Causality between Pillars of Development and Economic Growth: The Panel VAR Application

Rudra P. Pradhan, Indian Institute of Technology Kharagpur (India) and Asian Institute of Technology Bangkok (Thailand)

Email: rudrap@vgsom.iitkgp.ernet.in; rppradhan@ait.ac.th

Abstract

The paper examines the long-run relationship between financial development, social development and economic growth in 15 Asian countries for the period 1961-2012. Using principal component analysis (PCA) for the construction of development indices and panel vector autoregressive (VAR) model for testing the Granger causalities, the study finds bidirectional causality between economic growth and financial development and they predict the level of social development. The policy implication of this study is that the economic policies should recognize the differences in the financial development and economic growth in order to maintain sustainable social development in the 15 selected Asian countries.

Keywords: PCA, panel VAR, Granger causality

1. Introduction

This study initiates a fresh look on the relationship between financial development and economic growth with a view to identifying stunning issues and contributing some suggestions about how these may be addresses in the future. The empirical literature on this issue utilizes two different econometric methodologies (Arestis and
Demetriades, 1997): cross-country regressions (CCR) and time series regressions (TSR). The CCR approach involves averaging out variables over long time periods and using them in cross-section regressions aiming at explaining cross-country variations of growth rates. Hence, in principle the investigator is able to estimate the average influence of the determinants of economic growth (see, for instance, Cole et al., 2008; Beck and Levine, 2004; Levine et al., 2000; Beck et al., 2000; Levine and Zervos, 1998; King and Levine, 1993). On the contrary, TSR epitomizes the limitations associated with CCR and can detect the feedback relationships between the two (see, for instance, Mukhopadhyay et al. 2011; Ang, 2008; Goodhart, 2004; Levine, 2003; Levine et al., 2000; Luintel and Khan, 1999; Greenwood and Smith, 1997; Demetrides and Hussein, 1996). In this study, we deploy TSR to bring some new evidence on the causal relationship between financial development and economic growth.

The main innovations in this paper, compared to existing literature on finance-growth nexus, are two-folds.

First, the use of trivariate framework in which, in addition to growth and finance development, we incorporate social development. This marries the Granger causality literatures on the finance-growth nexus, social development-growth nexus and finance-social development nexus. The inclusion of social development in the finance-growth nexus is very relevant, as it is the ultimate aim of a particular country in the process of development. In fact, earlier economic growth theory argued that economic development is a process of innovations whereby the
interactions of innovations in both the financial and real sectors provide a driving force for dynamic economic growth (see, for instance, Hassan et al., 2011).

Second, we use composite index concept by deploying principal component analysis to study the interrelationships between financial development, social development and economic growth.

The rest of the paper is organized as follows. Section 2 highlights the methods of study. Section 3 discusses the empirical results. Finally, we summarize and conclude in Section 4.

2. Methods

We deploy two techniques to study the finance-social-growth nexus: Principal Component Analysis (PCA) and panel vector auto-regressive (VAR) model. PCA is used to construct the composite indices of finance-social development, which can signal the overall position of financial development and social development respectively. On the other hand, panel VAR model is used to know the casual-nexus between finance-social development and economic growth. The advantage of this method is to exploit individual time series and cross sectional variations in data and avoids biases associated with cross sectional regressions by taking the country-specific fixed effect into account (see, for example, Levine, 2005).

The OECD (2008) clarifies the methodology of composite indices by defining the ten steps: theoretical framework, data selection, imputation of missing data, choosing multivariate data analysis, normalization,
weighting and aggregation, uncertainty and sensitivity analysis, back to the data, links to other indices and visualization of results. Following these steps, variables are selected to construct the two composite indices, namely financial sector development index (FSDI) and social sector development index (SSDI). The indices are prepared on the basis of following steps: first, data are arranged in the same order to create the input matrix for PCA; second, data matrix is normalized based on the min-max method. Using PCA, eigen values, factor loadings and PCs are derived. Finally, the PCs are used to construct these two indices separately for each country for each year (see, for more details, Hosseini and Kaneko, 2012; 2011; Joliffe, 2002; Sharma, 1996; Manly, 1994). The variables that included for these two indices (FSDI and SSDI) are stated in Tables 1 & 2 respectively.

