The Impact of Macroeconomic Variables on Financial Market Performance in Egypt: An Empirical Analysis for the period (1980-2018)

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Abstract

The impact of macroeconomic variables on the financial market performance has been a hot topic for decades. Thus, this study focused on investigating the effect of oil price on the financial market performance and used a Vector Error Correction Model estimation technique on Egypt data from 1980 to 2018. the results revealed the long-run causality between the independent variables towards the dependent variable. Still, in the short-run, only Inflation and interest rates have causality effects on financial market performance. Also, the exchange rate and oil price do not have causality running to financial market performance. The results also emphasized that the short-run and long-run causality effects should be considered guidelines for policymakers to avoid misleading macroeconomic strategies in future strategic planning. The speed of adjustment reported from estimating the VECM is (-9.5%). Also, the model was found stable from using both the CUSUM and CUSUMQ statistics.

Key Words: Oil Price, VECM, Financial Market Performance, Economic Growth

الكلمات المفتاحية: سعر النفط ، نموذج تصحيح خطأ المتجه ، أداء السوق المالية ، النمو الاقتصادي

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ملخص

ضل تأثير متغيرات الاقتصاد الكلي على أداء السوق المالية موضوعًا ساخنًا لعقود. وهكذا ، ركزت هذه الدراسة على بحث تأثير سعر النفط على أداء السوق المالية واستخدمت تقنية تقدير نموذج تصحيح خطأ المتجه على بيانات مصر من ١٩٨٠ إلى ٢٠١٨. وكشفت النتائج أنه على الرغم من وجود السببية على المدى الطويل بين المتغيرات المستقلة تجاه المتغير التابع ، ولكن على المدى القصير ، يكون للتضخم ومعدلات الفائدة فقط آثار سببية على أداء السوق المالية. كما أن سعر الصرف وسعر النفط ليس لهما تأثير سببي على أداء السوق المالية.

لذا ، يجب اعتبار كل من التأثيرات السببية قصيرة المدى وطويلة المدى بمثابة موجهات يتبعها صانعو السياسات لتجنب أي استراتيجيات مضللة للاقتصاد الكلي في التخطيط الاستراتيجي المستقبلي. سرعة استعادة النظام وضع التوازن تقدر ب–) (9.5% كما يقدمه نموذج تصحيح خطاء المتجهً. كما وجد أن النموذج مستقر وفقاً لإحصائيات كوسم و كوسم كيو.

1. Introduction

A robust financial market has become one of the critical elements for economic development. Several driving forces have affected the financial market, including political stability, investment climate, macroeconomic policies, etc. The association between economic variables and the stock market is a rising concern, especially in light of the quick and sudden fluctuations at the world level (Ouma, W. &Muriu, P. 2014).

Many theories examined the relationship between macroeconomic variables and stock prices, such as the Quantitative Theory of Money (Q.T.M.), Cash Wallet model (C.W.M.), and the Efficient Market Theory (E.M.T.).

The quantity theory of money did not explicitly address the relationship between money supply and stock returns. The C.W.M. has contributed to the development of the assumptions made by Q.T.M. through the direct channel. Increasing the money supply disturbs the portfolio's balance, which leads the investor to search for a new equilibrium point by buying more shares.

Thus, increasing the demand for stocks, which leads to higher share prices, or through the impact of policy expectations, where investor expects with the increase in money supply, the tendency of the monetary authorities to restrict credit and raise the interest rate, and thus, lower growth and drop in stock prices.

As for the Efficient Market Theory (E.M.T.), which depends on information, Fama (1981) stipulated that an efficient market does not have any costs on transactions in the market. All information has been an oasis for all dealers entirely and promptly. Also, he divided the market into three formulas based on information availability;

a) A market that is ineffective and relies only on previous information.

b) a semi-strong market depends on prior knowledge and expected information about macro variables.

c) a stable market that depends on past and anticipated information about macro variables and private information about future share value.

This theory has become less prevalent due to the difficulty of maintaining efficient market conditions and predictable stock prices. For example, the Impact of January and psychological and behavioral factors, etc. furthermore, the capital asset pricing model (CAPM) can give better prediction in the form of a linear equation explaining the relationship between the expected return of a financial asset or a business portfolio and the expected risk for this asset or this portfolio, whether the chance of diversification and the risk of non-diversification.

This model marks the beginning of the emergence of capital asset pricing theories, and the Arbitrage Pricing Theory (A.P.T.) in the pricing of capital assets presented by Ross (1976), based on the fact that share prices are determined based on several macroeconomic variables. Ross examined the effect of four economic variables: Inflation, gross national product, investor confidence, and a change in the previous return on stock prices. He recommended that the knowledge not limit these four variables but rather include other variables, according to the nature of the money market and the economy in which the study was conducted.

Because theories had different points of view, there is no agreement on the effect of macroeconomic variables on stock prices except for the interest rate. There is almost agreement on its opposite effect on stock prices. In contrast, the rest of the variables differ. Some studies see that their influence is reversed, while others see their impact as direct, depending on the economy's nature, market efficiency, and other factors.

Previous economic and finance theories indicated the opposite effects of economic variables on financial markets' performance. Among those macroeconomic variables that have appeared in many studies were exchange rate, Inflation, interest rate, and oil price—furthermore, financial ma.

Market performance was measured in some studies by stock prices of those countries or using the financial market index (F.M.I.) as a proxy for financial market performance.

Among those studies, J. Issac Miller and Ronald A. Ratti (2009), Abdel Aziz, et al. (2008) examined the association between macroeconomic variables and stock market performance. Such studies are considered of particular interest for economic policymakers, investors, and economists alike. Understanding this relationship's nature allowed researchers and practitioners to manage financial portfolios, considering the risks that could come from the macroeconomic variables surrounding the financial markets.

These studies also found that oil prices play an intermediating role in explaining the real exchange rate's effect on stock prices. The impact of fluctuations in fuel prices and exchange rates is known to distress stock markets, but that effect varies from country to country, depends on whether that country is an exporter or importer of oil.

For instance, oil-exporting countries benefit from any increase in the world price of oil, leading to improved trade balances, current account surpluses, and net foreign assets position of these countries.

In contrast, for oil-importing countries, an increase in the prices of global crude oil will lead to a trade imbalance, which, in turn, plays an essential role in creating a deficit in the current account and trade deficit, which will lead to a slowdown economic growth in general.

1.1 Egypt Economy

According to a report declared by the International Monetary Fund (2019), Egypt continued implementing its determined national program for economic reform to revise large external and internal imbalances for the last three years. The economic reform program also moved on, inspiring containment growth, creating job opportunities, and increasing the most targeted social spending.

The following macroeconomic indicators draw a close picture of the significant characteristics of Egypt economy:

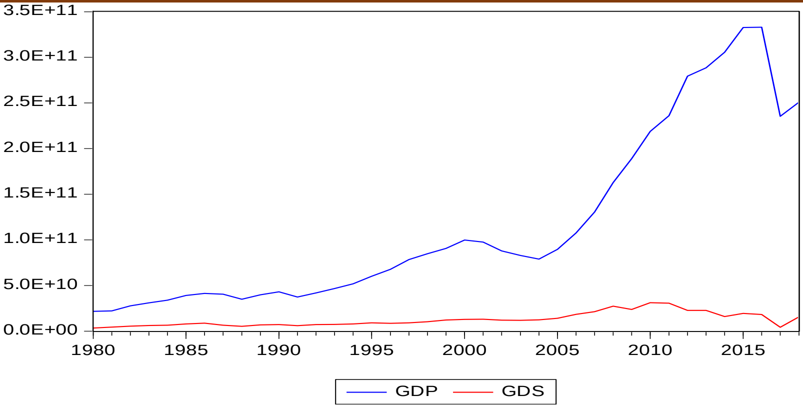
The report also revealed a high G.D.P. growth from 4.2% in FY2016-2017 to 5.3% in FY2017-18, the unemployment rate fell from 12% to less than 9%, current account deficit decreased from 5.6% of G.D.P. to 2.4%.

