Financial Developent and Economic Growth Nexus: Time Series Evidence from Middle Eastern and North African Countries

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Financial Development and Economic Growth: Empirical Evidence from MENA Countries

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Abstract

This paper examines the causal relationship between financial development and economic growth in five Middle Eastern and North African (MENA) countries for different periods ranging from 1960 to 2004, within a trivariate vector autoregressive (VAR) framework. We employ four different measures of financial development and apply Granger causality tests using the cointegration and vector error-correction (VEC) methodology. Our empirical results show weak support for a long-run relationship between financial development and economic growth, and for the hypothesis that finance leads growth. In cases where cointegration was detected, Granger causality was either bidirectional or it ran from output to financial development.

JEL classification: O16; G18; G28

Keywords: Financial development, Economic growth, MENA, Granger causality, Error-correction models, Cointegration.

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1. Introduction

The relationship between financial development and economic growth has been comprehensively treated in the theoretical and empirical literature. The theoretical foundation of this relationship can be traced as far back to the work of Schumpeter (1911) and later, to McKinnon (1973) and Shaw (1973). McKinnon and Shaw argued that government repression of financial systems through interest rate ceilings and directed credit to preferential non-productive sectors, among other restrictive measures, impedes financial development which they claim is essential for economic growth. The endogenous growth literature as well stresses the significance of financial development for long-run economic growth through the impact of financial sector services on capital accumulation and technological innovation. These services include mobilizing savings, acquiring information about investments and allocating resources, monitoring managers and exerting corporate control, and facilitating risk amelioration (Greenwood and Jovanovic, 1990; Bencivenga and Smith, 1991). On the other hand, influential economists such as Robinson (1952), Kuznets (1955) and Lucas (1988), contend that the role of financial development is either overstated or that financial development follows expansion of the real economy. This would indicate, in contrast to McKinnon and Shaw and the endogenous growth theorists that causality, if it exists, runs from economic growth to financial development.

Empirical analyses of the impact of financial development on long-run economic growth include, among others, the World Bank (1989); Roubini and Sala-i-Martin (1992), and King and Levine (1993a,b). These studies used cross-section analysis to link measures of financial development with economic growth. The evidence emerging from cross-section growth regressions (à la Barro, 1991) provided pooled estimates of the effects of financial development on economic growth, and disregarded country-specific factors. Furthermore, such cross-country

growth regressions were not able to capture the dynamics of the relationship between financial development and economic growth. Another pitfall of cross-country studies is that when economic growth is regressed on a wide spectrum of variables, researchers tend to interpret a significant coefficient of the measure of financial development as a confirmation of causality from financial development to economic growth. However, a significant coefficient of the financial measure in such a regression can be equally compatible with causality running from financial development to economic growth, with causality running from economic growth to financial development or with bi-directional causality between the two variables. Such inadequate assessments of causal relationships in a static cross-section setting have led to a search for more dynamic time series analyses to unravel whether financial development causes economic growth or vice versa. Granger causality tests have emerged as the principal tool for dealing with this issue.

Time series studies on a selection of countries by Gupta (1984), Jung (1986), Demetriades and Hussein (1996), Luintel and Khan (1999), Bell and Rousseau (2001), and Thangavelu and Ang (2004) have shown that the pattern of causality differs significantly among countries, and evidence for a unidirectional link from finance development to economic growth is generally weak. Thus, to enhance our understanding of the causal relationship between financial development and economic growth it is essential to perform studies on individual countries using a diverse set of financial measures. In the present work we adopt such an approach to gain insight into the causal relationship between financial development and economic growth in MENA[1] region. The study is restricted to Algeria, Egypt, Morocco, Syria, and Tunisia for the period 1960 to 2004.

[1] This region encompasses the 21 members of the Arab League, plus Iran, Israel, and Turkey.

Since the mid-eighties, many MENA countries have tried to implement reforms in their financial sectors in order to achieve high growth performance. These reforms were part of an overall strategy toward establishing a more market-based and private sector-led economy. Even though some of these reforms have been in practice for quite some time now, little work has been done to evaluate their effectiveness on enhancing economic growth. In this paper we try to fill this gap in the empirical literature. We address the drawbacks of the studies that focus on testing the causal relationship between financial development and economic growth in MENA countries.

To test causality, Darrat (1999) implemented Granger causality tests within a bivariate VAR for three MENA countries: Saudi Arabia, Turkey, and United Arab Emirates over the period 1964-1993. Using the currency\M1 ratio and M2\GDP ratio as alternative measures of financial development, Darrat's results suggest some support for the supply-leading hypothesis that financial deepening promotes economic growth, although the strength and consistency of his evidence varies across countries. Ghali's (1999) tested Granger causality between financial development and economic growth for Tunisia over the period 1963-1993 using two financial development measures: bank deposits liabilities\GDP ratio and private credit\GDP ratios, found that financial development Granger causes economic growth. Al-Yousif (2002) tested for Granger causality between financial development and economic growth in a bivariate VAR with the same two financial measures used in Darrat's (1990) study. The study was based on a sample of thirty developing countries, including 13 MENA countries, for the period 1970-1999. Al-Awad and Harb (2005) used both panel and individual country cointegration and Granger causality tests within a quadvariate VAR framework, for ten MENA countries for the period 1969-2000. They based their analysis on a single financial measure, namely, the ratio of private

credit to monetary base. Their cointegration results strongly support the existence of long-run relationship between the two variables but they fail to clearly establish the direction of causality. Another study addressing the finance-growth nexus in 16 MENA countries is by Boulila and Trabelsi (2004), who used cointegration and Granger causality tests based on a bivariate vector autoregression (VAR) and three different financial measures. Their findings support the view that causality runs from real economy to financial sector. However, for a large number of the countries the number of observation did not exceed 25 years and in the case of Bahrain the study was based on 19 observations only, which in our opinion, is not long enough to capture the long-run relationship between financial development and economic growth.

