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Financial Development and Economic Growth:

Time Series Evidence from Egypt

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This paper examines the causal relationship between financial development and economic growth in Egypt during the period 1960-2001. To perform this analysis we employ four different measures of financial development and apply Granger causality tests using the cointegration and vector error correction methodology. Our results significantly support the view that financial development Granger-causes economic growth either through increasing investment efficiency or through increasing resources for investment. This finding suggests that the financial reforms launched in 1990 can explain the rebound in economic performance since then and that further deepening of the financial sector is an important instrument to stimulate saving/investment and therefore long-term economic growth.

JEL classification: O16; G18; G28

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

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1. Introduction

Disparities in economic performances among countries is a subject that has attracted much attention recently. Among the major factors believed to account for this diversity is financial functioning. The relationship between financial development and economic growth has been comprehensively treated in the recent theoretical and empirical literature (see McKinnon, 1973; Shaw, 1973; Fry, 1978, 1988 and World Bank, 1989). Government restrictions on banking systems through interest rate ceilings on deposits and high reserve requirements create a shortage of funds and reduce the efficiency of capital - factors that are essential for economic growth. Government ownership of banks is another form of intervention in financial systems which may have adverse impact on financial development. Government owned banks provide politicians the power to allocate credit to incompetent enterprises to advance their political interests in the cost of productive private investment (Demetriades and Andrianova, 2004). Privatizing government owned banks can enhance credit allocation and thereby increase quantity and quality of investment (Demetriades and Andrianova, 2004). La Porta et al. (2002) examined the relationship between government ownership of banks, financial development and economic growth using a cross section data and found that such ownership has significant negative consequences on financial development and economic growth.

The endogenous growth literature stresses the importance of financial development for economic growth as many important services are provided by a country's financial system. These services include the collection and the analysis of information regarding possible investment projects and channeling funds to the most profitable ones thereby increasing the productivity of investment. Also, allowing risk sharing encourages risky and productive investment. Furthermore, a

more efficient financial sector reduces transaction costs and therefore increases the share of savings that is channeled to productive investments (Greenwood and Jovanovic, 1990; Bencivenga and Smith, 1991).

Numerous empirical studies have tested the relationship between financial development and economic growth utilizing different econometric methodologies, but mostly applying cross-country regressions (World Bank, 1989; King and Levine, 1993a, b among others). According to this approach a vast array of variables can be examined as potential determinants of economic growth. Results obtained by using a financial development indicator as a regressor and achieving a statistically significant positive coefficient in the equation of economic growth have been interpreted to confirm the theory that financial development promotes economic growth. However, this method fails to distinguish between statistical association and causation. In fact, what is being observed in these studies is merely an association between financial development and economic growth that bears no implications of statistical causation. Furthermore, evidence of a significant positive correlation is also consistent with financial development following economic growth (Robinson, 1952). Evidence concerning the effect of financial development on economic growth from these studies varied according to the set of countries in the sample, the time span, and the set of variables included in the regressions. Such ambiguity can be attributed, in part, to statistical pitfalls that cross-section regressions are known to suffer from.

Improper assessments of causal relationships in a static cross-section setting led researchers to seek more dynamic time series analyses to uncover whether financial development causes economic growth or vice versa. Granger causality tests have been the principal tool for investigating this issue.

Empirical work on causality between financial development and economic growth is sparse, owing to a lack of sufficiently long time series data for developing countries. Jung (1986) was among the first to test for causality by applying a Granger-causality procedure. He used annual data on per capita GNP and two measures of financial development: the ratio of currency to M1 and the ratio of M2 to GDP, for 56 developed and developing countries. However, his results were inconclusive because they varied according to the financial development indicator used and the development level of the various countries. For example, using the currency ratio as a measure for financial development, Granger causality from financial development to economic growth in LDCs was more frequently observed than the reverse and an opposite conclusion was obtained for the developed countries. However, when the M2/GDP ratio was used, causality from financial development to economic growth was as frequently observed as causality from economic growth to financial development both in LDCs and developed countries. Jung's test was conducted in a levels vector autoregression (VAR) framework without testing for stationarity of the data. As data are very likely to be nonstationary, Jung's findings are debatable (Granger and Newbold, 1974). In a frequently-cited paper, Demetriades and Hussein (1996) tested for cointegration among variables and used an error correction model for 16 countries to test for a possible long run causal relationship between financial development and economic growth. Their findings showed little evidence to support the view that finance leads economic growth.

In the present paper, we re-examine the causal relationship between financial and economic development from a time-series perspective for Egypt. For this, we apply the most current econometric techniques, in particular testing causality

applying cointegration tests and error correction models after pre-testing for unit roots in all variables and choosing the optimal lag order in our VAR system. These tests are essential for attaining the proper inferences. We use four different measures of financial development and relatively long annual time series data. We also include a third variable, namely the share of fixed investment in GDP, in the system. This allows us to test channels through which financial development affects economic growth, through increasing productivity or through increasing saving resources and therefore investment. Furthermore, using variance decompositions, we estimate the relative importance of financial development and investment for explaining changes in the growth rate of per capita GDP beyond the sample period.

We focus on Egypt since during the period 1960-2001, the Egyptian economy underwent a transition from financial repression with a negative trend of per capita GDP from the late 1970s to a period of economic growth that began in the early 90s. This economic rebound can be explained, at least in part, by the financial reforms launched in 1990, which relaxed most restrictions on the financial sector.

The paper proceeds as follows: Section 2 briefly reviews the economic and financial developments in Egypt for the past four decades including the 1990 financial reforms. In Section 3 we describe the variables used in the paper as well as the data sources. Section 4 lays out the econometric methodology based on cointegration and error-correction (ECM) models and Granger causality. Section 5 presents the empirical findings. Finally, Section 6 summarizes the major findings and makes some concluding remarks.

