Stock market performance and foreign exchange market in Egypt: Does the 25th January revolution matter?

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Abstract:
This paper examines the causal relationship between stock market performance and foreign exchange market in Egypt over the period 2009-2016. The study period is divided into two sub-periods: pre and post January 25th Egyptian revolution (ER). The reason is to examine how this revolution affects the causal relationship between the two markets' performance. In this study, the daily basis data are used to enable good and effective observation changes in the foreign exchange rate and stock market performance over time. Stock market indexes and stock market capitalization are used as proxies for stock market performance. Further, the Egyptian pound to US$ exchange rate is used as a measure for foreign exchange market performance. The study analysis is done in stages. The first is to check the variables' stationarity for the pre and post revaluation. The second is to examine the cointegration among the variables. The third is to run vector autoregression (VAR) estimates, after which VAR Granger-causality tests are employed. The results show that the data are not stationary at their levels but stationary in their first difference level while there is no cointegration in the long-run among the variables in both sub-periods. Further, findings indicate that, in the pre-January 25th revolution period, there is a significant causal relationship between the foreign exchange market and stock market indexes and a significant causal relationship between stock market performance (measured by market capitalization) and exchange rate at the 1% level. However, in the post January 25th revolution period, the study does not find a significant causal relationship between foreign exchange market and stock market indexes and capitalization. The results have important implications for investors, companies and policy makers.

Keywords*:* stock market performance, foreign exchange market, vector autoregression estimates (VAR), Granger causality, variance decomposition (VD), impulse response function (IRF), Egyptian revolution (ER).

JEL classification*:* E44; O47; O16; C58

1. Introduction

Existing literature has indicated the role of the stock market in fostering economic development (Ho, 2019). The stock market basically mediates the relationship between savers and borrowers as it mobilizes savings from a large pool of small savers and directs these funds into fruitful investments (Büyüksalvarci and Hasan, 2010). At the same time, globalization has converted the whole world into one single financial hub, which leads to the facilitation of capital movements across the globe. The developing economies have emerged as attractive destinations for international capital, providing better returns. However, these returns can be eroded in cases of the depreciation of the currency of host countries, thereby influencing the inflow of foreign capital either directly or indirectly. As the global financial system is highly integrated and interdependent, the advancement of information technology has induced synergetic correlation among the various organs of the financial system (Barakat et al. 2015). Hence, it attracts researchers, practitioners and policy makers to explore the dynamic relationship among various sub-financial systems, especially the interaction between stock market and foreign exchange market, where these two markets are the most sensitive segments of a financial system and are considered as barometers for the economic health of a country. Pradhan et al. (2015) examine the relationship between economic growth, oil prices, depth in the stock market, real effective exchange rate, inflation rate, and real rate of interest using a panel vector autoregressive model to test Granger causality for the G-20 countries over the period 1961-2012. The results show a robust long-run economic relationship between economic growth, oil prices, stock market depth, real effective exchange rate, inflation rate,

and real rate of interest. While the study found that the empirical evidence for short-run causality is mixed, there was clear evidence that real economic growth responds to various measures of stock market depth, allowing for real oil price movements and changes in the real effective exchange rate, inflation rate, and real rate of interest. García-Solanes et al. (2017) investigate the relationship between the nominal exchange rate and other macroeconomic variables in Greece, Italy, Spain and Portugal using panel cointegration and VEC models for the period 1970-2011. They find a positive relationship between national income ratios and real exchange rates. Using VAR analysis, Laopodis and Papastamou (2016) investigate the dynamic interactions between stock markets and the real economy in 14 emerging markets over the period 1995-2014 and they find that stock market is positively and robustly associated with present and future real economic development. Büyüksalvarci and Abdoglu (2010) examine the causal relationships between stock prices and macroeconomic variables in Turkey during the period 2001–2010 using techniques of the long-run Granger non-causality test. The results suggest that past stock prices significantly cause current changes in gold price, money supply and rate of inflation. However, the study fails to reject the null hypothesis of Granger non-causality from exchange rate, gold price, money supply, index of industrial production and rate of inflation to stock price at the 1% level of significance. Therefore, it seems that there is a unidirectional long-run causality from stock price to macro variables for Turkey. This implies that the stock market can be used as a leading indicator for future growth in exchange rate, gold price, money supply, index of industrial production and rate of inflation in Turkey. Narayan et al. (2014) examine the determinants of stock prices for major Indian banks using a panel Granger causality test that reveals the direction and sign of causality. They find evidence of panel cointegration among stock prices, economic activity, interest rates, and exchange rates for thirteen banks. Their results suggest that while economic activity and currency depreciation contribute to a rise in share prices, an increase in the interest rate reduces bank share prices. Moreover, only economic activity Granger-causes stock prices in the long run. Bahmani and Saha (2016) examine whether exchange rate changes have symmetric or asymmetric effects on stock prices in Brazil, Canada, Chile, Indonesia, Japan, Korea, Malaysia, Mexico, and the UK using the ARDL approach. They find that exchange rate changes have symmetric effects on stock prices, although the effects are mostly short-run. Boako and Alagidede (2017) investigate currency price risk and stock market returns in Africa (namely, Kenya, South Africa, Morocco, Nigeria, Botswana, and Egypt) using the ARMA model. They find evidence of non-homogenous weak negative dependence between stocks and the US dollar (USD) and Euro (EUR) exchange rates. It is inferred from the findings that foreign exchange price risk may command a premium in some African equity markets, particularly during market turmoil, to weaken any hedge capabilities of domestic stock markets for investors.

Revolutionary and socio-political movements such as those which occurred in Egypt, Tunisia, and other Arab countries in 2011, sometimes referred to as the Arab Spring, cannot be easily predicted by political scientists (Howard & Walters, 2014). Several studies such as Kollias et al. (2011), Pástor and Veronesi (2013), Chau, Deesomsak and Wang (2014), Lehkonen and Heimonen (2015), Ahmed (2017), Bonaime et al. (2018), Charfeddine and Al Refai (2019), Charfeddine and Goaied, (2019), and Goodell, McGee and McGroarty (2020), point out that political events such as parliamentary and presidential elections, political violence/turmoil, geopolitical tensions, revolutions/uprisings, demonstrations, assassinations, terrorist attacks, and military coups have a significant association with the development of investors' perception of the overall market risk. In addition, Worthington and Valadkhani (2004) claim that catastrophic events adversely affect both domestic and international capital markets through the creation of uncertainty and panic, the promotion of extreme price volatility, and the partial destruction of global financial centres. At times of political instability, the high volatility of

stock markets generates speculative actions by investors and capital flight to value. This may lead to considerable instability in other markets such as foreign exchange markets (Caporale et al. 2014). Surprisingly, few studies examine the associations between stock and foreign exchange performance before and after the Egyptian revolution. This paper examines whether or not a causal relationship exists between stock and foreign exchange markets over the period from 2009 to 2016. The study period is divided into two sub-periods. The first sub-period (pre-25th January revolution) covers the period from 07/09/2009 to 21/01/2011 (The Egyptian stock market shut down for 55 days from Friday 28th January 2011 until 22nd March 2011 to resume business on Wednesday 23rd March 2011). The second sub-period (post January 25th revolution) covers the period from 23/03/2011 to 01/09/2016. The reason behind this is to examine how the January 25th revolution has affected the causal relationship between the two markets' performance in Egypt. We excluded the during revolution period as the market was almost closed and also to avoid any bias. In this study, stock market indexes and capitalization are used as proxies for the stock market performance. Further, the Egyptian pound to US$ exchange rate (EX) is used. In this study, the daily-basis data is used rather than monthly or annual data to have good and effective observation changes in the foreign exchange rate and stock market performance over time. The time series data are used to examine the unit root, cointegration and vector autoregression among the variables in the short and long run and to detect their dynamic causal interactions.

The Egyptian revolution, with no doubt, had an impact on stock markets and macroeconomic variables in the national economy. The revolution in Egypt began by with series of popular movements on Tuesday, January 25, 2011. In the public business sector, it was claimed that the cost of responding to factional demands from 25th January 2011 until 12th June 2011 amounted to EG£1.5 billion with a possibility that it could be more, and the net profits of that sector declined by 36% during the period from 25th January 2011 to 31st March 2011, compared to the net profit of the same period for the previous year. During the five months of the revolution, the total railway losses due to rioting, hooliganism and factional demands amounted to 95 million pounds, and the rates of regular train movement have decreased by 20 % mostly in Upper Egypt (Abdelbaki, (2013). In addition, this period witnessed 125 cases of demonstrations on the tracks, resulting in the delay of 860 trains. The average percentage of delay per train reached 50 minutes which resulted in the loss of more than 1,160 travel hours in addition to the cancellation of nearly 9,000 train trips. Further, the Human Rights Centre admitted that employees' protests have fallen relatively as a result of the strike banning law. The month of July 2011 recorded a decline rate in protests by 22% (from 97 protests in June to 75 protests in July) as there were 22 sit-in protests, 19 strikes, 20 demonstrations, 10 standing protests and 3 gatherings. There were three suicide cases recorded after as workers were unable to provide the day-to-day requirements for their families. As a result of poor working conditions and lack of means of industrial safety and occupational health, it was recorded that 2,400 workers were displaced and four employees suffered from epilepsy (Abdelbaki, (2013). The period between the Egyptian revolution on 25th January 2011 and the announcement of the parliamentary elections' results on 30th November in 2011 had witnessed lots of political events such as demonstrations, sit-in protests, riots, strikes, and others These events impacted the Egyptian economy as a whole through affecting the output, employment, income and investment decisions. With no doubt, the Egyptian revolution appears to have significantly affected macroeconomic variables and stock markets within the national economy. In fact, the major macroeconomic indicators had been deteriorating even before the Egyptian revolution took place. Table (1) illustrates the main Egyptian economic indicators. The table indicates a remarkable deterioration in the Egyptian economy in 2011

and 2012 (see e.g. % annual GDP growth, GDP per capita growth, real interest rate, exports of goods and services, and foreign direct investment).

