FINANCIAL INCLUSION AND ECONOMIC GROWTH: EMPIRICAL EVIDENCE FROM INDIA

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Abstract:
This paper examines empirically the role of "financial inclusion" on Indian economic growth, with an emphasis on "bank-based-financial deepening". In contrast to previous research, I concentrate on the "causal relationship between the degree of 'financial deepening' and economic growth" in order to distinguish between numerous possible theoretical assumptions. To that purpose, Toda and Yamamoto (1995) used the modified Granger causality test technique in their work. Variables such as private sector credit, wide money, credit deposit ratio, and bank deposit liabilities are used to describe financial deepening. The findings largely support the concept that "bank-based financial deepening" is a significant determinant of economic growth, despite the fact that economic growth determines bank-based financial deepening. The causal linkages are primarily long-term in character. As a result, government policies targeted at boosting economic growth must be consistent and long-term in order to encourage India's financial depth.

Keywords: Financial Inclusion, Financial Deepening, Toda and Yamamoto causality test, Principal Component Analysis, Perron 97 unit root test.

1. Introduction:

Financial inclusion is the only option for a developing country to promote rapid and long-term economic development and progress. The degree of "financial inclusion" varies among countries, depending on its level of development. Surprisingly, India ranks second in the world in terms of financially excluded households, trailing only China. Normally, the poorer elements of society are largely overlooked by formal financial institutions in the drive to make large profits or the complexity involved in giving money to them. Financial inclusion, in its broadest meaning, refers to the delivery of an economy's financial system to its people. Financial inclusion is defined by the "Government of India's Committee on Financial Inclusion in India as the 'process of ensuring access' to financial services and timely adequate credit where needed by vulnerable groups {(Rangarajan Committee, 2008; Singh et al., 2014 Chhabra, 2015)} at an affordable cost". However, it emerged during the 1930s (Schumpeter, 1934). Majority of the "financial services" are coordinated through two major sources: banks and non-banking institutions. In this paper financial inclusion is approximated through banking inclusion. Financial exclusion, on the other hand leaves the disadvantaged and low- income sections of society with no other but informal options, making them vulnerable to financial distress, debt, and poverty (which remains a major concern for any country). In fact, Leeladhar (2005) defined "financial inclusion as delivery of banking services". In this paper we follow this suggestion and regard the terms "financial inclusion and banking based financial deepening" as synonymous. Financial deepening is a term used often by economic development experts and is "referred to the increased provision of financial services with a wider choice of services geared to all levels of society".

Various committees have evaluated India's financial inclusion status in terms of its people's access to banking and insurance services. Banking services are only available to 34% of India's population. Inclusive growth is a core goal of the "Eleventh Five Year Plan" (2007-12). The most challenging task in India is achieving inclusive growth since it is extremely tough to move 600 million rural Indians into the mainstream. Financial inclusion is one of the most effective means of achieving inclusive growth. In India, the process of "financial inclusion" can be divided into three stages: First Phase (1960-1990), emphasis remained on directing credit to the economy's neglected sectors. Second phase (1990-2005) was primarily concerned with strengthening "financial institutions as the part of financial sector" reforms. "Financial inclusion" in this phase was primarily encouraged by the implementation of a Self-Help Group (SHG)-bank linkage program, as well as "Kisan loans Cards" (KCCs) for granting loans to farmers. The "National Bank for Agriculture and Rural Development" (NABARD) began the SHG-bank linkage scheme in 1992, with policy support from the "Reserve Bank, to ease collective decision making by the poor and provide door step" banking. During the third Phase, "financial inclusion" was expressly stated as a policy goal, with the emphasis on providing a safe facility for savings deposits via 'no frills' accounts. The Report of Committee on "Financial Inclusion, chaired by Dr. C. Rangarajan", concluded that financial inclusion must be approached as a mission and proposed a "National Mission on Financial Inclusion" (NMFI) comprised of representation from all stakeholders for recommending overall policy changes and assisting stakeholders in the public, private, and non-governmental sectors in undertaking promotional initiatives.

In the "lack of well-developed non-banking institutions and stock market" in developing nations, banks play a crucial role in converting deposits into financial assets. They move funds from firms with excess liquidity to those with insufficient liquidity, boosting capital formation and trade. Banks also play a crucial role in information filtering by screening borrowers and monitoring their behavior in financial systems with incomplete and asymmetric information. Their increased efficiency is thus critical to the achievement of financial deregulation (Ephraim & Montfort, 2004). Well-developed financial systems, in this context, can be "expected to expedite the development process by channeling financial recourses to the most productive" use. Bank-based "financial system encourages long-term finance" which is dedicated to long-term productive investment that reduces speculative activities. The most influential works that underpin this hypothesis are (Levine and King 1993a, 1993b) suggested that "better financial systems lead to more robust economic growth". Bank-based "financial system may help implement expansionary monetary and industrial policy, given the relationship between financial and industrial" firms (Arestis and Demetriades, 1996).