The panel VAR model, on the contrary, involves three steps: first, panel unit root test to know the stationarity (i.e., order of integration) of time series variables; second, panel cointegration test to know the existence of long run relationship between the time series variables; and third, the final VAR model to know the direction of causality between the time series variables. The details descriptions of these three tests are as follows.

2. 1 Panel Data Unit Root Test

We use LLC (Levin-Lin-Chu: Levin et al., 2002) and IPS (Im-Pesaran-Shin: Im et al., 2003) for knowing the order of integration where the time series variable attain stationarity. Both LLC and IPS have been deployed on the principles of conventional ADF test. The LLC allows for
heterogeneity of the intercepts across members of the panel, while IPS allows for heterogeneity in intercepts as well as in the slope coefficients. Both the tests are applied by averaging individual ADF t-statistics across cross-section units. The test follows the estimation of following equation:

$$
\Delta Y_t = \mu_t + \gamma_t Y_{t-1} + \sum_{j=1}^{p_i} \beta_{i,j} \Delta Y_{t-j} + \lambda_i t + \varepsilon_{it}
$$

where \(i = 1, 2\ldots N; \ t = 1, 2\ldots T; \ Y_{it}\) is the series for country \(i\) in the panel over period \(t\); \(p_i\) is the number of lags selected for the ADF regression; \(\Delta\) is the first difference filter (I –L); and \(\varepsilon_{it}\) are independently and normally distributed random variables for all \(i\) and \(t\) with zero means and finite heterogeneous variances (\(\sigma_i^2\)).

The IPS tests the null hypothesis of unit root for each individual in the panel, that is, \(H_0: \gamma_i = 0\) for \(\forall i\) against an alternative \(H_A: \gamma_i < 0, \ i = 1, 2\ldots N_1; \ \gamma_i = 0, \ i = N_1 + 1, \ldots, N\), which allows for some of the individual series to be integrated. The IPS develops the t-bar statistic calculated as a simple average across groups of the individual ADF t statistics. This is as follows:

$$
\bar{t} = \frac{1}{N} \sum_{i=1}^{N} \frac{\hat{\gamma}_i}{\hat{\sigma}_{\hat{\gamma}_i}}
$$

The standardized t-bar statistic, \(Z_{tbar}\), converges to standard normal distribution sequentially, as \(N\) tends to very high.

The LLC unit root test is also based on model (1) but it differs from IPS in some ways. On the one hand, IPS allows the coefficients of the autoregressive term, \(\gamma_i\), to
differ across section units, while LLC considers the coefficients of the autoregressive term as homogenous across all individuals, i.e., $\gamma_i = \gamma$ for $\forall i$. The LLC tests the null hypothesis that each individual in the panel has integrated time series, i.e., $H_0: \gamma_i = \gamma = 0$ for $\forall i$ against an alternative $H_A: \gamma_i = \gamma < 0$ for $\forall i$. LLC considers pooling the cross-section time series data and it follows the t-star statistics, which is as follows:

$$t^*_\gamma = \frac{\hat{\gamma}}{se(\hat{\gamma})}$$

The t-statistic also asymptotically follows standard normal distribution.

2.2 Panel Data Cointegration Test

The concept of cointegration, introduced by Granger (see, for example, Granger, 1988) is relevant to the problem of the determination of long-run relationship between variables. The basic idea behind cointegration is simple. If the difference between two non-stationary series is itself stationary, then the two series are cointegrated. If two or more series are cointegrated, it is possible to interpret the variables in these series as in a long-run equilibrium relationship. Lack of cointegration, on the other hand, suggests that the variables have no long-run relationship; i.e., in principle they can move arbitrarily far away from each other.

When a collection of time-series observations becomes stationary only after being first-differenced, the individual time series might have linear combinations that are stationary without differencing. Such collections of series
are usually called cointegrated (Granger, 1988). If integration of ‘order one’ is implied, the next step is to employ cointegration analysis in order to establish whether there exists a long-run relationship among the set of such possibly ‘integrated’ variables. The Pedroni’s panel cointegration method (see Pedroni, 2000) is used to know the existence of cointegration among these three series. The technique starts with the following regression equation.

\[
SSDI_{it} = \beta_{0i} + \beta_{1i}t + \beta_{2i}GDP_{it} + \beta_{3i}FSDI_{it} + \varepsilon_{it} \tag{4}
\]

and

\[
\varepsilon_{it} = \gamma_{i}\varepsilon_{it-1} + \xi_{it} \tag{5}
\]

where \(i = 1, 2, \ldots, N; \ t = 1, 2, \ldots, T\). The SSDI is social sector development index, FSDI is financial sector development index, and GDP (gross domestic product) is a per capita economic growth. \(\beta_{0i}\) is the fixed effect or individual specific effect that is allowed to vary across individual cross-sectional units. The \(\beta_{1i}t\) is a deterministic time trend specific to individual countries in the panel. The slope coefficients \(\beta_{2i}\) can vary from one individual to another allowing the cointegrating vectors to be heterogeneous across countries.

