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# Finance-Growth Nexus: A Regional Evidence

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***Abstract***

*In the narrative on inclusive economic growth, financial development encompassing reallocation of resources for equitable growth through financial intermediaries has assumed greater significance. In India, like other emerging economies, it has become more relevant after recent policy initiatives like Pradhan Mantri Jan Dhan Yojana (PMJDY) for wider dissemination of financial services in the country. Against this background, this paper re-examines the nexus between financial development and economic growth at the sub-national level. In order to avoid state-specific bias at sub-national, in a single country setting, we have chosen states from a single region (North-Eastern India) that is considered more or less similar in terms of economic growth and financial development. Dumitrescu and Hurlin (2012) test was used to take care of cross-sectional dependence across sample states, which may be present because of their common geographical features and assistance from the centre. We found evidence for two-directional causality, implying financial development and economic growth are jointly determined or they complement each other. A major implication of our study is that recent policies aimed at enhancing the development of the financial sector in India can help to spur economic growth in this relatively backward region.*

***Keywords****: Financial Development, Economic Growth, Banking Services, Cointegration, Panel Data Analysis.*

## Introduction

Academic research on finance-growth nexus dates back at least to Bagehot (1873) who demonstrated the link between financial spheres and the real economy. She predicted that "*capital will run as surely and instantly where it is most wanted, and where there is most to be made of it, as water runs to find its level"* (Bagehot, 1873 p.12). Schumpeter (1934) argues that by favouring the funding of technological innovations and by making capital accumulation easier financial development (FD hereafter) paves the way for higher economic

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growth (EG hereafter). Hicks (1969) believed that industrial revolution in Britain was not an outcome of technological innovations alone but was significantly favoured by the introduction of financial innovations (like joint-stock company and limited liability) that eased the funding of large-scale investment. Research in this area received a fresh impetus after McKinnon (1973), Shaw (1973), Galbis (1977) and Fry (1978) provided new insights regarding finance-growth nexus, resulting in a plethora of literature in this area. Regarding the causality in this nexus, four distinct strands can be identified. The first strand – "supply-leading" view, based upon the critical functioning of finance in accelerating the economic growth introduced by Schumpeter (1934), suggests the positive impact of financial development (FD) on economic growth (EG). This causal relationship can be strengthened either by raising the efficiency of capital accumulation (Goldsmith 1969) or by raising the investment rate (Shaw 1973). Among others, theoretical support for this view is provided by Schumpeter (1911), Gurley and Shaw (1955) and Bencivenga and Smith (1991) while empirical verification is provided by Jung (1986), Roubini and Sala-i-Martin (1992), King and Levine (1993a, 1993b), Levine (1998), Christopoulos and Tsionas (2004), Dawson (2008), and Nazlioglu and Rufael (2014). Contrary to the supply- leading view, the "demand-following" view is sceptical about the role of financial development in economic growth and states that developments in the financial sector are responsive to changes in the real economy. As remarked by Robinson (1952, p.86), "by and large, it seems to be the case that where enterprise leads finance follows". The argument is that the demand for some categories of financial instruments and services is generated by economic growth and financial market effectively responds to such demand. This view is supported by Kuznets (1955), Lucas (1988), Agbetsiafa (2003), Waqabaca (2004) and Odhiambo (2008), among others. The third view also called as feedback view suggests a bidirectional causality between FD and EG. It is supported by many theoretical and empirical studies including Lewis (1955), Patrick (1966), Greenwood and Jovanovic (1990), Demetriades and Hussein (1996), Greenwood and Smith (1997), Luintel and Khan (1999). The fourth view is that there is no relationship between FD and EG. Lucas (1988, P.6) supporting this view states "economists badly overstress the role of finance in economic growth". In line with this view, Chandavarkar (1992) notes ‘‘none of the pioneers of development economics... even lists finance as a factor in development."

The purpose of this paper is to re-examine the finance-growth nexus by choosing data at the sub-national level and by using modern econometric techniques (Panel cointegration and causality tests). As revealed by the available literature, most of the panel based empirical studies carried in this context have focused on a cross country setting, and the literature regarding FD-EG linkage focusing on a single country (across regions of a country) is scant. Highlighting the need for such studies Scholnick et al. (2008) and Kendall (2012) point out that studies focusing on different regions of a single country can avoid the bias due to country specific heterogeneity. Such heterogeneity may be a result of different political governance, financial sector regulation, monetary and exchange rate policies, institutional development and some other factors. Following this Ang and McKibbin (2007), Hasan et al. (2009), and Crouzille et al. (2012) have analysed the FD-EG nexus using data at regional levels for Malaysia, China and Philippines respectively. In the Indian context, to the best of my knowledge, studies by Demetrides and Luintel (1997) and Bhattacharya and Sivasubramanian

(2003) use aggregate level data while Misra (2003), Acharya et al. (2009) and Sharma and Bardhan (2016) use the data at the sub-national level. This study, focusing on a single country (India) setting is different from previous studies at least in two contexts. First, we try to avoid state specific bias (heterogeneity at sub-national level) in a single country setting by choosing states from a single region (North Eastern India) that is considered more or less similar interms of economic growth and financial development. Second unlike Misra (2003), and Acharya et al. (2009) due care has been taken of cross-sectional dependence across states in the sample that may be a consequence of common monetary and fiscal policy, geographical features and assistance from the centre. In this context, it is apt to provide a brief account of India's northeast, with special reference to financial development and economic growth, in the next section before presenting the empirical aspects of the paper.