Table (1): is about here

This paper has important contributions to literature. To the best of our knowledge, this study is the first one to examine the causal interaction between stock and foreign exchange markets during the turbulent time; in this case the Egyptian revolution. Our empirical testing is linked to three theories, namely: Traditional Approach, Portfolio Balance Approach and Asset Market Approach. These theories are tested in the Egyptian context. We employ a daily dataset because the use of monthly data cannot capture the timing of uncomfortable events. Our analysis covers the period from 2009 to 2016, so it takes the effect of the Egyptian revolution on both markets. Due to its geographic location, its large population, and its significant role in the politics of the Arab world, stability and prosperity in Egypt are key not only for neighbour partners but also for the whole international community (Abdelghafar, 2018). In addition, as Egypt is an important country in a group of frontier emerging markets called CIVETS, namely: Colombia, Indonesia, Vietnam, Egypt, Turkey and South Africa (Vo and Truong, 2018), therefore it is important to examine the causal relationship between stock market performance and foreign exchange market behaviour in the context of Egypt, an important frontier market, one of the fast growing markets in the region.

This study is organized as follows. Section 2 reviews the previous literature. Section 3 presents the methodology and data. Section 4 presents the empirical results of the study. Section 5 concludes the study.

2. Literature Review

The strong connection between political events and financial markets has driven an expanding body of research over the years and across various regions of the world (Wang and Boatwright, 2019). On the theoretical front, Pástor and Veronesi (2013) and Lehkonen and Heimonen (2015) claim that there is a dearth of theories and conceptual frameworks that describe the mechanisms underlying the relationship between political events and financial markets. In their seminal works: *The Uncertain Information Hypothesis*, Brown et al. (1988) have developed a set of testable predictions about the reaction of risk-averse agents to major informational surprises. This hypothesis suggests that unanticipated news, whether good or bad, about the prospects for a firm, an industry, or the market as a whole, raises the level of uncertainty. In response to this increased uncertainty, agents initially set asset values below their fundamental prices (Ahmed, 2017). In terms of time, the uncertainty surrounding the resulting event gradually disperses, thereby bringing asset prices back to their fundamental values. Furthermore, if agents' preferences display absolute decreasing risk aversion, they will overreact (underreact) to bad (good) news. Pástor and Veronesi (2013) are among the first to relate political uncertainty to asset price movements. They theorise a general equilibrium approach which suggests that the risk-premium is affected by both economic shocks and non-economic shocks, such as political uncertainty. In their approach there is an *old* policy with which investors become familiar with over time. Uncertainty is created since the government can endogenously choose a *new* policy from a range of options at any time. Once the new policy is chosen and announced, investors again learn about its impact. The approach suggests that, independent of traditional risk factors, political uncertainty directly affects the risk premium (Pástor & Veronesi, 2012). An important implication of the approach is that political uncertainty drives up not only the equity risk premium but also the volatilities and correlations of stock returns, and these effects are immense, particularly in unstable economies (such as in

case of revolution). Using the option theory, Kelly et al. (2016) reinterpret this approach in the context of an election as their empirical evidence suggests that investors are willing to pay more for option protection in light of uncertainty around election results. Furthermore, the role of political instability continues to be a major concern for developed and developing markets likewise. The 9/11 attacks, the US invasion of Iraq, the Arab Spring revolutions, Greece's potential withdrawal from the Eurozone, Britain's withdrawal from the EU (Brexit), the recent Gulf rift, and North Korea's nuclear threats are example cases of political instability that seem to have threatened large financial markets, with persistent consequences for the real economy and investment strategies. In addition, a high probability of political unrest creates ambiguity about future macroeconomic conditions, encouraging risk-averse agents to start looking around for safe-haven investment options abroad (Ahmed, 2018).

The relationship between political events and financial markets has been widely examined in literature. Gemmill (1992) and Li and Born (2006) find that political uncertainty has a significant influence on the uncertainty of the financial markets. Smales (2014) investigates the influence of political uncertainty, surrounding the Australian federal election cycle, on financial market uncertainty. Their results indicate that increasing/decreasing levels of uncertainty around the election induce higher/lower levels of market uncertainty. Bussiere and Mulder (1999) used various indicators that quantify political instability during the crisis episodes of 1994 and 1997 in order to examine its effects on economic vulnerability. Jong-A-Pin (2009) also examined the impact of different political event indicators on economic growth and finds that higher degrees of instability of the political regime lead to lower economic growth. Chen and Feng (1996) show that regime instability, political polarization and government repression all have a negative impact on economic growth. Campos and Nugent (2002), find no evidence of a causal and negative long-run relation between political instability and economic growth. They only find evidence of a short-run effect. Recently, Li (2020) examines the behaviour of some inter-related European stock markets under the uncertainty of Brexit. The study finds that the impact of the Brexit decision on market co-volatility continues to be substantial and persists and the uncertainty of Brexit has decreased UK's influence on other EU markets.

Leadership changes in less democratic regimes can also affect the growth rate, either positively or negatively (Collier & Hoeffler, 2015; Jones & Olken, 2005). Alesina and Perotti (1996) show that socio-political instability generates an uncertain politico-economic environment, raising risks and reducing investment. Perotti (1996) also finds that socio-political instability adversely affects growth and investment. Studies by Diamonte et al. (1996) and Lehkonen and Heimonen (2015) show that a reduction in political risk could lead to higher portfolio and stock returns. However, Huang et al. (2015) find a positive association between international political events and government bond yields. Addoum and Kumar (2016) find that the political climate changes affect the returns of firms and industries that are politically sensitive. Using GARCH-M models, Asteriou and Sarantidis (2016) find a negative impact of the political events on the variance of general stock market returns. Further, political unrest such as a revolution, coup attempts, government/regime changes, protests/demonstrations, strikes, and unexpected elections, can have a great influence on a country's home currency. Markets view these events as potential political instability and uncertainty, which typically weighs a greater volatility in a country's currency value. As a result, the currency exchange rate may have a rapid drop off, which can occur in a very short period of time. This is consistent with the study of Crowley and Loviscek (2002) that examines the influence of major political unrests such as assassinations, bombings, unrest, military coups and coup attempts on the currency returns in Latin America markets by using daily data for the 1990s. It finds that political unrest,

immediately following the occurrence of such events, systematically affects currency returns for up to three calendar months. Jeribi et al. (2015) demonstrate that the 2010 Tunisian revolution had a substantial impact on the return volatilities of sectorial stock indices. In a more recent study, Li et al. (2018) show that political uncertainty is a major determinant of firms' downside tail risk.

Financial theory explains that the stock prices should be influenced by exchange rates. The upward and downward exchange rate changes may influence stock prices. Equally, the exchange rate behaviour is impacted by the changes in stock prices. Domestic investors spend more in local markets when there is an increase in assets' prices that results in an increase in the demand for domestic currency and also an increase in the behaviour of selling the foreign assets. The increase in demand of domestic currency will eventually attract the foreign investors to invest and gain maximum benefit (Jorion, 1991). It is evident that the relationship between stock and foreign exchange prices stems from three main theoretical approaches, namely: asset market approach, traditional approach, and portfolio balance approach. Asset market approach suggests that there exists either no or very weak association between the foreign exchange and stock markets due to the fact that both the markets may be driven by various variables (Kirikos,1993). In the traditional approach, Dornbusch and Fischer (1980) argue that the exchange rate leads the changes in the stock market. The advocates of this approach emphasize that fluctuations in exchange rates impact on international competitiveness and trade balance of the country. The devaluation of home currency leads to a higher competitiveness of domestic companies due to the availability of cheaper exports in international trade. The increased exports increase the domestic income and results in higher stock prices. However, Branson and Henderson (1985) assert that stock prices are expected to lead exchange rates. According to this approach, an increase in domestic stock is likely to enhance the wealth of local investors. Higher demand among domestic investors enhances interest rates and consequently leads to higher foreign demand for domestic currency to buy domestic assets and this results in an appreciation of the local currency. Thus, the correlation between stock prices and exchange rates would be negative. Nevertheless, it should be noted that since a market response is simultaneous, it means that the market can be affected by all approaches and a feedback association is likely to emerge. In such scenarios, the association between stock and foreign exchange rates cannot be predicted in advance and need to be examined.

Empirically, literature provides a strong evidence on the causal relationship between stock prices and exchange rates. Literature provides mixed results in developed, developing and emerging countries in cross countries, cross regions or single country studies. In single country studies, Ibrahim (2000) employs Granger causality tests of stock prices and exchange rates in Malaysia and finds no long-run relationship between exchange rates and stock prices. However, Baharumshah et al. (2002) find that stock market significantly affects exchange rates. Kabir et al. (2014) provide evidence of a significant statistical relationship existing between Malaysian stock prices, exchange rate and foreign stock prices, with the exchange rate being the leading variable. They also find evidence of a negative impact of the Asian financial crisis on Malaysian stock prices in the short run. In India, Khursheed et al. (2014) examine whether or not foreign exchange rate does not Granger-cause stock indices and the stock index does not Granger-cause foreign exchange rate during the period 2009-2012. They find that stock market does not Granger-cause currency prices and currency prices do not Granger-cause stock market. They conclude that both variables do not have any statistically significant relationship. However, Malarvizhi and Jaya (2012) examine the relationship between the Indian Nifty stock market index and exchange rate movements during the period 2001-2011 using Granger causality analysis. It is found that there is a bi-directional causal relationship