Throughout the modern history of economics, the "relationship between financial development and economic expansion" has attracted a considerable deal of attention. Its origins can be traced back to Lydia in Asia Minor, where the first money was found. However, the first evidence of public debate on the "relationship between money and growth, as well as experimentation with free banking", can be found in Rome in 33 AD. In that year there was probably the first classic case of public panic and run on the banks. The Romans debated intensely and fiercely at that time the possibility of placing a hitherto free banking system under the control of the government. Since then, of course, a great number of economists have dealt with the issue. An early and intellectual development came from Bagehot (1873), in his classic Lombard Street, where he emphasized the critical importance of the "banking system in economic growth" and highlighted circumstances when "banks could actively spur innovation and future growth" by identifying and funding productive investments. Schumpeter (1912) is one of the fundamental studies emphasizing the importance of financial services in promoting growth and was later attested by many others like Gurley and Shaw (1955), Patrick (1966), Goldsmith (1969), Mckinnon and Shaw (1973) and others. More recently the "endogenous growth literature has suggested that financial intermediation has a 'positive effect' on steady-

state growth" (see Pagano, 1993, for a survey), and that "government intervention in the financial system has a negative effect on the equilibrium growth rate" (King and Levine, 1993b). Later "studies like Levine and Zervos (1996) argue that financial systems do not promote economic growth rather respond to real sector development in an economy" Jung (1986); Levine, Loayza and Beck (1999) posit that in less developed countries "financial development causes economic growth" while, in developed countries "economic growth causes financial development". Other studies in the 1990s and 2000s namely King and Levine (1993a,b), Arestis and Demetriades (1997), Rosseau and Watchel (1998), Levine and Zervos (1998), Levine et al, (2000), Bell and Rosseau (2001) all had divergent views regarding the causal patterns and the endogeneity of model variables. This divergence seems to emanate from the different estimation procedures and data employed for analysis. Most importantly, results seem to be more greatly and fundamentally determined by the option of choice of financial deepening variables. Against this backdrop, and the fact that the India completed more than three decades with economic liberalization, the policy relevance of this study is not in doubt.

Numerous "research studies have been undertaken in the area of financial deepening and economic growth" using cross section, panel and time series data. Some of them are Luintel and Khan (1999), Demetriades and Hussein (1996), Rubini and Sala-i-Martin (1992), and Jung (1986), Guryay et al (2007) for North Cyprus, Agung and Ford (1998), Murinde and Eng (1994) for Singapore. Ghosh, J. (2013), Kumar, N. (2013), Kapoor, A. (2014).

This paper contributes to this ongoing debate and improves on previous studies by investigating empirically the causality between "bank-based financial deepening and economic growth" in India during 1970-2010 using the "Toda and Yamamoto (1995) non-causality test procedure". The "use of the superior Toda and Yamamoto causality test is the first point of departure between this study" and existing studies. Most of the Indian studies like Luintel and Khan (1999), Bhattacharya, P. and Sivasubramanian, M. (2003), Debashis Acharya, S Amanulla, Sara Joy (2009), used only a "single measure of financial deepening instead of considering alternative financial deepening variables".

These are gaps that our study seeks to close. The explicit goal of this study is to determine whether, in the words of Toda and Yamamoto (1995), the choice of proxy employed for financial deepening affects the "causality direction between 'bank-based' financial sector development and economic growth" in India.

The paper is structured as follows: section 2 reviews theoretical framework; section 3 reviews empirical literature; section 4 describes data and its sources; section 5 gives a brief account of research techniques used; section 6 discusses empirical results; and section 7 concludes with policy implications and the last section is about limitation and further scope of study.

2. Theoretical Framework

Theoretically, finance doesn't consider to play an essential role in economic development in the environment-friendly, appropriate technology-based, "decentralized Alternative Development Model". However, in the "conventional model of modern industrialism" attitudes in this regard differ greatly, Bhole (1999).

The theoretical literature and cross-sectional results on the topic can be loosely grouped into four main categories; Supply Leading approach, a Demand Following approach, independence between "financial development and economic growth" and a Cautionary or Feedback approach.

The "Supply-leading hypothesis proposes a unidirectional causation that runs from financial deepening to economic growth" implying that new "functional financial markets and institutions will enhance the supply of financial services". This hypothesis serves two goals namely: moving "resources from areas from poor growth to those with high growth and encourages entrepreneurial action" in the later. Hicks (1969) believes that history "shows that the 18th century industrial revolution in England was not the

result of new technological innovations but of the financial reforms". This hypothesis was backed by several renowned economists, {e.g. McKinnon (1973), Shaw (1973), Fry (1978), Diaz-Alejandro (1985), and Moore (1986)}. A few of the recent studies supporting this idea include {Calderon and Liu (2002), King and Levine (1993a, b,) and Levine, Beck, and Loayza (2000), Shandre M. Thangevelu and Ang Bang James Jiunn (2004)}.

