DISEQUILIBRIUM OF THE REAL EXCHANGE RATE IN ALGERIA THE EFFECTIVENESS OF THE PARALLEL EXCHANGE RATE

By
SI MOHAMMED. FAIZA
Simohammedfayza@hotmail.fr
Faculty of Economics, University of Tlemcen, Algeria
&
HAOULIA.YAHIA
haoulia-yahia@hotmail.fr
The center of Belhadj Bouchaib –Ain Temouchent

Abstract:

This study aims to measure the disequilibrium in the real exchange rate and the efficiencies of the parallel exchange rate through the study of the Algerian economy for the period from 1974 to 2012 and this by using a vector error correction model VECM, where the findings confirm the need for the approximation The real exchange rate of the equilibrium level, as well as the elimination of the parallel market .that it was confirmed by the results of the standard study
Key words: real exchange rate equilibrium, disruption of the real exchange rate, effective of the parallel exchange rate, vector error correction model.
Résumé :

Cette étude vise à mesurer la déséquilibration du taux de change réel ainsi que l'efficience du taux de change parallèle à travers une étude de cas de l'économie Algérienne durant la période (1974 – 2012) , en utilisant le modèle a correction d'erreur vectoriel (VECM) ou les résultats confirment la nécessité de l'approximation du taux change à son niveau d'équilibre ainsi que l'élimination de marche parallèle du change ,et cela était confirmé par les résultats de notre étude économétrique.
Mots clés : taux de change réel d'équilibre, la déséquilibration du taux de change réel, l'efficience du marché parallèle, Algérie, modèle a correction d'erreur vectorielle.

I. Introduction

The disequilibrium of the exchange rates or the differences between the current exchange rate and its equilibrium value at medium and long-term levels have adverse effects on the economy, and the existence of a parallel exchange foreign currency market suggests that the deviation of the official exchange rate of local currency values leads to a failure in the economy. For this reason, many countries tried either to eliminate the parallel market, or to adjust the official exchange rate to the parallel market rate.

The analysis of the exchange rate behavior has known many theoretical and experimental studies, where the PPA theory was discovered, and which has been analyzed by the Swedish economy expert " CASTLE ", and ~~as~~ the three main models appeared, which are: The FEER-Williamson Model (the basic exchange rate equilibrium), The BEER-Macdonald model (the real behavioral exchange rate equilibrium) in addition to the ordinary exchange rate model, which provides narrow analysis of the mechanisms of equilibrium at medium and long term. In 1994, AL-BADAWI discovered that the real equilibrium exchange rate in the long term is unstable, his method allows to know the real chronological path of current exchange rates and its long-term evaluation depends on the customizing a dynamics in which the real exchange rate is adjusted to the exchange rate equilibrium.

This study aims to shed light on the disequilibrium of the real exchange rate of Algerian Dinar from its equilibrium level by finding the factors that delineate the real equilibrium exchange rate basing on the models and approaches which explain it, thus knowing the extent to which equilibrium exchange rate represents this equilibrium level.

- **Thesis Statement:**

This paper attempts to investigate the optimal level of the real exchange rate equilibrium in Algeria, and the ability of the parallel exchange rate to represent Equilibrium value of Algerian Dinar.

- **Hypotheses of the study**

The above study yielded into a number of hypotheses, which are:

✓ H01 = recovering the real value of the currency leads to the correction of imbalances suffered by economy

✓ H02 = Considering the parallel exchange rate as an indicator of Disorder

✓ H03 = Using modern theories to count the real equilibrium exchange rate in Algeria.

✓ H04 = The parallel exchange rate is the rate which produces equilibrium in Algerian economy

- **Aim Of the Study:**

The main goal of this work is to estimate the real equilibrium exchange rate in Algeria and find out the periods of disequilibrium in the Algerian Dinar exchange. Also, to Study the extent to which the parallel exchange rate contributes as a tool to assess this disequilibrium

II. Literature Review and Theoretical Framework

The topic of equilibrium exchange rate tackled a standard set of studies, which focused on studying the long-term relationship between real exchange rate and a set of economic variables able to influence the overall internal and external equilibrium. In 1989, Edward estimated the real equilibrium exchange rate for a group of developing countries. He suggested the existence of a number of variables, which set the real equilibrium exchange rate, such as technological development and Capital accumulation. In 1996 Helper- 'Wyplosz research in The fundamental determinants of the equilibrium exchange for a group of developing countries in Eastern Europe, focus centered on the importance of labor productivity.