Also, public debt is expected to decrease to about 85% of the G.D.P. in the current fiscal year 2018-2019 after it recorded 103% of the G.D.P. in 2016-2017.

Furthermore, Egypt's foreign reserves increased from $ 17 billion in June 2016 to $ 44 billion in March 2019. They experienced a low inflation rate from 33% in July 2017 to 13% in April 2019, despite occasional shocks related to the supply of goods and volatility in some foodstuffs' prices.

Figuer1 below shows unceasing growth in the gross domestic product (G.D.P.) and total domestic savings (G.D.S.) from 1980 to 2018. However, the increase in gross domestic savings was refining with a rate less than G.D.P., which could be owing to many reasons, including low wages, population density, and inadequate Natural resources such as oil and gas.

A graphical representation of the economic performance in general, presented in figure 1, shows the long-run growth of gross domestic product and total domestic savings in Egypt from 1980 to 2018.



Source: World Bank Database

Figuer1: Gross Domestic Product and Gross

This paper will analyze the impact of macroeconomic variables on Egypt's financial market performance from 1980-2018.

The rest of the paper will consist of section 2 literature review, section 3 empirical analysis, section 4 conclusion and summary, and section 5 references.

2.Literature Review

Studying the relationship between exchange rate, interest rate, oil price, Inflation, crude oil, and stock prices have concerned many scholars' interest in the past.

Some studies concluded a positive relationship between macroeconomic variables and financial market performance; others discovered a negative association and no ties. Studies that dealt with macroeconomic variables on the financial market got varied results depending on the variables considered. Thus, further exertions to discover in-depth different countries mobilizing new data sets.

Investigating such relationships in developing countries classified as oil importers required using new variables that have not been discussed in the past, Barakat et al. (2016).

Felicia et al. (2020) examined the long-run impact of macroeconomic indicators such as interest rate, foreign capital flows, exchange rate, G.D.P. growth, Inflation, and trade on stock market performance (market capitalization) in Nigeria. Using data drawn from the World Development Indicators (W.D.I., 2018) and the Central Bank of Nigeria (CBN) Statistical Bulletin 2018, the study employed the VECM Analysis. The results found suggest that 1) macroeconomic variables and stock market performance are cointegrated and thus linked in the long run; 2) interest rate, Inflation, and trade bear a negative relationship with stock market performance; and 3) exchange rate, G.D.P. growth rate and foreign capital flows are positively related to stock market performance. Our results show that when there is a deviation from the long-run relation between stock market performance and macroeconomic fundamentals, it is primarily the stock market, interest rate, and foreign capital flows that adjust to ensure that the long-run link is restored. In contrast, the exchange rate, G.D.P. growth, Inflation, and trade are weakly exogenous. We estimate that any disequilibrium emanating from interest rate is more than fully corrected in one year, in the oscillating convergence sense.

In comparison, 29% and 5% of the stock market's disequilibrium and foreign capital flows are corrected in one year. A policy recommendation that emerges from the study is the need to strengthen policies to improve its macroeconomic environment. Specifically, this will involve policies to lower the interest rate, increase foreign capital flows, and strengthen trade terms.

Luan Vinicius Bernardelli and Gustavo Henrique Leite De Castro (2020) analyzed macroeconomic variables on the stock market. This theme's Analysis is crucial in the current economic context, given the severe crisis and the stock market's continued growth. This article covers an existing research gap about recent stock market movements. The Generalized Least Squares Method with Prais-Winsten transformation was applied to correct the first-order autoregressive problem. The results show that the macroeconomic variables continue to influence Ibovespa, as stated in the literature. However, the central government's financial stability variable has no explanatory power over the Brazilian stock market index, corroborating the literature and converging with the empirical observations from 2016 to 2019 regarding fiscal imbalance and growth Ibovespa.

Lutz Kilian and Cheolbeom Park (2009) investigated the influence of oil price shocks on the U.S. financial market. It revealed that the real stock dividend response in the United States caused by an oil shock varied greatly on whether the oil price alteration was driven by demand or supply shocks in the oil market. Also, they discovered that demand and supply shocks are pounding the global crude oil market account for 22% of the long-run variation in the U.S. real stock returns.

J. Issac Miller and Ronald A. Ratti (2009) investigated the long-run relationship between the world price of crude oil and international stock markets throughout 1971:1-2008:3 via a cointegrated Vector Error Correction Model (VECM). And they found indication for discontinuities after 1980:5, 1988:1, and 1999:9.

Basher et al. (2010) estimated Structural Vector Auto Regression to examine the dynamic association between oil price, exchange rate, and stock price. They calculated the Impulse Responses in two ways via Standard and Projection-based methods. Their study revealed that positive shocks to oil prices be inclined to lower emerging market stock prices and U.S. Dollar exchange rates in the short run.

Sana Zaouali (2007) carried out a quantitative analysis of the possible influence of the rise in oil prices on the Chinese economy. The study discovered that the increase in international oil prices caused an economic cost to the Chinese economy and a decline in welfare.

Cong et al. (2008) examined the collaborative associations between oil price shocks and Chinese Stock Markets using Multivariate Vector Auto Regression. They found that Oil Price Shocks do not reveal a statistically substantial impact on most Chinese stock indices' real stock returns.

Gerben Driesprong, Ben Jacobsen, and Benjamin Mat (2008) confirmed the effect of increasing oil prices, which significantly drops future stock yields of developed economies.

M.A. Abedeyi .et. al. (2012) estimated the impact of oil price shocks and exchange rates on Nigeria's real stock returns. Their empirical findings exhibited immediate and negative actual stock returns to the oil price shock in Nigeria.

To summarize, it is observable from the literature reviewed above that studies regarding the relationship between macroeconomic variables (oil prices, exchange rate, and Inflation) and financial market performance have produced varying results.

3.Empirical Analysis

3.1. Methodology

Early studies, by J. Issac Miller and Ronald A. Ratti (2009), Cong et al. (2008), Gerben Driesprong, Ben Jacobsen, and Benjamin Mat (2008), focused on estimating the impact of oil prices on the financial market found a positive relationship between oil prices and financial market performance.

Before proceeding to the empirical Analysis, few critical remarks need to mention. First, we need to check whether the time series is stable or not. If a unit root is present, it is essential to differentiate the variables, thereby eliminating the unit root and achieving stationarity before estimating the model.

For this purpose, (Dickey and Fuller,1979; Phillips and Perron,1988) test and the Durbin-Watson Statistic suggested by Sargan and Bhargava (1983) are used to determine whether the time series are stationary in first differences or levels.

Second, Determining the optimal lag through using V.A.R.

Third, a cointegration test was used to determine whether a long-run equilibrium relationship among Financial Market Index(F.M.I.), Exchange Rate(E.X.R.), Inflation (I.N.F.), Interest Rate (INT), and Oil Price (OILP) does exist or not.

Fourth, assist the model's dynamic adjustment; Engle and Granger (1987) used.

Fifth, Summary and Conclusion.