The "demand-following" hypothesis posits a one-way causal relationship from "economic growth to financial development". This indicates a passive impact of the financial system to economic growth, leading to implication that rising demand for financial services may lead to aggressive financial system expansion as the economy's real sector expands. Many studies support this idea, some of them among them are Robinson (1952), Gurley and Shaw (1955, 1967), Goldsmith (1969), Jung (1986), Kar & Pentecost, (2000), Omotor, (2007), and Ndlovu (2013).

Interestingly, another set of "prominent economists believe that financial deepening is almost entirely irrelevant" to economic growth Stern (1989) in his groundbreaking survey of the main works in development economics utterly disregarded the role that financial development plays in the process of economic expansion. In a paper explaining the process of economic development, Nobel Laureate Robert Lucas (1988) in his paper stated that economists have often inflated "the role of financial markets in economic development have only a modest influence on the process of economic growth". If true, the Stern-Lucas hypothesis rules out any credible causal relationship between financial deepening and real economic development. As a result, a "third pattern appears, indicating that the two variables are causally independent".

Apart from the three unique causal hypotheses mentioned above, a fourth and final statement can be deduced, "which is a combination of the supply-leading and demand-following hypotheses", i.e. the feedback method. In this instance "both hypotheses are jointly valid, implying that financial deepening and real economic development are mutually causal" (bidirectional causality). This form of causation pattern appears to be more likely in the long run. Studies such as Greenwood and Smith (1997), Al-Yousif (2002), and many others are examples of this form of causality.

It should be highlighted that numerous prior research has found a "high and positive association between financial deepening and real growth", which does not necessarily support the "supply-leading hypothesis" (discussed at number1). In fact, it is a priori consistent with all of the other alternative hypotheses explored in this study. If "causality actually follows the demand following hypothesis", then previous "empirical studies that regress real economic growth as a dependent variable on financial deepening as a independent variable become meaningless". Conversely, if hypothesis (3) is correct and the two variables are not causally connected, then past empirical findings tying "financial deepening to real economic growth are false", and the stated association is due to some missing variables. Finally, if the "Bi-directional hypothesis is valid, earlier results from single-equation models lack credibility" since they are biased and statistically inconsistent due to simultaneous-equation bias. Clearly, "research on the function of financial deepening in the economic growth process should focus on testing the direction of causality between the two variables" rather than the correlation.

3. Empirical Evidence:

The literature has addressed the issue of "causality between financial development and economic growth" both conceptually and experimentally. Recent research, on the other hand, has been inconclusive in its conclusions supporting the idea that "financial development" leads economic expansion. King and Levine (1993), for example, determined that "financial development leads economic growth", whereas Levine and Zervos (1998) discovered that stock market and banking development "leads" economic growth. Arestis and Demetriades (1997), Shan and Morris (2002), and Shan, Sun, and Morris (2001), on the other hand,

discovered that the theory was supported in only a few of the nations investigated, implying that no general implications could be derived.

The relationship between "economic growth and financial development" is extensively studied with mixed and inconclusive results. The "positive view of the finance-led growth hypothesis normally focuses on the role played by financial development in mobilizing domestic savings and investment" through a more open and more liberalized financial system, and in promoting productivity via creating an efficient financial market (Schumpeter (1912), Patrick (1966)). The view that "financial development (repression) has positive (negative) effects on economic growth in the steady state" is supported by many economist, some of them are mentioned in the bracket {Greenwood and Jovanovic (1990), Bencivenga and Smith (1991), Roubini and Sala-I-Martin (1992), Pagano (1993), King and Levine (1993b), Berthelemy and Varoudakis (1996), Greenwood and Smith (1997)}. Of the above, the studies by Roubini and Sala-I-Martin (1992), King and Levine (1993), Fry (1997), Levine and Zervos (1998) widely use cross-sectional techniques to support the "hypothesis that financial sector development" is growth enhancing and consequently financial repression policies are harmful for economic growth.

Robinson (1962) has suggested, in an original position, that "financial development follows economic growth". Newlyn (1977) considers the role of "finance in development as of subsidiary in nature". Likewise, Lucas (1988) concludes that the importance of "financial markets" is badly overstressed. A similar conclusion is shared by Chandavarkar (1992) who considers that finance is never been listed by the pioneers of development economics as a basic development factor. Some of the recent studies are reviewed in the following paragraphs.

In a multivariate VAR model, Rudra Prakash Pradhan (2009) investigates the "causal relationship" between "financial development" and "economic growth" in India. Cointegration and the causality test are used in the empirical analysis. The "cointegration test" determines "whether or not there is a long-run equilibrium relationship between financial development and economic growth". The "Granger causality" test reveals bidirectional correlation between the money supply and economic growth, bank credit and economic growth, money supply and foreign trade, and market capitalization and foreign trade.

Beck, Senbet, & Simbanegavi, (2015) studied the financial inclusion and innovation across Africa and stated that the "financial inclusion" process is quite beneficial for economies and for the societies.

Ozturk (2008) examines the "causality between 'financial development and economic growth' in Turkey" from 1975 to 2004 using a vector autoregression (VAR) framework "based on cointegration and error correction" representation of cointegrated variables. The results conclude that "there is a long-run bidirectional relationship between financial development and economic growth".

