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On the Integration of Emerging Stock Markets in the Middle East

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Results from the Johansen-Juselius test suggest that the Middle East emerging stock markets are segmented globally, but appear highly integrated within the region. Moreover, the Gonzalo- Granger test, in conjunction with error-correction models, indicates that the market in Egypt is a dominant force driving other markets in the region. The apparent segmentation of the markets in the Middle East from the global market implies that these emerging markets provide international investors with potential diversification gains.

I. Introduction

Capital markets across countries or regions may exhibit varying degrees of integration (segmentation). Theoretically, market linkages primarily stem from the "law of one price" that identical assets (physical or financial) should bear the same price across countries after adjusting for transaction costs. Rational (well-informed) investors would, or perhaps should, arbitrage away price disparities, leading to more integrated markets.

The body of empirical evidence suggests that significant capital market integration exists among major industrialized countries, thus limiting the potential benefits from international diversification (Meric and Meric (1989), Koutmos (1996), Sinquefield (1996), Ben Zion *et al*. (1996), Freimann (1998), and Bowe and Mylanidis (1999)). In contrast, linkages among emerging markets and between these markets and other developed markets appear to be relatively weak (Korajczyk (1996), Hakim and Andary (1997), and Bekaert and Harvey (1997)). Under market segmentation, there may be significant potential benefits from investing in emerging markets, and a great deal of research has in fact looked into such possibilities (Errunza (1994), and Ben Zion *et al*. (1996)).

This paper assesses market linkages in the case of three emerging markets in the Middle East; namely, Cairo (Egypt), Casablanca (Morocco), and Amman (Jordan). Each of these markets has been formed relatively recently, and to our knowledge, their possible integration, both within the region as well as globally, has not been examined in the literature.

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These markets provide a good example of newly emerging stock markets with remarkable growth potential (El-Erian and Kumer (1995)).[1] Apparently still isolated from the core of major international markets, preliminary inspection suggests that these markets are sensitive to changes in the countries political structure, have considerable growth potential, but also need to develop structural relations with major foreign markets and other regional stock exchanges.

Using cointegration and error-correction modeling techniques, we explore the pattern and extent to which the three emerging markets are linked among themselves and with international stock markets. We use the U.S. stock market (Standard & Poor 500) to represent the world market in our paper in view of the growing evidence that assigns considerable weight to the U.S. market in the global capital market (see, for example, Eun and Shim (1989), Lin *et al*. (1994), Phylaktis (1997), Ghosh *et al*. (1999), and Darrat and Zhong (2000)).

The rest of the paper is organized as follows. Section II describes the data used and analyzes their stochastic properties. Section III uses the cointegration approach to test for the degree of integration of the three Middle East markets, both regionally and globally. Section IV focuses on the lead/lag relationship among the markets in the context of a multivariate vector-error-correction model (VECM). Section V concludes the paper.

II. Data Used and Their Stochastic Properties

We employ monthly time series of the three Middle Eastern stock markets (Amman, Jordan (J), Casablanca, Morocco (M), and Cairo, Egypt (E)). The data is obtained from the *International Finance Corporation's Emerging Market Data Base (IFC's EMDB)*.[2] The time period covers 35 months from October 1996 through August 1999, the largest possible data set. For the U.S. data, Yahoo's website (http://www.quote.yahoo.com) provides the necessary monthly figures on S&P 500. Figure 1 plots the four time series data used in the paper, while Table 1 displays some relevant descriptive statistics. For risk-neutral investors, the Casablanca market seems to have outperformed both Egypt's and Amman's markets in the sense that it provides a higher average return with a lower, or at least similar, standard deviation. Statistics on the return distribution of each of the three emerging stock markets indicate evidence of non-normality since their distributions appear to be skewed to the right (a normal distribution has 0 skewness).

1. For example, over a ten-year span (1983-1993), capitalization in the Cairo stock market grew by almost fourfold (from $1 billion to about $3.8 billion) and the Casablanca market registered even a more impressive tenfold growth (from $250 million to more that $2.66 billion). Although capitalization of the Amman market grew only twofold (from $2.7 billion to about $4.9 billion), it is the most active of the three markets, where trading volume increased sharply by more than fourfold (from $300 million to almost $1.4 billion). The three markets also showed significant cross-correlations over the estimation period, ranging in absolute terms from 0.50 between Egypt/ Morocco markets to 0.87 for Jordan/Morocco markets.
2. On January 2000, the Standard & Poor 500 completed the acquisition of all IFC indices. Accordingly, the IFC's EMDB has since been published under the name S&P/EMDB.

