AN EMPIRICAL INVESTIGATION OF THE POTENTIAL ASYMMETRIC RELATIONSHIP BETWEEN THE STOCK MARKET AND THE EXCHANGE RATES IN THE UAE

1. Introduction

This paper aims at empirically investigating the dynamic relationship between the stock market and the exchange rates within the context of the UAE. This investigation is important for theoretical, practical and policy-making reasons. Academically, the association between financial markets such as foreign exchange markets and the stock markets is a key input to open macroeconomy models, portfolio diversification strategies or hedging models. Practically, knowledge of the underlying relation between asset prices is essential for investors in their pursuit of the diversification possibilities and for the hedging purposes in order to reduce the price risk of their investments in increasingly integrated international markets. Economic or financial legislators and regulators must be aware of the causal link between financial markets such as exchange rates and stock markets in order to formulate and implement proper policies.

According to the existing literature information about the dynamic interaction between stock markets and foreign exchange markets is important particularly for two reasons: (1) the efficiency of the market – whether or not each asset market is efficient in reflecting the pertinent information generated from the other market; (2) financial contagion – whether or not crisis in one market will spill over to another market.

This paper investigates the causal relationship between the stock market and the foreign exchange market in the UAE for the period 2002-2012 using daily data. A novelty of this paper is to investigate whether or not there is an asymmetric relationship between the stock market and the foreign exchange market. To the best knowledge, this property has not been investigated in the published literature on measuring the impact of foreign exchange markets on the stock markets. This is due to the fact that asymmetric Granger causality is a relatively new concept in the literature. However, allowing for

asymmetry in the empirical investigation of the potential impact of foreign exchange markets on the stock markets is an appropriate approach because it accords well with the reality. It is widely believed that investors in both markets tend to react more to negative news than positive ones. In addition, the paper makes use of computer intensive methods in order to generate appropriate critical values for each underlying hypothesis that is tested. This is important because financial variables are usually not normally distributed and therefore use of standard distributions might not be appropriate for implementing the empirical tests. Thus, the empirical findings based on the asymmetric causality tests combined with the leveraged bootstrapping can be more informative and more precise.

After this introduction the rest of the paper is structured as the following. Section 2 presents historical development of the stock market in the UAE and its legal financial structure. Section 3 reviews some pertinent published research. The econometric methodology is described briefly in Section 4. The empirical findings are presented in Section 5 and the last section concludes the paper.

2. The UAE financial market development

2.1 The Emergence of the Market

Complying with the international standards prevailing in professional and technology driven securities markets, the Securities and Commodities Authority (SCA, hereafter) was established in the UAE based on the Federal Law no. 4/2000 to supervise and regulate the activity of the securities and commodities markets. SCA was established to separate the supervisory responsibilities from the implementation responsibilities to avoid conflicts of interest, and organize the trading in securities and commodities under one umbrella, with the same regulatory structure and overall policy. Moreover, SCA is the regulatory body, which oversees and supervises the work of the markets and their participants (investors, brokers and parties with listed securities), while trading in securities is conducted by the SCA licensed securities markets, which adhere to SCA's rules and regulations. In the year 2000, the SCA licensed both Dubai Financial Market (DFM, hereafter) and Abu Dhabi Securities exchange (ADX, here after) to come in operation. The Emirates of Abu Dhabi local law no. 3/2000 also authorizes ADX to establish centers and branches outside the Emirate of Abu Dhabi.

To date it has done so in Fujeirah, Ras al Khaimah, Sharjah and Zayed City.

Moreover, as the trading was rambling around only 17 companies in 2003 and shareholding companies were hesitant to list their shares as that would bring them under public scrutiny, the Federal Authority in 2004 imposed new legislations to force all of the UAE public shareholding companies to list their shares in either DFM or ADX. Since then, the UAE securities market has developed significantly in term of the number of listing and capital. The number of companies increased gradually from 17 public shareholding companies in 2000 with less than one billion AED in capital to reach 127 companies with a capital exceeding 50 billion AED in 2010.

