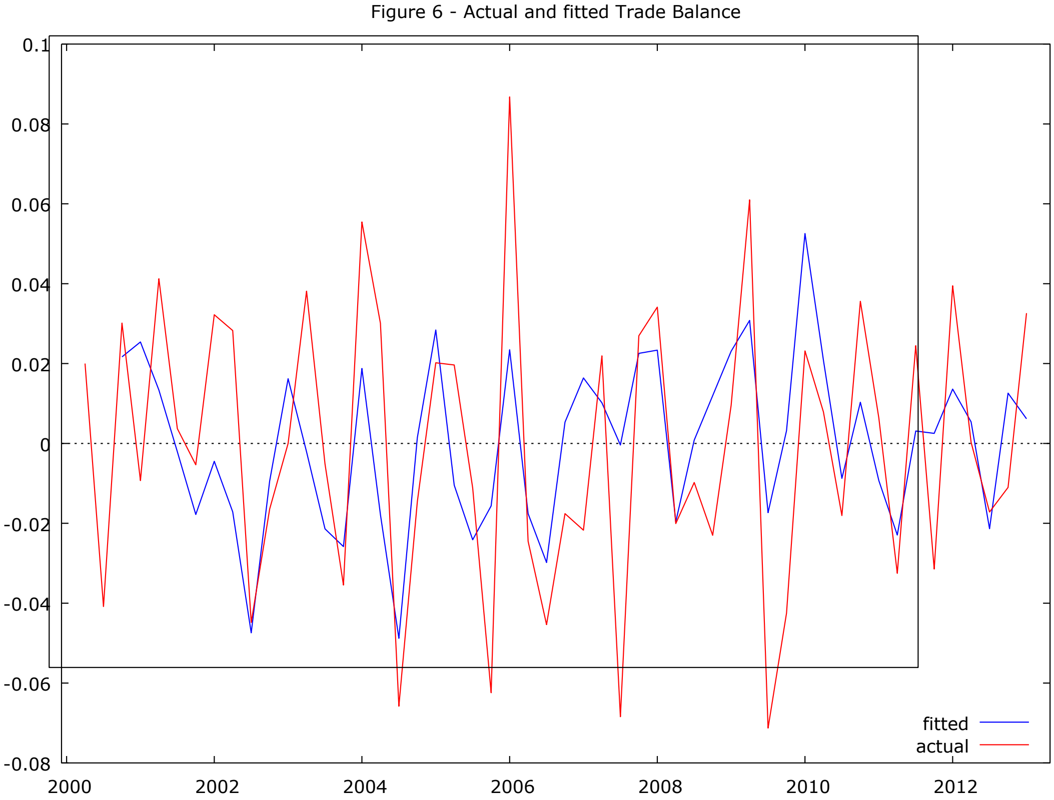


Figure 6 - Actual and fitted Trade Balance
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
2000
2002
2004
2006
2008
2010
2012
fitted
actual

