Financial Integration in the United Arab Emirates Stock Markets

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Abstract

This paper examines the integration of financial markets using data from the Dubai Financial Market Stock Exchange, Abu Dhabi Stock Exchange and the FTSE Nasdaq Dubai UAE 20 index. To do this, we apply a vector error correction model and a permanent-transitory decomposition of the series of prices. Our results reveal the existence of a long-run equilibrium relationship between the three financial indices suggesting that UAE stock markets are integrated. Shocks to any of these markets affect the other markets in the long and the short run through the equilibrium condition. We uncover a major role of the FTSE Nasdaq Dubai UAE 20 index in this equilibrium relationship. Our analysis of market integration also allows us to obtain a permanent-transitory decomposition given by two common factors that drive the three financial indices. Whereas the first factor is defined as a weighted combination of the two major financial indices the second factor is mainly determined by the FTSE Nasdaq Dubai. As a byproduct of our analysis, we find empirical evidence of short-run and long-run predictability running from the Dubai financial indices to the Abu Dhabi index.

Keywords: cointegration, market integration, permanent-transitory decomposition, UAE stock markets

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1 Introduction

United Arab Emirates (UAE) has been considered as one of the most important investment hubs within the Gulf Cooperation Countries (GCC) and in the Middle East. Oil revenues and strong focus on the diversification of economic activities, especially by Dubai and recently by Abu Dhabi, and a tax-free business environment have created an appealing atmosphere for investment. Like many other emerging markets, during the last few decades, United Arab Emirates (UAE) has opened up their financial markets to foreign investors with the aim of attracting foreign direct investment and capital for promoting economic growth.

Financial market integration has been the focus of many researchers, especially during the last three decades. It is documented that countries that are well integrated internationally have more efficient capital allocation, better governance, higher investment and growth, and risk-sharing opportunities. Information on financial market integration is also valuable to financial regulators for understanding the ocurrence of contagion risks and spill-over effects across markets as well as for setting appropriate financial policies. Mohd and Hassan (2003), Al-Khazali et al. (2006), Onour (2009), Sbeiti and Alshammari (2010), Chaudhry and Boldin (2012), Squalli(2006), Squalli (2007) and Hatemi-J (2012) analyze the integration of GCC stock markets domestically, regionally and with international stock markets. Some of these studies include the Dubai Financial Market (DFM) index and the Abu Dhabi index (ADX). These financial indices track the performance of the stock exchanges in Dubai and Abu Dhabi, respectively.

The aim of our paper is to shed light on stock market integration between UAE financial markets. Dubai and Abu Dhabi are the two most developed emirates in the UAE and their economies rely on different sectors. The emirate of Abu Dhabi is the major oil exporter in the UAE and oil and gas have contributed 35% to its GDP. In contrast, Dubai's oil contribution to GDP has gradually declined to nearly less than 1% of GDP at the end of

2018. Currently, the main revenues of Dubai are generated from tourism, real estate, trade and financial services. Thus, the stock exchanges that are considered in this study operate under very different economic conditions and business environments. These economies are also separated geographically in different trading locations, and different listed stocks coming from different industries. Hence, the disparity in the economic structures of these emirates and the different regulations governing their financial markets imply that the financial integration between these markets is far from obvious and needs to be formally assessed. Our interest in this study is to assess this empirically and determine the common drivers across markets.

To do this we analyse three financial indices that broadly represent the three main stock exchanges based in the UAE: the Abu Dhabi stock exchange whose performance is tracked by the ADX, the Dubai main stock exchange whose performance is tracked by the DFM index, and Nasdaq Dubai stock exchange. We should note that unlike for the ADX and DFM, there is no financial index that tracks the performance of the companies listed on the Nasdaq Dubai Exchange. We proxy the performance of this stock exchange by the FTSE Nasdaq Dubai UAE 20 index (FND). This financial index comprises 20 stocks admitted for trading on Nasdaq Dubai, the Dubai Financial Market and the Abu Dhabi Securities Exchange. The choice of this index implies that our analysis captures a combination of market integration between the stock exchanges and information spillovers from the FND to the ADX and DFM indices. We identify the existence of market integration with the presence of a long-run equilibrium relationship between the time series of prices of the different financial indices. The existence of a long-run equilibrium relationship between these indices also entails a permanent-transitory (P-T) decomposition of the price process. We focus on Gonzalo and Granger (1995)'s P-T decomposition. In this scenario, there is a set of common factors following independent unit root processes that drive the permanent component in each and every of the financial markets under investigation.

