

Simultaneous Equations Modeling of Growth Effect of SCBs operations relating to Deposit Mobilization and Credit Creation since 1991

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Abstract

The Research Paper deals with quantitative inter-relationship of development of banking industry and economic growth. Growth of Gross Domestic Product (GDP) is taken as indicator of economic growth and growth of deposits of Scheduled Commercial Banks (SCBs) have been taken as representative of development of banking industry. The conclusions of the Research Paper yield interesting results for the policy makers/top management.

Methodology

The Regression analysis carried out in a 'Simultaneous Equation model' developed by me showcases the direct impact of banking industry on the economy. As shall be demonstrate in the chapter on empirical results, the exactly identified equation in our model is solved with Ordinary Least Square Model (OLS) whereas the solution for over identified equation is found through Two Stage Least Square (TSLS) model.

Findings

Corresponding to increase of 1 unit in income, deposits increase by 0.8 units. This result is to be understood in the sense that income exercise decisive influence on the decision to save and the choice of investment option. Since low and middle income groups are mostly risk averters. The proportion of income saved is mostly invested in bank deposits. But 0.8 as a response of deposit to increase in income is pretty high. Thus Marginal Propensity to Save (MPS) is four times more than Marginal Propensity to Consume (MPC).

Keywords: Economic Growth, Banking industry, Simultaneous Equation Model, Regression Analysis, Ordinary Least Square, Two Stage Least Square

Introduction

It is being realized with great zeal in academia and corporate world alike that the overall growth of an economy is dependent to a great extent on the efficiency and soundness of its banking system. The recent passing of banking license bill in Lower House of Parliament is a positive step in support of this notion. A well controlled banking system serves as an important medium for pursuing economic growth by mobilization of small savings of unproductive domestic sectors and putting them to the productive use. Given the socioeconomic implications of the banking sector the analyses of relative linkages of banking industry with respect to economic growth has gained popularity among concerned functionaries/top management of banking sector, policy makers, researchers and academicians and other interested franchises.

The expansion of bank branches and growth of deposits are universal indicators of growth of banking industry. The growth of banking industry has been taken as representative of 'financial development' for the purpose of our research. Further, growth of deposits is primarily a function of 'number of branches' and Gross Domestic Product (GDP)/per capita GDP of a country. The Banks play a pivotal role in development of economy by way of its contribution to economic growth, although with a time lag. This 'lag' is due to the fact that effect of bank credit to economic

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sectors can be assessed only after a time period when the production/revenue generation has taken place. In the review of literature on the captioned subject there has been little work done on quantification of inter-linkage between 'economic growth' and 'financial development' represented by development of banking in India. We, therefore, focus on number of branches of banks opened, savings and Gross Domestic Product (GDP) in the last 20 years or so (i.e. during the period 1991-2012).

Deposits play a pivotal role in banking operations. But Deposits depend on GDP and number of branches and their geographical spread. Banks draw small funds available with masses as well as huge funds from institutions (both public and private) to form a corpus which leads to credit creation and thus contributing to economic growth, of course, with a time lag.

The period under study is from 1990 to 2012. Banking Institutions are an integral part of financial infrastructure of an economy. Banking industry furnishes a variety of financial services. These services are embodied in the functions that banks, especially Scheduled Commercial Banks (SCBs) perform. The following are the major functions of SCBs:

- SCBs ensure mobilization of small amounts of deposits from a large number of depositors and transformation of the small sums into huge amount of investible resources. They advance credit to the investors, each of whom draws a small fraction of total resources/deposits with the bank at any time.
- SCBs are the agency for the implementation of financial policy of the Central Bank. They maintain adequate liquidity so as to meet the demand for cash by the clients. The cheques, drafts, plastic money like credit cards and debit cards and other forms of money transfer act as substitutes of cash and reduce demand for liquidity (Cash in and out flows).
- SCBs furnish resources for financing highly capital intensive infrastructure and industrial projects. They also provide guidance to entrepreneurs in terms of technical skills required to run Small and Medium Enterprises (SME) and furnish financial assistance as part of government run social development schemes.
- The SCBs undertake the risk of Non Performing Assets (NPAs) in case the Loans are not returned at all or are not repaid timely. They bear the risk of failure of new projects.