Güryay, et. al. (2007) examines the connection between "financial development and economic growth" in Northern Cyprus using "Granger causality" test. Results conclude that "financial development" does not cause economic growth, but there is "evidence of causality from economic growth to the development of financial intermediaries".

Mohammed and Sidiropoulos (2006) use the "autoregressive distributed lag (ARDL) model to co-integration analysis by Pesaran and Shin (1999) to find the impact of financial development on economic performance" in Sudan (1970 – 2004). Their empirical findings show a weak relationship between "financial development and economic growth"; owing to banks' inefficient resource allocation, insufficient investment climate, which is necessary to stimulate significant private investment and sustain long-term growth, and the subpar distribution of bank credit.

Wadud (2005) investigates the "long-term causal relationship between financial development and economic growth" in three South Asian countries: India, Pakistan, and Bangladesh. He classified the "financial system as bank-based or capital-market-based." A cointegrated "vector autoregressive model was used in the study to analyze the long-run link between financial development and economic growth".

According to the "empirical data, the results of the error correction model imply" that financial development led to economic expansion.

Azege (2004) investigates the empirical relationship between "financial intermediary development" and growth. The study examined "aggregate deposit, money bank credit as well as GDP across time to find a marginally favorable association between financial deepening and economic growth". He concludes that "financial intermediary" development in Nigeria is critical to overall economic growth.

Chen (2002) used "the cointegration test and Bayesian vector auto regressions (BVAR) model to investigate the causal link" between interest rates, savings, and income in the Chinese economy from 1952 to 1999. He points out that "it is therefore important to establish well-developed financial institutions-particularly the independence of the Central Bank-interest rate liberalization and sound financial intermediation, all of which are important for the efficient allocation of capital, which, in turn, can help to establish sustainable economic growth" (Chen, 2002, pp. 59-60).

In the cases of other developing economies, Ansari (2002), who has used a "vector error correction" model (VECM) to analyzing the impact of financial development, money and public spending on Malaysian national income, argues that Malaysian experience has shown "an unambiguous support for the supply-leading view of financial development", implying the importance of financial sector development" (Ansari, 2002, p.72). Strong government ownership of banks, which is a typical phenomenon in the countries such as China, is said to be one of the sources of slow economic growth around the world.

Some of the earlier "Causality pattern based studies" include Sims (1972), Gupta (1984), Jung (1986), Toda and Phillips (1993), Murende and Eng (1994), Demetriades and Hussein (1996), Arestis and Demetriades (1996) and Kul and Khan (1999). A brief review of studies regarding causality between "financial development and economic growth" discovered that the pattern varies across countries, with the success of financial liberalization policies implemented in each country and with the overall level of development of the financial sector generally.

4. Data Sources, Study Period and Variables:

The necessary secondary data[1] for India (in Indian Rupees) for the period 1970-2011 is sourced from "Reserve Bank of India" and IMF Annual Financial Statistics.

Based on literature available, "economic growth is proxied by per capita GDP (YPC), while proxies for "financial development chosen are the ratio of bank credit to private sector to GDP (BCP), the ratio of broad money to GDP (M2Y), the ratio of bank deposit liabilities to GDP (BD) and the credit deposit ratio (CD), financial deepening index(FDI)".

5. Research Techniques:

This section is going to summarize the econometric techniques used to achieve the goals of this paper as mentioned in section 1.

The "standard Granger (1969) test has traditionally been used in the relevant literature to test" the causality between two variables. This test determines if prior values of a variable Y significantly contribute to forecasting the value of another variable Xt+1, then Y is said to Granger Cause X and vice versa. Regression used in the test are given below:

[1] Per Capita GDP is converted into log. Credit –Deposit Ratio belongs to Scheduled Commercial Banks.

$$Y_t = \beta_0 + \sum_{k=1}^{M} \beta_k Y_{t-k} + \sum_{l=1}^{N} \alpha_l X_{t-l} + u_t$$

$$X_t = \gamma_0 + \sum_{k=1}^{M} \gamma_k X_{t-k} + \sum_{l=1}^{N} \delta_l Y_{t-l} + v_t \quad \textbf{(1\&2)}$$

where "Y_t and X_t are the variables" to be tested, and "u_t and v_t are mutually uncorrelated" white noise errors, and t denotes the time period and *'k'* an *'l'* are number of lags. The "null hypothesis is $\alpha\iota = \delta\iota = 0$ for all l's versus the alternative hypothesis that $\alpha\iota \neq 0$ and $\delta\iota \neq 0$ for at least" some l's. If the coefficient $\alpha\iota$'s are "statistically significant" but $\delta\iota$'s are not, then X causes Y and vice versa. However if both $\alpha\iota$ and $\delta\iota$ are "significant" then causality runs both ways.

Granger (1986) states that the "test is valid if the variables are not co-integrated". Second, the findings of "Granger causality are extremely sensitive to the selection" of lag duration. Recent developments in "time series analysis have led to the suggestion" that the standard Granger test be improved. The most recent models start by evaluating the stationarity of the original variables before testing cointegration.