The empirical literature on the causality between financial development and economic growth in MENA countries, demonstrates some major disadvantages of the methods used. First, most of the studies were based on a bivariate VAR analysis so, owing to a possible misspecification bias, the results are questionable. In addition, a bivariate VAR analysis does not allow one to discern if the channels through which finance leads growth are through enhanced efficiency or capital accumulation. Second, most of these studies were based on financial measures that may not capture the mechanisms through which financial development can cause economic growth, such as efficiency enhancing. Later we discuss the complexity of measuring financial development and discuss the weaknesses of some of the measures. Third, the time span of some of the studies was too brief to capture the long run relationship between financial development and economic growth. Fourth, the above studies, besides Al-Awad and Harb (2005), tested for Granger causality between finance and growth within the sample period and did not attempt to evaluate the strength of their findings beyond the sample period by applying variance decomposition or impulse response functions.

In the present study we try to overcome the shortcomings of the aforementioned studies by testing the direction of causality between financial development and economic growth using Granger causality tests within a framework of a cointegration and an error-correction model. To overcome the misspecification bias we apply a trivariate vector autoregressive (VAR) system that includes the share of investment in GDP as an additional variable to financial development indicators and real GDP per capita. This allows us to test whether financial development affects economic growth through increasing productivity or through accumulation of resources. In addition to these causality tests, using variance decomposition, we are able to test the validity of the Granger causality results beyond the sample period. Unlike the aforementioned, we base our analysis on a longer time span that ranges between 38 to 45 years. In our view this time span is sufficiently long to capture the long-run relationship between financial development and economic growth. Since our data span goes far beyond the start of financial reforms in most of the countries under survey that were undertaken since the mid-eighties, our analysis can shed light on the effect of these reforms on the linkage between financial development and economic growth. Last, as financial development is a process that involves the interaction of many activities and institutions, it cannot be captured by a single measure. To deal with this complexity we use four measures of financial development.

The paper proceeds as follows: Section 2 describes the variables used in the paper as well as the data sources. Section 3 lays out the econometric methodology based on cointegration and error-correction (ECM) models and Granger causality. Section 4 presents the empirical findings. Finally, Section 5 summarizes the major findings and offers some concluding remarks.

2. Measurement and Data Sources

2.1 Financial Development Indicators

Financial development is usually defined as a process that marks improvement in quantity, quality, and efficiency of financial intermediary services. This process involves the interaction of many activities and institutions. Consequently, it cannot be captured by a single measure. In this study we employ four commonly used measures of financial development for the purpose of testing the robustness of our findings.

The first measure, M2Y, represents the ratio of money stock, M2, to nominal GDP. M2Y has been used as a standard measure of financial development in numerous studies (Gelb, 1989; World Bank, 1989; King and Levine, 1993a,b; Calderon and Liu, 2003). In developing countries, a large part of M2 stock consists of currency held outside banks. As such, an increase in the M2\GDP ratio may reflect an extensive use of currency rather than an increase in bank deposits, and for this reason this measure is less indicative of the degree of financial intermediation by banking institutions. Therefore, Demetriades and Hussein (1996) proposed to subtract currency outside banks from M2 and to take the ratio of M2 minus currency to GDP as a proxy for financial development. In all of the countries in this study besides Tunisia, the currency held outside banks\M2 ratio (C2M2) was higher than 30% on average over the period covered here. Even though this ratio has been declining steadily in all the countries over this period, as can be seen in Chart 1, it is still higher than 20% in Algeria, Morocco, and Syria. On these grounds, we chose QMY, the ratio of M2 minus currency to GDP, to serve as our second measure of financial development.

Our third measure of financial development is PRIVY, the ratio of bank credit to the private sector to nominal GDP. This indicator is frequently used to assess the allocation of financial assets, which M2Y and QMY cannot provide. An increase in private financial saving

results in higher M2Y and QMY ratios, but with high reserve requirements, credit to the private sector (which is eventually responsible for the quantity and quality of investment and therefore to economic growth) may not increase. Therefore, an increase in these ratios does not necessarily mean an increase in productive investments. On the other hand, PRIVY is related to the quantity and efficiency of investment and hence to economic growth (Gregorio and Guidotti 1995). PRIVY has been used extensively in numerous works (King and Levine, 1993a, b; Gregorio and Guidotti, 1995; Levine and Zeroves, 1993; Demetriades and Hussein, 1996; Beck et al., 2000 among others). As can be seen in Chart 2, in Syria PRIVY has stayed constant (around 8%) throughout the period under survey, but in Algeria it dropped from more than 50% in 1990 to less than 7% since. In Egypt and Morocco, there has been a steady increase in PRIVY since the late eighties, while in Tunisia it has been static since the early eighties.

The fourth financial development indicator is the ratio of credit issued to nonfinancial private firms to total domestic credit (excluding credit to banks), PRIVATE, which captures the role of the distribution of credit between private and public sectors.

2.2 Additional Variables

Following standard practice, we use real GDP per capita (GDPPC) as our measure for economic development (see Gelb, 1989; Roubini and Sala-i-Martin, 1992; King and Levine, 1993a, b; Demetriades and Hussein, 1996). In addition to the real GDP per capita and the financial development indicator, we introduce a third variable to our VAR system, namely the share of investment in GDP (IY). This variable is considered to be one of the few economic variables with a robust correlation to economic growth regardless of the information set (Levine and Renelt, 1992). Including the investment variable in our regressions enables us to identify the channels through which financial development causes economic growth. If financial

development causes economic development given the investment variable, then this causality supports the endogenous growth theories that finance affects economic growth mainly through the enhancement of investment efficiency. We also, can then assess if financial development causes economic growth through an increase of investment resources, by testing the causality between financial development indicators and investment on the one hand and between investment and economic growth on the other.

