Financial Development and Economic Growth: Evidence from Heterogeneous Panel Data of Low Income Countries

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Abstract

This paper examines empirical relationship between financial development and economic growth while incorporating the inflation rate effect on financial development for low income countries. The study focuses on both the indirect finance and the direct finance, separately as well as collectively. We apply most appropriate econometric methodology of Weinhold (1999) and Nair-Reichert and Weinhold (2001) for causality analysis in heterogeneous panel data. Two sets of results are reported. First, the relationship between financial development and economic growth from contemporaneous non-dynamic fixed effects panel estimation can at best be interpreted as mixed. *Negative and statistically significant estimates of coefficient of the inflation and financial development interaction variable indicate that financial sector development is actually harmful for economic growth when inflation is rising*. Second, in contrast with the recent evidence of Beck and Levine (2003), use of more appropriate econometric methodology of dynamic heterogeneous panel for causality analysis and a refined model reveal that there is no definite indication that finance spurs economic growth or growth spurs finance. Our findings are in line with the Lucas (1988) view on finance that the importance of financial matters is very badly over-stressed in popular and even much professional discussion.

Introduction

There is a longstanding tradition in economics with the issue of financial development and economic growth (Kirkpatrick 2000). Bagehot (1873) and Hicks (1969) argued that financial system played a critical role in igniting industrialization in England by facilitating the mobilization of capital for "immense works." Schumpeter (1934) emphasized the importance of the banking system in economic growth and highlighted circumstances when banks can actively spur innovation and future growth by identifying and funding productive investments. With the contributions of McKinnon (1973) and Shaw (1973), the relationship between financial development and economic growth has

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been an important issue of debate, and during the last thirty years these studies have fostered a fresh research interest in this relationship. However, Nobel Laureate Lucas (1988) dismisses finance as a major determinant of economic growth calling its role “over-stressed” by economists.

The road from the early work on finance growth nexus to where we are now, however, has not been a straight one (Kirkpatrick 2000). Levine (1997) acknowledges that some recent work has extended our knowledge about the causal relationships between financial development and economic growth but finds that the empirical studies have not unambiguously resolved the issue of causality. Resolving the debate and advancing our understanding about the role of financial factors in economic growth, if any, will help distinguish among competing theories of the process of economic growth (Levine, 2003b). Khan and Senhadji (2000) stresses that the relationship between financial development and economic growth needs to be refined and appropriate estimation methods employed. This paper is an attempt on both of these fronts.

There is both theoretical and empirical literature suggesting that increases in the rate of inflation can adversely affect financial market conditions (Khan, Senhadji, and Smith [2003]). Following Harris and Gilman (2004) we assume that financial development effect (the coefficient of the proxy for financial development) is a function of inflation rate, we introduce an interaction (of financial development and inflation) variable in the model relating financial development and growth and thus take the proxy for financial development and inflation rate both individually as well as in product in the empirical model we estimate.

Furthermore, in most of the empirical literature either individual country time series analysis or cross-sectional methodology has been used. Where time series analysis is confined to individual country studies, cross-sectional methodology has been criticized on its failure to control effectively for cross country heterogeneity. Some studies have used a panel GMM estimator to assess the finance and growth relationship. This approach improves upon pure cross-country work in various respects. However, Kiviet (1995) shows that panel data models that use instrumental variables estimation often lead to poor finite sample efficiency and bias. Considering the heterogeneous nature of the relationship between financial development and economic growth across countries, we use most appropriate methodology of panel causality analysis for heterogeneous panel data.

Our main objective is to investigate the causal relationship between financial development and economic growth by using panel data of 9 Low Income Countries (LIC) for the period 1973-2002. This paper contributes to the existing literature relating to finance growth nexus in at least two ways. First, this study uses most advanced and appropriate econometric methodology for causality analysis in heterogeneous panel data. Second, we use a refinement in the econometric model, generally used for empirical research related to finance growth nexus, by taking care of inflation rate effect on financial development.