Pedroni proposed seven different statistics for the cointegration test in the panel data setting. Of the seven proposed statistics, first four are known as panel cointegration statistics and that is within-dimension statistic, while the last three are known as group mean panel cointegrating statistics and that is between-dimension statistic. Their levels are based on the way the autoregressive coefficients are manipulated to arrive at the
final statistic. There are basically five steps to obtain these cointegration statistics.

Step 1: compute the residuals ($\hat{e}_{it}$) from the panel regression (equation 4). The estimation involves the inclusion of all appropriate fixed effects, time trends or common time dummies.

Step 2: Compute the residuals ($\hat{\xi}_{it}$) from the following regression:

$$\Delta Y_{it} = \beta_1 \Delta X_{it} + \beta_2 \Delta X_{it} + \ldots + \beta_m \Delta X_{it} + \xi_{it}$$  

(6)

Step 3: Compute ($\hat{\xi}_{it}$), the long run variance of $\hat{\xi}_{it}$:

$$\hat{\xi}_{it} = \frac{1}{T} \sum_{t=1}^{T} \hat{e}_{it}^2 + \frac{2}{T} \sum_{s=1}^{K} \left( 1 - \frac{S}{K_i + 1} \right) \sum_{j=1}^{T} \hat{e}_{i} \hat{e}_{i-s}$$  

(7)

Step 4: Compute the residuals of the ADF test for $\hat{e}_{it}$ ($\hat{u}_{it}$) and compute the following variances of these residuals

$$\hat{S}_{it}^2 = \frac{1}{T} \sum_{t=1}^{T} \hat{u}_{it}^2 \quad \text{and} \quad \hat{S}_{NT}^2 = \frac{1}{T} \sum_{t=1}^{T} \hat{S}_{it}^2$$  

(8)

Step 5: Computation of panel-t and group-t statistics (see, for details, Pedroni, 2000). These statistics are asymptotically normally distributed.

The null of no cointegration is then tested, based on the above description of standard normal distribution. The null hypothesis of no cointegration is $H_0$: $\gamma_i = 1$ for $\forall i$ against an alternative hypothesis $H_A$: $\gamma_i < 1$ for $\forall i$, in the residuals from the panel cointegration. In contrast, the group means panel cointegration statistics test the null hypothesis of no
cointegration against an alternative $H_A: \gamma_i < 1$ for $\forall i$, which allows the possibility of an additional heterogeneity source across the countries. These statistics diverge to negative infinity under the alternative hypothesis. So, the left tail of the normal distribution is usually employed here to reject the null hypothesis.

2.3 Panel Data Granger Causality Test

The panel causality test, proposed by Holtz-Eakin et al. (1988), is deployed to know the direction of causality between finance-social development and economic growth in selected 15 Asian countries. The following three models are used for the same.

**Model 1:**

\[
\Delta FSD_t = \eta_j + \sum_{k=1}^{p} \alpha_{1k} \Delta FSD_{t-k} + \sum_{k=1}^{q} \alpha_{2k} \Delta GD_{t-k} + \lambda_k EC_{t-1} + \varepsilon_{it} \tag{9}
\]

\[
\Delta GD_t = \eta_j + \sum_{k=1}^{p} \alpha_{1k} \Delta GD_{t-k} + \sum_{k=1}^{q} \alpha_{2k} \Delta FSD_{t-k} + \lambda_k EC_{t-1} + \varepsilon_{it} \tag{10}
\]

**Model 2:**

\[
\Delta SSD_t = \eta_j + \sum_{k=1}^{p} \alpha_{1k} \Delta SSD_{t-k} + \sum_{k=1}^{q} \alpha_{2k} \Delta GD_{t-k} + \lambda_k EC_{t-1} + \varepsilon_{it} \tag{11}
\]

\[
\Delta GD_t = \eta_j + \sum_{k=1}^{p} \alpha_{1k} \Delta GD_{t-k} + \sum_{k=1}^{q} \alpha_{2k} \Delta SSD_{t-k} + \lambda_k EC_{t-1} + \varepsilon_{it} \tag{12}
\]

