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The Growth-Finance Relationship: The Case of Jordan 1970-2002

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Abstract

The present study investigates the dynamic effects of domestic credit measured by claims on non financial public enterprises and claims on private sector on the real GDP in Jordan for the period 1970-2002. The stationarity properties and the order of integration of the data employed were empirically examined using the Augmented Dickey-Fuller test. The cointegration test proposed by Johansen was also employed to test for the existence of long-run relationship among the non stationary time series data. The result of the cointegration test suggests that there exists a cointegrating relationship between real GDP and claims on private sector. The short-run and long-run relationships between real GDP and claims on private sector were examined using the VEC technique. In the short run, real GDP turns out to have an impact which is statistically significant on the claims on private sector, while in the long run, the claims on private sector turn out to affect real GDP at the 1% significance level.

1. Introduction

The growth–finance relationship has become a major topic of empirical and theoretical research in just the last two decades. The increased importance of the financial sector in economic development is basically attributed to the prevailing paradigm, which postulates that competitive private sector capital markets can gather savings at market rates of interest and allocate capital to the most efficient private sector projects (Agung, 1998; Wachtel, 2001).

Recent studies by Khan (2000), Pagano (1993), and Levine (1997) identify four channels in which the financial sector promotes the efficient allocation of resources. First, the financial sector improves the screening of fund seekers and the monitoring of the recipients of funds. Second, the financial sector also encourages the mobilization of savings by providing more attractive instruments. Third, economies of scale in financial institutions lower costs of project evaluation, and facilitate the monitoring of projects through corporate governance. Finally, financial intermediaries provide opportunities for risk management and liquidity. According to these studies, financial institutions respond to a monetary contraction by reducing the supply loans, which has a negative impact on economic activity.

Despite the large amount of empirical work done on the growth-finance relationship, the empirical evidence for the existence of a bank-lending channel remains much less conclusive. This vagueness is due to the fact that most studies based on aggregated data fail to distinguish whether the decrease in credit that is observed after a monetary contraction is induced by bank policy or by demand.

The purpose of this study is to examine the productivity of domestic credit on economic activity in Jordan over the period 1970-2002. The dynamic relationship between these variables may provide valuable insights about the finance development led growth hypothesis (Tang, 2003). The finding also may provide important information for monetary policymakers' who intended to sustain economic development.

The present paper consists of five sections. The next section reviews the recent studies conducted on the growth-finance relationship. The third section describes the data used and the econometric methodology employed in estimating the growth-finance relationship. The fourth section discusses the empirical evidence. Concluding remarks are presented in the fifth section.

2. Literature Review

Empirical studies on the growth-finance relationships began to appear in the 1990s with King and Levine (1993a, b), Wachtel and Rousseau (1995) and Barro (1991). In the decade since those studies appeared, their empirical specifications have been widely used in more recent empirical studies, which provide evidence showing that the depth of financial sector development and the greater provision of financial intermediaries' services are associated with economic growth across countries and across historical eras.

King and Levine (1993a) introduced growth studies with cross-country data sets for the post-war period that have become the benchmark for other studies. They included measures of intermediary activity, developed from IMF and World Bank data sources that are available for 116 countries. They showed that rich countries have more developed intermediaries and market-based private sector institutions are more important than in poor countries. Financial intermediary liabilities are over two-thirds of GDP in very rich countries and about half as much in below median income countries. They also found that central banks allocate as much credit as commercial banks in below median income countries, while they are only about one-tenth as large in the very rich countries.

In his popular study, Wachtel (2001) criticized most of previous growth-finance studies that are based on a standard regression with panel data. These studies at least suffer two potential econometric problems. First, there may be simultaneous or severe causality between the finance (explanatory) variables, and economic growth (endogenous variable). This causality is due to the fact that rich countries usually have well-developed financial sectors because the income elasticity of the demand for financial services is large. Second, the regression specification assumes that any unobserved country specific effects are part of the error term. Thus, correlation between the error term and included explanatory variables or endogenous variable is likely, which leads to biased estimation of the regression coefficients.