The findings of our empirical analysis with weekly data from April 2007 to October

2018 are threefold. First, our analysis of cointegration shows that the Abu Dhabi and Dubai markets share a long-run equilibrium condition. In particular, we find a long-run positive relationship between the DFM and the FND indices and a negative relationship between the ADX and the DFM index. Second, the application of the Gonzalo-Granger P-T decomposition uncovers two common factors that drive the dynamics of the three prices. The first factor is a weighted combination of the ADX and DFM indexes and the second factor is mainly determined by the dynamics of the FND index. The P-T decomposition also allows us to find a permanent component that drives the long-run dynamics of each price series. In particular, we find that the permanent component of the ADX index is an equally weighted combination of the two common factors. The permanent component of the DFM index depends more heavily on the second factor, suggesting a strong contribution of the Nasdaq Dubai index in the long-run dynamics of the main Dubai stock index. The permanent component of the FND index is mainly driven by the second factor, highlighting the exogenous character of this financial index. Third, the presence of market integration also allows us to find evidence of short-run predictability running from the stock markets in Dubai (DFM and FND financial indices) towards the ADX index. However, we do not find evidence of predictive ability of the ADX index on any of the two Dubai financial indices.

The rest of the paper is organized as follows: In Section II we discuss the data and fit a cointegrated error correction model for testing for the presence of market integration and the presence of long-run causality between the UAE equity markets. Section III derives the permanent-transitory decomposition of the series of prices, and analyzes the common factors driving the permanent component of each series of prices. Section IV concludes the paper and offers some policy implications.

2 Model description

2.1 Dataset

The sample considered for this study consists of weekly prices of the DFM, ADX and FND financial indices. ADX, the largest of the three, was first established in November 2000. As of November 2018, there are 70 companies listed from ten industries with market capitalization of $134.84 billion. The DFM started operating in March 2000 with securities trading before expanding to a formal stock exchange. As of November 2018, there are 67 companies from ten industries listed with market capitalization of $101.05 billion. Nasdaq Dubai, the smallest of the three, began operations in September 2005. It is an international stock exchange open to domestic and foreign investors. As of November 2018, there are nine listed companies coming from five different industries with market capitalization of $4.23 billion. The dataset is obtained from Thomson Reuters Eikon for the period from 19 April, 2007 to 18 October, 2018. Figure 1 illustrates the dynamics of the three stock market indices over this period. The charts report very similar patterns across the entire period with only small differences in the last year.

[INSERT FIGURE 1 ABOUT HERE]

2.2 Vector error correction model

The following vector error correction model (VECM) allows us to gauge the existence of convergence between the different financial indices representing the stock markets in Abu Dhabi and Dubai. A typical representation of the VECM is

$$\Delta Y_t = \alpha Z_{t-1} + \sum_{i=1}^{p} \Gamma_i \Delta Y_{t-i} + \epsilon_t, \tag{1}$$

where $Y = (\mathrm{p}_{ADX}, \mathrm{p}_{DFM}, \mathrm{p}_{FND})'$ with p denoting the log-price of Abu Dhabi Stock Exchange Index, the log price of Dubai Financial Market Index and the log price of FTSE

Nasdaq Dubai 20 UAE, respectively. We interpret integration between the three markets as the existence of an equilibrium condition between the price of the three financial indices. In model (1) this is reflected in the error correction variable $Z_t = \beta' Y_t$ with β denoting the cointegrating vector and α the vector of loadings that measures the speed of convergence of individual prices to the equilibrium condition establishing market integration. The quantity ΔY_t represents the variables in first differences (financial returns). The matrices Γ_i capture the short-run Granger-casual relationships between the variables in first differences. The random vector ϵ_t denotes the error term of the cointegrated VAR model (1).

