Time Series Evidence of the Causal Relationship Between Financial Deepening and Economic Development

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I. Introduction

Verification of theory through empirical evaluation has become an important step in social science research. The philosophy of science continues to debate the criteria for acceptance of absolute cause and effect hypotheses. The current working procedure emphasizes the accumulation of evidence over time, reached either through the failure to refute the thesis or through the direct association of events (observations) compared with the likelihood of random probabilities. This paper seeks to add to the evidence concerning the role that financial deepening plays in the process of transforming developing economies. A substantial body of literature has emerged regarding the relative importance of monetary agents in determining the course of economic development.

The first section of the paper will review the debate between the "supply leading" proponents of financial deepening versus those who logically argue that financial deepening is a "demand following" phenomena. The policy implications are critically different depending upon the causal direction implied by both sides of the debate. The next section of the research develops a method by which measurement of the two multi-dimensional phenomena may be accomplished in order to empirically test the causal ordering. Neither economic development nor financial

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deepening can be easily captured in unique time series. Both are the combined result of many institutions and economic agents evolving over time. Capturing the interaction of those forces and assigning relative weights to each constitutes an important empirical step in this research.

The final section deals with applying modern stochastic time series techniques to the weighted indexes of economic development and financial deepening. The evidence of causation presented represents a new step in understanding the complex interaction of activities associated with transforming national economic systems into developed economies. The model is tested using the Philippines economy. The qualified results of this research are presented in the last section of this paper.

II. Background on Economic Development and Financial Deepening

Throughout the world, less developed countries (LDC's) are facing financial crisis (Silk). Major banks in the United States and other developed industrial countries, as well as the World Bank, have extended credit to these countries expecting the resulting economic development to yield the necessary dividends for repayment. However, the most expeditious road to economic development has never been a certain one for LDC's. One controversy deals with the degree and timing of maturity of the financial institutions and financial markets. Previous published research polarizes the role of financial institutions in the process of economic development between the supply-leading position and the demand-following hypothesis. However, the large proportion of researchers in the field believe in the affirmation effect of financial maturity on the economic development process. This supply-leading view is traditionally associated with Joseph Schumpeter's analysis of the theory of economic development (Abdi).

The statistical evidence is compelling. Raymond Goldsmith (1969) attempted to measure the degree of institutional maturity in the financial market using the ratio of total financial assets to national wealth. He showed that the higher the *financial inter-relations ratio* (FIR) value, the greater a nation's level of finan-

cial development. This and several other instruments have been used to denote the relative dimensions of financial structure in different countries over long periods of time in order to identify the association between financial development and real economic growth (Adelman and Morris, 1967; Cameron, et al., 1972; Patrick, 1966; Shaw, 1973; Gurley, 1967; Viksnins, 1980; Drake, 1980; Von Pischke, Adams and Donald, 1983; Ayres, 1983).

Drake summarizes this literature by identifying three focal points. Financial institution development: (1) augments the quantities of real saving and capital formation from any given national income, (2) increases net capital inflow from abroad, and (3) raises the productivity of aggregate investment by improving its allocation (p. 35). Porter (1966) has added (4) improved macroeconomic stabilization, arguing that "greater stabilization of the economy through monetary controls is attainable when the banking system is more widespread" (p. 356). Cameron (1972) goes a step further. Banks provide a basic intermediary function between savers and investors, or surplus and deficit spending units, but they are unique in being able to (5) supply liquidity to the economy by creating money. "They are in a position not merely to serve as the custodians of the stock of money but also to increase or decrease that stock. The consequence of this power for society at large can be considerable — and either favorable or unfavorable" (p. 7). Cameron further suggests that the banking system may function as (6) the provider of entrepreneurial talent and guidance for the economy as a whole. As potential entrepreneurs, they may set their country on the road to continuing growth, or they may waste its resources in uneconomical or fraudulent activities (p. 8).

The direct role of money in economic growth has been discussed at some length in the modern literature since Tobin constructed a neoclassical macro model combining the aggregate production function and the monetary sector in 1955. This work was modified by Levhari and Patinkin and others to include the use value of money more explicitly and the inter-temporal utility maximization of saving behavior.