The above is not an exhaustive list of financial services performed by scheduled commercial banks. These are just illustrative.

With the implementation of path breaking Economic Reforms in 1991, the aspirations of bailing out Indian economy from the Balance of Payment crisis became real and live. The intellectual class and masses both have had a direct and indirect experience of liberalization and globalization post 1991. Much water has flown since that time and we felt the need to evaluate the inter-linkage and assess the impact of economic growth on development of banking sector in quantitative terms. The claim of powers that be, in government agencies can be placed in better perspective if we conduct an extensive, quantitative analysis of facts and figures, which are now available in public domain. Moreover, such an analysis may help policy makers in arriving at better informed decisions.

Parameters of economic growth and development of banking industry

Post Second World War, the colossal problem of re-developing the war ravaged economies specially Japan and West European countries prompted the extant leading economists to conduct extensive empirical research (see Prakash 1994). Major contributors to growth and development were identified by analysts. Economists such as Simon Kuznets (1973), Arthur Lewis (1963) and Colin Clarke (1957) concentrated on the composition of shares of sectors contributing to growth of GDP in less developed economies. They inferred that during initial stages of growth transfer of human, financial resources from 'less productive' primary sectors to 'more productive' secondary sectors will lead to growth. However, in mature stages of growth of an economy, migration of resources from secondary to tertiary sector shall bolster growth. Gunnar Myrdal (1956) emphasised rapid industrialization approach to come out of the clutches of 'vicious cycle of poverty'. Economists like R Prebisch, Singer and Hirschman vouched for unbalanced growth strategy.

The popular 'growth model' of the economists of that era was:

$$G_o = G_L + G_K \quad (1)$$

G refers to rate of growth and subscripts O, L and K denote output, labour and capital respectively. The equation 1 is assumed to be exactly satisfied.

$$\text{Moreover, } K_t = \sum_{i=0}^{\infty} K_{t-i} - \text{DEP}_t$$

where DEP = depreciation and K_t is portion of capital being accumulated by credit created (CR).

However, empirical investigation of Schultz revealed that 59% of overall growth calculated for US economy in 1956 was not explained by the equation (1) above (when estimated rates of growth of income, labour and capital were substituted in empirical calculations). Schultz (1960) concluded that around 70% of the unexplained difference of 59% of overall growth of income was explained by investment in education.

Prima facie we may infer that: $G_o - G_L - G_K = 0$. However in real world situations we find that $G_o - G_L - G_K > 0$ which signifies presence of residual factors in growth model theory. Dennison (1961, 1964) like Schultz, postulated to be determined by investment in education. Abramovitz (1956) also analyzed trend of growth of output in US economy in terms of growth of resources used in production; he attributed it to technology. Kendrick (1961) and Solow (1962) associated residual factor of growth mainly to productivity. Mathur (1963) envisaged technology to be the harbinger and prime mover of growth. Salter (1960) emphasized productivity as the consequence of technical change which according to him accounts for the residual of growth. Productivity is, however, greatly affected also by techniques of organization, administration and management, which relate to human resource capability (Prakash-Balakrishnan, 2005).

In terms of growth in number of branches of banks across the country, it implies a major indicator of development of banking industry. The linkages effect that follow post starting of banks contributes to economic growth as well. Also, deposits received

by banks from common man and institutions and Credits created by banking sector on the basis of deposit base of the banks also form the core parameters of development of banking industry perse.

The concept of Economic 'Growth Poles' by François Perroux in 1949 had great influence on policy makers. The policy makers used this concept in the technical analysis. Perroux, however, defined growth poles in terms of what he called abstract economic space. Perroux conceived of abstract economic space to be of three types:

- an economic plan
- a field of force or influences
- a homogeneous aggregate

Perroux, rather than considering a geographic area such as a city or region to define 'growth pole' theory, emphasised 'dominance' as important factor for growth poles. A firm or industry A is said to be dominant over B if the flow of goods and services from A to B is a greater proportion of A's output than the flow from B to A is of B's output. A large firm or industry that has a high degree of interaction with others and is dominant in that interaction was said to be propulsive. The process of development of a propulsive firm or industry was called polarization.