Our empirical findings suggest that the relationship between financial development and economic growth from contemporaneous non-dynamic fixed effects panel estimation can at best be interpreted as mixed. Negative and statistically significant estimates of coefficient of the inflation and financial development interaction variable indicate that financial sector development is actually harmful for economic growth when inflation is increasing in low income countries. Furthermore, in contrast with the recent evidence of Beck and Levine (2003), use of more appropriate econometric methodology of dynamic heterogeneous panel for causality analysis and a refined model reveal that there is no definite indication that finance spurs economic growth or growth spurs finance. Our findings are in line with the Lucas (1988) view on finance that the importance of financial matters is very badly over-stressed in popular and even much professional discussion.

Next Section reviews some of the theoretical and the empirical work relating to the relationship between financial development and economic growth. Section 3 begins by embarking on the model we use in our empirical work in this paper. Here we show how we attempt to follow the advice of Khan and Senhadji (2000) to refine the relationship between financial development and economic growth. Here we detail the data issues related to the empirical work in this paper and then we discuss the methodology of dynamic heterogeneous panel approach of Nair-Reichert and Weinhold (2001) for causality analysis. In Section 4 we provide empirical results. Last Section, while concluding, gives a summary of the overall picture and through some light on policy implications.

2. Review of Literature

Economists hold startlingly different views about the impact of financial sector, including banks and markets on long- run economic growth. The views over finance-growth nexus can be grouped into four schools of thoughts. First, *finance promotes growth*. Banks are the best engines that ever were invented for creating economic growth [Bagehot (1873), Schumpeter, (1934), Hicks (1969), McKinnon (1973), Shaw (1973)]. Second, *finance hurts growth*. As is explained in Levine (2003) this followers of this school has the opinion that banks have done more harm to the morality, tranquility, and even wealth of this nation than they have done or ever will do good. It is argued that although financial institutions facilitate risk amelioration and efficient allocation of resources, this will not necessarily boost growth because better finance means greater returns to saving (which may lower the savings rates) and lower risk (which may also result in lower savings) and both may yield lower growth. Third, *finance follows growth* - where enterprise leads finance follows [Robinson (1952)]. Economic growth creates demand for financial arrangements and financial sector responds automatically to these demands. Fourth, *finance doesn't matter.* According to Lucas (1988) economists overstress the role of finance in economic growth.

Empirical work on finance and growth has been done in various dimensions[2]. A number of papers studied the issue in a cross-country framework. A lot of studies made purely time-series investigations. Some others used panel data approach. Where time series analysis is confined to individual country studies, cross-sectional methodology has been criticized on its failure to control effectively for cross country heterogeneity. Studies like Levine, Loayza and Beck (2000) and Beck, Levine, and Loayza (2000) have used a panel GMM estimator to assess the finance and growth relationship.

The use of panel GMM estimator improves upon pure cross-country work in various respects described above, but Kiviet (1995) shows that panel data models that use instrumental variables estimation often lead to poor finite sample efficiency and bias.

[2] Levine (1997) and Levine (2003b) provide a comprehensive survey in this regards

Some studies allow for heterogeneity but restricted to the intercept and not permitted in the slope coefficients. Pesaran and Smith (1995) show that if in a dynamic panel data model slope coefficients are assumed to be constant but in fact they vary across countries, the traditional panel estimators (fixed effects or GMM estimators) yield inconsistent estimates.

Furthermore studies that use period average, whereby time-series characterizing each variable is collapsed into single observation, are also criticized because of possibly nonstationary nature of these data. Van den Berg and Schmidt (1994) and van den Berg (1997) argue that nonstationarity of many time series makes the use of such period averages inappropriate. Variables are often nonstationary containing stochastic or deterministic trends. Such variables either have a mean that is changing through time or have expanding variance. Regression estimates from cross section data created from averages of such time series are not well suited for characterizing prospective long run relationship among variables.