However, the direction of causality has not been resolved. Some who have criticized the foundational propositions of these "monetary" growth models concede that there are important "financial breakthroughs" which provide efficiency and utility

(Pierson). These breakthroughs have tremendous effects when they occur, but thereafter contribute little. Their marginal products are significant and initially large but thereafter they rapidly decrease. Pierson holds that the establishment of a credit system and the establishment of an intermediary system are two critical growth promoting breakthroughs, both of which can exist without a medium of exchange. The introduction of a medium of exchange is a third great financial breakthrough, saving time, effort, and physical resources in the process of exchange. Pierson and others believe that with few exceptions, financial institutions and markets develop following the lead of general economic development.

This "demand-following" type of financial development is viewed as somehow accommodating or reacting passively to the growth of the real economy. As the economy moves from traditional subsistence production, grows more complex, and generally becomes monetized, certain demands are generated for the services of financial institutions. Such demands are created by the growing needs of firms for external finance, as their retained profits fall short of their investment expansion needs. In this approach to financial development, emphasis is placed on the demand for financial assets, and the responsiveness of existing or new financial institutions is taken for granted. A distinction of the demand-following type of financial development is that its contribution to economic development is minimal.

Much of the dispute over the role of financial deepening as it relates to LDC's is concerned with the difference between theoretical benefits associated with monetization and the growth of financial intermediaries and the actual realized benefits. Viksnins points out that in the ASEAN cuntries the bulk of the population will be found in rural areas engaged primarily in subsistence farming. For the average peasant farmer income and consumption are usually closely matched. Most farm surplus income is used to buy additional consumer goods (or used to enhance ceremonial-religious activities) rather than saved or transformed into productive investments. Viksnins notes several additional inhibitions to a growth promoting financial sector in LDC's. With a large surplus, the farmer is likely to buy more land, farm animals or agricultural implements. With supply of these items relatively fixed, prices of land and investment goods

are bid up and real investment remains about constant. Cultural and physical barriers may be a significant problem. Traveling to the provincial capital and depositing funds in a financial institution, filling out forms and dealing with clerks from different social groups would probably not even be considered.

Not only are financial institutions generally unavailable and inaccessible, but markets in LDC's may often allocate the scarce funds to less efficient project uses due to "financial repression." Both Shaw and McKinnon discuss this phenomenon, which results in the average saver being consistently offered a negative real rate of return on financial assets. In such markets the expected inflation rate is above the interest rate paid on deposits and securities. The real rate of interest becomes negative, the demand for loanable funds increases while the supply declines resulting in many borrowers and no willing lenders. The fragmented money and capital markets of LDC's that result are inefficient.

Market fragmentation reinforces the urban-rural split. An organized financial market in an LDC's in the past has meant the urban financial market. Nisbet found that only about 30 percent of the population had any dealings with financial institutions with the remainder having access only to money lenders or shopkeepers. Such imperfections stimulate average high interest rates in the unorganized rural sector. The fragmentation also results in a consistent bias for export of domestic savings. Economic agents who are active in the export sector will seldom convert their foreign exchange back to local currency, either because negative real interest rates are offered on assets in the organized money market or because they anticipate future convertibility limitations. Financially repressed economies also tend to develop a propensity to issue short-term instruments rather than long-term. The planning horizon of savers becomes logically short. Asset holders try to maximize their liquidity, avoiding being locked in at a very low or negative rate for a long time period. This results in investors attempting to finance capital projects by borrowing large amounts in the short-term money market.

While the supply-leading approach has much to suggest a more prosperous overall economy resulting from financial deepening; improved savings mobilization as lenders offer positive interest rates, average rates charged to borrowers falling as the

organized money market is merged with "curb finance," and perhaps an improved distribution of income, there is one final restraint retarding short-run financial reform. Owens and Shaw (1974) and Viksnins hold that politically powerful elites generally benefit from the existing conditions of financial repression. The elite groups support the dual society government which encourages large-scale, capital-intensive industries. Politically favored entrepreneurs are offered subsidized credit to mass their empires in land or large industries. Foreign exchange has been overvalued so the rich can import at artificially low prices their capital goods and luxury consumables.