'Linkage' as a concept developed in regional economics. Linkages may be forward or backward. If a growth in production in one industry stimulates production in the industries supplying it then that industry has backward linkages. For example, the steel industry has backward linkages to the iron ore mining industry, the coke and coal industries and the transportation industry involved in transporting those inputs to the steel industry. A forward linkage when the availability of the output of an industry to make possible the production of industries using that output. For example, the plastic producing industry makes it feasible for businesses requiring plastic to begin operation. Despite Perroux's denial that growth poles are geographic many of the applications of the concept are for geographic regions.

In the U.S. the concept of growth poles has usually taken the form emphasizing geographic locations which are called Growth Centers. Growth centers are related to the concept of agglomeration. In many ways the American work on growth centers is virtually independent of Perroux and the French literature on growth poles.

Albert Hirschman used the term polarization to refer to the negative impact of a growth pole on surrounding regions. 'Trickling down' was the term he used for the positive impact of a growth pole or growth center on adjacent regions. Gunnar Myrdal, the Swedish economist, used the terms 'backwash' and 'spread' for the same concepts as Hirschman's polarization and trickling down.

The American economist, John R. Friedman, has developed a concept that is related but distinct from the ideas of growth poles and growth centers. It is called the matter of the center versus the periphery. Altogether the concept of growth poles has been of only marginal importance in analyzing regional economic problems. Nevertheless the idea of growth poles has had a major role in formulating regional policy.

Objectives of the Study

This paper analyzes the quantitative linkages with respect to impact of economic growth on the development of banking in India. The quantitative relationship is studied among the 'number of branches' of banks opened, 'savings' and 'Gross Domestic Product (GDP)' during the period 1991-2012 and analyzed which may give an insight to policy makers while conceiving any development plan.

The role of finance has been investigated quite extensively since the time of Schumpeter (1912) who considered financial development as a source of economic growth. Robinson (1952) suggested that the financial sector simply 'responds' to the need of financial intermediation created by the expansion of the real sector of the economy. These conflicting views are 'supply-leading' and 'demand-following' models of inter-linkage between financial development and economic growth. Schumpeter argued in favor of 'supply-leading' hypothesis whereas Robinson vouched for 'demand-following' model.

India being a geographically and economically diversified subcontinent we consider the 'causation' between these two factors as a mixture of both. We have experienced both kinds of model in post independence era after year 1947. There was aggregation of financial/banking services in the states which were booming economically as well as there were states which were lagging behind in purchasing power and education of masses and government run special schemes and promotion of financial services (especially introducing banking in those areas) brought about a revolutionary change.

Firstly we examine what has been the interrelationship between branch expansion and GDP growth rate. Further what has been the impact of number of branches on aggregate deposit. The growth in deposits of banks leads to economic growth in the country via credit creation by banks with a time lag.

The Data Source

The data related to Credit Deposit Ratio have been taken from Reserve Bank of India (RBI) website www.rbi.org.in. The data related to Deposits, 'Number of branches in states', 'deposits mobilized' and 'credit creation' has been taken from Economic Survey, Central Statistical Organization (CSO) and Center for Monitoring Indian Economy (CMIE) database. At various instances data has been used from www.emeraldinsight.com. With over forty years' experience, Emerald Group Publishing is a leading independent publisher of global research with impact in business, society, public policy and education. In total, Emerald publishes over 275 journals and more than 130 book series, as well as an extensive range of online products and services. Emerald is both COUNTER 3 and TRANSFER compliant. The organization is a partner of the Committee on Publication Ethics (COPE) and also works with Portico and the LOCKSS initiative for digital archive preservation.

Review of Literature

A detailed review of 76 studies pertaining to impact of economic growth on development of banking industry has been done. Review of literature from books and journals (the details mentioned in references portion in the end) through Libraries across Delhi NCR and through a robust database in www.emeraldinsight.com—founded in 1967 as an offshoot of the

University of Bradford, Emerald Group Publishing has become the world's leading scholarly publisher of journals and books in business and management with a strong and growing presence in disciplines including LIS, social sciences, engineering, linguistics and audiology.