between exchange rate and the Nifty, i.e. changes in stock market affect exchange rate and vice versa, which means that the government and policy makers should give more weightings to this bi-directional causal relationship when framing policies. Sharma and Rai (2014) investigate the causality between the Indian stock market (BSE 30) with the Indian rupee exchange rate during the period 1992–2012 using a Granger causality test. They find that there is no strong evidence that GBP/INR exchange rates are frequently affected by their historical values; hence, the GBP can be considered a less important exchange currency with respect to INR than the USD, which is more frequently affected by their own historical values. In addition, the stock market fluctuations also affect the foreign exchange rate volatilities in India, i.e. stock markets also determine foreign exchange values for the Indian rupee. In addition, the results of Wu (2000)'s study on Singapore reveals that the SG$ currency appreciation against the US$ and Malaysian ringgit and depreciation against Japanese yen and Indonesian rupiah lead to a long-run increase in stock prices in most of the selected periods in the 1990s. On the other hand, Narayan (2009) finds that the depreciation of the rupee has increased volatility, and asymmetric volatility confirms that negative shocks generate more volatility than positive shocks. Noman et al. (2012) aim to uncover the direction of causality between foreign exchange market and stock market in Bangladesh, where financial markets were still in their early development stage during the period 1983-2010. The paper employs the Granger causality tests using monthly data and finds that the overall results indicate the absence of any causality running between foreign exchange market and stock market in the full sample and in the sub-samples created around the stock market crash. Ahmadi and Emamgholi (2014) examine the relationship between stock price and currency rate fluctuations in Iran during the period 2008–2012 using utilizing an autoregression model, Johansen test, Augmented Dickey-Fuller test, forecasting error analysis of variance, effect statistic tests, and maximum likelihood estimation. The results reveal that the relationship between market currency rate and index of 50 distinguished companies in the stock market is accepted. Kofi and Kwabena (2013) empirically examine the nexus between stock prices and exchange rates in Ghana using time series models during the period 1990-2009 using Granger causality. The used tests indicate that there are long-run relationships between stock prices and exchange rates in Ghana. The empirical findings based on the Granger causality test show that there is no Granger causality between these two variables. Büyüksalvarci and Abdoglu (2010) examine the causal relationships between stock prices and macroeconomic variables in Turkey during the period 2001–2010 using techniques of the long- run Granger non-causality test. The results suggest that past stock prices significantly cause current changes in exchange rate. Olugbenga (2012) examines the long-run and short-run effects of exchange rate on stock market development in Nigeria in the 1985-2009 period using Johansen cointegration tests. The empirical results show a significant positive stock market performance to exchange rate in the short-run and a significant negative stock market performance to exchange rate in the long run. The Granger causality test shows strong evidence that the causation runs from exchange rate to stock market performance, implying that variations in the Nigerian stock market are explained by exchange rate volatility. Mitra (2017) re-examined the relationship between the real effective exchange rate and the total value of stock transactions in South Africa using the cointegration technique in the period 1979–2014. He found a significantly positive long-run relationship between the real effective exchange rate and the total value of stock transactions, which is a tool to increase foreign investment in the country. Khan et al. (2018) investigate the association between stock and exchange rate returns in Pakistan using Granger causality test. They found no causal relationship between the two series. Though the parameter stability in the exchange rate equation is detected in the short run, the study finds no traces of a long-term relationship. Further, the study does not observe parameter stability in the stock market in the short and long term. Afshan et al. (2018) investigate the relationship between stock prices and the exchange

rate in Pakistan by using wavelets approach from 1997 to 2016. The study confirms the existence of bidirectional causality between the two series in the long term.

In cross country/region studies, Abdalla and Murinde (1997) investigate interactions between exchange rates and stock prices in the emerging financial markets of India, Korea, Pakistan and the Philippines, employing a bivariate vector autoregressive model using monthly observations on the IFC stock price index and the real effective exchange rate over 1985-1994. The results show unidirectional causality from exchange rates to stock prices in all the sample countries, except the Philippines. Further, Phylaktis and Ravazzolo (2005) examine the dynamic relationship between stock prices and exchange rates in the Asia Pacific countries. This study finds that stock and foreign exchange markets are positively correlated. Liang et al. (2013) re-examine the relationships between the equity market and currency market in the ASEAN-5 using panel Granger causality and panel DOLS methodologies in the period 2008-2011. Their results indicate that there is unidirectional causality from exchange rates to stock prices for the emerging economies of the ASEAN-5. Chkili and Nguyen (2014) examine the dynamic relationship between exchange rates and stock return in the BRICS countries (Brazil, Russia, India, China and South Africa) during the period 1997–2013 using the Markov switching vector autoregressive model. The study finds that exchange rate changes do not affect stock market returns of BRICS countries, regardless of the regimes. Inversely, the impact from stock market returns on exchange rates is significant for all countries, except South Africa, and is more pronounced during periods of high volatility. In another study on BRIC countries, Ho and Huang (2015) examine the causality and the relationships between the stock indexes and exchange rates using Granger causality in the period 2002-2013. Their results support the argument that volatility can be transmitted between stock indexes and exchange rates even when the returns of these two variables are either statistically uncorrelated or exhibit no causality in means. Bashir et al. (2016) examine the dynamics of the relationship between foreign exchange markets and stock markets in the period 1991-2015 in Latin America. Their results indicate a weak positive cross correlation between exchange rate and stock price for all Latin American countries, except for Mexico, which has a strong positive cross-correlation. Using data from the economies which were affected by the Asian financial crisis in 1997, Granger et al. (2000) examine the causal relationships between stock prices and exchange rates. They find that causality runs from exchange rates to stock prices in South Korea while the opposite movement of causality found in the Philippines market. The results also indicate strong bi-directional relations for Hong Kong, Malaysia, Singapore, Thailand and Taiwan markets. No causal relation was found for Indonesia and Japan. Pan et al. (2007) examine the dynamic linkages between exchange rates and stock prices for seven East Asian countries, namely Hong Kong, Japan, Korea, Malaysia, Singapore, Taiwan and Thailand, for the period January-October 1998. They find a causal relationship from the equity market to the foreign exchange market for Hong Kong, Korea and Singapore. Nieh and Lee (2001) examine the dynamic relationship between stock prices and exchange rates in the G-7 countries. However, they did not find any significant long-run relationship between stock prices and exchange rates. In addition, this study discovers a significant short-run relationship lasting only for one day in certain G-7 countries. Caporale et al. (2014) examine the linkages between stock market prices and exchange rates in six advanced economies, namely, Canada, Japan, the Eurozone, Switzerland, the US, and the UK in the period 2007-2010. They found a unidirectional Granger causality from stock returns to exchange rate changes in the US and the UK, in the opposite direction in Canada, and bidirectional causality in the Eurozone and Switzerland. The results of the time-varying correlations also show that the dependence between the two variables has increased during the recent financial crisis. Alagidede et al. (2011) examine the causality between exchange rates and stock prices in Australia, Canada, Japan, Switzerland and the UK

during the period 1992-2005 using flow- and stock-oriented models. They find that there is no long-run relationship between the two variables using two cointegration approaches and an extended dataset, but in the short-run there is a causal link from exchange rate to stock prices in Canada, Switzerland, and UK, while a causal link from stock price to exchange rate is only found in Switzerland. In addition, in non-linear causality there is causal link from stock price to exchange rate in Japan and a weak causality from exchange rate to stock market in Switzerland. Gurgul and Lach (2012) investigate the causal relationships between stock and currency markets in Switzerland and Poland during the period 2001-2008 using linear and nonlinear Granger causality tests. The results indicate strong causal links from stock to currency markets of both economies. Do et al. (2015) assess the interrelationship between stock and FX markets at the regional level in 18 European countries by investigating the spill-over effect and volatility using high frequency by employing VAR's GIR technique in the period 2002–2009. The study finds that the realized volatility spill-over effect between stock and FX markets is bidirectional and positive in nature. This result holds irrespective of market properties for either developed or emerging markets and in crisis or non-crisis periods. Nevertheless, the realized volatility spill-over effect between stock and FX markets is stronger during the crisis period compared to the non-crisis period. At the same time, there is a bidirectional and negative effect in emerging regions in both stable and volatile periods, whereas developed regions show no evidence of the skewness spill-over effect. Moore and Wang (2014) investigate the dynamic relationship between real exchange rates and stock return differentials in relation to the US market for the developed and emerging Asian markets in Indonesia, Malaysia, South Korea, the Philippines, Singapore, Thailand, Australia, Canada, Japan and the UK during the period from the 1980s to 2006 using a two-step estimation procedure. They find a negative dynamic relationship between the relative stock prices and real exchange rates. Cenedesey et al. (2016) investigate the relationship between international equity returns and FX returns using a portfolio approach in 43 countries during the period 1983-2011. They find that exchange rate movements dramatically fail to offset differentials in country-level equity returns, i.e. stock market returns say very little about exchange rates. In her paper, Tudor (2012) investigates the Granger causality between stock prices and exchange rates movements in 13 developed and emerging markets during the period 1997-2012. She finds that the equity market and the evolution of the exchange rate are two interactive time series at the 1% significance level. Wong (2017) examines the relationships between real exchange rate returns and real stock price returns in Malaysia, the Philippines, Singapore, Korea, Japan, Germany and the UK in the period 1985-2015. He finds a negative and significant relationship between real exchange rate return and real stock price return in Malaysia, Singapore, Korea and the UK, but an insignificant relationship for the Philippines, Japan and Germany. Thus, he concludes that the exchange rate markets are important in influencing the stock markets. Narayan et al. (2013) test for a common structural break in the stock prices of the US, the UK, and Japan. They divide each country's stock price series into sub-samples and investigate whether or not the structural break had slowed down the growth of stock markets. Their main findings indicate that the structural break has slowed down the growth rate of the US, the UK and Japanese stock markets.