The example selected for this study, the Philippines, remains an essentially dualistic economy, with low income levels in the agriculture sector in contrast to the more progressive industrial and export sectors. The Philippines have had the consistently slowest GNP growth rates among the ASEAN countries (Singapore, Malaysia, Philippines, Thailand and Indonesia) throughout the post war decades. Narasimham and Sabater (1974) report that in the post war period between 1947 and 1969, agriculture experienced a growth of 4.8 percent, while industrial production recorded an 8.4 percent annual growth rate. The early post war stimulus for industrialization favored industries in assembling and packaging. These industries rely heavily on imported raw materials which helped keep the growth in imports ahead of the moderate export expansion. The depletion of foreign reserves and the heavy debt burden resulting from a nearly unbroken annual trade deficit, resulted in severe economic problems for the country by the mid 1970's.

In order to judge the causal impact of financial deepening, if indeed one exists, there must be a suitable definition of both economic development and financial deepening. The following section attempts to specify the primary characteristics of these two processes.

III. Defining the Time Series for Financial Deepening and Economic Development

As is often the case with other socio-economic processes, financial deepening involves a combination of several activities

and institutions. From at least the time of the German Historical School, economists have attempted to evaluate the developmental impact of increasing the amount of financing of production and investment through specialized and organized markets. In the last twenty-five years this study has been referenced as financial deepening. Recently some economists have attempted to improve on the use of the term by careful attention to the definition and application. Cheng (1980) notes that in developing economies, the term is associated with increases in the activity of financial intermediaries, like commercial banks and savings institutions. In developed economies, financial intermediation is often dominated by direct placement or capital markets. For the Pacific Basin countries, Cheng suggests the degree of financial intermediation be measured by the proportion of national wealth held through financial intermediaries. This is measured by the ratio of the consolidated assets of each nation's financial intermediaries to national output. The ratio is also calculated on the basis of domestically held assets and foreign held assets. This follows the tradition of Goldsmith of searching for a single ratio to identify "financial interrelation."

Viksnins avoids the single ratio methodology by reporting "Selected Measures of Monetization," (p. 17). These include; Money Supply (M1), GNP/Money Supply, Quasi-money (M2), GNP/Quasi-money, Real Money (M1/P), Real Quasi-money (M2/P), M2/M1 (real terms), Currency Outside Banks (C), C/M1, and Monetizaton (SDRs per capita). While these variables are not used in a ratio, nor are they combined in any composite index weighted for their relative importance. A combined index, with each variable weighted according to its relative importance would constitute a robust measure of financial deepening. Such an index would be superior to a single ratio of financial assets and reduces the selectivity associated with a tabular data report. Following Cheng, there is no reason why the index of financial variables need use the same set of weights for any two countries. Nor for that matter, the relative weights may logically change over a sufficiently long period of the nation's economic history, as a developing nation reaches higher levels of economic development. Such an index was developed for the Philippines in the following section.

IV. Financial Deepening Weighted Index

To determine the series to be selected for the index, a factor analysis procedure was followed. Factor analysis is a statistical correlation technique that objectively reduces the set of variables to the underlying factor(s). The use of factor analysis as an empirical tool in economic research has recently gained support among regional and development economists. Edward George (1980) employed the method in developing business activity indexes for SMSA's. Walter Isard used factor analysis for objective treatment of data to reduce the possibility of error (or inconsistency) where subjective judgements must be made. It attempts to combine or reduce variables which are linked to each other into indexes reflecting basic structural features of the total situation being studied. The method employed in this study follows that of George (1980) in developing his business activity index.

The procedure first requires that the set of variables to be analyzed be deseasonalized and standardized. Seasonality was removed using the SAS-Census X-11 model. Once the time series were deseasonalized, they were standardized,

$$(1) \quad Y_{it} = (Z_{it} - \overline{Z}_i)/S_{zi}$$

where Z_{it} = deseasonalized z_{it}

$\overline{Z}_i$ = mean of Z_{it}

S_{zi} = standard deviation of Z_i

The next step is to estimate the degree of association commonly held between the various component variables assumed to be characteristic of financial deepening. As early as 1904, Charles Spearman was working on the statistical procedure that denoted certain systematic effects in the matrix of correlations between common category variables (preparatory school test scores). The result of this pioneer work led to the development of factor analysis. Many good sources are available; see for example Kendall (1975).