**North-Eastern Region**

The North Eastern Region (NER) of India includes the seven sisters- Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura along with a small and beautiful cousin in the Himalayan fringes, namely, Sikkim[†]. The region stretches from the foothills of the Himalayas in the eastern range and almost entire boundary (96 percent) of the region is an international border shared with Bangladesh, Bhutan, China, Nepal and Myanmar). With a total area of 2, 62, 179 Sq. Km. this region is a unique socio-cultural segment in the country marked by diversity in cultures, traditions, languages and ethnicity. Although in terms of area north-eastern region constitutes 7.97 per cent of the country's total geographical area, it is home to only 3.78 percent of India's total population (see Table 01). Arunachal Pradesh with an area of 83743 sq. Km. (31.94%) is the largest state in terms of the area while Assam with a total population of 31205576 (68.18%) is the most populated state of the region (see Table 01).

Richly endowed with natural resources, covered with dense forests[‡] and with small and large rivers nesting the land, this region is counted among the most bio-diverse regions in the world. Despite its unique features India's north-east region is often generalised, misunderstood and understudied[§]. Counted as one of the most backward regions of India, NE region was at the forefront of development before the partition of 1947 when global trade was conducted through the sea route, a network of inland waterways and land transportation through road and railways[**]. However, the partition of country (and creation of East Pakistan) not only pushed the region deep into backwardness by changing the economic landscape but also bleaked the future prospects of development. The closure of both land and sea routes for commerce and trade coupled with uneasy relationships with the neighbouring countries devoided it of all the benefits of expanding global trade that it harnessed for long because of its geographical location. To compound the problems further, connectivity to the rest of India

[†] Sikkim joined the Indian union through a referendum in 1975 and was recognised as part of Northeast India in the 1990s.

[‡] The forest cover in the region constitutes 52 per cent of its total geographical area.

[§] Thongkholal Haokip; "Is There a Pan-North-East Identity and Solidarity" Economic and Political Weekly, Vol. 47, No. 36 (SEPTEMBER 8, 2012), pp. 84-85.

[**] "North Eastern Region Vision 2020" published by Ministry of Development of North Eastern Region (2008).

was confined to a narrow 27 Km wide Siliguri corridor. This constrained access for movement of goods and people converted the region into a 'remote island' from which private investment started moving away at a greater pace. In order to give focused attention towards the development of NER, the Department of Development of North Eastern Region (DoNER) was set up in 2001. Later on, in 2004 it was converted into a full-fledged ministry, thereby giving it the distinction of being the only ministry with territorial jurisdiction in India. Looking at the economic indicators of the development, the percentage growth rate of GSDP shows a significant variation with states like Assam, Meghalaya and Tripura having growth average growth rates higher than the national average during 2016-17 to 2018-19 (Table 02). During the same period per capita SDP, which is commonly used to gauge the standard of living, has also shown a great variation among NE states. PCSDP of Assam, which is the most populated state of the region, is below the national average (Table 03). Regarding the financial sphere, the credit and deposit accounts, as well as amounts, have shown an increasing trend (Tables 5-7). However, most of such accounts are concentrated in states of Assam and Tripura.

**Model Specification, Data and Variables**

The specification we use for examining the relationship between financial development and economic growth and for testing the direction of causality is the following:

$$y_{it} = \alpha_i + \beta_i F_{it} + e_{it} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (01)$$

Where $y_{it}$ is a proxy measure for economic growth, $F_{it}$ represents the variable(s) used as a proxy for financial development and $e_{it}$represents the error term in a panel regression.

We use state-level data for seven north-eastern states of India[††]covering 38-year period, 1980-2017. Since data for some of the variables in case of certain states were not available for years prior to 1980, we restricted our analysis to this period. Therefore, for each variable under consideration, we have 38 observations for seven states, yielding a total of 266 observations.

To examine the relationship between economic development and financial development in sample states this study makes use of three variables- per capita Gross state domestic product capita per capita (GSDP), per capita credit (CRDT) and per capita deposits (DPST)[‡‡]. While GSDP is used as a measure of economic development, DPST and CRDT are used as indicators of financial development. This selection of variables was made on the basis of previous literature (Demetrides and Hussein 1996; Levine and Zervos 1998; Luintel and Khan 1999; Beck and Levine 2004; Christopoulos and Tsionas 2004; Beck et al. 2007,

[††]Our sample states are: Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. As data for some years in case of Mizoram state was not available (for some specific variables included), it could not be considered for analysis. Further, taking these states as a separate group is in line with the standard practice of comparing the economic performance of Indian states that treats north eastern states or smaller states (Like Goa) differently. This practice is evident in studies: (Ahluwalia, 2002; Sachs et al., 2002; Nachane et al., 2002).

