# Economic Growth and Financial Development: Evidence from Panel Cointegration in India and Pakistan

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*The paper examines the long run relationship between finance development and economic growth in India and Pakistan over the period 1970-2010. Two different measures of finance development (private sector credit and liquidity liabilities ratio) are captured in order to study the nexus between finance development and economic growth. The findings, however, suggest that finance development does not have substantial impact on economic growth, both in India and Pakistan. On the contrary, finance-growth nexus is considerably influenced by other factors such as trade openness and inflation. For India, it finds the existence of bidirectional causality between inflation and economic growth and a unidirectional causality from trade openness to finance development, from inflation to trade openness, from economic growth to trade openness, and from financial development to inflation. For Pakistan, it finds the bidirectional causality between openness and inflation and a unidirectional causality from economic growth to inflation and from trade openness to finance development. The panel causality latterly suggests the unidirectional causality from economic growth to finance development and from inflation to trade openness. It also finds the bidirectional causality between inflation and economic growth, between trade openness to finance development and between trade openness to economic growth.*

## INTRODUCTION

Financial development, broadly defined as an increase in the volume, quality and effectiveness of financial intermediary services, is a multidimensional concept and comprises a likely important mechanism for long-term economic growth (Graff, 2003; and Levine, 1997). The association between economic growth and financial development has been the focus of an immense theoretical and empirical research work. Overall, some prominent studies (Jalil *et al.*, 2010; Christopoulos and Tsionas, 2004; Calderon and Liu, 2003; Levine, 2003; Beck *et al.*, 2000; Xu, 2000; Levine *et al.*, 2000; Luintel and Khan, 1999; Neusser and Kugler, 1998; Levine, 1997; Greenwood and Bruce, 1997; Berthelemy and Varoudakis, 1996; King and Levine, 1993; Lucas, 1988; Buffie,

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1984; Wijnbergen, 1983; Mathieson, 1980; Fry, 1978; Galbis, 1977; Kapur, 1976; MacKinnon, 1973; Shaw, 1973; Goldsmith, 1969; Hicks, 1969; and Schumpeter, 1911) support the importance of finance as a constituent of economic growth, whereas another group (such as Stern, 1989; Lucas, 1988; and Robinson, 1952) esteems finance as inconsequential. Besides, a third group centrings on possible negative connection between finance development and economic growth.

In general, there are number of approaches for finance-growth nexus (see Baltagi *et al.*, 2009; Abu-Bader and Abu-Qarn, 2008; Demetriades and Andrianova, 2004; Godhart, 2004; Levine, 2003; Beck *et al.*, 2000; Von Furstenberg and Fratianni, 1996; Demetriades and Hussein, 1996; King and Levine, 1993; and Patrick, 1966). Schumpeter (1911) argues that well executing financial system can contribute economic growth by technological constructs which may occur due to efficient allocation of financial streams. On the contrary, Robinson (1952) states that financial development is a consequence of betterments in economic growth. But, in general, there are four views of thought for the finance-growth nexus. First one is supply-leading view, which holds the positive impact of finance development on economic growth (Rousseau and Wachtel, 2000; and King and Levine, 1993). The supply-leading view works in two different ways: first, by transferring resources from customary low growth sector to modern high growth sectors and second, by motivating the enterprises response to the modern sectors. The second one is demand following approach, which states that finance actually responses to change that happen in the real sector or 'where enterprise extends, finance follows' (Robinson, 1952). The demand-following approach actually involves the measurement of growth in demand of financial services which exclusively rely on economic growth and the process of commercializing and advancement of agriculture, industry and other sectors. The third vies is someplace between these two approaches, which is the one that claims mutual impact of financial development and economic growth (Demetriades and Hussein, 1996; and Greenwood and Smith, 1997). Finally, there are a number of studies that arguing no relationship between financial development and economic growth (Lucas, 1988).

The present study aims in making a contribution to the existing discussion by exhibiting empirical evidence from India and Pakistan during the period 1970-2010. The residual of the paper is organized into three sections including earlier introduction. Section 2 discusses the literature review. Section 3 offers hypothesis testing. Section 4 discusses the data base and methods. Section 5 provides the empirical results and its discussion thereof. Section 6 provides conclusion and implications. Section 7 stretches the limitations, recommendations and future directions.

## LITERATURE REVIEW

The notion that financial developments may matter in economic growth appears in several papers (see, for instance, Hsueh *et al.,* 2013; Mukhopadhyay *et al.*, 2011; Hassan

*et al.*, 2011; Jalil *et al.*, 2010; Panopoulou, 2009; Ang, 2008; Odhiambo, 2007; Christoppulos and Tsionas, 2004; Beck and Levine, 2004; Calderon and Liu, 2003; Levine, 2003; Arestis *et al.*, 2001; Levine *et al.*, 2000; Rousseau and Wachtel, 2000; Luintel and Khan, 1999; Choe and Moosa, 1999; Levine, 1997; Greenwood and Smith, 1997; Levine and Zervos, 1996; Demetriades and Luintel, 1996). It shows three different outcomes between financial development and economic growth, such as unidirectional causality, bidirectional causality and no causality between the two.

The outcomes are represented in four different ways: first, the Supply-Leading Hypothesis (SLH) where there is a presence of unidirectional causality from financial development to economic growth; second, the Demand-Following Hypothesis (DFH) where there is presence of unidirectional causality from economic growth to financial development; third, the Feedback Hypothesis (FBH) where the causation proceeds in both directions simultaneously; fourth, the Null Hypothesis (NUH) where the causation does not exist in any direction. Table 1 provides the summary of these hypotheses between financial development and economic growth.