2. A Brief Review of Economic and Financial Development in Egypt

Egypt has spent most of the period under study here, 1960-2001, operating in an illiberal economic environment, with commodity, labor, and financial markets all subject to significant degrees of government intervention. This intervention was dominant in particular in the financial markets with numerous financial repression means that included administrative control on most deposit and lending interest rates, control over the allocation of credit to particular sectors, preferential interest rates to some sectors, high taxation of the domestic banking sector through excessive reserves requirements, state ownership of banks, and tight control on external capital movements. Since 1990, however, liberalization has been a major theme of Egyptian economic policy, especially the financial markets, being freed from some of the restrictions previously applied. This liberalization initiative has opened up many possibilities for deeper and more effective financial markets that are essential for promoting economic development (Roe, 1998).

During the period under investigation, the economic performance of the Egyptian economy was largely affected by the government interventions. The massive intervention until 1990 resulted in lower saving rates leading to lower investment. Furthermore, most of the investment was undertaken by the inefficient public sector.

We divide our historical review of the Egyptian financial and economic development into three phases depending on the economic policies adopted by the Egyptian government: the socialist revolution during the 1960s, the Open Door policy during the 1970s and the 1980s, and finally the Economic Reform and Structural Adjustment Project (ERSAP) of the 1990s.

2.1 The Socialist Revolution 1960-1973

The period witnessed the maturation of certain trends, which were developing since 1956. Signs for state activism in advancing socio-economic development could be easily seen in many of the government actions. More drastic measures of agrarian reform and nationalization of large foreign and Egyptian enterprises were introduced successively in 1956, 1957, 1961, and 1964, leading to the expansion of the public sector which succeeded to dominate the largest part of the economy outside of agriculture. Public investments, which resulted in the establishment of a large number of state-owned enterprises, particularly in manufacturing were a major reason for this expansion of the public sector.

As can be seen in Figure 1, the economy had enjoyed a relatively high growth rates up to the mid 1960s. The fairly high GDP growth rates during this period were a result of the increased volume of investments rather than improving efficiency in the use of existing resources. The nationalization of the organized sector of the economy, increased the amount of potential savings under state disposal, and hence enabled it to increase the ratio of investment from 14% during the first half of the 1950's to 18% and 17.4% in 1963 and 1964 respectively. This rise was also possible thanks to large flows of foreign aid coming in particular from the Soviet Union, the USA, and the Federal Republic of Germany (Al-Sayyid, 2003).

In 1962, the banking system consisted of the central bank, three specialized banks, and five commercial banks each of them dealt with specific sector of the economy. The central bank controlled the commercial banks through credit ceilings and reserves ratio that was raised to 17.5% in 1962 and to 20% in 1966. These

restrictions resulted in a steady decline in credit to the private sector as can be seen in Figure 2. The share of credit to the private sector in GDP went down from 18.6% in 1960 to 11.2% in 1973. Over the same period the share of credit to the private sector in total domestic credit declined from 44.9% to 21.1%.

Between June 1967 and October 1973 the Egyptian economy had experienced the impact of two wars and it was a transition period in Egypt both economically and politically, from State Socialism before 1967 to Capitalism described as an Open Door Policy that was initiated in 1974 by Anwar El-Sadat who followed Gamal Abdel-Nassir as a President of Egypt in 1970.

The defeat of Egypt in the 1967 war cost the country loss of revenues from the Suez Canal and oil fields in Sinai and as a result of increased military expenditure to make up for weapons destroyed during that war and to enhance its defense capacities. Both saving/GDP and Investment /GDP ratios went down from their levels before 1967, averaging 8.8% and 12%, respectively, during the 1967-1973 period (see IY in Figure 1). The average growth rates of GDP and GDP per capita during this period were 3.1% and 1%, respectively. However, the economy recovered somewhat in 1969 and 1970 with growth rates of 6.8% and 5.6%, respectively, but such rates fell considerably in the early 1970's. The large drop in both the savings and investment rates during those years, particularly in 1970-1972, could be an immediate but not a sufficient cause for the sluggish growth rates in those years. Growth rates rose again after 1974, boosted primarily by hike in oil prices and revenues from the Suez Canal.

2.2 The Open Door Policy 1974-1990

The period 1974-1990 constituted a turning point in recent economic history of Egypt. It embarked the stage for a radical transformation of the Egyptian economy, social structure and politics. The "Open Door Policy" launched by Sadat in 1974 to encourage foreign capital to come to the country was only the first step towards a return to the private enterprise-dominated economy that preceded the shift to state-socialism in the 1960s. The political system moved away from the single mass-organization to multi-partyism, but still with the presence of a dominant party, which has the monopoly of government authority at national and local levels. Such shift to a more liberal political system allowed different types of interest groups to become in a position to influence government policy.

During this period, major structural imbalances in the Egyptian economy hindered sustainable growth. These include imbalance between government revenue and spending, savings and required investments, imports and exports, demand for labor and its supply. The severity of these imbalances was eased in some years due to rise in prices of oil or workers remittances, but apart from deficits in the state budget which narrowed down in the 1990's, such imbalances continued to constrain growth of the economy till the current days. Market inefficiencies were promoted through the 1980s by different restrictions such as administered prices, interest rate ceilings and various restrictions on private and foreign sectors. The financial sector suffered from segmentation, mandatory and subsidized credit allocation with negative real interest rates. The promotion of large scale public enterprises with the limits on export promotion weakened the private sector further. In 1982-3, the government implemented several policies to slow down the rate of growth of domestic credit and money supply. These policies included restrictions on lending

by significantly raising the reserves ratio. The major burden of the credit ceiling was placed on the private sector, although credit growth to the pubic sector was reduced as well (El-Erian et. al., 1996). The private investments that moved in at tandem with the share of private credit in total domestic credit (PRIVATE) and that had tripled their share in total investment between 1973 and 1975 in reaction to the Open Door Policy and sustained their high share until 1981, went down to less than 10% of GDP reaching their lowest level in 1986 (see PISHARE in Figure 1).