Studies by Allahoum. M.Achouch and .Kherbachi and T. Koranchellion have proven that the real exchange rate in Algeria was less than the equilibrium level until the year 1985 but regains equilibrium since 2003. These results are inconsistent with those, which ensure high real exchange rate in countries whose economics is characterized by currency exchange rate control.

Among the relevant literature dealing with the exchange rate in the parallel market in developing countries, the study conducted by BLEJER in (1978), who suggested in his research that the decline in the exchange rate in the parallel market led to a decrease in demand for domestic money as opposed to the money in three countries of Latin America namely: Brazil, Chile, and Colombia.

III. The Econometric Approach

❖ THE ESTIMATE THE REAL EQUILIBRIUM EXCHANGE RATE IN ALGERIA

In order to reach the real equilibrium exchange rate which attains an internal and external equilibrium in Algeria, this research used real annual statistical data for the period from 1974 to 2012 formalized by the Central Bank and the International Monetary Fund.

- **Model variables:**

For the sake of estimating the equilibrium exchange rate in Algeria this research will use on the model which was evaluated by Edwards (1989), and which has been expanded by *"BADAWI" (1994) shows that it is a cursor of key variables in the medium and long term. Thus,* the equation which describes the real equilibrium exchange rate in the long-term value as a function of the key variables is as follows:

LOG(RER) = C(1) C(2)*LOG(OPEN) +C(3)*LOG(TOT)+C(4)*LOG(GOV)+C(5)*LOG(M2) + u

Where

RER = real exchange rate OPEN = Trade openness

TOT= Commercial exchange rate. GDP = Gross domestic product

M2 = Money supply relative to GDP

- **The stability test:**

In order to discover the time series of the variables, object of the present study, we use the Augmented Dickey-Fuller (1979, 1981) and Phillips - Perron (1988) tests for stationary and non-stationary time-series. The results are represented in Table 1 showing that all variables are integrated of order one (I (1))

Table 1: Stationary Test Results

Variable	*ADF*		*PP*	
variables	***Level***	***First difference***	***Level***	***First difference***
Ln TCR	*0.81-*	*5.93-****	*0.96-*	*5.94-****
Ln GOV	*2.53-*	*4.49-****	*2.20-*	*4.35-****
Ln OPEN	*1.37-*	*1.63-***	*4.56-*	*4.48-****
Ln M2	*1.80-*	*4.56-****	*1.98-*	*4.48-****
Ln TOT	*3.87-*	*4.39-**	*1.99-*	*5.74-****

**show values are significant at 10 % level with MacKinnon (1996).*

***show values are significant at 1% level with MacKinnon (1996).*

****show values are significant at 5 % and 1 level with MacKinnon (1996).*

- **Cointegration Test**

Long-term relationships between variables in Johansen test are examined on the basis of two tests that are: the Trace test and Max-eigenvalue test. Cointegration test results are shown in Table 2.

Through the results of the Johansen conintegration test, it is discovered that the statistic λ_{trace} is lesser than the critical values, thus the hypothesis of the existence of complementary chronological relationships between variables is accepted, in a way the number of simultaneous integration vectors estimated (R = 2) at the abstract level of 5% and this is evidence of the existence of long-run equilibrium term relationships between some of the variables they do not stray too far from each other as they behave similarly at long-term.

Table 2. Johansen co-integration test

Null Hypothesis	*Critical Values*	*Trace Statistic*	*Max-Eigen Statistic*	*Critical Values 0.05*
r=0	*69.81889*	*81.58612*	*0.515470*	*0.0043*
r<=1	*47.85613*	*54.77684*	*0.497169*	*0.0098*
r<=2	*29.79707*	*29.33932*	*0.290961*	*0.0564*
r<=3	*15.49471*	*16.61705*	*0.261296*	*0.0338*
r<=4	*3.841466*	*5.411292*	*0.136059*	*0.0200*

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
** denotes rejection of the hypothesis at the 0.05 level*
***MacKinnon-Haug-Michelis (1999) p-values*

- **estimate the relationship in the long run:**

LOG (TCR) = 0.47994573062 + 0.641806373762*LOG (TOT) +0.0676297941159*LOG (OPEN) +
(0.83) (0.84)
0.0103870639929*LOG (GOV) + 0.897490562479*LOG (M2)..... (1)
(0.00) (0.98)

R^2=0.581242 DW= 1.734024 Prob (F-stat)=0.000004

The above equation shows that if the TOT and OPEN increase by 1 % then there is a growth in RER of 0.84 % and if M2 increases by 1 % there is an increase in RER of 0.98 %.

