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Financial development and economic growth nexus in the MENA countries: Bootstrap panel granger causality analysis

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ABSTRACT

This paper investigates the direction of causality between financial development and economic growth in the Middle East and North African (MENA) countries. The panel causality testing approach, developed by Kónya (2006) [Kónya, L. (2006), exports and growth: Granger causality analysis on OECD countries with a panel data approach, Economic Modelling, 23, 978–992], based on the Seemingly Unrelated Regressions and Wald tests with the country specific bootstrap critical values, is applied to the panel of fifteen MENA countries for the period 1980–2007. In order to capture the different aspects of financial development, six different indicators are used. Empirical results show that there is no clear consensus on the direction of causality between financial development and economic growth for all measurements of financial development and it is also observed that the findings are country specific.

1. Introduction

The relationship between financial development and economic growth has been one of the hotly debated issues of whether the financial sector actually contributes to the real sector in the process of economic development. There is a great deal of empirical literature that has scrutinized the experiences of the developed and developing economies. This special interest comes from the intermediary role of financial markets between savers and investors in the process of economic development. Specifically, financial systems facilitate the trading, hedging, diversifying, and pooling of risk, allocate resources, monitor managers and exert corporate control, mobilize savings, and ease the exchange of goods and services (Levine, 1997). It is, therefore, widely accepted that well-functioning financial markets can positively contribute to economic growth in both developed and developing economies.

The MENA countries, over the last two decades, have experienced a wave of liberalization in the financial sector (Ben Naceur et al., 2008) with an expectation that lifting government restrictions on the banking system in terms of interest rate ceiling, high reserve requirement, and directed credit programs which enhance financial development and, in turn, expected to promote economic growth (McKinnon, 1973; Shaw, 1973). A careful investigation of the results from these experiences provides additional evidence of whether the financial sector actually causes to economic growth. The aim of this paper is therefore to empirically investigate the direction of causality between financial development and economic growth in the MENA countries. To this end, the panel Granger causality testing procedure developed by Kónya (2006) is conducted for fifteen MENA countries over the period 1980–2007.

This paper contributes to the empirical literature on financial development and economic growth by three aspects. Firstly, the panel causality test carried out in this research is novel to the literature on financial development and economic growth. In particular, the panel causality approach controls for cross-sectional dependence across the members. Since the assumption of cross-sectional independence is difficult to satisfy in a panel data, neglecting this information causes bias and inconsistency in empirical results (Bai and Kao, 2006). To the best of our knowledge, there is no attempt to incorporate the hypothesis of cross-sectional dependence in the literature on financial development and economic growth in the MENA countries. Secondly, due to the multidimensional nature of financial development, six different indicators of financial development are utilized to capture these various aspects of financial sector in the process of economic development. Thirdly, the data set utilized in the analysis contains fifteen MENA countries for a quite long period, 1980–2007, which are based upon the availability of the data.

Structure of this paper is as follows: the theoretical framework which provides potential channels for financial sector to economic growth will be explained in Section 2. The existing empirical literature on financial development–economic growth nexus will be reviewed

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in Section 3. The measures of financial development will be introduced in Section 4, followed by the model specification and data in Section 5. The empirical methodology and findings will be presented in Section 6. The paper will end up with the concluding remarks.

2. Theoretical framework

The theoretical links between financial development and economic growth can be traced back to early last century and has been growing since the 1980s (Hermes, 1994, Levine, 1997; Khan and Senhadji, 2003; Trew, 2006). With regard to the theoretical literature on this issue, the views on the importance of financial sector in economic growth can be classified under two main categories (Hermes, 1994; Xu, 2000). The first one is rooted from the work of Schumpeter (1911) who was the earliest economist and highlighted the importance of finance in the process of economic development. Schumpeter (1911) emphasized the importance of financial services in promoting economic growth and highlighted circumstances when financial institutions can actively encourage innovation and promote future growth by determining and funding productive investments. The second one is traced back to the work of Robinson (1952) who considered finance as a relatively unimportant factor in growth process. In particular, Robinson (1952: 52, 86) argued that as output increases the demand for financial service increases too, which in turn has a positive effect on financial development. All other things being equal, financial development follows output growth and not the opposite.

Patrick (1966) also contributed to this literature by identifying two possible patterns in the causal relationship between financial development and economic growth. The first one is called demand-following which means that the creation of modern financial institutions, their financial assets and liabilities, and related financial services is in response to the demand for these services by investors and savers in the real economy (Patrick, 1966: 174). This approach implies that financial system can thus support and sustain the leading sectors in the process of growth. Here, an expansion of the financial system is induced as a consequence of real economic growth. The second one is termed as supply-leading which means the creation of financial institutions and the supply of their financial assets, liabilities, and related financial services in advance of demand for them, especially the demand of entrepreneurs in the modern, growth-inducing sectors. Supply-leading has two functions: to transfer resources from traditional (non-growth) sectors to modern sectors, and to promote and stimulate an entrepreneurial response in these modern sectors (Patrick, 1966: 75). In addition, Gurley and Shaw (1955) and Goldsmith (1969) have argued that more developed financial markets promote economic growth by mobilizing savings and facilitating investment.

Despite the previous literature stressing the importance of financial development in the process of economic growth (Gurley and Shaw, 1955; Patrick, 1966; Goldsmith, 1969), a convincing theoretical framework was lacking until the publications of McKinnon (1973) and Shaw (1973). According to them, pervasive government and central bank regulations distort financial markets and these distortions adversely affect savings and investment decisions. In other words, artificially low levels of interest rate depress savings and promote inefficient investment and, hence, hinder economic growth in the developing economies. The prescriptions of McKinnon–Shaw for the developing countries are to liberalize financial markets by deregulating interest rates and permitting financial institutions to allocate credit on the basis of viability and productivity of borrowers, their enterprises or projects. They basically argue that the determination of the rate of interest in the banking sector, usually the only organized financial institutions in developing countries, should be market-driven to achieve a superior allocation of funds for investment and hence faster economic growth. It is believed that financial liberalization through higher interest rate leads not only to a more efficient allocation of funds but also to an increase in loanable funds by attracting more households' savings to banking deposits. This in turn leads to greater investment and hence faster economic growth. McKinnon–Shaw approach constructed a theoretical link between financial liberalization and economic growth and implicitly highlighted that finance leads economic growth as in Schumpeter (1911).