The aforementioned imbalances coupled with market inefficiencies that were promoted by government intervention did not allow the economy to sustain the high growth rates that followed the hike in oil prices and that accompanied the rise in the share of private investment after 1974. Real per capita GDP growth rate fluctuated sharply during this period, with lower rates of 0.5%, 0.1% and 0% achieved in 1974, 1986 and 1987, respectively, and highest rates of 12.2%, 10.3% and 7.3% in 1976, 1977 and 1980, respectively.

2.3 The Economic Reform and Structural Adjustment Program (ERSAP)

The period since 1991 has been the most crucial in recent economic history of Egypt as it is marked by the definitive and explicit commitment of the Egyptian government to a policy of market economy based on private sector. The Egyptian government launched the Economic Reform and Structural Adjustment Program (ERSAP) that was formulated in close consultation with the International Monetary Fund and the World Bank to move the economy from a public sector dominated one to one in which the private sector assumes the largest responsibility for generating investment and leading growth. The plan included a variety of measures such as commodity price liberalization, privatization of some public enterprises,

encouraging and facilitating larger inflows of foreign capital. Reforms in the financial sector focused first, on enhancing the attractiveness of the domestic currency assets through interest and credit liberalization. The second phase focused on increasing private involvement in commercial banking and securities to improve the competitiveness of the financial sector. These reforms led to the expansion of the financial asset intermediation as is evident in Figure 2. Moreover, the banking system was restructured to become more attractive for foreign banks to participate in the Egyptian market. According to Lee (2002), the share of foreign banks in total banks in Egypt increased from 3% in 1995 to 20% in 2000 (foreign banks being defined by having at least 50% foreign ownership), thus increasing their assets share from 1% to 7%.

A prominent feature of investment in this period is the increasing proportion of private investment, and the end of the dominant position of public sector. Private sector investments started to exceed those of the public sector since 1991. The relative shares of the two sectors are fixed since 1995 with the private sector contributing about two thirds of investments. This pattern is a reversal of the observed pattern under the Open Door Policy in which the public sector provided no less than half of total investments with the exception of the two years of 1974 and 1975 (Al-Sayyid, 2003). A significant part of private sector investments originated from credit provided mostly by public sector banks which grew steadily during this period from 22% of GDP in 1991 to escalate to their highest ever level of 54.5% of GDP in 2001 (see PRIVY in Figure 2). Meanwhile, the volume of the public business sector of bank loans remained constant while that of the private sector kept increasing throughout the 1990's to pass 50% of total domestic credit in 1997

reaching their highest level ever of 58% of total domestic credit in 2001 (see PRIVATE in Figure 2).

1991 marked also a rebound in the economic performance of Egypt. Average growth rate of real per capita GDP for the period 1991-2001 was 2.2%, and 2.8% if we exclude the years 1991 and 1993. The first year was that of the Second Gulf War as well as the beginning of the implementation of the ERSAP. This rebound in the economic performance did occur despite greater difficulties of the Egyptian economy to mobilize investments. The investment/GDP ratio dropped from 22.2% in 1991 to below the 20% throughout the whole period except in 1998 and 1999. One can argue, therefore, that the rebound in the economic growth that has occurred despite the decline in total investment can be attributed to efficiency gains from private investment dominance, enhanced by the financial liberalization since 1991, as was mentioned earlier. Following the ERSAP there has been also considerable foreign interest in Egypt's privatization offerings and a rise in foreign direct investment to the country (Roe, 1998).

From the above historical review of the Egyptian economy one can learn that the economic performance of Egypt was largely affected by government policies and especially in the financial sector that determined the allocation of resources between the public and the private sectors. The larger the role played by the more efficient private sector the better is the economic performance of the economy. The development of the financial sector has been critical for the development of the private sector and therefore for economic growth. It is the matter of this paper to test the causal relationship between the financial development and economic development in Egypt throughout the past four decade.

3. Measurement and Data Sources

3.1 Financial Development Indicators

Financial development is usually defined as a process that marks improvements 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 sake of testing the robustness of our findings.

The first, 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). According to Demetriades and Hussein (1996), this indicator accords well with McKinnon's outside money model where the accumulation of lumpy money balances is necessary before self-financed investment can take place. However, it conflicts somewhat with the debt-intermediation approach developed by Gurley and Shaw (1995) and the endogenous growth literature, because a large part of the broad money stock in developing countries is 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. Financial intermediaries serve two main functions: to provide liquidity services and saving opportunities, the latter being relevant for promoting investment and consequently growth. For this reason, 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 the case of Egypt, currency held

outside banks consisted of about 50% of M2 on average for the period 1960-1975. However, this rate has declined steadily since then and even at a higher pace since 1990, reaching 13% by 2001 (see C2M2 in Figure 2). On this basis, 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 provide direct information about the allocation of financial assets. A ratio of M2 (including or excluding currency) to GDP may increase as a result of an increase in private financial saving. On the other hand, with high reserve requirements, credit to the private sector which eventually is responsible for the quantity and quality of investment and therefore to economic growth, may not increase. Therefore, an increase in this ratio does not necessarily mean an increase in productive investments. Rather, the private credit GDP ratio can be a better estimate of the proportion of domestic assets allocated to productive activity in the private sector. Figure 2 shows that M2Y had increased tremendously starting the late 1970 to reach 80% in 1982 and fluctuated in the range of 80%-90% between 1982 and 1995 and kept a stable rate of 80% since then (see Figure 2). During the period 1975-1990, the financial system in Egypt was largely repressed with high reserves requirements, therefore, with the relatively high inflation rates one should expect banks seeking a desired level of profitability to charge higher lending rates which will reduce the demand for loans and bring to lower deposits in contrast to the observed high M2Y ratio. Two explanations for this behavior were given by Roe (1998). The first is the possibility that the dominating state-owned banks did not have a profit maximizing goal. The second is that banks preferred to serve the interest of their non-private

clients, and offered loans to public enterprises even at the expense of their profitability. To sum up, the high M2Y rate, in Egypt's case, does not necessarily imply a larger pool of resources for the private sector and therefore is not a good indicator of financial development, in contradiction, to PRIVY. The latter is most evidently 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), with different definitions of the stock of private credit depending on the institutions supplying the credit.[1]

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

3.2 Other 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 per capita real GDP and the financial development indicator, we introduced a third variable in our VAR system, 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).[2] Including the investment variable in our regressions enables us to identify the

[1] For more details on this issue see the discussion in Beck et al. (2000).

