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FURTHER EVIDENCE ON THE LINK BETWEEN FINANCE AND CYCLICAL FLUCTUATIONS

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Abstract

This paper explores the possibility that financial market development mitigates cyclical fluctuations in several developing countries. The paper uses the GARCH approach to account for the time-varying behavior of macroeconomic volatility, and distinguishes between overall and sectoral macroeconomic volatility. Results from co-integration and error-correction models suggest that financial market development (alternatively measured) does exert a robust long-term dampening effect on macroeconomic volatility. In contrast, short-term effects of financial development on cyclical fluctuations are generally tenuous, or non-existent. These findings imply that financial reforms can contribute to macroeconomic stability, but only if these reforms persist over a prolonged period of time. The results also suggest that financial reforms impact economic sectors differently across the countries examined.

I. Introduction

The relation of financial market development to economic growth has been the subject of immense discussion and debate for many years, at least ever since the publication of Gurley and Shaw's (1960) seminal work. Theory shows that the creation and promotion of efficient financial markets (institutions) are necessary for a genuine and enduring economic growth process. Financial markets can ameliorate risk, improve corporate governance, mobilize savings, reduce transaction and information costs, and promote specialization [Gertler (1988), Bencivenga and Smith (1992), and Levine (1997)]. These theoretical conjectures receive considerable empirical support from numerous studies, and for a large group of countries [examples include Goldsmith (1969), King and Levin (1993 a, b), Levine and Zervos (1998), Rajan and Zingales (1998), and Darrat (1999)].

In contrast to the outpouring of research on the impact of financial development on economic growth, empirical work on the relation of financial development to macroeconomic volatility has been relatively scant. This neglect is surprising for at least two reasons. First, the issue of macroeconomic volatility is profoundly important for policy-makers attempting to mitigate the severity of business cycles. Smoothing out business cycles is a key objective of public policy since countries with lower macroeconomic volatility tend to grow faster [Ramey and Ramey (1995)]. Second, theory also supports a relation between financial development and macroeconomic volatility. Well-developed financial markets provide a closer match between savers and investors that help the macro economy absorb shocks more easily (Aghion, Banerjee, and Piketty, 1999). Financial deepening could also promote diversification (divisibility of investment projects) which can reduce risk and dampen cyclical fluctuations (Acemoglu and Zilibotti, 1997). In addition, financial market development mitigates information asymmetries and enables economic agents to process information more efficiently resulting in lower macroeconomic volatility (Greenwald and Stiglitz, 1993).

Although sparse, some recent empirical findings are, at least indirectly, consistent with these theoretical conjectures. Ramey and Ramey (1995), for example, examine cross-section data from many countries and report a negative correlation between macroeconomic volatility and growth. Since financial development is a significant growth determinant, Ramey and Ramey's evidence could be taken to imply the presence of a negative relation between macroeconomic volatility and financial development. Easterly, Islam, and Stiglitz (2000) also find empirical results suggesting that the amount of credit available to the private sector is critical for reducing investment and output fluctuations in several countries. Furthermore, Darrat (2001) argues that banking reforms improve the economic performance of some countries and smooth out their business cycles.

This paper extends empirical research on the role of financial market development in dampening macroeconomic volatility by examining the case for a group of MENA (Middle Eastern and North African) countries. Almost without an exception, the MENA countries have devoted enormous attention and a great deal of scarce resources to improving the scope and operation of their financial markets on the presumption that financial deepening is a pre-condition for sustained economic growth. Their presumption is partly based on the fact that key international financial institutions, such as the World Bank and the International Monetary Fund, have persistently argued that efficient financial markets are a catalyst of growth in developing countries. Consequently, several MENA countries have, and for many years now, pursued reform programs to improve their financial markets. Think tank organizations in the region, like the Economic Research Forum (ERF), seem to have endorsed similar policy moves.[1] In this light, it seems useful to investigate whether policies that promote financial market development in the MENA region are beneficial, not only for achieving a higher degree of economic growth, but also for maintaining economic stability and for smoothing out the severity of business cycles in the region. To our knowledge, this is the first attempt to study these issues, at least for countries in the MENA region.

The remainder of the paper is organized as follows. Section II provides a brief account of important measurement issues. Section III discusses key descriptive statistics. Section IV outlines the data and the statistical methods. Section V reports the empirical results. Section VI concludes the paper and offers some policy implications.

II. Measurement Issues

The focus of this paper is on the impact of financial market development on macroeconomic volatility in the MENA region. An important preludial task is to find proper measures of financial market development and macroeconomic volatility. We should note that financial markets, outside banks, are highly rudimentary in most developing countries. Therefore, researchers working with data on these countries typically use financial markets and banking systems interchangeably (McKinnon, 1973; Khan, 1980; Driscoll and Lahiri, 1983; and King and Levine, 1993 a, b)). Since financial development is most likely multi-dimensional, we use here two alternative proxies. The first (dubbed FD1) is the inverse of the broad-money income velocity, that is, the ratio of broad money stock (M2) to nominal GDP. This measure of financial development--which McKinnon (1973) and Shaw (1973) initially proposed, and King and Levine

[1] For example, the ERF hosted a major conference in 1996 in the United Arab Emirates, that was entirely devoted to financial market development in the region. Most conferences and research endeavors of the ERF pay a great deal of attention to the development of financial markets and institutions.

(1993a,b) used--is often called themonetization ratio. It reflects the relative size, or the depth, of the financial market. An increase in FD1 indicates further expansion in the financial (intermediary) sector relative to the rest of the economy.

The second proxy of financial deepening (dubbed FD2) is the ratio of demand deposits at banks to the narrow money stock. Vogel and Buser (1976) argue that this proxy represents the complexity, or sophistication, of the financial market (particularly banks). An increase in FD2 implies a higher degree of diversification of financial institutions and a greater availability or use of noncurrency balances (bank deposits) in the transaction process [2].

To measure macroeconomic volatility, we distinguish between overall macroeconomic volatility (volatility in real output growth) and sectoral macroeconomic volatility (volatility in the growth rates of real consumption and real investment). Such sectoral disaggregation is useful for it can reveal whether financial deepening has different influences on the household and business sectors. This information, masked by aggregation, is important for policy-makers attempting to reduce risk in a particular sector of the economy. It is possible, for example, that financial market development reduces business risk in a given country, while it could only dampen consumption risk in another.

A common measure of volatility in economic and financial time series is the standard deviation. However, this measure ignores pertinent information on the random process generating the variable in question (Engle, 1982). Standard-deviations also distort the volatility pattern due to smoothing (Bini-Smaghi, 1991). While heteroskedastic errors (time-varying variances) are typically thought to be a problem in cross-section data, recent econometric research shows that this problem can also befoul time-series data. A superior approach is the Generalized Auto-Regressive Conditional Heteroskedasticity (GARCH), initially proposed by Bollerslev (1986). Based on the work of Engle (1982), the GARCH model parameterizes time-varying conditional variances and covariances of stochastic processes. Applied literature has witnessed an explosion in using the GARCH approach to model volatility of numerous economic and financial time-series data (see for example, Chou, 1988; Lamoureaux and Lastrapes, 1990; Sentana and Wadhwani, 1992; Mills, 1993; Cuthbertson, 1996; and Darrat and Zhong, 2000).