In this context Hsueh *et al.* (2013), Bojanic (2012), Chaiechi (2012), Kar *et al.* (2011), Wu *et al.* (2010), Jalil *et al.* (2010), Abu-Bader and Abu-Qarn (2008), Ang (2008), Naceur and Ghazouani (2007), Boulila and Trabelsi (2004), Calderon and Liu (2003), and Thornton (1994) demonstrate the validity of a SLH. On the other hand, Kar *et al.* (2011), Odhiambo (2008 and 2010), Panopoulou (2009), Ang and McKibbin (2007), and Liang and Teng (2006) find evidence in favor of a DFH. Still other studies such as Wolde-Rufael (2009), Dritsakis and Adamopoulos (2004), Craigwell *et al.* (2001), and Ahmed and Ansari (1998) show the validity of FBH, while studies Mukhopadhyay *et al.* (2011) show the validity of NUH.

The aim of this study is to go for individual country study between India and Pakistan and a novel panel date estimation method (panel cointegration and causality tests) to establish the direction of causality between financial developments and economic growth. Since economic growth is only one aspect of performance of the economy, our paper also extends the literature by examining the possible link between the two (financial development and economic growth) and trade openness and inflation.

## HYPOTHESES TESTING

The study intends to tests the following hypotheses:

$H_1$ : *Financial development (FID) in any year Granger-causes economic growth in a subsequent year. This is termed the FID-led growth hypothesis.*

$H_2$ : *Inflation (INF) in any year Granger-causes economic growth in a subsequent year. This is termed the INF-led growth hypothesis.*

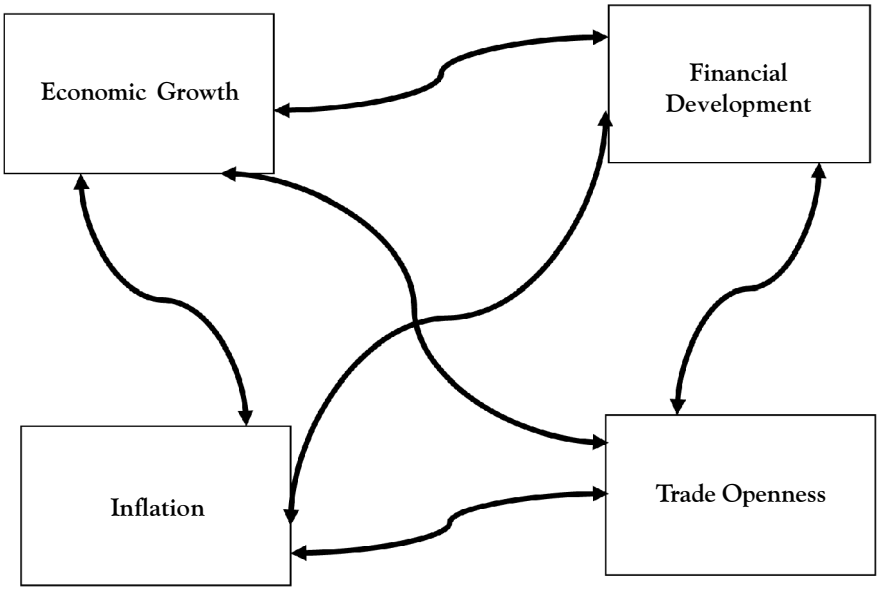
$H_3$ : *Trade openness (OPE) in any year Granger-causes economic growth in a subsequent year. This is termed the OPE-led ingrowth hypothesis.*

$H_4$ : *Financial development in any year Granger-causes inflation in a subsequent year. This is termed the FID-led inflation hypothesis.*

$H_5$ : *Financial development in any year Granger-causes trade openness in a subsequent year. This is termed the FID-led trade openness hypothesis.*

$H_6$ : *Inflation in any year Granger-causes trade openness in a subsequent year. This is termed the INF-led trade openness hypothesis.*

**Figure 1: Conceptual Framework of the Possible Causal Patterns between Economic Growth, Financial Development, Trade Openness and Inflation**




**Note:** Variables shown above are defined in Table 2.

Figure 1 presents the possible patterns of causal relations between financial development, economic growth, inflation and trade openness.

## DATA AND METHODOLOGY

This section discusses the data base and methods of study.

### DATA BASE

To analyze the finance-growth nexus, we use annual data set of India and Pakistan from 1970 to 2010. For economic growth, we deploy Per capita GDP (GDP) and for finance development, we deploy ratio of total credit to private sector (PSC) and liquidity

**Table 1: Summary of Studies Showing Causation Between Finance Development and Economic Growth**

| Studies | Study Area | Methods of Study | Period Covered |
|---|---|---|---|
| **Case 1: Studies Supporting SLH** | | | |
| Hsueh *et al.* (2013) | Ten Asian countries | BVGC | 1980-2007 |
| Chaiechi (2012) | South Korea, Hong Kong, UK | MVGC | 1990-2006 |
| Kar *et al.* (2011) | 15 MENA countries | MVGC | 1980-2007 |
| Wu *et al.* (2010) | European Union | MVGC | 1976-2005 |
| Abu-Bader and Abu-Qarn (2008) | Egypt | TVGC | 1960-2001 |
| Ang (2008) | Malaysia | MVGC | 1960-2003 |
| Naceur and Ghazouani (2007) | MENA region | MVGC | 1979-2003 |
| Calderon and Liu (2003) | 109 countries | MVGC | 1960-1994 |
| **Case 2: Studies Supporting DFH** | | | |
| Kar *et al.* (2011) | 15 MENA countries | MVGC | 1980-2007 |
| Odhiambo (2008) | Kenya | TVGC | 1969-2005 |
| Ang *et al.* (2007) | Malaysia | MVGC | 1960-2001 |
| Liang and Teng (2006) | China | MVGC | 1952-2001 |
| **Case 3: Studies Supporting FBH** | | | |
| Wold-Rufael (2009) | Kenaya | QVGC | 1966-2005 |
| Craigwell *et al.* (2001) | Barbados | MVGC | 1974-1998 |
| Ahmed and Ansari (1998) | India, Pakistan, Sri Lanka | MVGC | 1973-1991 |
| **Case 4: Studies supporting NOH** | | | |
| Mukhopadhyay *et al.* (2011) | 15 Asian countries | MVGC | 1961-2011 |

**Note:** 1. Supply Leading Hypothesis (SLH): if there is presence of unidirectional causality from an indicator of finance development (FID) to economic growth (GDP); demand following hypothesis (DFH): if there is presence of unidirectional causality form GDP to FID; Feedback hypothesis (FBH): if there is presence of bidirectional causality between FID and GDP; and Null hypothesis (NUH): if there is no causality between FID and GDP.
2. The definition of finance development varies across studies.
3. BVGC: Bivariate Granger Causality; TVGC: Trivariate Granger Causality; QVGC: Quadvariate Granger Causality; MVGC: Multivariate Granger Causality.

liabilities ratio (LIQ). Besides, we use two other variables such as inflation and trade openness. The data are obtained from IMF's International Financial Statistics database and are expressed in logarithms. The detail variable definitions are presented in Table 1.

