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What drives Tadawul All Stock Index of the Saudi Stock Market?

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ABSTRACT

This paper aims to detect factors, which drive Tadawul All Stock Index (TASI) of the Saudi Stock Market during the period August 2005 May 2017. The application of Autoregressive Distributed Lag model (ARDL) and Bounds test revealed that there is no long-run relationship exist if consumer price index, interest rate, oil prices, general price level (P) and government expenditure are included in the model. While price-earnings ratio, nominal effective exchange rate (NEER), money supply (M3), and long term credit (L) relate significantly to TASI in both the short-run and long-run with an error correction term -0.22 i.e. disequilibrium takes four and half month to correct. Half of explanatory variables are fixed namely NEER, and L, while PE and M3 are dynamic. The GARCH model presented that news plays significant role in the volatility of stock market returns. Smaller GARCH term than ARCH indicates that a shock will take short time to die out.

Key Words: ARDL, dynamic, fixed, GARCH, News, shock, volatility

INTRODUCTION

Stock markets play an unequivocal role in the economic activity serving as a mediator between lenders and borrowers. Stock prices are affected by expected returns and the discount rate which in turn influenced by macroeconomic variables (Kalyanraman and Tuwajin 2014). There two views referring to the relationship between stock market and macroeconomic variables, i.e. stock market is an indicator of economic activity if future performance of corporate and profits are reflected in prices, however the second one assumes the opposite, the stock market affects economic activity via aggregate consumption and investment (Ahmed 2008, Thaker 2009). Understanding the relationship macroeconomic variables and the stock market makes the government capable of stabilizing the stock market and the economy as a whole which attract investors and firms (Barakat, Algazzar and Hanafy 2016).

The trading shares of Arabian Cement, the National Bank, Riyad Bank and the Dutch Bank founded on supply and demand without any official censorship or supervision before 1980's was the starting point toward full-fledged Stock market. The number of companies increased with time to inspire the government to form a joint committee from Ministry of Finance and National Economy and Saudi Monitory Authority (SAMA) in 1984 to be responsible for organizing and monitoring the stock trading. A year later SAMA became the only supervisor, and in 2003 the Capital Market Authority `was established (Jarrah and Saleem 2016). The introduction of the first electronic trading system integrated for settlement and clearing was in 1990. Saudi Stock Exchange (KSE) is ranked as the second largest in Gulf Cooperative Council (GCC) in terms of market size. Listed comprises dealing in free floating shares that determine TASI performance are 163.

Many empirical researches identified factors manipulating the behaviour of Tadawul All Stock Index and recognized different sets of variables. The aim of this research is to answer the following question: what drives TASI of the Saudi Stock Exchange?

This research differs from others in terms of estimation method, where autoregressive distributed lag model is estimated as an appropriate model for mixture of integrated variables of order I(0) and I(1) as has been proven by Peseran and Shen (1997).

This research is organized as follows: introductory section precedes previous studies followed by conceptual framework, methodology, results, discussion, and conclusion.

PREVIOUS STUDIES

There is a vast literature on the determinants of the developed and emerging Stock markets**.** The number of Stock prices determinants varies from one to nine. Empirical research on Gulf Cooperative Council stock markets including Saudi Arabia established significant effects of two sets of macroeconomic variables on all stocks indices. The first commonly used set is composed of oil prices, money supply, and inflation, while the second set appeared in some studies comprises interest rate, exports, government expenditure, exchange rate, global stock prices, price - earnings ratio, and industrial production index.