A GARCH (p,q) model expresses the conditional variance of a given time series (σ^2) as a linear function of (p) lagged squared errors and (q) lagged variances. Since estimation is difficult with large values of p and q, researchers usually assume p = q = 1 (Cuthbertson, 1996; and Ng, 2000). A GARCH (1,1) process can be written as:

$$\sigma_t^2 = \beta_0 + \beta_1 \varepsilon_{t-1}^2 + \lambda \sigma_{t-1}^2 \qquad (1)$$

where ε_{t-1}^2 is the squared errors, lagged once. We distill these errors from regressing the variable in question on a constant. Note that only lagged (and thus available) information is used to predict variances in the GARCH approach, and it is in this sense that the resultant variance is called "conditional." The conditional variance, thus specified, is a function of three factors: the mean (E_0), news about volatility from the previous period (ε_{t-1}^2), and the last period variance (σ_{t-1}^2). Consequently, we predict the current period's variance from a weighted average of a persistent term (the constant factor), the forecasted variance from the last period (the GARCH factor), and from information about volatility observed in the previous period (the ARCH factor). We use this GARCH model to calculate the volatilities of real GDP growth, real consumption growth, and real investment growth in the MENA countries.

III. Descriptive Statistics

This paper examines the experience of four MENA countries; namely, Egypt, Jordan, Saudi Arabia, and Tunisia. A primary reason for selecting these particular countries in the region is the availability of consistent data on all necessary variables, and that these economies have also undergone a variety of economic growth experiences. Perhaps more than others in the region, governments in these four developing countries have devoted increasing attention to the operation of their financial markets. Therefore, studying implications for business cycles of such financial reforms appear warranted.

Our sample covers the annual period of 1970-1999, the longest possible time span. Table 1 below reports the main characteristics of the data across the four MENA countries. As the table shows, Saudi Arabia has the highest average annual growth rate of real GDP (= 6.59 percent), while Egypt has the worst (negative) real GDP growth rate (= -2.79 percent). Tunisia comes second, after Saudi Arabia, with a real GDP growth rate of 4.35 percent per year. Although Jordan escaped the economic downturn of Egypt, it achieves only 1.68 percent annual real GDP growth over the estimation period. Perhaps more importantly, the growth rates of real GDP in all four MENA countries show considerable variations from their mean. The sample standard deviations of real GDP growth rates are quite large, ranging from 22.06 percent for Saudi Arabia, to 13.09 percent in Tunisia. Such large standard deviations suggest a high degree of volatility in the growth experience of the four MENA countries.

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[2] Although both measures of financial market development have been extensively used in the literature, these measures are not without drawbacks. Other measures, like the ratio of claims on the nonfinancial private sector to total domestic credit, could not be used here due to data limitations.

The statistics in Table 1 also indicate that, across the four MENA countries, the private (business) sector is more volatile than the household (personal consumers) sector, though both sectors exhibit a high degree of volatility. Of course, this feature is not unique with the MENA region and generally characterizes most other economies as well [Gordon (2000)]. Besides dissimilar sectoral variability across the four MENA countries, private investment and personal consumption are also different in their rates of growth. Except for Saudi Arabia, the average growth rate of real investment is generally higher than that of real consumption in the MENA region. As to Saudi Arabia, real consumption and real investment have similar growth averages over the period (about 8 percent each).

Thus far, we compare the sample averages of standard deviations of the growth rates of real GDP, real consumption, and real investment. To analyze changes over time, we use the GARCH approach to measure volatility. Figure 1 plots the standard deviations (square roots of variances) obtained from GARCH (1,1) models. It is clear from the figure that Egypt has the highest degree of volatility of real GDP growth, and Tunisia has the lowest degree of volatility, compared to the other two MENA countries in the sample[3]. Thus, while simple (unconditional, time-invariant) standard-deviations (reported in Table 1) and the corresponding GARCH estimates provide similar conclusions for Tunisia (being the country with the lowest degree of volatility of real GDP growth), the two alternative volatility measures differ in terms of their selection of the country with the highest volatility (the simple standard deviation measure selects Saudi Arabia, but the GARCH model selects Egypt). Consistent with estimates from simple standard-deviations, the GARCH model also suggest that real investment growth displays a higher degree of volatility than that of real consumption growth in the MENA countries.

Looking at measures of financial market development, Jordan has the highest mean of FD1 (= 96 percent) among the four MENA countries, while Saudi Arabia has the lowest FD1 (= 38 percent). This implies that Jordan has the largest monetary sector relative to the size of the economy, while Saudi Arabia has the smallest monetary sector, among the four MENA countries. Inspection of Figure 1 also suggests that most expansion in the monetary markets in the four MENA countries occurred around the mid 1980s. The availability of financial institutions and the public's banking habit (as represented by FD2) appear relatively high in Saudi Arabia and Tunisia (about 60 percent in both countries). For Egypt and Jordan, their FD2 ratios reach about 35 percent, implying that currency in Egypt and Jordan is probably a more popular means of payment than bank deposits are (by almost two-to-one margin). This suggests that there might be an insufficient number (or diversity) of banking institutions in Egypt and Jordan, or perhaps the public in the two countries lack familiarity with the available financial institutions and with the services they provide. The plots further reveal that Saudi Arabia witnessed a gradual and persistent increase over the years in the bank deposit ratio, while the other three countries did not. This seems to imply that, unlike other countries in the region, Saudi Arabia has had a steady improvement over the period in the diversification level of her financial institutions.

As we discussed in the introduction section, there are some theoretical bases for expecting a close link between financial market development and the degree of macroeconomic volatility. This potential link may also be gleaned from the plots in Figure 1, especially in the case of Jordan and Tunisia. Changes in one or more volatility measures tend to be associated with similar movements in financial market development. However, the relations are not sufficiently tight to discern whether financial deepening is a significant explanatory variable for macroeconomic volatility in any of the four MENA countries over the past three decades. The time patterns of these relations are not clear either. To distill a more definitive conclusion about the link between financial deepening and macroeconomic volatility, we turn now to a formal statistical analysis.

IV. Data and Methodology

Our data span the period from 1970 through 1999, and they come from the *International Financial Statistics Database CD-ROM* of the International Monetary Fund. We measure all variables in millions of U.S. dollars, and use the GDP deflator to get corresponding real figures.

The statistical approach in this paper follows multivariate Granger-causality tests in the context of cointegrated systems[4]. Briefly, a stationary time series (x_t) is said to Granger-cause another stationary time series (y_t) if the prediction error from regressing (y_t) on (x_t) significantly declines when using past values of (x_t) in addition to past values of (y_t). Granger-causality tests require stationary variables (e.g., whose stochastic properties are time invariant). The use of nonstationary time series in a given model yields spurious regressions (Granger and Newbold, 1974; and Phillips, 1986). Moreover, Stock and Watson (1989) also show that the usual tests and diagnostic statistics (like t, F, DW, and R^2) become invalid under nonstationarity since they will exhibit nonstandard distributions.

Granger (1986) demonstrates that a nonstationary time series (Z_t) can become stationary if differenced appropriately. To find the proper order of integration

[3] The average GARCH values are 16.09 percent for Egypt, 15.75 percent for Jordan, 13.43 percent for Saudi Arabia, and 12.19 percent for Tunisia.

[4] We attach the name "Granger" to "cause" since controversy still surrounds the Granger concept of causality which somewhat differs from the definition of causality in the strict philosophical sense. In fact, tests of Granger-causality are essentially tests of the "incremental predictive content" of economic time series. See Bishop (1979) for a fruitful discussion.

(differencing), we use the Augmented Dickey-Fuller (ADF), the Perron–Phillips (PP), and the Weighted-Symmetric (WS) testing procedures. We utilize several testing procedures to ensure that our inferences regarding the stationarity requirements are reasonably robust.