3. Methodology and Data

Testing causality among variables is one of the vital issues in economics. Granger causality tests can be one of the authentic tests to investigate this. As per Granger (1988), "causality really implies a correlation between the current value of one variable and the past values of others; it does not mean changes in one variable cause changes in another, causality must exist in at least one direction which indicates the presence of Granger causality". Thus, according to Granger, "It is possible to have causality running from variable X to Y, but not Y to X; from

Y to X, but not X to Y and from both Y to X and X to Y, although in this case interpretation of the relationship is difficult" (Granger, 1988). This means that if the past value of X statistically improves the prediction of Y, it can be concluded that X Granger-causes Y. Then, using an F-test it is possible to jointly test for the significance of the lags on the explanatory variables; this, in effect, tests for 'Granger causality' between these variables. The Granger causality test is very sensitive to the lag structures of underlying VAR specification. Thus, we test the sensitivity of causality results under different lag structures, together with the choice of optimal lags and to go beyond the conventional two-variable relationship by building a multiple-variable VAR model to escape a potential specification bias (Johansen, 1991; Toda and Yamamoto, 1995). We used the Granger-Causality test to examine the causality between stock market performance and the foreign exchange market. For the causality from stock market performance and foreign exchange market, the test determines whether lagged values of foreign exchange market contain information that is not already included in past values of the stock market, and vice versa. Our choice of the methodology is consistent with previous studies such as Ibrahim (2000), Tudor (2012), Khursheed et al. (2014), Malarvizhi and Jaya (2012), Noman et al. (2012), Kofi and Kwabena (2013), Olugbenga (2012), and Sharma and Rai (2014). The majority of empirical studies are based on results of a linear association between stock price performance and exchange rate movement (El-Masry, 2006). However, a small number of studies examine nonlinear association but the estimated effects are limited (see Gurgul and Lach, 2012, for justification). Therefore, for the comparison purposes, we assume a linear relationship between the study variables.

The first step in the empirical analysis is to test the unit root for variables stationarity. The test is conducted in levels as well as first differences for pre and post revaluation, via the Augmented Dickey-Fuller (ADF) test and the Phillips Perron (PP) test, based on a standard regression with constant and linear trend. If there is a stationarity between the variables, we should run a direct Granger causality test, and if there is no stationarity between the variables, we should test the cointegration between the variables. The second step in our analysis is to examine the cointegration between the variables to detect stable long-run relationships between two or more variables. Although each series may wander widely and possess differing short-run dynamics, some linear combination of the series may be stationary so that they are bound in a long equilibrium relationship, taking into consideration the necessary conditions of Engle and Granger (1991) for the cointegration test is that "all the variables should be integrated at the same order or contain a deterministic trend". If there is a cointegration between the variables, we should run the vector error-correction model (VECM), and if there is no cointegration in the long run between the variables, we can still check the presence of Granger causality between the variables by estimate using a VAR to discern dynamic causal interactions among the variables in the system instead. The third step is to run vector autoregression estimates, but we should note that the test is very sensitive to the number of lags included in the regression. The Akaike Information Criterion (AIC) is the most common criterion employed in previous literature to find the optimal length of lags for the vector autoregression model (VAR). It should be taken into consideration that the VAR process is not able to specify which variable is exogenous and which one is endogenous. Hence, Granger causality tests are employed. Finally, we run the Granger causality to test whether the variable Granger-causes the other variable and if the inclusion of one variable improves the forecast of the other variable and vice versa. If both variables Granger-cause each other, a feedback relationship is given.

Following all of the above, this study follows these steps to examine the causality relationship between exchange rate and stock market performance using a time-series data-based model as it provides a powerful test to investigate the causality in varied types of situations and to test

whether exchange rate Granger-cause stock market development and vice versa. The following model is tested.

$$X_t = A_0 + \sum_{i=1}^{p} A_i X_{t-i} + e_t X_t = A_0 + \sum_{i=1}^{p} A_i X_{t-i} + e_t$$

…… (1)

A0 is a 4 × 1 vector of constant terms, Ai is a 4 × 4 matrix of coefficients, et is a 4 × 1 vector of error terms,
p is the optimal lag order set to render the error terms serially uncorrelated.

Thus, the following vector auto regression model for exchange rate and stock market performance is estimated as follows:

$$\Delta Ex_t = a + \sum_{i=1}^{p1} \beta_i \Delta Egx30_{t-1} + \sum_{i=1}^{p2} \emptyset_i \Delta Ex_{t-1} + e_t$$

$$\Delta Ex_t = a + \sum_{i=1}^{p1} \beta_i \Delta Egx30_{t-1} + \sum_{i=1}^{p2} \emptyset_i \Delta Ex_{t-1} + e_t$$ ……..(2)

Δ is the first-difference level
Egx30 is the stock market index
Ex is the exchange rate

To test the causality relationship between exchange rate and stock market performance for the period from 07/09/2009 to 01/09/2016, stock market indexes and stock market capitalization are used as proxies for the stock market performance, whereby the EG pound to US$ exchange rate is used. All data analysed in this paper are taken from the Egyptian Exchange (EE) except daily exchange rates are obtained from Thomson Reuters Eikon (Datastream). In this paper, the daily basis data is used rather than monthly or annual data to enable good and effective observation changes in exchange rate and stock market performance over time. We employ the main indexes of the Egyptian stock market: EGX30, EGX20, EGX100, EGX70 and market capitalization (CAP) to measure the stock market performance. We examine the causality relationship between exchange rate and each stock market index separately. The Egyptian Exchange (EE), as an important component of the Egyptian economy, is likely to continue to act as a useful platform for both corporates and SMEs wishing to raise capital. The ability of the EE to attract new listings and investors is linked to the wider question of Egypt's macroeconomic performance. Despite the economic, social and political difficulties facing the country since 2011, the Egyptian Exchange was one of the best-performing markets in the world in local currency terms in 2017 (Tsymbaluk, 2018). The Egyptian stock market or Egyptian Exchange (EE) has several indexes that track its performance: EGX20, EGX30, EGX70, and EGX100. EGX20 is a weighted index of the 20 most highly capitalized and liquid stocks in the market. EGX30 index, previously known as CASE30, is the most popular benchmark free-float capitalization weighted index of the 30 most highly capitalized and liquid stocks traded on the Egyptian Exchange. The index was developed in 1998 with a base level of 1000. EGX70 is a weighted index of the 70 most highly capitalized and liquid stocks in the market. EGX100 is a weighted index of the 100 most highly capitalized and liquid stocks in the market. Stock market development has more dimensions than market capitalization as it is considered a better and less arbitrary proxy than a composite index. However, Demirguç-Kunt and Levine (1996) have found that individual indexes are highly correlated with stock market capitalization. As a large degree of public ownership in Egypt could bias stock market capitalization to not fully represent the true degree of stock market development, market indexes are also used to measure stock market performance (see Demirguç-Kunt & Maksimovic, 1998; Levine & Zervos, 1998; Garcia & Liu, 1999; Bekaert et al. 2001; Billmeier & Massa, 2007; Li, 2007; and Pan & Mishra, 2018). Therefore, this study uses the main indexes

i.e. EGX20; EGX30; EGX70; and EGX100 indexes and market capitalisation as proxies for stock market performance.

4. Empirical Results

The descriptive statistics relevant to the entirety of market indexes, capitalization and exchange rate are depicted in Table (2). Plots of the study variables pre-and post- revolution are shown in Figure (1). As can be noticed, the entirety of market indexes' and market capitalization mean has proved to be positive during the pre-revolution period. All of the market indexes' and capitalization mean seem to have witnessed a noticeable decline in post-revolution period compared to the pre-revolution period. In addition, the mean of exchange rates indicates a higher mean during the pre-revolution period than this in the post-revolution period. In addition, the Skewness values highlight well that marginal distributions are asymmetrical to the right, in which case the values are positive, or to the left, where they appear to be negative. The Kurtosis values, relevant to all indices, are around 2. The Jarque Bera values prove that the distributions are not normal, especially in the post revolution period.

Table (2) and Figure (1): are about here

In Table 3, the results clearly show that the null hypothesis of non-stationarity is confirmed at the 5% significance level, which reflects that the all variables are non-stationary at their level; however, they are stationary in their first difference at the 5% significance level. Since the series are stationary in their first difference, the automatic Akaike Information Criterion (AIC) is employed to find the optimal length of lags.

Table (3): is about here

In Table 4, as the prob. values are more than 5% and the statistic value is smaller than the critical values in both the Trace and Maximum Eigenvalue tests', we cannot reject the null hypothesis, which means that the variables are not cointegrated in the long-run. Nevertheless, we still can check for the presence of Granger causality between the variables by estimating the VAR to discern dynamic causal interactions among the variables in the equation.

Table (4): is about here

Table 5 represents the VAR estimations for the pre-revolution and post revolution periods. In the pre-revolution period, the table shows that EGX30 is statistically affected by the first lag periods of EGX30. On the other hand, the second lag period of EGX30 and the first lag periods of EX have a statistical effect on EX. The first lag period of EGX20 and the second lag period of EX have a statistical effect on EGX20 while the first and second lag periods of EGX20 and the first periods of EX have a statistical effect on EX. EGX100 is statistically affected by the first lag period of EGX100. In addition, the first and the second lag periods of EX are statistically affected by the first and second lag periods of EGX100 and the first lag period of EX. With regards to EGX70, Table 5 shows that it is statistically affected by the first and the second lag periods of EGX70 as well as the first and the second lag periods of EX. On the other hand, EX is statistically affected by the first and second lag periods of EGX100 and the first lag period of EX. CAP is statistically affected by the first lag period of CAP. It is also statistically affected by the first and the second lag periods of EX. On the other hand, EX is

statistically affected by the first and second lag periods of EGX100 and the first lag period of EX.

With regards to the post-revolution period, Table 5 indicates that EGX30 is statistically affected by the first and the second lag periods of EGX30 while EX is statistically affected by the first and the second lag periods of EX. It can also be seen from the same table that EGX20 is statistically affected by the first and the second lag periods of EGX20 while EX is statistically affected by the first and the second lag periods of EX. The same table also shows that EGX100 is statistically affected by the first and the second lag periods of EGX100 while EX is statistically affected by the first and the second lag periods of EX. A close inspection also shows that the first and the second lag periods of EGX70 have a statistical effect on EGX70 while the first and the second lag periods of EX have a statistical effect on EX. From Table 5, it can also be concluded that CAP is statistically affected by the first and the second lag periods of CAP while EX is statistically affected by the first and the second lag periods of EX.