[‡‡] We take data of credit as per place of utilisation in order to observe whether credit utilised in a given state exerts effect on states' per capita income levels.

Peiaand Roszbach 2015; Sharma and Bardhan 2017) in this area. Data for the variable GSDP is procured from the state-level database of Economic and Political Weekly (EPW Research Foundation, 2018). Using data splicing technique GSDP data for all states was converted to the base year 2004-05. State level annual data for both the financial variables was retrieved from 'Basic Statistical Returns of Scheduled Commercial Banks in India' published by Reserve Bank of India (RBI).

**Econometric Methodology**

The econometric methodology applied consists of four steps. The first step involved the use of Im et al. (2003) unit root test to determine the order of integration of each variable used in this study. In the second step, we made use of Pedroni (1999, 2004) cointegration test to examine for the existence of a long-run relationship between variables taken as proxies for growth and financial development. In the third step, we used dynamic least squares (DOLS) technique to estimate the long run and short-run coefficients. Finally, we used the panel causality test developed by Dumitrescu and Hurlin (2012) to check the causality relationship between variables under consideration.

**Integration Analysis**

Many macroeconomic time series are dominated by a stochastic trend (contain unit root or are not integrated of order zero) leading to their non-stationarity nature (Nelson and Plosser, 1982). This non-stationarity nature of variables invalidates many standard empirical results. Granger and Newbold (1974), using simulation found that F statistic in case of a regression involving non-stationary variables does not follow the standard normal distribution. Consequent to this, the significance of test is overstated, under the null hypothesis of no causality, resulting in spurious regression. Hence, before using any test of cointegration or causality, it is imperative to carry out the integration analysis to know the order of integration for different variables. To this end, we adopt the approach developed by Im et al. (2003)-thereafter IPS panel unit root test- which is less restrictive and more suitable to deal with the cross-sectional heterogeneity. This test allows for heterogeneous autoregressive coefficient and is based on the following autoregressive model.

$$y_{it} = \rho_i y_{i,t-1} + \sum_{j=1}^{j=p_i} \varphi_{ij} \Delta y_{i,t-j} + z_{it}\gamma_i + \epsilon_{it} \quad \ldots\ldots\ldots\ldots \text{(02)}$$

Where i=1, 2…. N refers to cross-sectional units (individual states in this study) in the panel and t= 1, 2…T refers to the time period.

IPS (2003) assumes $\epsilon_{it}$ is independently and normally distributed for all i and t and it allows $\epsilon_{it}$ tohave heterogeneous variances $\delta_i^2$ across panels. $z_{it}$ term is used to represent panel specific means and time trend. If it is specified as $z_{it} = 1$ then the term $z_{it}\gamma_i$ will represent panel specific means and if it is specified as $z_{it} = (1, t)$ then expression $z_{it}\gamma_i$ represents time specific means and linear time trend. $p_i$ represents the number of lags used in the autoregressive model and $\rho_i$panel specific coefficients. The null hypothesis for the test is that each series in the panel contains a unit root ( $H_0: \rho_i = 1\ \forall_i$ ). The alternative hypothesis is that at least one of the series in the panel is stationary ($H_1: \rho_i < 1\ forsomei$). Under this null hypothesis IPS panel unit root test computes t-bar statistics as the average of individual ADF-t statistics while allowing for different orders of serial correlation.

$\widetilde{t} = N^{-1}\left[\sum_{i=1}^{i=N} t_{\rho i}\right]$ …………… (03)

**Cointegration Analysis**

In the next step, we employ Pedroni (1999, 2004) cointegration test to examine the long-run relationship between proxy variables for economic growth and financial development. This residual-based test starts with the following regression equation:

$$y_{it} = \alpha_i + \rho_i t + \beta_{1i}x_{1i,t} + \beta_{2i}x_{2i,t} + \beta_{3i}x_{3i,t} + \ldots + \beta_{Mi}x_{Mi,t} + \epsilon_{it} \quad \ldots\ldots\ (04)$$

*for t= 1,2….T; i=1,2,…N and m= 1,2,…M*

Where T refers to the number of observations over time, N refers to the number of cross-sectional units and M represents the number of regressors. $\beta_1, \beta_2, \ldots \ldots \beta_M$ represent slope parameters. $\alpha_i$ represents member specific effect or fixed effect parameter and $\rho_i t$ is the deterministic time trend which is specified to the individual series of the panel. Starting with equation 7, the testing procedure consists of four steps.