The emergence of endogenous growth theory in the 1980s (Romer, 1986, 1990; Lucas, 1988; Barro, 1991) has attracted a renewed attention to the relationship between financial development and economic growth. Several studies, therefore, have attempted to explain how the operation of the financial sector may affect the rate of economic growth in the endogenous framework (Greenwood and Jovanovic, 1990; Bencivenga and Smith, 1991; King and Levine, 1993a, b; Roubini and Sala-i Martin, 1992, Pagano, 1993, Bencivenga et al., 1996; Blackburn and Hung, 1998; Deidda, 2006). In these studies, financial intermediaries such as information collection and analysis, risk sharing, liquidity provision are explicitly modeled in which financial development is generally growth-promoting (Levine, 1997).

However, Robinson (1952), Lucas (1988), Stern (1989), Chandavarkar (1992), Stiglitz (1994) and Singh and Weisse (1998) question the importance of the financial system in promoting economic growth. In particular, while Lucas (1988: 6) states that "the importance of financial matters is very badly overstressed", Chandavarkar (1992: 134) notes that "none of the pioneers of development economics … even list finance as a factor of development". Singh and Weisse (1998) emphasize the risks of financial collapse and consequent economic recession that may result from a rapid deregulation of once repressed financial systems.

These theoretical discussions reveal that there is not a consensus on the role of finance in economic growth and the direction of causal inference between finance and growth. However, the debate whether the financial sector leads economic growth or *vice versa* has important policy implications for both developed and developing countries. As Levine (1998) notes that empirical evidence concerning the causality between financial development and economic growth could assist governments to carry out whether the reforms should be prioritized in the financial sectors. The proponents of the first view (Schumpeter, 1911; Gurley and Shaw, 1955; Goldsmith, 1969; McKinnon, 1973; Shaw, 1973; Greenwood and Jovanovic, 1990; Bencivenga and Smith, 1991; King and Levine, 1993a,b; Roubini and Sala-i Martin, 1992, Pagano, 1993) suggest that government policies should be directed towards improving financial system, since financial development has important causal effects on growth. On the other hand, the supporters of the second view (Robinson, 1952; Lucas, 1988; Stern, 1989; Chandavarkar, 1992; Stiglitz, 1994) argue that government policies towards improving financial system has little effects on growth, since financial development results from economic growth and has little impact on it (Xu, 2000: 332).

The divergent theoretical approaches, discussed above, towards the relationship between finance and growth show that economists and policy-makers are still confronted with supply-leading and demand-following dichotomy (Murinde, 1996; Murinde and Eng, 1994a,b; Shan et al. 2001; Deidda, 2006). Conflicting results from numerous empirical studies for country groups and specific countries have not contributed to reach a firm conclusion. Instead, the empirical results seem to be deepened the existing dichotomy further, since the results are ambiguous (Lawrence, 2006).

3. Literature review

The relationship between financial development and economic growth has been recently tested empirically in a number of studies for many specific country or country groups. So far, there is no general consensus on the relationship between financial development and

economic growth in terms of the role and importance of finance on growth and the direction of causality. One can reach this firm judgment shortly after a quick review of the empirical works on this subject (Gupta, 1984; Jung, 1986; Odedokun, 1989; King and Levine, 1993a,b; Murinde and Eng, 1994a,b; Lyons and Murinde, 1994; Gregorio and Guidotti, 1995; Demetriades and Hussein, 1996; Akinboade, 1998; Rousseau and Wachtel, 1998; Ram, 1999; Levine et al., 2000; Shan et al., 2001; Rousseau and Wachtel, 2001; Arestis et al., 2001; Hahn, 2002; Manning, 2003; Khan and Senhadji, 2003; Christopoulos and Tsionas, 2004; Rioja and Valev, 2004; Liang and Teng, 2006; Yang and Yi, 2008; Odhiambo, 2009; Colombage, 2009). The enormous and growing literature on this subject can be summarized under two main tendencies. On the one hand, cross country and panel data studies find a positive effect of financial development on output growth by controlling for potential biases induced by simultaneity, the omitted variables and the unobserved country specific effects. On the other hand, most of the time-series studies, which offer an opportunity to analyze the causality pattern and its evolution over the time between financial development and economic growth, find either unidirectional causality from finance to growth or bi-directional causality.

With regard to the empirical literature in this subject on the MENA region, there is a limited number of empirical studies (Al-Tamimi et al., 2002; Achy, 2004; Boulila and Trabelsi, 2004; Creane et al. 2004, Al-Avad and Harb, 2005; Abu-Bader and Abu-Qarn, 2008a).[1] Al-Tamimi et al. (2002) investigate the causal relationship between the indicators of financial development and economic growth by using time-series analysis for selected Arab countries. The results indicate that financial development and real GDP growth are strongly linked in the long-run. However, Granger causality tests and the impulse response functions indicate that the linkage is weak in the short-run. Moreover, there is no clear evidence that financial development affects economic growth or *vice versa*.

Achy (2004) examines the relationship between financial development and economic growth for five MENA countries for the period 1970–1997. By controlling fundamental variables such as private investment, human capital, and policy related variables in terms of trade openness, inflation rate, and the burden of external debt, the empirical results show that financial depth indicators fail to explain growth experience in the MENA countries under investigation.

Boulila and Trabelsi (2004) investigate the subject for sixteen MENA countries for the period 1960–2002. The empirical findings obtained either with cointegration based analysis or standard Granger causality methods support the hypothesis that causality is running from the real to the financial sector. Moreover, there is a little evidence on the view that finance is a leading sector in the determination of long-run growth in the MENA region.

Creane et al. (2004) assess the financial sector development in the MENA countries – by collecting data on a wide range of financial sector issues, including from new surveys on economists from the MENA countries at the IMF in 2000/01 and 2002/03 – and propose several policy measures to enhance this sector's performance. Based on the data, they construct new indices of financial development for the MENA countries encompassing six themes: development of the monetary sector and monetary policy, banking sector development, nonbank financial sector development, regulation and supervision, financial openness, and institutional quality, such as the strength of creditor rights. Using a subset of indicators, they also analyze the MENA region's performance over time relative to a few other regions. The authors find that, within the MENA region, there is a substantial variation in the degree of financial development; some countries are fairly well advanced, whereas a few others have significant room for improvement. Compared to the experiences from most of other developing country groups, the MENA region performs well, but it ranks far behind the industrialized countries and the East Asia.