In general, assume that there are $n < t$ factors $\delta_1, \delta_2, ..., \delta_n$, where there are n components of which are observed t characteristics, and that

$$(2) \quad Y_i = \sum_{k=1}^{n} \ell_{ik}\delta_k + \varepsilon_i$$

The ℓ's measure, regardless of the individual number, the extent to which a variable Y is compounded in the underlying factors δ. The score of any particular individual j is regarded as the selection of a value of each δ_k peculiar to it and a value of the ε also specific to it:

$$(3) \quad Y_{ij} = \sum_{k=1}^{n} \ell_{ik}\,\delta_{kj} + \varepsilon_{ij}$$

The model assumes that

(a) The δ's are independent normally distributed variables with zero mean and unit variance;
(b) each ε is independent of all other ε's and of the δ's;
(c) and thus the covariance matrix of the δ's is the identity matrix I;
(d) and the covariance matrix of the ε's is a diagonal matrix Σ with elements which may be expressed as variances (σ_i^2).

Here an important distinction arises between factor analysis and principal component analysis. If n were equal to t, the ε's would not exist and the case would revert to a transformation of a set of independent variables. However, factor analysis specifically attempts to present an economical model where n is chosen as small as possible and thus less than t.

Finally, since the δ's are by assumption independent unit variance and normally distributed, they are not uniquely determinable. As a consequence, the ℓ's have no unique solution. By assumption

$$(4) \quad COV(Y_i, Y_j) = E\ [\ (\sum_{k=1}^{n} \ell_{ik}\,\delta_k + \varepsilon_i)\ (\sum_{m=1}^{n} \ell_{jm}\,\delta_m + \varepsilon_j)\ ]$$

$$= \sum_{k=1}^{n} \ell_{ik}\,\ell_{jk}\ ,\ i \neq j$$

$$(5) \quad VAR(Y_i) = \sum_{k=1}^{n} \ell_{ik}^2 + \sigma_i^2$$

While the model is indeterminate within a rotation of the factors, it may be regarded as determining the *factor space* within which one can determine any orthogonal set of axes that correspond to the factors.

The coefficients ℓ in component analysis are denoted as "weight." The coefficients in equation (2) are called "loadings," ℓ_{ik} being the loading of the ith variable on the k factor. The variables ε are referred to as "specific factors" or residuals. The variance of Y_i in equation (5) is the sum of a component in the ℓ's and the specific σ_i^2. The first part is the "communality" and the second the "residual variance."

Through an iterative procedure, the method will produce a set of rotated factors $\delta_1, \delta_2, ..., \delta_n$ which are orthogonal, explain the variation of the data variables and only one will have a large loading for any given data variable. Therefore for any factor δ_j an index may be constructed that will explain the data variables that have high loadings on the factor; which will be a set of Y_{ij}.

To derive the overall index, two simultaneous equations in two unknowns; C (a scalar to nominalize the index) and B (the correlation between two observed variables sharing one common factor), must be solved. The index value is presumed to be zero activity and 100 at mean activity (see George, p. 29). With the data standardized the index value is assumed to be 0 at 6σ and 100 at mean activity. Thus, at mean:

$$(6) \quad F_{t(average)} = \sum_{i=1}^{n} f_i (Y_i + b)$$

where b=6 for minimum value of index; $F_{t(min)} = 0$;

$$= \sum_{i=1}^{n} C\ell_i (Y_i + 6) = 100$$

The weight of each variable in constructing the index is defined by the index coefficient g_i, where

$$(7) \quad g_i = 100 \; \ell_i / (6 \; \Sigma \; \ell_i)$$

The overall index is

$$(8) \quad G_i = \sum_{i=1}^{n} g_i \; (Y_i + 6)$$

However in the index of financial deepening, two factors were required to achieve 90 percent explanation of communality. Consequently the first two factors were weighted based on their relative contributions as measured by their eigenvalues (Ψ"s)

$$(9) \quad GI_{ij} = \sum_{i=1}^{n} g_i^1 \; (Y_{ij} + 6) \; \frac{\Psi_1}{\Psi_1 + \Psi_2}$$

$$+ \sum_{i=1}^{n} g_i^2 \; (Y_{ij} + 6) \frac{\Psi_2}{\Psi_1 + \Psi_2}$$

The variables selected for factor weighting were
  1) SDR's (in millions of U.S. dollars)
  2) Currency Outside of Banks (millions of pesos)
  3) Commercial Bank's Demand Deposits (millions of pesos)
  4) Commercial Banks Time and Savings Deposits (millions of pesos)
  5) Development and Savings Banks' Bonds (millions of pesos)
  6) Domestic Credit (millions of pesos)
  7) Money-M1 (millions of pesos)
  8) Development and Savings Banks' Time and Savings Deposits (millions of pesos)
  9) Consumer Price Index
  10) Monetization (SDR's/Population)