Methods and Models

The Regression analysis carried out in a 'Simultaneous Equation model' developed by me shall showcase the direct impact of banking industry on the economy. As shall be demonstrated in the chapter on empirical results, the exactly identified equation in our model is solved with Ordinary Least Square Model (OLS) whereas the solution for over identified equation is found through Two Stage Least Square (TSLS) model.

For the purpose of estimating the inter-linkage of relationship among the key variables (such as Income, Consumption, Savings, Deposits etc) for measurement of economic growth we have tried to formulate a quantitative model which would facilitate the planners in devising the development policy with precision.

The basic causal relationship is taken as follows:

$$\begin{aligned}(Y) &= f(C, I) \\ (S) &= f(Y, C, R) \\ (CR) &= f(D) \\ (D) &= f(S), \\ (C) &= f(Y),\end{aligned}$$

Where D = Deposits, S = Savings, Y = Income, I = Investment, CR = Credit, C = Consumption, R = Rate of Interest

The Structural equations constituting our economic growth model would thus be as follows:

$$\begin{aligned}\text{We know that} \\ Y = C + S \equiv C + I \\ \text{(By definition)}\end{aligned}\quad (2)$$

$$\begin{aligned}\text{Where} \\ S \equiv I \\ \text{(Savings are equal to Investment in an economy at equilibrium)}\end{aligned}\quad (3)$$

The study is based on a simple simultaneous equation model which comprises of four variables out of which two are endogenous/dependent and two are exogenous/pre-determined/independent. Current income and current interest are identified as exogenous variables.

Deposits are assumed to depend partly upon current income and current interest rates. It means deposits are not assumed to be interest neutral. Two variables, Deposit (D_t) and Credit created by banks (CR_t) are treated as endogenous. The other two viz., Income (Y_t) and rate of interest (R_t) are exogenous variables.

$$D_t = \alpha_0 + \alpha_1 Y_t + \alpha_2 R_t + U_1 \quad (4)$$

$$CR_t = \beta_0 + \beta_1 D_t + U_2 \quad (5)$$

The following identity is imposed to close the model

$$S_t = D_t \quad (6)$$

It implies that all the savings are transformed into bank deposits and increase in bank interest rate encourages savers and investors to save more, while lower interest rate discourages both savings and deposits. Besides, deposits obviously constitute the base of credit creation by banks. Greater the deposits greater is credit creation.

As above is the simultaneous equation model, it needs addressing the problem of identification.

Reduced form of equation (5) is as follows:

$$CR_t = \beta_0 + \beta_1(\alpha_0 + \alpha_1 Y_t + \alpha_2 R_t + U_1) + U_2$$

$$\bullet \quad CR_t = (\beta_0 + \beta_1 \alpha_0) + \beta_1 \alpha_1 Y_t + \beta_1 \alpha_2 R_t + \beta_1 U_1 + U_2$$

Or

$$CR_t = \pi_0 + \pi_1 Y_t + \pi_2 R_t + v \quad (7)$$

First equation excludes one variable; it satisfies the necessary condition of exact identification. As against this equation, the second equation of the model is over identified and it shall be estimated by Two Stage Least Square.

Here we can substitute following 'Structural Coefficients' from equation (7) denoted by π (Greek letter 'Pi') in order to simplify the calculations

$$\pi_0 = \beta_0 + \beta_1 \alpha_0 \quad (8)$$

$$\pi_1 = \beta_1 \alpha_1 \quad (9)$$

$$\pi_2 = \beta_1 \alpha_2 \quad (10)$$

Thus we have a consistent framework of structural equations which yield exact value of economic variables when we apply OLS method in equation (4) and Two Stage Least Square in equation (5).

We have 5 variables with 2 dependent variables in our structural equations. The number of exogenous variables in equation (4) is 3 which signify it is exactly identified. Upon inspection we find that equation (5) is over identified.

Test of Stationarity of Data

This study uses two alternative approaches in determining whether time series of data is stationary; Random Walk Model/Dickey-Fuller Test and Harvey Model on the individual series of variables.