Al-Avad and Harb (2005), for ten MENA countries for the period 1969–2000 and by using panel cointegration approach, conclude that the long-run financial development and economic growth may be related to some level. However, in the short-run, the evidence of causality is very weak. In a more recent study, Abu-Bader and Abu-Qarn (2008a) examine the causal relationship between financial development and economic growth for six Middle Eastern and North African countries within a vector autoregressive framework. The authors employ four different measures of financial development and apply the Toda and Yamamoto approach to Granger causality. The results strongly support the hypothesis that finance leads to growth in five out of the six countries. Only in Israel wherein a weak support could be found for causality from economic growth to financial development. These findings suggest the need to accelerate the financial reforms that have been launched since the mid 1980s and to improve the efficiency of these countries' financial systems to stimulate saving/investment and, hence, long-term economic growth.

4. Measurement of financial development

One of the most important issues in assessing the relationship between financial development and economic growth is how to obtain a satisfactory empirical measure of financial development. This difficulty comes from the meaning of financial development which is the capability of one country to channel savings into investment efficiently and effectively within its own borders owing to (i) the quality of its institutional and regulatory framework, (ii) the size of its financial markets, the diversity of its financial instruments and private agents' ease of access to them and (iii) the financial markets' performance, e.g. in terms of efficiency and liquidity (Dorrucci et al., 2009). Similarly, Hartmann et al. (2007) define financial development as the process of financial innovation, as well as institutional and organizational improvements in a financial system, which reduce asymmetric information, increase the completeness of markets, add possibilities for agents to engage in financial transactions through (explicit or implicit) contracts, reduce transaction costs and increase competition. The scope of financial development, therefore, includes improvements (innovations) in products, institutions and organizations in banking sector, non-banking financial structures and capital markets.

Several indicators of financial development have been proposed in the literature and different indicators will proxy different aspects of financial system. In this paper, the indicators of financial development for the stock and bond markets are not employed in the empirical analysis, since the capital markets in the region are still, in general, underdeveloped. In particular, over the last two decades, MENA countries, like many other developing countries, have experienced a wave of financial sector liberalization. In addition, since the mid-1980s, the financial system has been gradually liberalized by reducing and eliminating interest rate subsidies to priority sectors; managing liquidity through a more active use of reserve requirements and a more market-based allocation of refinancing; introducing new banking laws to increase the autonomy of the central banks and to introduce prudential regulations in line with international standards; and updating stock market legislation and activities (Ben Naceur et al., 2008). Therefore the whole region's economy can be classified as a bank-based economy since banks are the dominant financial institutions.

As far as the nature of the financial sector in the MENA countries is concerned, three types of proxies are used to measure the developments in the financial sector in the empirical analysis in this paper:

[1] In the literature, there are case studies which empirically investigated the causality issue for a single country in the MENA region. For instance, Demetriades and Hussein (1996), Kar and Pentecost (2000) and Nazlioglu et al. (2009) for Turkey, Bolbol et al. (2005), Abu-Bader and Abu-Qarn (2008b) and Al-Yousif (2002) for Egypt and Ghali (1999) for Tunisia are among few of these studies.

monetary aggregates, domestic and private credit values and banking variables (Lynch, 1996; Demetriades and Hussein, 1996; Arestis and Demetriades, 1997; Luintel and Khan, 1999; Khan and Senhadji, 2003; Liang and Teng, 2006; Odhiambo, 2009).

Initially, indicators of financial development are based on monetary aggregates such as M1 or M2, mainly because these aggregates are widely available. In the literature, the most commonly used measure of financial development for monetary aggregates is the ratios of narrow (M1) and broad measure of the money stock (M2) to the level of nominal income (King and Levine, 1993a,b; Wood, 1993; Murinde and Eng, 1994a,b; Lyons and Murinde, 1994; Berthelemy and Varoudakis, 1995; Gregorio and Guidotti, 1995; Arestis and Demetriades, 1997; Sinha and Macri, 2001; Odhiambo, 2009). This simple indicator measures the degree of monetization in the economy. The monetization variable is designed to show the real size of the financial sector of a growing economy in which money provides valuable payment and saving services. The 'narrow money' stock (M1) best reflects the former – payment services – and 'broad money' (M2) the latter, savings function. Narrow money balances should rise in line with economic transactions, but broad money should rise at a faster pace if financial deepening is occurring (Lynch, 1996).

In some cases, however, monetary aggregates – especially narrow money aggregates – may be very poor indicators of the extent of financial development. For example, Gregorio and Guidotti (1995) criticize the use of narrow money to income ratio as a proxy for financial development on the grounds that a high level of monetization (M1/GDP) is most likely the result of financial underdevelopment, while a low level of monetization is the result of a high degree of sophistication in financial markets which allows individuals to economize on their money holdings. In addition, Khan and Senhadji (2003) argue that these monetary aggregates are more related to the ability of the financial system to provide transaction services than to the ability to channel funds from savers to borrowers. Gregorio and Guidotti (1995) suggest the use of a less liquid monetary aggregate (M3 or M2/GDP) as a proxy for financial development. Although M3 overcomes some shortcomings associated with M1 and M2, it still contains M2 and therefore maybe influenced by factors other than financial depth.

An alternative to a broad money ratio is a ratio of bank deposit liabilities to income as a quality proxy for financial development (Demetriades and Hussein, 1996; Luintel and Khan, 1999, Liang and Teng, 2006). In developing countries, a large component of the broad money stock is currency held outside the banking system. In principle a rising ratio of broad money to income may reflect the more extensive use of currency rather than an increase in the volume of bank deposits. Therefore in order to obtain a more representative measure of financial development, currency in circulation should be excluded from the broad money stock.