All variables were quarterly observations from the first quarter 1969 through the forth quarter of 1981, as reported in the World Bank's, *Internatonal Financial Statistics*. Table 1 reports the factor analysis results for the Philippines financial deepening index.

Table 1

FINANCIAL DEEPENING

	Factor 1	Factor 2	Combined Weight
Eigen Values	8.3731	1.1060	
Factor Loadings			
SDR's	0.0370	0.9674	2.9437
Currency	0.9945	0.0468	1.8257
Demand Deposits	0.9667	0.1142	1.9791
Time & Savings Deposits	0.9879	−0.1115	1.3429
Bonds	0.7315	−0.3589	0.1716
Domestic Credit	0.9966	−0.0637	1.4999
Money (M1)	0.9923	0.0527	1.8393
Development Bank Deposits	0.9918	−0.0764	1.4540
Consumer Prices	0.9882	0.0749	1.8982
Monetization	0.9971	0.0073	1.7122
Proportion of Communality	.8833	.1167= .9479	

V. Economic Development Weighted Index

The use of factor analysis as a tool for evaluating economic development was employed by Rummel (1972), but no index was developed to uniquely isolated the time series pattern in his research. This present study required the single time series index of economic development in order to test for the causal pattern. Consequently, the method developed for incorporating multivariate time series in an index of financial deepening was duplicated for development. The quarterly data was developed from monthly reports from the *Monthly Bulletin of Statistics,* United Nations. The periods from 1969 through 1981 were collected to match the financial data. The variables included were

1) Cement Production (1,000's metric tons)
2) Electricity Production (Millions of KWH)
3) Manufactured Gas Production (Terajoules)
4) Exports (U.S. dollar value in millions)

5) GNP (Billions of pesos)
6) International Sea Borne Shipping (Goods loaded in 1,000's of metric tons)
7) Copper Ore Production (1,000's of metric tons.)

Again the first two factors had to be combined in order to achieve the eightieth percentile in explained correlation between the variables. Table 2 reports the results of the factor anaylsis performed on the development variables.

Table 2

ECONOMIC DEVELOPMENT

	Factor 1	Factor 2	Combined Weights
Eigen Values	4.7163	1.0175	
Factor Loadings			
Cement	0.7878	-0.2239	2.4075
Electric Production (KWH)	0.98005	-0.0762	3.6216
Manufactured Gas	-0.8261	0.3241	-2.2476
Exports	0.9464	-0.0294	3.6344
GNP	0.9723	-0.1586	3.3360
Shipping	-0.0729	0.9642	2.7003
Copper Ore	0.6951	0.1545	3.2145
Proportion of Communality	.6450	.1775 = .8225	

The two time series were developed based on the factor loadings in combination with their relative proportions of communality. Their means were standardized to an index value of 100 as the procedure requires. The final step was to conduct a test for the direction of the causal pattern.

VI. Testing for Causation Between Time Series

There exists no single intellectual exercise which uniquely "proves" that one event, action or condition definitively causes another. The philosophy of science has thrived on this issue for

centuries. The current state of understanding seems to conclude that the best we can do is to provide an accumulation of evidence that tends to support or refute a stated hypothesis. So it is with the empirical causation model employed here. The quantitative evidence presented here tends to support a plausible hypothesis and thus contributes to the forward movement of knowledge.

The procedure assumes a certain type of "causality" based on innovative adoption of statistical probability tests. This definition of causality was espoused by C.W.J. Granger (1969) and is developed in terms of predictability which can be easily applied to temporal systems. The definition states; 'A variable X causes another variable Y, with respect to a given universe or information set that includes X and Y, if present Y can be better predicted by using past values of X than by not doing so, all other information contained in the past of the universe being used in either case.' (Pierce and Haugh, pp. 266-67). The definition assumes that (1) the variables being tested result from stochastic processes (not deterministic), (2) the series are jointly covariance-stationary and (3) the future cannot cause the past. Effect must be temporally separated from cause. Sims (1972) developed a practical method of testing for linear causal patterns based on the Granger definition. Several alternative procedures now exist in the literature (Pierce and Haugh), however, an adjusted version of the Sims' method has gained wide application (Keleher and Haulk) and is empolyed in this paper.