Table (5): is about here

Table 6 shows the causal relationship between index and exchange rate in the pre and post revolution periods. In pre-revolution period we did not find a causal relationship between EX and EGX30, but a significant causal relationship at the 10% level between EGX30 and EX was found. In addition, there is a significant causal relationship at 10% between EX and EGX20 and a significant causal relationship at 10% between EGX20 and EX. Further, there is a significant causal relationship at 10% between EX and EGX100 and a significant causal relationship at 1% between EGX100 and EX. Likewise, there is a significant causal relationship at 10% between EX and EGX70 and a significant causal relationship at 1% between EGX70 and EX. Besides, there is a significant causal relationship at 5% between EX and CAP and a significant causal relationship at 1% between the CAP and EX. As shown in Table 4, with regard to the post-revolution period, we did not find a significant causal relationship between EX and EGX30 and there is no significant causal relationship between EGX30 and EX even at 10%. There is also, a significant causal relationship between EX and EGX20 at 10% but there is no significant causal relationship between EGX20 and EX even at 10%. In addition, there is no significant causal relationship between EX and EGX100 and there is no significant causal relationship between EGX100 and EX even at 10%. Moreover, there is no significant causal relationship between EX and EGX70 and there is no significant causal relationship between EGX70 and EX even at 10%. Furthermore, there is no significant causal relationship between EX and CAP and there is no significant causal relationship between CAP and EX even at 10%.

Table (6): is about here

Table 7 demonstrates identical results with the VAR Granger causality test as presented in Table 4. This means that there is a unidirectional causal relationship between stock market index (EGX100) and EX and bidirectional causal relationship between EX and stock market capitalization (CAP) in the pre-revolution period. Moreover, there is no causal relationship between EX and stock market performance in the post-revolution period.

Table (7): is about here

It is worth noting that our results are consistent with previous studies. In fact, our results reveal that before the January 25th revolution, there were two types of causality relationship. The first one is a bi-directional causality between market capitalization (CAP) and foreign exchange

market (EX). This fact confirms the results of Pan et al. (2007), Malarvizhi and Jaya (2012), Kumar (2013), Caporale et al. (2014), Do et al. (2015) and Bashir, et al. (2016). Malarvizhi and Jaya (2012) find that there is a bi-directional causal relationship between the exchange rate and the Nifty; i.e. changes in stock market affect the exchange rate. Granger et al. (2000) find a strong bi-directional relationship for Hong Kong, Malaysia, Singapore, Thailand, and Taiwan markets. Do et al. (2015) find that the realized volatility spill-over effect between stock and FX markets is bidirectional and positive in 18 European countries. This result means that the government and policy makers should give more weightings to this bi-directional causal relationship when framing policies. The second type is the unidirectional causality between the foreign exchange market (EX) and stock market performance and this result is supported by El-Masry (2006) and Ahmadi and Emamgholi (2014). Abdalla and Murinde (1997) show unidirectional causality from exchange rates to stock prices in all the sample countries (emerging financial markets of India, Korea, Pakistan, and the Philippines), except the Philippines. Liang et al. (2013) indicate that there is unidirectional causality from exchange rates to stock prices for the emerging economies of the ASEAN-5. Caporale et al. (2014) found a unidirectional Granger causality from stock returns to exchange rate changes in the US and the UK. In the opposite direction in Canada, and bidirectional causality in the Eurozone and Switzerland. In addition, the results indicate that in the post January 25th revolution period, there is no causal relationship between stock market indexes and the exchange rate. This is consistent with many studies e.g. Olugbenga (2012), Kofi and Kwabena (2013), Moore and Wang (2014), Kabir et al. (2014) and Ho and Huang (2015). Ibrahim (2000) finds no long-run relationship between exchange rates and stock prices. Noman et al. (2012) find no causality between the foreign exchange market and the stock market. Kofi and Kwabena (2013) find no Granger causality between the stock prices and the exchange rates in Ghana. Khan et al. (2018) claim no causal relationship between stock and exchange rate returns in Pakistan. Khursheed et al. (2014) find that the stock market does not Granger-cause the currency prices and currency prices do not Granger-cause the stock market in India. Chkili and Nguyen (2014) find that exchange rate changes do not affect stock market returns of BRICS countries, regardless of the regimes. Granger et al. (2000) find no causal relation for Indonesia and Japan. Nieh and Lee (2001) did not find any significant long-run relationship between stock prices and exchange rates in G-7 countries. Alagidede et al. (2011) find that there is no long-run relationship between exchange rates and stock prices in the long term. Cenedesey et al. (2016) find that stock market returns say very little about exchange rates in 43 countries. Moreover, the results also show a negative unidirectional causal relationship between the exchange rate and stock market indexes. This result is supported by the findings of Liang et al. (2013), Caporale et al. (2014), Boako and Alagidede (2017), and Wong (2017). Moore and Wang (2014) find a negative dynamic relationship between stock prices and real exchange rates in developed and emerging Asian markets. Wong (2017) finds a negative and significant relationship between real exchange rate return and real stock price return in Malaysia, Singapore, Korea and the UK, but an insignificant relationship for the Philippines, Japan, and Germany.

To check the robustness of our findings, and following Bai et al. (1998), we model structural breaks for the data in the whole period (2009-2016). To test for a break, Bai et al. (1998) use two tests: the maximum Wald statistic and the logarithm of exponential Wald statistic. The identified break point numbers and time periods are indicated in Table 8 and Figure (2). They show the breaks detected by Bai-Perron tests and are significant at the 0.05 level. In this study, Bai-Perron tests of L+1 vs. L sequentially determined-breaks have detected four structural breaks in EGX30 and EGX100 series. However, the methods detected three structural breaks in EGX20, EGX70, CAP and EX series. All details of these breaks are shown in Table (8).

Narayan et al. (2013) suggest that the structural breaks slow down the growth rates of the US, the UK, and Japanese equity markets.

Table (8) and Figure (2) are about here

5. Conclusion

Increasing the importance of indirect foreign investment in stock markets has attracted researchers to study the relationship between foreign exchange rate and stock market performance. The paper attempts to examine the existence of a causal relationship between two important financial markets, namely, foreign exchange market and stock market performance over the period from 07/09/2009 to 01/09/2016 on a daily basis. Time series data are used to examine the unit root, cointegration and vector autoregressions among the variables in the short and long run and detect their dynamic causal interactions. The study was divided into two sub-periods, the first period, pre-January 25th revolution period, covers the period from 07/09/2009 to 21/01/2011, and the second period, post January 25th period, covers the period from 23/03/2011 to 01/09/2016. The empirical results show that the variables' data are not stationary at their level but stationary at their first difference level and there is no cointegration in the long run between the variables in both sub-periods. Therefore, we run the vector autoregression estimates and employ the VAR Granger causality tests. These analyses indicate there is a causal relationship from exchange rate to most stock market indexes direction at 10% level. The most interesting element in the relationship between EG£/US$ exchange rate and stock market performance is the presence of both traditional and portfolio balance approaches during the pre-revolution sub-period in Egypt. This is consistent with previous studies such as Kabir et al. (2014) who find that the exchange rate is being the leading variable. In addition, we find a significant causal relationship from most stock market indexes to exchange rate direction at 1% level. Further, there is a significant causal relationship from exchange rate to market capitalization (CAP) direction at 5% and a significant causal relationship from market capitalization (CAP) to exchange rate direction at 1% in the pre-revolution period. In the post-revolution period we did not find a significant causal relationship between exchange rate and most stock market indexes' direction and stock market capitalization' direction; however, there is a significant causal relationship from most stock market indexes' direction to stock market capitalization and exchange rate direction at 10%. Further, in the post-revolution period, the results do not indicate a causal relationship between exchange rate and stock market performance. The results of this study are in line with literature. Baharumshah et al. (2002) find that stock market significantly affects exchange rates. Tudor (2012) finds that the equity market and the evolution of the exchange rate are two interactive time series. Büyüksalvarci and Abdoglu (2010) suggest that past stock prices significantly cause current changes in exchange rate. Sharma and Rai (2014) find that stock markets impact on foreign markets in India. Pan et al. (2007) find a causal relationship from the equity market to the foreign exchange market for Hong Kong, Korea, and Singapore. Alagidede et al. (2011) find a causal link from stock price to exchange rate in Switzerland. Kabir et al. (2014) provide evidence of a significant statistical relationship existing between Malaysian stock prices and exchange rate. Mitra (2017) finds a significantly positive long-run relationship between the real effective exchange rate and the total value of stock transactions. Phylaktis and Ravazzolo (2005) find that stock and foreign exchange markets are positively correlated in Asia Pacific countries. Bashir et al. (2016), in Latin America, indicate a weak positive cross correlation between the exchange rate and the stock price for all Latin American countries, except for Mexico, which has a strong positive cross-correlation. In conclusion, the results of this study suggest that during the whole period,

the exchange rate and the stock market performance are exhibiting a causal relationship between both variables leading and lagging simultaneously in the market and this is clearly present in pre-revolution period therefore, we can accept the evidence of the presence of both traditional and portfolio balance approaches in the Egyptian economy. This implies that the exchange rate leads the stock market and the stock market leads the exchange rate. However, this relationship either does not exist or is very weak in the post revolution period. This result suggests the presence of asset market approach in the Egyptian economy which confirms that both stock and foreign exchange markets were driven by different factors in the post-revolution period.