The year 2005 witnessed the beginning of opening up the UAE financial market to foreign investment, after the general assemblies for a large number of public shareholding companies adopted resolutions to amend their statutes, and to allow non-UAE nationals to own a stake in their capital, with a variation in the rate of foreign ownership ranging between 49 percent to 20 percent. The impetus behind this step was to expand the base of shareholders of public shareholding companies, thereby raising the level of liquidity by increasing the volume of demand, supply and trading on the shares of these companies, in addition to the employment of a significant proportion of non-nationals' funds in the UAE financial markets instead of being diverted to outside of the UAE.

Opening up the UAE financial market for foreign investment has allowed foreign investments contribution in 2005 to raise the prices of many listed companies towards their fair value in light of UAE strong economic performance with continued growth in gross domestic product (GDP), which impacted the growth of corporate profitability and distribution. This initiative, also, widened the base of investors and speculators in the financial markets, where the number of traders and investors jumped in both ADX and DFM to more than one million investors in 2005 relative to two hundred thousand investors at the beginning of the establishment of financial markets in 2000. Moreover, the trading volume has increased significantly from 2.14 billion AED in 2001 to 509.7 billion AED in 2005 and it continued to increase to reach 537 billion AED in 2008.

However, UAE financial market has been affected negatively by the repercussions of the global financial crisis and its impact on the performance of global financial markets which led to extensive exit of foreign investment from UAE financial market, especially during the second half of 2008, when the volume of foreign investors selling

exceeded the purchase volume in DFM by 6 billion AED relative to what happened in 2007, when the volume of foreign investors purchases exceeded the selling volume by 12 billion AED.

These losses in the index called for restricting the impact of foreign investment in the UAE financial market. Therefore, many shareholding companies regretted allowing non-nationals to own shares in their companies, while others have prompted reduced foreign ownership proportion such as the Sorouh Real Estate Company and the First Gulf Bank.

2.2 Financial Reporting Environment

Two financial reporting periods can be identified in the UAE; before and after February 2000 when SCA was established and DFM and AMX were commenced on operation according to Al-Shayeb (1999). Earlier to February 2000, two forces had shaped the legal and regulatory framework for financial reporting in the UAE; the Ministry of Economy and the Central Bank of the UAE. The UAE Companies Act no. 8/1984 and its Amendments no. 13/1988 represented the departure point towards regulating financial reporting practices in the UAE. The Act required firms to maintain records of their operation and to provide audited financial statements to the federal and state authorities. This umbrella was very broad in scope and the wording was too general in addition to the absence of any effective disciplinary authority. Al-Shayeb (2003a) reported that firms had not benefit from such umbrella due to the absence of an independent supervisory body able to regulate accounting and auditing profession and the absence of an official stock market.

Financial institutions, banks, finance and investment firms were also governed by another additional legal and regulatory framework, which has helped in tightening the reporting requirements and practices, the Central Bank of the UAE. Decree no. 10/1980 authorizes the Central Bank to organize, regulate and develop the financial profession besides monitoring of the financial system. In this respect, Al-Shayeb (2003b) reported that firms in the service sector were likely to disclose less information than those in the banking and insurance sectors due to the absence of enforcement authority relative to banking and insurance sectors. Accordingly, the Central Bank accounting and disclosure requirements started with provision no. 445/1988 requiring financial institutions to prepare audited annual reports in accordance with the format from the Central Bank,

in addition to detailed information about assets and liabilities. The provision also instructed auditors to verify the consistency of the annual report with the facts and to provide the Central Bank with a report in this regard. However, Al-Shayeb (2003a) reported that the overall degree of compliance in the U.A.E unregulated financial market was not optimum level prior to the establishment of SCA, FDM and ADX. He showed that out of 54 companies only ten companies (18 percent) scored more than 60 percent using disclosure index.

The wide use of the International Accounting Standards (IAS) in regards to accounts of banks and other financial institutions forced the Central Bank to issue Circular 20/1999 concerning the adoption of the IAS. It is expected that the adoption of the IAS has filled the gap between the need for acceptable standards and the deficiencies in the current financial reporting requirements and practices.

The second period has started after February 2000 when SCA was established and DFM and ADX were commenced on operation and many regulations enacted and implemented gradually such as the law of securities markets, the law of the Capital Market Authority, in addition to a set of rules and regulations governing their work and their relation to listed companies and brokers and investors. In this respect, Al-Shayeb (2003b) reported that the overwhelming majority of the sampled users of financial statement acknowledged a moderate level of improvement in corporate financial reporting practices as compared to the situation existing prior to establishment of regulatory authorities.