To establish the nexus between economic growth and finance development in India and Pakistan, we follow the standard methods of Granger causality test (as in, for

example, Granger (1981 and 1988). But the precondition to Granger causality test is integration and cointegration properties of the relevant time series variables (see Johansen, 1988). That means there are three tests through which we can study the nexus between finance development and economic growth: first, test of order of integration; second, test of cointegration; third, test of Granger causality. We apply all these three tests at the individual country level and at the panel level. In the below, we briefly describe these techniques.

## UNIT ROOT TEST

The Augmented Dickey Fuller (ADF) (Dickey *et al.*, 1991) unit root test is generally used to detect the order of integration of time series variables at the individual country analysis. But the traditional ADF unit root test suffers the problem of low power in rejecting the null hypothesis of stationarity of the time series, particularly for small size of data. To resolve this issue, the LLC (Levin *et al.*, 2002) and IPS (Im *et al.*, 2003) panel unit root tests are used. Both (LLC and IPS) tests have higher power than the unit root test based on individual time series. LLC and IPS are exceptionally popular and both are based on the appearance of ADF principles. LLC assumes homogeneity in the dynamics of the autoregressive coefficients for all panel numbers, while IPS assumes heterogeneity in these dynamics. LLC offers a panel-base ADF test with a panel setting and restricts $\gamma$ to keep it identical across cross-sectional regions. The test levies homogeneity on autoregressive coefficient that indicates the presence/absence of a unit root, whereas intercept and trend may vary across individual series. The model allows heterogeneity only in the intercept and is given by

$$\Delta Y_{i,t} = \alpha_i + \gamma Y_{i,t-i} + \sum_{j=1}^{p_i} \beta_j \Delta Y_{i,t-j} + \varepsilon_{i,t} \qquad \ldots(1)$$

where $Y_{i,t}$ is a series for panel member (country) $i$ ($i$ = 1, 2,..N) over period $t$ ($t$ = 1, 2, …$T$), and $p_i$ is the number of lags in the ADF regression. The error term ($\varepsilon_{i,t}$) are assumed to be IID (0, $\sigma^2$) and to be independent across the units of the sample. The model allows for fixed effects, unit specific time trends, and common time effects. The coefficient of the lagged dependent variable is restricted to be homogenous across all units of the panel. Hence, the null hypothesis of non-stationary is stated as:

$H_0$ : $\gamma_i = 0$, is tested against the alternative,

$H_A$ : $\gamma_i = \gamma < 0$ for all $i$ ...(2)

The fixed effect model in Equation (1) is based on the usual $t$-statistic.

$$t_\gamma = \frac{\hat{\gamma}}{s.e(\hat{\gamma})}$$

where, $\gamma$ is restricted by being kept identical across members of the panel under both the null and alternative hypothesis.

The IPS test commences by specifying a separate ADF regression for each cross sectional units (country):

$$\Delta Y_{i,t} = \alpha_i + \gamma_i Y_{i,t-i} + \sum_{j=1}^{p_i} \beta_{i,j} \Delta Y_{i,t-j} + \varepsilon_{i,t} \quad \ldots(4)$$

where series $y_{it}$ ($i = 1, 2, \ldots, N$; $t = 1, 2, \ldots, T$) is the series for panel member (country) $i$ over period, $p_i$ is the number of lags in the ADF regression and the error terms $\varepsilon_{i,t}$ are assumed to be IID $(0, \sigma_i^2)$ for all $i$ and $t$. Both $\gamma_i$ and the lag order $\beta$ in Equation (4) are allowed to vary across sections (countries). The IPS decompresses the assumption of homogeneity of coefficients of lagged dependent variable. It tests the null hypothesis that each series in the panel has a unit root for all cross-section units against the alternative that at least one of the series is stationary.

$$H_0 \ : \ \gamma_i = 0 \text{ for all } i, \text{ is tested against the alternative,}$$

$$H_A \ : \ \gamma_i = \gamma_i < 0 \text{ for } i = 1, 2, \ldots., N_1, \gamma_i = 0,$$

$$i = N_1 + 1, N_1 + 2, \ldots, N \quad \ldots(5)$$

The alternative hypothesis merely implies that some or all of individual series are stationary. The IPS produced two test statistics and called them the t-bar and LM-bar tests. The IPS t-bar statistic is calculated using the average of the individual Dickey-Fuller $\tau$ statics shown below.

$$\bar{t} = \frac{1}{N} \sum_{i=1}^{N} \tau_i \quad \ldots(6)$$

$$\tau_i = \frac{\hat{\gamma}_i}{s.e(\hat{\gamma}_i)} \quad \ldots(7)$$

Assuming cross sectional units are independent, IPS proposes the use of standardized t-bar statistic.

$$\bar{Z} = \frac{\sqrt{N}(\bar{t} - E(\bar{t}))}{\sqrt{Var(\bar{t})}} \quad \ldots(8)$$

The term $E(\bar{t})$ and $Var(\bar{t})$ here are the mean and variance of $\tau$ statistic.