One possible solution to the problems discussed above is the use of time-series, cross-section panel data estimation. This allows the researchers to control for country-specific, time-invariant "fixed effects," and include dynamic, lagged dependent variables which can also help to control for omitted variable bias. The ability to lag explanatory variables may also help control for endogeneity bias. But the traditional panel data fixed effects estimators (FEE) imposes homogeneity assumptions on the coefficients of lagged dependent variables when in fact the dynamics are heterogeneous across the panel. Pesaran (1995) argues that this misspecification can lead to serious biases that cannot be remedied with instrumental variable estimation. Then we have Mean Group Estimators of

Pesaran and Smith (1995)[3]. The MG estimator gives us an unweighted average of the country specific coefficients and is thus particularly sensitive to outliers. A simple RC estimator, on the other hand, calculates a variance weighted average, but unfortunately it is not possible to estimate dynamic RC models [Nair-Reichert and Weinhold (2001)].

The Mixed Fixed Random (MFR) effects approach of Hsiao et al (1989) which has been exploited by Weinhold (1999) and Nair-Reichert and Weinhold (2001) falls somewhere in between the two extremes of FEE and MGE in terms of allowing for heterogeneity. This method imposes more structure on the coefficient values of the exogenous variables than the MGE (after all, if the relationship is completely idiosyncratic across countries then it is difficult to meaningfully interpret the results from an economic or policy perspective). As compared to FE estimator with small T, MFR coefficients approach produces considerably less biased parameter estimate [Nair-Reichert and Weinhold (2001)]. Weinhold (1999) shows that the MFR coefficients model performs well compared to instrumental variables (GMM) approaches as well.

In addition, the MFR coefficients model has other features which make it ideally suited to the task of testing for causality in heterogeneous panel data sets. In particular, Weinhold (1999) allows for a distribution of causality across the panel, rather than imposing an assumption that causality occurs everywhere, or nowhere, in the panel. We may use the distributional information to gain a general idea of the degree of heterogeneity. The combination of a less-biased mean estimate and an idea of the degree of heterogeneity

[3] There is another estimator, the pooled mean group estimator of Pesaran, Shin and Smith (1999), which is used specifically when variables are cointegrated and cointegration relationship can theoretically be expected to be equal (homogeneous) across all countries.

gives a researcher more information about the underlying process than traditional panel causality tests.

Nausser and Kugler (1998) uses heterogeneous panel data approach but this study is only for a limited number of developed countries of OECD and that after doing panel cointegration analysis this study uses individual country Granger causality methodology for causality analysis.

Recently, Christopoulos and Tsionas (2003) use panel unit root tests and panel cointegration analysis to examine the relationship between financial development and economic growth in ten developing countries. But for causality analysis they use time-series tests to yield causality inferences within a panel context.

After showing that the relationship between financial development and economic growth is heterogeneous across countries, we use most appropriate methodology of panel causality analysis for heterogeneous panel data.

Other than the methodological issues the literature on finance growth relationship has ignored (to the best of our knowledge) the inflation rate effects on financial development. Chari, Jones and Manuelli (1996) argue that financial regulations and their interaction with inflation have substantial effects on growth. There are some other studies which discuss how inflation is linked with the financial sector. Choi, Smith, and Boyd (1996) argue that inflation reduces real return to savings and makes more severe the adverse selection problems in capital markets inducing a high degree of credit rationing and have negative impact on financial development. In a monetary growth model Huybens and Smith (1999) show that, at the steady state, higher rates of money creation reduces the real return on all assets and, under certain conditions, lead to a reduction in the volume of trading in equity markets. Boyd, Levine and Smith (2001) consider alternative theory regarding the relationship between inflation and financial sector performance and that is a fiscal story. Governments combine high inflation with various restrictions on the financial sector to help fund expenditures. As a result, they have both poorly developed financial systems and high inflation.

Barro (1997) finds that permanent increases in the rate of inflation have significant negative effects on the long run real growth rates. Khan, Senhadji, and Smith (2003) asserts that the real effects of inflation derives from the consequences of inflation for financial markets conditions. Thus analysis of finance development and economic growth relationship is incomplete without considering the inflation rate effects on financial development. We fill this gap in literature by incorporating a financial development and inflation interaction variable in the model relating economic growth and financial development.