[2] Many articles have investigated the causal relationship between exports and growth in Egypt (see Reizman et al., 1996 and Abu-Qarn and Abu-Bader, 2004). When we included this variable in our system, our main findings were not affected by its exclusion.

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. Furthermore, we can then test if financial development causes economic growth through an increase of investment resources. We can examine this supposition indirectly by testing the causality between financial development indicators and investment on the one hand and between investment and economic growth on the other.

In addition to the three variables described above, we introduced a dummy variable that takes the value zero up to 1990 and the value one afterward, to account for the 1990 financial reforms launched in Egypt. All the variables in our data set are expressed in natural logarithms.

3.3 Data Sources

We used the following data resources: Financial development measures were calculated from *International Financial Statistics* (IFS) 2003 CD-ROM. IY and GDDP data were obtained from the World Development Indicators (WDI) 2003 CD-ROM. Our sample covers the period 1960-2001; the choice of this period is governed by data availability.

4. The Econometric Methodology

Standard Granger Causality (SGC)

According to Granger's (1969) approach, a variable *Y* is caused by a variable *X* if *Y* can be predicted better from past values of both *Y* and *X* than from past values

of *Y* alone. For a simple bivariate model, we can test if *X* is Granger-causing *Y* by estimating Equation (1) and then test the null hypothesis in Equation (2) by using the standard Wald test.

$$Y_t = \mu + \sum_{j=1}^{p} \gamma_{11\,j} Y_{t-j} + \sum_{j=1}^{p} \gamma_{12\,j} X_{t-j} + u_t \tag{1}$$

$$\begin{aligned} H_0 &: \gamma_{12\,j} = 0 \quad \textit{for } j = 1,..., p \\ H_1 &: \gamma_{12\,j} \neq 0 \quad \textit{for at least one } j, \end{aligned} \tag{2}$$

where μ is a constant and u_t is a white noise process. Variable *X* is said to Granger-cause variable *Y* if we reject the null hypothesis (2), where γ_{12} is the vector of the coefficients of the lagged values of the variable *X*. Similarly, we can test if *Y* causes *X* by replacing *Y* for *X* and vice versa in Equation (1).

The assumptions of the classical regression model require that both $\{X_t\}$ and $\{Y_t\}$ be stationary and that errors have a zero mean and finite variance. In the presence of nonstationary variables, there might be what Granger and Newbold (1974) called a spurious regression, whereby the results obtained suggest that there are statistically significant relationships between the variables in the regression model when in fact all that is obtained is evidence of a contemporaneous correlation rather than meaningful causal relations. Thus, before conducting causality tests, variables must be found stationary individually or, if both variables are nonstationary, they must be cointegrated. The series $\{X_t\}$ will be integrated of order *d*, that is, $X_t \sim I(d)$, if it is stationary after differencing it *d* times. A series that is *I(0)* is stationary. To test for unit roots in our variables, we use the Augmented Dickey Fuller (ADF) test. This test is based on an estimate of the following regression:

$$\Delta X_t = a_0 + a_1 t + \beta X_{t-1} + \sum_{j=1}^{p} \delta_j \Delta X_{t-j} + \varepsilon_t \qquad (3)$$

where a_0 is a drift, *t* represents a time trend, and *p* is a lag length large enough to ensure that ε_t is a white noise process. Using the results of Dickey-Fuller (1979), the null hypothesis that the variable *X* is nonstationary $(H_0 : \beta = 0)$ is rejected if β is significantly negative. Since it has been shown that ADF tests are sensitive to lag lengths (Campbell and Perron, 1991) we determine the optimal lag length by using the Schwarz criterion (SC).

The next step is to test for cointegration if the variables are nonstationary in their levels. Generally, a set of variables is said to be cointegrated if a linear combination of the individual series, which are *I(d),* is stationary. Intuitively, if X_t *~I(d)* and Y_t*~I(d),* a regression is run, such as:

$$Y_t = \beta X_t + \varepsilon_t \qquad (4)$$

If the residuals, ε_t, are *I(0),* then X_t and Y_t are cointegrated. We use Johansen's (1988) approach, which allows us to estimate and test for the presence of multiple cointegration relationships, *r*, in a single-step procedure. A class of models that embodies the notion of correction has been developed and is referred to as the Error Correction Model (ECM). In general, an ECM derived from the Johansen test can be expressed as:

$$\Delta Y_t = \mu_y + \alpha_y ECT_{t-1} + \sum_{k=1}^{p} \beta_{yx,k} \Delta X_{t-k} + \sum_{k=1}^{p} \beta_{yy,k} \Delta Y_{t-k} + \sum_{k=1}^{p} \beta_{yz,k} \Delta Z_{t-k} + \varepsilon_{yt} \qquad (5)$$

$$\Delta X_t = \mu_x + \alpha_x ECT_{t-1} + \sum_{k=1}^{p} \beta_{xx,k} \Delta X_{t-k} + \sum_{k=1}^{p} \beta_{xy,k} \Delta Y_{t-k} + \sum_{k=1}^{p} \beta_{xz,k} \Delta Z_{t-k} + \varepsilon_{xt} \qquad (6)$$

$$\Delta Z_t = \mu_z + \alpha_z ECT_{t-1} + \sum_{k=1}^{p} \beta_{zx,k} \Delta X_{t-k} + \sum_{k=1}^{p} \beta_{zy,k} \Delta Y_{t-k} + \sum_{k=1}^{p} \beta_{zz,k} \Delta Z_{t-k} + \varepsilon_{zt} \qquad (7)$$

where ECT_{t-1} is the error correction term lagged one period, *Z* is a third endogenous variable in the system, and $\beta_{ij,k}$ describes the effect of the *k*-th lagged value of variable *j* on the current value of variable *i; i,j=X,Y,Z*. The ε_{it} are mutually uncorrelated white noise residuals.