The results of this study have important managerial and practical implications. The existence of long-run bi-directional causality means that portfolio managers and hedgers may have improved their understanding regarding the dynamic relationship between foreign exchange market and stock market performance as this may help them to plan and implement suitable hedging strategies to guard against currency risk in future crises or events. The existence of strong causal links from stock to currency markets seems to have a practical application for investors; helping to hedge their portfolios against currency shocks (Gurgul & Lach, 2012). Investors, fund and portfolio managers and policymakers should give much attention to these event-specific interactions when they make capital budgeting decisions and implement regulation policies. In addition, our results are also important for policymakers from a financial point of view, providing both government and state bank insights into volatility spill-overs and risk transmission between the foreign exchange market and the stock market. Furthermore, our results may allow portfolio managers, investors and policymakers to assess the importance of informational efficiency for both markets. In addition, our results are of particular interest to researchers and scholars concerned about the impact of political uncertainty on financial markets. Besides, our results are of great significance to regulators and international investors who wish to invest in those markets. Therefore, it is crucial for the governments to restore business confidence in order to promote the country's financial stability and economic growth. This study can be extended in future with the nexus of other financial, economic or social variables: interest rate, gross domestic product, money supply, inflation rate, economic growth, and oil prices that can be reasonable on theoretical aspects in an economic framework. As this study focuses on the causal relationship between foreign exchange and stock markets before and after the 25th January Revolution, other macroeconomic variables such as consumer price index, interest rate, GDP etc. were excluded for the comparison purposes with other studies. This study can be extended in future with the nexus of other financial, economic or social variables: interest rate, gross domestic product, money supply, inflation rate, economic growth, and oil prices that can be reasonable on theoretical aspects in an economic framework. Further, it would be interesting to see more studies employing cross-country analysis to include countries that have similar political backgrounds or that faced similar political events. In addition, since a number of studies have documented the impact of other political events (e.g. elections, wars, terrorist attacks etc.) on financial markets behaviour, a comparative analysis of the markets' reaction to different political events would also be an interesting area for future research. Furthermore, an event-based study concerning with the effect of other political events (e.g. elections, military coups and terrorist attacks) on the stock market performance and reaction, as well as the effect of political instability on economic growth and foreign exchange market may constitute an interesting idea for future research. Finally, the study of dependence between the different sectorial indexes throughout the political instability and unrest period may also make an interesting theme for a future study.

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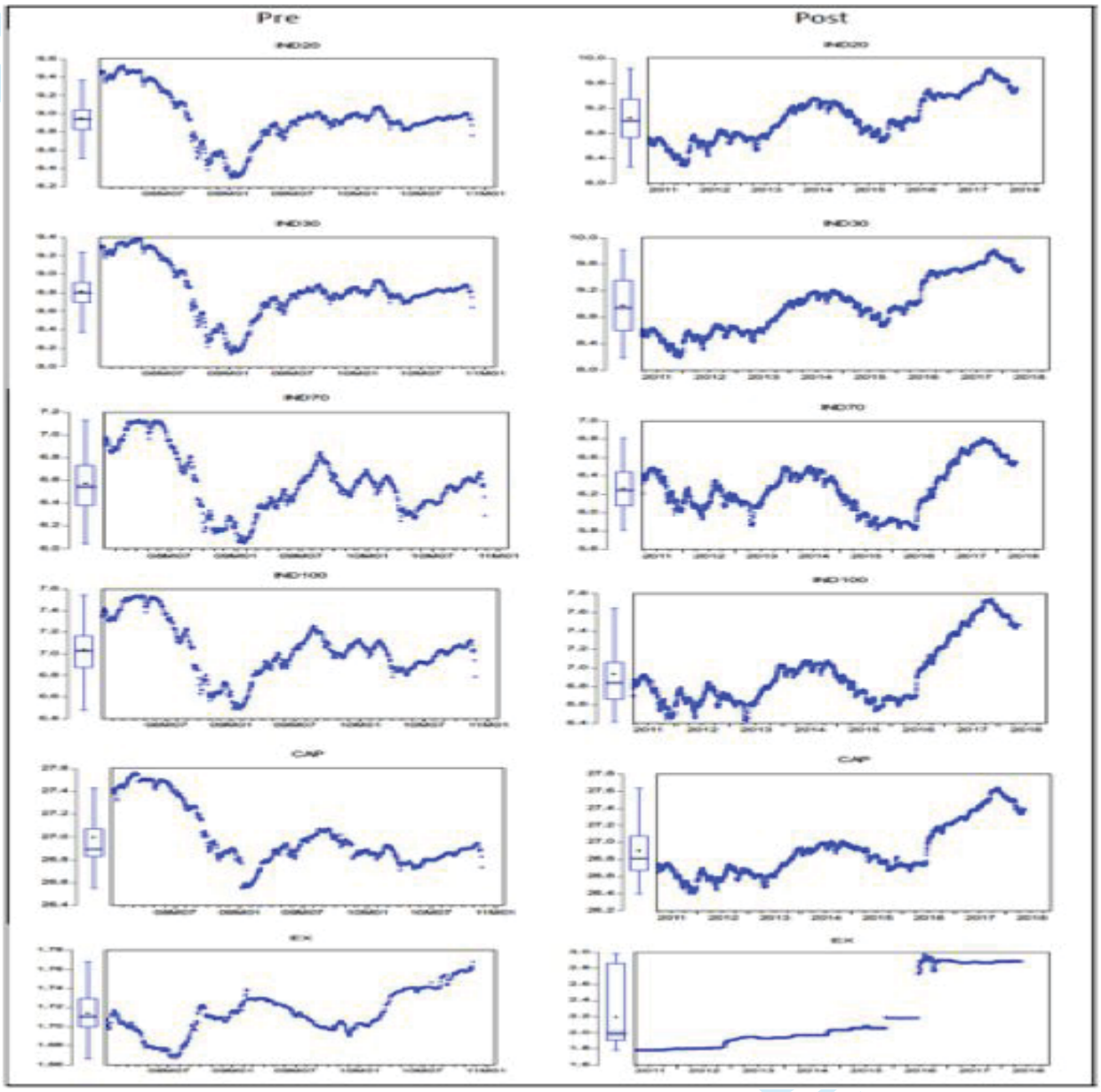
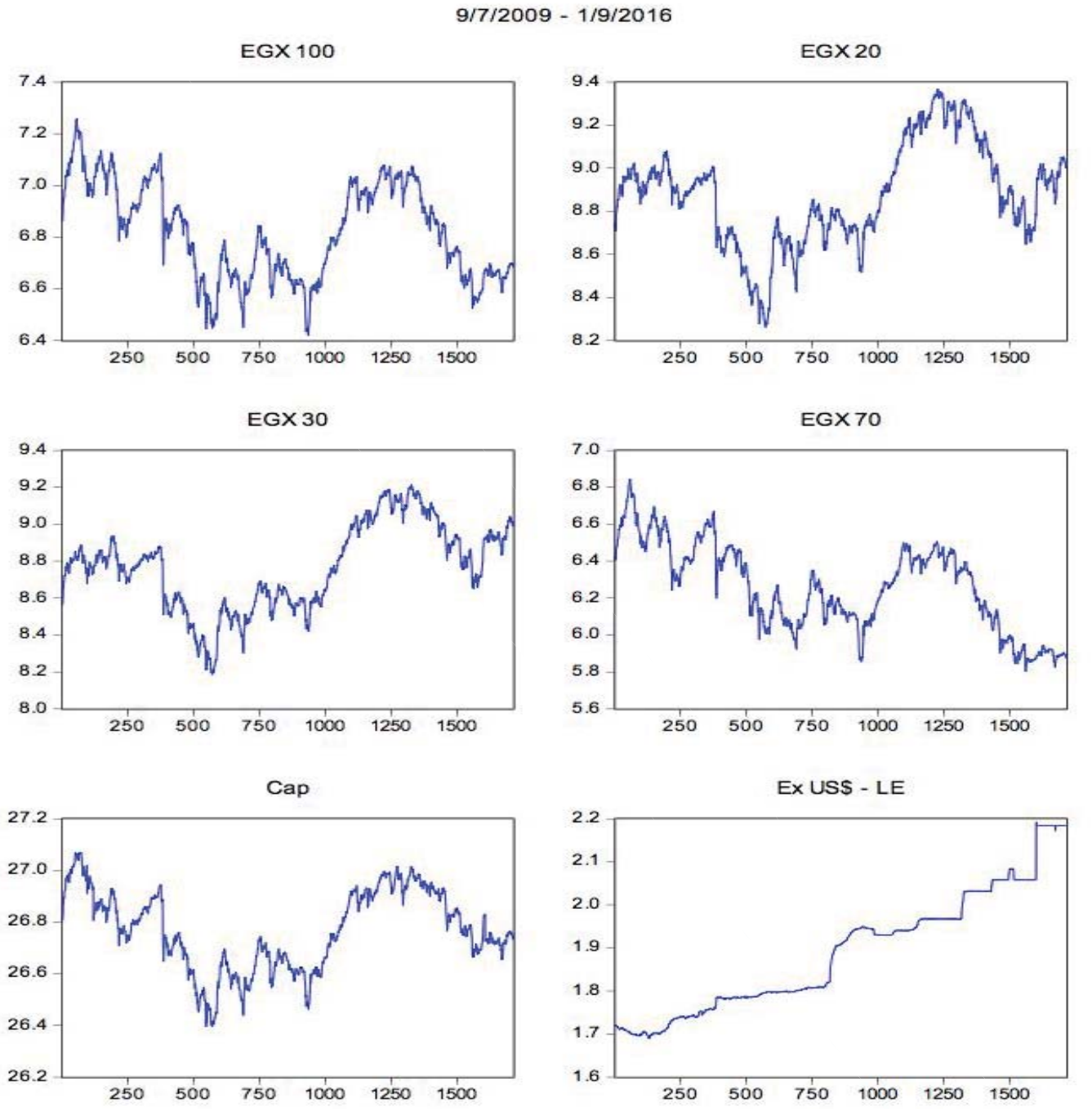
FIGURES

Figure (1): Plots of the study variables pre-and post- revolution



Notes: This graph shows plots of the study variables pre-and post- revolution

Figure (2): Plots of the study variables (the whole period)



Note: This graph plots the breaks in the study variables (the whole period)