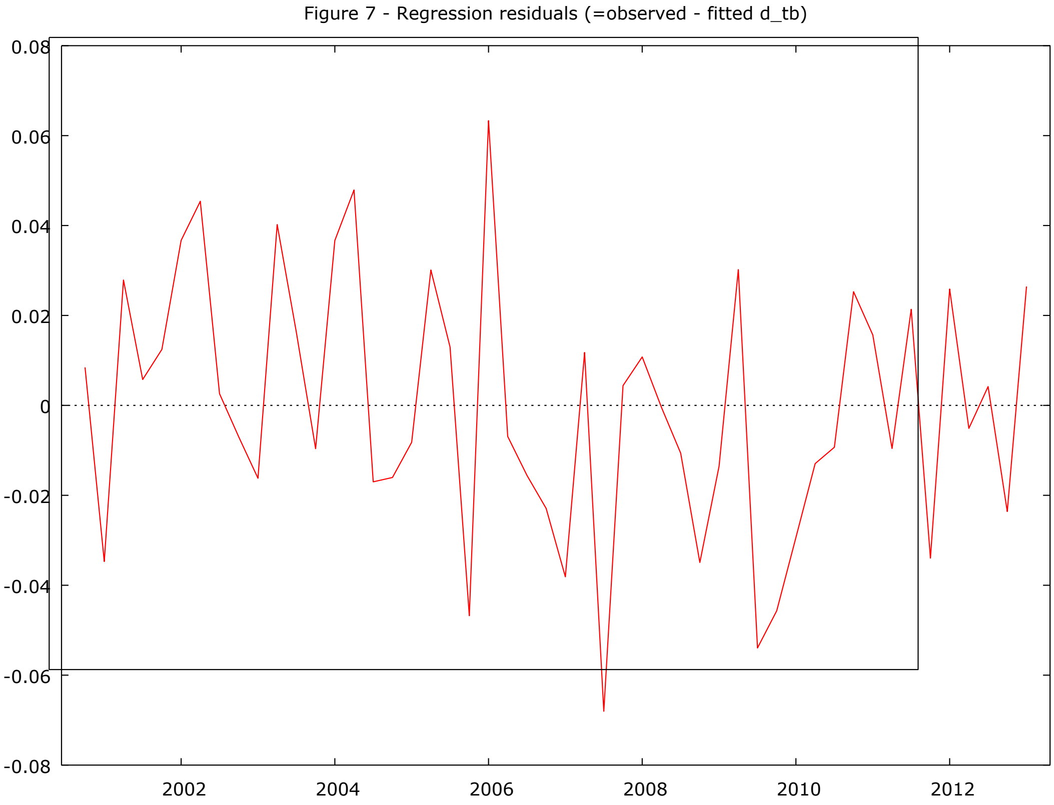
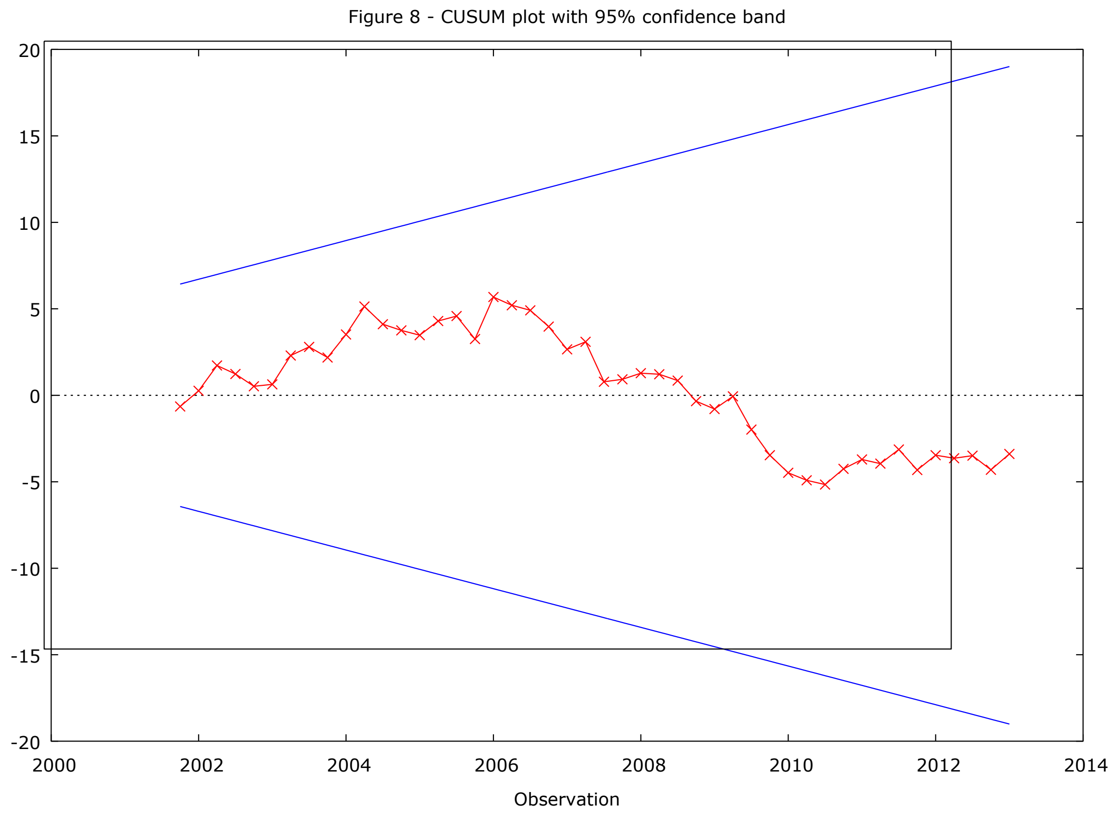


Figure 7 - Regression residuals (=observed - fitted d_tb)
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
2002
2004
2006
2008
2010
2012

Stability tests

The parameters of the EC Model have been tested for stability, using a recursive procedure based on CUSUM and CUSUMSQ.

The CUSUM plotted in Figure 8 test is based on a normalized version of the cumulative sums of the residuals. The scaling is such that under the null hypothesis of perfect parameter stability, the CUSUM statistic is zero however many residuals are included in the sum. A set of ±2 standard error bands is usually plotted around zero and any statistic lying outside the bands is taken as evidence of parameter instability. The results indicate structural stability.