2.3 Data Sources

Financial development measures were calculated from *International Financial Statistics* (IFS) 2005 CD-ROM. IY and GDPPC data were obtained from the World Development Indicators (WDI) 2005 CD-ROM. The sample covers the following periods: Algeria (1965-2003), Egypt (1960-2004), Morocco (1965-2004), Syria (1965-2002), and Tunisia (1961-2004). The choice of these countries was governed by availability of at least thirty observations for each country with no missing values in between.

3. Econometric Methodology

3.1 Cointegration and Granger Causality

The cointegration technique pioneered by Engle and Granger (1987) made a significant contribution towards testing causality. Two or more variables are said to be cointegrated if they share a common trend. As long as the relevant variables have a common trend, Granger causality must exist in at least one direction (Granger, 1988). However, although cointegration indicates the presence or the absence of Granger causality, it does not indicate the direction of causality between the variables. This can be detected using the vector error-correction model (VECM), which is derived from the vectors of cointegration as explained below.

3.2 Vector Error-Correction Model

Let us consider the following VAR model of order P:

$$Y_t = \mu + A_1 Y_{t-1} + ... + A_{P-1} Y_{t-P} + \varepsilon_t \quad (1)$$

where Y_t is a 3x1 vector of I(1) variables consisting of $Y_1 = GDPPC$, $Y_2 = FD$ and $Y_3 = IY$ with *FD* being the financial development measure. Let us suppose that all the variables are I(1) in their levels. If these variables trend together towards a long-run equilibrium, then by the Granger representation theorem, the VAR model can be expressed as the following VECM:

$$\Delta Y_t = \mu + \Gamma_1 Y_{t-1} + ... + \Gamma_{P-1} \Delta Y_{t-P+1} + \Pi Y_{t-1} + \varepsilon_t \quad (2)$$

where Δ is a difference operator, and ε_t is a vector of white noise residuals. If Π is of rank $1 \le r < 3$, then it can be decomposed into $\Pi = \alpha \beta'$, where $\alpha_{(3xr)}$ and $\beta_{(3xr)}$, and equation (2) can be reformulated as:

$$\Delta Y_t = \mu + \Gamma_1 \Delta Y_{t-1} + ... + \Gamma_{P-1} \Delta Y_{t-P+1} + \alpha(\beta' Y_{t-1}) + \varepsilon_t \quad (3)$$

where the rows of β are interpreted as distinct cointegration vectors, and the αs are the adjustment coefficients (loading factors) indicating the adjustment to long-run equilibrium. The linear combinations $\beta' Y_{t-1}$ are stationary processes; therefore, all the variables in equation (3) are stationary. Johansen's (1988) cointegration techniques allow us to test and determine the number of cointegrating relationships between the nonstationary variables in the system using a maximum likelihood procedure.

In our trivariate VAR model, equation (3) can be represented explicitly as

$$\Delta Y_{1t} = \mu_1 + \sum_{h=1}^{r} \alpha_{1,h} ECT_{h,t-1} + \sum_{k=1}^{p-1} \delta_{11,k} \Delta Y_{1,t-k} + \sum_{k=1}^{p-1} \delta_{12,k} \Delta Y_{2,t-k} + \sum_{k=1}^{p-1} \delta_{13,k} \Delta Y_{3,t-k} + \varepsilon_{1t} \quad (4)$$

$$\Delta Y_{2t} = \mu_2 + \sum_{h=1}^{r} \alpha_{2,h} ECT_{h,t-1} + \sum_{k=1}^{p-1} \delta_{21,k} \Delta Y_{1,t-k} + \sum_{k=1}^{p-1} \delta_{22,k} \Delta Y_{2,t-k} + \sum_{k=1}^{p-1} \delta_{23,k} \Delta Y_{3,t-k} + \varepsilon_{2t} \quad (5)$$

$$\Delta Y_{3,t} = \mu_3 + \sum_{h=1}^{r} \alpha_{3,h} ECT_{h,t-1} + \sum_{k=1}^{p-1} \delta_{31,k} \Delta Y_{1,t-k} + \sum_{k=1}^{p-1} \delta_{32,k} \Delta Y_{2,t-k} + \sum_{k=1}^{p-1} \delta_{33,k} \Delta Y_{3,t-k} + \varepsilon_{3t} \quad (6)$$

where $ECT_{h,t-1}$ is the *h*th error-correction term, the residuals from the *h*th cointegration equation, lagged one period, and $\delta_{ij,k}$ describes the effect of the *k*th lagged value of variable *j* on the current value of variable *i*: $i, j = Y_1, Y_2, Y_3$.

In addition to indicating the direction of the causality among the variables, the VECM approach allows us to distinguish between the two types of Granger causality: short-run and long-run causality. In the above setting (equations 4-6), long-run Granger causality from variable Y_i to variable Y_j in the presence of cointegration is evaluated by testing the null hypothesis that $\alpha_{j,h} \cdot \beta_{h,i} = 0 \ \ for \ h = 1,..,r$, where $\beta_{h,i}$ is the coefficient of variable Y_i in the *h*th cointegration equation. Short-run Granger causality from variable Y_i to variable Y_j is evaluated by testing the null hypothesis that $\delta_{ji,1} = ... = \delta_{ji,P-1} = 0$, using the standard *F* test. By rejecting either one or both of the two null hypotheses, we can conclude that variable Y_i Granger-causes variable Y_j.