More recently, credit to the private sector has been favored as an alternative measure of financial intermediation (Khan and Senhadji, 2003). To this end, the ratio of domestic credit to income can be used as another proxy for financial development (Odedokun, 1989; Liang and Teng, 2006). This represents the domestic assets of the financial sector. This is the major item on the asset side of the consolidated balance sheet of the financial sector. It is expected to increase in response to improved price signalling, represented primarily by the establishment of positive real interest rates. In order to obtain a more direct measure of financial intermediation, the private sector credit ratio is also widely employed as a fourth measure of financial development (Colombage, 2009). It is assumed that credit provided to the private sector generates increases in investment and productivity to a much larger extent than do credits to the public sector. It is also argued that loans to the private sector are given more stringently and that the improved quality of investment emanating from financial intermediaries' evaluation of project viability is more significant for private sector credits.

5. The model specification and data

Following the existing empirical literature on the causality between financial development and economic growth, the bivariate model is described as follows:

$$Economic\ Growth = f(Financial\ Development) \quad (1)$$

Based on the discussion presented in Section 4, this study employs six indicators of financial development: (i) M/Y: the ratio of narrow money to income, (ii) QM/Y: the ratio of quasi money to income, (iii) M2/Y: the ratio of M2 to income, (iv) BDL/Y: the ratio of deposit money bank liabilities to income, (v) CPS/Y: the ratio of private sector credit to income, and (vi) DC/Y: the ratio of domestic credit to income. Real income (RY) is chosen as a proxy for the economic growth. The data were compiled from the IMF's *International Financial Statistics* online database. The panel consists of fifteen MENA countries (Algeria, Bahrain, Egypt, Iran, Israel, Jordan, Kuwait, Libya, Morocco, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, and Turkey) and covers annual data for the period 1980–2007. Natural logarithms of all the variables are used in the econometric analysis.

6. The method and findings

The Granger causality means that the knowledge of past values of one variable (X) helps to improve the forecasts of another variable (Y). To test for the Granger causality among the variables in a panel data requires a careful treatment at least in terms of two issues. First issue is to control for a possible cross-sectional dependence across the members of panel. The rationale behind taking into account the cross-sectional dependence is due to fact that a shock affecting one country may also affect other countries because of a high degree of globalization as well as of international trade and financial integration. If there is a cross-sectional dependence, estimating sets of equations with Seemingly Unrelated Regressions (SUR) is more efficient than that of equation-by-equation with least-squares (OLS) (Zellner, 1962: 363). The Monte Carlo experiment carried out by Pesaran (2006) emphasizes the importance of testing for the cross-sectional dependence in a panel data study and also illustrates the substantial bias and size distortions when cross-sectional dependence is ignored (Pesaran, 2006: 970).

Second issue is to consider the heterogeneity in estimated parameters for each individual of panel in order to impose a restriction for the causal relationship. As Granger (2003) points out, the causality from one variable to another variable by imposing the joint restriction for whole panel is the strong null hypothesis. Assuming the homogeneity for the parameters in a panel data setting is not able to capture heterogeneity due to country specific characteristics (Breitung, 2005). Whereas, in many economic relationships such as financial development and economic growth nexus, it is highly possible to find out that while a significant relationship may exist in some countries, *vice versa* may also be true in some other countries. In particular, the homogeneity assumption for the MENA countries in analyzing causal relationships between financial development and economic growth may result in misleading findings due to the well-known fact that these countries have a certain degree of heterogeneity in terms of financial development and economic structure (see Creane et al. 2004).

To examine the direction of causality in a panel data, three approaches to date have been employed. First approach is based on estimating a panel vector error correction model by means of a generalized method of moments (GMM) estimator. However, this approach is not able to take into account neither the cross-sectional dependence nor the heterogeneity. Furthermore, the GMM estimators can produce inconsistent and misleading parameters unless the slope coefficients are in fact homogeneous (Pesaran et al. 1999). Even

though second approach proposed by Hurlin (2008) controls for the heterogeneity, it is not able to account for the cross-sectional dependence. On the other hand, the third approach proposed by Kónya (2006) is well enough to account for both the cross-sectional dependence and the heterogeneity. This approach is based on the SUR estimation that allows taking into account cross-sectional dependence across the members of panel. Since the direction of causality is tested based on the Wald tests with the country specific bootstrap critical values, this approach does not require the joint hypothesis for all the members of panel. Furthermore, the testing procedure does not require any pre-testing for panel unit root and cointegration (Kónya, 2006).

The panel causality approach of Kónya (2006) entails describing a system which includes two sets of equations. This system can be formulated as follows:

$$\begin{aligned} y_{1,t} &= \alpha_{1,1} + \sum_{i=1}^{ly_1}\beta_{1,1,i}y_{1,t-i} + \sum_{i=1}^{lx_1}\delta_{1,1,i}x_{k,1,t-i} + \varepsilon_{1,1,t} \\ y_{2,t} &= \alpha_{1,2} + \sum_{i=1}^{ly_1}\beta_{1,2,i}y_{2,t-i} + \sum_{i=1}^{lx_1}\delta_{1,2,i}x_{k,2,t-i} + \varepsilon_{1,2,t} \\ &\vdots \\ y_{N,t} &= \alpha_{1,N} + \sum_{i=1}^{ly_1}\beta_{1,N,i}y_{N,t-i} + \sum_{i=1}^{lx_1}\delta_{1,N,i}x_{k,N,t-i} + \varepsilon_{1,N,t} \end{aligned} \tag{2}$$

and

$$\begin{aligned} x_{k,1,t} &= \alpha_{2,1} + \sum_{i=1}^{ly_2}\beta_{2,1,i}y_{1,t-i} + \sum_{i=1}^{lx_2}\delta_{2,1,i}x_{k,1,t-i} + \varepsilon_{2,1,t} \\ x_{k,2,t} &= \alpha_{2,2} + \sum_{i=1}^{ly_2}\beta_{2,2,i}y_{2,t-i} + \sum_{i=1}^{lx_2}\delta_{2,2,i}x_{k,2,t-i} + \varepsilon_{2,2,t} \\ &\vdots \\ x_{k,N,t} &= \alpha_{2,N} + \sum_{i=1}^{ly_2}\beta_{2,N,i}y_{N,t-i} + \sum_{i=1}^{lx_2}\delta_{2,N,i}x_{k,N,t-i} + \varepsilon_{2,N,t} \end{aligned} \tag{3}$$

where Y denotes the real income, X_k refers to the indicator of financial development that subscripts k represents M/Y, QM/Y, M2/Y, BDL/Y, CPS/Y, and DC/Y, N is the number of the members of panel ($j=1,\ldots,N$), t is the time period ($t=1,\ldots,T$), l is the lag length. This system has two distinctive features. Firstly, since each equation in the system has different predetermined variables while the error terms might be contemporaneously correlated (i.e., cross-sectional dependency), these sets of equations are the SUR system. Secondly, since country specific bootstrap critical values[2] are used, the variables in the system do not need to be stationary, implying that the variables are used in level form irrespective of their time-series properties (Kónya, 2006: 979).