5.1. Unit Root Test and Cointegration:

As a "first step in time series econometrics researcher has applied unit root test[2] in order to check the order of integration". There are "many unit root tests" available with each having their own advantage and disadvantage but in the present paper researcher has applied following unit root tests: **Augmented Dicky Fuller (ADF), the Philip-Perron (PP) and Perron 97**. Unit Root tests verify the stationarity properties (absence of trend and long-run mean reversion) of the time series data so as to avoid spurious regressions. A series is said to be "stationary" (weakly or covariance) if the mean and autocovariance of a series do not depend on time. A series is said to be "integrated of order d", denoted by I(d), if it has to be differenced d times before it becomes stationary. Consider the equation:

$$\gamma_t = \rho\gamma_{t-1} + \chi_t \delta + \varepsilon_t \quad (3)$$

Where χ_t are optional "exogenous regressors" which may consist of constant, or a constant and trend, ρ and δ are parameters to be estimated, and ε_t is assumed to be "white noise". If $|\rho| \geq 1$, γ is a "nonstationary series" and the variance of γ increases with "time" and approaches infinity if $|\rho| < 1$, γ is a (trend) stationary series. Thus, the "hypothesis" of (trend) stationarity can be evaluated by "testing" whether the "absolute" value of ρ is strictly less than one.

ADF test using MacKinnon (MacKinnon, 1991) critical values, constructs a "parametric correction for higher-order correlation" by assuming that the y series follows an AR (p) process and adding p lagged difference "terms of the dependent variable y" to the "right-hand side of the test" regression.

$$\Delta\gamma_t = \alpha\gamma_{t-1} + \chi_t\delta + \beta_1\Delta\gamma_{t-1} + \beta_2\Delta\gamma_{t-2} + \ldots + \beta_2\Delta\gamma_{t-2} + \nu_t \quad (4)$$

"This augmented specification" is then used to test the hypothesis:

$$H_0: \alpha = 0, \text{ against } H_1: \alpha < 0 \quad (5)$$

If "null hypothesis is not rejected" by researcher then $H_0: \alpha = 0$, it means that $\alpha = 0$ and the series α contains a unit root. Where $\alpha = \rho - 1$ and is "evaluated" using the conventional t-ratio for α

$$\mathbf{t_\alpha = \alpha\hat{} \,/\, (se(\alpha\hat{}))} \quad (6)$$

Where $\alpha\hat{}$ is an estimate of α and *se* ($\alpha\hat{}$) is the "coefficient" standard error.

[2] For a detailed discussion on unit root test please refer to text book on time series econometrics.

Phillips (1987) and Phillips-Perron (1988) suggest an alternative approach for checking the "presence of unit roots" in the data. They formulate a "nonparametric test to the conventional t-test" which is robust to a wide variety of "serial correlation and time dependent" hetroscedasticity. The PP unit root test requires "estimation of the following equation" (without trend).

$$X_t=\mu_t+\sum_{i=1}^{T} X_{i-T} + u_t \quad (7)$$

But both the above mentioned test can't capture "structural change in time series data" which is a very natural situation in today's economy. Economic crises, policy changes, institutional changes, and regime transitions all generate structural change in different time series. In recent years, the topic of structural change has become increasingly "important for the analysis of macroeconomic time series". One of the challenges associated with "structural change is testing the null hypothesis of structural stability against the alternative of a one-time structural break". If such changes occur during the data gathering process but are not accounted for in the "specification of an econometric model, the results may be biased toward incorrect non-rejection of the non-stationarity hypothesis".

Perron 1989 1997 (Leybourne and Newbold 2003). Perron and Vogelsang (1992) and Perron (1997) presented a "class of test statistics" that allow for two types of structural breaks: the "Additive Outlier (AO) model, which allows for the structural change to occur instantly, and the Innovational Outlier (IO) model." The "Innovational Outlier (IO) model" is used in this work, in which changes are believed to occur gradually.

The Perron 97, "IO model" allows for a "gradual change in the intercept (IO1)" and "gradual changes in both the intercept and the slope" of the trend function (IO2) such that:

$$\textbf{IO1: } x_t =\mu + \phi DU_t + \beta_t + \delta D(T_b)_t + \alpha x_{t-1} +\sum_{i=1}^{k} c_t\Delta x_{t-1} +\varepsilon_t \quad (8)$$

$$\textbf{IO2: } x\ t=\mu + \phi DU_t+\beta_t+\gamma DT_t+\delta D(T_b)_t +\alpha x_{t-1} +\sum_{i=1}^{k} c_t\Delta x_{t-1} +\varepsilon_t \quad (9)$$

where T_b represent the time of break ($1 < T_b < T$) which is unknown, 1 *t DU* = if $t > T_b$ and "zero otherwise", $DT_t = T_t$ if $t > T_b$ and "zero elsewhere", D (T_b) = 1 if $t = T_b + 1$ and "zero otherwise, x_t is any general ARMA process and e_t is the assumed white noise" residual term .