Alshogeathry (1998) employed VECM and GARCH to recognize the impact of narrow and broad money supply M1, M2, interest, inflation, bank credit, oil prices, nominal effective exchange rate, NEER, and Standard and Poor index on TASI; Aroura et al. (2011). The study supported the long-run and short-run relationship between oil prices and the stock market in GCC. The study of Mgammal (2012) on KSA and UAE verified the impact of inflation, interest rate, and exchange rate on the general index. Samontaray et al (2014) employed step-wise regression and correlation analysis to recognize only three factors viz. oil (West Texas Light), price-earnings ratio, and exports. Kalyanaraman and Al-Tuwajri (2014) used vector error correction model to study the impact of five macroeconomic variables on TASI to find a significant impact of consumer price index, industrial output, money supply, exchange rate and oil prices.. Kalyanaraman (2015) used vector error correction model to estimate the impact of inflation, industrial production, money supply, exchange rate, oil prices and global stock prices on the returns of 15 listed sectors on the Saudi stock market. Al-Mutairy and Al-Omer (2006) utilized vector autoregression technique to study the impact of interest rate, money supply, inflation, and government expenditure on traded shares in Kuwait Stock market; oil prices and economic variables Fundamentals Jarrah and Salim (2016) analyzed Aljazira report that contains internal and external news and events on 13 sectors of Tadawul i.e. oil prices, company news and industry performance, performance and investors sentiment, economic outlook, inflation, deflation, changing in economic policy, and the value of US dollar

Ahmed (2008) employing Bayesian Vector Autoregression investigated the causal relationship between stock prices and key macroeconomic variables namely the index of industrial production, exports, foreign direct investment, money supply, exchange rate, interest rate, NSE Ninfty and SE Sensex in India. Thaker, et al. (2009), used error correction model to identify the effects of money supply M2, inflation, and nominal effective exchange rate NEER in Malaysia. Eryigit (2012) verified via vector autoregression the dynamic relationship between interest rates, exchange rates, oil prices and Istanbul index; Ahmad et al. (2015) found that per capita GDP, gross domestic saving GDS, foreign direct investment (FDI), Inflation, interest rate, nominal effective exchange rate NEER, M2 have an impact on global index in Nigeria, Barakat et al. (2016) utilized causality and cointegration methods to establish long-run relationship among consumer price index (CPI), exchange rate, M2, interest rate in emerging markets: Egypt and Tunisia. Kasman (2003),Tabak (2006), Sifunjo (2012) and Al-Daham (2017) empirically supported the cointegration relationship between exchange rate and stock prices and causality (exchange rates cause stock prices) in Kenya, Turkey, Brazil and six GCC respectively contrary to Amarasinghe (2014) results on Sri Lankan index, while Kutty (2010)

showed that stock prices in Mexico lead exchange rate and there is no long-run relationship between the two variables. Širůček (2013) confirmed via Granger test the effect of the change of the money supply on the development of the Dow Jones Industrial Average (DJIA) index

CONCEPTUAL FRAMEWORK

Money Supply:

Changes in money supply through Treasury Bills change interest rates leading to alterations in mortgage rate and home affordability. Then shifts in the demand for durable goods are inevitable and ultimately the attraction of investments in stocks Hunkar Ozyasar (2013). Veselá (2007) perceives that money supply is the predicting indicator of the development of equity prices. Efficient market hypothesis postulates that stock prices incorporate all relevant information; while monetary market hypothesis expects an increase in money supply will result in an increase in almost all economic activities including the stock market (Friedman 1988). Fama (1981) expects negative impact of an increase in money supply is possible if it results caused inflationary pressures. Tobin's q ratio hypothesizes that the purchases of new investment goods lead to new issuance of stock at higher prices, and raise production and vice-versa.

Nominal Effective Exchange Rate NEER:

Exchange rate fluctuations are the transmission channel that affects firms' value through changes in competitiveness and value of assets and liabilities dominated in foreign currency, ultimately affecting their profits and therefore the value of their equity (Ahmad et. al. 2015). Stock prices may affect exchange rate via inflows/outflows of foreign capital (Thaker, et al. 2009).

Real GDP:

High economic growth creates demand for financial instruments and thereby financial markets are effectively responding to these demands and change (Choong et al. 2003). Stock market can affect economic growth through channeling saving and investment, improvement of capital productivity, and efficient allocation of resources. If the economy is expected to expand investors buy shares in prospects of future profits and vice- versa (Jarrah and Salim 2016).