Table 1 presents the results of unit root tests (Augmented Dickey Fuller (ADF) and Phillips and Perron (P-P)) for the sample under study. Both tests provide statistical evidence for not rejecting the null hypothesis of non-stationarity and accepting, in turn, the unit root hypothesis for all series. Tables 2 and 3 present different statistics based on the cointegration methodology introduced in Johansen (1988, 1991). The results provide evidence of a single cointegration relationship between the variables in the system with the optimal number of lags equal to two, which is decided according to the Akaike Information Criteria (AIC) and Akaike's Final Prediction Error Criterion (FPE). This is reported in Tables 2 and 3, respectively. Table 4 presents the estimation of the model parameters.

[INSERT TABLES 1 TO 4 ABOUT HERE]

The cointegration vector β characterizes the following variable Z_t that is stationary by construction:

$$Z_t \equiv \mathrm{p}_{DFM} + \underset{(0.72)}{2.57}\mathrm{p}_{ADX} - \underset{(0.49)}{3.00}\mathrm{p}_{FND} - 5.39. \tag{2}$$

Market integration entails equilibrium between the different financial indices such that $Z_t = 0$. In this case the above condition implies that the long-term relationship between prices is

$$\mathrm{p}_{DFM} = -\underset{(0.72)}{2.57}\mathrm{p}_{ADX} + \underset{(0.49)}{3.00}\mathrm{p}_{FND} + 5.39. \tag{3}$$

Expression (3) shows that the DFM index is given by a linear combination of the FND index and the ADX index. This analysis uncovers a long-run positive relationship between the DFX and the FND indices and a negative relationship between the ADX and the DFM index. The FND index seems to be positively related to both major financial indices.

An interesting implication of the vector error correction model is the possibility of testing for long-run causality from the equilibrium condition Z_{t-1} to the series. More formally, a statistically significant parameter α suggests that departures of Z_t from zero have predictive ability for the dynamics of the return process ΔY_{t+1}. That is, a negative value of the parameter α entails mean reversion to the equilibrium condition (3). The magnitude of the parameter α measures the speed of convergence of the process to restore equilibrium in the system. The vector of α coefficients corresponding to the above VECM with one lag is

$$\alpha = \left(\underset{(0.006)}{-0.014}, \underset{(0.004)}{-0.010}, \underset{(0.007)}{-0.003)} \right)'. \tag{4}$$

These results suggest that positive values of Z_t, for example due to an abnormal increase in the price of DFM not corresponded by the rest of variables in the system, yield a negative correction of the price of DFM ($\alpha_1 = -0.014$), ADX ($\alpha_2 = -0.010$) and FND ($\alpha_3 = -0.003$, but not significant) in the next period. According to these estimates, we can say that the FTSE Nasdaq Dubai 20 UAE is an exogenous index with dynamics not affected by departures from the equilibrium condition (3).

We also check whether the three series considered in the study Granger-cause each other or not in the VECM setting. Granger-causality analyses the existence of predictive ability of past returns on the ADX, DFM and FND financial returns. Under the efficient market hypothesis, we should not expect statistical significance of past returns on current returns. However, the results in Table 5 partly contradict these theoretical insights since we find that both DFM and FND Granger-cause ADX and both DFM and ADX Granger-cause FND. The ADX index, on the other hand, has no effect on the returns on the DFM index although ADX has more listed companies in the index, trading volume is higher and market capitalization stronger than for the other financial indices. Compared to ADX, DFM has higher liquidity and the index is more open to foreigners. These two facts could be determining the leadership of the DFM market. These findings are in line with the existing empirical literature. Thus, examining return and volatility spillover effects between DFM and ADX, Maghyereh and Awartan (2012) suggest that there is a significant lead-lag relationship between the UAE national markets in which the DFM is playing the dominant role in transmitting information.