**Model 3:**

\[
\Delta FSD_t = \eta_j + \sum_{k=1}^{p} \alpha_{1k} \Delta FSD_{t-k} + \sum_{k=1}^{q} \alpha_{2k} \Delta SSD_{t-k} + \lambda_k EC_{t-1} + \varepsilon_{it} \tag{13}
\]

\[
\Delta SSD_t = \eta_j + \sum_{k=1}^{p} \alpha_{1k} \Delta SSD_{t-k} + \sum_{k=1}^{q} \alpha_{2k} \Delta FSD_{t-k} + \lambda_k EC_{t-1} + \varepsilon_{it} \tag{14}
\]
where FSDI is the composite index of financial sector development, SSDI is composite index of social sector development, GDP is per capita GDP growth. The ECT is the lagged error correction term derived from the long run cointegrating relationship. The $\varepsilon_{1it}$ & $\varepsilon_{2it}$ are the disturbance terms. The null hypotheses are to test $\alpha_{12i} \neq 0 \& \lambda_{1i} \neq 0$ in equation (9) and $\alpha_{22i} \neq 0 \& \lambda_{2i} \neq 0$ in equation (10). The significance of $\alpha_{12}$ and $\alpha_{22}$ represent the possibility of short run causality, while the significance of $\lambda_{1i}$ & $\lambda_{2i}$ represent the possibility of long run causality. In the similar fashion, model 2 and model 3 can be interpreted.

The empirical analysis is based on panel of selected 15 Asian countries, namely Bangladesh, Bhutan, India, Pakistan, Sri Lanka, China, Hong Kong, Japan, South Korea, Indonesia, Malaysia, Philippines, Singapore, Thailand and Vietnam, over the period 1960-2012. The data are obtained from World Development Indicators, World Bank, Washington. The variables incorporated in the panel VAR model are used in natural logarithms so that their first differences approach the growth rates.

3. Empirical Results

The investigation starts with the integration and cointegration properties of time series variables. The estimated results confirm that variables are integrated of order one [1 (1)] and cointegrated (see, Tables 3 & 4 respectively), indicating the presence of long run equilibrium relationship between financial development, social development and economic growth.
After knowing the status of cointegration, the next step is to check the direction of causality between them. The panel Granger causality test, based on panel VAR model, is used for the same. The Figure 1 illustrates the symmetric representation of the Granger causal relationships among financial development, social development and economic growth.

The estimated results depict the existence of bidirectional causality between financial development and economic growth. It is imparting to the support of both ‘demand following’ and ‘supply leading’ hypothesis of finance-growth nexus. This result is consistent with the earlier findings of Demetriades and Luintel (1996), Demetriades and Hussein (1996), Blackburn and Hung (1998), Luintel and Khan (1999), Levine (1999), Shan et al. (2001), Caleron and Liu (2003), Ang (2008), Wolde-Rufael (2009), Pradhan (2011), Bangake and Eggoh (2011), Pradhan (2011), and Hassan et al. (2011). On the contrary, this goes against the views of Christopoulos and Tsionas (2004), who found unidirectional causality from financial development to growth, and Jung (1986), who found unidirectional causality from growth to financial development. The latter is, in fact, more appropriate in the developing countries because of the increasing demand for financial services.

The study further finds unidirectional causality from economic growth to social development. This implies that social sector development depends upon the level of economic growth. This results are consistent with the findings of Ram (1985), Goldstein (1985), Strauss and
Thomas (1995), Mazumdar (1996), Iqbal and Nadeem (2006), Cutler et al. (2005), Haddad et al. (2003), and Hosseini and Kaneko (2012). The study also finds unidirectional causality from financial development to social development and supports the findings of Outreville (1999). The estimated results of these three findings are supported by the generalized impulse response functions (GIRFs), which are very responsive to panel VAR results.

In brief, the empirical results suggest that financial development and economic growth cause each other and they are very instrumental to determine the level of social development. The results are consistent with the assertion that well-developed financial sectors may help to increase both economic growth and social development in the 15 selected Asian countries.