General Price Level:

Higher prices lead to higher interest rate bringing stock prices down, on the contrary deflation lowers profits and decreases economic activity, investors begin selling their shares and invest in real assets tending to go down (Alsogeathry 1998, Jarrah and Salim 2016). Inflation influence on stock prices may be positive if stock prices looked at claims on real resources or negative due the adverse effect on real activity and consequently stocks (Fama 1981).

Price-Earnings Ratio:

The release of favourable financial reports specifically the ratio of price to earnings, raises investor's optimism and the likelihood of profits, stock demand will ascent and so will its price, on the other hand negative report causes stock price to fall. High price-earnings ratio may point toward overvaluation of stock while low one indicates undervaluation (Motley Fool 2016).

Bank Credit:

Changes in money supply and credit aggregates have been observed to be associated with stock prices Kindleberger (1978).The asymmetry of information leads to a deterioration of bank loan quality as a consequence of over-optimism and relaxation of loan rule at the time of

economic expansion. This is in line with Kiyotaki and Moore (1997) who postulate that equity serves as a guarantee for lending and investment, which ultimately affect the stock prices.

METHODOLOGY, DATA, AND EMPIRICAL RESULTS

Methodology and Data

ARDL cointegration technique is preferable when dealing with variables that are integrated of different order, I(0), I(1) or combination of both and, robust when there is a single long-run relationship between the underlying variables in a small sample size (Nkoro & Uko 2016). The ARDL approach can be applied regardless of whether the underlying regressors are integrated of order one [I(1)], order zero [I(0)] or fractionally integrated (Odhiambo 2010). An autoregressive distributed lag model ARDL is a least squares regression containing lags of the dependent and explanatory variables. Pesaran and Shin (1997) showed that if variable are I(1) the OLS estimator of the short-run parameters are $\sqrt{T}$consistent and the long-run are super-consistent. The variables in the cointegrating relationship can be either I(0) or I(1), without requiring to pre-specify which are I(0) or I(1) and no need for lag symmetry. ARDL(p,q) is composed of explanatory variables that are

$$y_t = \alpha_0 + \alpha_1 t + \sum_{i=1}^{p} \theta_i \, y_{t-i} + \beta' x_t + \sum_{i=0}^{q-1} \beta_i^{*\prime} \Delta x_{t-i} + \mu_t$$

$$\Delta x_t = P_1 \Delta x_{t-1} + P_2 \Delta x_{t-2} + \cdots + P_s \Delta x_{t-s} + \varepsilon_s$$

Where x_t is k-dimensional I(1) variables that are not cointegrated among themselves and ε_t and $\mu_t$are serially uncorrelated with zero means and constant-covariances and P_i are k × k coefficient matrices such that the VAR process in $\Delta x_t$is stable.

Empirical Results

Description of Variables: according to Bounds test only four variables have been selected. Tadawul All Stocks Index (TASI), nominal effective exchange rate (NEER), and price-earnings ratio (PE) are presented in points, money supply (M3), and long term bank credit (L) are in million Riyals, and all variables are available in web site of the Capital Market Authority for the period August 1997-May 2017. http:/sama.gov.sa/ar-sa/Economic Reports/Pages/Annual Report.aspx

Movements of Tadawul All Stock Index (TASI)