Stationary series, albeit desirable, can also filter out low-frequency (long-run) information if the variables in the model are in fact cointegrated. A nonstationary variable, by definition, tends to wander extensively over time, but a pair of nonstationary variables might have the property that a particular linear combination would keep them together, that is, they do not drift too far apart from each other. Under this scenario, the two variables are said to be cointegrated, or possess a long-run (equilibrium) relation. Examples of possibly cointegrated economic and financial time series are short and long-term interest rates, consumer prices and money supply, and consumption and income. Equations estimated with stationary variables, but without regards to the underlying cointegration, are inappropriate due to the possibility of an omitted-variable bias. Of course, the concepts of cointegration and causality are closely related. Granger (1986) shows that if cointegration exists between any two or more variables, then there must be Granger-causality flowing between them in at least one direction. In this paper, we test for possible cointegration among the variables using the Johansen (1988) efficient approach. Evidence in Cheung and Lai (1993) and Gonzalo (1994), among others, supports the use of the Johansen approach over several alternative tests, including the Engle and Granger (1987) two-step procedure.

Engle and Granger (1987) demonstrate that a system of cointegrated variables can be represented by a dynamic error-correction model (ECM) through the Granger's (1986) Representation Theorem. Specifically, to the model containing stationary variables, we add the residuals (lagged once)[5] that are obtained from the underlying cointegrating (long-run) relation. These residuals are called the error correction (EC) term whose coefficient reflects the process by which the dependent variable adjusts in the short-run to its long-run equilibrium path. Interestingly, the EC term provides another channel through which Granger-causality can occur, in addition to the traditional channel through lagged independent variables (see Jones and Joulfaian, 1991; and Granger and Lin, 1995). In particular, the EC term represents long-run Granger causality, while the traditional channel reflects short-run Granger-causality.

Before turning to our empirical results, an important comment remains pertaining to the fact that factors besides financial development might also influence the degree of macroeconomic volatility. Potential candidates include the volatilities of money growth, the exchange rate, the size of the government sector, and the degree of economic openness. Volatilities of economic openness and the exchange rate are necessary to control for the possible effects of external shocks. On the other hand, volatility of the government size could be important given the common perception that governments play a key role in shaping economic activities, especially in developing countries. Finally, money growth volatility is considered here in recognition of Friedman's (1984) hypothesis that money growth volatility exerts a significant effect on business cycles through interaction with the underlying money velocity. This Friedman's hypothesis receives empirical support from Hall and Noble (1987), among others.

Therefore, our basic bivariate model (containing a financial development measure and a macroeconomic volatility measure) could be seriously biased if one or more of the above candidates are correlated with either of the basic two variables (Lutkepohl, 1982). To avoid this potential problem, we control for the possible additional effects of the above four candidates. We also use the GARCH model to obtain the volatilities of the additional four variables. We measure money supply by M1; the exchange-rate by the rate between local currencies and the SDRs[6]; the size of the government sector by government spending as a share of GDP; and economic openness by the ratio of exports plus imports to GDP. The data on these variables are similarly measured in millions of U.S. dollars and are compiled from the same source, the *International Financial Statistics Database*. Preliminary results suggest that volatilities in the government size and in economic openness are insignificant contributors to macroeconomic volatility.[7] In contrast, volatilities of money growth and of the exchange rate generally prove important determinants of macroeconomic volatility across the four MENA countries. Therefore, our volatility growth models of real output, real consumption, and real investment discussed in the next section contain three explanatory variables (besides own lagged values): an index of financial market development, volatility in money growth, and volatility in the exchange rate.

IV. Empirical Results

We begin our empirical investigation by testing for nonstationarity (the presence of unit roots) in all variables. For each of the four MENA countries, we have five series. These are: the volatility of real output growth (XGV), the volatility of real consumption growth (CGV), the volatility of real investment growth (IGV), the volatility of money growth (MGV), the financial-market depth measure (DF1), and the financial-market sophistication measure (FD2). All volatility measures

[5] Additional lags of the error-correction term are unnecessary since they are already reflected in the distributed lags of the other explanatory variables, see Miller (1991).

[6] We use the bilateral exchange rate relative to the SDRs since local currencies in most MENA countries are typically fixed relative to the U.S. dollar.

[7] Of course, economic openness might become redundant in the presence of the exchange rate, and the government size could only influence the level (not the variability) of economic growth.

are the square-roots of time-varying variances obtained from GARCH (1,1) models.

Next, we examine the two groups of variables (five volatility series and either of the two financial development measures) to see if each variable is individually stationary. Table 2 reports the unit root results for the four MENA countries from the ADF, PP, and WS tests. These results suggest that each variable across the four countries is stationary in first-differences not in levels. Accordingly, we use all variables in their first-differences in the subsequent Granger-causality tests to avoid the problem of spurious regressions. Since each variable contains a unit root, it is possible that the variables, as a group, share a common root and thus become cointegrated.

We use the Johansen (1988) efficient approach to test for cointegration among the two groups of variables (the first group uses FD1 to measure financial deepening, and the second uses FD2). Given the brevity of our sample, the cointegration tests incorporate one annual lag, provided that the errors are also white-noise [Gonzalo (1994)]. Otherwise, we extend the lag beyond one annual lag. Note that the estimation period spans 30 years (from 1970 to 1999) and, as such, should be sufficiently long for conducting cointegration tests [Hakkio and Rush (1991)]. Nevertheless, we guard against possible finite sample biases by correcting the Johansen test statistics (both the maximal eigenvalue and the trace) using Reimers' (1992) correction procedure.

Tables 3-A through 3-D report the multivariate cointegration results from the Johansen test for the four MENA countries using FD1 and FD2 to measure financial market development. As is clear from all these tables, there is a significant cointegrating relation binding financial market development (however defined) and macroeconomic volatility (however defined) across all four MENA countries. This inference is supported by the maximal eigenvalue and by the trace statistics of the Johansen test. Both of these statistics are sufficiently large to reject the null hypothesis of no cointegration among financial market development and macroeconomic volatility across all countries at least at the 95 percent level of significance. Indeed, in several cases, the Johansen test indicates the presence of more than one significant cointegrating vectors. Such a finding lends additional strength to the underlying long-run (equilibrium) relations since it suggests that these cointegrating relations are robust in more than one direction (Dickey, Jansen, and Thornton, 1991). We can thus conclude that financial market development is reliably linked over the long-run to macroeconomic volatility in the four MENA countries.

The presence of potent cointegrating (long-run) relations clear the way to specify error-correction models (ECMs) to investigate the extent of dynamic (short-run) links between financial market development and macroeconomic volatility in the four MENA countries. As we discussed earlier, the presence of significant cointegration implies, *a l*< Granger's (1986) Representation Theorem, that causality between the two variables must exist in at least one direction. In this paper, we are interested in pursuing whether financial market development Granger-causes (negative) changes in macroeconomic volatility[8].