A pertinent issue in this regard is to investigate the impact of the exchange rates on the stock market in the UAE. Since the domestic currency is fixed with regard to the dollar we make use of the Euro dollar exchange rates.

3. Literature review

Most previous studies have concentrated on the US and have found different empirical results (see, Aggarwal, 1981; Solnik, 1974; Soenen and Hennigar, 1988; Bahmani Oskooee and Sohrabian, 1992, among others). Succeeding studies have not managed to produce uniform results. For example, Abdalla and Murinde (1997) established that exchange rates precede stock prices in Korea, Pakistan and India but the reverse is true for the Philippines. A study conducted by Ajayi *et al*. (1998) claims that exchange rates lead stock markets in the frontier markets (Canada, Germany, France, Italy, Japan and the UK) but different results are obtained for the emerging markets.

The authors found bidirectional causality in the case of Taiwan however a unidirectional causality was found for Indonesia and the Philippines, which is from stock prices to exchange rates. A reverse relationship was found in Korea and no relationship was found in Hong Kong, Singapore, Thailand or Malaysia.

Recent papers have also not been capable of settling this matter. A well-known study conducted by Granger *et al*. (2000) showed that exchange rates derive stock prices in South Korea but it is driven by stock prices in the case of Hong Kong, Malaysia, the Philippines, Singapore, Thailand as well as Taiwan. In addition, they established that there is no causality between the two underlying time series in Japan and Indonesia. Hatemi-J and Irandoust (2002) investigated the issue for Sweden and found that stock prices cause exchange rates. Smyth and Nandha (2003) conducted a study of this issue for the South Asian countries of Bangladesh, India, Pakistan and Sri Lanka by utilizing daily data during the period 1995 to 2001. Via cointegration and Granger-causality test methods, they found no steady-state connection between exchange rates and stock prices in these four national markets. They also found that the exchange rates Granger-cause stock prices in India and Sri Lanka. However, there was no causality in the case of Pakistan and Bangladesh. Hatemi-J and Roca (2005) investigated the causal relationship between these two variables for ASEAN4 countries (i.e. Malaysia, Indonesia, Philippines and Thailand) before and during the 1997 Asian financial crisis. The results showed that the variables were causally linked during the normal period. However, this causal relationship broke down during the financial crisis. Tsai (2012) analyses the relationship between stock prices and the exchange rates for Singapore, Thailand, Malaysia, the Philippines, South Korea and Taiwan covering the period January 1992-December 2009. The author finds that in all six countries the relationship between the underlying variables is negative.

In all of the mentioned studies, the conducted analysis has assumed a symmetric structure regarding the potential relationship between the stock markets and the foreign exchange markets. The aim of this paper is to advance one step further by conducting asymmetric empirical analysis.

4. Data and methodology

The Morgan Stanley Capital International (MSCI) stock price index and the euro dollar exchange rate data are used for

the period 2002-2012 on daily basis. Since the domestic currency (dirham) is fixed with regard to the dollar, the euro dollar rate is in fact representing the euro dirham rate, which is the most relevant exchange rate for the UAE.

The underlying methodology to conduct the empirical analysis is based on the asymmetric Granger causality test suggested by Hatemi-J (2012). This test separates the causal impact of positive changes from the negative ones. Allowing for asymmetric causal impact seems to accord well with the reality especially in financial markets in which the investors typically react more to adverse changes than favorable ones. It is widely agreed that both exchange rate index (denoted by X) and stock price index (denoted by S) are integrated variables. Therefore, each variable can be expressed as an integrated process of the first degree. That is,

$$X_t = X_{t-1} + \varepsilon_{1t} = X_0 + \sum_{i=1}^{t} \varepsilon_{1i}\,, \tag{1}$$