[INSERT TABLE 5 ABOUT HERE]

An alternative view on the practical importance of these empirical findings is from the point of view of an international investor. The presence of cointegration between these markets entails the existence of a long-run relationship and, more specifically, implies that the three markets are driven in the long run by the same shocks. This implies that whereas each market can be driven in the short-run by idiosyncratic shocks, in the long-run the three markets will move together according to the long-run relationships found above. These joint dynamics have negative implications on portfolio diversification for international investors aiming to invest in the stock markets in the region. This is so because the three markets move together in the long run and, hence, the potential benefits of diversification are drastically reduced if one plans to develop investment portfolios that are fully invested on the DFM, FND and ADX financial indices.

To undersdand the effect of these shocks we have estimated the impulse response functions corresponding to the VECM estimated above. This is obtained by calculating the impulse response functions (IRFs) of the corresponding VECM. We should note that unlike for stationary VAR models, the IRFs of VECM do not always die out. This is because the non-stationary unit root variables modelled in a cointegrating VECM are not mean-reverting. In this model, shocks to VECM can give rise to two different scenarios.

When the effect of a shock dies out over time, the shock is said to be transitory. When the effect of a shock does not die out over time, the shock is said to be permanent. Interestingly, the IRFs reported in Figure 2 are calculated for orthogonalized shocks and present an scenario in which all shocks to the different variables are permanent. In most cases, the shocks have a positive permanent effect that slightly increases over time. Shocks to the ADX market are more complex to analyze. The effect of an orthogonalized shock to the ADX index has a negative permanent effect. In contrast, the same shock has a positive and decreasing effect on the FND index suggesting that the shock is transitory.

[INSERT FIGURE 2 ABOUT HERE]

3 Permanent-transitory decomposition

The above cointegration model can be further exploited to disentangle the permanent and transitory components of the different financial indices and also for assessing empirically the advantages of market integration for forecasting ability. This can be done by applying under minimal restrictions the P-T decomposition of Gonzalo and Granger (1995). In this decomposition the transitory component is a linear combination of the error-correction term Z_t in (1) whereas the permanent component is characterized by a set of common factors f_t that exhibit unit root behavior and drive the long-term dynamics of prices of the financial indices characterizing the stock markets in the UAE.

3.1 Permanent-transitory decomposition

We follow Gonzalo and Granger (1995) P-T decomposition to identify the common factors that define the permanent component. This is achieved by imposing the following two conditions: i) the factors are linear combinations of the original variables Y_t and ii) the transitory component does not have predictive ability on the common factors. Under these two conditions the only linear combinations of the original variables such that the transitory component has no long-run impact on them are

$$f_t = \alpha'_\perp Y_t, \tag{5}$$

with $\alpha_\perp$ defined in our application by a 3×2 matrix satisfying $\alpha'_\perp \alpha = 0$. This representation indicates that there are two common factors that drive the dynamics of the three financial indices. Once the common factors f_t are identified the P-T decomposition of Y_t is obtained as a linear combination of the factors f_t with loadings A_1 and a transitory component given by the cointegrating vector Z_t with loadings A_2. More formally, for the vector Y_t the corresponding P-T decomposition is

$$Y_t = Y_t^* + A_2 Z_t, \tag{6}$$

with $Y_t^* = A_1 f_t$ the vector of efficient prices that capture the permanent component of each of the three financial indices. In this decomposition the matrix A_1 contains the sensitivity of each price to the common factors such that $A_1 = \beta_\perp(\alpha'_\perp \beta_\perp)^{-1}$ with $\beta_\perp$ a 3×2 vector satisfying that $\beta'_\perp \beta = 0$. Similarly, the matrix A_2 is defined as $A_2 = \alpha(\beta'\alpha)^{-1}$. The factors f_t contain the linear combinations of ΔY_t that have the common feature of not containing the levels of the error correction term Z_t in them. For more details on the method the interested reader is referred to Gonzalo and Granger (1995).