Granger causality from variable *j* to variable *i* in the presence of cointegration is evaluated by testing the null hypothesis that $\beta_{ij,k} = \alpha_i = 0$ for all *k* in the equation where *i* is the dependent variable, using the standard F test. By rejecting the null, we conclude that variable *j* Granger-causes variable *i*. These tests differ from standard causality tests in that they include error correction terms (ECT_{t-1}) that account for the existence of cointegration among the variables. At least one variable in Equations (5) to (7) should move to bring the relation back into equilibrium if there is a true economic relation, and therefore at least one of the coefficients of the error correction terms has to be significantly different from zero (Granger, 1988).

5. Empirical Results

5.1 Granger Causality Results

The first step of our empirical work was to determine the degree of integration of each variable. The ADF test results for the levels and first differences are reported in Table 1. The results show that all the variables are nonstationary – I(1) – in their levels, but stationary in their first differences.[3]

The second step was to test for a cointegration relationship among the relevant variables. The results of Johansen's maximum eigenvalue test ($\lambda_{\max}$) (see Table 2) support the existence of a unique long run relation between per capita

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

GDP, the investment ratio and financial development under the various measures of the latter. In all cases, we reject the null of a no-cointegration relationship at least at the 5% level. In Table 3 we see that financial development and economic growth have a positive long run relationship in all except when M2Y is used as an indicator of financial development. We previously outlined the inappropriateness of M2Y to serve as an indicator of financial development in Egypt and our results are in line with our expectations.

Now that cointegration has been determined, we apply the ECM to detect the direction of causality between the variables. The main results of the causality tests as shown in Tables 4 and 5 can be summarized as follows:

(a) The null hypothesis of no causality from financial development to economic growth was significantly rejected in three out of four cases (fourth column of Panel A in Table 4). The causality is unidirectional since the other direction of causality from economic growth to financial development was not observed (see fourth column of Panel B in Table 4). Only when M2Y was used for financial development, the null hypothesis of no Granger causality from financial development to economic development was not rejected even at the 10% significance level.

(b) Table 5 presents the causality results between financial development and investment and between investment and economic growth. We found significant causality from financial development to investment (fourth column in panel A) using all financial indicators. Also, as expected, we found significant causal relationship from investment to economic growth, as can be seen from Panel B of Table 5, regardless of the measure of financial development used. Therefore, we can infer an indirect causality

from financial development to real GDP per capita through investment. As this is the only way M2Y causes GDPPC, one may conclude that M2 channels funds to investment but does not increase the allocative efficiency of investment.

The results of the cointegration and Granger causality tests support the finance-led growth paradigm either directly through enhancing investment efficiency or through increasing investment resources. By the inclusion of the investment variable we could test if financial development affects economic growth by increasing investment efficiency rather than by only increasing resources available for investment. The three financial development indicators, PRIVY, PRIVATE, and LQMY affected economic growth either through increasing investment resources or through the enhancement of investment efficiency. However, M2Y affected economic growth only through increasing investment resources, as expected, in a country where a large part of M2 is held in the form of currency outside the banking sector. These findings are in line with earlier studies suggesting that PRIVY and PRIVATE rather than M2Y stimulate economic growth through improving investment efficiency (King and Levine, 1993a,b for example).

5.2 Variance Decomposition Results

Our empirical findings reveal both direct causality from financial development to economic growth (in three of four cases) and indirect causality through investment (in all cases). So, we next determine the relative importance of each of the financial development indicators and the investment variable in explaining real per capita growth beyond the sample period by using variance decomposition of the forecast error of per capita income.

Taking into account the VEC model in Equations 5-7, a change in any one of the random innovations $\varepsilon_{it}, i = X, Y, Z$ will immediately change the value of the dependent variable and thus 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 future values of itself and the other two variables, it is possible to break down the forecast-error variance of economic growth in each future period and to determine the percentage of variance that each variable explains. Figures 3 and 4 present the forecast results for twenty periods ahead. Table 6 gives the numerical values of the percentages for periods: five, ten and twenty. To assign variance shares to the different variables, the residuals in the equations must be orthogonalized. Therefore, we applied the Choleski decomposition method using the following ordering: financial development indicator, investment GDP ratio, real per capita income.

Table 6 presents the percentages of the forecast-error variance of per capita GDP that are attributable to random innovation shocks in financial development and the investment variables after five, ten and twenty years. The table also presents the percentages of the forecast-error variance of investment variable that is attributable to random innovation shocks in the financial development variable. Figures 3 and 4 show the same results for periods one to twenty years after an innovation shock takes place.[4] As can be seen, almost all the percentages of forecasting error variance of per capita GDP and the investment variables converge to their long run limit after ten years.

[4] The accumulative sum of the variance percentages does not sum up to 100% in a specific year because in each regression one financial development measure is used with the per capita GDP and investment variables.

In line with our Granger causality findings, financial development measures explain a large proportion of the forecasting error variance of real GDP per capita. The PRIVATE variable explains 27.4% of the variance after 5 years, 23.4% after 10 years and 19.4% after 20 years. Larger proportions are explained by PRIVY, where 35.1% of the variance is explained after 5 years and about 24% after 20 years. M2Y, the financial measure that was shown not to Granger cause economic growth, explains 17.8% of the error variance after 5 years but this percentage falls to 13.1% in period 20. How essential financial development for increasing investment resources? From Table 6 we can see that more than 30% of the forecast error variance of the investment variable is explained by M2Y even after 20 years but less than 14% is explained by PRIVY.