4. Empirical Results

4.1 Cointegration Tests

A necessary but insufficient condition for cointegration is that each of the variables is integrated of the same order $d \geq 1$ (Granger, 1986). Therefore, the first step of our analysis was to determine the degree of integration of each variable. To test for unit roots we employed the

ADF test (Dickey and Fuller, 1979) for the levels and first difference of each variable. The ADF test results are reported in Table 1, where we can see that all the variables are integrated of order 1 in their levels, but stationary in their first differences.[2]

The second step was to test for a cointegration relationship among the relevant variables. The results of Johansen's maximum eigenvalue (λ_{max}) and trace tests in Table 2, using an optimal lag structure for the VAR, show different results for different countries and for the alternative financial measures. Using the traditional measure of financial development, M2Y, cointegration was found only in the case of Egypt, whereas each of the other three financial measures was found to be cointegrated with per capita income in three countries. Using QMY, we found cointegration between financial development and real GDP per capita in Algeria, Egypt, and Tunisia. PRIVATE was found to be cointegrated with per capita income in Egypt, Morocco, and Syria, and PRIVY was found to be cointegrated with per capita income in Egypt, Syria, and Tunisia.

The cointegration results showed that Egypt is the only country where all the financial measures are significantly cointegrated with per capita income. In Syria and Tunisia two financial measures were found to be cointegrated with real GDP per capita, and in Algeria and Morocco only one financial measure was found to be cointegrated with real GDP per capita.

Now that cointegration has been determined, we can apply the VECM to determine the direction of causality between the variables.

4.1.1 Causality results

[2] Using the Phillips-Perron test we obtained similar results.

The VECM-based causality tests are conducted using Johansen cointegrating vectors. In Tables 3-6, we report the *t*, likelihood ratio (*LR*), and *F* test results relating to the exclusion of the relevant variables from the VEC model. Our null hypothesis is always that causality is non-existent. As mentioned, there are two possible channels of causation: long and short-run. The *t*-test (column 3) and *LR*-test (columns 4 and 5) statistics test for long-run causality, and the *F*-test statistic (columns 6) tests for short-run causality.

The results presented in Table 3, where the M2Y serves as the financial development measure, reveal a strong unidirectional causality from economic growth to financial development in Egypt. Since M2Y was found to be cointegrated with real GDP per capita only in the case of Egypt, we could not test for long-run causality for the other countries. Also, since the optimal lag length that was chosen by the Schwarz information criterion (SC) in the unrestricted VAR was one for the rest of the countries, we conclude that no short-run causality exists between financial development and economic growth in these countries when M2Y is used as the financial development measure.

The results in Table 4, Panel A indicate the presence of long-run causality from QMY to economic growth for Algeria, but only at the 10% significance level. The results in Panels A and B reveal strong unidirectional causality from economic growth to financial development, represented by QMY, in both Egypt and Tunisia. Again, as in the case of M2Y, there is no evidence of short-run causality between financial development measured by QMY and economic growth.

The results from Table 5 Panels A and B reveal significant evidence of long-run bidirectional causality between PRIVATE and economic growth in the cases of Egypt, Morocco, and Syria. Finally, from Table 6, a strong bidirectional long-run causality between PRIVY and

real GDP per capita is evident in the case of Egypt, and a long-run unidirectional causality from economic growth to financial development is evident in the cases of Syria and Tunisia.

After discussing the results of direct causality between financial development and economic growth, we will turn now to discuss the evidence of indirect causality from financial development to economic growth through the investment\GDP ratio, IY. This was accomplished by first testing for causality from financial development to IY, and then from IY to economic growth. In all of the cases where cointegration was detected, besides Tunisia, we found clear evidence of causality running from IY to economic growth but in no case we could find evidence of causality from financial development to IY, and therefore no evidence of indirect causality from financial development to economic growth through the investment\GDP variable. Only in Egypt when QMY is used as the financial measure, we were able to detect a short-run indirect causality from financial development to economic growth.[3]

To summarize, our cointegration results show little support for the existence of a long-run relationship between financial development and economic growth in the five countries under survey. Furthermore, Granger causality tests support either bi-directional causality between the two variables or causality running from economic growth to financial development. It worth noting that direct causality from financial development to economic growth, through enhancing efficiency, was detected only when PRIVY and PRIVATE were used as the financial measures. On the other hand, financial development affected economic growth through increasing investment resources only in the case of Egypt when QMY were used as financial measures. These findings are in line with earlier studies suggesting that PRIVY and PRIVATE, rather than

[3] Results were not presented here to save space and are obtainable by request.

M2Y, stimulate economic growth through improving investment efficiency (for example, King and Levine, 1993a,b).

4.2 Results of Variance Decomposition

Based on the VECM, our empirical findings reveal either bidirectional causality between financial development and economic growth or unidirectional causality running from economic growth to financial development. However, the VECM can indicate Granger causality only within the sample period, and does not allow us to gauge the relative strength of Granger causality among the variables beyond the sample period. By portioning the variance of the forecast error of a certain variable into proportions attributable to shocks in each variable in the system including itself, variance decomposition can provide an indication of Granger causality beyond the sample period.