Oliner and Rudebusch (1996) argued that most of previous studies failed to identify whether banks lending is demand or supply determined. To overcome this problem, they employed disaggregate panel data of a large number of non financial firms in the USA, on quarterly basis since 1977.1. The study showed that following a monetary contraction; small firms reduce their amount of credit while large firms demand more loans, thus suggesting the credit market is demand determined. Kashyap and Stein (1997) used US quarterly data at the individual bank level, providing empirical support for a lending channel. They found that monetary policy has an important role on the lending behavior of relatively small banks with less liquidity balance sheets.

Rousseau and Wachtel (2000) examined the ratio of the broad money supply to GDP with panel data that include two 8-year average observations for 47 countries. The study presented evidence showing that the ratio of broad money to GDP averages about 40%, and it is larger in countries where the depository institutions are more actively intermediating between savers and investors while it is smaller where the banks do little more than provide transactions service. The results indicate that increasing that ratio by 10 percentage points (increasing the activity and depth of the depository institutions) will, particularly in countries without high inflation, increase the rate of growth by between 0.6 and 1 percentage point a year.

Kakes (2000) used aggregate data to examine the relevance of bank lending channels in Netherlands. The findings presented in this study showed that bank lending is not likely to be an important transmission mechanism of monetary shocks. This finding is consistent with the earlier findings that banks generally hold a buffer stock of securities which they use to offset monetary shocks.

Tang (2003) investigated the effects of the sector-wise commercial banks lending on Malaysian economic growth over the period 1971-1997. The results confirm the presence of a long-run relationship among real economic activity and sector-wise classification of commercial bank's financing. In long run, bank financing on general trade, manufacturing, and housing is significantly promoting economic activity.

3. The Data and the Econometric Methodology

To examine the productivity of domestic credit, the dynamic relationship between real gross domestic product (y_{1t}) and domestic credit is examined. In this study, domestic credit is measured by claims on non financial public enterprises (y_{2t}), and by claims on private sector (y_{3t}). All variables are measured in real magnitude (1995 = 100) and logarithmic form. The time series came from the international financial statistics yearbooks (50-56) of the IMF. In examining the effects of domestic credit on real GDP, we estimate the regression model

$$y_{1t} = \beta_0 + \beta_1 y_{2t} + \beta_2 y_{3t} + e_t \qquad (1)$$

There are many plausible reasons why economic time series data used in the present study may contain stochastic trends. Assuming stationarity when that is false might yield spurious regression that is associated with inconsistent and less efficient ordinary least squares (OLS) parameter estimates if non stationary variables are not cointegrated. The distortion here implies that most of the statistics calculated from the regression involving the non-stationary time-series data do not follow the standard distributions. Thus the significance of the test is overstated and a spurious regression result is obtained (Chang, 2002).

In this paper, the stationarity properties of the data are empirically investigated using the Augmented Dickey-Fuller (1981) (ADF) test. This test can be carried out by testing the presence of unit roots in time series-data in the regression model

$$\Delta X_t = \delta_0 + \theta X_{t-1} + \sum_{i}^{n} \varphi_i \Delta X_{t-i} + \eta_t \qquad (2)$$

where Δ is the first-difference operator, X_t is the series under consideration, η_t is a stationary random error, δ_0, θ, and φ_I's are parameters to be estimated. The hypothesis of nonstationarity is rejected when θ is significantly negative. Here n must be selected large enough to ensure that η_t is a white noise. In this study, the Akaike (1969) Information Criterion (AIC) is used to determine the appropriate lag length n that will be enough to ensure the stationarity of the error term η_t. The AIC is defined as

$$AIC = T^*\ln (ESS/T) + 2\,k \tag{3}$$

where T is the sample size, ESS is the sum of squared errors of the regression equation 1, and k is the number of parameters, k = n + 2.

Once a unit root has been confirmed for each data series, the question is whether there exists some long-run equilibrium relationship among the variables (y_{1t}, y_{2t}, y_{3t}). While the theory of cointegration reveals a long-run equilibrium relationship among the dependent and independent variables, analysis of the short-run dynamics of the system is equally important. An important issue in econometrics has been the need to integrate short-run with long-run equilibrium.