The "null hypothesis of a 'unit root' is ruled out if the 'absolute value' of the t-statistic for testing α=l is greater than the corresponding critical value". Perron (1997) suggests that the time of "structural break (T_b)" can be determined two ways: the "first approach is that equations (1) or (2) are sequentially estimated" assuming different T_b with T_b chosen to minimize the t-ratio for α =1; in "second approach, T_b is chosen amongst all other possible break point values to minimize the t-ratio on the estimated" slope coefficient (γ).

The "truncation lag parameter (k)" is calculated using Perron's (1997) data-dependent approach. The "t-ratio on the coefficient associated with the last lag in the estimated auto regression is used" to determine the value of k in this approach. The optimal k (or k*) is chosen up to a maximum order k, so "that the coefficient on the final lag in an autoregression of order k* is relevant" and the last coefficient in an "autoregression of order greater than k* is inconsequential" (Perron, 1997). The least restricted model is tried first, followed by others.

To determine whether there exists a "long run relationship between financial development and economic growth", we employ the multivariate Johansen approach (Johansen 1988, 1992) and (Johansen and Juselius, 1990) cointegration procedure in line with Kar and Pentecost (2000). The Johansen approach utilizes two statistic tests namely: the trace test and the maximal eigenvalue test.

First, the "likelihood Ratio (LR) test" based on the trace statistics (λ trace) which tests the H_0: r ≤ q against the H_1: q = r is calculated thus:

$$\lambda_{trace}(r) = -T \sum_{i=1+1}^{P} \ln(1 - \hat{\lambda}_t) \qquad (10)$$

Where λr+1,….λn are the least value eigenvectors (p-r).

The second test is maximal eigenvalue test (λ_{max}) which tests the H0: there are r-cointegrating vectors against H1: there are r+1 cointegrating vectors and is calculated thus:

$$\lambda_{max}(r, r+1)) = -T\ln(1 - \hat{\lambda}_{r+1}) \qquad (11)$$

If a long run cointerating relationship exit between variables, then "causality between them" is tested by the error correlation model. If the "null hypothesis of non-stationarity is rejected and the variables are not cointegrated then the standard Granger causality test" is appropriate.

5.2. Granger Causality in Toda and Yamamoto Version

The classic "Granger (1969) causality" test for inferring leads and lags among integrated variables produces false regression results, and the F-test is invalid unless the variables in levels are cointegrated. New innovations in econometrics include the "error correction model (developed by 'Engle and Granger (1987)' and the "vector autocorrelation model" (Johansen and Jesulius, 1990) as alternatives for the testing of non-causality between economic time series. Unfortunately, these tests are complicated and sensitive to the nuisance parameter values in limited samples, making their conclusions inaccurate (see Toda and Yamamoto, 1995; Zapata and Rambaldi, 1997).

Toda and Yamamoto (1995) suggested a simple approach that requires the estimation of an "augmented VAR", even when cointegration exists, and guarantees the "asymptotic distribution" of the MWald statistic. As a result, "Toda-Yamamoto causality procedure has been designated as the long-run causality" tests. All that is "required here is to identify the maximal order of integration d_{max}, that we expect to see in the model and construct a VAR in their levels" with a total of ($k + d_{max}$) lags. Toda and Yamamoto observe that, for d=1, the lag selection technique is always valid, "at least asymptotically", since k > =1=d. If d=2, then the procedure is valid unless k=1. Moreover, according to "Toda and Yamamoto, the MWald statistic is valid regardless whether a series is I(0), I(1) or I(2) that is non-cointegrated or cointegrated" of an arbitrary order.

A simple example of a "bivariate model", with one lag (k=1) is considered to clarify the principle, that is,

$$x_t = A_0 + A_1 x_{t-1} + e_t \qquad (12)$$

Or more fully

$$\begin{bmatrix} x_{1t} \\ x_{2t} \end{bmatrix} = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \end{bmatrix} + \begin{bmatrix} \alpha_{11}^{(1)} & \alpha_{12}^{(1)} \\ \alpha_{21}^{(1)} & \alpha_{22}^{(1)} \end{bmatrix} \begin{bmatrix} x_{1,t-1} \\ x_{2,t-1} \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix} \quad (13)$$

where

$$E(e_t) = E\begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix} = 0$$

And

$$E(e_t e_t^{/}) = \Sigma$$

We will apply the parameter limitation 12 (1) =0 to ensure that x2 does not "Granger cause" x1. A "typical t-test" is no longer valid if we suppose that x1t and x2t are I(1). We test (1) 12(1) =0 as Dolado and Lutkepohl (1996) did. by generating the standard "Wald test in the augmented model" using least squares estimates:

$$\begin{bmatrix} x_{1t} \\ x_{2t} \end{bmatrix} = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \end{bmatrix} + \begin{bmatrix} \alpha_{11}^{(1)} & \alpha_{12}^{(1)} \\ \alpha_{21}^{(1)} & \alpha_{22}^{(1)} \end{bmatrix} \begin{bmatrix} x_{1,t-1} \\ x_{2,t-1} \end{bmatrix} + \begin{bmatrix} \alpha_{11}^{(2)} & \alpha_{12}^{(2)} \\ \alpha_{21}^{(2)} & \alpha_{22}^{(2)} \end{bmatrix} \begin{bmatrix} x_{1,t-2} \\ x_{2,t-2} \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix} \quad (14)$$