A change in any one of the random innovations $\varepsilon_{it}, i = 1,2,3$ of the VECM in Equations 4-6, will immediately change the value of the dependent variable and thus also the future values of the other two variables through the dynamic structure of the system. Since an innovation in each of the three variables produces changes in their future values as well as the other two variables, it is possible to break down the forecast-error variance of each variable in each future period and to determine the percentage of variance that each variable explains. Tables 7-10 depict the decomposition of the forecast error variances of the economic growth and financial development variables, up to fifteen periods ahead. To assign variance shares to the different variables, the residuals in the equations must be orthogonalized. Therefore, we applied Choleski's decomposition method using the following ordering: financial development indicator, investment/GDP ratio, real GDP per capita income. The main results in Tables 8-11 can be summarized as follows:

Table 8 shows that in Egypt about 16% of the total variance of M2Y is explained by economic growth in the long-run, whereas only about 8% of the variance of economic growth is explained by M2Y. From Table 9 we obtain the same conclusion for Egypt when QMY is used as the financial measure as when M2Y is used. In Algeria, a one standard error innovation shock to growth rate of QMY generates a permanent effect on economic growth that reaches 23%, about 5% lower than the permanent effect of economic growth on QMY growth rate. In Tunisia, economic growth explains about 23% of variance of QMY, whereas QMY fails to explain more than 1% of the variance of economic growth even after 15 years.

From Table 10, we can see that about 34% of the variance of economic growth in the case of Egypt is explained by innovations in PRIVATE, whereas economic growth explains less than 2% of the variance PRIVATE in the long-run. For Syria we obtain a different picture where economic growth succeeds to explain about a third of the total variance of PRIVATE, whereas PRIVATE explains only a fourth of that percentage. For Morocco, each of the two variables explains about 12% of the variance of the other in the long-run. Table 11 conveys the same conclusion when PRIVY is used as the financial measure as when PRIVATE is used.

6. Concluding Remarks

Our aim in this study was to examine the causal relationship between financial development and economic growth in five MENA countries for the past five decades, within a trivariate VAR framework. We included the investment\GDP ratio in our system, and therefore once causality was detected were able to determine if financial development affects economic growth by enhancing efficiency or indirectly by increasing resources for investments. We also used four different financial measures to capture the different channels through which finance may affect economic growth. Then our cointegration results only weakly support a long-run

relationship between financial development and economic growth. Furthermore, where cointegration was detected, the long-run Granger causality results give more support for the hypothesis that finance follows rather than leads economic growth, whereas short-run causality tests show no evidence of causality between the two variables (see the summary of Granger causality results in Table 7).

Based on these results, we can conclude that the financial reforms that most of the countries in this study have undertaken in the past two decades were not as successful in achieving the desired results of enhancing economic growth, either by improving efficiency or through increasing resources for capital accumulation. These findings may be attributed to several factors. First, the institutional environment, the quality of institutions, including the judicial system, bureaucracy, law and order, and property rights, are all of poor quality, which hinders commercial activity and investment, and hence growth (Creane et al., 2003). Second, the proper infrastructures that are necessary for successful investment remain weak. Third, even though there has been clear improvement in the financial sector over the past few decades, the degree of financial development is still below the threshold needed to spur economic growth. Therefore, to achieve the desired benefits of financial development, efforts should be devoted to deepening the financial sector by restricting government involvement in financial systems, enhancing competition, investing in human resources and the legal environment on the one hand and to improving the quality of institution on the other.

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Table 1.		**Results of ADF unit root test**					
Country	Variable	ADF levels	P*	LM(4) (Pvalue)	ADF in 1st difference	P*	LM(4) (Pvalue)
Algeria	LGDPPC	-1.74	0	3.46 (0.48)	-7.91***	0	3.52 (0.48)
	LM2Y	-2.81	1	4.24 (0.37)	-5.21***	1	1.69 (0.79)
	LQMY	-3.45*	1	3.06 (0.55)	-5.21***	1	1.69 (0.79)
	LPRIVATE	-1.81	0	0.93 (0.92)	-5.77***	0	0.20 (0.995)
	LPRIVY	-1.74	0	2.87 (0.92)	-5.16***	0	1.92 (0.75)
	LIY	-2.20	0	4.04 (0.40)	-3.17**£	3	6.21 (0.18)
Egypt	LGDPPC	-2.35	1	2.07 (0.72)	-3.83**	0	3.67 (0.45)
	LM2Y	-1.90	1	6.22 (0.18)	-3.97**	0	5.56 (0.23)
	LQMY	-1.71	1	5.70 (0.22)	-3.80**	0	3.00 (0.56)
	LPRIVATE	-2.17£	1	6.68 (0.15)	-7.49**	0	5.37 (0.25)
	LPRIVY	-2.50	0	1.33 (0.86)	-6.74***	0	1.03 (0.91)
	LIY	-1.55	0	3.82 (0.43)	-5.82***	0	1.67 (0.79)
Morocco	LGDPPC	-2.96	1	6.25 (0.18)	-9.8***	0	4.32 (0.36)
	LM2Y	-1.48	1	1.32 (0.86)	-8.82***	0	1.46 (0.83)
	LQMY	-2.73	0	4.75 (0.31)	-8.10***	0	3.60 (0.46)
	LPRIVATE	-1.37	0	2.61 (0.63)	-5.48***	0	6.72 (0.15)
	LPRIVY	-1.95	0	2.37 (0.67)	-7.23***	0	0.66 (0.96)
	LIY	-2.58	0	5.00 (0.29)	-6.59***	0	5.94 (0.20)
Syria	LGDPPC	-1.69	0	2.61 (0.62)	-7.45***	0	3.02 (0.56)
	LM2Y	-2.61	1	1.51 (0.82)	-4.61***	0	3.37 (0.50)
	LQMY	-2.10	1	3.32 (0.51)	-4.49***	0	3.50 (0.48)
	LPRIVATE	-2.43	0	6.04 (0.20)	-3.42**£	1	4.81 (0.31)
	LPRIVY	-3.00	0	1.56 (0.82)	-4.31***£	1	0.40 (0.98)
	LIY	-2.08	0	5.27 (0.26)	-4.82***	0	2.25 (0.69)
Tunisia	LGDPPC	-1.86	0	2.20 (0.70)	-6.67***	0	4.72 (0.32)
	LM2Y	-2.81	0	3.82 (0.43)	-7.29***	0	1.68 (0.79)
	LQMY	-2.39£	1	2.84 (0.58)	-7.90***	0	2.52 (0.64)
	LPRIVATE	-2.61£	3	6.98 (0.14)	-3.28**£	2	4.42 (0.35)
	LPRIVY	-2.92	0	1.51 (0.82)	-7.09***	0	2.56 (0.63)
	LIY	-2.64£	1	5.45 (0.24)	-6.38***	0	4.82 (0.31)