- **Vector error correction model**

Cointegration test demonstrated that there is long-term dependence between those variables. However, cointegration is leaving aside the possibility of the short-term fluctuations between the 4 examined variables. The vector error correction model (VECM) is used for detection of these fluctuations during cointegration. Vector error correction model is ad adequate tool to analyze short-term deviations, necessary to achieve long term.

• (ECT) is negative and estimated as =-0.469155 indicates that the real exchange rate adjusts towards its equilibrium value in each time period by the disruption of the balance which remains form the period (t-1) equivalent to 46.91%, which means that when this latter deflects from the equilibrium value in the period (t-1) it is modifying the equivalent of 46.91% of this deviation in the period t.

• The correction ratio reflects the high speed of adjustment in the model, in the sense that the real exchange rate takes more than two years (1 / 0.4691 = 2.13) toward equilibrium value

after the occurrence of any shock in the model as a result of the change in one of its determinants.

❖ **The disequilibrium of the exchange rate**

Disequilibrium has been calculated according to the following equation:

Mésalignement = [RER / RERE -1] × 100

Where

RERE: real exchange rate equilibrium RER: the real exchange rate.

- Figure **(01)**: represents excessive periods of low valuation in the exchange rate and the behavior of the imbalance index allows us to give the following classifications:

Periods of low Rating: 1974, 1986, 1990, 1995-1997, 2000, 2005-2008, 2010-2012

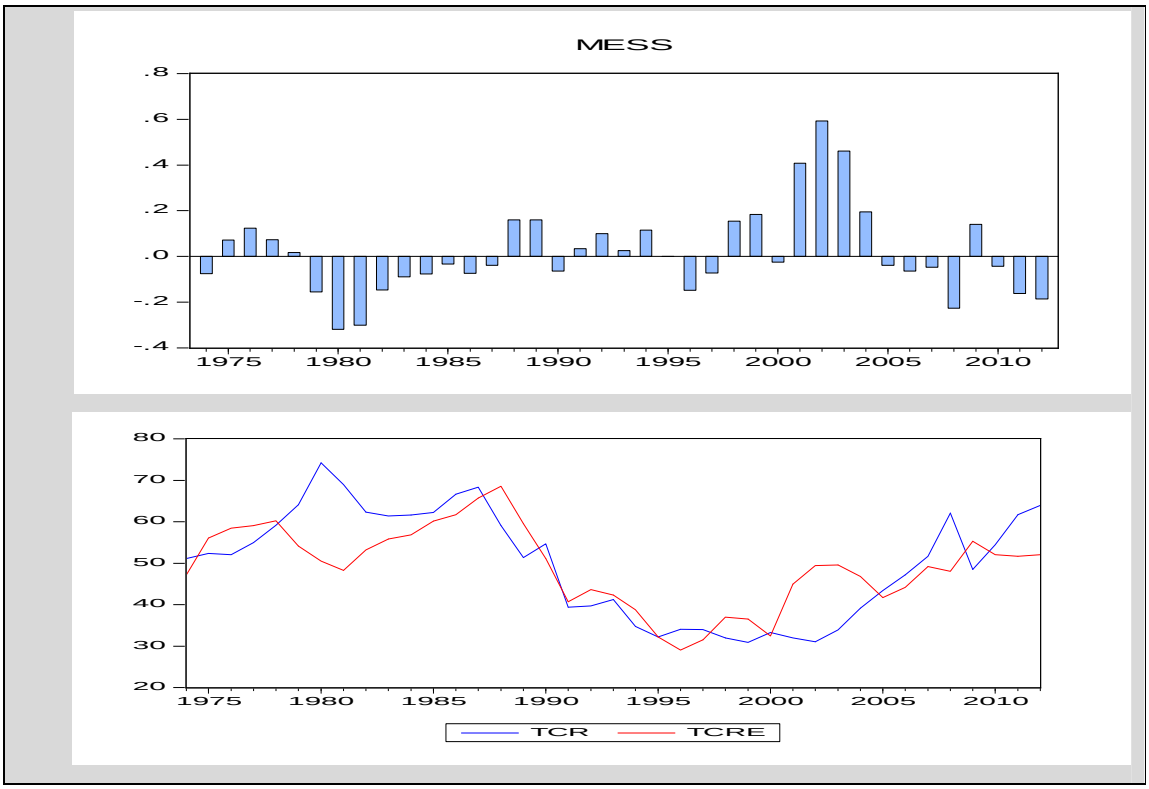
Periods of overvaluation: 1975- 1978, 1988-1989, 1991-1994, 1998-1999, 2001-2004.