According to index figures the real commencement of the Saudi market was in early 1994 where the first mounting wave responded to increased capitalization and improvement in the economy after the liberation of Kuwait. The index rose from 1283 to expire at 1958 in 1997. Owing to the economic crisis in East Asia that affected adversely the petrochemical companies, fall of oil prices, lower world prices of cement accompanied by low local demand, and high interest rate in Riyal the index declined to 1413 in 1998 to mark thereafter the second surge that has been ascending to reach the peak of 16713 in 2005. The prominent events were: big leap in oil prices, opening the door to investment in the Saudi market to foreign investors through local equity funds, amendment of commission, reduction of tariffs on imported goods, payments of farmers and contractors dues, Cabinet allowance of GCC nationals to trade in the shares of banks and insurance, issuance of new regulations by Capital Market Authority (CMA) i.e. securities regulation and the list of authorized persons, and the Kingdom joining to WTO. The third wave was the response to the declaration of minister of finance that the stock prices were overvalued, combined with other factors such as increased political tension in the region that ended in US-Iraq war, the declared intention to sell part of the State shares in joint stock

companies that led to negative effect on big corporations in the market which causing sharp decline to 7933 points in 2006. In the Fourth wave the index raised to 11039 in 2007 to decline in 2008 to 4803 points (the lowest points in the current decade), then continued climbing up combined with small swings ups and downs till the year 2013 that ended at 8536 points. The fifth wave started from the peak of the fourth session to show downward trend owing to reduction in oil prices and Yemen war.

Diagnostic Tests

The noticeable features of annex (1) are lack of normality at both the level and natural logarithm of the model variables; price-earnings ratio (PE) is the most dispersed variable, while NEER is the least one.

Unit roots tests have been run for level and natural logarithm of the model variables to ensure that none of the variable is integrated of order two or over. Results displayed in table (1) below illustrate that all variables are integrated of order one at 1% level of significance except PE which is stationary at 5% and 1% for the level and logarithmic form as quantified by ADF& PP tests respectively.

Table (1) Unit Root Test Results

	Augmented Dickey-Fuller		Phillips-Peron	
Variable	Level	Ist. Diff.	Level	Ist. Diff.
INDEX	-1.959	-12.453***	-1.991	-12.469***
LOG(INDEX)	-1.691	-12.533***	-1.634	-12.725***
M3	-1.689	-7.644***	1.869	-17.854***
LOG(M3)	-0.114	-16.817***	-0.128	-16.798***
NEER	-1.847	-11.000***	-1.779	-11.000***
LOG(NEER)	-1.864	-11.038****	-1.851	-11.097***
PE	-3.299**		-3.233****	-5.257***
LOG(PE)	-3.126***		-3.073***	
L	1.599	-5.451***	1.717	-20.056***
LOG(L)	-2.398	-17.644***	-2.608*	-17.497***

(*) (**) (***) indicates rejection of null hypothesis of unit root at 10%, 5%, and 1%

The long-run relationship between model variables has been explored by Johansen System Cointegration test to detect 3 cointegration equations at 5% as presented in table (2).

Table (2) Cointegration Results

Date: 08/29/17 Time: 17:03				
Sample (adjusted): 2006M01 2017M05				
Included observations: 137 after adjustments				
Trend assumption: Linear deterministic trend				
Series: LOG(INDEX) LOG(M) LOG(PE) LOG(L) LOG(NEER)				
Lags interval (in first differences): 1 to 4				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.238427	91.43081	69.81889	0.0004
At most 1 *	0.160665	54.11617	47.85613	0.0115
At most 2 *	0.143766	30.12129	29.79707	0.0459
At most 3	0.057634	8.857296	15.49471	0.3787
At most 4	0.005277	0.72482	3.841466	0.3946
Trace test indicates 3 cointegrating equation(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Estimation Results

However the established long-run relationship between model variables which are a mixture of I(0) and I(1) involves electing an appropriate model which in this situation is the ARDL.