For each of the four MENA countries, we estimate six separate ECMs. That is, with FD1 as the measure of financial market development, we estimate an ECM using the volatility of real output growth as the dependent variable, another ECM with the volatility of real consumption growth as the dependent variable, and a third ECM with the volatility of real investment growth as the dependent variable instead. Similarly, we estimate three more ECMs using FD2 (instead of FD1) for each of the four MENA countries. This process yields a total of 24 ECMs for the four MENA countries. To conserve space, we only report here the ECM results using FD1 as the measure of financial market development. Results using FD2 are qualitatively similar and are available from the authors upon request. Note also that specifying multivariate ECMs with long lags can quickly deplete scarce degrees of freedom, especially in small samples. Therefore, we limit our lag profiles in the ECMs to one year. We experimented with higher lags but the results (available upon request) yield similar conclusions. In a few cases, the estimated ECMs show evidence of structural instability according to the Chow test. Therefore, we include a (0,1) dummy variable in these equations to represent the Gulf War. The dummy variable takes the value of one for every year over 1990-1999, and takes the value of zero otherwise. Finally, also in a few cases, the estimated regressions show significant serial correlation, and we use the maximum likelihood procedure (AR1) to correct for the problem.

Table 4 reports the final ECM regression estimates for the MENA countries. These results prove statistically adequate with reasonably high R-squares that range from 0.21 to 0.90[9]. Furthermore, the results evince no significant problems of autocorrelation or misspecification according to the Durbin-h, Breusch-Godfrey, and Ramsey's RESET tests. Another important finding is that the measure of financial market development displays the theoretically correct (negative) sign in the estimated ECMs. That is, consistent with the underlying theory, higher financial market development dampens macroeconomic volatility[10].

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[8] We make no attempt in this paper to test for a "reverse" Granger-causality running from macroeconomic volatility to financial market development. Such causality, if it exists, is irrelevant to the central theme of this paper.

[9] Observe that the variables are measured in growth rates (percentages). Therefore, the values of R-squares are not spurious. See Granger and Newbold (1974).

[10] Results in Table 4 use FD1 to measure financial development in all cases, except for two cases where FD2 is used instead. These two exceptions are the equation of output-growth volatility for Jordan, and the equation of consumption-growth volatility for Tunisia. Coefficients on FD1 in these

The most striking result from the ECM equations reported in Table 4 is the high statistical significance of the coefficients on the lagged error-correction terms (ECTL) in almost all equations (9 out of 12 equations). This inference corroborates our earlier findings from the Johansen test and supports the presence of robust cointegration relations linking financial market development with macroeconomic volatility in the four MENA countries. At least two other implications follow from this inference. First, research on the role of financial development in business cycles, particularly in the case of developing economics, should incorporate possible cointegrating relations in the model to avoid specification biases. Second, the above inference also implies that financial development Granger-causes significant reductions in macroeconomic volatility in the four MENA countries over the long-term. By contrast, lagged coefficients on the financial development variable (FD1) fail to achieve statistical significance (at the 5 percent level) in almost all equations (11 out of 12 cases). Indeed, the lagged financial development measure achieves significance at only the weaker 10 percent level, and then only in 4 cases. The majority of the ECM equations provide virtually no support for any significant short-term effect of financial market development on economic volatility. Clearly, these results indicate that, in contrast to potent *long-run* effects, *short-run* Granger-causality effects from financial market development to macroeconomic volatility are very tenuous, or non-existent, in all four MENA countries under examination.

Finally, the results reported in Table 4 also support our theoretical contention that financial market development influences economic sectors differently in the four MENA countries. In particular, financial development in Egypt and in Jordan significantly and quickly (in the short-run) dampens the volatility of investment growth, but has no short-run effects on consumption volatility. The opposite occurs for Saudi Arabia, where financial market development rapidly mitigates short-run volatility of consumption, though without any short-run impacts on the volatility of investment.

Therefore, policy-makers in Egypt and Jordan could rely on financial market development to smooth out short-run cyclical fluctuations in the investment sector. However, financial development seems unable to produce similar short-run cyclical benefits in the case of Saudi Arabia.[11] On the other hand, financial development in Tunisia can contribute to economic stability, but only over the long-term.

VI. Conclusions and Policy Implications

This paper explores empirically the possibility that financial market development reduces macroeconomic volatility in four countries in the MENA region (Egypt, Jordan, Saudi Arabia, and Tunisia). We use alternative measures of financial market development (the depth of financial markets and the degree of their complexity), and we distinguish between overall macroeconomic volatility (volatility in real output growth) and sectoral volatility (volatility in real consumption growth and volatility in real investment growth). To avoid possible misspecification, we expand the model by including theoretically relevant variables. We use the GARCH approach to estimate volatility, and utilize the Johansen efficient approach to test for multivariate cointegration among the variables. We also estimate error-correction models (ECMs) to study short-run dynamics. The estimation period spans 30 years (1970 through 1999).

Results from cointegration tests provide decisive support for the contention that financial development (however measured) shares a robust long-run relation with macroeconomic volatility (both overall and sectoral) across the four MENA countries. Therefore, failure to account for such pronounced cointegrating relations between the two variables, at least in the context of the MENA region, can lead to serious biases and incorrect inferences.

Estimates from ECMs provide additional support to these cointegration inferences as the error-correction effects prove statistically robust. The results imply the presence of important long-run Granger-causality effects flowing from financial market development to macroeconomic volatility. Over the short-run, however, the results suggest that Granger-causality effects of financial deepening on macroeconomic volatility are generally very tenuous, or non-existent. These findings suggest some difficulty for policymakers in the MENA region in their attempt to achieve economic stability. This is because programs to improve financial markets and institutions in the region will likely require a long time to reduce cyclical fluctuations. Such delayed impacts could defuse interest in these programs and fuel the misguided impression that improving the scope and operation of financial markets and institutions are ineffective for achieving economic stability. However, the results in this paper unambiguously reject this posture, at least for long-term considerations. Our finding that financial market development requires a relatively long time to dampen macroeconomic volatility primarily suggests that financial reforms in the MENA region should persist over

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equations yield perverse (positive) signs, while FD2 displays the correct theoretical (negative) signs. Moreover, the two equations with FD1 continue to show signs of structural instability and misspecification, whereas equations with FD2 do not. These results provide some support for Darrat's (2001) inference that interest-based bank deposits hamper economic and financial efficiency since a major difference between FD1 and FD2 is that the latter measure omits interest-based (saving) deposits.

[11] Results in Table 4 provide support to Friedman's hypothesis only in Tunisia, where money-growth volatility significantly raises in volatilities of output and investment growth. Results for Tunisia also show significant negative effects of exchange-rate volatility on her macroeconomic volatility (output, consumption, and investment). Note that the signs of the effects are consistently negative, implying that higher exchange-rate risk leads to *lower* macroeconomic volatility (which in turn encourages higher economic growth). As De Grauwe (1988) argues, these results can be taken to imply that Tunisian exporters must be very risk-avert to justify the negative relation.

a prolonged period of time. Cyclical fluctuations in the region are long-term problems, and financial reforms, although effective, do not provide "quick fixes".

The results also imply that financial deepening impacts economic sectors differently in the MENA region. In particular, the results suggest that policymakers in Egypt and Jordan could rely on financial reforms to dampen short-run fluctuations in the business sector. However, for Saudi Arabia, financial reforms will unlikely produce similar short-run cyclical relief. As for Tunisia, financial market development has virtually no short-term consequences, and the results show that financial reforms can only contribute to the country's long-term economic stability.