Overvaluation periods of the exchange rate: The eighties are characterized by a sharp decline in oil prices in 1986 and a prominent decadence in the nineties. This situation is the result of the liberalization program adopted by Algeria 1992-1993 enhanced by the implementation of the stability program in 1994 adopted by the International Monetary Fund and the World Bank for the reserves and savings.

Improvement in oil prices in 1996-1997 helped restore external imbalances, especially in the late nineties where the degree of overvaluation declined in the exchange rate, also noticed is a decline in the assessment by the commercial repercussions of the global financial crisis of 2008 that prompted the Algerian monetary authorities at the end of December from the year 2008 to devaluation of the dinar by about 20% of its value.

The volume of the deviation of the real exchange rate from its equilibrium level ranges between [6, -3.9], whenever the real exchange rate rises, the competitive skill of Algeria grows, because the real exchange rate of Algerian dinar against the dollar reflects the difference between the purchasing power in America and the purchasing power in Algeria.

Figure 1: the disequilibrium of the real exchange rate



❖ **the effectiveness of the parallel exchange rate**

The second measure to calculate the disequilibrium in the exchange rate depends on the disorder between the official and parallel exchange rates as this indicator is intended to capture the disequilibrium in the real exchange and distortions in the foreign market exchange rate and the premium of parallel exchange rate

$$RE = ERP\text{-}NER / NER$$

- **volatility of the real exchange rate from its level equilibrium and premium parallel market**

The volatility of the real exchange rate from its level equilibrium: is a function of the premium parallel market

$$RER - RERE^{*} = F(ERP\text{-}NER)$$

Where: TCR: real exchange rate TCRE*: real exchange rate equilibrium

ERP: the exchange rate in the parallel market **v**: premium Parallel Market

NER: the nominal exchange rate

ME = RER-RERE *: the volatility of the real exchange rate from its level equilibrium

- The relationship between the volatility of the real exchange rate from its level equilibrium and premium parallel market can be represented in the following equation:

$$ME = C(1) + C(2)*V$$

$$ME = -0.589772180018 + 0.0327122584365*V$$

$$(0.7) \qquad (0.08)$$

$$R^2=0.20$$

There is a positive relationship between the parallel foreign market exchange and the volatility of the real exchange rate from its equilibrium level. Where the deviation of the real exchange rate from its equilibrium level is affected directly by the existence of a parallel exchange market.

- **The Impact of the Parallel Exchange Rate on the Imports:** In order to analyze the impact of the existence of a parallel exchange rate in economy on the imports, we will assume a model that includes the parallel exchange rate, and the disequilibrium, to examine their relationship to the suiting variable, which is the imports.

- After applying this model on the Algerian economy during the study period, the following results were obtained:

$$LOG(M) = C(1) + C(2)*ERP + C(3)*MS$$

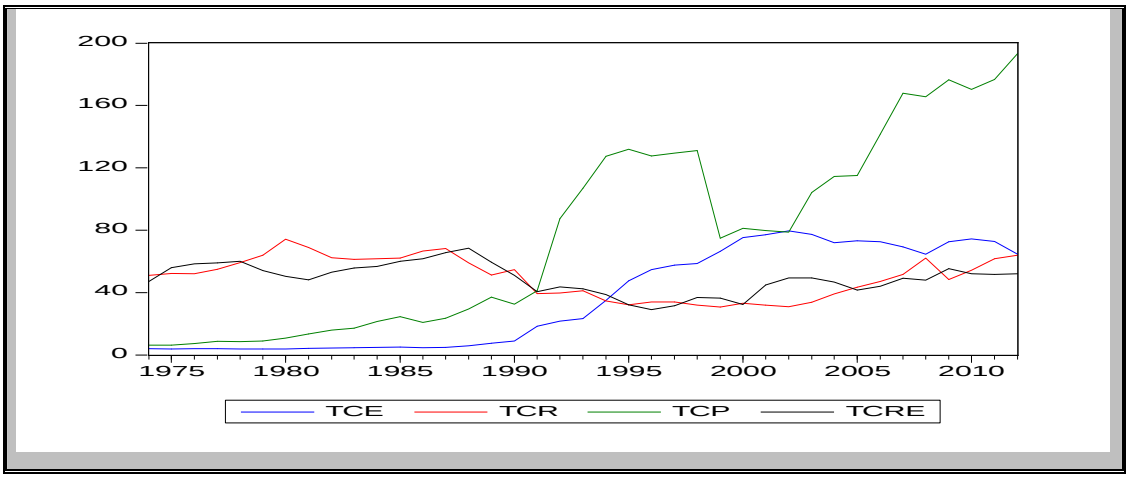
$$LOG(M) = 22.9677264466 + 0.00558185164262*ERP - 0.469236027411*MS$$

$$(0.00) \qquad (0.00) \qquad (0.13)$$

$$R^2=0.49\% \qquad prob(f\text{-}statistic)=0.000$$

The appropriate exchange rate for Algerian economy can be concluded through a comparison between the different levels of exchange rates: nominal and real, as well as parallel to the level of the real equilibrium exchange rate, which is calculated by the estimated equation.

Figure 2: the Comparative Evolution of Exchange Rates



There is development in the official and the parallel exchange rate at the same pace from 1974 until 1991, as the Algerian Dinar lost more than 30% of its value during the period from 1986 to 1988. For this reason, a program was put forward to absorb part of the surplus liquidity to limit the continuous decline in the Parallel exchange rate and bring it close to the official exchange rate. The gap reached its peak between parallel and official exchange rate in the period from 1994 to 1998 to begin to fall where we observe an alignment between the two prices during the period 2000-2002. The nineties period represented a turning point in the conduct of the Algerian Dinar especially with pressures like inadequate exchange reserves to support the value of the Dinar , the increase of foreign debt, the control which led to make the value of the Algerian Dinar overstated.

A disagreement of the real exchange rate with the nominal exchange rate is noticed, and that reflects a negative impact on ~~the~~ Algerian economy. An overvalued exchange rate could lead to an imbalance in the overall economy with weak economic performance (high inflation, increasing unemployment rates, rising exports prices), thereby reducing the competitiveness of the country and therefore the deterioration of the external position and all this impacts negatively on the balance of payments.

Conclusion

As a result and through our analysis of the four curves, an alignment between the real exchange rate and its equilibrium level is noticed throughout the studied period. The real exchange rate can be considered as the most suitable for Algerian economy, unlike Parallel exchange rate that moves away from the real equilibrium level, this is probably due to the exaggeration in prices in the parallel market exchange.

Références

1. Lokas Stemitsotis: « References of exchange rates and international monetary system» Edition Economica-1992-.
2. Keith Cuthbertson: « Quantitative Financial Economics» of Boek University s.a, 1st edition
3. Philippe Darvisenet, Jean –Pierre petit: « Trade and international finance» The Bank Review 1996 edition.
4. Paul Krugman, Maurice Obstfeld: «International economy », of Boeck and Larcier.s.a, 3rd edition, 2001.
5. Richard Baillie, Patrick Mc Mahon: « the foreign exchange market» edition ESKA, Paris -1997.
6. Peyrard : « International Financial Management» édition Vuibert, paris 1999.
7. Patrice Fontaine : « Foreign exchange risk management» édition Economic - paris ,1996.
8. Yves Simon, Samir Mannai : «International Financial Techniques» Ed. Economic ,7 th édition, 2002.
9. Raphaëlle Bellano, Armand Coline : « international finance» Paris -1993.
10. Rofoff.k-Aasim .M hussen.Atoka moody .Robin Brooks. Nicene Ozes (2003) “evaluation and performance of exchange rate regimes” IMF working paper we/03/243.
11. Jeffery A, Frankel, no single currency regimes is right for all countries or at all times, nber working paper series, Cambridge, n°7338-1999.
12. www.Christian -Bilalès p.net le 02/12/2013.
13. Stephen Morris. Journal of development economics .inflation dynamic and parallel market for foreign exchange 02/1990.
14. Reuven Glick, fixed or floating: is it still possible to manage the middle? pacific basin working paper series ,federal reserve bank of san Francisco ,working paper n°.Pb00-02,2000.
15. Staff paper n° 81’’ the concept of equilibrium exchange rate’’ /a survey of literature.
16. A Survey of Literature Reza Y. Sireg: «The Concepts of Equilibrium Exchange Rate» Staff Paper No 81.