TABLES

Table (1): Economic Indicators in Egypt over the period 2008-2017

Indicators (US$)	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Population growth (annual %)	1.77	1.85	1.97	2.11	2.21	2.25	2.21	2.12	2.02	1.93
GDP growth (annual %)	7.16	4.67	5.15	1.78	2.22	2.19	2.92	4.37	4.35	4.18
GDP per capita growth (annual %)	5.28	2.76	3.09	-0.34	-0.01	-0.08	0.67	2.18	2.26	2.19
Unemployment, % of total labour force)	8.52	9.09	11.85	11.85	12.60	13.15	13.10	13.05	12.41	12.08
Inflation, consumer prices (annual %)	18.32	11.76	11.27	10.05	7.12	9.42	10.15	10.36	13.81	29.50
Real interest rate (%)	0.11	0.71	0.82	-0.55	-6.27	3.29	0.41	1.54	6.92	-3.87
Imports of goods and services*	25.02	24.81	24.79	24.86	24.97	24.97	24.97	24.98	24.96	25.38
Exports of goods and services*	24.75	24.60	24.57	24.57	24.55	24.59	24.48	24.47	24.31	24.93
External debt stocks, total*	24.25	24.29	24.33	24.29	24.41	24.56	24.46	24.60	24.93	25.14
Foreign direct investment, net inflows*	22.97	22.63	22.58	.	21.75	22.16	22.25	22.66	22.82	22.72
Foreign direct investment, net outflows*	21.38	20.16	20.88	20.25	19.17	19.52	19.35	19.02	19.15	19.11
International tourism, number of arrivals*	16.32	16.29	16.46	16.07	16.23	16.03	16.08	16.03	15.48	15.86

Notes: Foreign direct investment, net inflows were negative US$482700000 in 2011 (Revolution year). *Natural logarithm (LN) was employed. Data are obtained from the World Bank (https://data.worldbank.org/country/egypt-arab-rep)

Table (2): Descriptive statistics

Panel A: Pre-Revolution, Obs.=359						
	EX	EGX20	EGX30	EGX70	EGX100	CAP
Mean	1.720	8.933	8.794	6.534	7.015	26.882
Median	1.713	8.941	8.802	6.545	7.025	26.861
Maximum	1.758	9.079	8.936	6.847	7.260	27.071
Minimum	1.690	8.706	8.562	6.241	6.784	26.707
Std. Dev.	0.020	0.060	0.058	0.128	0.102	0.090
Skewness	0.303	-0.366	-0.468	-0.039	-0.023	0.377
Kurtosis	1.590	3.984	4.544	2.654	2.562	2.299
Jarque-Bera	35.137	22.428	48.630	1.874	2.888	15.822
Probability	0.000	0.000	0.000	0.392	0.236	0.000
Sum	615.918	3197.916	3148.223	2339.032	2511.451	9623.777
Sum Sq. Dev.	0.139	1.288	1.199	5.870	3.710	2.904
Panel B: Post Revolution, Obs.= 1334						
	EX	EGX20	EGX30	EGX70	EGX100	CAP
Mean	1.939	8.862	8.759	6.177	6.763	26.737
Median	1.942	8.807	8.728	6.163	6.732	26.722
Maximum	2.192	9.368	9.215	6.507	7.081	27.016
Minimum	1.781	8.261	8.185	5.803	6.419	26.395
Std. Dev.	0.122	0.262	0.259	0.193	0.162	0.152
Skewness	0.351	0.105	-0.018	-0.032	0.297	0.046
Kurtosis	2.261	2.218	1.877	1.830	2.039	2.061
Jarque-Bera	57.715	36.372	70.047	76.194	70.840	49.353
Probability	0.000	0.000	0.000	0.000	0.000	0.000
Sum	2580.439	11795.300	11658.660	8221.338	9001.644	35587.030
Sum Sq. Dev.	19.638	91.626	89.417	49.355	34.995	30.929

Notes: Descriptive statistics of the study variables pre and post revolution

Table (3): ADF Unit Root and PP Unit Root Tests

ADF Unit Root Tests	Level				First Difference			
	pre		post		pre		post	
	ADF	Prob.*	ADF	Prob.*	ADF	Prob.*	ADF	Prob.*
EGX30	-2.605089	0.2783	-1.702854	0.7495	-18.28440	0.0000	-14.36585	0.0000
EGX20	-2.446065	0.3551	-1.848531	0.6801	-18.31338	0.0000	-11.53553	0.0000
EGX100	-1.542747	0.8131	-1.784504	0.7117	-17.17598	0.0000	-11.00276	0.0000
EGX70	-1.465089	0.8397	-1.783583	0.7122	-16.18259	0.0000	-11.14774	0.0000
CAP	-1.687596	0.7550	-2.101661	0.5436	-12.60181	0.0000	-15.26856	0.0000
EX	-2.678358	0.2463	-2.059430	0.5672	-6.661675	0.0000	-4.683712	0.0008
PP Unit Root Tests	Level				First Difference			
	pre		post		pre		post	
	PP	Prob.*	PP	Prob.*	PP	Prob.*	PP	Prob.*
EGX30	-2.660178	0.2540	-1.332858	0.8789	-18.27566	0.0000	-26.52147	0.0000
EGX20	-2.495365	0.3303	-1.489363	0.8329	-18.30460	0.0000	-25.36232	0.0000
EGX100	-1.699280	0.7499	-1.473965	0.8379	-17.39855	0.0000	-26.34917	0.0000
EGX70	-1.648802	0.7716	-1.604362	0.7909	-16.57970	0.0000	-26.44212	0.0000
CAP	-1.545008	0.8123	-1.599909	0.7927	-19.54033	0.0000	-26.55892	0.0000
EX	-5.467048	0.0000	-2.477157	0.3395	-23.40562	0.0000	-44.37706	0.0000

Note: the test equations include both drift and trend terms. The lag order in the ADF test equation is based on AIC.
* and ** denote significance at 1% and 5% respectively

Table (4): Unrestricted Cointegration Rank Test

	Pre-Revolution: 9/7/2009 1/21/2011					
Pre		**Hypothesized No. of CE(s)**	**Eigenvalue**	**Statistic**	**Critical Value 5%**	**Prob.****
EGX30	Trace	None	0.028544	17.41747	25.87211	0.3844
		At most 1	0.019768	7.108042	12.51798	0.3334
	Maximum Eigenvalue	None	0.028544	10.30943	19.38704	0.5858
		At most 1	0.019768	7.108042	12.51798	0.3334
EGX20	Trace	None	0.028843	17.02824	25.87211	0.4129
		At most 1	0.018394	6.609238	12.51798	0.3870
	Maximum Eigenvalue	None	0.028843	10.41900	19.38704	0.5741
		At most 1	0.018394	6.609238	12.51798	0.3870
EGX100	Trace	None	0.025285	12.81321	25.87211	0.7526
		At most 1	0.010328	3.696047	12.51798	0.7855
	Maximum Eigenvalue	None	0.025285	9.117168	19.38704	0.7123
		At most 1	0.010328	3.696047	12.51798	0.7855
EGX70	Trace	None	0.025749	13.07961	25.87211	0.7320
		At most 1	0.010598	3.792975	12.51798	0.7719
	Maximum Eigenvalue	None	0.025749	9.286638	19.38704	0.6947
		At most 1	0.010598	3.792975	12.51798	0.7719
CAP	Trace	None	0.021994	11.63403	25.87211	0.8366
		At most 1	0.010386	3.716896	12.51798	0.7826
	Maximum Eigenvalue	None	0.021994	7.917139	19.38704	0.8288
		At most 1	0.010386	3.716896	12.51798	0.7826
	Post-Revolution: 3/23/2011 to 9/1/2016					
Post		**Hypothesized No. of CE(s)**	**Eigenvalue**	**Statistic**	**Critical Value 5%**	**Prob.****
EGX30	Trace	None	0.011377	11.07753	25.87211	0.8708
		At most 1	0.000949	0.848533	12.51798	0.9997
	Maximum Eigenvalue	None	0.011377	10.22900	19.38704	0.5943
		At most 1	0.000949	0.848533	12.51798	0.9997
EGX20	Trace	None	0.011427	11.12915	25.87211	0.8678
		At most 1	0.000955	0.854170	12.51798	0.9997
	Maximum Eigenvalue	None	0.011427	10.27498	19.38704	0.5895
		At most 1	0.000955	0.854170	12.51798	0.9997
EGX100	Trace	None	0.009130	9.263326	25.87211	0.9525
		At most 1	0.001189	1.063934	12.51798	0.9986
	Maximum Eigenvalue	None	0.009130	8.199392	19.38704	0.8033
		At most 1	0.001189	1.063934	12.51798	0.9986
EGX70	Trace	None	0.007630	8.126091	25.87211	0.9802
		At most 1	0.001429	1.278885	12.51798	0.9960
	Maximum Eigenvalue	None	0.007630	6.847206	19.38704	0.9109
		At most 1	0.001429	1.278885	12.51798	0.9960
CAP	Trace	None	0.011353	11.24147	25.87211	0.8611
		At most 1	0.001156	1.034267	12.51798	0.9988
	Maximum Eigenvalue	None	0.011353	10.20721	19.38704	0.5967
		At most 1	0.001156	1.034267	12.51798	0.9988

Note: the lag order in the test system is set to 4, which is sufficient to render the error terms uncorrelated