Table 6 reports the parameter estimates of the above decomposition. More specifically, the left panel of Table 6 reports the coefficients of the matrix $\alpha_\perp$ defining the common factors and the right panel reports the coefficients of the factor loadings A_1 characterizing the permanent component of Y_t. The reported parameter values are constructed using the estimates of the vector error correction model specification fitted in the previous section. The results show that there are two common factors driving the dynamics of the three series. The common factors are driven by a linear combination of the three variables. The first factor, determined by the vector $(-0.57, 0.81, -0.05)$, gives a prominent role to the ADX and the DFM such that the factor can be characterized as $f_{1t} \approx -0.57ADX_t + 0.81DFM_t$. Similarly, the second factor that is determined by the vector $(-0.18, -0.05, 0.98)$ gives a much more prominent role to the FND index such that we can approximate the dynamics of the factor by $f_{2t} \approx -0.18ADX_t + 0.98FND_t$. Thus, whereas the first factor is mainly driven by the dynamics of the major UAE indices, the second factor is driven to a large extent by the smaller and more specialized FTSE Nasdaq Dubai index.

[INSERT TABLE 6 ABOUT HERE]

These findings can be applied to disentangle the dynamics of the efficient price vector Y_t^*, characterized by the estimated matrix A_1 and the common factors f_t. The right panel of Table 6 shows that the permanent component of the ADX index is an equally weighted combination of the two common factors. Interestingly, this combination assigns a major role to the dynamics of the FTSE Nasdaq Dubai 20 UAE index for its dynamics are a major determinant of the second factor. In contrast, the permanent component driving the dynamics of the DFM index depend more heavily on the second factor than on the first factor. This finding provides further evidence on the importance of the FTSE Nasdaq Dubai index for understanding the dynamics of the UAE stock exchanges.

Figure 3 illustrates the good approximation of the common factors to each of the financial indices. The difference between the actual price series Y_t and the permanent decomposition Y_t^* defines the stationary component of each financial index.

[INSERT FIGURE 3 ABOUT HERE]

4 Conclusions

This paper examines the integration of financial markets using data from the main three UAE financial indices. The results reveal the existence of a long-run equilibrium relationship between the three financial indices suggesting that UAE stock markets are integrated. Shocks to any of these markets affect the other markets in the long and the short run through the equilibrium condition. In the short-run, we also find empirical evidence of predictability running from the Dubai financial indices (Dubai Financial Market and FTSE Nasdaq Dubai UAE 20) to the Abu Dhabi ADX index. Information is first incorporated into stock prices of the DFM and FND indices and then into stocks of the ADX index. In the long-run, we also find a superior predictive ability of the forecasting method that exploits the presence of cointegration between the series of log-prices compared to forecasts only relying on the history of prices of each financial index.

Our analysis of cointegration also allows us to uncover the existence of two common factors that drive the three financial indices. In particular, the first factor is determined by a weighted combination of the ADX and DFM index and the second factor is mainly determined by the FND index. Interestingly, the FND index is exogenous to the system of prices suggesting that the short-run dynamics of its returns are not statistically affected by departures from the equilibrium condition.

This study also allows us to draw implications for investment in UAE financial markets and policy. For the former, the presence of a long-run equilibrium condition between the different financial indexes suggests that portfolio diversification in the context of the UAE stock markets should bring little or no benefits to investors with long-term horizons. In contrast, the existence of Granger-causality suggests that short-term gains remain a possibility. For the latter, a major implication for policy is to increase the participation of foreign investors as well as to limit the effect of government stock ownership. This will lessen the direct government intervention in the stock market, lead to greater liberalization of trade and hence higher levels of market efficiency. Knowing the degree of financial integration within the stock markets in UAE is also important for investors and regulators. For investors, it is important to understand the implications in portfolio diversification activities. For regulators, it is important in order to assess the presence of contagion risk and spill-over effects across markets as well as in terms of setting appropriate financial regulations and policies.