To test for Granger causality in this system, alternative causal relations are likely to be found for country j: (i) there is one-way Granger causality from X to Y if not all $\delta_{1,j,i}$s are zero, but all $\beta_{2,j,i}$s are zero. (ii) There is one-way Granger causality from Y to X if all $\delta_{1,j,i}$s are zero, but not all $\beta_{2,j,i}$s are zero. (iii) There is two-way Granger causality between X and Y if neither $\delta_{1,j,i}$s nor $\beta_{2,j,i}$s are zero. (iv) There is no Granger causality between X and Y if all $\delta_{1,j,i}$s and $\beta_{2,j,i}$s are zero.

Since the results from the causality test may be sensitive to the lag structure, determining the optimal lag length(s) is crucial for robustness of findings. For a relatively large panel, equation- and variable-varying lag structure would lead to an increase in the computational burden substantially. To overcome this problem, following Kónya (2006) we allow maximal lags to differ across variables, but to be the same across equations. We estimate the system for each possible pair of ly_1, lx_1, ly_2, and lx_2 respectively by assuming from 1 to 4 lags and then choose the combinations minimizing the Schwarz Bayesian Criterion.

Table 1
Results for cross-sectional dependence tests.

Financial development indicator						
Test	M/Y	QM/Y	M2/Y	BDL/Y	CPS/Y	DC/Y
CD_{BP}	224.51***	199.35***	223.68***	202.74***	232.79***	199.68***
CD_{LM}	8.24***	6.51***	8.19***	6.74***	8.81***	6.53***
CD	4.02***	5.47***	4.46***	3.14***	5.23***	3.59***

*** Indicates rejection of the null hypothesis at 1 percent level of significance.

As outlined earlier, testing for the cross-sectional dependence in a panel causality study is crucial for selecting the appropriate estimator. To investigate the existence of cross-sectional dependence we carried out three different tests[3] and illustrated results in Table 1. It is clear that the null of no cross-sectional dependence across the members of panel is strongly rejected at the conventional levels of significance, implying that the SUR method is appropriate rather than country-by-country OLS estimation. The cross-sectional dependence across the MENA countries indicates that a shock to either the real or financial sector in a country is likely to affect other countries in the MENA region.

In order to save from the space and to summarize the findings[4], results obtained from the panel Granger causality test[5] for each pair of the financial development indicators are illustrated in Table 2. We use the following notation in order to simplify the presentation of findings: "→" denotes the direction of the causality from financial development to economic growth and "←" implies the direction of the causality from economic growth to financial development.

At first glance, the results show that the direction of causality from financial development (economic growth) to economic growth (financial development) is sensitive to the measurement of financial development in each MENA country. For instance, none of the financial development indicators causes economic growth in the cases of Algeria, Egypt, Iran, and Sudan. Besides, the same picture is observed for Bahrain, Jordan, and Tunisia in which only one of the financial development indicators causes economic growth.

For Israel and Morocco, the findings support strong evidence on supply-leading hypothesis which implies that financial development induces economic growth. On the other hand, the results do not show a uniform structure for Kuwait, Libya, Qatar, Saudi Arabia, Syria, and Turkey where economic growth is associated with the different indicators of financial development. For example, while the monetary aggregates lead to increase in the real income in Kuwait and Libya, either domestic/private credit values or banking variables cause economic growth in Syria and Tunisia.

As regards the causality from economic growth to financial development, the results given in Panel B in Table 2 show that financial development is not sensitive to economic growth in Algeria, Egypt, Iran, Qatar, Saudi Arabia, and Syria in which either none of or only one of the financial development indicators is associated with the real income. For the remaining cases, the results provide weak evidence in favor of the demand-following hypothesis. However, it is possible to draw a conclusion that an increase in the income level leads to an increase in credits to private sector since the causality runs from the real income to CPS/Y in 9 out of 15 cases. This finding implies that as the level of income in the MENA countries increases, the real sector will induce financial development in terms of credits given to

[2] See Appendix A for the procedure regarding how bootstrap samples are generated for each country.

[3] See Appendix B for a detailed description of the cross-sectional dependence tests.

[4] Details of the panel Granger causality test can be seen on the Appendix C.

[5] The TSP routine written by László Kónya was used to obtain the results for the panel Granger causality test. We are grateful to László Kónya for sharing his codes.

Table 2
Summary for the direction of causality.

Countries	M/Y	QM/Y	M2/Y	BDL/Y	CPS/Y	DC/Y
Panel A: from financial development to economic growth						
Algeria						
Bahrain	→					
Egypt						
Iran						
Israel	→	→	→		→	→
Jordan						→
Kuwait	→		→			
Libya		→	→			
Morocco		→	→	→	→	→
Qatar		→	→			→
Saudi Arabia	→			→		→
Sudan						
Syria				→		→
Tunisia				→		
Turkey			→		→	
Panel B: from economic growth to financial development						
Algeria						
Bahrain	←			←	←	
Egypt		←				
Iran					←	
Israel	←				←	
Jordan		←			←	
Kuwait				←	←	
Libya		←	←		←	←
Morocco	←		←			
Qatar						
Saudi Arabia					←	
Sudan	←			←	←	←
Syria						
Tunisia			←		←	
Turkey		←	←			

private sector. This finding in fact implies that the nature of the relationship between financial development and economic growth in terms of banking system is driven by the sustainability of economic growth.