## COINTEGRATION TEST

Once the order of stationarity has been outlined, the next step is to employ panel cointegration test. Granger (1988) demonstrated that when the time series become

stationary only after being differenced once, they might have linear combinations that are stationary without differencing. Such series are generally called cointegrated. If integration of order one is connoted, the next step is to use cointegration analysis in order to establish whether there exists a long run relationship among the set of integrated variables. In this investigation, Johansen (Johansen, 1988) cointegration test is deployed first to test the existence of long run equilibrium relationship between financial development and economic growth at the individual country level. The test follows the estimation of following equation:

$$Y_{it} = \beta_{i0} + \beta_{i1}X_{i1t} + \beta_{i2}X_{i2t} + .... + \beta_{ik}X_{ikt} + \varepsilon_{it} \quad ...(9)$$

But we note that the above test could not deal with panel settings. So, Pedroni (2004) panel cointegration has been used for the same. The test starts with the estimation of parameters of the following panel regression,

$$Y_{i,t} = \alpha_i + \sum_{j=1}^{p_i} \beta_{ji}X_{jit} + \varepsilon_{it} \text{ and} \quad ...(10)$$

$$\varepsilon_{it} = \rho_i\varepsilon_{i(t-1)} + w_{it} \quad ...(11)$$

where $Y_{it}$ and $X_{jit}$ are the observable variables with dimension of ($N^*$ $T$)) x 1 and ($N^*$ $T$) x $m$ respectively; $\varepsilon_{it}$ represents the disturbance term from the panel regression; $\alpha_i$ would allow for the possibility of country-specific fixed effects and the coefficients of $\beta_{ji}$ would allow for variation across individual countries. The null hypothesis of no cointegration of pooled (within-dimension) estimation is $H_0$: $\rho_i = 1$ for all $i$ against $H_0$: $\rho_i = \rho < 1$ for some $i$. The null hypothesis of no-cointegration of the pooled (between-dimension) estimation is $H_0$: $\rho_i = 1$ for all $i$ against $H_0$: $\rho_i < 1$. Pedroni suggested two types of tests to determine the existence of heterogeneity of cointegration vector. First, the test uses within- dimension approach (i.e., panel test). It includes four statistics that are panel $v$- statistic, panel $\rho$- statistic, panel PP- statistic and panel ADF- statistic (Pedroni, 1999). These statistics pool the autoregressive coefficients across different members for the unit root tests to be performed on the estimated residuals. Second, the test based on between-dimension approaches (group test), which includes three statistics: group $\rho$-statistic, group PP-statistic and group ADF-statistic. These statistics are based on estimators that simply average the individually estimated coefficients for each member. The contingents of heterogeneous panel and heterogeneous group mean panel cointegration statistics are calculated as follows:

Panel $v$-statistic

$$Z_v = \left[\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{\varepsilon}_{it-1}^{2}\right]^{-1} \quad ...(12)$$

Panel $\rho$- statistic

$$Z_\rho = \left[\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{\varepsilon}_{it-1}^{2}\right]^{-1}\sum_{i=1}^{N}\sum_{t=1}^{T}L_{11i}^{-2}\left(\hat{\varepsilon}_{it-1}\Delta\hat{\varepsilon}_{it}-\hat{\lambda}_i\right) \quad ...(13)$$

Panel PP-statistic

$$Z_t = \left[\hat{\sigma}^2\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{\varepsilon}_{it-1}^{2}\right]^{-0.5}\sum_{i=1}^{N}\sum_{t=1}^{T}L_{11i}^{-2}\left(\hat{\varepsilon}_{it-1}\Delta\hat{\varepsilon}_{it}-\hat{\lambda}_i\right) \quad ...(14)$$

Panel ADF-statistic

$$Z_t^* = \left[\hat{s}^{*2}\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{\varepsilon}_{it-1}^{*2}\right]^{-0.5}\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{\varepsilon}_{it-1}^{*}\Delta\hat{\varepsilon}_{it}^{*} \quad ...(15)$$

Group $\rho$-statistic

$$\tilde{Z}_\rho = \sum_{i=1}^{N}\left(\sum_{t=1}^{T}\hat{\varepsilon}_{it-1}^{2}\right)^{-1}\sum_{t=1}^{T}\left(\hat{\varepsilon}_{it-1}\Delta\hat{\varepsilon}_{it}-\hat{\lambda}_i\right) \quad ...(16)$$

Group PP-statistic

$$\tilde{Z}_t = \sum_{i=1}^{N}\left(\hat{\sigma}^2\sum_{t=1}^{T}\hat{\varepsilon}_{it-1}^{2}\right)^{-0.5}\sum_{t=1}^{T}\left(\hat{\varepsilon}_{it-1}\Delta\hat{\varepsilon}_{it}-\hat{\lambda}_i\right) \quad ...(17)$$

Group ADF-statistic

$$\tilde{Z}_t^* = \sum_{i=1}^{N}\left(\sum_{t=1}^{T}\hat{s}_i^2\hat{\varepsilon}_{it-1}^{*2}\right)^{-0.5}\sum_{t=1}^{T}\left(\hat{\varepsilon}_{it-1}^{*}\Delta\hat{\varepsilon}_{it}^{*}\right) \quad ...(18)$$

where, $\hat{\varepsilon}_{it}$ is the estimated residual from equation (10) and $\hat{L}_{11i}^{-2}$ is the estimated long run covariance matrix for $\Delta\hat{\varepsilon}_{it}$. Similarly, $\hat{\sigma}_i^2$ and $\hat{s}_i^2\left(\hat{s}_i^{*2}\right)$ are the long run and contemporaneous variances for individual *i*. All the seven tests are based asymptotically standard normal distributions given by the respective panel/group cointegration statistic. The panel-v is a one sided test, where large positive values reject the null hypothesis of no cointegration. The other remaining statistics diverge to negative infinite, which means that large negative values reject the null hypothesis. Each of these tests is able to accommodate individual specific short-run dynamics, individual specific fixed effects and deterministic trends as well as individual specific slope coefficients (Pedroni, 1999 and 2004).

## GRANGER CAUSALITY TEST

The conventional Granger causality (Granger, 1981) is usually used to perceive the direction of causality between two (or more) time series variables at the individual country analysis. But for the panel setting, the following panel VAR (Holtz-Eakin *et al.*, 1988) is considered.