We only focus on UAE markets, however, our approach can be extended to assess the long-run relationship of these markets with major economies such as US, Europe or China. In this study we have found a linear long-run relationship between the financial indices, however, for other countries in which the economic and financial links with the UAE are not immediate, we may need to resort to nonlinear techniques that uncover regime-specific causality relationships, see for example Hatemi-J (2012).

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Appendix

Table 1: Unit Root Test Results of the indexes over the period from April 2007 to October 2018.

Variables	Augmented Dickey Fuller Test		Philipps Perron Test	
	Levels	First Difference	Levels	First Difference
Abu Dhabi Stock Exchange	-1.026	-21.73	-1.353	-21.89
Dubai Financial Market	-1.201	-24.03	1.087	-24.05
Nasdaq Dubai Stock Exchange	-1.306	-24.80	-1.398	-24.84

Table 2: Johansen cointegration test results for the time series of indexes over the period from April 2007 to October 2018.

Null Hypothesis	Log Likelihood	Trace Statistics	Critical Values
$r_0 = 0$	43555.9	30.95	29.68
$r_0 \leq 1$	4366.8	9.06	15.41

Table 3: Lag Selection for Cointegration Test

Lags	LL	LR	FPE	AIC	HQIC	SBIC
0	862.31	-	7.2e-09	-10.23	-10.21	-10.17
1	1471.25	1217.9	5.7e-12	-17.37	-17.28	-17.15
2	1496.7	51.003	4.7e-12	-17.57	-17.41	-17.18
3	1503.37	13.25	4.8e-12	-17.54	-17.31	-16.98
4	1509.61	12.48	5.0e-12	-17.51	-17.21	-16.78

Table 4: Vector Error Correction Model estimation (Equation 1) for the time series of indices over the period from April 2007 to October 2018.

	DFM	ADX	Nasdaq
Z_{t-1}	-0.014^{**} (0.006)	-0.010^{***} (0.004)	-0.003 (0.007)
DFM_{t-1}	0.254^{**} (0.095)	0.179^{***} (0.067)	0.448^{***} (0.106)
ADX_{t-1}	0.160 (0.113)	0.036 (0.080)	0.323^{***} (0.126)
$Nasdaq_{t-1}$	-0.255^{***} (0.082)	-0.184^{***} (0.058)	-0.538^{***} (0.091)

Standar errors are reported in parantheses.

Table 5: Granger Causality Test Results

Null Hypothesis	Chi-sq	Prob.
ADX does not Granger cause DFM	2.20	0.1384
Nasdaq Dubai does not Granger cause DFM	9.61	0.0019
DFM does not Granger cause ADX	7.05	0.0079
Nasdaq Dubai does not Granger cause DFM	10.08	0.0015
DFM does not Granger cause Nasdaq Dubai	17.74	0.0000
ADX does not Granger cause Nasdaq Dubai	6.50	0.0108

Table 6: Parameter estimates corresponding to the Gonzalo-Granger Permanent-Transitory Decomposition for the analysis of UAE Stock indexes. The sample period comprises weekly data from April 2007 to October 2018. Left panel reports the parameters of the matrix $\alpha_\perp$ in (5) and the right panel reports the parameters of the matrix A_1 in (6).

$\alpha_\perp$		A_1 loadings	
-0.57	-0.18	-1.36	1.34
0.81	-0.05	0.25	1.02
-0.05	0.98	-0.23	1.32

Figure 1: Dynamics of UAE stock indices.