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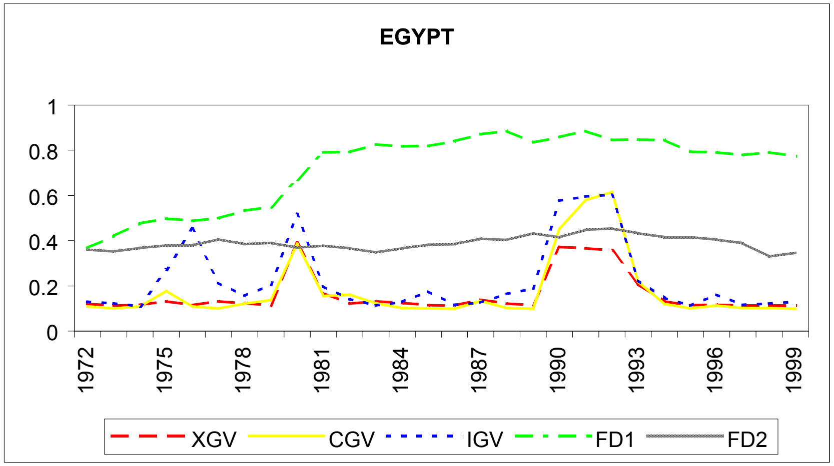
Figure 1: GARCH (1,1) Volatility of Real GDP Growth (XCV), Real Consumption Growth (CGV), and Real Investment Growth (IGV) Compared to Financial Development (FD1 and FD2)



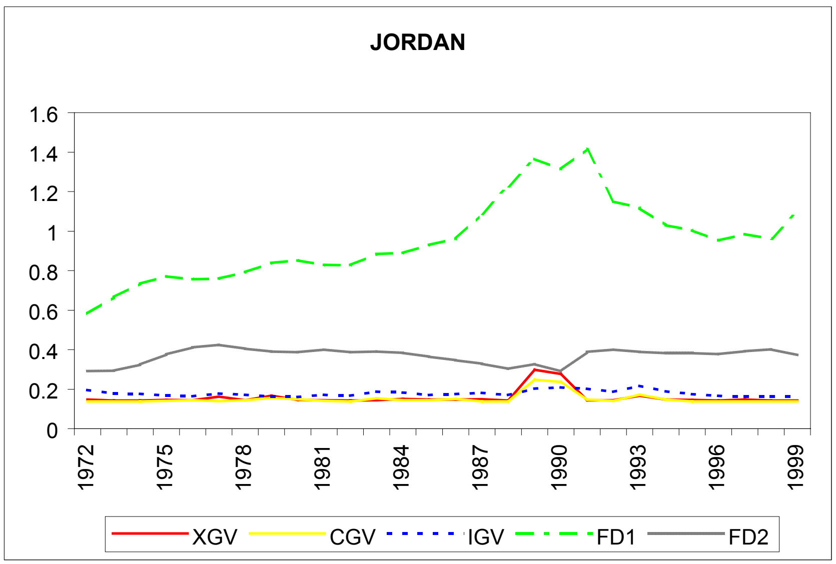
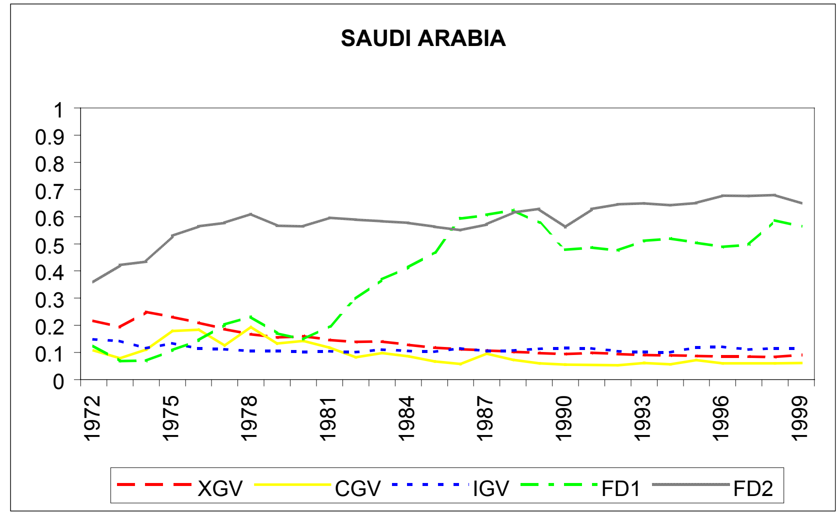


Figure 1: Contd.



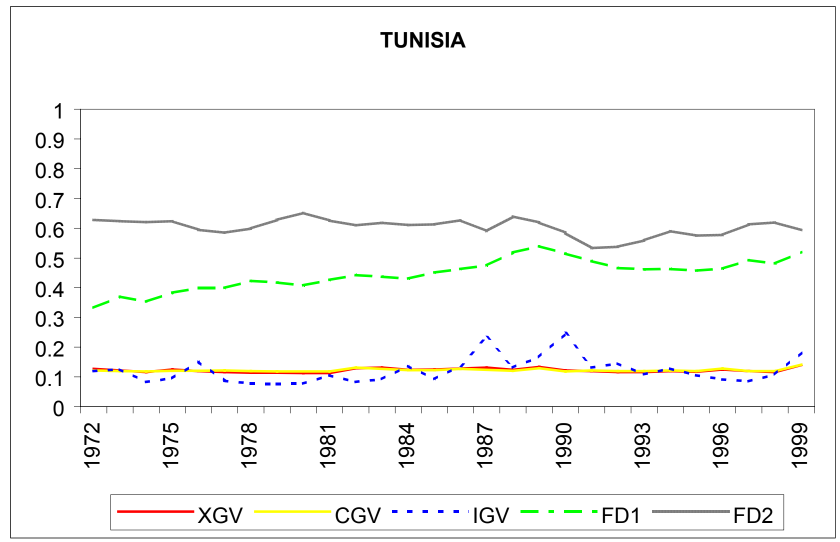


Table 1: Summary Statistics for Real GDP Growth (XG), Real Consumption Growth (CG),Real Investment Growth (IG), and Financial Market Development (FD1, FD2) in Four MENA Countries Sample Period: 1970-1999

	Country															
	Egypt				Jordan				Saudi Arabia				Tunisia			
Variables	**Mean**	**Std dev**	**Min**	**Max**	**Mean**	**Std dev**	**Min**	**Max**	**Mean**	**Std dev**	**Min**	**Max**	**Mean**	**Std dev**	**Min**	**Max**
XG(%)	-2.79	19.66	-54.42	15.2	1.68	14.9	-49.26	21.26	6.59	22.06	-25.01	89.89	4.35	13.09	-17.93	32.7
CG(%)	-2.38	19.08	-53.03	20.67	1.36	17.26	-53.38	25.2	8.21	13.28	-11.8	41.8	3.92	12.77	-16.25	33.42
IG(%)	-0.45	26.58	-64.05	55.92	3.1	21.07	-46.28	37.7	8.00	19.14	-22.3	55.12	5.35	14.64	-22.42	33.05
FD1(%)	72.1	16.42	36.74	88.55	95.62	20.8	58.23	1.42	37.59	18.92	6.86	62.39	44.57	5.13	33.22	53.95
FD2(%)	38.96	3.11	33.01	45.36	36.82	3.9	29.04	42.49	58.42	7.63	35.98	67.94	60.28	2.85	53.27	65.11

Notes: All figures are in percent. FD1 measures the depth of the financial market and is computed by the inverse of the broad-money velocity, i.e., the ratio of the broad money stock (M2) to nominal GDP. FD2 measures the degree of sophistication of the financial market and is computed by the demand deposit ratio in the narrow money stock (M1), i.e., the ratio of demand deposits to M1. We use logarithmic first-differences to calculate percentages (growth rates).