3.2. Data

The variables used for this study obtained from the following sources as shown in table 1 below;

Table (1): Variables and Sources

Variable	Source	Year Issued
Financial Market Index	International Monetary Fund (International Finance Data Base)	2019
Real Exchange Rate (Egyptian Bound/US$)	World Bank (World Economic Indicators)	2019
Inflation Rate (measured by C.P.I.)	World Bank (World Economic Indicators)	2019
Interest Rate	International Monetary Fund (International Finance Data Base)	2019
Oil Prices	OPEC (annual oil price 1960-2020) $/Barrel	2020

٢To have a sense of the variables, they plotted, as shown in figure

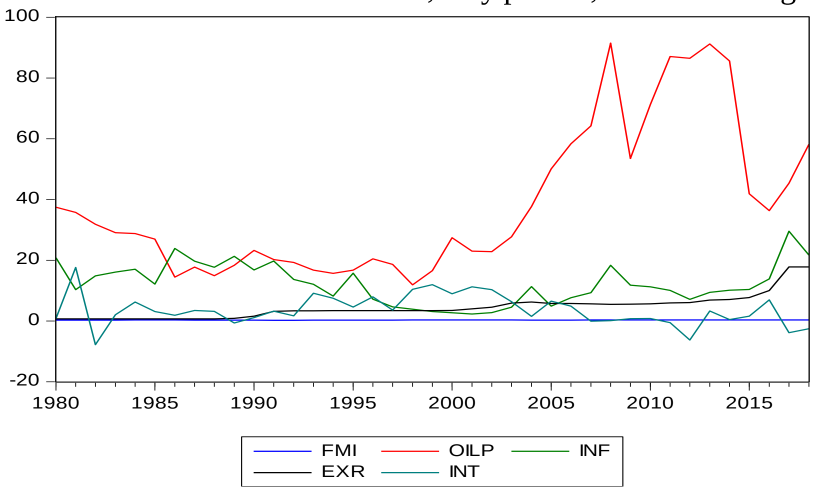


Figure 2: Plotting Variables

3.3. Research Variable

This research paper attempts to investigate the impact of macroeconomic variables on financial market performance in Egypt. The financial market performance is represented by the financial market index (F.M.I.). The macroeconomic variables under consideration consist of the Egyptian Pound /USD exchange rate as a proxy for the exchange rate and C.P.I. As an alternative to Inflation, interest rates, and oil prices.

3.4. Theoretical Model:

The identified model is a five variable model that hypothesizes that financial market performance is a function of the exchange rate, inflation rate, interest rate, and oil price. Thus, model specification is correct when the relevant independent variables are chosen and included in the model. The appropriate functional form of a variable in the model is selected (Gujarati & Porter, 2009). Therefore, when irrelevant independent variables are set, they are correlated with the error term, which will provide biased results.

The functional method of the theoretical model would be as shown below;

$$FMI = B_0 \pm B_1 EXR \pm B_2 INF \pm B_3 INT \pm B_4 OILP \pm \varepsilon \ldots (1)$$

Where:
Fmi: financial market index
Exr: official exchange rate
Inf: inflation rate (consumer price index)
Int: real interest rate
Oilp: oil price
B_0: Intercept
B_1, B_2, B_3, B_4: Coefficients for the explanatory variables.
ε: error term

Before proceeding with the Analysis, we need to conduct a unit root test, obtain optimal lags, and perform a cointegration test. And according to (Green 2018), based on the results from the cointegration test, we decide which type of models we should implement, such as (V.A.R., VECM, etc.) in the rest of the Analysis.

3.5. Unit Root Test

It is known in econometrics that many macroeconomic variables are non-stationary. And to ensure that the data are stationary, the Unit Root Test was performed first before Co-integration Test. So, this test was implemented to avoid spurious regression. In this study, we apply two sets of unit root tests for stationarity, namely the Augmented Dickey-Fuller (A.D.F.) and the Philips-Perron (P.P.) tests (Dickey and Fuller,1979; Phillips and Perron,1988). The outcomes are shown in table 2 below;

Table (2): Unit Root Test Results

ADF UNIT ROOT TEST					
Variable		A.D.F. value (constant		A.D.F. value (constant and	
		Level	First differenced	Level	First
F.M.I.		-1.238	-12.420	-1.787	-12.382
E.X.R.		-1.455	-12.663	-0.365	-12.954
I.N.F.		-2.562	-9.555	-0.941	-9.603
INT		-1.305	-9.378	-1.607	-9.386
OILP		-1.475	-12.334	-2.455	-12.309
Critical values	1%	-3.646342	-3.632900	-4.296729	-4.243644
	5%	-2.954021	-2.948404	-3.568379	-3.544284
	10%	-2.615817	-2.612874	-3.218382	-3.204699
PP UNIT ROOT TEST					
Variable		P.P. value (constant		P.P. value (constant and linear	
		Level	First differenced	Level	First
F.M.I.		-1.372932	-12.44098	-1.984497	-12.40445
EXR		1.679192	-12.68751	-0.392914	-12.94647
INF		-2.508804	-13.42776	-2.298776	-15.31683
INT		-4.234833	-23.16584	-4.393979	-31.92605
OILP		-1.512195	-12.33740	-2.387499	-12.31143
Critical values	1%	-3.472813	-3.473096	-4.018349	-4.018748
	5%	-2.880088	-2.880211	-3.439075	-3.439267
	10%	-2.576739	-2.576805	-3.143887	-3.143999

Notes:*indicates significance at one percent or rejection of the null of no unit root at the one percent level.

**indicates significance at five percent or rejection of the null of no unit root at the Five percent level.

***indicates significance at ten percent or rejection of the null of no unit root at the Ten-Percent level.

The unit root tests for the stationarity of the time series are reported in table 1 above. The P.P. tests are non-parametric unit root tests modified such a serial correlation does not affect their asymptotic distribution.

The P.P. tests reveal that all variables integrated of order one, both with and without linear trends and intercept terms.

Table (2) indicates that all variables are non-stationary at the level with intercept or intercept and trend (with t-statistics less than the critical values at 1%, 5%, and 10%). After taking the first difference, all variables became stationary, with intercept or intercept and trend (with t-statistics less than the critical values at 1%, 5%, and 10%).

3.6. Optimal Lag Selection:

The multivariate information criteria are used to determine the optimal lag length of the estimated V.A.R. model. Furthermore, the three commonly used information criteria are Akaike Information Criterion (A.I.C.), Schwarz Bayesian Information Criterion (SBIC), and Hannan-Quinn Information Criterion (HQIC) (Akaike, 1974; Hannan and Quinn, 1979; Schwarz, 1978).

We ran the unrestricted V.A.R. system over the variables and found that the A.I.C. criterion has the lowest value so, we used it in the selection process and came up with three lags, as reported in Table 3 below;

Table (3): V.A.R. Lag Order Selection Criteria
Endogenous variables: FMI EXR INF INT OILP
Exogenous variables: C
Date: 11/23/20 Time: 21:43
Sample: 1980 2018
Included observations: 36

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-376.808	NA	1121.31	21.2115	21.431	21.2883
1	-262.685	190.204*	8.05768*	16.2603	17.5799*	6.7208*
2	-243.640	26.4524	12.2133	16.5911	19.0103	17.4355
3	-210.259	37.0891	9.67230	16.1255*	19.6444	17.3537

* indicates lag order selected by the criterion

L.R.: sequential modified L.R. test statistic (each test at 5% level)
F.P.E.: Final prediction error
A.I.C.: Akaike information criterion
SC: Schwarz information criterion
H.Q.: Hannan-Quinn information criterion

We can see that the A.I.C. criterion has the least value (16.50115), indicating the optimal lag is three lags.

3.7 Cointegration Test

To perform cointegration, we follow Johansen-Jesules Test (1990). The number of lags used is three lags, as it was obtained from the optimal lag selection using V.A.R.