The "Wald statistic will be asymptotically distributed as a Chi Square", with degrees of freedom equal to the number of "zero restrictions, irrespective of whether x_{1t} and x_{2t} are I (0), I (1) or I (2), non-cointegrated or cointegrated of an arbitrary" order.

Employing the "seemingly unrelated regression (SURE) framework", we estimate a VAR (5) as follows:

$$\begin{bmatrix} p_t \\ q_t \\ r_t \\ s_t \\ t_t \end{bmatrix} = \beta_0 + \beta_1 \begin{bmatrix} p_t - 1 \\ q_t - 1 \\ r_t - 1 \\ s_t - 1 \\ t_t - 1 \end{bmatrix} + \beta_2 \begin{bmatrix} p_t - 2 \\ q_t - 2 \\ r_t - 2 \\ s_t - 2 \\ t_t - 2 \end{bmatrix} + \beta_3 \begin{bmatrix} p_t - 3 \\ q_t - 3 \\ r_t - 3 \\ s_t - 3 \\ t_t - 3 \end{bmatrix} + \beta_4 \begin{bmatrix} p_t - 4 \\ q_t - 4 \\ r_t - 4 \\ s_t - 4 \\ t_t - 4 \end{bmatrix} + \begin{bmatrix} p_t - 5 \\ q_t - 5 \\ r_t - 5 \\ s_t - 5 \\ t_t - 5 \end{bmatrix} + \begin{bmatrix} ep_t \\ eq_t \\ er_t \\ es_t \\ et_t \end{bmatrix} \quad (15)$$

Variables entering the model are: Real Per Capita Income (YPC), Broad Money relative to GDP (M2Y), Bank "Credit to the Private Sector" relative to GDP (BCP), Bank Deposit Liabilities (BD) and Credit Deposit Ratio (CD) denoted as "p, q, r, s and t" respectively.

5.3. Principle Component Analysis

PCA is an Orthogonal Linear Transformation that converts data to a new coordinate system so that the greatest variance by any projection of the data falls on the "first coordinate (referred to as the first principal component), the second greatest variance falls on the second coordinate", and so on. By keeping lower-order "principal components" and disregarding higher-order ones, PCA can be used to reduce dimensionality in a data set while conserving those aspects of the data set that contribute the most to its variance. The "most important" aspects of the data are frequently contained in such low-order components. However, depending on the application, this may not always be the case. Theil (1971)[3] goes into great length about the process of Principal Component Analysis.

[3] Theil (1971)

6. Empirical Results

As the first step order of integration for all the five variables is determined using ADF, PP and Perron 97 test:

Table 1

UNIT ROOT TEST ON LEVELS

Variables	With a constant		With a constant and Trend		Perron97 IO2 Model		
	ADF	PP	ADF	PP	T_b and k	T_α	Result
YPC	3.822	4.734	-1.125	-1.016	1993:4	-2.343	I(1)
BCP	1.715	1.104	0.414	-0.218	2000:2	-2.729	I(1)
M2Y	0.95	0.557	-0.975	-1.482	1993:3	-4.010	I(1)
BD	3.843	3.167	1.516	1.302	2004:3	-3.156	I(1)
CD	3.603	2.905	1.515	0.959	1995:3	-4.341	I(1)
Critical Values	-2.964	-2.961	-3.544	-3.544		-5.550	

Table 1 show that all the chosen variables have a unit root test at levels but they are tested and found stationary at first difference[4]. Perron 97 is done to capture "structural break in the time series" under test. Result of Perron 97 result has shown that all chosen series had a "break after liberalization in India" suggesting towards some impact of liberalization process adopted in 1991. Knowing the nature of integration in the series, a "long run relationship between economic growth and financial development variable" was first established using the Johansen multivariate cointegration approach by Johansen (1988, 1992); and Johansen and Juselius (1990).

The results of the "Johansen multivariate cointegration" test are shown in table 2 below.

Table 2A

UNRESTRICTED COINTEGRATION RANK TEST (TRACE TEST)

Null	Alternative	Trace Statistic	5% Critical Value
r = 0	r = 1	107.6915	70.4900
r<= 1	r = 2	64.1005	48.8800
r<= 2	r = 3	28.9395	31.5400

Table 2B

UNRESTRICTED COINTEGRATION RANK TEST (MAXIMAL EIGENVALUE TEST)

Null	Alternative	Trace Statistic	5% Critical Value
r = 0	r = 1	43.5910	33.6400
r<= 1	r = 2	35.1610	27.4200
r<= 2	r = 3	20.5077	21.1200

[4] Results are not presented due to paucity of space but are available from researcher on demand.