Table (3) ARDL Results

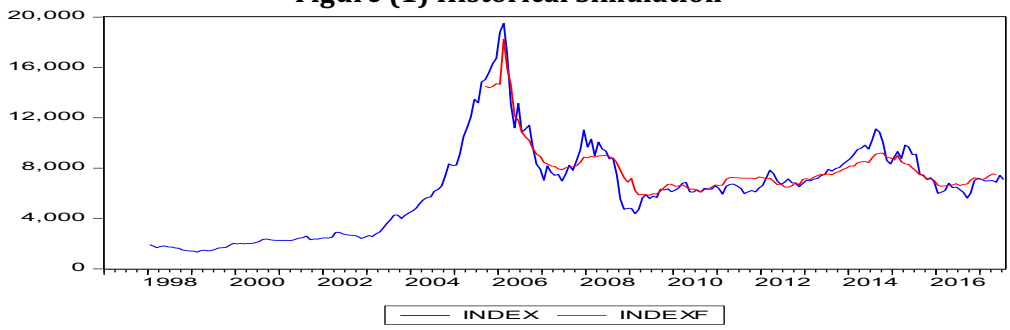
Short Run Coefficients		
	Level	Logarithm
Variable	Coefficient	Coefficient
DLOG(M3)	0.004963**	0.617252***
DLOG(NEER)	-30.429**	-0.45713***
DLOG(PE)	78.376***	0.390678***
DLOG(L)	0.006078**	0.218193***
CointEq(-1)	-0.1733***	-0.22029***
Long Run Coefficients		
Variable	Coefficient	Coefficient
LOG(M3)	-0.00611*	-0.67582***
LOG(NEER)	-175.591**	-2.07512***
LOG(PE)	146.4977***	0.568777***
LOG(L)	0.035075***	0.990479***
C	22112.06***	14.18386***
Akaiki Information Criteria	15.766	-2.859
Schwarz Information Criteria	15.933	-2.691
Bounds Test	1.826>2.45	2.45<3.154<3.52

(*) (**) (***) indicates rejection of null hypothesis of unit root at 10%, 5%, and 1%

According to Akaiki and Schwarz information criteria the logarithmic form is favorite to the level, in addition the null hypothesis of the bounds test that no long-run relationship exists for the level model are accepted since the test statistic is less than the lower bound, and they are inconclusive for the logarithmic one, therefore the second model outweighs the first. The estimated coefficient got the expected signs. Money supply affects stock prices positively in the short run and negatively in the long run. Price-earnings ratio, long term credit influence stock

prices positively in the short and long run. NEER has adverse effects on stock prices in the short-run and long-run. All estimated coefficients of the second model are significant at 1%, while the significance of first model varies from 10% to 1%. The number of variable contained by the second model is adequate as Ramsey RESET Test ($F_{1,132} = 0.226, Prob. 0.635$) shows. The second model does not suffer from first order autocorrelation (DW=2.04) or second order ($F_{2,131} = 0.235, Prob. 0.791$) , while the hypothesis of homoscedasticity ($F_{7,133} = 4.180, Prob. 0.000$), and no ARCH effect ($F_{1,28} = 8.437, Prob. 0.002$) are rejected despite this weakness the model forecast traces the original data as depicted by the historical simulation figure (1) where Theil inequality coefficient is 0.04, bias proportion 0.015, variance proportion 0.147, and covariance proportion 0.838. About 0.173 and 0.22 of the disequilibrium corrected each month in first and second model respectively. The speed of adjustment of the first model takes approximately six months while second takes about four and half months to correct.

Figure (1) Historical Simulation



The role of news was investigated through GARCH model at both the level and logarithmic form as table (4) shows. The estimated model at the level presents insignificant coefficients of bank credit and NEER, while all the coefficients of logarithmic form are significant at 1%. Therefore the second model is far better than the level in terms of significance of estimated coefficients, and R squared. The correction of autocorrelation has been done by moving average MA(1). ARCH-LM test accepts the null hypothesis of homoscedasticity, Ljung-Box Q, Q^2 statistics ascertain the stationarity of the second model residuals. The ARCH term is positive and greater than the GARCH denotes that bad news affects the stock market volatility and previous asset prices have insignificant effect. The sum of ARCH & GARCH terms is .981 point out that GARCH model is covariance stationary (Nelson 1990). The lesser GARCH term is indicating that a shock will take short time to die out so volatility is not persistent.