3. Model, Data, and Econometric Methodology

3.1 Model

Following King and Levine (1993) the growing body of empirical work models the relationship between financial development and economic growth using the linear regression equation give below.

$$G = \alpha + \beta F + \gamma X + e \qquad (3.1)$$

where G is the proxy for economic growth, F is the proxy for financial development and X is the set of conditioning information to control for other factors associated with economic growth. e is finally the error term.

In spirit of model (3.1) above, this paper starts with a similar model for our heterogeneous panel data

$$G_{it} = \alpha_i + \beta_i' F_{it} + \gamma_i X_{it} + e_{it} \tag{3.2}$$

where $i = 1,2,...,N$, and $t = 1,2,...,T_i$.

N refers to the number of countries, and T_i refers to the number of observations over time for country i in the panel. G denotes proxy for economic growth and F denotes proxy for financial development. The parameter α_i is the country specific intercept, or fixed effect parameter, which of course is also allowed to vary across individual countries[4]. Slope coefficient is also allowed to vary across nations to take into account the possible heterogeneity[5] among the various countries in a panel.

Let us see what includes the conditioning set. Following the recent literature on the analysis of financial development and economic growth, four other variables are included in the conditioning set to control for other factors associated with economic growth, in addition to the initial real GDP per capita. These include measures of (in)stability (inflation), fiscal policy (government consumption to GDP ratio), trade policy (overall trade to GDP ratio), and education (secondary school enrollment ratio). We use secondary school enrollment ratio with 5 year lag because people in secondary school at time t will generally be entering the labour force in some latter time and will not be productive for 5 years or so. We proxy the initial level of income by real GDP per capita

[4] Country specific fixed effects heterogeneity is assumed on the basis of differences in technology.
[5] Even though we have grouped countries according to their level of income, there is still heterogeneity between the countries in the panel. There are different sources of such heterogeneity like differences in population size, differences in political and economic institutions, differences in geography, and differences in culture. Thus we take slope coefficients to be heterogeneous in the causality analysis we do.

and we use this with 1 year lag as we take annual growth rates on LHS of the regression equation. Thus we relate the real per capita growth (GRGPC) to initial level of education, the initial level of GDP, rate of inflation (INFL), the ratio of government consumption to GDP (GCGR), and the ratio of exports plus imports to GDP (TRGR). Previous studies have shown that these variables correlate significantly with real per capita GDP growth (Barro, 1997). GRGPC is negatively related to Inflation (INFL), government consumption to GDP ratio (GCGR), and initial level real per capita GDP (RGPC); and is positively related to overall trade to GDP ratio (TRGR) and initial level of secondary school enrollment ratio (SSER).

We can write (3.2) as:

$$GRGPC_{it} = \alpha_i + \beta_{1i}' F_{it} + \beta_{2i} INFL_{it} + \beta_{3i} GCGR_{it} + \beta_{4i} TRGR_{it} + \beta_{5i} SSER_{it-5} + \beta_{6i} RGPC_{it-1} + \varepsilon_{it} \quad (3.3)$$

ε_{it} are assumed to be idiosyncratic errors.

Before adding the proxy for financial development we will estimate **general model** (meaning generally used) that is contemporaneous non dynamic fixed effects panel model of economic growth by regressing the GRGPC on all its determinants: INFL, GCGR; TRGR; SSER; and initial RGPC. Dropping the insignificant variables (if any) from among these we will be left with a parsimonious **basic model** for economic growth. To this basic model we will add the proxy for financial development and have an **intermediate model** to see what financial development contributes to the economic growth.

In order to capture the (adverse) impact of increases in the rate of inflation on financial market conditions, following Harris and Gilman (2004), we assume that financial development effect, β'_{1i} is a function of inflation rate effect. A simply way to allow for such an effect is to write β'_{1i} as $\beta'_{1i} = \beta_{1i} + \beta_{7i} INFL_{it}$. By substituting it back into (3.3) we get.

$$GRGPC_{it} = \alpha_i + \beta_{1i} F_{it} + \beta_{2i} INFL_{it} + \beta_{3i} GCGR_{it} + \beta_{4i} TRGR_{it} + \beta_{5i} SSER_{it-5} + \beta_{6i} RGPC_{it-1} + \beta_{7i} (F * INFL)_{it} + \varepsilon_{it} \quad (3.4)$$

In this way we arrive at our **final model** which includes the proxy for financial development and inflation both individually as well as in product to our basic model.