Sims' causality test involves regressing one variable on current, past, and future values of the other variable and assessing the significance and magnitude of the future coefficients as a whole. First, systematic movements in the data are removed by a filtering process or prewhitening. This produces an uncorrelated error structure in the residuals and ensures that autocorrelation will not be present among the residuals after estimation, thus satisfying F test requirements. The prewhitening was accomplished by estimating an ARIMA model on the presumed causor variable (Makridakis, Wheelwright and McGee, 1983, pp. 489-492).

This procedure removes all known pattern in order to leave a "white noise" series. The input series x_t is modeled as an ARIMA (p_x, d_x, q_x) process which can be defined as

$$(10) \quad \phi_x(B) x_t = \theta_x(B) \alpha_t$$

where $\phi_x(B)$ is the autoregressive operator, $\theta_x(B)$ is the moving average operator, and α_t is the random shock term (the white noise term). The terms are rearranged in order to convert the x_t series into the α_t series:

$$(11) \quad \frac{\phi_x(B)}{\theta_x(B)} x_t = \alpha_t$$

where α is the prewhitened series of x_t.

Assuming x_t is the causor variable, let y_t be the effector series. Applying the prewhitening transformation to x_t means that we have to apply the *same* transformation to the y_t series in order to preserve the integrity of the functional relationship between vairable x and y. The transformation in y_t does not necessarily convert y_t to white noise, thus the transformed effector time series is considered "quasi-prewhitened." The same parameters estimated by the ARIMA (p_x, d_x, q_x) model for the causor series are used again to transform the effector series:

$$(12) \quad \frac{\phi_x(B)}{\theta_x(B)} y_t = \beta_t$$

This prewhitening of x_t and quasi-prewhitening of y_t assures that the variation "within" the causor series has been removed prior to the testing, leaving the variation "between" the series to surface during the causation tests. As such it should be noted that determination of the causal relation between two time series is made with the use of innovations generated from ARIMA models of the two series rather than the actual series themselves.

According to the Sims test, causality is unidirectional from α_t to β_t, if (1) future values of α_t have coefficients which (as a group) are insignificant but the coefficients of current and past values of α_t are significant in regressions of β_t on α_t and (2) future values of β_t have coefficients which (as a group) are significant when regressing α_t on β_t. If causality runs from β_t to α_t, the reverse results must hold. Remember that the prewhitening process must

be recalculated when the hypothesis about the direction of causation is reversed so that the new assumed causor variable would become y_t with the quasi-prewhitening conducted on the effector variable x_t.

The results of these tests will support one of four possibilities:

1) unidirectional causality from financial deepening to economic development;
2) unidirectional causality from economic development to financial deepening;
3) bidirectional causality; or
4) no causal relationships between the variables.

VII. Prewhitening the Indices

For both economic development and financial deepening, ARIMA models were identified. Although the quarterly data had been deseasonalized using the X-11 procedure prior to the factor loading weighting process, it was discovered that there was still some stochastic seasonality in both of the time series. Thus, it was necessary to develop seasonal ARIMA models. The models were identified using the Akaike Information Criterion adopted from the Box-Jenkins procedure (Ang, Chuaa and Fatemi, 1982).

Various models were evaluated on the basis of the Box-Pierce Q statistic (Box and Pierce, 1970). The models were built on the entire set of 52 observation with ARIMA (1,1,1) (0,0,2) for economic development and ARIMA (1,1,0) (0,0,4) for financial deepening. The two prewhitening filtering processes are listed in Table 3.

The parameters estimated for the financial deepening white noise series were used to "prewhiten" the economic development index when the causor variable was assumed to be financial deepening. Alternatively, the economic development ARIMA parameters were used to produce a quasi-white noise series in financial deepening when the test assumed that financial deepening was the effective series.