**Model 1:** If the time series variables are integrated of order one [i.e., 1 (1)] and not cointegrated, we deploy the following causality model:

$$\Delta GDP_{it} = \eta_{1j} + \sum_{k=1}^{p} \alpha_{1ik} \Delta GDP_{it-k} + \sum_{k=1}^{q} \beta_{1ik} \Delta OPE_{it-k} + \sum_{k=1}^{r} \delta_{1ik} INF_{it-k} + \sum_{k=1}^{s} \lambda_{1ik} FID_{it-k} + \varepsilon_{1it} \quad \ldots(19)$$

$$\Delta FID_{it} = \eta_{2j} + \sum_{k=1}^{p} \alpha_{2ik} \Delta GDP_{it-k} + \sum_{k=1}^{q} \beta_{2ik} \Delta OPE_{it-k} + \sum_{k=1}^{r} \delta_{2ik} INF_{it-k} + \sum_{k=1}^{s} \lambda_{2ik} FID_{it-k} + \varepsilon_{2it} \quad \ldots(20)$$

$$\Delta OPE_{it} = \eta_{3j} + \sum_{k=1}^{p} \alpha_{3ik} \Delta GDP_{it-k} + \sum_{k=1}^{q} \beta_{3ik} \Delta OPE_{it-k} + \sum_{k=1}^{r} \delta_{3ik} INF_{it-k} + \sum_{k=1}^{s} \lambda_{3ik} FID_{it-k} + \varepsilon_{3it} \quad \ldots(21)$$

$$\Delta INF_{it} = \eta_{4j} + \sum_{k=1}^{p} \alpha_{4ik} \Delta GDP_{it-k} + \sum_{k=1}^{q} \beta_{4ik} \Delta OPE_{it-k} + \sum_{k=1}^{r} \delta_{4ik} INF_{it-k} + \sum_{k=1}^{s} \lambda_{4ik} FID_{it-k} + \varepsilon_{4it} \quad \ldots(22)$$

where, GDP represents economic growth, OPE represents trade openness, INF represents inflation, FID stands for financial development, which is measured through two indicators such as liquidity ratio (LIQ) and private sector credit (PSC).

**Model 2:** If the time series variables are integrated of order one [i.e., 1 (1)] and cointegrated, then direction of causality is tested by using error correction model. This is represented as follows:

$$\Delta GDP_{it} = \eta_{1j} + \sum_{k=1}^{p} \alpha_{1ik} \Delta GDP_{it-k} + \sum_{k=1}^{q} \beta_{1ik} \Delta OPE_{it-k} + \sum_{k=1}^{r} \delta_{1ik} \Delta INF_{it-k} + \sum_{k=1}^{s} \lambda_{1ik} FID_{it-k} + \eta_1 EC_{1it-k} + \varepsilon_{1it} \quad \ldots(23)$$

$$\Delta FID_{it} = \eta_{2j} + \sum_{k=1}^{p} \alpha_{2ik} \Delta GDP_{it-k} + \sum_{k=1}^{q} \beta_{2ik} \Delta OPE_{it-k} + \sum_{k=1}^{r} \delta_{2ik} \Delta INF_{it-k} + \sum_{k=1}^{s} \lambda_{2ik} FID_{it-k} + \eta_2 EC_{2it-k} + \varepsilon_{2t} \quad \ldots(24)$$

$$\Delta INF_{it} = \eta_{3j} + \sum_{k=1}^{p} \alpha_{3ik} \Delta GDP_{it-k} + \sum_{k=1}^{q} \beta_{3ik} \Delta OPE_{it-k} + \sum_{k=1}^{r} \delta_{3ik} \Delta INF_{it-k} + \sum_{k=1}^{s} \lambda_{3ik} FID_{it-k} + \eta_3 EC_{3it-k} + \varepsilon_{3it} \quad \ldots(25)$$

$$\Delta OPE_{it} = \eta_{4j} + \sum_{k=1}^{p} \alpha_{4ik} \Delta GDP_{it-k} + \sum_{k=1}^{q} \beta_{4ik} \Delta OPE_{it-k} + \sum_{k=1}^{r} \delta_{4ik} \Delta INF_{it-k} + \sum_{k=1}^{s} \lambda_{4ik} FID_{it-k} + \eta_4 EC_{4it-k} + \varepsilon_{4it} \quad \ldots(26)$$

EC is error correction term which is derived from the cointegration equation and FID $\varepsilon_{it}$ is a normally distributed random error term for all *i* and *t* with a zero mean and a finite heterogeneous variance.

We look for both short-run and long-run causal relationships among the variables. Short-run causal relationships are measured through *F*-statistics and the significance of the lagged changes in the independent variables. Long-run causal relationships are measured through the significance of *t*-tests of the lagged ECs. Based on Equations (27)-(30), Table 2 presents various possible hypotheses concerning the causal nexus between financial development, economic growth, inflation and trade openness. The testable hypotheses in Table 2 are meaningful, if the time-series variables are integrated of order one [denoted by I (1)] and cointegrated. If the variables are I (1) and not cointegrated, then EC component will be removed in the estimation and testing process. Thus, the pre-condition to the estimation process is to check the order of integration and cointegration among the variables.

**Table 2: Definition of Variables**

| Variables | Definition |
|---|---|
| PSC | **Private sector credit:** This credit is expressed as a percentage of Gross Domestic Product (GDP). The credit refers to financial resources provided to the private sector, such as through loans, purchases of non-equity securities, and trade credits and other accounts receivable, that establish a claim for payment. |
| LIQ | **Liquid liabilities**: These liabilities are expressed as a percentage of GDP. Liquid liabilities include currency and deposits, commercial paper, and shares of mutual funds or market funds held by residents. |
| INF | **Inflation rate**: In percentage, calculated by using the consumer price index |
| OPE | **Trade openness**: the sum of exports and imports as a percentage of GDP. |
| GDP | **Growth rate of per capita income** (in percentage): Income is defined as GDP. This is our measure of economic growth |

**Note:** 1. The monetary units of all variables are expressed in US dollars.
2. Variables above are defined in the World Development Indicators, published by the World Bank.