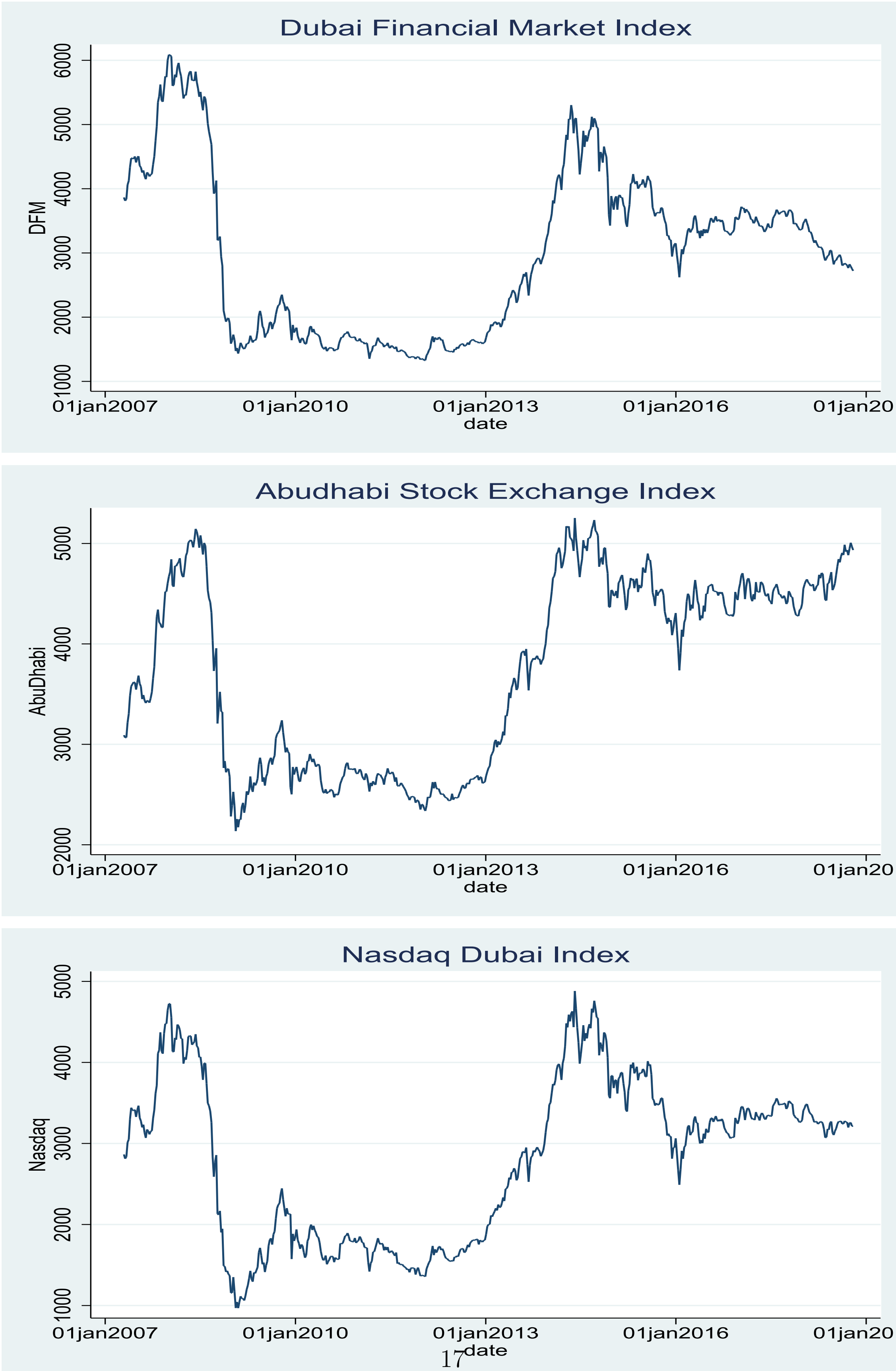

Figure 2: Impulse response functions for VECM in (1). Left top panel reports the IRF of a shock to ADX on DFM. Middle top panel reports IRF of a shock to FND on DFM and right top panel reports IRF of a shock to DFM on DFM. Middle and bottom panels report the impact of a shock on ADX and FND, respectively.