The results reported in table 3 below;

Table (4) Cointegration Test

Rank	**Max-Eigen Stati.**	**Critical Value (Eigen) at 5%**	**Prob.****	**Trace Stati.**	**Critical Value (Trace) at 5%**	**Prob.****
None* (r=0)	41.432	33.876	0.005	92.545	69.818	0.000
At most 1* (r ≤ 1)	20.622	27.584	0.299	51.113	47.856	0.023
At most 2* (r ≤ 2)	16.951	21.131	0.174	30.491	29.797	0.041
At most 3 (r ≤ 3)	13.192	14.264	0.073	13.540	15.495	0.096
At most 4 (r ≤ 4)	0.3483	3.8414	0.555	0.3482	3.842	0.555

Trace test indicates three cointegrating equations at the 5% level.
*represents the rejection of the hypothesis at the 5% level
Max-eigenvalue test shows one cointegrating equation at the 5% level.
* represents the rejection of the hypothesis at the 5% level
**MacKinnon-Haug-Michelis (1999) p-values

The results from table 4 show that both Maximum Eigen Statistic and Trace Statistic are a presence of cointegration among all variables at 5 percent levels. It means that the long-run association between F.M.I., E.X.R., I.N.F., INT, and OILP Do exist.

At the null hypothesis, the Trace Statistic value is 92.5458, higher than the Critical Value (Trace) 69.8188 at a significance level of 5 percent. The P-value (0.000) is less than 0.05, which means we can reject the null hypotheses. This Trace Statistic result clarified that this equation has the long-run relationship between variables at a significance level of 5%.

By the same talking, for the Trace Statistic based on the rank $r \leq 1$ and the rank $r \leq 2$, the values are higher than Critical Value (Trace), and p-values are lower than 5%. At the rank $r \leq 3$, the Trace Statistic value is 13.5400 lower than the Critical Value (Trace) of 15.4947 at a significance level of 5 percent.

However, at the Max-Eigen Statistic, the value in rank $r = 0$ is 41.4324 higher than the Critical Value (Eigen) of 33.8768, and the P-value (0.005) is more significant than 0.05, which means we can reject the null hypothesis. The result shows that the relationship between variables in the long-run at a 5 percent significance level does exist.

Also, for the Max-Eigen Statistic from the rank $r \leq 1$, the values are lower than Critical Value (Eigen), it is also has exceeded the significance level, which same as the case of Trace Statistic and Critical Value (Trace). At the rank $r \leq 1$, the Max-Eigen statistic value is 20.6220 lower than the Critical Value (Eigen) of 27.5843 at a significance level of 5 percent.

Furthermore, the normalized cointegration coefficients are shown in table 5 below;

Table (5): Johansen Normalized Interpretation

1 Cointegrating Equation(s): Log-likelihood -203.3934 Normalized cointegrating coefficients (standard error in parentheses)				
FMI	EXR	INF	INT	OILP
1.000000	-0.006075 (0.00502)	-0.007767 (0.00295)	-0.024492 (0.00600)	-0.002934 (0.00076)
Interpretation:	In the long-run, all variables have a positive impact on F.M.I., on average, ceteris paribus.			
Conclusion:	The null hypothesis of no cointegration is rejected against the alternative of a cointegration relationship in the model.			

Note: The signs of the coefficients are reversed in the long-run

The results also reveal that cointegration implies causality in at least one direction, and this is determined by implementing a vector error correction model.

Since all variables are cointegrated, we can move forward to estimate the vector error correction model.

3.7. Vector Error Correction Model

To estimate V.E.C., all cointegrating equation variables are assumed to be endogenous in a V.A.R. structure. The VECM builds on this by using differenced data and lagged differenced data for the V.A.R. structure's chosen variables.

One of the essential elements of the VECM is the error correction term or factor. The error-correction term's coefficient is theoretically expected to be negatively expressed with a value between zero and one. This result ensures that the error correction equilibrium within the system over time will be at least meaningful. Atypical VECM, in its purest form, appears as shown in equation (2):

$$\Delta fmi_t = b_0 + \sum_{i=1}^{n} b_i\, \Delta fmi_{t-i} + \sum_{i=1}^{n} b_i\, \Delta exr_{t-i} + \sum_{i=1}^{n} b_i\, \Delta inf_{t-i} + \sum_{i=1}^{n} b_i\, \Delta int_{t-i} + \sum_{i=1}^{n} b_i\, \Delta oilp_{t-i} + \varphi_1 exr_{t-1} + \varphi_2 inf_{t-1} + \varphi_3 int_{t-1} + \varphi_4 oilp_{t-1} + \sum_{i=1}^{n} \varphi_5\, E.C._{t-1} + +\mu_t \ldots\ldots(2)$$

Where:
Fmi: financial market index
Exr: official exchange rate
Inf: inflation rate (consumer price index)
Int: real interest rate
Oilp: oil price
E.C.: error correction
u_t: error term
Δ: difference
b_i: short-run coefficients
φ_i: long-run coefficients
t: time
i: number of lags
Note: we used (p-1) for the lag length; in other words, we reduced the lags to 2 lags.

The results from estimating equation 2 (VECM) reported in table 6 below: (detailed results reported in Appendix A)

Table 6: Vector Error Correction Count.Eq1

E.C.	D(FMI)	D(EXR)	D(INF)	D(INT)	D(OILP)
CointEq1	-0.09579	-5.81499	-0.08918	-12.8892	-74.5153
	(0.0440)	(4.6023)	(18.464)	(12.177)	(49.208)
	[-2.1750]	[-1.2634]	[-0.0048]	[-1.0584]	[-1.5142]

Results in Table 6 indicate one cointegration equation's existence, and the value of The error correction term is negative (-0.095792), as expected, and Standard errors in ( )& t-statistics in [ ]. Even though we have values for the t-statists, but we need to know the P-value for each variable to be sure whether to accept or reject the null hypothesis.

And to obtain the P values, we constructed a system of equations, got 60 coefficients for five models, and reported model one only.

From the system of equations obtained in the previous step, we estimate model 1 as shown below;

D(FMI) = C(1)*(FMI(-1) - 0.0265278796367*EXR(-1) + 0.0181818573912*INF(-1) + 0.0397453478293*INT(-1) + 0.00507700905119*OILP(-1) - 0.718276529366) + C(2)*D(FMI(-1)) + C(3)*D(FMI(-2)) + C(4)*D(EXR(-1)) + C(5)*D(EXR(-2)) + C(6)*D(INF(-1)) + C(7)*D(INF(-2)) + C(8)*D(INT(-1)) + C(9)*D(INT(-2)) + C(10)*D(OILP(-1)) + C(11)*D(OILP(-2)) + C(12)

Where,

D(F.M.I.) is the change in financial market performance (dependent variable), and, C1 is the coefficient of cointegrating model "(FMI (-1) - 0.0265278796367*EXR (-1) + 0.0181818573912*INF(-1) + 0.0397453478293*INT(-1) + 0.00507700905119*OILP(-1) - 0.718276529366))".

Estimating the above model, and the results reported in the table (7) below: (Detailed results reported in Appendix B)

Table (7): Results from Estimating Model 1
Dependent Variable: D(F.M.I.)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 11/24/20 Time: 12:51

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.095792	0.044041	-2.175050	0.0397
C(2)	0.000349	0.166728	0.002095	0.9983
C(3)	0.481696	0.166470	2.893593	0.0080
C(4)	-0.000149	0.002651	-0.056323	0.9556
C(5)	-0.004692	0.006893	-0.680628	0.5026
C(6)	0.000293	0.000886	0.330519	0.7439
C(7)	7.64E-06	0.000654	0.011681	0.9908
C(8)	0.002650	0.001024	2.587951	0.0161
C(9)	0.001675	0.000616	2.718119	0.0120
C(10)	0.000244	0.000187	1.300865	0.2057
C(11)	0.000239	0.000169	1.412997	0.1705
C(12)	0.002630	0.002858	0.920243	0.3666

C (1) is the error correction term or the speed of adjustment towards equilibrium (-0.095792); in other words, the system restores its long run due to any shock with a speed of adjustment equal to **9.57%.**

Having that said, we need to discuss two issues: a) Long-run causality and b) Short-run causality.

a) Long-run causality:

If the C (1) is negative in sign and significant, we can say that there is a long-run causality running from E.X.R., I.N.F., INT, and OILP F.M.I.