Cointegration tests in this study are carried out using the method proposed by Johansen (1988). The Johansen method applies the maximum likelihood procedure to examine the presence of cointegrating vectors in non stationary time series. Following Hendry and Juselius (2000b), a three-dimensional (3×1) vector autoregressive model with Gaussian errors can be expressed by

$$y_t = \phi_1 y_{t-1} + \phi_2 y_{t-2} + \ldots + \phi_k y_{t-k} + \mu + \varepsilon_t \tag{4}$$

where t = 1,2, …..,T, $y_t = (y_{1t}, y_{2t}, y_{3t})$, and $\varepsilon_t \sim$ i.i.d. N $(0,\Lambda)$. The covariance matrix of the error process, Λ, and the parameters ϕ_1, ϕ_2, ϕ_k, and μ are to be estimated. By taking first differencing on the vector level, the model in error correction form is

$$\Delta y_t = \Gamma_1 \Delta y_{t-1} + \Gamma_2 \Delta y_{t-2} \ldots\ldots + \Gamma_{k-1} \Delta y_{t-k+1} - \Pi y_{t-1} + \mu + \varepsilon_t \tag{5}$$

where $\Gamma_i = -(I - \phi_1 - \phi_2 - \ldots - \phi_i)$ are short-run parameter matrices, $\Pi = (I - \phi_1 - \phi_2 - \ldots - \phi_k)$ and the sub-index k is the lag-length. The matrix Π conveys information about the long-run relationship among y_{1t}, y_{2t}, and y_{3t},. Testing for cointegration involves testing for the rank of the Π matrix by examining whether the eigenvalues of Π are significantly different from zero. Three possible conditions exist: (a) the Π matrix has full column rank, implying that y_t is stationary in level to begin with; (b) the Π matrix has zero rank, in which case the system is a traditional first-differenced VAR; and (c) the Π matrix has rank r such that $0 < r \leq 2$, implying that there exist r linear combinations of y_t that are cointegrated. If the condition (c) prevails, then the Π matrix can be decomposed into three $3{\times}r$ matrices, α and β, such that $\alpha\beta' = \Pi$. The loading matrix α represents the error correction parameters, which can be interpreted as speed of adjustment, while the vectors of β represent the r linear cointegrating relationships such that $\beta' y_t$ is stationary.

Following Johansen (1988) and Johansen and Juselius (1990), the likelihood ratio will be used for testing the number of cointegrating vectors (or the rank of Π). The likelihood ratio statistic for the trace test is

$$LHR = -T\sum_{i=r+1}^{p-2} \ln(1-\hat{g}_i) \qquad (6)$$

where $\hat{g}_{r+1}, \ldots, \hat{g}_p$ are the estimated p-r smallest eigenvalues, and r is the number of cointegrating equations. Given that there are three variables in the model, there can be a maximum of two cointegrating vectors. The null hypothesis to be tested is that there are at most r cointegrating vectors. That is, the number of cointegrating vectors is less than or equal to r, where r is 0, 1 or 2. In each case, the null hypothesis is tested against the general alternative of r + 1 cointegrating vectors. Thus, the null hypothesis r = 0 is treated against the alternative that r =1, r =1 is tested against the alternative that r =2, and so forth.

Since cointegration tests are very sensitive to the choice of lag length used in carrying out such tests, the Schwarz (1978) Criterion (SC) will be used to select the optimal number of lags required in estimating the cointegration test. The SC is defined as follows:

$$SC = \ln \Omega_n^2 + n \ln (N)/N \qquad (7)$$

where Ω_n^2 is the maximum likelihood estimator of the residual variance obtained from a model with lag length n, that is $\Omega_n^2 = SSE_n/N$, N is the sample size, and n is the number of lags selected to numerically minimize SC in equation (7).