Figure 1 A Comparison of Middle Eastern Emerging Markets with the U.S. (S&P 500)

Table 1 Descriptive Statistics of Monthly Stock Returns of the U.S. (S&P 500) and Three Middle Eastern Markets
Sample Period: October 1996 - August 1999

	U.S.	Egypt	Jordan	Morocco
Mean	0.019779	−0.000244	0.005822	0.015793
Median	0.022805	−0.031954	0.006840	0.017398
Maximum	0.108330	0.282150	0.105530	0.150470
Minimum	−0.083459	−0.134650	−0.077345	−0.091922
Standard Deviation	0.041203	0.088515	0.038367	0.049696
Skewness	−0.189950	1.535130	0.278820	0.231610
Kurtosis	0.013352	2.550870	1.231870	0.494040

An important property of the data series is their stationarity. The use of non-stationary data yields spurious empirical results (Phillips (1986)), and distorts diagnostic tests (Stock and Watson (1989)). A common procedure for testing unit roots is the Augmented Dickey-Fuller (ADF) test. Results from the ADF test suggest that first-differencing is required to convert all variables to stationary processes (i.e., each ~I(1)).[3] We perform alternative procedures (the Phillips-Perron and the Weighted-Symmetric tests), and the results (available upon request) corroborate the inferences from the ADF test for all variables.

III. Evidence on Integration from Cointegration Tests

In this section, we examine the price linkages within the three Middle Eastern stock markets and investigate their sensitivity to price movements in U.S. stocks. The objective, of course, is to determine whether these markets are integrated from a regional and an international perspective. The traditional approach to investigate these issues is to use regression analysis where one evaluates the correlation of returns across markets as, for example, in Meric & Meric (1989). However, this approach is inappropriate in our case since it presupposes that the time series being examined are stationary (in levels). This presupposition is clearly violated in the case at hand since stock prices in all four markets are non-stationary in levels. Therefore, we rely instead on the theory of cointegration discussed in Engle and Granger (1987) and use the testing procedure developed by Johansen and Juselius (1990).

Briefly, cointegration analysis suggests that two (or more) variables which are not individually stationary may become stationary if expressed in a linear combination of them.

3. For the levels of the variables, the ADF test statistics are −0.94, −1.85, −2.08, −0.65 for Egypt, Jordan, Morocco, and the U.S. markets, respectively. None of these statistics is large enough to reject the null hypothesis of non-stationarity even at the 10% level of significance. The ADF test statistics for the case of first-differences are, respectively, −5.24, −3.73, −3.15, and −4.26, each of which is highly significant at the 5% level. Note that the proper lag lengths in the ADF tests are selected by the Akaike Information Criteria (AIC), and the testing equations include constants but no time trends.

Specifically, if two variables X and Y are both ~I(1) but a linear combination of them (X— β Y) is ~I(0), then they are said to be cointegrated, where β approximates their cointegrating relationship. Naturally, β may not be unique in a multivariate setting. Johansen and Juselius (1990) outline an appropriate maximum likelihood approach for investigating cointegratedness in multivariate time series models. Analyzing cointegration can assess the degree to which the Middle Eastern stock markets are integrated among themselves, and in relation to the U.S. stock market.

We investigate the cointegrating relationships in the context of bivariate, trivariate, and quadrivariate models using the Johansen-Juselius (JJ) test. We examine the following systems:

Bivariate: {M,E}, {M,J}, {J,E}, {M,S}, {E,S}, {J,S}

Trivariate: {J,M,E}, {J,M,S}, {M,E,S}, {J,E,S}

Quadrivariate: {J,M,E,S}

where M = Morocco, E = Egypt, J = Jordan, S = U.S. Given the results from the unit root tests discussed in the preceding section, we perform the cointegration tests on the levels (non-stationary form) of stock prices in all four markets. Since results from cointegration tests may be sensitive to the lag structure chosen for the underlying testing models, we determine the proper lag profile on the basis of the Akaike Information Criterion (AIC) procedure, with the added requirement that the errors be white-noise processes (Gonzalo (1994)). For ease of exposition, we do not report here full details of the results from the maximum eigenvalue and the trace versions of the JJ test for all possible system combinations (these detailed results are available from the authors upon request). Table 2 assembles the test results for only those combinations that reveal significant cointegration linkages.[4] The significant relationships are associated with the bivariate model of Egypt and Jordan, the bivariate model of Egypt and Morocco, and the trivariate model of Egypt, Jordan, and Morocco. Interestingly, the results from the JJ test indicate no significant cointegration between the three Middle Eastern and U.S. stock markets.[5] Of course, such a finding may be seen as statistical evidence for segmentation of the Middle Eastern stock markets from the international market (as represented by the U.S. market). That is, stock prices in the three Middle Eastern stock markets could diverge significantly and permanently from U.S. stock prices. One implication is that investors in Middle Eastern stocks stand a good chance to gain from international diversification of financial risks.

4. The JJ test statistics are corrected for finite sample biases using the adjustment procedure proposed by Reimers (1992).

5. For testing the null hypothesis that the cointegrating rank is zero among the four markets, the λ-max statistic is only 23.87 which is less than the 90% critical value of 25.80; and the trace statistic is also too low at 43.03 compared to the 90% critical value of 49.95. Of course, the 95% critical values suggest even a stronger rejection of the cointegration hypothesis.

Table 2 Johansen-Juselius Cointegration Test Results

H_0=Number of Cointegrating Vectors	Trace Test			Maximal Eigenvalue Test		
	Statistics	C.V. (95%)	C.V. (90%)	Statistics	C.V. (95%)	C.V. (90%)
A. Cointegrating Systems: Stock Prices of Egypt and Morocco						
None	28.46**	25.77	23.08	26.85**	19.22	17.18
At most one	1.61	12.39	10.55	1.61	12.39	10.55
B. Cointegrating Systems: Stock Prices of Egypt and Jordan						
None	26.51**	20.18	17.88	23.70**	15.87	13.81
At most one	2.81	7.53	9.16	2.81	9.16	7.53
C. Cointegrating Systems: Stock Prices of Egypt, Jordan, and Morocco						
None	33.82*	34.87	31.93	20.54*	22.04	19.86
At most one	13.27	20.18	17.88	9.70	15.87	13.81
At most two	3.57	9.16	7.53	3.57	9.16	7.53

Notes: The testing models employ three lags which also yield white-noise residuals according to likelihood-ratio tests. System A incorporates a deterministic time trend, while systems B and C incorporate intercepts. Both trace and maximal-eigenvalue test statistics are corrected for small sample biases using Reimers' (1992) adjustment procedure. Asymptotic critical values are obtained from Osterwald-Lenum (1992).

An * indicates rejection of the null hypotheses at the 90% level of significance, while ** indicate rejection at the 95% level.

At the regional level, the above cointegration results suggest the presence of a long-run (equilibrium) relation connecting the three Middle Eastern markets together. Thus, although one market may drift away from the group temporarily in the short-run, sufficient forces appear to exist inducing that market to divert back to the long-run equilibrium with its regional counterparts. Such forces may be attributed to socio-economic or political factors common in the three markets of these Middle Eastern countries. After all, the three countries share a long history of economic and political cooperation with deep cultural and religious ties. It should not, therefore be totally surprising that their markets are found fundamentally linked.

Another interesting implication from the cointegration results is the absence of any significant cointegrating relation linking Jordan with Morocco. Only when Egypt is included to form a trivariate model would the three Middle Eastern markets show evidence of integration. This, of course, suggests the importance of the Egyptian market in regional integration. Given its critical policy implication, we address this issue in perhaps a more direct way by testing for the common long-memory components of the cointegrating system. This test, recently developed by Gonzalo and Granger (1995), identifies the main force (s) driving long-run relationships in cointegrated systems. For the null hypothesis that the Egyptian market is not a main driving force in the region, the likelihood-ratio ($\div^2$) test statistic is quite large (=6.85) permitting a strong rejection of the null at better than the 5% level of significance (the 5% critical value = 5.99 with d.f. = 2, where d.f. is equal to $v - r$ where v is the number of variables in the system (=3) and r is the rank of the cointegrating vector (=1)).