4. Conclusion and Policy Implications

Understanding the policy implications of the nexus between financial development, social development and economic growth is of great importance in the development economics. Much still needs to be understood about the various integrations among these three in order for the policy makers to make the right decisions about the development policy.

We presume that financial development and economic growth is the key to long run social development. The debate is, however, whether they cause each other or they predict the level of social development in the economy. The existing literature provides, particularly on the causal nexus between financial development and economic growth, very
inconclusive findings (see, for instance, Hassan et al., 2011; De Gregorio and Guidotti, 1995). This study provides some more limelight on this unending debate by investing for 16 Asian countries over the period 1960-2012.

The findings demonstrate the presence of long run relationship between financial development, social development and economic growth. The causality analysis confirms the existence of bidirectional causality between financial development and economic growth and they predict the level of social development in the panel of 15 Asian countries. The policy implications of these empirical are straightforward. If policymakers want to promote social development, the attention should be more on the long run relationships between financial development and economic growth. This requires well-functioning financial systems, particularly with sound financial intermediation and liberalized financial indicators like market capitalization, turnover ratio and liquid liabilities, all of which are important for the efficient allocation of financial resources, which in turn help to maintain sustainable economic growth and social development in these countries.

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References


### Table 1. Definition of Variables for Financial Sector Development

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAC</td>
<td>Market capitalization: Percentage change in the market capitalization of the listed companies.</td>
</tr>
<tr>
<td>TRA</td>
<td>Traded stocks: Percentage change in the total value of traded stocks.</td>
</tr>
<tr>
<td>TUR</td>
<td>Turnover ratio: Percentage change in the turnover ratio in the stock market.</td>
</tr>
<tr>
<td>BRM</td>
<td>Broad money: This is the ratio of broad money (currency plus demand deposits and quasi-money) to GDP.</td>
</tr>
<tr>
<td>CLM</td>
<td>Claims on private sectors: It include gross credit from the financial system to private sector.</td>
</tr>
<tr>
<td>DCB</td>
<td>Domestic credit to private sector: It is the ratio of domestic credit to GDP. It refers to financial resources provided to the private sector.</td>
</tr>
<tr>
<td>PSC</td>
<td>Private sector credit. It is the ratio of private credit by deposit money banks relative to GDP.</td>
</tr>
<tr>
<td>RES</td>
<td>Total reserves: It comprise holdings of monetary gold, special drawing rights, reserves of IMF members held by the IMF, and holdings of foreign exchange under the control of monetary authorities.</td>
</tr>
<tr>
<td>LIQ</td>
<td>Liquid liabilities: It is the ratio of liquid liabilities of the financial system to the GDP.</td>
</tr>
</tbody>
</table>

*Note1:* All monetary measures are in US dollars.

*Note2:* All these indicators are used here as a proxy for “levels of financial sector development”.
Table 2. Definition of Variables for Social Sector Development

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAB</td>
<td>Labour force participation: The percentage of the working-age population (aged 15+ years) who are in the labour force.</td>
</tr>
<tr>
<td>LIF</td>
<td>Life expectancy: The average number of additional years a person can expect to live from a given age onwards.</td>
</tr>
<tr>
<td>URB</td>
<td>Urbanization: The percentage of total population residing in the urban areas.</td>
</tr>
<tr>
<td>IMR</td>
<td>Infant mortality rate: The number of infant deaths per 1000 births.</td>
</tr>
<tr>
<td>CDR</td>
<td>Crude death rate: The total number of deaths per year per 1000 population.</td>
</tr>
<tr>
<td>GER</td>
<td>Gross enrolment ratio: The number of students enrolled in education as a percentage of total population.</td>
</tr>
<tr>
<td>TEL</td>
<td>Telecommunication: The main telephone lines per 100 inhabitants.</td>
</tr>
</tbody>
</table>

Note: All these indicators are used here as a proxy for “levels of social sector development”.