## THE EMPIRICAL FINDINGS

To analyze the dynamic interactions between finance development and economic growth, we adopt a vector autoregressive (VAR) framework. The expounding of the VAR results proceeds in three stages. After a brief review of methodological issues, we provide the results that pertain to stationarity of time series variables such as economic growth (GDP), finance development [as in, private sector credit (PSC) and liquidity liabilities ratio (LIQ)], inflation (INF) and trade openness (OPEN). Second, we examine whether there is any cointegration among the following time series variables. Third, we attempt to explicate the direction of causal nexus among the cointegrated variables. Our estimating results are based on individual time series analysis and at the panel level.

**Table 3: Hypotheses Tested in this Study**

| Causal Flow | Restrictions |
|---|---|
| FID => GDP | $\lambda_{1ik} \neq 0;\ \eta_{1i} \neq 0$ |
| OPE => GDP | $\beta_{1ik} \neq 0;\ \eta_{1i} \neq 0$ |
| INF => GDP | $\delta_{iik} \neq 0,\ \eta_{1i} \neq 0$ |
| FID => OPE | $\beta_{2ik} \neq 0;\ \eta_{2i} \neq 0$ |
| FID => INF | $\delta_{2ik} \neq 0;\ \eta_{2i} \neq 0$ |
| OPE => INF | $\beta_{3ik} \neq 0;\ \eta_{3i} \neq 0$ |

**Note:** 1. *FID*: Financial development; *GDP*: per capita economic growth rate; *OPE*: Trade Openness; *INF*: inflation Rate.
2. FID is defined in terms of liquidity assets (LIQ) and private sector credit (PSC).

Coming to stationarity issue, we find time series variables are non-stationary at the level data but found stationary at the first difference (see Table 4). This indicates that the variables are integrated of order one [i.e., I (I)]. This is exclusively true for both India and Pakistan at individually and collectively (i.e. at the panel level). The following results give an indication of cointegartion relationship among the time series variables. The Johansen Maximum Likelihood test ($\lambda_{Tra}$ and $\lambda_{Max}$) is used to ascertain whether or not the variables are cointegrated at the individual country analysis, while Pedroni panel cointegration is used for panel data analysis. The results of both the statistics are reported in Tables 5 and 6. The results indicate that the variables under study are cointegrated (both at individual country and at the panel), which substantiates the possibility of causality between variables. Having confirmation about the cointegration among GDP, PSC, LIQ, INF and OPEN, the next step is to detect the direction of causal-nexus. The Granger causality, based on Vector Error Correction Model (VECM), is deployed for the same. Table 7 provides the empirical results of VECM. The findings of causality are summarized as follows:

1. For India, it encounters the unidirectional causality from trade openness to liquidity ratio [OPE => LIQ], from inflation to openness [INF => OPE],

from economic growth to openness [GDP => OPE], from liquidity ratio to inflation [LIQ => INF] and from openness to private sector credit [OPE => PSC]. Besides, it detects the bidirectional causality between inflation and economic growth [INF <=> GDP].

**Table 4: Unit Root Test Results at the First Difference Level**

| Individual Country ADF Test | | | | | | |
|---|---|---|---|---|---|---|
| | India | | Conclusion | Pakistan | | Conclusion |
| | C | C+T | | C | C+T | |
| GDP | –6.02* | –6.46* | I [1] | –5.11* | –3.48* | I [1] |
| INF | –5.70* | –5.68* | I [1] | –5.88* | –4.16* | I [1] |
| OPE | –7.44* | –7.45* | I [1] | –7.49* | –8.26* | I [1] |
| LIQ | –3.48* | –6.71* | I [1] | –4.38* | –5.61* | I [1] |
| PSC | –3.88* | –5.58* | I [1] | –8.28* | –8.19* | I [1] |

| Panel Unit Root Test | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | C | | | | C+T | | | |
| | LLC | IPS | ADF | PP | LLC | IPS | ADF | PP |
| GDP | –16.4* | –15.1* | 31.7* | 61.8* | –5.58* | –1.17 | 141.9* | 286.2* I [1] |
| INF | –5.70* | –7.75* | 51.1* | 51.6* | 3.09* | 0.72 | 23.67* | 281.8* I [1] |
| OPE | –9.94* | –11.1* | 44.6* | 34.4* | 0.59 | –7.57* | 74.43* | 287.9* I [1] |
| LIQ | –7.86* | –7.81* | 52.7* | 79.9* | –8.01* | –7.25* | 52.35* | 295.5* I [1] |
| PSC | –5.51* | –7.24* | 78.9* | 47.3* | –6.10* | –5.39* | 52.42* | 307.4* I [1] |

**Note:** GDP: Per Capita Gross Domestic Product; INF: Inflation Rate; OPE: Trade Openness; LIQ: Liquidity ratio; PSC: Private Sector Credit; C: Constant; C+T: Constant plus Trend; ADF: Augmented Dickey Fuller Test; LLC: LLC statistics; IPS: IPS statistics; PP: PP statistics; I (1): Integrated of order one; and *: Indicates statistically significant at 5% level.

**Table 5: Johansen's Cointegration Likelihood Ratio Test**

| Hypothesized Cointegrating $H_o$ | Number of Relationships $H_A$ | Test Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | India | | | | Pakistan | | | |
| | | $\lambda$-Max | CV | $\lambda$-Tra | CV | $\lambda$-Max | CV | $\lambda$-Tra | CV |
| Cointegration: LIQ, GDP, INF, OPE | | | | | | | | | |
| $r = 0$ | $r > 0$ | 45.73* | 40.17 | 24.52* | 24.16 | 143.9* | 40.17 | 84.28* | 24.16 |
| $r \leq 1$ | $r > 1$ | 21.21 | 24.28 | 13.83 | 17.80 | 50.60* | 24.28 | 36.07* | 17.80 |
| $r \leq 2$ | $r > 2$ | 7.379 | 12.32 | 07.12 | 11.22 | 14.53* | 12.32 | 11.77* | 11.22 |
| $r \leq 3$ | $r > 3$ | 0.258 | 4.129 | 0.258 | 4.129 | 2.765 | 4.129 | 2.765 | 4.129 |