First, the residuals obtained after estimating equation 04 are stored as $\widehat{\epsilon}_{it}$. In the second step, we difference the original data for each series and compute the residuals for the regression:

$$\Delta y_{it} = \sigma_{1i}\Delta x_{1i,t} + \sigma_{2i}\Delta x_{2i,t} + \sigma_{3i}\Delta x_{3i,t} + \ldots + \sigma_{Mi}\Delta x_{Mi,t} + \eta_{it} \quad \ldots\ldots\ (05)$$

and store its residuals as $\hat{\eta}_{it}$. Next, we calculate $\widehat{L_{11\iota}^2}$ as the long-run variance of $\hat{\eta}_{it}$ using any kernel estimator. In the fourth step the residual of the original cointegration equation-($\epsilon_{it}$in eq. (7)), is used for the estimation of the autoregressive model. With this basic framework, Pedroni (1999, 2004) proposes seven test statistics that test the null hypothesis of no cointegration in non-stationary panels. Four of these test statistics (panel ν, panelρ panel PP and Panel ADF) also called as panel statistics are based on within dimension approach. These statistics essentially pool the autoregressive coefficients across different cross-sectional units and also take into account common time factors and heterogeneity across different series of the panel. Remaining three statistics (group ρ, group PP and group ADF), called as group statistics are based on between dimension approach. These statistics are based on averages of individual autoregressive coefficients associated with unit root test of the residuals for each series in the panel. Both the groups contain parametric (ν and ADF) and non-parametric (ρ and PP) statistics.

For the non-parametric statistics $\widehat{\epsilon}_{i,t} = \hat{\psi}_i\, \widehat{\epsilon}_{i,t-1} + \hat{\kappa}_{i,t}$ is estimated and residuals are used for the computation of long-run variance of $\hat{\kappa}_{i,t}$, denoted by $\hat{\sigma}_i^2$. Using this value, the term $\lambda_i$ is calculated as $\hat{\lambda}_i = {}^1\!/_2\, (\hat{\sigma}_i^2 - \hat{s}_i^2)$,

Where $s_i^2$ is the simple variance of $\hat{\kappa}_{i,t}$. The $\widehat{\epsilon}_{i,t} = \hat{\psi}_i\, \widehat{\epsilon}_{i,t-1} + \sum_{k=1}^{K} \hat{\psi}_i\, \Delta\widehat{\epsilon}_{i,t-1} + \hat{\mu}_{i,t}$ is estimated for the non-parametric tests and residuals are used to compute the variance of $\hat{\mu}_{i,t}$ denoted by $\hat{s}_i^{*2}$. Having estimated the above equations and computed the parameters introduced, the seven statistics are developed using different equations (See Pedroni [1999] for a complete discussion on how these statistics are constructed).

**Cointegration Estimation**

After establishing the presence of a long-run relationship between variables, we proceed to estimate long-run coefficients for equation 01. The asymptotic properties of cointegration regression coefficients and associated statistical properties are different from those of time series cointegration regression models (Phillips and Moon 1999). After investigation of the finite sample properties of the OLS estimator, associated t statistic, bias-corected OLS estimator and bias-corrected t- statistic Chen, McCoskey and Kao (1999) found that bias corrected coefficient (and associated t statistic) does not improve over the OLS estimator (and associated t statistic). However, they suggested use of Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS) for estimating the panel cointegration regressions. Pedroni (2000) suggested the use of DOLS so as to address the problem of endogeneity and serial correlation. However, FMOLS proposed by Pedroni (2000) takes care of simultaneity bias and the problem of non-stationary regressors. Further estimation using DOLS may be more promising than FMOLS and OLS (Kao and Chiang 2000). So, we have used DOLS for estimation of long-run coefficients. Long run panel DOLS may generally be specified as:

$y_{i,t} = \alpha_{i,t} + \delta_i x_{i,t} + \sum_{j=1}^{j=q} \gamma_{i,j} \Delta x_{i,t-j} + \in_{i,t}$ ……….. (06)

Where $y_{i,t}$ is a vector of independent variables, $x_{i,t}$ is a vector of independent variables and $\Delta$ stands for first difference. Also $E(\in_{i,t}, \in_{i,t}) = \sigma_{i,j}$ and $E(\in_{i,t}, \in_{j,s}) = \sigma_{i,j}$ for all i, j and $t \neq s$

**Causality**

To determine the direction of causality between financial development and economic growth, Dumitrescu and Hurlin (2012) panel granger causality was employed. It is based upon simple bi-variate regressions in panel context represented as:

$$y_{it} = \alpha_{0,i} + \alpha_{1,i} y_{i,t-1} + \alpha_{2,i} y_{i,t-2} + \cdots + \alpha_{l,i} y_{i,t-l} + \beta_{1,i} x_{i,t-1} + \beta_{2,i} x_{i,t-1} + \ldots + \beta_{k,i} y_{i,t-k} + \in_{i,t} \ldots\ldots.. \quad (07)$$

$$x_{it} = a_{0,i} + a_{1,i} x_{i,t-1} + a_{2,i} x_{i,t-2} + \cdots + a_{m,i} x_{i,t-m} + b_{1,i} y_{i,t-1} + b_{2,i} y_{i,t-2} \ldots. + b_{n,i} y_{i,t-n} + \varepsilon_{i,t} \quad \ldots\ldots.. \quad (08)$$