The variance decomposition results in Table 6 provide further support for the argument that private credit measured either as PRIVY or PRIVATE is more significant to economic growth through increasing investment efficiency than the other measures, especially the ratio of broad money stock M2 to GDP. Furthermore, banking credit plays a major role in financing private investment, especially in a developing country such as Egypt.

6. Concluding Remarks

Utilizing the most recent econometric time series techniques, we examined the causal relationship between measures of financial development, ratio of fixed capital GDP, and real GDP per capita in Egypt over the past four decades. We tested whether the financial reforms undertaken by the Egyptian economy in the early 1990s can explain, at least partially, the recovery in Egypt's economic performance

since then. Even though the share of investment in GDP did not increase following the financial liberalization, there was a steady increase in the share of private investment in total investment. Our results support our belief that the rise in private investment that was facilitated by the financial liberalization in 1990 led to the rebound in economic performance of Egypt in the 1990s. Therefore, relaxing financial constraints and deepening the financial sector are essential to boost economic development through either increasing investment resources or enhancing investment efficiency.

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Table 1 - ADF Unit Root Test Results

Variable	ADF with trend and intercept					
	Levels			First differences		
	ADF	k*	LM(4)	ADF	k*	LM(4)
LGDPPC	-2.218	1	1.658	-3.806***	0	3.161
LPRIVATE	-1.773	0	9.782	-7.309***	0	4.701
LPRIVY	-2.097	0	1.272	-6.589***	0	0.853
LM2Y	-1.776	1	7.112	-3.806***	0	5.888
LQMY	-1.735	1	5.603	-3.806***	0	3.089
LIY	-2.132	1	3.74	-4.388***	0	4.130

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

k* the optimal lag lengths chosen by Schwarz selection criterion with a maximum of 9 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 $\chi^2_{(4)}$.

Table 2 - Johansen Cointegration Test Results

Variables	λ_{max}			P*	r*
	r = 0	r = 1	r=2		
LGDPPC, LIY, LPRIVATE	24.967**	7.660	0.541	1	1
LGDPPC, LIY, LPRIVY	21.207**	5.036	0.701	1	1
LGDPPC, LIY, LM2Y	23.032**	12.443	0.175	1	1
LGDPPC, LIY, LQMY	32.84***	10.162	2.428	2	1

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

λ_{max} is the maximum eigenvalue statistic.
*p** represents the optimal lag length based on AIC from the unrestricted VAR model.
*r** is the number of cointegration vectors based on Johansen's method.

Table 3 – Cointegration Equations

Financial development indicator	Cointegration equation
LPRIVATE	$LGDPPC = 2.43 + 1.08LIY + 0.52LPRIVATE$
LPRIVY	$LGDPPC = 4.22 + 0.75LIY + 0.32LPRIVY$
LM2Y	$LGDPPC = 3.92 + 5.42LIY - 3.16LM2Y$
LQMY	$LGDPPC = 7.76 - 1.44LIY + 1.13LQMY$

Table 4 - Results of Granger Causality Tests (Direct)

Panel A

Financial development indicator	Null Hypothesis: Financial development does not Granger cause income growth			α_Y	P*	LM(3) (P-value)
	$F(\beta_{YX} = 0)$	$t(\alpha_Y = 0)$	$F(\beta_{YX} = \alpha_Y = 0)$			
LPRIVATE	5.768**	-2.44***	5.616***	-0.046	1	6.590 (0.68)
LPRIVY	12.685***	-2.53***	21.544***	-0.055	1	5.483 (0.79)
LM2Y	1.035	-1.247	1.462	-0.005	1	9.336 (0.41)
LQMY	10.215***	-1.299	6.831***	-0.019	2	10.208 (0.33)

Panel B

Financial development indicator	Null Hypothesis: Income growth does not Granger cause financial development			α_x	P*	LM(3) (P-value)
	$F(\beta_{XY} = 0)$	$t(\alpha_X = 0)$	$F(\beta_{XY} = \alpha_X = 0)$			
LPRIVATE	1.426	2.10***	2.214	0.236	1	6.590 (0.68)
LPRIVY	0.943	2.11**	2.233	0.319	1	5.483 (0.79)
LM2Y	0.070	-0.692	0.250	-0.007	1	9.336 (0.41)
LQMY	1.643	2.54***	2.205	0.128	2	10.208 (0.33)

$F(\beta_{ij} = 0)$ and $t(\alpha_i = 0)$ are the standard F-statistic values for testing the null that all coefficients β_{ij} in equation *i* are zeroes and the t-statistic for testing the null that α_i is zero, respectively, in Equation 5-7, where $i, j = X, Y, Z$. *Y* stands per capita income, *X* stands for the financial development indicator, and *Z* stands for investment GDP ratio. $F(\beta_{ij} = \alpha_i = 0)$ is the standard F-statistic value for testing the joint null hypothesis that all β_{ij} and α_i in equation *i* are zeroes.

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

Lag lengths of the three variables were determined using Akaike's AIC method, with maximum lags of 4 allowed for each variable.