To provide a sense of whether there is a casual relationship between economic growth and the financial development we turn to the dynamic panel form of (3.4) in which GRGPC is modeled as a function only of lags of itself and of all other right hand side variables in (3.4). That is:

$$GRGPC_{it} = \alpha_i + \gamma_i GRGPC_{it-1} + \beta_{1i} F_{it-1} + \beta_{2i} INFL_{it-1} + \beta_{3i} GCGR_{it-1} + \beta_{4i} TRGR_{it-1} + \beta_{5i} SSER_{it-6} + \beta_{6i} RGPC_{it-2} + \beta_{7i} (F * INFL)_{it-1} + \varepsilon_{it} \quad (3.4a)$$

To take care of the linear influences of the remaining right-hand side variables in (3.4a) on the candidate causal variable, we orthogonalize the candidate causal variable and thus our **final model in dynamic form** becomes:

$$GRGPC_{it} = \alpha_i + \gamma_i GRGPC_{it-1} + \beta_{1i} F^{o}_{it-1} + \beta_{2i} INFL_{it-1} + \beta_{3i} GCGR_{it-1} + \beta_{4i} TRGR_{it-1} + \beta_{5i} SSER_{it-6} + \beta_{6i} RGPC_{it-2} + \beta_{7i} (F * INFL)_{it-1} + \varepsilon_{it} \quad (3.5)$$

All the variables in the model are assumed to be stationary.

3.2 Data

One of the important issues pertaining to the analysis of the finance growth nexus is that of selection of proxies to measure financial development and economic growth. For economic growth, following King and Levine (1993), we use the real per capita GDP growth. We denote it by GRGPC[6].

There does not exist a single accepted empirical definition of financial development [Beck, Demirguc-Kunt, and Levine (2001)]. Previous studies have used various indicators of financial intermediary and stock market size and activity to measure the financial development. Following King and Levine [1993]; Levine and Zervos [1998]; and Beck, Demirguc-Kunt, and Levine [2001] we use various indicators of size and activity of the indirect as well as direct finance as a proxy for financial sector development. We also combine the size and activity measures of direct and indirect finance to proxy the overall financial sector development. As a whole, we have six measures of financial sector development which will be used one by one in this study. These measures are discussed below.

The size of indirect finance

To measure size of the financial intermediaries we use currency plus demand and interest bearing liabilities of banks and other financial intermediaries divided by GDP which is generally known as liquid liabilities to GDP ratio. We denote it by LLGR. This is the broadest available indicator of financial intermediation.

[6] For complete list of data variables and sources of data see Appendix.

The proxy for size of the financial sector may not accurately measure the functioning of the financial system. Here we also consider a measure which takes into account the activity of the financial sector.

The activity of indirect finance

To measure the activity of financial intermediaries we consider private sector credit by deposit money banks and other financial institutions to GDP ratio. We denote it by PCGR. There is a positive significant correlation between real per capita GDP growth and the extent to which loans are directed to the private sector (Levine, 1997).

The size of direct finance

As an indicator of the size of direct finance we use the stock market capitalization to GDP ratio, denoted by MCGR, which equals the market value of listed shares divided by GDP.

The activity of direct finance

As an indicator of the activity of direct finance we use total value of the shares traded in the stock market to GDP ratio, dented by VTGR.

The size of overall financial sector

To have an overall size measure of the financial sector we combine the two size measures and call it as financial depth to GDP ratio, denoted by FDGR, which is sum of the LLGR and MCGR.

The activity of overall financial sector

To have an overall activity measure of the financial sector we combine the two activity measures and call it as financial activity to GDP ratio, denoted by FAGR, which is sum of the PCGR and VTGR.