Unlike simple panel granger causality test which assumes that all coefficients are same across all the cross-sections i.e. $\alpha_{0,i} = \alpha_{0,j}, \alpha_{1,i} = \alpha_{1,j}, \ldots. \alpha_{l,i} = \alpha_{l,j} \;\; \forall \, iand \, j$ and

$$\beta_{1,i} = \beta_{1,j}, \beta_{2,i} = \beta_{2,j}, \ldots\ldots, \beta_{k,i} = \beta_{k,j} \;\; \forall \, iand \, j$$

Dumitrescu and Hurlin (2012) test makes an extreme opposite assumption, allowing the coefficients to vary across cross-sections i.e.

$$\alpha_{0,i} \neq \alpha_{0,j}, \alpha_{1,i} \neq \alpha_{1,j}, \ldots. \alpha_{l,i} \neq \alpha_{l,j} \;\; \forall \, iand \, j$$

$$\beta_{1,i} \neq \beta_{1,j}, \beta_{2,i} \neq \beta_{2,j}, \ldots\ldots, \beta_{k,i} \neq \beta_{k,j} \;\; \forall \, iand \, j$$

This test starts with the homogeneous non-causality hypothesis (HNC), which implies that no individual causality relationship is running from x to y—starting with the eq. 07 the null hypothesis for the test is that there is no causality running from x to y. i.e.

$$H_0 : \beta_{1,i} = \beta_{2,i} = \beta_{3,i} = \cdots \beta_{k,i} = 0 \;\; \forall i = 1 \ldots N$$

The alternative hypothesis is there is $N_1$<N individual processes with no causality from x to y. the alternative hypothesis can be specified as:

$$: \beta_{1,i} = \beta_{2,i} = \beta_{3,i} = \cdots \beta_{k,i} = 0 \;\; \forall i = 1 \ldots N_1$$

$$\beta_{1,i} \neq 0, = \beta_{2,i} \neq 0, = \beta_{3,i} \neq \ldots \ldots \beta_{k,i} \neq 0 \quad \forall i = N_1 + 1, N_1 + 2 + \cdots + N$$

Where $N_1$ satisfies the condition $0 \leq N_1 < N$, but is not known. Hence $\frac{N_1}{N} < 1$. If $N_1$=N, it implies there is no causality for any of the individual series in the panel which is equivalent to the Homogeneous non-Causality null Hypothesis (HNC). In contrast, if $N_1$=0, there is a causality for the entire series in the sample.

Accepting the null hypothesis implies that x does not granger cause y in all the series of the panel. On the other hand, if HNC hypothesis is rejected and $N_1$=0 then x granger causes y for all the series of the panel which supports the homogeneous causality (HC) hypothesis. The causality relationship will be heterogeneous if $N_1$>0. Also, in this case regression model and the causality relationships are different for different cross-sectional units in the sample (Dumitrescu and Hurlin 2012).

With this basic framework, Dumitrescu and Hurlin (2012) proposed a Wald statistic ($W_{NT}^{HNC}$) which is basically the average of N individual wald statistics, to test the Granger non causality hypothesis for individual cross-sectional units. This statistic can be specified as:

$$W_{N,T}^{HNC} = \frac{1}{N} \sum_{i=1}^{i=N} var(w_{i,t})$$

Where $w_{i,t}$ represents the wald statistic for individual cross-sectional units corresponding to the test slope coefficients ($\beta's$) are equal to zero. The distribution of $W_{N\,T}^{H\,N\,C}$ is derived using the Lyapunov central limit theorem and the standardised statistic ($\bar{Z}_{N,T}^{HNC}$ ) is calculated by:

$$\bar{Z}_{N,T}^{HNC} = \frac{\sqrt{N}[W_{N,T}^{HNC} - N^{-1}\sum_{i=1}^{N} E(w_{i,t})]}{\sqrt{N^{-1}\sum_{i=1}^{N} var(w_{i,t})}} \quad \ldots\ldots\ldots\ldots\ldots (09)$$

Where $E(w_{i,t})$ denotes the mean and $var(w_{i,t})$ denotes variance of $w_{i,t}$. The decision rule for accepting/rejecting the hypothesis is as: if the realised value of standardised statistic ($\bar{Z}_{N,T}^{HNC}$) is greater than the corresponding normal critical value for a given level of significance the null hypothesis of homogeneous non causality (HNC) is rejected. In case itsrealised value is lesser then we cannot reject the hypothesis.

## Results and Discussion

### *Integration analysis*

Before estimating the long-run relationship between GSDP and indicators of financial development, we conduct the Im et al. (2003) IPS unit root test to examine the stationarity property of each variable under consideration. Results presented in table 4 reveal that the test fails to reject the null hypothesis of unit root presence at level for all three variables; hence they are non-stationary. However, first differenced series for all the variables turn out to be stationary. We conclude that all the variables are I (1) (i.e. integrated of order one) and same is true at 1% level of significance after using Akaike Information Criterion for choosing no. of lags for each series.