LM(3) is the Lagrange multiplier test for up to the third-order serial correlation in the residuals which is asymptotically distributed $\chi^2_{(2)}$

Table 5 - Results of Granger Causality Tests (Indirect)

Panel A

Financial development indicator	Null Hypothesis: Financial development does not Granger cause fixed capital formation share in GDP			α_Z	P*	LM(3) (P-value)
	$F(\beta_{ZX}=0)$	$t(\alpha_Z=0)$	$F(\beta_{ZX}=\alpha_Z=0)$			
LPRIVATE	0.010	2.932***	4.230**	0.35	1	6.590 (0.68)
LPRIVY	0.007	3.082***	4.852**	0.47	1	5.483 (0.79)
LM2Y	12.046***	4.400***	14.122***	0.09	1	9.336 (0.41)
LQMY	6.108***	-4.109***	7.441***	-0.38	2	10.208 (0.33)

Panel B

Financial development indicator	Null Hypothesis: Fixed capital formation share in GDP does not Granger cause income growth given the financial indicator below			α_y	P*	LM(3) (P-value)
	$F(\beta_{YZ}=0)$	$t(\alpha_Y=0)$	$F(\beta_{YZ}=\alpha_Y=0)$			
LPRIVATE	1.851	-2.44***	7.305***	-0.046	1	6.590 (0.68)
LPRIVY	0.179	-2.53***	4.158**	-0.055	1	5.483 (0.79)
LM2Y	5.593***	-1.247	4.754**	-0.005	1	9.336 (0.41)
LQMY	8.204***	-1.299	5.741***	-0.019	2	10.208 (0.33)

$F(\beta_{ij}=0)$ and $t(\alpha_i=0)$ are the standard F-statistic values for testing the null that all coefficients β_{ij} in equation *i* are zeroes and the t-statistic for testing the null that α_i is zero, respectively, in Equation 5-7, where $i,j=X,Y,Z$. *Y* stands per capita income, *X* stands for the financial development indicator, and *Z* stands for investment GDP ratio. $F(\beta_{ij}=\alpha_i=0)$ is the standard F-statistic value for testing the joint null hypothesis that all β_{ij} and α_i in equation *i* are zeroes.

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

Lag lengths of the three variables were determined using Akaike's AIC method, with maximum lags of 4 allowed for each variable.

LM(3) is the Lagrange multiplier test for up to the third-order serial correlation in the residuals which is asymptotically distributed $\chi^2_{(2)}$

Table 6 - Variance Decomposition of LGDPPC

After	***fev* = forecast error variance**		
	% of LGDDPC's *fev* Explained by LPRIVATE	**% of LGDDPC's *fev* Explained by LIY**	**% of LIY's *fev* Explained by LPRIVATE**
5 years	27.4%	35.1%	3.6%
10 years	23.4%	37.4%	3.5%
20 years	19.4%	40.1%	3.9%
	% of LGDDPC's *fev* Explained by LPRIVY	**% of LGDDPC's *fev* Explained by LIY**	**% of LIY's *fev* Explained by LPRIVY**
5 years	35.1%	24.1%	15.2%
10 years	29.8%	26.2%	14.5%
20 years	23.9%	31.0%	13.7%
	% of LGDDPC's *fev* Explained by LM2Y	**% of LGDDPC's *fev* Explained by LIY**	**% of LIY's *fev* Explained by LM2Y**
5 years	17.8%	15.5%	41.0%
10 years	16.5%	17.6%	32.3%
20 years	13.1%	17.7%	29.6%
	% of LGDDPC's *fev* Explained by LQMY	**% of LGDDPC's *fev* Explained by LIY**	**% of LIY's *fev* Explained by LQMY**
5 years	45.9%	5.8%	56.7%
10 years	33.3%	6.8%	49.3%
20 years	20.1%	4.0%	46.5%