Table 2: Unit Roots (Nonstationarity) Test Results of GARCH and Financial Development Series

	Country										
	Egypt			Jordan			Saudi Arabia			Tunisia	
Variables	**ADF(L)**	**PP(L)**	**WS(L)**	**ADF(L)**	**PP(L)**	**WS(L)**	**ADF(L)**	**PP(L)**	**WS(L)**	**ADF(L)**	**PP(L)**
In Levels											
Real Output Volatility (XGV)	-2.54[2]	-13.47[2]	-2.89[2]	-2.24[3]	-13.31[3]	-2.62[3]	-2.50[2]	-6.05[2]	-1.71[2]	-1.74[2]	-15.40[2]
Real Consumption Volatility (CGV)	-2.10[3]	-10.18[3]	-2.51[3]	-1.62[4]	-12.87[4]	-2.10[4]	-1.77[2]	-12.92[4]	-1.87[4]	-1.94[2]	-28.18[2]**
Real Investment Volatility (IGV)	-2.98[2]	-12.36[2]	-3.19[3]	-1.49[2]	-11.26[2]	-1.82[2]	-2.20[2]	-10.95[2]	-0.93[2]	-1.50[2]	-16.54[2]
Money Growth Volatility (MGV)	-3.00[2]	-13.28[2]	-3.31[3]**	4.77[4]	2.79[4]	4.66[4]**	-2.33[4]	-13.34[4]	-2.04[4]	2.51[3]	-12.90[3]
Exchange-Rate Volatility (EGV)	-2.85[2]	-15.57[2]	-3.21[2]**	-2.47[2]	-13.62[2]	-2.77[2]**	-2.29[2]	-11.17[2]	-2.62[2]	-2.89[2]	-25.16[2]**
Financial Market Depth (FD1)	-0.51[2]	-1.41[2]	-0.92[3]	-2.28[4]	- 6.12[4]	-2.15[4]	-1.34[3]	-5.15[3]	-1.52[3]	-2.23[2]	-8.13[4]
Financial Market Sophistication (FD2)	-1.07[2]	-4.02[2]	-1.83[2]	-3.27[4] *	- 8.54 [2]	-2.09[2]	-4.49[2]**	-9.90[2]	-1.51[2]	-2.09[3]*	-10.83[3]

Table 2: Contd

	Country										
	Egypt			Jordan			Saudi Arabia			Tunisia	
Variables	ADF(L)	PP(L)	WS(L)	ADF(L)	PP(L)	WS(L)	ADF(L)	PP(L)	WS(L)	ADF(L)	PP(L)
In First-Differences Δ											
ΔXGV	-3.35[2]*	-27.89 2]**	-3.69[2]**	-3.41[3]**	-19.07[3] *	-3.77[3]**	-5.63[2]**	-28.72[4]**	-3.51[4]**	-2.63[2]	-30.43[2]*
ΔCGV	-3.90[2]**	-22.90[2]**	-4.30[2]**	-3.32[3]**	-17.10[3]	-3.67[3]**	-1.90[2]	-34.11[4]**	-2.74[4]**	-3.10[3]**	-32.53[3]
ΔIGV	-2.22[4]	-20.53[4]**	-2.46[4]*	-3.26[2]	-28.55[2]**	-3.05[2]*	-3.28[2]*	-33.91[2]**	-3.63[2]**	-2.15[3]	-31.31[3]**
ΔMGV	-3.82[2]**	-24.02[2]**	-4.21[2]**	0.57[4]**	3.96[4]**	2.78[4]	4.18[2]**	-24.45[4]**	-1.90[4]	3.23[3]*	18.60[3]**
ΔEGV	-3.71[2]**	-26.77[2]**	-4.06[2]**	-3.53[2]**	-26.69[2]**	-3.85[2]**	-3.81[2]**	-28.45[2]**	-4.19[2]**	-3.78[3]**	-31.92[3]**
ΔFD1	-3.26[4]*	-17.20[4]	-3.11[4]*	-2.40[4]*	-26.04 [3]	-2.99[3]*	-2.81 [2]*	-16.78[2]**	-2.97[2]**	-2.23[2]	-25.23 [2]
ΔFD2	-1.85[2]	-33.69[2]**	-2.32[2]	-2.95[2]	-25.65 2]**	-2.99[2]*	-3.21 2]**	-24.07[3]**	-1.91[3]	-3.91[2]*	-22.25[2]**

Notes: All volatility measures are standard-deviations derived from GARCH (1,1) models. ADF is the Augmented Dickey-Fuller test, PP is the Perron-Phillips test, and WS is the Weighted-Symmetric test. L refers to the proper lag truncation in the tests according to the Akaike's Information Criterion (AIC). An * indicates rejection of the null hypothesis of nonstationarity at the 10% level of significance, while an ** indicates rejection at the 5% level. Critical values of the ADF, PP, and WS come from the TSP International, Version 4.5.

Table3A: The Johansen Cointegration Test Results for Egypt

	λ-Max Test				Trace Test			
Null Hypotheses	Alternative Hypotheses	Test Statistics	Critical Values (95%)	Critical Values (90%)	Alternative Hypotheses	Test Statistics	Critical Values (95%)	Critical Values (90%)
Results using FD1								
Cointegrating Vector: XGV; FD1, MGV, EGV								
r = 0	r = 1	29.72**	28.27	25.80	r ∃ 1	60.45**	53.98	49.95
r # 1	r = 2	23.01**	22.04	19.86	r ∃ 2	30.72	34.87	31.93
r # 2	r = 3	5.96	15.87	13.81	r ∃ 3	7.71	20.18	17.88
r # 3	r = 4	1.75	9.16	7.53	r = 4	1.75	9.16	7.53
Cointegrating Vector: CGV, FD1, MGV, EGV								
r = 0	r = 1	53.45**	28.27	25.80	r ∃ 1	97.85**	53.98	49.95
r # 1	r = 2	33.15**	22.04	19.86	r ∃ 2	44.40**	34.87	31.93
r # 2	r = 3	6.42	15.87	13.81	r ∃ 3	11.25	20.18	17.88
r # 3	r = 4	4.82	9.16	7.53	r = 4	4.82	9.16	7.53
Cointegrating Vector: IGV, FD1, MGV, EGV								
r = 0	r = 1	28.50**	28.27	25.80	r ∃ 1	54.30**	53.98	49.95
r # 1	r = 2	16.30	22.04	19.86	r ∃ 2	25.80	34.87	31.93
r # 2	r = 3	6.18	15.87	13.81	r ∃ 3	9.50	20.18	17.88
r # 3	r = 4	3.32	9.16	7.53	r = 4	3.32	9.16	7.53

Table 3A: Contd.