Here we have the value of C(1) is (-0.095792) and the P-value is 0.0397 (less than 5%), and we can conclude that there is long-run causality running from E.X.R., I.N.F., INT, and OILP to F.M.I.

b) Short-run causality:

We need to check whether each independent variable cause change towards the dependent variable or not, as follows:

i) E.X.R. (-1), E.X.R. (-2)=0 or not; in other words, we need to check whether C(4) and C(5)=0 or not.
ii) I.N.F. (-1) and I.N.F. (-2)= 0 or not; in other words, we need to check whether C(6) and C(7) =0 or not.
iii) INT(-1) and INT(-2)=0 or not; in other words, we need to check whether C(8) and C(9) =0 or not.
iv) OILP(-1) and OILP(-2)=0 or not; in other words, we need to check whether C(10) and C(11) =0 or not.

And to do so, we run the Wald test, and the results are reported in Table 8 below:

Table 8: Results from Wald Tests
Equation: E.X.R. causing F.M.I.

Test Statistic	Value	df	Probability
F-statistic	0.247523	(2, 24)	0.7827
Chi-square	0.495047	2	0.7807

Null Hypothesis: C(4)=C(5)=0

Equation: I.N.F. causing F.M.I.

Test Statistic	Value	df	Probability
F-statistic	0.097795	(2, 24)	0.9072
Chi-square	0.195590	2	0.9068

Null Hypothesis: C(6)=C(7)=0

Equation: I.N.T. causing F.M.I.

Test Statistic	Value	df	Probability
F-statistic	3.836186	(2, 24)	0.0358
Chi-square	7.672371	2	0.0216

Null Hypothesis: C(8)=C(9)=0

Equation: Oilp causing F.M.I.

Test Statistic	Value	df	Probability
F-statistic	1.759914	(2, 24)	0.1935
Chi-square	3.519827	2	0.1721

Null Hypothesis: C(10)=C(11)=0

Results Reported in Table 8 revealed the following findings of the short-run causality running from the independent variables to the dependent variable, as follows;

Exchange rate (E.X.R.): The Chi-square p-value is 78% and greater than 5%, meaning that we cannot reject the null hypotheses C(4)=C(5)=0.

There is no short-run causality running from E.X.R. to our dependent variable, F.M.I.

Inflation (I.N.F.): The Chi-square p-value is 90% and greater than 5%, meaning that we cannot reject the null hypotheses C (6) =C (7) =0.

There is no short-run causality running from I.N.F. to our dependent variable, F.M.I.

Interest Rate (INT): The Chi-square p-value is 2.1% and less than 5%, meaning that we can reject the null hypotheses C (8) =C (9) =0.

There is a short-run causality running from INT to our dependent variable, F.M.I.

Oil Price (Oilp): The Chi-square p-value 17.2% and greater than 5%, meaning that we cannot reject the null hypotheses C(10) =C(11 =0.

There is no short-run causality running from OILP to our dependent variable, F.M.I.

AS a summary of causality between the independent and dependent variables, we can say there is a long-run causality running from E.X.R., I.N.F., INT, and OILP towards F.M.I. But in the short run, only INT has a short-run reason on F.M.I., E.X.R., I.N.F., and OILP do not have short-run causality running to F.M.I.

The reasoning behind the magnitude of the short-run causality due to the following reasons:

There were political variables for Inflation and interest rates from 2011 to 2013 (the period of revolution and state liquidity). There were some global price changes for oil prices as a reflection of the region's political instability.

Besides, the beginning of state cohesion (from 2014 to 2015)

The economic reform program (from 2016 to 2018) and ongoing contributed to explaining the short-run causality.

3.8. Variance Decomposition

The variance decomposition indicates the amount of information each variable contributes to the other variables in the autoregression. It determines how much of the forecast error **variance** of each variable can be explained by exogenous shocks to the other variables. We employed a five-year forecasting (out-of-sample forecast) horizon and observed the variable ordering's relevance over time.

The short-run period will be year one and year 2, while the long-run period will be year 3 through year 5.

Table 9: Interpretation of the variance decomposition of F.M.I.:

Variance Decomposition of F.M.I.:						
Periods	S.E.	FMI	EXR	INF	INT	Oilp
1	0.011292	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.015673	88.67880	0.344040	7.350784	1.026384	2.599993
3	0.021034	77.77127	2.158720	13.96142	2.188336	3.920258
4	0.026614	64.97666	1.514927	21.50222	7.008184	4.998011
5	0.032851	51.12868	6.470195	26.01543	11.94851	4.437186

The interpretation for F.M.I. will go this way, in year 1, the variable itself explains 100% of forecast error variance in F.M.I.

And we can see the contribution from E.X.R., I.N.F., INT, and Oilp are strongly exogenous, which implies that they have a feeble influence on predicting F.M.I. in the future.

For the long-run in period 5, we can see the influence of F.M.I. on itself is dawdling the further we move to the future, while the impact from E.X.R., I.N.F., INT, and Oilp are increasing as you move further into the future. That tells us that E.X.R., I.N.F., INT, and Oilp are exhibiting strong endogenous influence on F.M.I. as you move on into the future.

Table 10: Interpretation of the variance decomposition of E.X.R.:

Variance Decomposition of E.X.R.:						
Periods	S.E.	*FMI*	EXR	INF	INT	Oilp
1	1.180070	0.000360	99.99964	0.000000	0.000000	0.000000
2	2.090957	0.196248	94.76182	0.004742	0.023691	5.013498
3	2.707364	0.554979	71.04543	0.029380	3.396090	24.97412
4	2.971255	0.495356	61.39752	0.071728	9.679584	28.35581
5	3.496856	1.080153	69.41068	0.135330	8.888431	20.48540

The interpretation for E.X.R. will be similar to that for F.M.I. We can see from the E.X.R. decomposition that all other variables in the model are not significant. The impact of F.M.I., I.N.F., INT, and Oilp is barely coming to 29% by summing. So, E.X.R. has a strong influence on itself in the future.

Table 11: Interpretation of the variance decomposition of I.N.F.:

Variance Decomposition of I.N.F.:						
Periods	S.E.	*FMI*	EXR	INF	INT	Oilp
1	4.734483	3.869000	34.09618	62.03482	0.000000	0.000000
2	6.424645	10.84244	40.57036	48.07144	0.242744	0.273016
3	7.586729	7.795508	29.20978	51.41734	1.569228	10.00814
4	8.907078	9.293179	31.76043	47.39973	4.284989	7.261668
5	10.04481	10.82874	27.85724	45.10687	3.401061	12.80609

From the I.N.F. decomposition, the variable is strongly predicted from year 1 to year 5, and the influence from all other variables in the model is significant. By summing the impact coming from F.M.I., E.X.R., INT, and Oilp come to 54%. So, I.N.F. has a moderate influence on itself in the future.

Table 12: Interpretation for the variance decomposition of INT:

Variance Decomposition of INT:						
Periods	S.E.	FMI	EXR	INF	INT	Oilp
1	3.122324	1.160100	13.04662	12.27078	73.52249	0.000000
2	4.287367	0.615300	29.74790	10.30295	49.61336	9.720487
3	4.943102	0.513288	34.58133	15.10894	41.11174	8.684699
4	6.686097	0.284481	58.52744	12.88953	23.43007	4.868468
5	8.650889	0.782731	37.34069	9.573831	17.89335	34.40940

IN the INT decomposition, the variable decreases in predicting itself from year 1 to year 5, indicates itself from year 1 to year 5. The influence of all other variables in the model is significant.

By summing, the effect of F.M.I., E.X.R., INT, and Oilp comes to 82%. So, INT has a weak influence on itself in the future.