Taken together, the message from these results for international portfolios is that the three Middle Eastern markets are regionally integrated and thus each market offers little diversification over another. This feature may not be so bad, however, because it also suggests that these markets obey the "law of one price" across their borders, whereby stock prices in each country in the region are equalized by the force of arbitrage. However, restrictions on capital flows and other barriers would metastasize their integration. From that perspective, regional integration between the three Middle Eastern markets is a step forward towards market efficiency and a better allocation of scarce resources in the region. It is therefore not surprising that these three countries have all recently taken major steps toward privatization and trade liberalization. Globally, however, the three Middle Eastern markets appear segmented from major international markets like that of the U.S. and, as such, could provide investors considerable benefits from international diversification.

IV. Causal Relationships Among Middle Eastern Stock Markets

The presence of cointegration among the three Middle Eastern stock markets implies, by virtue of Granger's (1991) Representation Theorem, that Granger-causality exists among these markets in at least one direction. In this section, we conduct some tests to identify the direction of these causal relationships. Briefly, if ÄY and ÄX are two stationary series, the Granger concept of causality rests on the question of whether the current ÄX is linearly informative about the future of ÄY, and if so, then X is said to Granger-cause Y. This would require that the event ÄX precedes the event ÄY, or that past history of ÄX significantly contributes in the forecast of current ÄY.

To conduct the Granger-causality test, each series is represented as a vector autoregression and regressed on its own lag and those lags of other variables. To examine the causal linkages among cointegrated markets, we specify and estimate vector error-correction model (VECM) of the form (time subscript t is omitted for simplicity):

$$ÄJ = a_0 + a_1 L\,ÄJ + a_2 L\,ÄM + a_3 L\,ÄE + a_4 L\,EC + u_1, \quad (1)$$

$$ÄM = b_0 + b_1 L\,ÄJ + b_2 L\,ÄM + b_3 L\,ÄE + b_4 L\,EC + u_2, \quad (2)$$

$$ÄE = c_0 + c_1 L\,ÄJ + c_2 L\,ÄM + c_3 L\,ÄE + c_4 L\,EC + u_3, \quad (3)$$

where L is the lag operator ($LZ=Z_{t-1}$), EC is the error-correction term distilled from the JJ's efficient estimations, the u's are white-noise disturbance terms, and Ä denotes first-differences as required to induce stationarity in the variables.

As Granger (1988) points out, neglect of the error-correction term when testing for causality among cointegrated variables leads to serious biases due to filtering out low-frequency (long-run) information. Another advantage of specifying and estimating the above VECM is that two sources of causality can be identified (see Perman (1991)). There is, on the one hand, the traditional channel of causality through lagged independent variables (representing short-run causality) and, secondly, there is also the additional causal effects through the error-correction channel (representing long-run causality).

Table 3 reports the test-statistics we obtain from estimating the above VECM. To enhance the statistical efficiency of our estimations, we pooled the three equations together and estimated them jointly by Zellner's seemingly unrelated regression (SUR) procedure. The results in Table 3 suggest that none of the independent variables in the Egypt and Jordan equations (except for the EC term in the Egyptian equation) is statistically significant, suggesting that neither market is influenced by its regional counterparts in the short-run. However, a different picture emerges from the results for the Moroccan market. Specifically, the null hypotheses that stock prices in Egypt and in Jordan do not cause significant short-run changes in the Moroccan stock prices are soundly rejected at the 5% level of significance. Therefore, in addition to strong cointegrating linkages among the three Middle Eastern markets in the long-run, discussed earlier, results from the VECM estimations reported in Table 3 indicate that there are also significant relationships connecting these markets in the short-run as well. Observe also that significant EC terms reported in Table 3 further support the presence of long-run (causal) relationships among the Middle Eastern markets.

Table 3 Joint VECM Test Results of Granger-Causality

	Lagged ÄE	Lagged ÄJ	Lagged ÄM	Lagged EC
ÄE	1.17	1.02	1.51	−2.41**
ÄJ	1.35	0.06	0.08	−1.30
ÄM	3.76*	6.40**	3.24*	−1.98**

Notes: E = Egypt's stock prices, J = Jordan's stock prices, M = Morocco's stock prices; Ä = first-difference operator; an * indicates rejection of the no-causality hypothesis at the 10% level of significance, while ** indicate rejection at the 5% level. Statistics on lagged EC terms are t-ratios and measure long-run causality, while statistics on lagged independent variables are F-values and assess short-run causality.