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Figure 1

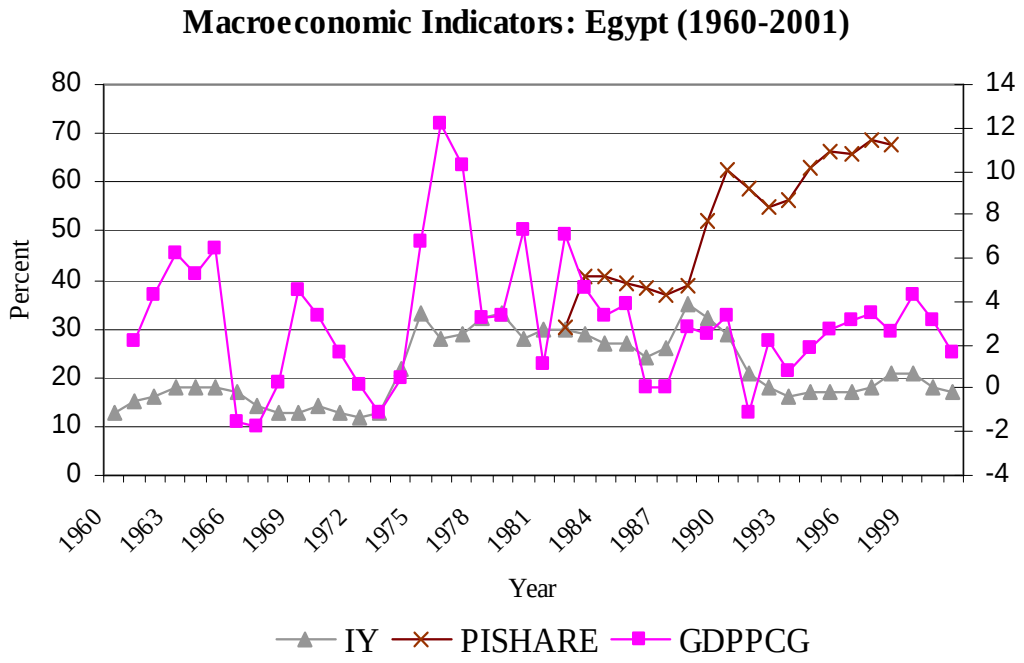

Figure 2

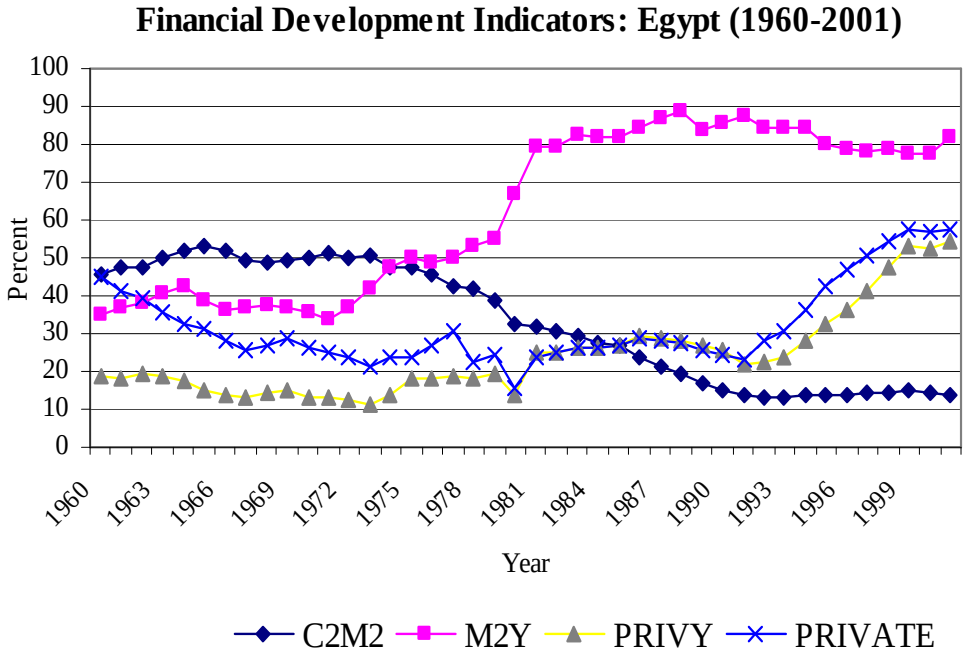

Figure 3

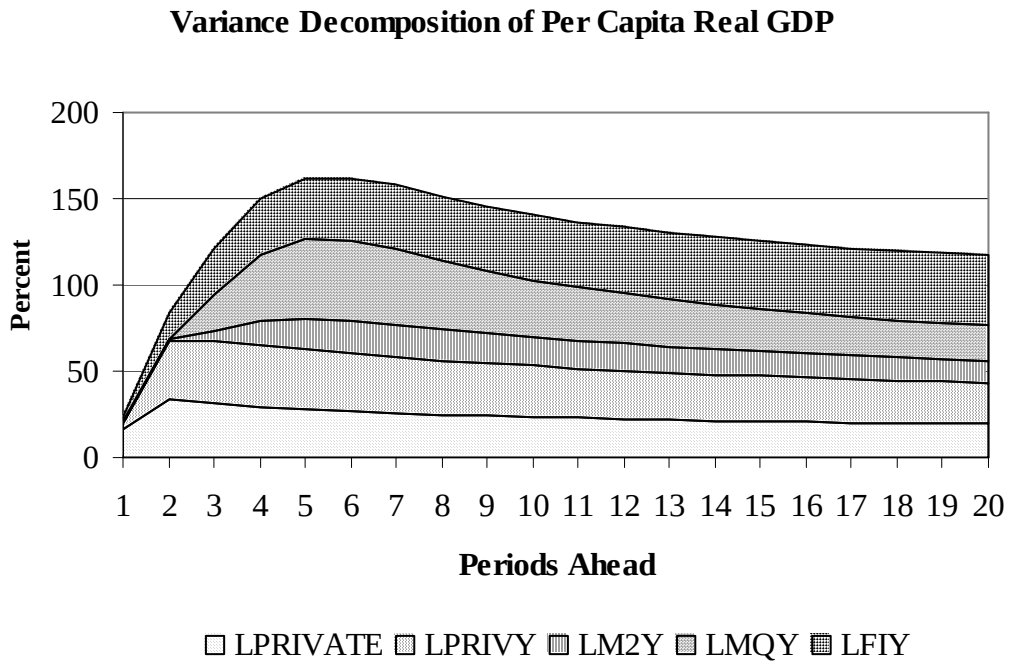
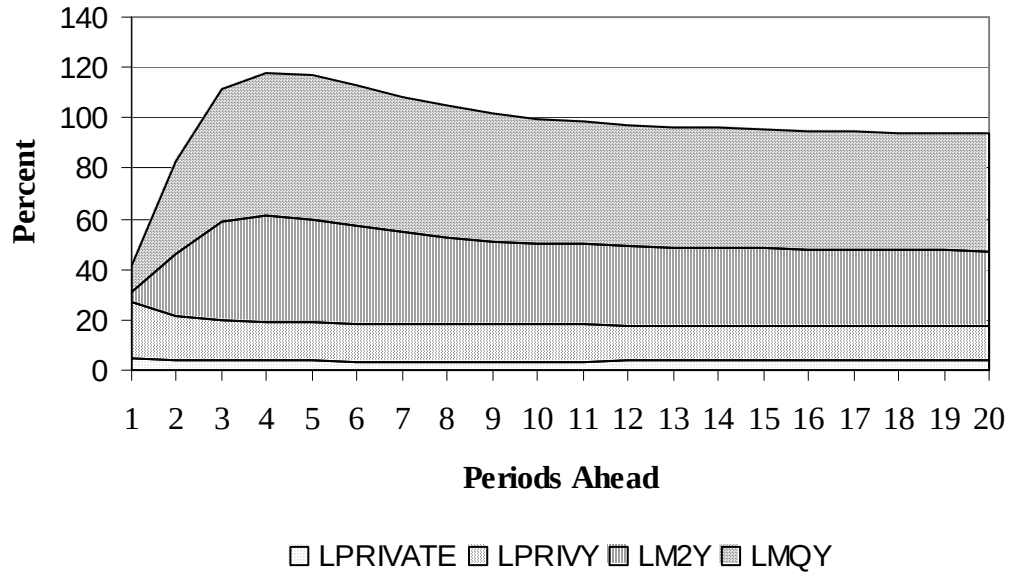
Figure 4