Table 13: Interpretation of the variance decomposition of Oilp:

Variance Decomposition of OILP:						
Periods	S.E.	FMI	EXR	INF	INT	Oilp
1	12.61744	0.685538	6.771732	0.134742	24.31124	68.09675
2	18.16286	0.381131	5.880642	0.361284	42.04788	51.32906
3	22.77271	7.749164	10.48277	0.663838	46.48130	34.62292
4	30.50427	7.290777	36.11521	0.695874	31.34258	24.55556
5	38.52961	5.843823	29.31959	0.760620	27.57180	36.50418

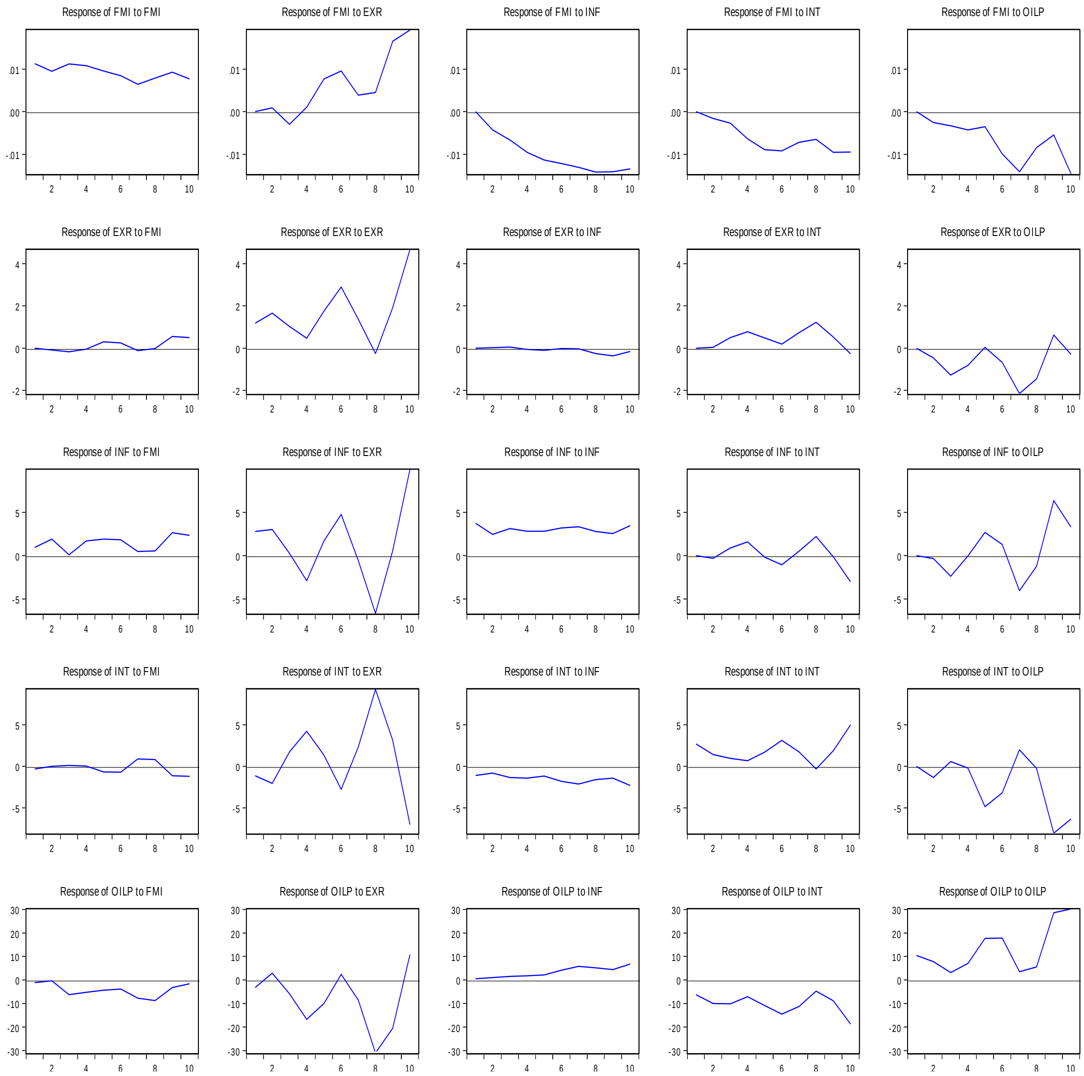
We can see from the Oilp decomposition the variable is decreasing in predicting itself from year 1 to year four and start to increase in year 5. And the influence of all other variables in the model is significant. By summing the impact of F.M.I., E.X.R., I.N.F., and INT are coming to 54%. So, I.N.F. has a moderate influence on itself in the future.

3.9. Impulse Response Function

Impulse term to establish how the variables react to each other. The ordering of the variables is an essential consideration in the calculation of impulse responses and variance decompositions. In practice, the error terms are likely to be correlated across V.A.R. equations to some extent. A failure to assume this would lead to a misrepresentation of the system dynamics.

In this case, the usual approach involves generating orthogonalized impulse responses while considering the sensitivity of the results at every stage. The results of the impulse response analysis are reported in figure 3 below; The impulse response functions, based on the Cholesky decomposition, are used here to explain the inter-relationships among variables as shown in figure 3 below;

Response to Cholesky One S.D. (d.f. adjusted) Innovations



The impulse response graph, panel I, shows that The one standard deviation shock in financial market performance equals one standard deviation (S.D.) results in an increase in exchange rate by about 0.05% of S.D. during the first two years. This response returns to the negative impact of an increase in financial market performance on the exchange rate. Furthermore, the inflation rate decreased by 20% of S.D. and continued to reach close to zero by year 8; it moved unchanged. Also, Oil price decreased by 0.04% in the first 3 Year, and after that continued to year 5, then declined sharply to reach close to zero by year 7 to increase again till year 9, and after that decreased to zero by year 10.

The impulse response graph, panel II, shows that a one standard deviation shock in exchange rate resulted in a decrease in financial market performance by about 0.02% of S.D. during the first three years. This response returns to an increase from period 4 to period 7 to reach zero, then a slight decrease during period 8, to move up again and continue to period 10. Furthermore, the inflation rate moved close to zero to period 7, then decreased by about 0.03% of S.D. and continued till period 10. Besides, interest rate moved unchanged in the short-run, then started to increase till period four by 0.05%, then declined to close 0.01% in period 6, where it picked up again by 0.10% in period eight after that dropped to reach zero in year 10. As for the oil price, we can notice that one slandered deviation shock in the exchange rate will result in an inverse response in oil price and takes the opposite magnitude in the negative.

The impulse response graph, panel III, shows that a one standard deviation shock in inflation rate resulted in an increase in financial market performance by about 0.10% of S.D. during the first two years. This response returns to zero by year 4, then slightly increased and decreases above the zero levels till period 10 (no significant increase). The same thing was noticed for the other variables (interest rate and oil price); they respond up and down, as shown in panel III.

The impulse response graph, panel IV, shows that one standard deviation shock in interest rate resulted in almost no effect on financial market performance till period 5, where it slightly decreased by about 0.02%, then increased in period six by about 0.02% for two periods, then declined somewhat till period 10. The same thing was noticed for the other variables (interest rate and oil price). They respond up and down, as shown in panel IV.

The impulse response graph, panel V, shows that a one standard deviation shock in oil price resulted in a decrease in financial market performance by about -0.07% of S.D. after the first two periods. This response continued negative but with no significant till period 9, where it started to move up close to zero by period 10. The same thing was noticed for the other variables (interest rate and oil price). They respond up and down, as shown in panel V.