	λ-Max Test				Trace Test			
Null Hypotheses	**Alternative Hypotheses**	**Test Statistics**	**Critical Values (95%)**	**(90%)**	**Alternative Hypotheses**	**Test Statistics**	**Critical Values (95%)**	**(90%)**
Results using FD2								
Cointegrating Vector: XGV; FD1, MGV, EGV								
r = 0	r = 1	55.74**	28.27	25.80	r ∃ 1	92.46**	53.98	49.95
r # 1	r = 2	25.77**	22.04	19.86	r ∃ 2	36.72**	34.87	31.93
r # 2	r = 3	9.22	15.87	13.81	r ∃ 3	7.71	20.18	17.88
r # 3	r = 4	1.73	9.16	7.53	r = 4	1.75	9.16	7.53
Cointegrating Vector: CGV, FD1, MGV, EGV								
r = 0	r = 1	55.12**	28.27	25.80	r ∃ 1	80.10**	53.98	49.95
r # 1	r = 2	13.45	22.04	19.86	r ∃ 2	24.98	34.87	31.93
r # 2	r = 3	9.59	15.87	13.81	r ∃ 3	11.53	20.18	17.88
r # 3	r = 4	1.93	9.16	7.53	r = 4	1.93	9.16	7.53
Cointegrating Vector: IGV, FD1, MGV, EGV								
r = 0	r = 1	51.62**	28.27	25.80	r ∃ 1	77.14**	53.98	49.95
r # 1	r = 2	13.76	22.04	19.86	r ∃ 2	25.51	34.87	31.93
r # 2	r = 3	9.73	15.87	13.81	r ∃ 3	11.76	20.18	17.88
r # 3	r = 4	2.03	9.16	7.53	r = 4	2.03	9.16	7.53

Notes: See Tables 1 and 2 for definitions of the variables. An * indicates rejection of the null hypothesis at the 90% level of significance. An ** indicates rejection of the null hypothesis at the 95% level of significance. We correct the test statistics for finite sample bias using Reimers' (1992) procedure.

Table 3B: The Johansen Cointegration Test Results for Jordan

	λ-Max Test				Trace Test			
Null Hypotheses	Alternative Hypotheses	Test Statistics	Critical Values (95%)	Critical Values (90%)	Alternative Hypotheses	Test Statistics	Critical Values (95%)	Critical Values (90%)
Results using FD1								
Cointegrating Vector: XGV; FD1, MGV, EGV								
r = 0	r = 1	47.49**	28.27	25.80	r ∃ 1	90.21**	53.98	49.95
r # 1	r = 2	28.53**	22.04	19.86	r ∃ 2	42.73**	34.87	31.93
r # 2	r = 3	11.69	15.87	13.81	r ∃ 3	14.20	20.18	17.88
r # 3	r = 4	2.51	9.16	7.53	r = 4	2.51	9.16	7.53
Cointegrating Vector: CGV, FD1, MGV, EGV								
r = 0	r = 1	42.05**	28.27	25.80	r ∃ 1	93.95**	53.98	49.95
r # 1	r = 2	39.06	22.04	19.86	r ∃ 2	51.90**	34.87	31.93
r # 2	r = 3	10.86	15.87	13.81	r ∃ 3	12.84	20.18	17.88
r # 3	r = 4	1.99	9.16	7.53	r = 4	1.99	9.16	7.53
Cointegrating Vector: IGV, FD1, MGV, EGV								
r = 0	r = 1	42.36**	28.27	25.80	r ∃ 1	78.09**	53.98	49.95
r # 1	r = 2	17.14	22.04	19.86	r ∃ 2	35.73**	34.87	31.93
r # 2	r = 3	14.63	15.87	13.81	r ∃ 3	18.59	20.18	17.88
r # 3	r = 4	3.96	9.16	7.53	r = 4	3.96	9.16	7.53

Table 3B: Contd.

Null Hypotheses	λ-Max Test: Alternative Hypotheses	Test Statistics	Critical Values (95%)	(90%)	Trace Test: Alternative Hypotheses	Test Statistics	Critical Values (95%)	(90%)
Results using FD2								
Cointegrating Vector: XGV; FD1, MGV, EGV								
r = 0	r = 1	50.46**	28.27	25.80	r ∃ 1	106.05**	53.98	49.95
r # 1	r = 2	37.14**	22.04	19.86	r ∃ 2	55.59**	34.87	31.93
r # 2	r = 3	10.76	15.87	13.81	r ∃ 3	18.45 *	20.18	17.88
r # 3	r = 4	7.69	9.16	7.53	r = 4	7.69	9.16	7.53
Cointegrating Vector: CGV, FD1, MGV, EGV								
r = 0	r = 1	45.55**	28.27	25.80	r ∃ 1	109.96**	53.98	49.95
r # 1	r = 2	42.47**	22.04	19.86	r ∃ 2	64.41**	34.87	31.93
r # 2	r = 3	14.41*	15.87	13.81	r ∃ 3	21.95**	20.18	17.88
r # 3	r = 4	7.53	9.16	7.53	r = 4	7.53	9.16	7.53
Cointegrating Vector: IGV, FD1, MGV, EGV								
r = 0	r = 1	43.32**	28.27	25.80	r ∃ 1	80.42**	53.98	49.95
r # 1	r = 2	21.68 *	22.04	19.86	r ∃ 2	37.09**	34.87	31.93
r # 2	r = 3	8.02	15.87	13.81	r ∃ 3	15.42	20.18	17.88
r # 3	r = 4	7.40	9.16	7.53	r = 4	7.40	9.16	7.53

Notes: See Notes to Table 3A

Table 3C: The Johansen Cointegration Test Results for Saudi Arabia

	λ-Max Test				Trace Test			
Null Hypotheses	**Alternative Hypotheses**	**Test Statistics**	**Critical Values (95%)**	**(90%)**	**Alternative Hypotheses**	**Test Statistics**	**Critical Values (95%)**	**(90%)**
Results using FD1								
Cointegrating Vector: XGV; FD1, MGV, EGV								
r = 0	r = 1	31.38**	28.27	25.80	r ∃ 1	56.46**	53.98	49.95
r # 1	r = 2	17.05	22.04	19.86	r ∃ 2	25.07	34.87	31.93
r # 2	r = 3	4.89	15.87	13.81	r ∃ 3	8.02	20.18	17.88
r # 3	r = 4	3.14	9.16	7.53	r = 4	3.14	9.16	7.53
Cointegrating Vector: CGV, FD1, MGV, EGV								
r = 0	r = 1	36.34**	28.27	25.80	r ∃ 1	54.66**	53.98	49.95
r # 1	r = 2	10.87	22.04	19.86	r ∃ 2	18.33	34.87	31.93
r # 2	r = 3	4.58	15.87	13.81	r ∃ 3	7.46	20.18	17.88
r # 3	r = 4	2.88	9.16	7.53	r = 4	2.88	9.16	7.53
Cointegrating Vector: IGV, FD1, MGV, EGV								
r = 0	r = 1	28.87**	28.27	25.80	r ∃ 1	47.76**	53.98	49.95
r # 1	r = 2	8.10	22.04	19.86	r ∃ 2	18.89	34.87	31.93
r # 2	r = 3	5.84	15.87	13.81	r ∃ 3	10.79	20.18	17.88
r # 3	r = 4	4.95	9.16	7.53	r = 4	4.95	9.16	7.53

Table 3C: Contd.