Table (5): Vector Autoregression Estimates

Panel A: Pre-Revolution: 07/09/2009 to 21/01/2011															
Included observations: 359 after adjustments															
EGX30			EGX20			EGX100			EGX70			CAP			
pre	EGX30	EX		EGX20	EX		EGX100	EX		EGX70	EX		CAP	EX	
EGX30 (-1)	1.001156 (0.0000)	-3.52E-05 (0.0583)	EGX20 (-1)	1.001088 (0.0000)	-3.53E-05 (0.0172)	EGX100 (-1)	1.087781 (0.0000)	-0.000281 (0.0032)	EGX70 (-1)	1.149304 (0.0000)	-0.000433 (0.0014)	CAP (-1)	0.948272 (0.0000)	-5.89E-13 (0.0095)	
EGX30 (-2)	-0.040528 (0.4452)	3.45E-05 (0.0353)	EGX20 (-2)	-0.038591 (0.4671)	3.29E-05 (0.0262)	EGX100 (-2)	-0.099127 (0.0605)	0.000264 (0.0058)	EGX70 (-2)	-0.158550 (0.0026)	0.000412 (0.0024)	CAP (-2)	0.036521 (0.4931)	5.24E-13 (0.0212)	
EX (-1)	332.2521 (0.0583)	0.959676 (0.0000)	EX (-1)	349.4647 (0.0713)	0.959293 (0.0000)	EX (-1)	65.92404 (0.0260)	0.942865 (0.0000)	EX (-1)	48.44287 (0.0194)	0.938473 (0.0000)	EX (-1)	3.18E+10 (0.0126)	0.958260 (0.0000)	
EX (-2)	-353.0427 (0.0449)	0.014341 (0.7912)	EX (-2)	-396.8026 (0.0412)	0.012913 (0.8113)	EX (-2)	-64.99076 (0.0284)	0.027041 (0.6134)	EX (-2)	-46.78777 (0.0241)	0.032318 (0.5455)	EX (-2)	-3.18E+10 (0.0123)	0.008127 (0.8508)	
C	378.1265 (0.1188)	0.149781 (0.0451)	C	549.7682 (0.0620)	0.173110 (0.0350)	C	7.159407 (0.8727)	0.187201 (0.0208)	C	-3.066953 (0.9197)	0.177817 (0.0239)	C	7.05E+09 (0.7225)	0.218003 (0.0100)	
Panel B: Post-Revolution: 23/03/2011 to 01/09/2016															
Included observations: 1334 after adjustments															
EGX30			EGX20			EGX100			EGX70			CAP			
post	EGX30	EX		EGX20	EX		EGX100	EX		EGX70	EX		CAP	EX	
EGX30 (-1)	1.133092 (0.0000)	1.99E-05 (0.2028)	EGX20 (-1)	1.182214 (0.0000)	1.99E-05 (0.1219)	EGX100 (-1)	1.152848 (0.0000)	1.16E-05 (0.9148)	EGX70 (-1)	1.143697 (0.0000)	-5.54E-05 (0.7274)	CAP (-1)	1.133554 (0.0000)	1.91E-13 (0.5268)	
EGX30 (-2)	-0.134185 (0.0001)	-1.87E-05 (0.2339)	EGX20 (-2)	-0.183379 (0.0000)	-1.89E-05 (0.1430)	EGX100 (-2)	-0.156316 (0.0000)	-1.17E-05 (0.9143)	EGX70 (-2)	-0.148259 (0.0000)	5.10E-05 (0.7489)	CAP (-2)	-0.136766 (0.0000)	-1.76E-13 (0.5610)	
EX (-1)	-107.7557 (0.1304)	0.866036 (0.0000)	EX (-1)	-148.6750 (0.0835)	0.864962 (0.0000)	EX (-1)	-13.48473 (0.1908)	0.871439 (0.0000)	EX (-1)	-6.571389 (0.3474)	0.872927 (0.0000)	EX (-1)	-4.74E+09 (0.1973)	0.869241 (0.0000)	
EX (-2)	117.7554 (0.0985)	0.128987 (0.0001)	EX (-2)	160.9396 (0.0611)	0.129852 (0.0001)	EX (-2)	14.73545 (0.1531)	0.126355 (0.0002)	EX (-2)	7.183876 (0.3045)	0.125022 (0.0002)	EX (-2)	5.29E+09 (0.1501)	0.127434 (0.0001)	
C	-53.53520 (0.2119)	0.026302 (0.1916)	C	-65.68875 (0.2194)	0.028125 (0.1768)	C	-4.721665 (0.3785)	0.015760 (0.3654)	C	-1.436676 (0.7047)	0.016978 (0.3491)	C	-2.17E+09 (0.2561)	0.016945 (0.3295)	

Notes: Prob. in ( )

Table (6): VAR Granger Causality/Block Exogeneity Wald Tests

VAR Granger Causality/Block Exogeneity Wald Tests: Pre-January 25th Revolution					VAR Granger Causality/Block Exogeneity Wald Tests: Post-January 25th Revolution				
Dependent variable	**Excluded**	**Chi-sq**	**df**	**Prob.**	Dependent variable	Excluded	Chi-sq	df	Prob.
EGX30	EX	4.118255	2	0.1276	EGX30	EX	3.964175	2	0.1378
EX	EGX30	4.648459	2	0.0979	EX	EGX30	2.454544	2	0.2931
EGX20	EX	4.835364	2	0.0891	EGX20	EX	4.715879	2	0.0946
EX	EGX20	5.790190	2	0.0553	EX	EGX20	3.285112	2	0.1935
EGX100	EX	4.992669	2	0.0824	EGX100	EX	3.831526	2	0.1472
EX	EGX100	9.784547	2	0.0075	EX	EGX100	0.011595	2	0.9942
EGX70	EX	5.497150	2	0.0640	EGX70	EX	2.122476	2	0.3460
EX	EGX70	11.30748	2	0.0035	EX	EGX70	0.191959	2	0.9085
CAP	EX	6.375129	2	0.0413	CAP	EX	4.143014	2	0.1260
EX	CAP	8.874251	2	0.0118	EX	CAP	0.660823	2	0.7186

Notes:
Pre-January 25th Revolution: 07/09/2009 to 21/01/2011.
Post-January 25th Revolution: 23/03/2011 to 01/09/2016

Table (7): Pairwise Granger Causality Tests

Pairwise Granger Causality Tests			**Pairwise Granger Causality Tests**		
Pre-January 25th Revolution			**Post-January 25th Revolution**		
Null Hypothesis:	F-Statistic	Prob.	Null Hypothesis:	F-Statistic	Prob.
EX does not Granger Cause EGX30	2.05913	0.1291	EX does not Granger Cause EGX30	1.98209	0.1384
EGX30 does not Granger Cause EX	2.32423	0.0994	EGX30 does not Granger Cause EX	1.22727	0.2936
EX does not Granger Cause EGX20	2.41768	0.0906	EX does not Granger Cause EGX20	2.35794	0.0952
EGX20 does not Granger Cause EX	2.89510	0.0566	EGX20 does not Granger Cause EX	1.64256	0.1941
EX does not Granger Cause EGX100	2.49633	0.0838	EX does not Granger Cause EGX100	1.91576	0.1478
EGX100 does not Granger Cause EX	4.89227	0.008	EGX100 does not Granger Cause EX	0.00580	0.9942
EX does not Granger Cause EGX70	2.74858	0.0654	EX does not Granger Cause EGX70	1.06124	0.3465
EGX70 does not Granger Cause EX	5.65374	0.0038	EGX70 does not Granger Cause EX	0.09598	0.9085
EX does not Granger Cause CAP	3.18756	0.0425	EX does not Granger Cause CAP	2.07151	0.1266
CAP does not Granger Cause EX	4.43713	0.0125	CAP does not Granger Cause EX	0.33041	0.7187

Notes:
Pre-January 25th Revolution: 07/09/2009 to 21/01/2011. Lags: 2.
Post-January 25th Revolution: 23/03/2011 to 01/09/2016 Lags: 2

Table (8): Structural breaks of market indexes, capitalisation and exchange rate

Indicator	Sequential F-statistic determined breaks	Break dates	Repartition	Event
EGX100	3	09/04/2012	642	The military used force to break up a camp that protesters had set up in Tahrir Square
		24/12/2013	1057	The government designates the Muslim Brotherhood a terrorist organisation
		17/08/2015	1458	Egypt adopts controversial anti-terrorism law
EGX 20	4	23/03/2011	386	EE resumed resume business on 23rd March 2011
		13/08/2012	725	Morsi announced a controversial constitutional decree. Morsi sacked Mohamad Hussein Tantawi, head of the country's armed forces, and Sami Anan, the Army chief of staff,
		08/01/2014	1066	Announcement of Constitutional Referendum in Egypt on amendments to the 2012 constitution
		05/07/2015	1431	Over 100 dead in clashes between Egyptian security forces and ISIL-affiliated militants in the area of Sheikh Zuweid in North Sinai
EGX 30	4	23/03/2011	386	EE resumed resume business on 23rd March 2011
		14/08/2012	726	An Egyptian lawyer filed a legal challenge over Morsi's removal of Tantawi and Anan
		09/01/2014	1067	Announcement of Constitutional Referendum in Egypt on amendments to the 2012 constitution
		16/08/2015	1457	Egypt bans girls from wearing hijabs to school - until they reach puberty. Blood on the Egyptian Exchange trading floor, equity investors lose US$1.4 billion
EGX 70	3	15/09/2011	505	Egyptian student protests hit elite Cairo university
		20/10/2013	1011	The US suspends delivery of tanks, helicopters and fighter jets to Egypt
		27/04/2015	1384	Former President of Egypt, Mohamed Morsi, is sentenced to 20 years in prison for his role in the arrest and torture of protesters during his tenure as President
CAP	3	27/08/2012	733	President Morsi issued a new law cancelling the Mubarak-era practice of temporarily detaining journalists for so-called "publication offences"
		08/01/2014	1066	Announcement of Constitutional Referendum in Egypt on amendments to the 2012 constitution
		19/08/2015	1460	Bomb outside of Cairo courthouse injures 30, ISIL-affiliate Sinai Province takes responsibility for attack
EX	3	17/01/2011	378	Activists call for an uprising in the country, to protest against poverty, unemployment, government corruption and the rule of president Hosni Mubarak
		09/01/2013	824	Morsi meets Abbas and Hamas leader in Cairo
		29/01/2015	1324	A series of attacks by ISIL-affiliated militants kill 44 people, including 14 civilians, in North Sinai.

Notes. Break points and time periods are detected by Bai-Perron tests of L+1 vs. L sequentially determined breaks.
The sample period is from September 7, 2009 to September 1, 2016. Events are collected from different sources.