LY, LM2Y, LQMY, LPRIVATE, LPRIVY, and LIY are, respectively, the natural logarithms of real GDP per capita, share of M2 in GDP, share of M2 minus currency outside of banking in GDP, share of credit to private sector in total domestic credit, share of credit to private sector in GDP, and share of gross fixed capital formation in GDP.

k* is the optimal lag lengths chosen by Schwarz information criterion with a maximum of 4 lags.

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

LM(4) is the Lagrange Multiplier test for up to fourth-order serial correlation in the residuals, which is asymptotically distributed $\chi^2_{(4)}$.

£ optimal lag lengths chosen by Schwarz information criterion were modified to guarantee white noise in residuals.

Table 2.	**Cointegration Test Results**				
Country	Financial indicator	Hypothesis	k*	$\lambda_{\max}$	Trace
Algeria	LM2Y	H_A	1	10.79	21.49
		H_B		6.5	10.7
	LQMY	H_A	1	15.53	30.63**
		H_B		11.51	15.1
	LPRIVATE	H_A	1	9.94	17.7
		H_B		5.73	7.77
	LPRIVY	H_A	1	9.27	16.42
		H_B		6.21	7.15
Egypt	LM2Y	H_A	2	22.09*	28.66**
		H_B		5.7	6.57
	LQMY	H_A	2	24.27**	31.78**
		H_B		6.42	7.51
	LPRIVATE	H_A	1	24.20**	32.90**
		H_B		8.12	8.7
	LPRIVY	H_A	1	20.04*	29.61*
		H_B		9.18	9.57
Morocco	LM2Y	H_A	1	15.15	22.91
		H_B		7.64	7.75
	LQMY	H_A	1	16.81	25.27
		H_B		8.31	8.46
	LPRIVATE	H_A	1	23.89**	31.50**
		H_B		7.59	7.61
	LPRIVY	H_A	1	14.65	21.00
		H_B		6.20	6.35
Syria	LM2Y	H_A	1	13.73	22.01
		H_B		5.33	8.28
	LQMY	H_A	1	15.19	22.6
		H_B		5.74	7.41
	LPRIVATE	H_A	1	20.71*	29.03*
		H_B		7.63	8.32
	LPRIVY	H_A	1	24.08**	38.30***
		H_B		9.04	14.22
Tunisia	LM2Y	H_A	1	14.96	22.13
		H_B		6.62	7.17
	LQMY	H_A	1	23.87**	30.82***
		H_B		6.20	6.95
	LPRIVATE	H_A	1	12.52	22.36
		H_B		9.36	9.85
	LPRIVY	H_A	1	22.13**	31.19**
		H_B		8.05	9.06

Under the trace statistic

$H_A : H_0 : r = 0 \ \textit{against} \ \ H_1 : r \geq 1$

$H_B : H_0 : r \leq 1 \ \textit{against} \ \ H_1 : r \geq 2$, and under $\lambda_{\max}$ statistic $H_A : H_0 : r = 0 \ \textit{against} \ \ H_1 : r = 1$

$H_B : H_0 : r = 1 \ \textit{against} \ \ H_1 : r = 2$

*,**,*** indicate significance at the 10%, 5%, and 1% levels, respectively.

λ_{max} and Trace are Johansen's maximum eigenvalue and Trace statistics, respectively.

*k** represents the optimal lag length based on Schwarz information criterion from the unrestricted VAR model.

Table 3 - Granger Causality Test Results (FD=M2Y)

Panel A

Country	**H_0: Financial development does not Granger cause income growth**					***k****	**LM(4)** **(P-value)**
	α_1	$t_{(\alpha_1=0)}$	$LR_{(\beta_{LY}=0)}$	$LR_{(\beta_{LDF}=0)}$	$F_{(\delta_{12}=0)}$		
Egypt	-0.03	-1.28		14.14***	1.11	2	10.60 (0.30)

Panel B

Country	**H_0: Income growth does not Granger cause financial development**					***k****	**LM(4)** **(P-value)**
	α_2	$t_{(\alpha_2=0)}$	$LR_{(\beta_{LY}=0)}$	$LR_{(\beta_{LDF}=0)}$	$F_{(\delta_{21}=0)}$		
Egypt	0.18	3.62***	12.98***		1.01	2	10.60 (0.30)

Table 4 - Granger Causality Test Results (FD=QMY)

Panel A

Country	H_0: Financial development does not Granger cause income growth					k^*	LM(4) (P-value)
	α_1	$t_{(\alpha_1=0)}$	$LR_{(\beta_{LY}=0)}$	$LR_{(\beta_{LFD}=0)}$	$F_{(\delta_{12}=0)}$		
Algeria	-0.11	-1.84*		4.02*		1	7.37 (0.60)
Egypt	-0.03	-1.28		12.88***	1.53	2	9.84 (0.36)
Tunisia	0.03	0.67		13.60***		1	9.85 (0.36)