In the same vein

$$S_t = S_{t-1} + \varepsilon_{2t} = S_0 + \sum_{i=1}^{t} \varepsilon_{2i} \tag{2}$$

for $t = 1,2,\ldots T$. The constants X_0 and S_0 represent the initial value for each variable. The error terms are signified by ε_{1i} and ε_{2i}, which are assumed to be white noise processes. Positive and negative changes are identified as $\varepsilon_{1i}^{+}=(\varepsilon_{1i}=0)+$, $\varepsilon_{2i}^{+}=(\varepsilon_{2i}=0)+$, $\varepsilon_{1i}^{-}=(\varepsilon_{2i}=0)-$ and $\varepsilon_{2i}^{-}=(\varepsilon_{2i}=0)^{-}$, where, the positive sign of the exponent above the parenthesis represents maximum value and the negative exponent represents the minimum values. Based on this identification of positive and negative shocks, we have $\varepsilon_{1i}=\varepsilon_{1i}^{+}+\varepsilon_{1i}^{-}$ and $\varepsilon_{2i}=\varepsilon_{2i}^{+}+\varepsilon_{2i}^{-}$. This in turn implies that we can express the following:

$$X_t = X_{t-1} + \varepsilon_{1t} = X_0 + \sum_{i=1}^{t} \varepsilon_{1i}^{+} + \sum_{i=1}^{t} \varepsilon_{1i}^{-},$$

and

$$S_t = S_{t-1} + \varepsilon_{2t} = S_0 + \sum_{i=1}^{t} \varepsilon_{2i}^{+} + \sum_{i=1}^{t} \varepsilon_{2i}^{-}\,.$$

Based on these results, the cumulative positive and negative changes are defined as $X_t^+ = \sum_{i=1}^{t} \varepsilon_{1i}^+$, $X_t^- = \sum_{i=1}^{t} \varepsilon_{1i}^-$, $S_t^+ = \sum_{i=1}^{t} \varepsilon_{2i}^+$ and $S_t^- = \sum_{i=1}^{t} \varepsilon_{2i}^-$.

These components allow for the possibility to test for asymmetric causality. For instance, if the null hypothesis that negative shocks in the exchange rate do not cause positive shocks in the stock prices is to be tested then the data vector is $y_t^- = (S_t^-, X_t^-)$[1]. Next, the following vector autoregressive model of order L, VAR (L)[2], can be estimated[3]:

$$y_t^- = v + A_1 y_{t-1} + \ldots + A_p y_{t-L}^- + u_t^-, \quad (3)$$

where v is the 2×1 vector of intercepts, and u_t^- is a 2×1 vector of error terms. The parameter matrix A_r is a 2×2 matrix of coefficients for lag order L (L = 1, …, L-*max*). The optimal lag order is selected by minimizing the following information criterion:

$$\text{HJC} = \ln(|\hat{\Omega}_j|) + L2^{-1}T^{-1}(m^2 \ln T + 2m^2 \ln(\ln T)), \quad \text{L=0,…, L-max.} \quad (4)$$

where $|\hat{\Omega}_j|$ is the determinant of the estimated variance-covariance matrix of u_t^- based on lag length L, m is the number of the variables in the VAR model, and T is the sample size[4]. After finding the optimal lag, the following null hypothesis is tested[5]:

H_0: the row j, column k element in A_r equals zero for r = 1,…, L. (5)

This null hypothesis can be tested by using a Wald test. Prior to defining this test there is need to define some denotations in order

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[1] The idea of constructing cumulative sums of positive and negative shocks originates from Granger and Yoon (2002), which was used for hidden cointegration analysis.

[2] The VAR model was introduced by Sims (1980).

[3] For causality testing between positive cumulative shocks the vector $y_t^+ = (S_t^+, X_t^+)$ is used.

[4] The *HJC* is recommended by Hatemi-J (2003, 2008). The conducted simulation experiments have indicated that this information criterion is successful in picking up the optimal lag order even when ARCH effects prevail. The information criterion seems to also have good forecasting capabilities.

[5] An additional unrestricted lag is included in the VAR model to account for the effect of one unit root following the recommendation by Toda and Yamamoto (1995).

to make the representation of the test more compact. Thus, let us define[6]:

Y:= $(\bar{y_1},\ldots,\bar{y_T})$ $(m\times T)$ matrix,

D:=$(v,A_1,\ldots,A_L)$ $(m\times(1+mL))$ matrix,

$$Z_t := \begin{bmatrix} 1 \\ \bar{y_t} \\ \bar{y}_{t-1} \\ \vdots \\ \bar{y}_{t-p+1} \end{bmatrix} \quad ((1+mp\mathrm{L})\times 1) \text{ matrix, for } t = 1, \ldots, T,$$

Z:=$(Z_0,\ldots,Z_{T-1})$ $((1+mL)\times T)$ matrix, and

δ:=$(\bar{u_1},\ldots,\bar{u_T})$ $(m\times T)$ matrix.