Engle and Granger (1987) show that if two non stationary variables (y_{1t} and y_{2t}) are cointegrated, the error-correction model is conducted for determining the causality. The error correction model is as follows:

$$\Delta Ly_{1t} = \alpha_0 + \sum_{i=1}^{m} \alpha_{1i}\Delta Ly_{1t-i} + \sum_{j=1}^{n} \alpha_{2j}\Delta Ly_{2t-j} + \gamma_1 EC_{1t-1} + u_{1t} \qquad (8)$$

$$\Delta Ly_{2t} = \beta_0 + \sum_{i=1}^{q} \beta_{1i}\Delta Ly_{1t-i} + \sum_{j=1}^{r} \beta_{2j}\Delta Ly_{2\,t-j} + \gamma_2 EC_{2t-1} + u_{2t} \qquad (9)$$

where Δ is the first difference operator, u_{1t} and u_{2t} are white noise terms, and EC_{it-1} (i = 1, 2) is the error-correction term (lagged one period) derived from long-run cointegrating relationship to capture the long-run dynamics. The inclusion of these terms, which must be stationary if the variables are cointegrated, differentiates the error–correction model from the standard Granger causality test. The Granger tests involve tests on the significance of α_2's and β_2's conditional on the selected lag lengths m, n, q and r.

On the basis of error-correction models in (8) and (9), unidirectional causality from y_{2t} to y_{1t} is implied if not only the estimated coefficients on the lagged Δy_{2t} variables in equation (8) are statistically different from zero as a group, but also the coefficient on the error correction term in equation (8) is significant, and if the set of estimated coefficients on the lagged Δy_{1t} variables in equation (9) are not statistically different from zero. Similarly, y_{1t} causes y_{2t} if the estimated coefficients on the lagged Δy_{1t} variable in equation (9) are statistically different from zero as a group, the coefficient on the error correction term in equation (9) is significant, and if the set of estimated coefficients on the lagged Δy_{2t} variables in equation (8) are not statistically different from zero. Finally, feedback between y_{2t} and y_{1t} would exist if the set of estimated coefficients on the lagged Δy_{2t} variables in equation (8) were statistically significant as a group and the set of estimated coefficients on the lagged Δy_{1t} variables in equation (9) were also statistically significant as a group, and also the coefficients of error correction terms in both equations are significant.

4. The Empirical Results

As reported in Table 1, we first test for the stationarity of each time series using the ADF test. In each case, an intercept is included in the testing equations, and the number of lags is varied from 1 to 3. The appropriate lag length selected by estimating equation 2 over a selected grid of values of n at which AIC attains its minimum. The ADF test results corresponding to the level form provide evidence on nonstationarity for all variables except Ly_{2t}. The same test is also carried out for the set of remaining variables in first difference form. The results provide evidence supporting the stationarity of Ly_{1t} and Ly_{3t} series in first difference at the lag structure of n = 1. The nonstationarity for these variables could be attributed to policy measures placed by governments in attempts to stabilize the economy, or to the legislations that have been implemented to regulate the banks credit.

Table 1
Augmented Dickey-Fuller Test Results

Variable	Level: I (0)					
	Lag	AIC(n)	ADF	Critical ADF		
				1%	5%	10%
Ly_{1t}	1	2.177	1.005	3.658	2.959	2.618
Ly_{2t}	1	0.811	3.217[b]	3.658	2.959	2.618
Ly_{3t}	2	1.929	2.962	3.666	2.963	2.620
	First Difference: I (1)					
Ly_{1t}	1	2.001	2.720[a]	2.642	1.953	1.622
Ly_{3t}	1	1.632	1.965[b]	2.642	1.953	1.622

a and b denote significance at the 1% and 5% levels, respectively.

Since a unit root has been confirmed for Ly_{1t} and Ly_{3t} data series, the question is whether there exists some long-run equilibrium relationship between these time series. The Schwarz Criterion suggests two lags for each VAR model examined. As shown in Table 2, the cointegration tests are carried out under two assumptions: (a) no intercept or trend in CE or test VAR, and (b) intercept and trend-no trend in VAR. Trace tests indicate that there exists one cointegrating equation between Ly_1 and Ly_3. This finding implies that real GDP and credit provided by banks to private sector would not move too far away from each other.