Random Walk Model

In case of 'time series data' being the base of analysis, it is desirable to evaluate the stationary or non-stationary nature of the series. For this purpose, Random Walk Model (RWM) is used as preliminary step. Since our study is also based on 'time series data' pertaining to number of branches, deposits and GDP, Random Walk Model (RWM) has been used to evaluate whether the said time series is stationary or not. This model is essential in so far as the models and methods used to analyze a non-stationary 'time series data' furnish spurious results.

The following is the Random Walk Model (RWM):

$$Y_t = Y_{t-1} + U_t \quad (\text{h.1})$$

It is obvious that the random walk model is a simple example of auto-regressive integrated moving average process with one difference; the random walk model has zero intercept and slope coefficient is put as unit (Cf. Harvey, 1984):

$$Y_t - Y_{t-1} = \Delta Y_t = U_t \quad (\text{h.2})$$

The form of the model is exactly the same as that of the first order auto-regressive model. Models h.1 and h.2 are derived from the following auto-regression model of first order:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + U_t \quad (\text{h.3})$$

if $\beta_1 = 1$ and $\beta_0 = 0$ are substituted in relation (h.3), we move back to relation (h.1).

But it violates the condition that β_1 , the coefficient of Y_{t-1} in the first order Auto-Regression process (AR1), the predictor of Y_t :

$$Y_{t+m}^* = \beta_1^m Y_t$$

is contained within the unit circle. It means that the process of generation of values is not stationary. Repeated substitution for past values of Y_t will yield the following relation:

$$Y_t = \sum_{j=0}^{t-1} U_{t-j} + Y_0$$

j

$j=1, 2, \dots, t-1.$

Mean of Y_t is thus a function of the initial value Y_0 , which is taken to be fixed. Then, the first condition of a stationary time series, that the mean should be constant, is satisfied. Though the series is stationary, yet the process of the generation of its values will still be non-stationary. The variance and covariance of the series will be given by

$$V = t\sigma^2$$

$$\text{Covariance} = t-m / \sigma^2$$

Where $t-m$ shows the periods that lapse between t and m , the stage at which the covariance is considered. Thus, covariance of Y_t is a purely a function of period, m that lapses between the two points t and m in time, and not the point in time at which the covariance is calculated, since both σ^2 and t are constant.

The random walk process meanders away from its mean with the passage of time. But the random process can still be obtained, since the first differences of the series follow white noise as is shown by relation 2.

If a constant is added to the relation 2, which is a stationary first order ARMA process, it will permit it to have a non-zero mean without altering its basic behaviour (Harvey, 1984). Addition of the constant to the right hand side of 2 yields the following relation:

$$\Delta Y_t = \beta_0 + U_t \quad (\text{h.4})$$

This is defined as Random Walk Model with Drift, which is only a variant of random walk model. β_0 in relation 4 is the coefficient of drift, which takes cognizance of a fixed factor/value, that is loaded additionally on the influence of random errors on the value, Y_t . The drift takes the value of Y_t away from Y_{t-1} . If we substitute the lagged values of Y_t repeatedly in relation 2 and proceed to take expectation, then we will get the following relation:

$$E(Y_t) = Y_0 + \beta_0 t \quad (\text{h.5})$$

This shows that fix value of Y_0 is like the intercept of a regression function, while the value of t is governed by a linear trend.

If either model 1 or 2 is found to fit the given time series well, then the series is non-stationary. However, the first differences of Y_t , that is, ΔY_t may still approximate stationary time series. It is possible that ΔY_t is also a non-stationary series but it may still encompass deterministic trend. This is evident from relation 5. In that case, first order differences with trend may be taken in the regression model:

$$\Delta Y_t = \beta_1 Y_{t-1} + \beta_2 T + U_t \quad (\text{h.6})$$

Relation (h.6) depicts the random walk model with a deterministic trend.

Dickey Fuller Unit Root Test---Unit root test of stationary time series has gained great popularity among researchers. The Dickey-Fuller Test shows that if the root is found to be significantly lower than unit for equations, the series is proved to be stationary.

The unit root test is outlined below:

$$\Delta Y_t = (\rho - 1) Y_{t-1} + U_t \quad (\text{h.7})$$

Model h.1 is obtained if we substitute $(\rho - 1) = \beta_1$ in model (h.6).