These denotations allow for representing the VAR(L) model compactly as

$$Y = DZ + \delta. \tag{6}$$

A Wald statistic for testing the null hypothesis of non-Granger causality, $\mathrm{H}_0: RB = 0$, can be defined as:

$$Wald = (RB)'[R((Z'Z)^{-1}\otimes S_U)R']^{-1}(RB), \tag{7}$$

where $B = vec(D)$ and vec is the column-stacking operator; the symbol $\otimes$ is the tensor product, and R is an indicator matrix of dimension $L\times m(1+mL)$ that consists of ones for restricted parameters and zeros for the unrestricted ones. S_U is the unrestricted variance-covariance matrix, which is estimated as $\mathrm{S}_U = \dfrac{\hat{\delta}_U{}' \hat{\delta}_U}{T-q}$, where q is the number of parameters in each equation of the VAR model. If the normality assumption is fulfilled, then the Wald statistic presented by equation (7) is asymptotically χ^2 distributed with L degrees of freedom. Though, if the data does not have a normal distribution (as many financial variables do not) and if ARCH effects exist then the small-sample null distribution of this statistic differs substantially from the asymptotic one. A solution for this problem is to make use of bootstrap simulations with leveraged corrections. This procedure is implemented as the following. The regression model (6) is estimated with the restrictions under the null hypothesis imposed. Next, the bootstrap data, denoted by Y_t^*, is generated as $Y^* = \hat{D}Z + \delta^*$, where

[6] The initial values are assumed to be available (see Lütkepohl, 2005).

δ^* represents the bootstrapped residuals, which are produced by T independent random draws from the regression's modified residuals. Each bootstrap sample of the bootstrapped residuals is mean-adjusted in order to make sure that the theoretical assumption of mean equal to zero for the residuals is fulfilled. It should be mentioned that the original residuals of the regression are adjusted by *leverages* to account for ARCH effects[7]. Thus, the bootstrapping is based on these modified residuals. The bootstrap simulations are run 10000 times. Each time the Wald statistic is estimated. By this way the distribution of the test statistic is generated. The bootstrap critical value at the α-level of significance (denoted by c_α^*) is obtained by taking the $(\alpha)th$ upper quantile of the distribution of bootstrapped Wald statistic. Lastly, the calculated Wald statistic based on the original data is compared to c_α^* for determining whether or not the null hypothesis of no asymmetric Granger causality can be rejected. This asymmetric test for causality based on leveraged corrections is implemented by using a statistical software component produced by Hatemi-J (2011), which is available on line.

5. Empirical findings

Prior to testing for causality, we tested for multivariate normality and multivariate ARCH effects. The results not reported but available on request showed that these assumptions are not fulfilled. Therefore, we implement bootstrap simulations with leverage corrections in order to create more reliable critical values for each null hypothesis. Since the variables are integrated of the first order, we also included an extra unrestricted lag in the VAR model in order to account for the unit root effect as suggested by Toda and Yamamoto (1995)[8]. The implication of the stock price index being integrated of the first order is consistent with the premise of market efficiency in the weak form. The results of symmetric as well as asymmetric causality tests are provided in Table 1. As it is evident, the null hypothesis that the exchange rate does not cause the stock price index cannot be rejected

[7] Details on leverage adjustment are provided by Davison and Hinkley (1999) for univariate analysis and Hacker and Hatemi-J (2006) for multivariate analysis.

[8] The unit root tests results are not presented to save space. The results are available on request however. The graphical illustrations of the variables are also in line with unit root process.

at any conventional significance level. This is the case regardless if an asymmetric structure is allowed for in the causality testing or not. This could be an indication of the robustness of the empirical results. The interpretation of this empirical result might be that the UAE stock market is informationally efficient with regard to exchange rate fluctuations regardless if these fluctuations are positive or negative.