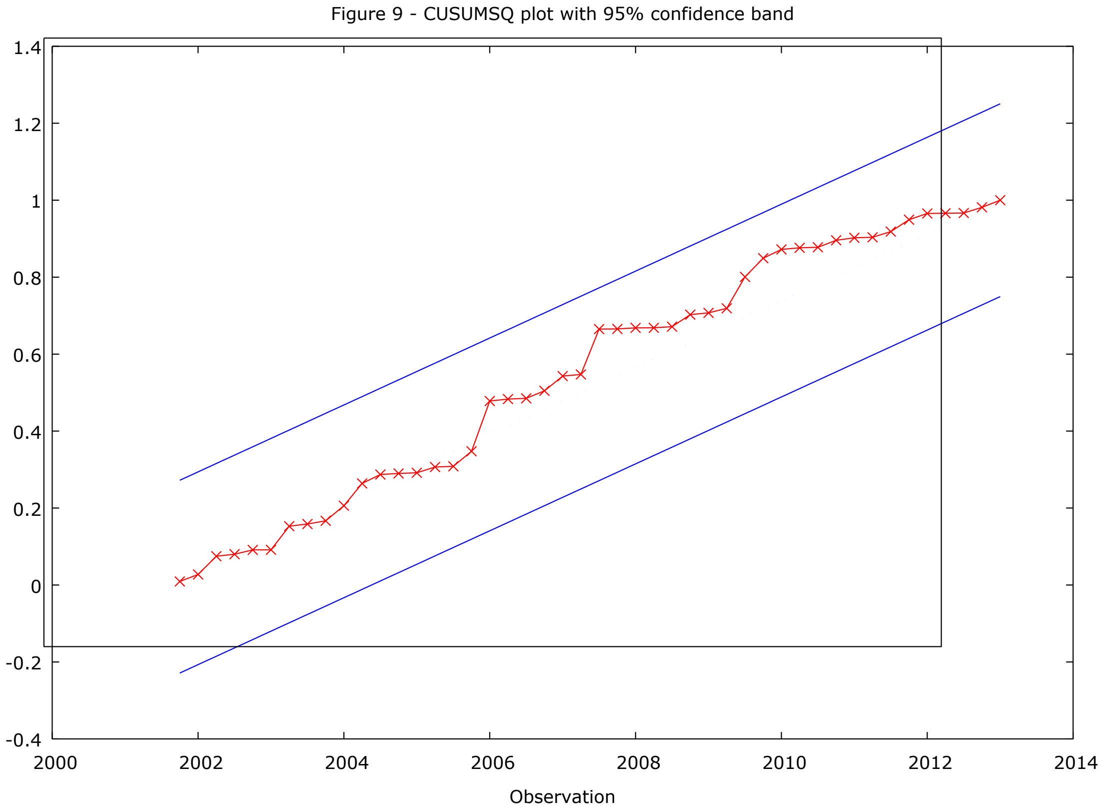
CUSUM test for parameter stability -

Null hypothesis: no change in parameters

Test statistic: Harvey-Collier t(45) = -0.499961

with p-value = P(t(45) > -0.499961) = 0.619538 (>0.05)

The CUSUMSQ plotted in Figure 9 test is based on a normalized version of the cumulative sums of squared residuals. The scaling is such that under the null hypothesis of parameter stability, the CUSUMSQ statistic will start at zero and end the sample with value one. Again a set of ±2 standard error bands is usually plotted around zero and any statistic lying outside these is taken as evidence of parameter instability. Again, the results indicate structural stability.



4. Summary and Conclusions

In the present thesis, using quarterly data from the first quarter of the year 2000 to the first quarter of the year 2013, we tried to identify the determinants of the trade balance in Sweden. We have used two kind of explanatory variables, the exchange rate and the income differential. The univariate time series analysis has indicated that all variables concerned are I(1) and the trade balance equation is cointegrated.

Having identified and estimated the long run equilibrium trade balance equation, we have also examined the speed of adjustment to equilibrium in the context of an EC Model. The error correction term is interpreted as a disequilibrium term. In the VECM with lag order one, the error correction of the trade balance is -0.29 (EC1=-0.294197) suggesting that about one third of the discrepancy is corrected within a quarter and is statistically significant. This is a quick rate of adjustment to equilibrium. Likewise, deviations of the exchange rate from the equilibrium are corrected 17 per cent within a quarter. Once again, the error correction coefficient is statistically significant. Moreover, the VECM suggest that there is no significant bilateral causality between the trade balance and the exchange rate.

Furthermore, we performed two stability tests, CUSUM and CUSUMSQ, in order to confirm the stability of the parameters of the OLS regression model. Both tests have shown that the null hypothesis of stability is not rejected.

All in all, the trade balance of Sweden seems to be related to the traditional determinants of trade flows, such as the exchange rate and incomes in a stable way.

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