Where Δ denotes first order difference operator. If $(\rho - 1) = 0$ in model equation 5, then, $\rho = 1$. It is this condition which is referred as unit root problem for testing whether given time series is stationary. In such cases, $\beta_1 = 0$ will hold, and both Y_t and ΔY_t will be non stationary. If, however, $\rho < 1$, β_1 will be negative and the series will be stationary. If $\rho > 1$, then $\beta_1 > 0$, the series will approximate the explosive Cobweb model.

It is possible that the original values of the variable constitute a non-stationary time series, but it may be smoothed by link relatives (Y_t / Y_{t-1}) as was shown by Henry Moore (1914). This may suggest that the ratios of the values of two inter-related variables of the time series may be freed from non stationary feature and furnish a stationary time series. This series may then be used in the regression model.

The distinguishing feature of our model is that it cannot be decomposed into two parts: a linear trend and a stationary disturbance term.

Harvey Model-tests the assumption that successive values of time series equal the preceding values:

$$Y_0 = Y_1 = Y_2 = \dots = Y_T$$

The model is as follows

$$Y_t - \mu = \beta(Y_{t-1} - \mu)$$

It means that $Y_t = Y_{t-1}$ if $\beta = 1$. But for purposes of estimation, the model is specified as follows:

$$y_t = \beta y_{t-1} + U_t$$

Where $y_t = Y - \bar{Y} = Y - \mu$

Empirical Results-are presented systematically; first we examine the Test of Stationarity and estimates of growth curve. The following are the OLS estimates of the Harvey Model in case of individual series of GDP or Y_t -

$$y_t = 1.13 y_{t-1}; R^2 = 0.9637; F = 558.72 > F^* = 4.34E - 16 \text{ with}$$

Results of Harvey Model show that model fits the data well; coefficient of determination has very high value and coefficient of explanatory variable is statistically significant. However, the estimated value of regression coefficient exceeds '1' significantly; $(1.13-1)/\text{Standard Error (S.E.)}$

$$\Rightarrow 1.13-1.00/0.047$$

$\Rightarrow t = 2.7659$. So the 't' value is also statistically significant (compared to stipulated value of 1.96). So, GDP or Y_t is shown to be non-stationary.

Empirical Analysis

OLS estimate of the Random Walk Model without Drift, with Drift and Stochastic trend are reported as hereunder. For the evaluation of relationship between Economic Growth and Development of banking, regression models have been used.

The data which forms the core of our investigation is mentioned below-

(in Rupees Billion)

Year	Aggregate Deposits (D _t)	GDP at Factor Cost at Current Prices (Y _t)	Rate of Interest (R _t)	$\hat{D}_t = -7063.07 + 260.26 R_t + 0.7907 Y_t$	Bank Credit (CR _t)
1990-91	1925.41	5318.13	9.5	-385.03	1163.01
1991-92	2307.58	6135.28	12	911.82	1255.92
1992-93	2685.72	7037.23	11	1364.82	1519.82
1993-94	3151.32	8179.61	10	2007.95	1644.18
1994-95	3868.59	9553.85	11	3354.96	2115.60
1995-96	4338.19	11185.86	12	4905.81	2540.15
1996-97	5055.99	13017.88	11.5	6224.44	2784.01
1997-98	5984.85	14476.13	10.75	7182.43	3240.79
1998-99	7140.25	16687.39	10	8735.89	3688.37
1999-00	8133.45	18472.73	8.75	9822.41	4359.58
2000-01	9626.18	19919.82	8.75	10966.77	5114.34
2001-02	11033.60	21677.45	7.75	12096.44	5897.23
2002-03	12808.53	23382.00	5.125	12761.21	7292.15
2003-04	15044.16	26222.16	4.625	14877.08	8407.85
2004-05	17001.98	29714.64	5.5	17866.65	11004.28
2005-06	21090.49	33905.03	6.375	21408.13	15070.77
2006-07	26119.33	39532.76	7.625	26183.86	19311.89
2007-08	31969.39	45820.86	8.375	31351.68	23619.14
2008-09	38341.10	53035.67	8.375	37057.14	27755.49
2009-10	44928.26	60914.85	6.5	42799.99	32447.88
2010-11	52079.69	71574.12	8.625	51782.38	39420.83
2011-12	59090.82	82326.52	9.25	60448.03	46118.52

- (1) The said time series data is first of all checked for stationarity to be sure that the results obtained in our empirical analysis are not spurious. After checking the

stationarity we shall apply regression analysis upon different parameters to establish our result.