### *Cointegration analysis*

In a panel setting the results of cointegration and causality may be sensitive to the assumption of cross-sectional dependence. Therefore, before going for cointegration and causality analysis, we conducted Pesaran (2004) and Baltagi, Feng, and Kao (2012) tests for checking the presence/absence of cross-sectional dependence for the basic model (eq.01). Results reported in Table 09 indicate the presence of cross-sectional dependence at 1% level of significance.

With variables integrated of order one and cross-sectional dependence present, we make use of Pedroni (1999, 2004) cointegration test, which is more suitable for balanced panels and allows for cross-sectional dependence with different individual effects. Results are presented in table 10. Out of seven test statistics, three panel (Panel v, Panel PP and Panel ADF) and two group (Group PP and Group ADF) statistics reject the null hypothesis of no cointegration while one statistic (panel rho) statistic rejects the null at a relatively higher level of significance. Only one test statistic (Group rho) cannot reject the null hypothesis. Since relative power of test statistic is not entirely clear and as reported by Pedroni (2004) the group and panel ADF statistics have the best power properties when $T < 100$ (as is the case in this study), we can conclude that variables in consideration are cointegrated.

***Panel estimation***

Given the existence of long-run relationship between GSDP and financial development indicators, we estimated the long-run coefficients by employing the panel DOLS method. Results in table 11 show that both per capita deposits and per capita credit have a positive and significant influence on per capita income. Results based upon FMOLS also provided similar results of cointegration relationship and are provided in Table 12.

***Causality results***

Table 13 reports Dumitrescu and Hurlin (2012) panel causality results. As shown in the table, there is evidence of bi-directional causality running from both the indicators of financial development (CRDT & DPST) to economic growth in the case of sample states.

## Conclusion

This paper examines the relationship between economic growth and financial development at the regional level by taking data from North-Eastern States of India. Using annual data for 38 years and taking due cognisance of cross-sectional dependence, we used panel cointegration and causality analysis to examine the nature of relationship and direction of causality in finance-growth nexus. Results support the existence of a significant and positive relationship between economic growth and measures of financial development as proxied by per capita deposits and per capita credit. Further, results indicate the bi-directional causality for the sample states that are more or less similar as far as growth and level of development are concerned. The implication is that various programmes and policies that aim at improving and extension of financial services will have in the long run significant impact on the growth process. As such, the significance of undertaking financial reforms for economic growth is empirically verified for such regions.

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## Appendix

Table 1: Area (square kilometers) and Population as per Census 2011

| | Arunachal Pradesh | Assam | Manipur | Meghalaya | Mizoram | Nagaland | Sikkim | Tripura | NER | All India | NE as % (India) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Area | 83743 | 78438 | 22327 | 22429 | 21081 | 16579 | 7096 | 10486 | 262179 | 3287469 | 3.78 |
| Percentage (of NE region) | 31.94 | 29.92 | 8.52 | 8.55 | 8.04 | 6.32 | 2.71 | 4.00 | | | |
| Population | 1383727 | 31205576 | 2855794 | 2966889 | 1097206 | 1978502 | 610577 | 3673917 | 45772188 | 1210854977 | 7.97 |
| Percentage (of NE region) | 3.02 | 68.18 | 6.24 | 6.48 | 2.40 | 4.32 | 1.33 | 8.03 | | | |

*Source: Government of India, Census 2011*

Table 2: The percentage growth rate of GSDP at constant prices (2011-12 series) for last three years

| | India | Arunachal Pradesh | Assam | Manipur | Meghalaya | Mizoram | Nagaland | Sikkim | Tripura |
|---|---|---|---|---|---|---|---|---|---|
| 2016-17 | 8.3 | 3.55 | 5.74 | 4.01 | 5.29 | 10.32 | 6.75 | 7.15 | 14 |
| 2017-18 | 7 | 8.12 | 13.18 | 3.88 | 9.26 | 4.8 | 5.34 | 6.95 | 10.17 |
| 2018-19 | 6.1 | 4.59 | 7.97 | 6.44 | 9.05 | 1.3 | 7.05 | 7.05 | 10.85 |
| AVG. | 7.13 | 5.42 | 8.96 | 4.77 | 7.86 | 5.47 | 6.38 | 7.05 | 11.67 |

*Source: EPW Research Foundation (http://www.epwrf.res.in)*

Table 3: Per Capita SDP in Rupees at constant prices (2011 Series)

| | India | Arunachal Pradesh | Assam | Manipur | Meghalaya | Mizoram | Nagaland | Sikkim | Tripura |
|---|---|---|---|---|---|---|---|---|---|
| 2016-17 | 94751 | 95322 | 60271 | 52985 | 65041 | 111987 | 75349 | 237979 | 77763 |
| 2017-18 | 100268 | 100972 | 67457 | 53864 | 69565 | 115273 | 79369 | 252178 | 84641 |
| 2018-19 | 105361 | 103513 | 71928 | 56112 | 74249 | 114708 | 84075 | 267104 | 92705 |
| AVG. | 100127 | 99936 | 66552 | 54320 | 69618 | 113989 | 79598 | 252420 | 85036 |