Table (4) GARCH Results

	Level	Logarithm
Variable	Coefficient	Coefficient
M3	0.003547***	-0.64093***
L	0.001779	0.635989***
PE	203.7446***	0.944861***
NEER	-8.26953	-1.9797***
MA(1)	0.679839***	13.64842***
Variance Equation		
C	6630.099***	0.001223***
RESID(-1)^2	0.483604***	0.657135***
GARCH(-1)	0.57547***	0.324827***
R-squared	0.70123	0.913224
Adjusted R-squared	0.692507	0.910034
Akaiki Information Criteria	16	-2.233
Schwarz Information Criteria	16.17	-2.045

(*) (**) (***) indicates rejection of null hypothesis of unit root at 10%, 5%, and 1%

DISCUSSION

The understanding of the relationship between the index and influencing factors is important to investors, the public, and policy makers. The monitory and fiscal policies influence on share prices run directly through the control of money supply, sale of government shares, commission, and indirectly via lending by manipulating the interest rate, however the link between the stock market and the rest of world is reflected by nominal effective exchange rate. The negative sign of the money supply in the long-run should alert the government about inflationary pressures. Nominal effective exchange rate has adverse effects in the short-run and long-run affecting adversely profits and therefore the value of equity also via inflows/outflows of foreign capital. Release of favorite price-earnings ratio induces investors to purchase such shares so positive sign is in line with axiom. Long term credit is affecting stock prices positively as equity serves as a guarantee for lending and investment which ultimately affect the stock prices. The estimated model traces the historical data closely particularly turning points. About 22 percent of the disequilibrium corrected each month i.e. four and half months.

The efficiency of the Saudi stock market has been tested by the runs and variance ratio tests to yield contradicting results. The run test rejected the randomness hypothesis by the mean and median cut point while accepting it by mode. The variance ratio test accepted the random walk hypothesis. The joint null hypothesis for all periods showed that the Chow-Denning maximum $|z|$ statistic of 1.792883 is associated with the period 8 individual test. The approximate p-value of 0.2615 accepts the null of a random walk and so do the individual period's tests. Results of GARCH model disclose that bad news has profound influence on the stock market than good news.

CONCLUSION

The effect of macroeconomic economic variables on stock prices has been empirically determined for developed and emerging market. This paper aimed at recognizing the influential economic variables on Tadawul All Stock Index. Four variables were selected namely price-earnings ratio, money supply, nominal effective exchange rate, and long term credit. All the variables are nonstationary and attain stationarity after the first difference except the stationary price-earnings ratio. Cointegration analysis detected three cointegrating equations establishing long-run relationship among variables. Different analytical tools i.e.

autoregressive distributed lag model and GARCH has been used to identify factors influence and news respectively. Detected factors belong to economy conditions, and industry conditions namely money supply (M3), long term lending, price-earnings ratio, and nominal effective exchange rate, revealed significant impact, bad news has greater effect than good news, and shocks will take short time to die out so volatility is not persistent.

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ANNEX

Annex (1) Descriptive Statistics

	INDEX	M3	PE	L	NEER
Mean	8096.396	1209013	18.72563	255708.8	107.3665
Median	7159.405	1175023	15.22	211680.5	105.515
Maximum	19502.65	1828169	112.24	456836	124.45
Minimum	4384.59	529188	8.9	131182	96.09
Std. Dev.	2709.375	418941.2	13.67579	105900.9	7.418502
Skewness	2.025189	0.030967	4.094683	0.620912	0.750852
Kurtosis	7.628462	1.676336	21.92323	1.771713	2.517049
CV	0.334	0.347	0.730	0.414	0.069
Jarque-Bera	223.817	10.3892	2515.497	18.05067	14.72278
Probability	0.00000	0.005546	0.00000	0.00012	0.000635
Sum	1149688	1.72E+08	2659.04	36310649	15246.05
Sum Sq. Dev.	1.04E+09	2.47E+13	26370.83	1.58E+12	7759.817
Observations	142	142	142	142	142