17. Agra soy, Emmer, How important is the choice of exchange Rate Regime for economic Growth in Emerging Market Economies? McGill University, Canada, 2006-.

Annex:

Dependent Variable: LOG(TCR)
Method: Least Squares
Sample: 1974 2012
Included observations: 39

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.479946	2.437065	0.196936	0.8451
LOG(TOT)	0.641806	0.361159	1.777077	0.0845
LOG(OPEN)	-0.067630	0.325319	-0.207887	0.8366
LOG(GOV)	0.010387	0.411578	0.025237	0.9800
LOG(M2)	0.897491	0.141844	6.327324	0.0000

R-squared	0.581242	Mean dependent var	3.873659
Adjusted R-squared	0.531977	S.D. dependent var	0.276031
S.E. of regression	0.188839	Akaike info criterion	-0.376637
Sum squared resid	1.212443	Schwarz criterion	-0.163360
Log likelihood	12.34442	Hannan-Quinn criter.	-0.300115
F-statistic	11.79813	Durbin-Watson stat	1.734024
Prob(F-statistic)	0.000004		

Dependent Variable: D(TCR)
Method: Least Squares
Date: 06/14/14 Time: 00:10
Sample (adjusted): 1977 2012
Included observations: 36 after adjustments
D(TCR) = C(1)(TCR(-1) + 0.448239172238*OPEN(-1) + 2.22221001861 *GOV(-1) - 0.730210298394*M2(-1) - 67.0450928033) + C(2)*(TOT(-1) + 0.0114363352018*OPEN(-1) + 0.0116395826773*GOV(-1) + 0.00188441885685*M2(-1) - 1.94587837674) + C(3)*D(TCR(-1)) + C(4)*D(TCR(-2)) + C(5)*D(TOT(-1)) + C(6)*D(TOT(-2)) + C(7)*D(OPEN(-1)) + C(8)*D(OPEN(-2)) + C(9)*D(GOV(-1)) + C(10)*D(GOV(-2)) + C(11) *D(M2(-1)) + C(12)*D(M2(-2)) + C(13)*

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.469155	0.167316	-2.803998	0.0101
C(2)	16.94328	7.853838	2.157326	0.0417
C(3)	0.124112	0.207341	0.598588	0.5553
C(4)	-0.041971	0.190093	-0.220794	0.8272
C(5)	-33.90407	38.38492	-0.883265	0.3862
C(6)	-49.88024	34.26772	-1.455604	0.1590

C(7)	-0.177732	0.287506	-0.618187	0.5425
C(8)	-0.195147	0.276268	-0.706369	0.4871
C(9)	0.096585	1.200187	0.080475	0.9366
C(10)	0.864155	1.186125	0.728553	0.4736
C(11)	-0.133857	0.237061	-0.564651	0.5778
C(12)	-0.185696	0.261761	-0.709410	0.4852
C(13)	-0.920675	1.098896	-0.837818	0.4108

R-squared	0.387715	Mean dependent var	0.330793
Adjusted R-squared	0.068262	S.D. dependent var	5.810384
S.E. of regression	5.608565	Akaike info criterion	6.560664
Sum squared resid	723.4881	Schwarz criterion	7.132491
Log likelihood	-105.0920	Hannan-Quinn criter.	6.760247
F-statistic	1.213683	Durbin-Watson stat	2.012103
Prob (F-statistic)	0.001554		