Null Hypotheses	λ-Max Test: Alternative Hypotheses	Test Statistics	Critical Values (95%)	(90%)	Trace Test: Alternative Hypotheses	Test Statistics	Critical Values (95%)	(90%)
Results using FD2								
Cointegrating Vector: XGV; FD1, MGV, EGV								
r = 0	r = 1	41.36**	28.27	25.80	r ∃ 1	75.25**	53.98	49.95
r # 1	r = 2	24.86**	22.04	19.86	r ∃ 2	33.90*	34.87	31.93
r # 2	r = 3	6.67	15.87	13.81	r ∃ 3	9.04	20.18	17.88
r # 3	r = 4	3.37	9.16	7.53	r = 4	3.37	9.16	7.53
Cointegrating Vector: CGV, FD1, MGV, EGV								
r = 0	r = 1	35.21**	28.27	25.80	r ∃ 1	66.42**	53.98	49.95
r # 1	r = 2	16.91**	22.04	19.86	r ∃ 2	31.22**	34.87	31.93
r # 2	r = 3	11.14	15.87	13.81	r ∃ 3	14.32	20.18	17.88
r # 3	r = 4	3.17	9.16	7.53	r = 4	3.17	9.16	7.53
Cointegrating Vector: IGV, FD1, MGV, EGV								
r = 0	r = 1	29.45**	28.27	25.80	r ∃ 1	55.64**	53.98	49.95
r # 1	r = 2	11.38	22.04	19.86	r ∃ 2	26.19	34.87	31.93
r # 2	r = 3	10.26	15.87	13.81	r ∃ 3	14.81	20.18	17.88
r # 3	r = 4	4.55	9.16	7.53	r = 4	4.55	9.16	7.53

Notes: See Notes to Table 3A

Table3D: The Johansen Cointegration Test Results for Tunisia

	λ-Max Test				Trace Test			
Null Hypotheses	Alternative Hypotheses	Test Statistics	Critical Values (95%)	(90%)	Alternative Hypotheses	Test Statistics	Critical Values (95%)	(90%)
Results using FD1								
Cointegrating Vector: XGV; FD1, MGV, EGV								
r = 0	r = 1	38.44**	28.27	25.80	r ∃ 1	70.83**	53.98	49.95
r # 1	r = 2	16.60	22.04	19.86	r ∃ 2	32.40 *	34.87	31.93
r # 2	r = 3	10.96	15.87	13.81	r ∃ 3	15.79	20.18	17.88
r # 3	r = 4	4.83	9.16	7.53	r = 4	4.83	9.16	7.53
Cointegrating Vector: CGV, FD1, MGV, EGV								
r = 0	r = 1	40.72**	28.27	25.80	r ∃ 1	77.01**	53.98	49.95
r # 1	r = 2	20.15*	22.04	19.86	r ∃ 2	36.29**	34.87	31.93
r # 2	r = 3	10.00	15.87	13.81	r ∃ 3	16.14	20.18	17.88
r # 3	r = 4	6.14	9.16	7.53	r = 4	6..14	9.16	7.53
Cointegrating Vector: IGV, FD1, MGV, EGV								
r = 0	r = 1	35.10**	28.27	25.80	r ∃ 1	68.32**	53.98	49.95
r # 1	r = 2	16.27	22.04	19.86	r ∃ 2	33.22 *	34.87	31.93
r # 2	r = 3	10.60	15.87	13.81	r ∃ 3	16.94	20.18	17.88
r # 3	r = 4	6.35	9.16	7.53	r = 4	6.35	9.16	7.53

Table 3D: Contd.

	λ-Max Test				Trace Test			
Null Hypotheses	Alternative Hypotheses	Test Statistics	Critical Values (95%)	(90%)	Alternative Hypotheses	Test Statistics	Critical Values (95%)	(90%)
Results using FD2								
Cointegrating Vector: XGV; FD1, MGV, EGV								
r = 0	r = 1	40.37**	28.27	25.80	r ∃ 1	63.88**	53.98	49.95
r # 1	r = 2	11.76	22.04	19.86	r ∃ 2	23.52	34.87	31.93
r # 2	r = 3	7.63	15.87	13.81	r ∃ 3	11.75	20.18	17.88
r # 3	r = 4	4.11	9.16	7.53	r = 4	4.11	9.16	7.53
Cointegrating Vector: CGV, FD1, MGV, EGV								
r = 0	r = 1	44.73**	28.27	25.80	r ∃ 1	72.02**	53.98	49.95
r # 1	r = 2	13.45	22.04	19.86	r ∃ 2	27.28**	34.87	31.93
r # 2	r = 3	9.81	15.87	13.81	r ∃ 3	13.83	20.18	17.88
r # 3	r = 4	4.02	9.16	7.53	r = 4	4.02	9.16	7.53
Cointegrating Vector: IGV, FD1, MGV, EGV								
r = 0	r = 1	40.22**	28.27	25.80	r ∃ 1	77.08**	53.98	49.95
r # 1	r = 2	21.48*	22.04	19.86	r ∃ 2	36.87**	34.87	31.93
r # 2	r = 3	9.80	15.87	13.81	r ∃ 3	15.38	20.18	17.88
r # 3	r = 4	5.60	9.16	7.53	r = 4	5.60	9.16	7.53

Notes: See Notes to Table 3A.

Table 4: **Granger-Causality Regression Results from Error-Correction Models**

	Egypt			Jordan			Saudi Arabia			Tunisia		
Independent	**Dependent Variables**											
Variables	**XGV**	**CGV**	**IGV**	**XGV**	**CGV**	**IGV**	**XGV**	**CGV**	**IGV**	**XGV**	**CGV**	**IGV**
C	0.02	0.03	0.03	-0.01	-0.02	0.003	-0.003	-0.001	-0.002	-0.0003	-0.001	-0.004
	(0.84)	(0.65)	(0.89)	(0.81)	(1.71)*	(0.56)	(1.12)	(0.27)	(0.90)	(0.02)	(0.05)	(0.65)
XGVL	-0.03	-	-	-0.11	-	-	-0.28	-	-	0.16	-	-
	(0.04)	-	-	(0.22)	-	-	(1.27)	-	-	(0.55)	-	-
CGVL	-	0.53	-	-	0.67	-	-	0.23	-	-	0.12	-
	-	(0.93)	-	-	(1.77)*	-	-	(1.75)*	-	-	(0.39)	-
IGVL	-	-	0.33	-	-	0.01	-	-	0.02	-	-	0.14
	-	-	(0.74)	-	-	(0.07)	-	-	(0.08)	-	-	(0.49)
FD1L	-0.96	-1.44	-1.62	-0.84	-0.02	-0.06	-0.13	0.12	-0.01	-0.01	-0.02	0.66
	(2.00)*	(1.57)	(1.68)*	(2.22)**	(0.27)	(2.10)**	(1.71)*	(1.63)*	(0.23)	(0.14)	(0.31)	(1.60)
MGVL	-0.12	-0.76	-0.56	3.90	-29.86	1.69	0.05	-0.28	0.04	0.10	0.06	0.71
	(0.28)	(1.27)	(1.03)	(0.45)	(3.09)**	(0.64)	(1.17)	(6.52)**	(1.09)	(2.37)**	(1.48)	(2.84)**
EGVL	0.29	0.66	0.81	0.21	-0.28	0.01	0.21	-0.43	0.01	-0.57	-0.36	-2.66
	(0.35)	(0.80)	(0.43)	(0.48)	(1.06)	(0.18)	(0.71)	(2.06)**	(0.03)	(2.72)**	(2.24)**	(1.71)*
ECTL	-1.29	-1.61	-1.21	-2.18	-2.14	-0.89	-0.16	-1.69	-0.74	-0.77	-1.14	-0.53
	(1.09)	(2.23)**	(1.99)*	(2.55)**	(3.95)**	(3.64)**	(0.64)	(7.28)**	(2.98)**	(2.37)**	(2.57)**	(2.25)**
Summary Statistics												
R^2	0.25	0.25	0.21	0.37	0.50	0.52	0.32	0.90	0.43	0.43	0.45	0.53
Dh	0.10	-0.32	0.43	0.32	0.82	4.06**	1.40	0.37	-0.91	0.24	0.87	-2.82**
BG	0.01	0.11	0.19	0.10	0.67	1.38	1.96	-	0.83	0.06	0.75	-
REST	0.07	2.49	0.91	1.92	1.40	1.15	4.85**	-	1.91	0.79	0.94	-