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Financial development and economic growth in India: some evidence from non-linear causality analysis

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Abstract

In the light of the recent observation that the relationship between financial development and economic growth is one of non-linear and limitations of granger test, this paper re-examined relationship in the framework of non-linear Granger causality employing (Diks and Panchenko in *Stud Nonlinear Dyn Econ* 9(2), [2006](#)) test. The limitation of non-stationarity of earlier study is also addressed using the Toda and Yamamoto (*J Econ* 66:225–250, [1995](#)) test. The present study attempts to undertake this

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financial development and economic growth bear no causal relationship, a finding contrary to the findings of several of the existing studies in the Grangerian framework.

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4. We have skipped the details of the test. Interested readers may refer to Kapetanios et al. ([2003](#)) and Tiwari and Shahbaz ([2014](#)).
5. We have also performed TY test on the level data, but there is no difference in findings. Results can be obtained, upon request.
6. For Methodological details please refer to Johansen ([1988](#)) and Johansen and Juselius ([1990](#)).
7. D-P test also has been performed on the unfiltered data; there is no difference in overall findings, though values of statistics differ.
8. As Diks and Panchenko ([2006](#)) suggested that value of epsilon depends on the length of time series and given 1.5 for 100 observations. We have also used epsilon value of 0.7, but there is no difference in inference.

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Appendix 1

The main data sources include global financial development (GFDD), Reserve Bank of India (RBI), Prowess and Bombay stock exchange (BSE). All data are annual. The sample period is 1990–2010. The variables taken from other than GFDD, have been calculated following the same procedure as mentioned in GFDD database.

Proxy to measure	Indicator code	Description of variables	Source
Financial institution access	A	Bank accounts per 1000 adults	RBI (no. of Bank accounts) and World Bank (Population) data
	B	Bank branches per 100,000 adults	RBI (no. of branches of commercial Banks) and World Bank (Population)
	A		

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Financial institution department	D B P C G	Bank private credit to GDP (%)	Global financial development Database (GFDD: 2012), please visit www.worldbank.org/financialdevelopment for detail definition
	D D M B G	Deposit money bank assets to GDP (%)	
	D D M B C	Deposit money bank assets to deposit money bank assets and central bank assets (%)	
	D L L G	Liquid liabilities to GDP (%)	
	D C A G	Central bank assets to GDP (%)	
	D F D	Financial system deposits to GDP (%)	

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	D N L V G	Non-Life insurance premium volume to GDP (%)	
	D P C G	Private credit by deposit money banks and other financial institutions to GDP (%)	
Financial market depth	D S M G	Stock market capitalization to GDP (%)	(GFDD: 2012)
	D S T G	Stock market total value traded to GDP (%)	
	D O P D G	Outstanding domestic private debt securities to GDP (%)	
	D O P	Outstanding domestic public debt securities to	

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Financial institution efficiency	ENIM	Ratio of net interest income to total assets (%)	RBI
	ENIT	Non-interest income to total income (%)	
	EOCA	Intermediation cost to total assets (%)	
	EROA	Return on assets (%)	
	EROE	Return on equity (%)	
	ECTI	Cost to income ratio (%)	
	ECE	Credit to government and state-owned	(GFDD: 2012)

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Financial institutions stability	EBCAT	Bank capital to total assets (%) (bank capital = capital plus reserves; assets = total assets)	RBI
	EBBCB	Bank credit to bank deposits (%)	(GFDD: 2012)
	ELADF	Liquid assets to deposits and short term funding (%)	
Financial market stability	EVOLS	Volatility of stock price index	BSE

Appendix 2

PCA has been applied on the raw data and has been performed on the symmetric correlation

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the PCA to the standardized variance of the first principal component. These contributions are the weights used to construct the financial indexes by using aggregation method.

Variables/indicators	Component scores/loadings used to generate factor scores
<i>Weights used to construct financial access (AFS) index</i>	
ABA	0.42
ABB	0.438
AMcap	0.519
<i>Weights used to construct financial depth (DFS) index</i>	
DBPCG	0.028
DDMBG	0.128
DDMBC	0.231
DLLG	0.141
DFDG	0.136
DLVG	0.050
DNLVG	0.220
DPCG	0.028
DSMG	-0.068
DSTG	0.149

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Variables/indicators	Component scores/loadings used to generate factor scores
EOCA	0.030
EROA	0.282
EROE	0.252
ECTI	-0.170
ECEG	0.169
ESTRNR	0.183
<i>Results of PCA to construct financial stability (SFS) index</i>	
SBCTA	0.110
SBCBD	0.508
SLADF	-0.515
SVOLST	0.057
<i>Weights used to construct financial development (FDI) index</i>	
AFS	-0.223
DFS	0.469
EFS	0.426
SFS	0.161

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indices and final index of financial development and GDP

Appendix 3

Status of variable	Levels		DF-GLS	PP	KPS S
Level	Constant	AF	-1.02	-1.14	0.52
		S	1	2	6**
		D	-1.92	-0.99	0.51
		FS	9	6	6**
		EF	-2.52	-1.93	0.43
		S	1	5	7***
	SF	-1.25	-0.59	0.46	
	S	5	3	6**	
	G	-0.27	9.916	0.61	
	D	2		9**	
P					
F	-1.45	-1.25	0.49		
DI	8	8	4**		
Constant + trend	Constant + trend	AF	-1.20	-0.41	0.40
		S	1	4	2*
		D	-1.94	-1.23	0.16
FS	5***	4	2**		
EF	-1.86	-2.32	0.15		

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Status of variable	Levels		DF-GLS	PP	KPS S
First difference	Constant	AF S	-6.56 1*	-4.97 6*	0.37 5
		D FS	-2.23 7*	-2.12 5	0.17 3
		EF S	-5.75 6*	-6.16 *	0.15 0
		SF S	-3.52 6**	-2.66 7***	0.33 6
		G D P	-3.56 9**	-0.67 6	0.45 7***
		F DI	-5.60 1*	-5.15 4*	0.18 1
	Constant + trend	AF S	-5.08 7*	-6.30 1*	0.07 3
		D FS	-1.85 5**	-2.25 1	0.12 3
		EF S	-5.60 7*	-8.10 7*	0.07 7
		SF S	-2.66 6*	-3.43 9*	0.07 0
		G	-3.56	-3.26	0.11

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KPSS tests was selected with Newey–West using Bartlett kernel. *, **, and *** denotes statistical significance at 1, 5, and 10 % level of significance, respectively

See Tables [5](#), [6](#) and [7](#).

Table 5 Results of non-linear unit root test

Table 6 Johansen cointegration test between GDP and sub-indices and final index of financial development

Table 7 Results of vector error correction model for GDP and SFS

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