Overall, this study does not provide strong evidence supporting the view that financial development is an important determinant of economic growth in the MENA countries. This result can be attributed to main features of the MENA region (Boulila and Trabelsi, 2004). In particular, there has been a strict control of the financial sector for a long time in these economies. Implementation of the financial reforms has been delayed and necessary measurement to resolve the persistent issues (non-performing loans in particular) has not carried out in the MENA countries. In addition, the high information and transaction costs have hindered development in the financial sector. Furthermore, the banking sector is dominated by the state-owned banks in many of the MENA countries. Hence, government intervention in credit allocation and financing losses of public sector enterprises are main characteristics of the financial system which, in turn, constrain to the role of financial system in economic growth in these countries. In addition, a different reason for why the economic growth is less associated with financial development in the MENA region can be explained by Islamic motives. Since Islam prohibits interest and, therefore, private sector may be reluctant to borrow from the conventional banks. This motive may hinder financial development in these countries (Boulila and Trabelsi, 2004).

This study also highlights that the causality between financial development and economic growth differ across countries in the MENA region. On the one hand, possible reasons for the mixed results are differences in banking regulation and supervisions as well as in the size of urban population in the MENA countries (Baliamoune-Lutz, 2008). On the other hand, mixed findings can be explained by the substantial variation in the degree of financial development that some countries (for example, Israel, Kuwait, Qatar, Saudi Arabia, and Turkey) have advanced financial sectors, while some other countries such as Iran, Libya, Sudan and Syria have limited progresses (Creane et al., 2004).

7. Conclusion

The relationship between financial development and economic growth has long remained an important issue of debate in the literature. With the emergence of endogenous growth theories which implicitly assume a causal relation from financial development to economic growth, the direction of causality is still an empirical issue.

In this paper, the direction of causality among the variables in question is investigated for the period 1980–2007 for fifteen MENA countries. In order to see the impact of various aspects of financial development, six alternative financial development indicators are used. The method applied here is the recently proposed panel causality testing approach which takes into account cross-sectional dependence across the countries.

The empirical results show that the direction of causality between financial development and economic growth is sensitive to the measurement of financial development in the MENA countries. The findings support evidence on both demand-following and supply-leading hypotheses. Therefore the direction of causality seems to be country and financial development indicator specific. This implies that financial sector and real sector are interrelated to each other in most cases. Economic policies, on the one hand, focus only on the development of the financial sector may not result in economic development where the financial sector follows economic growth in the MENA countries. On the other hand, the financial sector should provide sufficient resources by creating new instruments, institutions and organizations for the demand of real sector with the progress of economic development where the economic growth leads development of the financial sector.

It is the fact that there is a vast diverse figure in terms of financial development in these countries. Some of them have a relatively developed financial sector but others are not. In addition, there is a growing securities market in some of these countries and, therefore, their role in this process should also be taken into account, since this provides another channel of resources for the real sector. This research can be extended to answer the question why there are differences in the financial markets in this region. It is recently argued that legal origin, trade openness, financial integration, deposit insurance, regulatory and supervisory framework, human capital and macroeconomic policies such inflation and budget deficits may have an impact on the development of financial system.

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Appendix A. The bootstrap procedure

The procedure to generate bootstrap samples and country specific critical values consists of the following five steps (Kónya, 2006: 985–986):

(i) Estimate Eq. (2) under the null hypothesis of no-causality from X to Y by imposing $\delta_{1,j,i}=0$ for all j and i and obtain the residuals. From these residuals develop the $N\times T[e_{H_{0,j,t}}]$ matrix.
(ii) Re-sample these residuals by randomly selecting a full column from the matrix $[e_{H_{0,j,t}}]$ at a time and denote the selected bootstrap residuals as $[e_{H_{0,j,t}}]^*$ where $t=1,2,3,...,T^*$ and T^* can be greater than T.

(iii) Generate the bootstrap sample of Y under the assumption of no-causality from X to Y as $y^*_{j,t} = \hat{\alpha}_{1,j} + \sum_{i=1}^{ly_1} \beta_{1,j,i} y^*_{j,t-1} + e^*_{H_{0j,T'}}$.

(iv) Substitute $y^*_{j,t}$ for $y_{j,t}$, estimate Eq. (2) without any parameter restrictions and then carry out the Wald test for each country to test for the null of no-causality.

(v) Develop the empirical distributions of the Wald test statistics repeating the steps 2–4 many times and generate the bootstrap critical values by selecting the appropriate percentiles of these sampling distributions. In this step, we obtained bootstrap critical values from 10,000 replications.

Appendix B. Cross-sectional dependence tests

Since testing for the cross-sectional dependence is equivalent to testing for contemporaneous correlations in the errors of the system described in Eqs. (2) and (3), one can utilize following Lagrange multiplier statistic for cross-sectional dependence (hereafter, CD_{BP}) developed by Breusch and Pagan (1980).

$$CD_{BP} = T \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij}^2 \quad (1)$$

where $\hat{\rho}_{ij}$ is the estimated correlation coefficient among the residuals obtained from individual OLS estimations. Under the null hypothesis of no cross-sectional dependence with a fixed N and $T \to \infty$, CD_{BP} is asymptotically distributed as chi-squared with $N(N-1)/2$ degrees of freedom.

Pesaran (2004) indicates that CD_{BP} test has a drawback when N is large, implying that it is not applicable when $N \to \infty$. To overcome this problem, following Lagrange multiplier statistic for cross-sectional dependence (hereafter, CD_{lm}) developed by Pesaran (2004) can be used.

$$CD_{lm} = \sqrt{\frac{1}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} (T\hat{\rho}_{ij}^2 - 1) \quad (2)$$

Under the null hypothesis of no cross-sectional dependence with the first $T \to \infty$ and then $N \to \infty$, this test statistic is asymptotically distributed as standard normal. However, this test is likely to exhibit substantial size distortions when N is large relative to T. A new test for cross-sectional dependence (hereafter, CD) of Pesaran (2004) can be used where N is large and T is small. The CD statistic is calculated as follows:

$$CD = \sqrt{\frac{2T}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij} \right) \quad (3)$$

Under the null hypothesis of no cross-sectional dependence with $T \to \infty$and $N \to \infty$ in any order, CD test is asymptotically distributed as standard normal.