*Source: Source:  EPW Research Foundation (http://www.epwrf.res.in)*

Table 4: Number of Deposit accounts (Scheduled Commercial Banks) (in Thousands)

| Month and Year | Arunachal Pradesh | Assam | Manipur | Meghalaya | Mizoram | Nagaland | Tripura | Sikkim | Regional Total |
|---|---|---|---|---|---|---|---|---|---|
| March 2010 | 597 | 13054 | 637 | 1025 | 372 | 547 | 1894 | 346 | 18472 |
| March 2011 | 667 | 14729 | 701 | 1205 | 412 | 649 | 2148 | 390 | 20901 |
| March 2012 | 728 | 16629 | 776 | 1391 | 488 | 717 | 2372 | 443 | 23544 |
| March 2013 | 747 | 18521 | 1016 | 1567 | 608 | 795 | 2763 | 542 | 26559 |
| March 2014 | 859 | 21657 | 1295 | 1749 | 742 | 859 | 3699 | 625 | 31485 |
| March 2015 | 1061 | 27155 | 1797 | 2032 | 893 | 1063 | 4428 | 729 | 39158 |
| March 2016 | 1229 | 33013 | 2085 | 2332 | 1089 | 1178 | 5248 | 870 | 47044 |
| March 2017 | 1424 | 40277 | 2521 | 2664 | 1280 | 1351 | 5872 | 972 | 56361 |
| March 2018 | 1546 | 42720 | 2785 | 2745 | 1373 | 1433 | 6244 | 1004 | 59850 |
| % (March 2018) | 2.58 | 71.38 | 4.65 | 4.59 | 2.29 | 2.39 | 10.43 | 1.68 | |

*Source: Basic statistical returns of Scheduled Commercial Banks in India, RBI. (Various issues)*

Table 5: Amount deposited in all scheduled commercial banks (in Lakh Rupees)

| Month and year | Arunachal Pradesh | Assam | Manipur | Meghalaya | Mizoram | Nagaland | Tripura | Sikkim | Regional Total |
|---|---|---|---|---|---|---|---|---|---|
| March 2010 | 412623 | 4859374 | 269940 | 764267 | 223934 | 418779 | 745915 | 313443 | 8008275 |
| March 2011 | 519218 | 5849638 | 336192 | 958283 | 254967 | 520744 | 856914 | 329219 | 9625175 |
| March 2012 | 575272 | 6657055 | 407068 | 1105379 | 335605 | 574185 | 1041022 | 401031 | 11096617 |
| March 2013 | 701131 | 7668026 | 513592 | 1365261 | 414760 | 634363 | 1180096 | 494152 | 12971381 |
| March 2014 | 752519 | 8383959 | 506252 | 1458319 | 471469 | 654430 | 1346766 | 515210 | 14088924 |
| March 2015 | 800856 | 9738143 | 573007 | 1664394 | 531524 | 693827 | 1546267 | 571442 | 16119460 |
| March 2016 | 873212 | 10230388 | 603605 | 1816824 | 591322 | 772839 | 1732515 | 635395 | 17256100 |
| March 2017 | 1186571 | 12097573 | 777351 | 2044994 | 716578 | 942183 | 2048135 | 695444 | 20508829 |
| March 2018 | 1344892 | 13428709 | 901874 | 2150262 | 846794 | 1001408 | 2202023 | 853284 | 22729246 |
| % (March 2018) | 5.92 | 59.08 | 3.97 | 9.46 | 3.72 | 4.41 | 9.69 | 3.75 | |

*Source: Basic statistical returns of Scheduled Commercial Banks in India, RBI. (Various issues)*

Table 6: No. of credit accounts (as per utilisation) in all scheduled commercial banks

| Month - year | Arunachal Pradesh | Assam | Manipur | Meghalaya | Mizoram | Nagaland | Tripura | Sikkim | Regional Total |
|---|---|---|---|---|---|---|---|---|---|
| March 2010 | 62572 | 1509265 | 86704 | 129677 | 72776 | 101107 | 318137 | 44323 | 2324561 |
| March 2011 | 66279 | 1652762 | 91441 | 137913 | 71818 | 99114 | 278196 | 37745 | 2435268 |
| March 2012 | 71401 | 1787055 | 92537 | 143681 | 82112 | 136529 | 339014 | 38468 | 2690797 |
| March 2013 | 75548 | 1945415 | 103461 | 128653 | 96022 | 116463 | 414583 | 40917 | 2921062 |
| March 2014 | 78680 | 2238367 | 108061 | 177816 | 111702 | 115229 | 444253 | 43603 | 3317711 |

| Month - year | Arunachal Pradesh | Assam | Manipur | Meghalaya | Mizoram | Nagaland | Tripura | Sikkim | Regional Total |
|---|---|---|---|---|---|---|---|---|---|
| March 2015 | 81682 | 2307482 | 111642 | 191486 | 115037 | 115642 | 460145 | 42768 | 3425884 |
| March 2016 | 83359 | 3443425 | 124605 | 220070 | 127972 | 123843 | 796581 | 62025 | 4981880 |
| March 2017 | 89020 | 3817425 | 137421 | 231735 | 131781 | 137978 | 854127 | 64872 | 5464359 |
| March 2018 | 104518 | 4115926 | 165976 | 254285 | 137842 | 136659 | 940933 | 71078 | 5927217 |
| % (March 2018) | 1.76335 | 69.4411 | 2.80023 | 4.29012 | 2.32557 | 2.30561 | 15.8747 | 1.1991 | |