Table 2
Johansen Cointegration Test Results

Hypothesized No. of CE (s)	Eigen value	Trace Statistic	5% Critical Value	1% Critical Value	Test Assumption
None*	0.47	24.51	24.31	29.75	No intercept or trend in CE or test VAR
At most 1	0.16	5.24	12.53	16.31	
At most 2	0.00	0.06	3.84	6.51	
None*	0.53	44.98	42.44	48.45	Intercept and trend-no trend in VAR
At most 1	0.43	22.31	25.32	30.45	
At most 2	0.16	5.23	12.25	16.26	

* denotes rejection of the hypothesis at the 5% level.

The third step in the analysis begins by estimating the VEC model of (Ly_{1t}, Ly_{2t}, and Ly_{3t}). A vector of Dummy variables (D1 and D2) is included in the VEC model to reflect the demand and supply shocks that have struck the Jordanian economy. The dummy variable D1 (= 1 for 1975, 1976, 1978, 1980, and 0 otherwise) is included to reflect the structural shifts in aggregate demand that stem from the huge and rapid change in oil price after 1973 Arab Israeli War. During the second half of 1970's real GDP grew at an average of about 15%, while domestic credit has grown on an average of above 20 percent. On the other hand a dummy variable D2 (where D2 = 1 for 1989 and 1990, and 0 otherwise) is also included to reflect the supply shock that hit the Jordanian economy, which resulted from the deterioration in the foreign exchange rate of the Jordanian dinar in late 1980's.

As shown in Table 3, the vectors $\Delta(Ly_{1t})$ and Δ (Ly_{3t}) show fairly good explanatory power (adjusted-R^2 = 0.67 and 0.69, respectively), while the vector $\Delta(Ly_{2t})$ shows very poor explanatory power (adjusted-R^2 = 0.19). The latter result is quite compatible with the insignificance of all coefficients estimated in the vector of ΔLy_2. As shown in Table 4, the variable Ly_{2t} is dropped out to achieve a parsimonious specification of VEC model (Tang 2003).

Table 3
Vector Error Correction Estimates

Error Correction	Δ (LY1)	Δ (LY2)	Δ (LY3)
EC	-1.08** [-3.32]	-1.17 [-0.98]	0.13 [0.33]
Δ (LY1(-1))	0.44* [2.17]	1.35 [1.82]	0.04 [0.16]
Δ (LY1(-2))	0.30 [1.50]	0.42 [0.58]	0.41 [1.67]
D(LY2(-1))	0.05 [0.70]	0.26 [0.97]	0.03 [0.32]
Δ (LY2(-2))	0.05 [0.66]	0.47 [1.68]	0.06 [0.61]
Δ (LY3(-1))	-0.27 [-1.54]	-0.72 [-1.13]	0.06 [0.27]
Δ (LY3(-2))	-0.21 [-1.24]	-0.16 [-0.26]	-0.51* [-2.45]
C	0.04* [2.78]	0.01 [0.11]	0.08** [4.38]
D1	0.12** [3.22]	0.09 [0.64]	0.26** [5.78]
D2	-0.11* [-2.79]	-0.17 [-1.14]	-0.12* [-2.38]
Summary Statistics			
R^2	0.77	0.44	0.78
Adj- R^2	0.67	0.19	0.69
Sum Sq. Resids	0.04	0.56	0.06
S.E. Regression	0.05	0.17	0.06
F-statistic	7.44	1.75	8.02
Schwarz SC	-2.60	-0.01	-2.17

* & ** denote rejection of the hypothesis at the 5% & 1% levels.
Figures in parentheses are t-ratios.

Finally, we turn out to examine the Granger-causality between Ly_1 and Ly_3 based on equations 8 and 9. It is clear that the estimated coefficient on the error correction term (EC) is statistically significant at 1% significance level in the real GDP equation only, confirming the long-run effect of credit on real GDP. To test the significance of the estimated coefficient on the lagged values of ΔLy_3 or ΔLy_1 in equations 8 and 9 as a group , the following F-test is conducted

$$F_{r,\, n-k} = [(ESSr - ESSu)/r]/\ [ESSu/n\text{-}k] \qquad (10)$$

where r refers to the number of restrictions imposed in each equation, ESSr and ESSu refer to the sum of squared residuals of restricted and unrestricted models, and (n-k) is the number of degrees of freedom. The F-tests reveal evidence supporting the hypothesis that the estimated coefficients on the lagged values of ΔLy_3 are not different from zero as group ($F_{2,22}$ = 0.21), confirming no causation running from claims on private sector to real GDP. In contrast, the hypothesis that the estimated coefficients on the lagged values of ΔLy_1 are not different from zero as group ($F_{2,22}$ = 2.98) is rejected only at the 7% significance level. This result implies that real GDP Granger-causes claims on private sector in the short run only. Finally, an important point to be mentioned here is the dominating significance of the dummy variables included to reflect the effect of the demand and supply shocks that have been mentioned earlier.