Annex (2) Descriptive Statistics of Logarithmic Form

	LOG(INDEX)	LOG(M3)	LOG(PE)	LOG(L)	LOG(NEER)
Mean	8.955757	13.93893	2.811281	12.371	4.673947
Median	8.876178	13.9768	2.722609	12.26272	4.658853
Maximum	9.878306	14.41883	4.720639	13.03208	4.823904
Minimum	8.385851	13.1791	2.186051	11.78434	4.565285
Std. Dev.	0.28093	0.377079	0.40768	0.397523	0.067605
Skewness	1.071118	-0.39829	2.490115	0.383668	0.651559
Kurtosis	4.348152	1.99968	9.783695	1.570766	2.429629
CV	0.031	0.027	0.145	0.032	0.014
Jarque-Bera	37.90622	9.674842	419.0255	15.5698	11.972
Probability	0	0.007927	0	0.000416	0.002514
Sum	1271.718	1979.329	399.2019	1756.681	663.7005
Sum Sq. Dev.	11.12794	20.04854	23.43467	22.2815	0.644434
Observations	142	142	142	142	142

Annex (3) Cointegration Results

Date: 08/30/17 Time: 09:54				
Sample (adjusted): 2006M01 2017M05				
Included observations: 137 after adjustments				
Trend assumption: Linear deterministic trend				
Series: INDEX M3 L PE NEER				
Lags interval (in first differences): 1 to 4				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.232443	97.24038	69.81889	0.0001
At most 1 *	0.195248	60.99807	47.85613	0.0018
At most 2 *	0.119233	31.23878	29.79707	0.0339
At most 3	0.08817	13.84492	15.49471	0.0873
At most 4	0.008718	1.199635	3.841466	0.2734
Trace test indicates 3 cointegrating equation(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Annex (4) Cointegration Results of Logarithmic Form

Date: 08/30/17 Time: 09:56				
Sample (adjusted): 2006M01 2017M05				
Included observations: 137 after adjustments				
Trend assumption: Linear deterministic trend				
Series: LOG(INDEX) LOG(M3) LOG(PE) LOG(L) LOG(NEER)				
Lags interval (in first differences): 1 to 4				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.235884	101.1865	69.81889	0.0000
At most 1 *	0.190903	64.3286	47.85613	0.0007
At most 2 *	0.146476	35.30699	29.79707	0.0105
At most 3	0.089953	13.60878	15.49471	0.0943
At most 4	0.005062	0.69531	3.841466	0.4044
Trace test indicates 3 cointegrating equation(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

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Annex (5) ARDL Cointegrating and Long Run Form

Dependent Variable: INDEX				
Selected Model: ARDL(1, 1, 0, 1, 0)				
Date: 08/29/17 Time: 16:46				
Sample: 1997M01 2017M07				
Included observations: 141				
Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(M3)	0.004963	0.001621	3.062392	0.0027
D(NEER)	-30.429	15.40882	-1.97478	0.0504
D(PE)	78.376	21.89651	3.579384	0.0005
D(L)	0.006078	0.002961	2.052484	0.0421
CointEq(-1)	-0.1733	0.053376	-3.24669	0.0015
Cointeq = INDEX - (-0.0061*M3 -175.5907*NEER + 146.4977*PE + 0.0351				
*L + 22112.0569)				
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
M3	-0.00611	0.003355	-1.82112	0.0708
NEER	-175.591	62.75205	-2.79817	0.0059
PE	146.4977	60.31634	2.428823	0.0165
L	0.035075	0.012697	2.76242	0.0066
C	22112.06	6311.023	3.50372	0.0006

Annex (6) ARDL Cointegrating and Long Run Form (logarithmic Form)