TABLE 1 - *The Asymmetric Causality Test Results*

NULL HYPOTHESIS	Test Value	Bootstrap CV at 1%	Bootstrap CV at 5%	Bootstrap CV at 10%
$E \neq > S$	2.017	9.141	5.949	4.595
$E^{+} \neq > S^{+}$	3.636	13.533	8.789	6.461
$E^{-} \neq > S^{-}$	5.144	11.642	7.626	6.203

Notes:

1. E represents the exchange rate and S is the stock price index. The vector represents the cumulative positive shocks and represents the cumulative negative shocks.
2. The optimal lag length in the VAR model is set to one based on minimizing the information criterion in equation 4.
3. We tested for multivariate normality using the Doornik and Hansen (2008) statistic. The results showed that the data is not normally distributed. We also tested for multivariate ARCH effects by using a bootstrap test introduced by Hacker and Hatemi-J (2005). The simulations were conducted by the statistical software component provided by Hacker and Hatemi-J (2009). The results showed that the multivariate ARCH effects exist.
4. The max lag order considered is four. The optimal lag order is two for positive and the negative cases and it was two for the data without separating the shocks, based on minimizing equation (4). Both variables are used in logarithmic form.
5. The symbol $A \neq > B$ means that A does not cause B. The denotation CV signifies the critical value.

6. CONCLUSIONS

This paper investigates the causal reaction of the stock market with regard to the exchange rates in the UAE for the period 01:01:2002-07:03:2012. Unlike existing literature on the topic, this paper applies asymmetric causality tests that separate the impact of positive changes from the negative ones. Since the data is not normally distributed with time varying volatility, a bootstrap simulation technique with leverage corrections is used to create reliable critical values. The estimation results reveal that the null hypothesis that the exchange rates do not cause the stock price index cannot be

rejected at any conventional significance level. This is the case when the hypothesis of no causality is tested with regard to negative exchange rate fluctuations or positive ones. Thus, there seems to be no causal link from exchange rates to the stock prices in the UAE.

The financial economic implication of this empirical finding is that the UAE stock market can be considered as informationally efficient with regard to the exchange rate fluctuations regardless if these fluctuations are positive or negative. It should be noted that market efficiency is considered from the perspective of predictability based on the information content of the exchange rate. Thus, forecasts aimed at making arbitrage based on the fluctuations on the exchange rates are not going to be successful in the merging financial market of the UAE.

ABDULRAHMAN AL-SHAYEB
Department of Economics and Finance, UAE University, Al Ain, United Arab Emirates

ABDULNASSER HATEMI-J
Department of Economics and Finance, UAE University, Al Ain, United Arab Emirates

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ABSTRACT

In the increasingly globalized financial markets the impact of exchange rates fluctuations are progressively the center of focus for investors and policy makers. The main objective of this paper is to empirically investigate the causal link between the stock market and the exchange rates in the UAE. This is achieved by implementing new tests for causality that allow for asymmetry in the potential dynamic relationships between the underlying variables. The empirical findings indicate that the exchange rate fluctuations do not cause the stock price fluctuations regardless if the underlying fluctuation is positive or negative. This empirical finding might support the view that the stock market in the UAE is informationally efficient with regard to any type of exchange rates fluctuations.

Keywords: Stock Market, Exchange Rates, Asymmetric Causality, the UAE
JEL Classification: C32, E17

RIASSUNTO

Un esame empirico della potenziale relazione asimmetrica tra mercato azionario e tasso di cambio negli Emirati Arabi

L'impatto delle fluttuazioni dei tassi di cambio sui mercati finanziari globali è sempre più al centro dell'interesse degli investitori e dei *policy makers*. Questo studio si propone di effettuare un'analisi empirica sulla relazione causale tra mercato azionario e tasso di cambio negli Emirati Arabi. A tal fine si applicano nuovi test di causalità che consentono l'asimmetria nelle relazioni tra le variabili considerate. Le evidenze trovate indicano che le fluttuazioni dei tassi di cambio non causano fluttuazioni nel mercato azionario, sia in caso di fluttuazioni positive che negative. Tale risultato supporterebbe l'ipotesi che il mercato azionario degli Emirati Arabi è *informationally efficient* con riferimento ad ogni tipo di fluttuazione dei tassi.