The trace and maximal eigenvalue test result in table 2A & 2B above suggests "two cointegrating" equation at the 0.05 level of significance thus "confirms the rejection of the 'null hypothesis' of no cointegrating vectors" among the chosen variables.

The results above are based on the assumptions of linear deterministic trend and lag interval in first difference of 1 to 1. Overall, the "Johansen cointegration" test suggests that there exists a sustainable cum long-run equilibrium relationship between economic growth proxied by real per capita income (YPC) and financial deepening variables proxied by BCP, M2Y, BD and CD. Finally table 3 presents "the causality test" results of Toda-Yamamoto test based on SUR estimation[5].

In the Toda-Yamamoto sense, "the causality test" suggests that growth proxied by "real per capita income" (YPC) causes bank- based financial deepening without a feedback in case of following three proxies of financial deepening namely "ratio of private sector credit" to GDP (BCP), "ratio of broad money" to GDP (M2Y) and bank deposit ratio (BD). These outcomes suggest growth led "bank-based" finance. This empirical result validates Waqabaca (2004) and Kar and Pentecost (2000) but fails to validate Levine et al (1999) and Jung (1986). However Growth (LYPC) and credit deposit ratio (CD) turned out to be independent, thus supporting independence approach.

Table 3

TODA-YAMAMOTO TEST BASED ON SUR ESTIMATION

NULL HYPOTHESIS	MWALD STATICS	P-Value	Result
BCP does not Granger cause YPC	.41130	[.521]	*Cannot Reject* H_0
YPC does not Granger cause BCP	6.0428*	[.014]	*Reject* H_0
M2Y does not Granger cause YPC	1.2121	[.271]	*Cannot Reject* H_0
YPC does not Granger cause M2Y	16.6891*	[.000]	*Reject* H_0
BD does not Granger cause YPC	.51576	[.473]	*Cannot Reject* H_0
YPC does not Granger cause BD	3.2499*	[.071]	*Reject* H_0
CD does not Granger cause YPC	.26884	[.604]	*Cannot Reject* H_0
YPC does not Granger cause CD	.85994	[.354]	*Cannot Reject* H_0
GROWTH-VS- FINANCIAL DEEPENING			
FDI does not Granger cause YPC	.83604	[.361]	*Cannot Reject* H_0
YPC does not Granger cause FDI	6.2301*	[.013]	*Reject* H_0

*Note: * indicates significance at 5% and above level. p-values of MWALD statistics are given in parentheses. Source: Researcher's Calculation*

To have a much clear picture of growth and bank based financial deepening, all the variables used for financial deepening are converted into an index of financial deepening (FDI) using PCA. The test suggests "growth led bank based financial deepening" in India during the period of 40 years (1970-2009) and not the other way round thus assisting many who supported demand following hypothesis.

7. Conclusion and Policy Implications

Given the brevity of the annual sample period, in addition to the well-known caveats associated with the Granger concept of causality, the "conclusion of this paper is only suggestive" and should thus be interpreted cautiously.

However, the "empirical results" suggest that all the chosen series for variables used had a structural break after the adoption of liberalization process; thereby implying a strong possibility of the liberalization process having an impact on "financial inclusion and economic growth" in India.

[5]One lag was chosen by AIC and SBC for the model and maximum order of integration is one. So the model is worked with two lags.

Financial inclusion (defined by bank based financial deepening) and economic growth were found to be positively co-integrated indicating a "stable and long-run equilibrium relationship between financial inclusion and economic growth" in India.

The findings also exhibited that for four (i.e. bank private sector credit and broad money, bank deposit ratio and financial deepening index) out of the five variables used for proxing bank based financial deepening thus financial inclusion, there is a "unidirectional causality between bank- based financial deepening and economic growth" implying thereby, that "economic growth leads to bank based financial deepening" in India supporting the famous "Demand Following" Approach in context of financial inclusion.

However, for the fifth variable, i.e. Credit Deposit Ratio, proxied for "bank based financial deepening thus financial inclusion", there is "independence between bank based financial deepening and economic growth", thus supporting the Independence Approach.

Therefore, the conclusion drawn of this study were found to be mixed and an important conclusion of this study is that the choice of variables proxied for bank based financial deepening thus financial inclusion may influence and impact the "direction of Causality" with economic growth in India.

As the majority of the results obtained confirm that "Economic Growth leads to financial inclusion" (defined by bank based financial deepening), the focus of the economic policies adopted by the policy makers should be on growth enhancing policies, however this should not be done at the cost of policies related with bank based financial deepening.

8. Limitation and scope for further research

Despite the fact that this study may have been the only one to use a time series for 40 years, "an important limitation" of this study may be the number and choice of variables used as proxy for bank based financial deepening.

The above result also defines the further scope for research, which should be to confirm the result obtained here under through application of a wider and bigger set of variables as proxy to the bank based financial deepening thus financial inclusion in India.

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