We have two types of measures: first, the ratio of a stock variable to a flow variable that is LLGR; and second the ratios of two flow variables that is PCGR. Whereas stock variables are measured at the end of a period, the flow variables are defined relative to a period. This presents a problem in the first type of measures, both in terms of correcting timing and in terms of deflating correctly. To address these problems, we deflate the end-of-year financial aggregates by end-of-year consumer price indices (CPI_e) and deflate the GDP series by annual consumer price index (CPI_a) following Demirguc-Kunt and Levine (2001). Then we compute average of the real financial aggregate in year t, and $t-1$ and divide this average by real GDP measured in year t. The end-of-year CPI is either the value for December, or, where December-CPI is not available, for the last quarter. The formula, for LLGR, is the following:

$$LLGR = 0.5 * \left(\frac{LLB_t}{CPI_{e,t}} + \frac{LLB_{t-1}}{CPI_{e,t-1}} \right) \Big/ \left[\frac{GDP_t}{CPI_{a,t}} \right] \qquad (3.6)$$

In case of the ratio of two flow variables measured in the same time deflating is not necessary.

We use a dataset of 9 LIC countries listed in the Appendix. The countries have been selected from the overall list of Low Income Countries for which World Bank publishes income classification in its World Development Indicators[7]. The countries included are selected on two criterions: there is data both on indirect as well direct finance; and that data are available for at least 15 observations for both type of finance. The time dimension of the dataset is that we use annual data starting from 1973 which is the year in which heroic pieces of work by MacKinnon and Shaw were published.

3.3 Methodology

In recent empirical research there has been an upsurge of interest in the development and use of methods for nonstationary panels, including panel unit root and panel cointegration tests. In particular, there exist some interesting contributions on heterogeneous panels. Before moving to regression analysis we test for stationarity of the variables we use. For this purpose we apply Im Pesaran and Shin (2002) panel unit root test for dynamic heterogeneous panels which is based on the average (across countries) of the (augmented) Dickey-Fuller statistics.

3.3.1 Panel Unit Root Tests

First we consider the calculation of individual country unit root (augmented) Dickey-Fuller test-statistics denoted by $\tilde{t}_{iT_i}$. The process starts by estimating the following (augmented) Dickey-Fuller regression

$$\Delta y_{it} = \alpha_i + \delta_i t + \rho_i y_{it-1} + \sum_{j=1}^{p_i} \Delta y_{it-j} + \varepsilon_{it} \tag{3.7}$$

[7] The World Development Indicators for year 2002 has been used. The country classification is based on World Bank estimates of per capita GNI during 2000. Countries for which estimates of per capita GNI are US$ 755 or less are classified as Low Income Countries.

for each of the cross sectional unit in the panel and estimating the value of the t-statistics and then averaging them. The decision of the number lags of the dependent variables to be included depends on stationarity of the error term and here we will be using step down procedure by starting at maximum lag of four.

The null hypothesis for the IPS panel unit root test is

$$H_0 : \rho_i = 0 \text{ for all } i \tag{3.8}$$

against the alternatives

$$H_1 : \rho_i < 0, \text{ for } i = 1,2,...,N_1, \text{ and } \rho_i = 0, \text{ for } i = N_1 + 1, N_1 + 2,..., N \tag{3.9}$$

This formulation of alternative hypothesis allows for ρ_i differing across groups It allows for some (but not all) of the individual series to have unit roots under the alternative hypothesis. Essentially, the IPS test averages the ADF individual unit root test statistics that are obtained from estimating (3.7) for each i (allowing each series to have different lag length, p_i if necessary); that is:

$$\tilde{t} - bar_{NT} = \frac{1}{N}\sum_{i=1}^{N}\tilde{t}_{iT_i} \tag{3.10}$$

which is referred to as $\tilde{t} - bar$ statistic.

IPS shows that under the assumption that $\varepsilon_{it}, i = 1,2,..., N, t = 1,2,..., T_i$ in (3.7) are independently and identically distributed for all i and t with mean zero and finite heterogeneous variances σ_i^2, $\tilde{t}_{iT_i}$ are independently (but not identically) distributed for $T_i > 9$ and that the standardized $\tilde{t} - bar$ statistic

$$Z_{tbar} = \frac{\sqrt{N}\left\{\tilde{t} - bar_{NT} - N^{-1}\sum_{i=1}^{N} E(\tilde{t}_{T_i})\right\}}{\sqrt{N^{-1}\sum_{i=1}^{N} VAR(\tilde{t}_{T_i})}}, \tag{3.11}$$

converges to standard normal variate[8] as N increases indefinitely.