Table 4
The Estimated Vector Error Correction Models 8-9.

Error Correction	**Unrestricted**		**Restricted**	
	Δ (LY1)	**Δ (LY3)**	**Δ (LY1)**	**Δ (LY3)**
EC	-0.37** [-3.13]	0.13 [0.99]	-0.34 ** [-3.21]	0.25 [2.00]
Δ (LY1(-1))	0.26 [1.45]	-0.02 [-0.10]	0.20 [1.52]	——
Δ (LY1(-2))	-0.02 [-0.14]	0.46* [2.38]	-0.10 [-0.82]	——
Δ (LY3(-1))	-0.02 [-0.12]	0.10 [0.77]	——	0.03 [0.27]
Δ (LY3(-2))	-0.10 [-0.62]	-0.48 * [-2.58]	——	-0.19 [-1.46]
C	0.03 [2.02]	0.08 ** [4.54]	0.03*b [2.17]	0.08 ** [4.76]
D1	0.18 ** [4.30]	0.26 ** [5.71]	0.16 ** [5.79]	0.22 ** [5.57]
D2	-0.12 * [-2.66]	-0.11* [-2.30]	-0.12 ** [-2.89]	-0.12 * [-2.36]
Summary Statistics				
R^2	0.69	0.77	0.69	0.71
Adj- R^2	0.59	0.70	0.62	0.65
Sum Sq. Resids	0.06	0.07	0.06	0.09
S.E. Regression	0.05	0.06	0.05	0.06
F-statistic	7.03	10.69	10.45	11.82
Schwarz SC	-2.5	-2.35	-2.74	-2.33

* & ** denote rejection of the hypothesis at the 5% & 1% levels.
Figures in parentheses are t-ratios.

5. Conclusions

This study investigated the dynamics of real GDP and domestic credit measured by claims on non financial public enterprises and claims on private sector using Jordanian annual data for the period 1970-2002. The stationarity properties and the order of integration of the data employed in the analysis were empirically examined using the Augmented Dickey-Fuller test. The nonstationarity hypothesis is not rejected for real GDP and claims on private sector. Since nonstationarity is confirmed for two series, the cointegration technique is employed to test for the existence of long-run relationship between real GDP and domestic credit. The test provides empirical evidence supporting the existence of one cointegrating equation between Real GDP and claims on private sector.

The VEC model was also used to examine the short-run and long-run relationships between these variables. The VEC model shows that claims on private sector turn out to have a long-run effect on real output which is statistically significant at the 5% significance level, but not the opposite. Finally, real GDP turns out to have a short-run positive effect which is statistically different from zero on credit provided to private sector.

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العلاقة بين النمو والتمويل في الأردن

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ملخص البحث

تبحث هذه الدراسة آثار القروض القطاعية للبنوك التجارية على النشاط الاقتـصادي فـي الأردن خلال الفترة الزمنية 1970 – 2002، حيث تم اختبار استقرار بيانات الدراسة وإمكانيـة وجود تكامل مشترك فيما بينها باستخدام اختبارات ديكي – فولار الموسـع وجوهانـسن للتكامـل المشترك، وقد دعمت نتائج الاختبار المعتمدة على نموذج تصحيح الخطأ وجود تكامل مشترك بين النشاط الاقتصادي والقروض البنكية للقطاع الخاص، كما بينت النتائج وجود تأثير قـصير الأمـد للناتج المحلي الحقيقي على تمويل القطاع الخاص، بينما يؤثر تمويل القطاع الخاص على النـاتج المحلي الحقيقي على الأمد الطويل.