Appendix C. Results for bootstrap panel Granger causality test

Appendix Table 1. Results for panel causality (FD indicator: M/Y).

Countries	H_o: M/Y does not cause RY				H_o: RY does not cause M/Y			
	Wald stat.	Bootstrap Critical Values			Wald stat.	Bootstrap Critical Values		
		1%	5%	10%		1%	5%	10%
Algeria	0.45	24.39	13.51	8.84	3.78	38.87	20.86	14.55
Egypt	2.80	25.72	13.50	9.16	0.60	38.65	21.25	14.52
Israel	14.73***	33.19	17.00	11.72	22.12***	43.72	24.16	16.85
Jordan	0.42	24.35	13.27	9.02	3.78	39.72	21.03	14.50
Syria	17.11***	35.72	17.67	12.16	0.72	32.16	16.56	11.09
Iran	15.04	45.67	25.04	17.54	3.29	42.81	22.79	15.93
Qatar	0.49	40.02	21.96	15.19	0.63	30.01	15.78	10.65
Kuwait	17.72***	39.62	18.53	12.12	0.90	28.41	14.01	9.35
Morocco	2.86	30.86	16.81	11.33	57.97*	56.20	31.26	22.43
Sudan	0.95	31.92	16.85	11.80	19.35***	37.58	20.41	14.02
Tunisia	0.65	25.30	14.07	9.27	0.78	34.22	18.88	13.14
Turkey	0.22	26.90	13.55	8.92	0.63	36.31	18.97	13.45
S. Arabia	17.85***	39.92	21.95	14.85	0.42	29.89	17.06	11.46
Libya	7.90	29.78	15.74	10.67	11.91	35.45	18.63	12.50
Bahrain	13.12***	35.77	18.56	12.72	33.25*	32.75	17.09	12.11

*, **, and *** indicate rejection of the null hypothesis at the 1, 5, and 10 percent levels of significance, respectively.

Appendix Table 2. Results for panel causality (FD indicator: QM/Y).

Countries	H_o: QM/Y does not cause RY				H_o: RY does not cause QM/Y			
	Wald stat.	Bootstrap Critical Values			Wald stat.	Bootstrap Critical Values		
		1%	5%	10%		1%	5%	10%
Algeria	7.15	33.36	16.41	11.16	0.49	24.84	13.22	9.26
Egypt	1.54	31.76	14.80	9.88	14.12***	30.56	17.33	11.72
Israel	14.31***	56.83	20.16	11.86	0.13	18.87	10.19	7.06
Jordan	0.93	23.31	11.77	7.71	22.86**	41.11	21.21	14.69
Syria	3.85	46.64	26.54	19.22	3.58	38.62	20.33	14.11
Iran	0.66	35.12	17.41	11.88	0.32	38.43	20.69	14.73
Qatar	15.01***	31.99	17.84	12.08	1.34	30.68	16.22	11.23
Kuwait	5.34	32.35	17.01	11.56	3.23	30.84	15.96	10.62
Morocco	15.02**	27.50	13.78	9.21	9.55	29.75	16.39	10.98
Sudan	0.91	35.55	19.02	12.79	0.73	31.53	16.98	11.85
Tunisia	0.23	30.85	15.26	10.72	5.10	44.46	25.74	17.80
Turkey	4.74	32.32	15.50	9.65	47.31*	28.11	15.15	10.50
S. Arabia	12.43	35.82	18.97	12.99	1.13	30.15	16.71	11.27
Libya	37.22*	28.12	14.54	10.14	24.72**	36.32	19.06	13.16
Bahrain	1.55	59.58	23.95	14.80	3.45	17.47	9.76	6.67

*, **, and *** indicate rejection of the null hypothesis at the 1, 5, and 10 percent levels of significance, respectively.

Appendix Table 3. Results for panel causality (FD indicator: M2/Y).

Countries	H_o: M2/Y does not cause RY				H_o: RY does not cause M2/Y			
	Wald stat.	Bootstrap Critical Values			Wald stat.	Bootstrap Critical Values		
		1%	5%	10%		1%	5%	10%
Algeria	2.78	24.22	13.36	9.06	0.19	38.52	20.52	14.29
Egypt	1.89	30.85	15.27	10.17	2.57	27.22	15.13	10.27
Israel	26.48**	75.47	23.11	13.37	0.32	19.79	10.45	7.46
Jordan	1.74	26.30	13.41	9.07	11.21	34.30	19.29	13.42
Syria	5.28	34.06	18.48	12.37	3.20	43.26	23.42	15.78
Iran	0.18	38.35	19.93	13.89	3.45	38.70	21.57	15.25
Qatar	16.46***	40.26	20.38	13.89	0.32	27.78	15.13	10.51
Kuwait	13.96***	36.01	18.30	12.32	8.22	28.39	14.27	9.38
Morocco	13.37***	33.69	18.29	11.96	50.87*	38.50	21.63	15.03
Sudan	11.14	29.49	16.55	11.40	4.88	38.19	20.25	14.12
Tunisia	0.93	31.30	16.05	10.87	17.09***	39.49	22.37	15.73
Turkey	13.05***	31.60	15.34	10.41	61.69*	26.08	13.94	9.52
S. Arabia	14.61	41.02	21.52	14.69	4.72	34.99	18.17	12.72
Libya	15.76***	28.48	16.32	11.43	17.90***	34.82	19.10	13.09
Bahrain	4.34	51.25	22.38	14.35	4.90	20.27	10.60	7.19

*, **, and *** indicate rejection of the null hypothesis at the 1, 5, and 10 percent levels of significance, respectively.

Appendix Table 4. Results for panel causality (FD indicator: BDL/Y).