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Table 3. Results of Panel Unit Roots Test

<table>
<thead>
<tr>
<th>Variables</th>
<th>Statistics</th>
<th>At Level</th>
<th>At First Difference</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSDI</td>
<td>LLC</td>
<td>-0.82</td>
<td>-4.80*</td>
<td>1 (1)</td>
</tr>
<tr>
<td></td>
<td>IPS</td>
<td>-1.99</td>
<td>-4.30*</td>
<td>1 (1)</td>
</tr>
<tr>
<td>SSDI</td>
<td>LLC</td>
<td>-1.95</td>
<td>-5.00*</td>
<td>1 (1)</td>
</tr>
<tr>
<td></td>
<td>IPS</td>
<td>-0.82</td>
<td>-4.82*</td>
<td>1 (1)</td>
</tr>
<tr>
<td>GDP</td>
<td>LLC</td>
<td>4.16</td>
<td>-10.0*</td>
<td>1 (1)</td>
</tr>
<tr>
<td></td>
<td>IPS</td>
<td>-1.21</td>
<td>-11.1*</td>
<td>1 (1)</td>
</tr>
</tbody>
</table>

Note: *: Indicates statistical level of significance at 1%; FSDI is financial sector development index; SSDI is social sector development index and GDP is per capita GDP; and LLC and IPS are unit root test statistics.
Table 4. Results of Panel Cointegration Test

<table>
<thead>
<tr>
<th>Test Statistics</th>
<th>No Deterministic Intercept or Trend</th>
<th>Deterministic Intercept &amp; Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1: FSD and GDP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panel v- Statistics</td>
<td>1.84 [0.01] 3.06 [0.01]</td>
<td></td>
</tr>
<tr>
<td>Panel ρ- Statistics</td>
<td>-3.31 [0.00] -3.08 [0.01]</td>
<td></td>
</tr>
<tr>
<td>Panel PP- Statistics</td>
<td>-2.94 [0.00] -4.66 [0.00]</td>
<td></td>
</tr>
<tr>
<td>Panel ADF- Statistics</td>
<td>-1.79 [0.00] -2.65 [0.02]</td>
<td></td>
</tr>
<tr>
<td>Group ρ- Statistics</td>
<td>-0.23 [0.20] -0.82 [0.03]</td>
<td></td>
</tr>
<tr>
<td>Group PP- Statistics</td>
<td>-0.76 [0.10] -0.61 [0.00]</td>
<td></td>
</tr>
<tr>
<td>Group ADF- Statistics</td>
<td>-1.55 [0.01] -1.90 [0.01]</td>
<td></td>
</tr>
<tr>
<td>Model 2: SSD and GDP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panel v- statistic</td>
<td>1.629 [0.05] 3.970 [0.00]</td>
<td></td>
</tr>
<tr>
<td>Panel ρ- statistic</td>
<td>-1.346 [0.09] 1.629 [0.05]</td>
<td></td>
</tr>
<tr>
<td>Panel PP- statistic</td>
<td>-1.718 [0.04] -1.630 [0.05]</td>
<td></td>
</tr>
<tr>
<td>Panel ADF- statistic</td>
<td>-0.950 [0.17] -0.994 [0.18]</td>
<td></td>
</tr>
<tr>
<td>Group ρ- statistic</td>
<td>0.153 [0.56] 0.142 [0.66]</td>
<td></td>
</tr>
<tr>
<td>Group PP- statistic</td>
<td>-1.346 [0.09] -1.298 [0.09]</td>
<td></td>
</tr>
<tr>
<td>Group ADF- statistic</td>
<td>-1.040 [0.15] -0.750 [0.16]</td>
<td></td>
</tr>
<tr>
<td>Model 3: FSD and SSD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panel v- statistic</td>
<td>2.010 [0.02] 1.890 [0.03]</td>
<td></td>
</tr>
<tr>
<td>Panel ρ- statistic</td>
<td>-1.320 [0.09] -1.450 [0.05]</td>
<td></td>
</tr>
<tr>
<td>Panel PP- statistic</td>
<td>-1.220 [0.11] -1.420 [0.06]</td>
<td></td>
</tr>
<tr>
<td>Panel ADF- statistic</td>
<td>0.550 [0.52] 0.65 [0.56]</td>
<td></td>
</tr>
<tr>
<td>Group ρ- statistic</td>
<td>-1.837 [0.03] -1.498 [0.05]</td>
<td></td>
</tr>
<tr>
<td>Group PP- statistic</td>
<td>-1.994 [0.02] -1.830 [0.03]</td>
<td></td>
</tr>
<tr>
<td>Group ADF- statistic</td>
<td>-2.911 [0.00] -2.656 [0.00]</td>
<td></td>
</tr>
</tbody>
</table>

Note: Parentheses indicate probability level of significance.
Figure 1. Causal Relations among Financial Development, Social Development and Economic Growth