The output results under different scenarios of Random Walk Model (RWM) are summarized below---

	α_0	α_1	α_2	R Square	F	F*	t_1	t_2	t_3
		1.169		0.9191	25688.5	1.43E-32	160.27		
Deposits	209.35	1.1619		0.9984	12521.6	1.87E-29	0.9711	111.9	
	-309.79	1.1186	110.2118	0.9987	7399.85	3.35E-28	-0.992	50.28	2.152
		1.1962		0.9987	16204	1.40E-30	127.29		
Credit Created	152.087	1.1894		0.9977	8713	7.00E-28	0.7988	93.34	
	-363.43	1.1425	93.6542	0.9981	5201	9.50E-27	-1.24	47.14	2.2057
		1.1503		0.9996	57438	4.60E-36	239.66		
Income	-433.11	1.1615		0.9991	24620	2.18E-32	-1.901	156.9	
	-59.96	1.2038	-133.75	0.9993	14972	4.17E-31	-0.2285	61.59	-2.3067
		0.9888		0.9805	1060	8.30E-19	32.5716		
Interest Rate	0.8048	0.9024		0.8168	89.19	8.10E-09	0.9539	9.44	
	0.7494	0.9045	0.0036	0.8169	42.38	9.80E-08	0.6778	8.92	0.0804

Results- We find that the individual time series of Deposits, Credit, Income and Rate of Interest are non-stationary or near explosive as evaluated through three variants of Dickey-Fuller RWM (as above).

Problem of Interpretation

The model formulated in equations (4), (5) and (6) above has three relations which hold simultaneously together, the third relation $S_t = D_t$ is included to close the model with exactly identifiable solution. The total variables in the model are four, two of which are jointly determined. D_t and CR_t are specified as jointly determined variables. R_t and Y_t are treated as predetermined variables of the model. The first equation excludes one variable. This satisfies the necessary and sufficient condition of exact identification. This is estimated by OLS (Ordinary Least Square). As against the first equation, the second equation excludes both the pre-determined variables therefore this equation is over identified and admits its estimation by Two Stage Least Square method. Therefore following version of second equation is estimated-

$$CR_t = \pi_0 + \pi_1 \bar{D}_t + v_t$$

{Where π are reduced form parameters from which structure parameters are estimated.}

Consumption is treated as exogenous to the model which is not included in equation system to make the more tractable. Even otherwise Consumption Investment functions are complimentary. From Consumption function, Investment function may be derived and vice versa. The relation between these two functions is assumed to be like that in Production and Cost functions.

Interpretation of the results obtained

Ordinary Least Square (OLS) estimates of (Deposits) D_t function- Intercept captures the influence of some variables. The significance of variable (Consumption in this case) is not equal to

zero. The negative sign refers to influence of Consumption expenditure. Therefore in this equation Consumption expenditure emerges as the variable which inversely affects the function. This interpretation is obvious from the fact that, as stipulated by J. M. Keynes $Y = C + S$. So, $S = Y - C$. Thus greater the value of C lesser shall be the value of ' S ' and consequently D_t . This holds true both at micro and macro level.

In view of the results of Dickey Fuller Test and Harvey Model for stationarity of time series we are prompted to use Engle Granger Test of unit root of residuals on the assumption that even if individual series are non-stationary their linear combination in a regression function can be found to be stationary.

$$D_t - \bar{D}_t = \text{error}$$

We take difference of these "error" values and apply

Engle Granger Test to test stationarity with relation as

$$\delta U_t = U_{t-1}$$

$$\bar{D}_t = -7063.07 + 260.26 R_t + 0.7907 Y_t \quad (11)$$

$$\text{Also } \bar{CR}_t = -1491.63 + 0.7781 \bar{D}_t \quad (12)$$

By applying Engle Granger Test on difference of D_t and $\bar{D}_t$ (found as per equation 7 above) and similarly for CR_t and $\bar{CR}_t$ (as per equation 8), we have--