Countries	H_o: BDL/Y does not cause RY				H_o: RY does not cause BDL/Y			
	Wald stat.	Bootstrap Critical Values			Wald stat.	Bootstrap Critical Values		
		1%	5%	10%		1%	5%	10%
Algeria	8.78	29.16	15.21	10.42	0.24	45.77	26.66	18.49
Egypt	3.21	27.79	14.34	9.83	1.36	42.33	23.04	16.07
Israel	5.03	27.46	13.74	9.34	0.57	38.07	20.46	14.38
Jordan	0.86	39.93	17.12	10.39	0.65	29.98	15.92	10.79
Syria	22.38***	40.49	22.40	15.46	0.16	32.28	18.52	12.64

Appendix Table 1 (*continued*)

Countries	H_o: M/Y does not cause RY				H_o: RY does not cause M/Y			
	Wald stat.	Bootstrap Critical Values			Wald stat.	Bootstrap Critical Values		
		1%	5%	10%		1%	5%	10%
Tunisia	0.65	25.30	14.07	9.27	0.78	34.22	18.88	13.14
Turkey	0.22	26.90	13.55	8.92	0.63	36.31	18.97	13.45
S. Arabia	17.85***	39.92	21.95	14.85	0.42	29.89	17.06	11.46
Libya	7.90	29.78	15.74	10.67	11.91	35.45	18.63	12.50
Bahrain	13.12***	35.77	18.56	12.72	33.25*	32.75	17.09	12.11

*, **, and *** indicate rejection of the null hypothesis at the 1, 5, and 10 percent levels of significance, respectively.

(continued on next page)

Appendix Table 4 (*continued*)

Countries	H_o: BDL/Y does not cause RY				H_o: RY does not cause BDL/Y			
	Wald stat.	Bootstrap Critical Values			Wald stat.	Bootstrap Critical Values		
		1%	5%	10%		1%	5%	10%
Iran	0.84	38.09	20.79	14.35	0.19	41.45	23.57	16.40
Qatar	11.58	61.68	30.40	20.31	0.69	18.81	10.12	6.66
Kuwait	7.23	33.86	17.32	11.60	26.30**	36.11	19.24	12.70
Morocco	10.62**	25.40	13.63	9.16	0.88	30.46	16.48	11.16
Sudan	13.55	38.05	20.76	14.61	17.79***	36.98	20.46	14.35
Tunisia	10.70***	30.05	15.11	10.07	7.32	25.97	15.06	10.18
Turkey	3.52	28.14	14.46	9.55	0.42	53.00	30.43	22.27
S. Arabia	39.54**	39.64	22.02	15.24	0.32	35.38	18.13	12.61
Libya	1.37	41.22	20.90	13.80	7.56	27.11	14.88	9.80
Bahrain	10.81	37.83	19.81	12.97	33.08**	34.33	18.20	12.58

*, **, and *** indicate rejection of the null hypothesis at the 1, 5, and 10 percent levels of significance, respectively.

Appendix Table 5. Results for panel causality (FD indicator: CPS/Y).

Countries	H_o: CPS/Y does not cause RY				H_o: RY does not cause CPS/Y			
	Wald stat.	Bootstrap Critical Values			Wald stat.	Bootstrap Critical Values		
		1%	5%	10%		1%	5%	10%
Algeria	3.56	27.32	14.37	9.68	0.54	40.07	21.74	15.24
Egypt	1.64	32.39	15.87	10.55	14.13	45.57	24.21	16.90
Israel	38.26*	29.41	15.38	10.44	19.21**	32.09	17.30	12.32
Jordan	0.68	27.98	15.20	9.88	31.24**	45.05	23.78	16.57
Syria	2.93	37.29	19.85	13.31	7.85	37.68	19.97	13.82
Iran	1.47	28.69	15.06	10.18	18.67***	38.66	22.13	15.28
Qatar	4.41	40.17	22.12	15.17	0.50	24.76	12.70	8.71
Kuwait	0.65	35.88	19.37	12.79	26.64**	38.76	20.92	13.94
Morocco	13.66***	29.57	15.97	10.51	12.30	66.25	37.49	27.30
Sudan	2.88	31.49	15.68	10.53	17.64***	41.97	22.75	15.44
Tunisia	2.35	31.27	15.96	10.87	12.17***	25.00	13.00	9.04
Turkey	10.22***	31.00	15.25	10.14	0.65	23.36	13.38	9.37
S. Arabia	16.09	53.70	28.50	19.94	14.50***	33.95	18.40	12.71
Libya	1.19	32.79	16.58	11.26	29.35**	35.35	17.98	12.64
Bahrain	2.32	41.18	20.42	13.72	21.50**	31.16	17.25	11.93

*, **, and *** indicate rejection of the null hypothesis at the 1, 5, and 10 percent levels of significance, respectively.

Appendix Table 6. Results for panel causality (FD indicator: DC/Y).

Countries	H_o: DC/Y does not cause RY				H_o: RY does not cause DC/Y			
	Wald stat.	Bootstrap Critical Values			Wald stat.	Bootstrap Critical Values		
		1%	5%	10%		1%	5%	10%
Algeria	2.72	35.30	17.84	11.49	12.41	41.11	22.12	14.61
Egypt	0.62	25.91	13.29	9.19	0.27	27.81	15.74	10.96
Israel	100.73*	33.55	16.76	10.80	3.94	44.52	25.08	17.69
Jordan	27.36*	23.79	13.02	8.62	5.05	35.71	19.55	13.67
Syria	48.19*	38.37	21.29	14.75	1.92	39.82	22.95	15.37
Iran	0.26	42.91	22.28	15.88	0.85	37.16	20.17	14.30
Qatar	27.81**	40.35	21.18	14.93	0.36	28.93	15.61	10.56
Kuwait	5.93	36.27	18.19	11.96	0.42	29.88	16.02	10.70
Morocco	23.15**	33.66	17.37	11.57	8.56	39.97	19.80	13.73
Sudan	3.56	30.36	15.88	10.99	15.30**	26.82	14.79	10.30
Tunisia	5.15	27.59	14.73	9.99	2.16	30.68	15.86	11.00
Turkey	3.26	21.94	11.69	8.06	8.72	36.52	19.48	13.74
S. Arabia	30.89**	48.84	25.30	17.40	2.16	30.01	16.92	11.72
Libya	5.38	42.26	21.08	13.85	16.41***	29.71	17.13	11.29
Bahrain	2.50	51.28	20.89	13.11	1.14	27.16	14.53	9.98

*, **, and *** indicate rejection of the null hypothesis at the 1, 5, and 10 percent levels of significance, respectively.

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