Response of LOG(TCR):					
Period	TCR	TOT	OPEN	GOV	M2
1	5.608565	0.000000	0.000000	0.000000	0.000000
2	3.993389	-0.361649	-1.056954	-0.597023	1.126915
3	2.911873	-0.546351	-1.967231	0.138262	1.515495
4	2.662946	0.495668	-0.794995	-0.402202	2.579335
5	2.766697	0.658213	0.340910	-1.924432	3.214556
6	3.309962	0.418342	0.782773	-2.066870	3.904283
7	3.180627	0.049011	0.715069	-1.952657	4.998412
8	3.281828	0.032752	0.351717	-2.278928	5.643715
9	3.729368	0.227841	0.383879	-2.573152	5.718411
10	3.886668	0.150294	0.590863	-2.773096	5.828657
Response of LOG(OPEN):					
Period	TCR	TOT	OPEN	GOV	M2
1	-2.039137	-0.935038	5.281257	0.000000	0.000000
2	-3.583181	-1.874325	6.156206	-2.296758	2.019010
3	-3.019003	-2.180136	5.265918	-1.080808	2.148523
4	-3.062642	-1.933087	4.922223	-1.010697	3.246277
5	-2.903311	-1.855502	4.440786	-1.986214	3.329275
6	-2.192399	-1.756218	4.575324	-1.977067	3.003814
7	-2.331865	-2.130113	4.730665	-1.951768	3.215865
8	-2.366466	-2.419342	4.341078	-1.903493	3.271583
9	-2.149095	-2.384201	4.095154	-1.725052	3.015796
10	-2.097182	-2.390749	4.016374	-1.728591	2.718402
Response of LOG(TOT):					
Period	TCR	TOT	OPEN	GOV	M2
1	0.004991	0.026226	0.000000	0.000000	0.000000
2	0.005449	0.022398	-0.007792	-0.006521	-0.002518
3	0.010086	0.022798	-0.014837	-0.003382	0.001518
4	0.008995	0.020601	-0.015983	-0.004343	0.003997
5	0.013072	0.019550	-0.017849	-0.008100	0.002666
6	0.016802	0.017613	-0.019050	-0.006478	-0.001710
7	0.016561	0.014748	-0.021885	-0.003864	-0.004377
8	0.016091	0.013545	-0.025821	-0.001372	-0.008264

9	0.016365	0.014003	-0.027781	0.000580	-0.013263
10	0.015886	0.014102	-0.028393	0.001847	-0.017794
Response of LOG(GOV):					
Period	TCR	TOT	OPEN	GOV	M2
1	0.330147	0.391966	-0.945562	0.896940	0.000000
2	0.496890	0.617138	-1.474906	0.980769	-0.118306
3	0.731703	0.892761	-1.534150	0.697572	-0.472982
4	0.767636	0.881729	-1.252877	0.763603	-0.750093
5	0.554669	0.731575	-1.136864	0.873546	-0.643509
6	0.463016	0.710583	-1.224684	0.937470	-0.576575
7	0.520661	0.818736	-1.232937	0.928670	-0.616608
8	0.534891	0.866964	-1.168047	0.872141	-0.651639
9	0.506021	0.852840	-1.128135	0.874750	-0.626127
10	0.468887	0.845454	-1.113627	0.890310	-0.555724
Response of LOG(M2):					
Period	TCR	TOT	OPEN	GOV	M2
1	1.062776	0.810379	-3.070959	0.309877	4.682731
2	3.499587	1.297517	-2.730205	0.143321	5.323352
3	5.724795	1.688604	-1.511214	-2.114694	5.630575
4	6.323081	0.671339	-1.247232	-1.806503	5.085318
5	5.714584	0.046028	-1.606420	-0.581142	5.751944
6	5.124354	0.253381	-2.043724	-0.619626	6.054253
7	5.498336	0.918293	-1.775710	-1.026501	5.596332
8	5.529211	1.058523	-1.097922	-1.187409	5.492732
9	5.171153	0.823188	-0.902144	-1.138108	5.948331
10	5.042336	0.836711	-0.972444	-1.088664	6.410176

Dependent Variable: LOG(M)
Method: Least Squares
Sample (adjusted): 1974 2011
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	22.96773	0.091114	252.0769	0.0000
TCP	0.005582	0.000968	5.766479	0.0000
MESS	-0.004692	0.003046	-1.540552	0.1324

R-squared	0.493975	Mean dependent var	23.37255
Adjusted R-squared	0.465059	S.D. dependent var	0.475285
S.E. of regression	0.347622	Akaike info criterion	0.800252
Sum squared resid	4.229425	Schwarz criterion	0.929535
Log likelihood	-12.20478	Hannan-Quinn criter.	0.846250
F-statistic	17.08325	Durbin-Watson stat	0.236793
Prob (F-statistic)	0.000007		