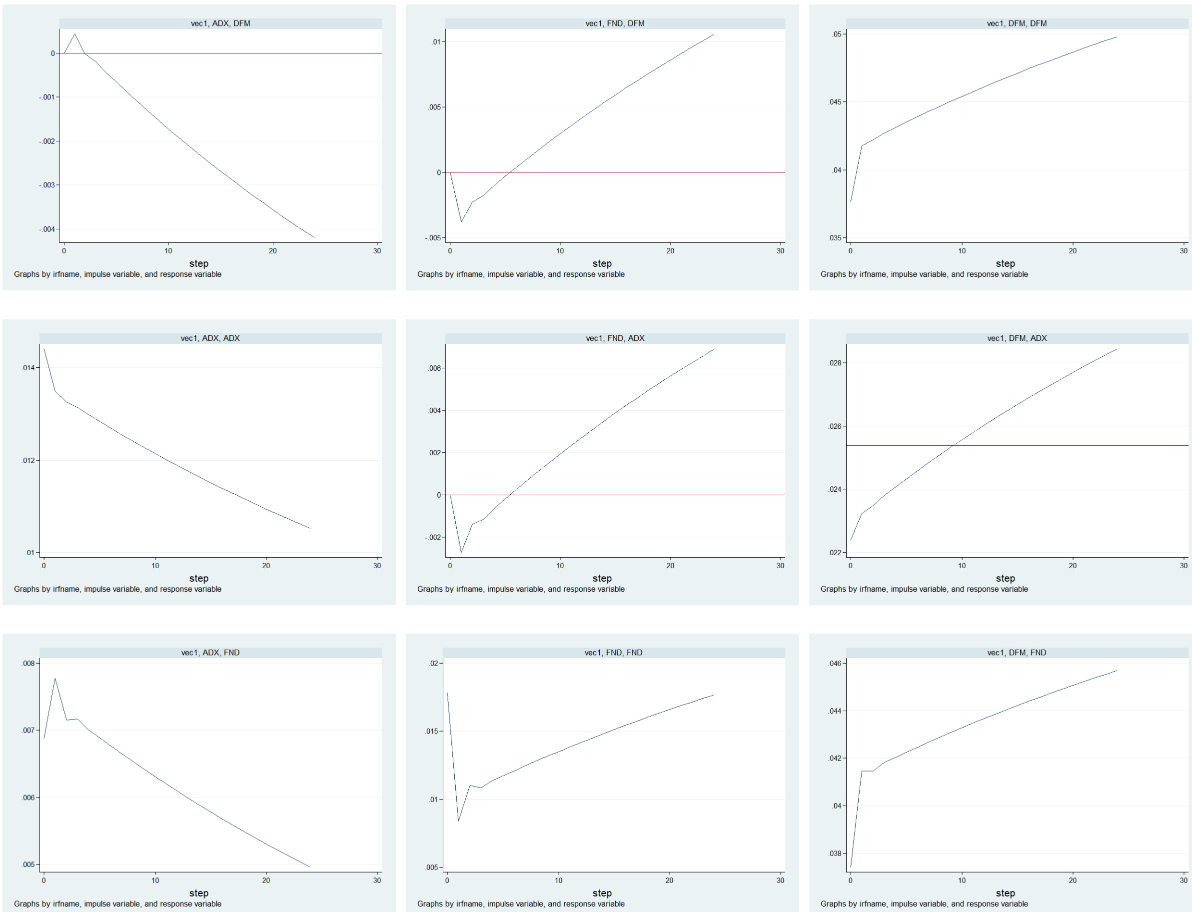

Figure 3: Dynamics of the pair (Y_t^*, Y_t) for the time series of Dubai, Abu Dhabi Stock Exchange and FTSE Nasdaq Dubai UAE 20 index using decomposition (6).