Two further implications can be deduced from Table 3. First, the results reveal that the markets in Egypt and Jordan may provide useful information to forecast stock prices in the Moroccan market, but not the reverse. It is, therefore, tempting to argue that the market in Morocco is informationally less efficient than those in Egypt and Jordan. Secondly, from a technical standpoint, the causality results indicate that the strong correlations commonly observed among the three Middle Eastern markets (see footnote 1) appear primarily the outcome of the markets in Egypt and Jordan unidirectionally causing movements in the Moroccan market.

Taking a more global perspective, it is interesting to check whether the markets in Egypt and Jordan remain exogenous internationally, or instead they are endogenous to the U.S. market. It is, of course, possible that changes initially originate in the U.S. stock market, and then spillover to markets in Egypt and Jordan which in return influence the Moroccan market. To explore the possibility of short-run spillover effects from the U.S. market,[6] we add a column vector consisting of the first-differences of the S&P 500 - its stationary format - to the previous VECM system. The results (available from the authors upon request) do not

6. Note that the emphasis here is on short-run relationships since cointegration tests deny the presence of any long-run linkages between the three Middle Eastern markets and that of the U.S.

reveal any significant impact of the S&P 500 on any of the three Middle Eastern markets (the t-values for the S&P 500 variable are −0.07, 0.65, and 0.22 in the equations for Egypt, Jordan, and Morocco, respectively. None of these statistics is statistically significant even at the 10% level with a critical value of 1.77). We should further note that the inclusion of the S&P 500 variable in the VECM system does not alter our previous inferences regarding the significant role of the Egypt and Jordan markets in determining stock prices in Morocco (the corresponding t-values are 1.94 and 2.52, both of which maintain their statistical significance at the 5% level). These VECM results accord well with those deduced from the cointegration analysis and suggest that the three emerging markets in the Middle East are integrated within their region, but largely segmented from the U.S. market.

V. Summary and Conclusion

Our main purpose in this paper is to investigate the degree to which three emerging markets in the Middle East are integrated, both regionally and globally. Empirical results deduced from the Johansen-Juselius (JJ) efficient approach suggest the presence of a stable relationship linking the three markets over the long-run. The cointegrating relationship represents a stabilizing equilibrium force in the sense that stock prices in these emerging markets are unlikely to drift apart permanently from each other. We also find some statistical evidence, based on the Gonzalo-Granger (1995) test of common long-memory components, that the Egypt market is a dominant force in the region. Therefore, the Egypt market appears to shoulder considerable responsibility toward financial stability of the Middle Eastern region. Internationally, results from the JJ test reject the presence of any significant long-run equilibrium relationship between the three Middle Eastern markets (whether individually or as a group) with the global market as approximated by the U.S. market. This is statistical evidence that, although regionally integrated, the three Middle Eastern markets appear segmented globally.

Besides long-run linkages, we also address possible short-run market interactions using the Granger-causality approach in the context of VECM analyses. The empirical results suggest that short-run causality primarily run from the markets in Egypt and Jordan to that in Morocco, without feedback. This is yet another indication pointing to the importance of the market in Egypt in the regional context. In addition, the VECM results provide further evidence for the insensitivity of the three Middle Eastern stock markets to movements in the U.S. market since short-run effects of U.S. stock prices prove statistically insignificant for all three markets in the region.

The message of these results for international investors appears clear. The three emerging markets in the Middle East offer diversification potentials for international investors. Since the body of evidence in support of the integration of major world stock markets is quite impressive, international investors often search for new emerging markets which offer the risk-reward trade-offs they cannot get in more matured markets. Our results suggest that Middle Eastern markets may have such potential benefits. Stocks in these markets can minimize the risk of spillovers from other foreign markets (like the U.S. market) and may thus limit the contagion effects which inflect more globally integrated markets. The apparent segmentation of the three Middle Eastern markets suggests that these markets are

not only emerging, with enormous growth potentials, but they may also offer international investors diversification benefits unavailable elsewhere.

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