*Source: Basic statistical returns of Scheduled Commercial Banks in India, RBI (Various issues)*

Table 7: Amount outstanding (in all scheduled commercial banks) (Lakh Rupees)

| Month and year | Arunachal Pradesh | Assam | Manipur | Meghalaya | Mizoram | Nagaland | Tripura | Sikkim | Regional Total |
|---|---|---|---|---|---|---|---|---|---|
| March 2010 | 141838 | 1966381 | 121014 | 249731 | 129298 | 168298 | 235706 | 155277 | 3167543 |
| March 2011 | 142423 | 2274003 | 123198 | 283384 | 126965 | 143117 | 284125 | 205289 | 3582504 |
| March 2012 | 163203 | 2685230 | 134948 | 311938 | 140660 | 273462 | 330381 | 232245 | 4272067 |
| March 2013 | 269129 | 2855075 | 154912 | 336190 | 160342 | 212736 | 421859 | 185473 | 4595716 |
| March 2014 | 186628 | 3348272 | 172236 | 417665 | 191144 | 212851 | 438359 | 191926 | 5159081 |
| March 2015 | 233352 | 3618860 | 197884 | 447820 | 212069 | 236365 | 526287 | 211153 | 5683790 |
| March 2016 | 253825 | 4435938 | 255134 | 457220 | 246758 | 268360 | 622075 | 223713 | 6763023 |
| March 2017 | 297306 | 5097998 | 308538 | 537302 | 270960 | 311720 | 748225 | 219525 | 7791574 |
| March 2018 | 406877 | 5906484 | 407187 | 661298 | 323380 | 348761 | 912527 | 253246 | 9219760 |
| % (March 2018) | 4.41 | 64.06 | 4.42 | 7.17 | 3.51 | 3.78 | 9.89 | 2.75 | |

*Source: Basic statistical returns of Scheduled Commercial Banks in India, RBI(Various issues)*

Table 8: IPS Unit root test results

| Variable | Level | p-value | First difference | p-value |
|---|---|---|---|---|
| GSDP | 1.643 | 0.949 | -10.078 | 0.000* |
| DPST | 6.0085 | 1.000 | -2.1644 | 0.015** |
| CRDT | 0.9183 | 0.8208 | -9.321 | 0.000* |

* significant at 1% level; ** significant at 5% level of significance

Table 9: Cross-sectional dependence test results

| Test | Test static value | P-value |
|---|---|---|
| Bias-corrected scaled LM | 26.29006 | 0.000* |
| Pesaran CD | 7.156719 | 0.000* |

*significant at 1% level of significance

Table 10: Pedroni Cointegration test results

| Panel Statistic | | | Group Statistic | | |
|---|---|---|---|---|---|
| Test static | value | probability | Test static | value | p-value |
| Panel v-Statistic | 5.245548 | 0.000* | Group rho-Statistic | 0.01783 | 0.507 |
| Panel rho-Statistic | -1.546579 | 0.061*** | Group PP-Statistic | -4.28695 | 0.000* |
| Panel PP-Statistic | -4.114287 | 0.000* | Group ADF-Statistic | -5.51278 | 0.000* |
| Panel ADF-Statistic | -5.385977 | 0.000* | | | |

*significant at 1% level; **significant at 5% level; ***significant at 10% level of significance

Table 11: DOLS estimates

| Variables | coefficient | Standard error | t-statistic | p value |
|---|---|---|---|---|
| DPST | 0.392097 | 0.072608 | 5.400165 | 0.000* |
| CRDT | 0.435271 | 0.213377 | 2.039916 | 0.0427** |

*significant at 1% level; ** significant at 5% level

Table 12: FMOLS estimates

| Variables | Coefficient | Standard error | t-statistic | p-value |
|---|---|---|---|---|
| DPST | 0.387850 | 0.026297 | 14.74895 | 0.0000* |
| CRDT | 0.213702 | 0.069847 | 3.059547 | 0.0025* |

Table 13: Pairwise Dumitrescu Hurlin's panel causality test

| Null Hypothesis | W-Stat | □ statistic | p-value |
|---|---|---|---|
| DPST does not homogeneously cause GSDP | 6.9457 | 3.3896 | 0.0007 |
| GSDP does not homogeneously cause DPST | 13.1828 | 9.08045 | 0.0000 |
| CRDT does not homogeneously cause GSDP | 14.9825 | 10.7225 | 0.0000 |
| GSDP does not homogeneously cause CRDT | 7.35213 | 3.76042 | 0.0002 |

* significant at 1% level; ** significant at 5% level