3.10. Model Stability

To check whether our model stable over time, a CUSUM & CUSUMQ stability tests performed, as shown in figures four and five bellow:

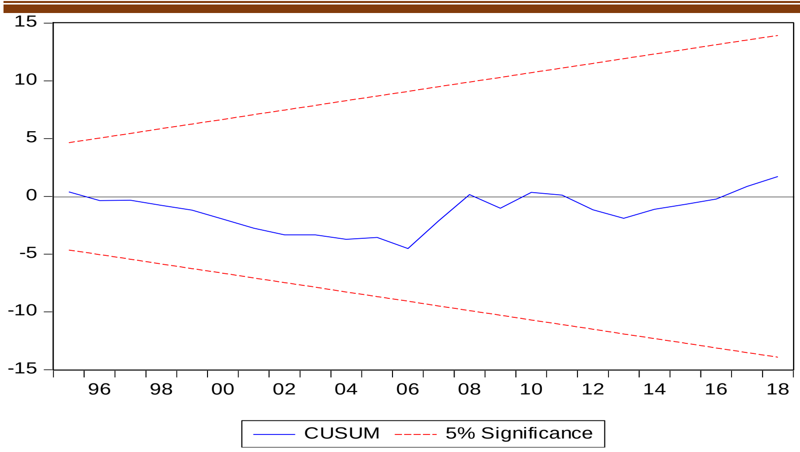


Figure 4: CUSUM Stability Test

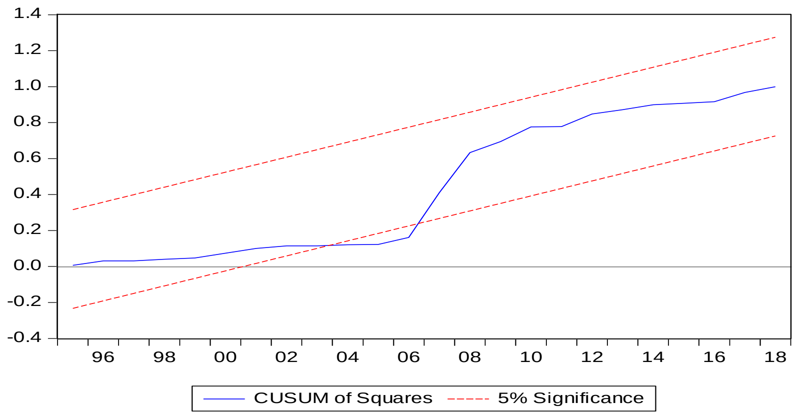


Figure 5: CUSUMQ Stability Test

The straight lines denote the critical bounds at a 5% significance level.

Figures five show that the CUSUM statistics plots do not cross the critical bounds, indicating stability in the VECM, but for

CUSUMQ statistics plots, figure 6, do not cross the essential bounds years from 2004-2006, indicating overall stability in the VECM.

4. Conclusion and Summary

The impact of macroeconomic variables on the financial market performance has been a hot topic for decades. Many previous studies indicate the crucial role that the exchange rate, Inflation, and interest rate play in influencing financial market performance.

Besides, another line of researchers believes that oil prices cannot be overlooked in affecting financial markets. The researchers considered this from two angles, the first if the country is an oil exporter, and here the effect of the increase in oil prices is positive on the performance of financial markets. Still, in oil-importing countries, any rise in oil prices will negatively affect those countries' negative markets' performance.

Even though the long-run causality existed between the independent variables towards the dependent variable, in the short run, only interest rates have a short-term reason for financial market performance, and the exchange rate, Inflation, and oil price do not have short-run causality running to financial market performance.

As a recommendation, both the short-run and long-run causality effects should be considered guidelines to be followed by policymakers to avoid misleading macroeconomic strategies in future strategic planning.

The results from the estimation of the vector error correction model indicated that R-squared is 0.448, somehow close to 60%, so we accept the model considering we are using VECM. The Durbin-Watson stat is 2.17, meaning no serial correlation among the time series.

For the variance decomposition to measure the impact of the macroeconomic shocks on the financial market performance, we found that in the short-run (years 1&2) a 100% and 89%, respectively, of forecast error variance in F.M.I. is explained by the variable itself.

And we can see the contribution from E.X.R., I.N.F., INT, and Oilp are strongly exogenous, which implies that they have a feeble influence on predicting F.M.I. in the future.

For the long-run in period 5, we can see the influence of F.M.I. on itself decreases as we move to the future, while the impact from E.X.R., I.N.F., INT, and Oilp is increasing as we move further into the future. That tells us that E.X.R., I.N.F., INT, and Oilp are exhibiting strong endogenous influence on F.M.I. as you move on into the future.

Finally, the model was found stable from using both; the CUSUM and CUSUMQ statistics in the VECM...

References

Abedeyi, M. A., et al. (2012). Analysis of Interaction Between Global Crude Oil Price, Exchange Rate, Inflation, and Stock Market in India: Vector Auto Regression Approach. *Journal of Management*, 14 (1): 120-133.

Ahmed, Hossam E. M. (2013). Investigating the Transmission Mechanism of Monetary Policy in Egypt. Phd. Theses, The University of Birmingham, UK.

Akaike, H. (1974) A New Look at the Statistical Model Identification. IEEE, 19: (6): 716-723.

Basher, Syed Abul, (2010). Has the non-oil sector decoupled from the oil sector? A case study of Gulf Cooperation Council Countries. *MPRA Paper* No. 21059

Bhargava Sarganand, (1983). Testing Residuals from Least Squares Regression for Being Generated by the Gaussian Random Walk. *Econometrica*, 51(1):153-174

Cong et al. (2008). Relationships between oil price shocks and stock market: An empirical analysis from China. *Energy Policy*, 36(9): 3544-3553

Dickey and Fuller (1979). Distribution of the Estimators for Autoregressive Time Series with a Unit Root. *Journal of the American Statistical Association*, 74(366): 427-431.

Engleand Granger, (1987). Co-Integration and Error Correction: Representation, Estimation, and Testing. *Econometrica*, 55(2): 251-276.

Fama, E. F. (1981), ¡°Stock returns, real activity, Inflation, and money¡±, American Economic Review, 71(4): 545-565

Fama, E.F. (1970). Efficient capital markets: A review of theory and empirical work. *The Journal of Finance*, 25(2): 383-417.

Felicia O. Olokoyo, Oyakhilome W. Ibhagui & Abiola Babajide (2020) Macroeconomic indicators and capital market performance: Are the links sustainable?, Cogent Business & Management, 7(1): 58-75

Gujarati, D.N. & Porter DC (2009). Basic econometrics. McGraw-Hill.

Gerben Driesprong, Ben Jacobsen, and Benjamin Mat (2008). Striking oil: Another puzzle? *Journal of Financial Economics*, 89(2): 307-327.

Greene, William H. (2018). Econometric Analysis (8th Ed., pp. 1048-1051), Pearson Publisher, UK.

Hannan, E.J. and Quinn, B.G. (1979) The Determination of the Order of an Autoregression. Journal of the Royal Statistical Society. Series B (Methodological), 41: (2): 190-195.

International Monetary Fund (2019). May report.

Johansen, S. and Juselius, K. (1990) Maximum Likelihood Estimation and Inference on Cointegration – with Applications to the Demand for Money. Oxford Bulletin of Economics and Statistics, 52: (2): 169-210.

Luan Vinicius Bernardelli and Gustavo Henrique Leite De Castro, (2020) Stock Market and Macroeconomic Variables: Evidence for. Revista Catarinense da Ciência Contábil, v. 19, 1-15.

Lutz Kilian and Cheolbeom Park, (2009) The Impact Of Oil Price Shocks on the US Stock Market. *International Economic Review*, 50(4):1267-1287

Mahmoud Ramadan Barakat, Sara H. Elgazzar& Khaled M. Hanafy, (2016). Impact of Macroeconomic Variables on Stock Markets: Evidence from Emerging Markets. *International Journal of Economics and Finance*, 8(1): 195-207.