Dependent Variable: LOG(INDEX)				
Selected Model: ARDL(1, 1, 0, 1, 0)				
Date: 08/29/17 Time: 16:49				
Sample: 1997M01 2017M07				
Included observations: 141				
Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(M3)	0.617252	0.372377	1.657599	0.0998
DLOG(NEER)	-0.45713	0.171181	-2.67044	0.0085
DLOG(PE)	0.390678	0.082523	4.734144	0.0000
DLOG(L)	0.218193	0.090456	2.412144	0.0172
CointEq(-1)	-0.22029	0.050085	-4.39832	0.0000
Cointeq = LOG(INDEX) - (-0.6758*LOG(M3) -2.0751*LOG(NEER) + 0.5688				
*LOG(PE) + 0.9905*LOG(L) + 14.1839)				
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(M3)	-0.67582	0.307988	-2.19431	0.0299
LOG(NEER)	-2.07512	0.56457	-3.67557	0.0003
LOG(PE)	0.568777	0.117965	4.821555	0.0000
LOG(L)	0.990479	0.287237	3.448301	0.0008
C	14.18386	2.931836	4.837877	0.0000

Annex (7) GARCH Results

Dependent Variable: INDEX				
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)				
Date: 08/29/17 Time: 20:50				
Sample (adjusted): 2005M08 2017M05				
Included observations: 142 after adjustments				
Convergence achieved after 48 iterations				
Coefficient covariance computed using outer product of gradients				
Presample variance: backcast (parameter = 0.2)				
GARCH = C(6) + C(7)*RESID(-1)^2 + C(8)*GARCH(-1)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
M3	0.003547	0.000585	6.065386	0.0000
L	0.001779	0.001695	1.049852	0.2938
PE	203.7446	10.86658	18.74965	0.0000
NEER	-8.26953	5.17222	-1.59884	0.1099
MA(1)	0.679839	0.090648	7.499731	0.0000
Variance Equation				
C	6630.099	3939.352	1.683043	0.0924
RESID(-1)^2	0.483604	0.16292	2.968349	0.003
GARCH(-1)	0.57547	0.062336	9.231782	0
R-squared	0.70123	Mean dependent var		8096.396
Adjusted R-squared	0.692507	S.D. dependent var		2709.375
S.E. of regression	1502.405	Akaike info criterion		16.005
Sum squared resid	3.09E+08	Schwarz criterion		16.17152
Log likelihood	-1128.36	Hannan-Quinn criterion		16.07266
Durbin-Watson stat	1.686408			
Inverted MA Roots	-0.68			

Annex (8) GARCH Results of Logarithmic Form

Dependent Variable: LOG(INDEX)				
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)				
Date: 08/29/17 Time: 16:57				
Sample (adjusted): 2005M08 2017M05				
Included observations: 142 after adjustments				
Convergence achieved after 186 iterations				
Coefficient covariance computed using outer product of gradients				
Presample variance: backcast (parameter = 0.2)				
GARCH = C(7) + C(8)*RESID(-1)^2 + C(9)*GARCH(-1)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
LOG(M3)	-0.64093	0.10163	-6.30648	0
LOG(PE)	0.635989	0.024586	25.86781	0
LOG(L)	0.944861	0.083045	11.37764	0
LOG(NEER)	-1.9797	0.1821	-10.8715	0
C	13.64842	1.049251	13.00777	0
MA(1)	0.480089	0.106373	4.513266	0
Variance Equation				
C	0.001223	0.000608	2.013381	0.0441
RESID(-1)^2	0.657135	0.275018	2.389423	0.0169
GARCH(-1)	0.324827	0.188016	1.727661	0.084
R-squared	0.913224	Mean dependent var		8.955757
Adjusted R-squared	0.910034	S.D. dependent var		0.28093
S.E. of regression	0.084263	Akaike info criterion		-2.23308
Sum squared resid	0.965633	Schwarz criterion		-2.04574
Log likelihood	167.5487	Hannan-Quinn criterion		-2.15695
Durbin-Watson stat	1.542025			
Inverted MA Roots	-0.48			