Table 5 (Cont.)

| Hypothesized Cointegrating $H_o$ | Number of Relationships $H_A$ | Test Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | India | | | | Pakistan | | | |
| | | $\lambda$-Max | CV | $\lambda$-Tra | CV | $\lambda$-Max | CV | $\lambda$-Tra | CV |
| **Cointegration: PSC, GDP, INF, OPE** | | | | | | | | | |
| $r = 0$ | $r > 0$ | 64.61* | 40.17 | 33.44* | 24.16 | 158.3* | 40.17 | 82.34* | 24.16 |
| $r \leq 1$ | $r > 1$ | 31.17* | 24.28 | 18.24* | 17.80 | 76.00* | 24.28 | 42.95* | 17.80 |
| $r \leq 2$ | $r > 2$ | 14.94* | 12.32 | 12.22* | 11.22 | 33.06* | 12.32 | 30.01* | 11.22 |
| $r \leq 3$ | $r > 3$ | 2.719 | 4.129 | 2.720 | 4.129 | 3.052 | 4.129 | 3.052 | 4.129 |

**Note:** $r$ indicates the number of cointegrating relationships; *: Indicates statistically significant at 5% level; and other notations are defined earlier.

**Table 6: Results of Panel Cointegration Test**

| Test Statistics | Calculated Value | Probability |
|---|---|---|
| **Cointegration: LIQ, GDP, INF, OPE** | | |
| Panel $v$- statistic | –1.948 | [0.97] |
| Panel $\rho$- statistic | –5.285 | [0.00] |
| Panel PP- statistic | –5.930 | [0.00] |
| Panel ADF- statistic | –1.457 | [0.07] |
| Group $\rho$- statistic | –2.835 | [0.00] |
| Group PP- statistic | –4.280 | [0.00] |
| Group ADF- statistic | –1.510 | [0.06] |
| **Cointegration: PSC, GDP, INF, OPE** | | |
| Panel $v$- statistic | –1.852 | [0.97] |
| Panel $\rho$- statistic | –1.397 | [0.08] |
| Panel PP- statistic | –7.403 | [0.00] |
| Panel ADF- statistic | –5.440 | [0.00] |
| Group $\rho$- statistic | –1.060 | [0.14] |
| Group PP- statistic | –5.640 | [0.00] |
| Group ADF- statistic | –3.658 | [0.00] |

**Note:** The parentheses indicate the probability of significance; and other notations are defined earlier.

2. For Pakistan, we find the bidirectional causal-nexus between trade openness and inflation [OPE <=> INF] and between inflation and economic growth [INF <=> GDP]. In addition, there is existence of unidirectional causality from economic growth to inflation [GDP => INF] and from trade openness to private sector credit [OPE => PSC].

3. For panel data analysis, it finds the unidirectional causal-nexus from economic growth to liquidity ratio [GDP => LIQ] and from inflation to trade openness [INF => OPE]. Further, it detects the presence of bidirectional causality between inflation and economic growth [INF <=> GDP], between trade openness and liquidity ratio [OPE => LIQ] and between trade openness and economic growth [OPE <=> GDP].

**Table 7: Granger Causality Test**

| Model A: Causality between LIQ, GDP, INF, OPE | | | | | | |
|---|---|---|---|---|---|---|
| | | ΔLIQ | ΔGDP | ΔINF | ΔOPE | EC |
| India | ΔLIQ | – | 0.406 | 0.896 | 3.571* | -1.757 |
| | ΔGDP | 0.764 | – | 5.934* | 6.030* | -1.428 |
| | ΔINF | 5.340* | 4.732* | – | 0.693 | -1.095 |
| | ΔOPE | 2.170 | 5.838* | 12.75* | – | 3.264* |
| Pakistan | ΔLIQ | – | 0.875 | 1.535 | 1.525 | -0.844 |
| | ΔGDP | 0.607 | – | 23.94* | 4.368* | -1.428 |
| | ΔINF | 0.793 | 37.46* | – | 32.62* | -6.790* |
| | ΔOPE | 2.075 | 25.36* | 18.74* | – | -3.426* |
| Panel Causality Test | ΔLIQ | – | 6.359* | 1.980 | 2.570 | -2.394 |
| | ΔGDP | 1.374 | – | 8.359* | 11.65* | -2.669* |
| | ΔINF | 0.991 | 33.09* | – | 2.440 | -1.441 |
| | ΔOPE | 3.880* | 26.68* | 21.59* | – | -4.449* |
| **Model B: Causality between PSC, GDP, INF, OPE** | | | | | | |
| | | ΔPSC | ΔGDP | ΔINF | ΔOPE | EC |
| India | ΔPSC | – | 2.317 | 2.381 | 6.838* | -1.684 |
| | ΔGDP | 0.604 | – | 5.516* | 4.807* | -1.349 |
| | ΔINF | 1.882 | 6.350* | – | 0.429 | -1.388 |
| | ΔOPE | 2.097 | 21.16* | 11.12* | – | 3.521* |
| Pakistan | ΔPSC | – | 3.106* | 0.212 | 6.719* | -0.826 |
| | ΔGDP | 3.789 | – | 27.74* | 7.440* | 1.606 |
| | ΔINF | 4.256* | 28.58* | – | 34.50* | 6.729* |
| | ΔOPE | 3.433* | 13.95* | 21.42* | – | 4.384* |
| Panel Causality Test | ΔLIQ | – | 1.348 | 0.956 | 2.990* | -0.910 |
| | ΔGDP | 0.202 | – | 6.090* | 6.320* | -1.459 |
| | ΔINF | 0.830 | 38.14* | – | 34.83* | -1.820 |
| | ΔOPE | 2.296 | 20.38* | 21.09* | – | -4.820* |