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.425754654		$U_t = D_t - \bar{D}_t$					
R Square	0.181267026		Engle Granger Test					
Adjusted R Square	0.133647978		with equation as $\Delta U_t = U_{t-1}$					
Standard Error	726.9232721							
Observations	22							
ANOVA								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	1	2456817.897	2456817.9	4.649388334	0.0434183			
Residual	21	11096766.31	528417.443					
Total	22	13553584.21						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Lag Ut-1	-0.28819467	0.133655869	-2.15624403	0.042811607	-0.566147264	-0.010242	-0.566147	0.010242076

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.446845506							
R Square	0.199670906		$V_t = CR_t - \bar{CR}_t$					
Adjusted R Square	0.152051858		Engle Granger Test					
Standard Error	501.933639		with equation as $\Delta V_t = V_{t-1}$					
Observations	22							
ANOVA								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	1	1319952	1319952	5.239206	0.033097			
Residual	21	5290685	251937.4					
Total	22	6610637						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Lag Vt-1	-0.175912867	0.076854	-2.28893	0.032547	-0.33574	-0.01609	-0.33574	-0.01609

The Linear equation of Deposits and Credit Creation is thus proved to be stationary as value of 't' statistics is -2.15 and -2.28 for Deposits and Credit respectively. This is much lower than the critical value of 't' as 1.96 at 95% confidence interval.

Conclusions

The regression shows that Rate of Interest (R_t) is not only statistically significant but it influences Deposits (D_t) greatly. Corresponding to an increase of 1 percentage point in rate of interest, Deposits tend to rise by 260. This finding runs counter to general belief that Savings and hence Deposits are Rate of Interest neutral. This understanding is based on premise that once consumption decision has been taken, Savings as 'residual' factor emerges automatically. It is then only a matter of further decision to allocate given amount of savings in different options as investment which is generally guided by considerations of returns, safety and security. Only such persons invest in stock market who is not risk averters but majority of Indians are risk averters. They give greater preference to safety, security and fixed returns. This makes bank deposits as most favored option. However, income also influences savings and deposits significantly. But this influence is much lower than that of rate of interest, which is fixed and secure option for investors. Corresponding to increase of 1 unit in income, deposits increase by 0.8 units. This result is to be understood in the sense that income exercise decisive influence on the decision to save and the choice of investment option. Since low and middle income groups are mostly risk averters. The proportion of income saved is mostly invested in bank deposits. But 0.8 as a response of deposit to increase in income is pretty high. Thus Marginal Propensity to Save (MPS) is four times more than Marginal Propensity to Consume (MPC). The function explains 99.5 percent of total change in annual deposits in Indian economy.

Two Stage Least Square (TSLS) estimate of function of Credit Creation (CR_t)

The following is the TSLS estimate of the function of CR_t -

$$CR_t = \beta_0 + \beta_1 \hat{D}_t$$

$$CR_t = -1491.63 + 0.7781 \hat{D}_t, R^2 = 0.9887; F = 1760.625 > F^* = 5.66 \text{ E-}21$$

with 't' value of intercept being -3.3162 and that of $\hat{D}_t$ being 41.9598.

The model fits the data well. Though the value of R^2 implies 98.87 % of change in CR_t is explained by this function yet very definite meaning cannot be imputed to R^2 (Coefficient of Determination) in case of Two Stage Least Square (TSLS) estimates (Cf. K.E. Wallis, 1971). The reason for this inference of Wallis seems to be the fact that the independent variable like $\hat{D}_t$ (estimated deposits) in this function estimated by TSLS carries the correlation of deposits with rate of interest and income: it is difficult to eliminate this part from the coefficient of determination of this function. As in case of function of deposit, the function of Credit Creation (CR_t) also has a negative value of intercept. In our view the negatively significant intercept indicates the inverse influence of such policy variables as Statutory Liquidity Ratio (SLR) and Cash Reserve Ratio (CRR). Since these ratios don't change frequently, we have not incorporated the same as

included factors. But the coefficients attached to deposit are highly significant statistically. This implies that Marginal Propensity of bank to credit creation is highly responsive to deposits. Corresponding to 1 unit of deposit the credit created increases by 0.78 units.

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