Miller, J., and Ronald Ratti (2009). *Energy Economics*, 31(4): 559-568

Ouma, W. N., &Muriu, P. (2014). The impact of macroeconomic variables on stock market returns in Kenya. *International Journal of Business and Commerce*, 3(11): 1-31

Phillips and Perron (1988). Testing for a unit root in time series regression, Biometrika, 75(2): 335–346

Ross, S. A. (1976). The Arbitrage Theory of capital asset pricing. *Journal of Economic Theory*, 13(3): 341-360.

Sana Zaouali, (2007). Impact of higher oil prices on the Chinese economy. *OPEC Review*, 31(3): 191-214.

Schwarz, G. (1978) Estimating the Dimension of a Model. The Annals of Statistics, 6(2):461-464

Appendices

Appendix (A): Vector Error Correction Model Estimation

Vector Error Correction Estimates
Date: 11/24/20 Time: 10:41
Sample (adjusted): 1983 2018
Included observations: 36 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
FMI(-1)	1.000000
E.X.R. (-1)	-0.026528 (0.00973) [-2.72665]
INF(-1)	0.018182 (0.00554) [3.28120]
INT(-1)	0.039745 (0.01143) [3.47659]
OILP(-1)	0.005077 (0.00150) [3.38375]
C	-0.718277

Error Correction:	D(F.M.I.)	D(E.X.R.)	D(I.N.F.)	D(INT)	D(OILP)

CointEq1	-0.095792	-5.814993	-0.089188	-12.88925	-74.51538
	(0.04404)	(4.60234)	(18.4648)	(12.1772)	(49.2088)
	[-2.17505]	[-1.26349]	[-0.00483]	[-1.05847]	[-1.51427]
D(FMI(-1))	0.000349	-7.596753	110.1947	18.92505	83.17980
	(0.16673)	(17.4233)	(69.9029)	(46.1000)	(186.292)
	[0.00210]	[-0.43601]	[1.57640]	[0.41052]	[0.44650]
D(FMI(-2))	0.481696	-5.854879	-126.9223	56.62986	-397.3757
	(0.16647)	(17.3963)	(69.7945)	(46.0285)	(186.003)
	[2.89359]	[-0.33656]	[-1.81852]	[1.23032]	[-2.13640]
D(EXR(-1))	-0.000149	0.079069	0.872681	-1.887622	1.658520
	(0.00265)	(0.27699)	(1.11131)	(0.73289)	(2.96165)
	[-0.05632]	[0.28545]	[0.78527]	[-2.57557]	[0.56000]
D(EXR(-2))	-0.004692	-0.928217	-3.673859	3.548942	-14.12344
	(0.00689)	(0.72036)	(2.89013)	(1.90600)	(7.70221)
	[-0.68063]	[-1.28854]	[-1.27118]	[1.86199]	[-1.83369]
D(INF(-1))	0.000293	0.088052	-0.397623	0.091885	0.942152
	(0.00089)	(0.09262)	(0.37158)	(0.24505)	(0.99026)
	[0.33052]	[0.95073]	[-1.07010]	[0.37496]	[0.95142]
D(INF(-2))	7.64E-06	0.067735	0.184075	-0.085415	0.757430
	(0.00065)	(0.06833)	(0.27415)	(0.18080)	(0.73062)
	[0.01168]	[0.99125]	[0.67144]	[-0.47243]	[1.03670]
D(INT(-1))	0.002650	0.138652	-0.189607	-0.264171	0.968232
	(0.00102)	(0.10701)	(0.42935)	(0.28315)	(1.14421)
	[2.58795]	[1.29564]	[-0.44162]	[-0.93298]	[0.84620]
D(INT(-2))	0.001675	0.067465	-0.082020	-0.244926	0.109606
	(0.00062)	(0.06439)	(0.25832)	(0.17036)	(0.68843)
	[2.71812]	[1.04781]	[-0.31751]	[-1.43769]	[0.15921]
D(OILP(-1))	0.000244	-0.015443	-0.031788	-0.062942	0.127939
	(0.00019)	(0.01957)	(0.07852)	(0.05178)	(0.20925)
	[1.30087]	[-0.78909]	[-0.40485]	[-1.21553]	[0.61142]
D(OILP(-2))	0.000239	-0.063891	-0.175224	0.044973	-0.230556
	(0.00017)	(0.01771)	(0.07106)	(0.04686)	(0.18938)
	[1.41300]	[-3.60726]	[-2.46587]	[0.95968]	[-1.21746]

C	0.002630	0.741666	0.949223	-0.189636	4.434780
	(0.00286)	(0.29869)	(1.19836)	(0.79030)	(3.19364)
	[0.92024]	[2.48305]	[0.79210]	[-0.23995]	[1.38863]
R-squared	0.448597	0.481850	0.452139	0.659320	0.343193
Adj. R-squared	0.195870	0.244365	0.201036	0.503175	0.042157
Sum sq. resids	0.003060	33.42156	537.9679	233.9737	3820.794
S.E. equation	0.011292	1.180070	4.734483	3.122324	12.61744
F-statistic	1.775027	2.028969	1.800613	4.222486	1.140038
Log-likelihood	117.6271	-49.74407	-99.75883	-84.77221	-135.0463
Akaike A.I.C.	-5.868170	3.430226	6.208824	5.376234	8.169238
Schwarz SC	-5.340330	3.958066	6.736663	5.904073	8.697078
Mean dependent	0.001247	0.474091	0.189762	0.145573	0.731111
S.D. dependent	0.012593	1.357537	5.296745	4.429720	12.89211

Determinant resid covariance (dof adj.)	1.918725
Determinant resid covariance	0.252672
Log-likelihood	-230.6470
Akaike information criterion	16.42483
Schwarz criterion	19.28396
Number of coefficients	65

Appendix B: Results from Estimating Model 1

Dependent Variable: D(F.M.I.)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 11/24/20 Time: 12:51
Sample (adjusted): 1983 2018
Included observations: 36 after adjustments
D(FMI) = C(1)*(FMI(-1) - 0.0265278796367*EXR(-1) + 0.0181818573912*INF(-1) + 0.0397453478293*INT(-1) + 0.00507700905119*OILP (-1) - 0.718276529366) + C(2)*D(FMI(-1)) + C(3)*D(FMI(-2)) + C(4) *D(EXR(-1)) + C(5)*D(EXR(-2)) + C(6)*D(INF(-1)) + C(7)*D(INF(-2)) + C(8)*D(INT(-1)) + C(9)*D(INT(-2)) + C(10)*D(OILP(-1))+ C(11)*D(OILP(-2)) + C(12)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.095792	0.044041	-2.175050	0.0397
C(2)	0.000349	0.166728	0.002095	0.9983
C(3)	0.481696	0.166470	2.893593	0.0080
C(4)	-0.000149	0.002651	-0.056323	0.9556
C(5)	-0.004692	0.006893	-0.680628	0.5026
C(6)	0.000293	0.000886	0.330519	0.7439
C(7)	7.64E-06	0.000654	0.011681	0.9908
C(8)	0.002650	0.001024	2.587951	0.0161
C(9)	0.001675	0.000616	2.718119	0.0120
C(10)	0.000244	0.000187	1.300865	0.2057
C(11)	0.000239	0.000169	1.412997	0.1705
C(12)	0.002630	0.002858	0.920243	0.3666

R-squared	0.448597	Mean dependent var	0.001247
Adjusted R-squared	0.195870	S.D. dependent var	0.012593
S.E. of regression	0.011292	Akaike info criterion	-5.868170
Sum squared resid	0.003060	Schwarz criterion	-5.340330
Log-likelihood	117.6271	Hannan-Quinn criteria.	-5.683940
F-statistic	1.775027	Durbin-Watson stat	2.176966