**Note:** * Indicates statistically significant at 5% level; and other notations are defined earlier.

## CONCLUSION AND IMPLICATIONS

The central goal of the paper is to examine causal-nexus between financial development and economic growth. The study has rendered desegregated evidence on the finance-growth nexus in India and Pakistan over the period from 1970 to 2010. The findings suggest that financial development does not have extensive impact on economic growth, both in India and Pakistan. This is in line with the studies of Mukhopadhyay *et al.* (2011), Stern (1989), Lucas (1988) and Robinson (1952), which indicates that finance is unimportant. To support this finding, Singh (1997) exacts that financial development may not be beneficial for economic growth for various reasons. First, the underlying volatility and arbitrariness of stock market pricing process under developing countries conditions make it a mediocre guide to efficient investment allocation. Second, the integration between the stock markets and currency markets in the wake of unfavorable economic shocks may worsen macroeconomic instability and can reduce the long-run economic growth. Third, the stock market development is probably undermining the existing group-banking systems in the developing countries, which, even though their many difficulties, have not been without merit in several countries, not least in the extremely successful East Asian economies.

On the contrary, the finance-growth nexus is considerably influenced by other factors such as trade openness and inflation. For India, it finds the existence of bidirectional causal-nexus between inflation and growth and a unidirectional causality from trade openness to financial development (for both liquidity ratio and private sector credit), from inflation to trade openness, from economic growth to trade openness, and from financial development (for liquidity ratio only) to inflation. For Pakistan, it suggests the bidirectional causality between openness and inflation and a unidirectional causality from economic growth to inflation and from trade openness to finance development (for private sector credit only). The panel causality latterly suggests the unidirectional causal-nexus from economic growth to finance development (for liquidity ratio only), and from inflation to trade openness. It also suggests the bidirectional causal-nexus between inflation and economic growth, trade openness and finance development (for liquid ratio only), and trade openness to economic growth. Over and above, financial development has a moderate effect on economic growth, both in India and Pakistan. This goes against several earlier findings (see, for example, Jalil *et al.* (2010), Beck *et al.* (2000), Neusser and Kugler (1998), King and Levine (1993), Odedokun (1996), MacKinnon (1973) and Shaw (1973)). But, in reality, finance is supposed to be crucial factor for economic growth, particularly in the country like India and Pakistan. The negative results may be due to weakly financial development in these countries, besides other factors like infrastructure growth, economic stability and so on.

Hence to have sustainable economic growth, government has to heighten the financial sector and undertake necessary measures to beef up the long run relationship between financial development and economic growth. These steps include more financial

integration, minimize government interference in the financial systems, increasing the status of financial institutions and so forth. These are very crucial and useful for strengthening the causal-nexus between financial development and economic growth. Undeniably, it could be that below a level of financial development there is no effect on economic growth or a lower effect and a larger effects as financial development cross a particular threshold limit (see, for instance, Chrisopoulos and Tsionas, 2004). The lack of same not only affects the finance-growth nexus (see, McKinnon, 1973) but also overall socioeconomic development in the country (see, for instance, Greenwood and Jovanovic, 1990). Hence, government has to take the initiative with greater caution.

## LIMITATIONS, RECOMMENDATIONS AND FUTURE RESEARCH DIRECTIONS

This section scans the limitation, recommendations and future research directions.

### LIMITATIONS OF THE STUDY

This study has contributed to the literature of financial development by incorporating the individual country impact and the panel data estimation. To our knowledge, for the first time this study integrated the causal nexus between financial development, trade openness, inflation and economic growth in the finance-growth literature for the two neighboring countries such as India and Pakistan. The study has, however, based on certain limitations:

First, it incorporates two banking sector indicators (such as liquidity ratio and private sector credit) only and hence, can be criticized for the same as an indicators to financial development.

Second, the impact of stock market like market capitalization, turnover ratio, etc., is also substantial influence on finance-growth nexus. The study is criticized for missing of these stock market variables in the finance-growth nexus.

Third, the study uses only two macroeconomic variables (inflation and trade openness) to the finance-growth nexus. It is criticized on the ground that other macroeconomic variables may have substantial impact on finance-growth nexus.

Fourth, the study is criticized on the ground on that the issue of structural break is missing in the finance-growth nexus. The presence of structural break may affect the outcome of finance-growth nexus in both the neighboring counties (India and Pakistan).

Five, the panel data used in this study in the context of two countries (India and Pakistan) only. The outcome will be more effective and more reality, if more countries and more time periods can be added in the process.

Last but not the least, now-a-days several advanced techniques for examining the causal inference have been evolved, like the theory of Pearl (2009) invokes non-parametric structural equations models as a formal and meaningful language for defining causal quantities, formulating causal assumptions, and explicating many concepts used

in causal discourse. Such a powerful and comprehensive methodology could have been incorporated in our study to enrich our empirical research work. The study by White *et al.* (2011) re-established the above concepts of causal inference and linked their model with Granger Causality.

## RECOMMENDATIONS AND FUTURE RESEARCH DIRECTIONS

On the basis of above limitations, the study suggests the following recommendations and future directions:

First, the future study can be replicated in countries with similar socioeconomic condition and more number of data size. If there is inclusion of more data points in the study in the form of more time periods (monthly or quarterly) and more number of countries, the analysis will give better and more stable results.

Second, if the future study can incorporate more number of variables like broad money supply, inclusion of insurance sector, market capitalization, market turnover ratio, etc., than the impact of financial development will give better reflection to finance-growth nexus in these two countries.

Third, the future study can incorporate more number of macroeconomic variables in the finance-growth nexus. For instance, if there is inclusion of more number of macroeconomic factors (like infrastructure investment, foreign direct investment, tax revenue, institutional factors, etc.), and then the outcome of finance-growth nexus can be more representative in these two neighboring countries.

Fourth, the study can use some other advanced techniques which can reflect better reflection to the finance-growth nexus. For instance, the use of Andrew-Zivot structural break test (Zivot and Andrews, 1992) may give better reflection to order of integration test for individual country study, as it can predict the structural break issue in the finance-growth nexus.

Last but not the least, a comparative analysis of finance-growth nexus can be done by including more number of countries (Asian or African or European) in the study.

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