Panel B

Country	H_0: Income growth does not Granger cause financial development					k^*	LM(4) (P-value)
	α_2	$t_{(\alpha_2=0)}$	$LR_{(\beta_{LY}=0)}$	$LR_{(\beta_{LFD}=0)}$	$F_{(\delta_{21}=0)}$		
Algeria	0.27	1.61	3.58*			1	7.37 (0.60)
Egypt	0.23	3.79***	11.36***		1.90	2	9.845 (0.36)
Tunisia	0.27	4.91***	12.12***			1	9.85 (0.36)

$t_{(\alpha_i=0)}$ and $F_{(\delta_{ij}=0)}$ are the t-statistic for testing the null that α_i is zero and the standard F-statistic values for testing the null that all δ_{ij} coefficients in equation *i* are zeroes, respectively, in equations 4-6, where $i, j = Y_1, Y_2, Y_3$. Y_1 stands for per capita income, Y_2 stands for the financial development indicator, and Y_3 stands for investment GDP ratio. $LR_{\beta_{LY}=0}$ and $LR_{\beta_{FD}=0}$ are the likelihood ratios for testing the nulls that the coefficient of the natural logarithm of real GDP per capita and the coefficient of the natural logarithm of the financial development variable are zero in the cointegration vector, respectively. LR is asymptotically distributed as χ_1^2.

*, **, *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Lag lengths of the three variables were determined using Shwarz's criterion, with maximum lags of 4 allowed for each variable in the unrestricted VAR.

Table 5 - Granger Causality Test Results (FD=PRIVATE)

Panel A

Country	H_0: Financial development does not Granger cause income growth					k^*	LM(4) (P-value)
	α_1	$t_{(\alpha_1=0)}$	$LR_{(\beta_{LY}=0)}$	$LR_{(\beta_{LFD}=0)}$	$F_{(\delta_{12}=0)}$		
Egypt	-0.04	-3.27***		13.72***		1	6.48 (0.69)
Morocco	-0.12	-2.15**		11.24***		1	5.22 (0.81)
Syria	-0.12	-1.89*		4.57**		1	6.19 (0.72)

Panel B

Country	H_0: Income growth does not Granger cause financial development					k^*	LM(4) (P-value)
	α_2	$t_{(\alpha_2=0)}$	$LR_{(\beta_{LY}=0)}$	$LR_{(\beta_{LFD}=0)}$	$F_{(\delta_{21}=0)}$		
Egypt	0.18	3.35***	13.92***			1	6.48 (0.69)
Morocco	0.21	4.05***	16.29***			1	5.22 (0.81)
Syria	0.57	4.89***	10.37***			1	6.19 (0.72)

$t_{(\alpha_i=0)}$ and $F_{(\delta_{ij}=0)}$ are the t-statistic for testing the null that α_i is zero and the standard F-statistic values for testing the null that all coefficients δ_{ij} in equation *i* are zero, respectively, in Equations 4-6, where $i, j = Y_1, Y_2, Y_3$. Y_1 stands for per capita income, Y_2 stands for the financial development indicator, and Y_3 stands for investment GDP ratio. $LR_{\beta_{LY}=0}$ and $LR_{\beta_{FD}=0}$ are the likelihood ratios for testing the nulls that the coefficient of the natural logarithm of real GDP per capita and the coefficient of the natural logarithm of the financial development variable are zero in the cointegration vector, respectively. LR is asymptotically distributed as χ_1^2.

*, **, *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Lag lengths of the three variables were determined using Shwarz's criterion, with maximum lags of 4 allowed for each variable in the unrestricted VAR.

Table 6 - Granger Causality Test Results (FD=PRIVY)

Panel A

Country	H_0: Financial development does not Granger cause income growth					k^*	LM(4) (P-value)
	α_1	$t_{(\alpha_1=0)}$	$LR_{(\beta_{LY}=0)}$	$LR_{(\beta_{LFD}=0)}$	$F_{(\delta_{12}=0)}$		
Egypt	-0.07	-3.65***		9.70***		1	10.73 (0.29)
Syria	-0.02	-0.47		4.39***		1	4.27 (0.89)
Tunisia	0.03	1.14		13.26***		1	7.08 (0.63)

Panel B

Country	H_0: Income growth does not Granger cause financial development					k^*	LM(4) (P-value)
	α_2	$t_{(\alpha_2=0)}$	$LR_{(\beta_{LY}=0)}$	$LR_{(\beta_{LFD}=0)}$	$F_{(\delta_{21}=0)}$		
Egypt	0.23	2.55***	9.78***			1	10.73 (0.29)
Syria	0.26	4.17***	4.66***			1	4.27 (0.89)
Tunisia	0.16	3.47***	11.54***			1	7.08 (0.63)

$t_{(\alpha_i=0)}$ and $F_{(\delta_{ij}=0)}$ are the t-statistic for testing the null that α_i is zero and the standard F-statistic values for testing the null that all coefficients δ_{ij} in equation *i* are zero, respectively, in Equations 4-6, where $i, j = Y_1, Y_2, Y_3$. Y_1 stands for per capita income, Y_2 stands for the financial development indicator, and Y_3 stands for investment GDP ratio. $LR_{\beta_{LY}=0}$ and $LR_{\beta_{FD}=0}$ are the likelihood ratios for testing the nulls that the coefficient of the natural logarithm of real GDP per capita and the coefficient of the natural logarithm of the financial development variable are zero in the cointegration vector, respectively. LR is asymptotically distributed as χ_1^2.