Table 4 reports the results of the causation tests. When the entire time series is taken as a whole, there is insufficient evidence of any unidirectional causation. However, when the

Table 3

ARIMA Transformation Models

	Financial Deepening	Economic Development
Parameter Estimates		
AR1	-.2027	.2103
MA1	.4832	.6795
SMA4	-.2890	.2800
SMA8		.2179
Constant	1.0257	.9261
MSE	6.510	21.5170
Q Statistic	7.963	13.540
χ^2 (at 95%)	14.61	13.85

time periods are divided into two equal parts the results are different. Over the first half of time series, unidirectional causation is established from financial deepening to economic development. Equation (II.4) of Table 4 indicates the significant addition of leading financial deepening to the dependent variable, economic development. Equation (III.2) of Table 4 also indicates the significance of adding economic development as the causor variable of the effector variable, financial deepening.

VIII. Conclusion

The purpose of this study was two-fold. First, an empirical test was developed using the Granger definition of causality to contribute to the debate between economic development and financial deepening. The controversy is over the supply-leading nature of financial deepening, attributed partly to the work of Schumpeter. Alternatively, there is some evidence that the effect financial deepening may have on a developing nation is minimal, if at all. This results in a demand-following scenario with development eventually pushing the financial sector into new and more sophisticated activities. The current state of international finance between the developed countries and the less developed

Table 4 CAUSATION SUMMARY

Regression Equations	F Due to Regression	Table F	Model F for Added Variables	Table F for Added Variables	Model F for t, t-1, t-2	Table F for t, t-1, t-2
I. All Time Periods: (IQ, 1969–IVQ, 1981)						
1. $FD_t = f(ED_t + ED_{t-1} + ED_{t-2})$	.159	2.825	—	—	—	—
2. $FD_t = f(ED_t + ED_{t-1} + ED_{t-2} + ED_{t+1} + ED_{t+2})$	.29	2.45	.51	3.23	.29	2.84
3. $ED_t = f(FD_t + FD_{t-1} + FD_{t-2})$	.72	2.83	—	—	—	—
4. $ED_t = f(FD_t + FD_{t-1} + FD_{t-2} + FD_{t+1} + FD_{t+2})$	1.37	2.45	2.28	3.23	.76	2.84
II. First Half Time Periods: (IQ, 1969–IVQ, 1975)						
1. $FD_t = f(ED_t + ED_{t-1} + ED_{t-2})$	.183	3.16	—	—	—	—
2. $FD_t = f(ED_t + ED_{t-1} + ED_{t-2} + ED_{t+1} + ED_{t+2})$	.119	2.85	.05	3.63	.16	3.24
3. $ED_t = f(FD_t + FD_{t-1} + FD_{t-2})$	.22	3.16	—	—	—	—
4. $ED_t = f(FD_t + FD_{t-1} + FD_{t-2} + FD_{t+1} + FD_{t+2})$	.63	2.85	3.64*	3.24	.28	3.24
III. Last Half Time Periods: (IQ, 1975–IVQ, 1981)						
1. $FD_t = f(ED_t + ED_{t-1} + ED_{t-2})$	.51	3.10	—	—	—	—
2. $FD_t = f(ED_t + ED_{t-1} + ED_{t-2} + ED_{t+1} + ED_{t+2})$	3.75	2.77	7.76*	3.55	1.07	3.16
3. $ED_t = f(FD_t + FD_{t-1} + FD_{t-2})$	3.01	3.10	—	—	—	—
4. $ED_t = f(FD_t + FD_{t-1} + FD_{t-2} + FD_{t+1} + FD_{t+2})$	2.34	2.77	1.24	3.55	3.08	3.16

* Indicates significant at .05 level.

has resulted in a resurgence of interest in this debate.

The second focus of the study was necessitated by the first. In order to conduct an empirical test of causation, a single index representing financial deepening was needed. This was achieved by combining several variables reported to be related to the process of financial deepening through a weighting methodology which employs factor analysis. A similar index was developed for economic development.

The Philippines was used as a sample economy upon which to develop the model. The results indicate evidence of stages of development where the initial stage is characterized by financial deepening playing the role as the causor series. In the most recent stage, the economy's economic development has demanded increased financial deepening, delegating it a new role as the effector variable. The switch between cause and effect is consistent with the hypothesis developed by Drake (1980). The role played by financial deepening depends on the relative stage of development found in the economy.

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