*, **, *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Lag lengths of the three variables were determined using Shwarz's criterion, with maximum lags of 4 allowed for each variable in the unrestricted VAR.

Table 7 Summary of Granger Causality Results§

Financial measure	M2Y		QMY		PRIVY		PRIVATE	
Country	Finance causes growth	Growth causes finance	Finance causes growth	Growth causes finance	Finance causes growth	Growth causes finance	Finance causes growth	Growth causes finance
Algeria			YES	NO				
Egypt	NO	YES	NO	YES	YES	YES	YES	YES
Morocco							YES	YES
Syria					NO	YES	YES	YES
Tunisia			NO	YES	NO	YES		

Blank cells denote the absence of cointegration between the financial measure and income.
§The results above relate to long run causality as no short run causality was detected in any country.

Table 8.	**Variance Decomposition**			
	LGDPPC response to a shock on LM2Y			
Year Country	2	5	10	15
EGY	0.523	6.772	8.192	8.390
	LM2Y response to a shock on LGDPPC			
EGY	0.112	3.243	13.298	15.507

The figures in the table show the percentage of the forecast error variance of LGDPPC (LM2Y) that is explained by LM2Y (LGDPPC).

Table 9.	**Variance Decomposition**			
	LGDPPC response to a shock on LQMY			
Year Country	2	5	10	15
ALG	1.548	9.510	18.549	22.782
EGY	0.418	6.162	8.227	8.658
TUN	0.137	0.523	0.769	0.856
	LQMY response to a shock on LGDPPC			
ALG	4.972	11.686	21.254	27.529
EGY	0.469	2.513	11.882	14.285
TUN	4.895	11.771	19.688	22.766

The figures in the table show the percentage of the forecast error variance of LGDPPC (LQMY) that is explained by LQMY (LGDPPC).

Table 10.	**Variance Decomposition**			
	LGDPPC response to a shock on LPRIVATE			
Year Country	2	5	10	15
EGY	13.447	24.678	31.404	33.725
MOR	9.485	11.207	11.849	12.038
SYR	0.166	1.622	4.989	7.641
	LPRIVATE response to a shock on LGDPPC			
EGY	0.072	0.617	1.308	1.584
MOR	2.017	7.344	9.994	10.783
SYR	2.331	13.611	28.036	32.846

The figures in the table show the percentage of the forecast error variance of LGDPPC (LPRIVATE) that is explained by LPRIVATE (LGDPPC).

Table 11.	**Variance Decomposition**			
	LGDPPC response to a shock on LPRIVY			
Year Country	2	5	10	15
EGY	4.267	22.323	37.541	43.382
SYR	0.015	0.128	0.368	0.564
TUN	0.322	1.531	2.583	3.012
	LPRIVY response to a shock on LGDPPC			
EGY	3.552	4.708	5.674	5.953
SYR	15.497	12.382	35.444	57.714
TUN	26.678	20.978	15.888	13.399

The figures in the table show the percentage of the forecast error variance of LGDPPC (LPRIVY) that is explained by LPRIVY (LGDPPC).

Chart 1: Currency Outside Banks\M2 Ratios

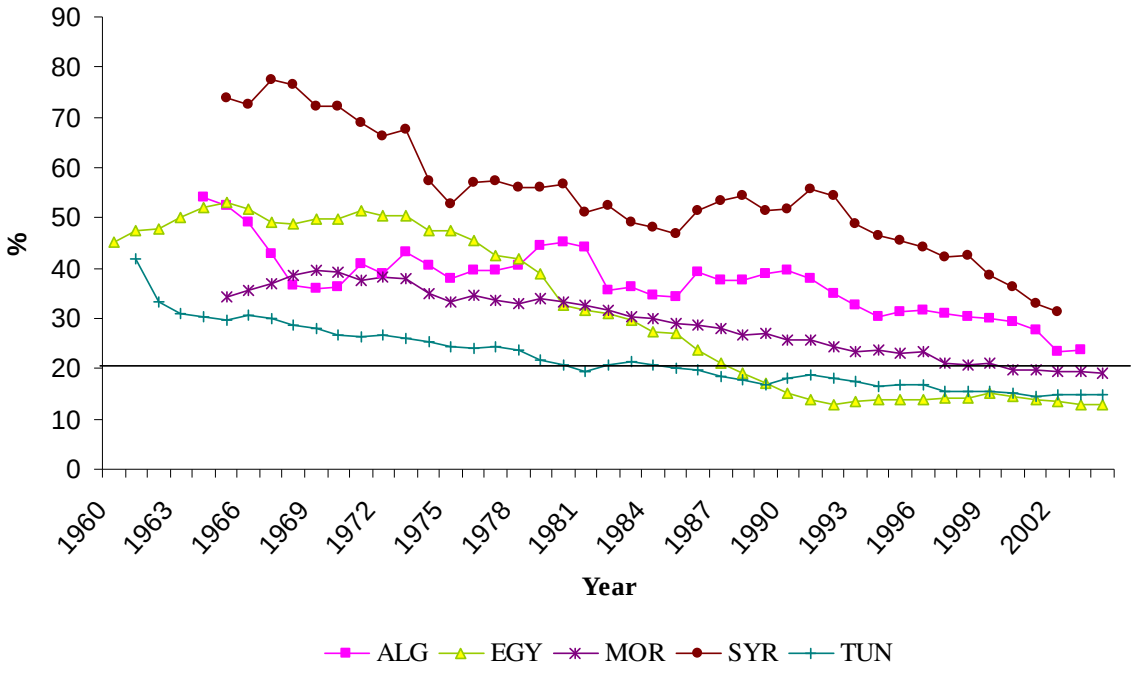

Chart 2: Private Credit\GDP ratios