While testing for panel unit roots at level we take both unobserved effects and heterogeneous time trend in our equation as in equation (3.7). If in no case we can reject the null hypothesis that every country has a unit root for the series in levels, we then test for a unit root in first differences.

If we find that the main variables of interest that is the proxy for economic growth and that for financial development are of same order of integration and that none of the control variables is of higher order than that of the dependent variable then we move towards testing for possible cointegration between financial development and economic growth. Otherwise we say the order of integration of series of interest does not support to move to cointegration analysis. Since, on the basis of the evidence documented in Lee, Pesaran and Smith (1997) and in Canning and Pedroni (1999), we expect our dependent variable (growth in real GDP per capita) and the variables of interest to be stationary and hence we do not expect to be in need of the application of panel cointegration analysis and thus we do not discuss it.

3.3.2 Contemporaneous Fixed Effects Model Estimation

After ensuring the stationarity of the variables of interest we move to the estimation process. Assuming the slope coefficients to be homogeneous we estimate model in (3.4)

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[8] IPS standardized their test statistics based on simulations of the mean and variance (with different values obtained depending on the lag length used in the ADF tests and the value of N). These simulated values are given in IPS (2002).

using fixed effects methodology in with the country specific fixed effects are wiped out and each variable is replaced by its deviation form cross-sectional means. To this transformed data OLS method is applied. However, for calculating the estimated t-values robust variance estimator proposed in Arellano (1987) is used to address the issue of possible heteroscedasticity.

3.3.3 Panel Causality Analysis for Dynamic Heterogeneous Panel Data Model

We then examine the direction of causality, if there is any, between financial development and economic growth using most advanced and appropriate econometric methodology of panel causality analysis for dynamic heterogeneous panel data models given by Weinhold (1999) and Nair-Reichert and Weinhold (2001). This methodology is based upon mixed fixed random (MFR) coefficients approach of Hsiao et al (1989).

We examine the direction of causality between financial development and economic growth, and vice versa, using methodology introduced by Weinhold (1999) and Nair-Reichert and Weinhold (2001) for causality analysis in heterogeneous panel data which is based upon mixed fixed random (MFR) coefficients approach of Hsiao et al (1989).

Following Nair-Reichert and Weinhold (2001), we consider the model

$$y_{it} = \alpha_i + \gamma_i y_{it-1} + \beta_{1i} x^o_{1it-1} + \beta_{2i} x_{2it-1} + \varepsilon_{it} \qquad (3.14)$$

where $\beta_{ji} = \overline{\beta}_j + \eta_i$. η_i is a random disturbance. Here $\beta_{ji} \sim N(\overline{\beta}_j, \sigma^2_{\beta_j})$. The variable x^o_{1it-1} denotes the orthogonalized candidate causal variable after the linear influences of the remaining right-hand side variables have been taken into account. Orthogonalization[9] provides for appropriate interpretation of the estimated variances by making sure that the coefficients are independent. Unobserved effects (α_i) and the coefficient of the lagged dependent variable are fixed and country specific; and the coefficients on the exogenous explanatory variables are drawn from a random distribution with mean $\bar{\beta}_j$ and finite variance[10].

Let Y be dependent variable; Z contains vector of 1s for intercept, and the lagged dependent variables, i.e. those for which we have fixed coefficients; X has orthogonalized causal candidate variable, and other control variables, i.e. all other right hand side variables for which we have random coefficients. We denote the vector of all the right hand side variables (including unobserved effects) by W, i.e. it contains all the variables that are in Z and X. Let θ_2 be vector of fixed coefficients (which are f in number) and θ_1 be vector of random coefficients (which are r in number). Let θ denotes the vector of all fixed as well as random coefficients.

We estimate θ_1 by

$$\tilde{\theta}_1 = [\sum_{i=1}^{N} X_i'\phi_i^{-1} X_i - \sum_{i=1}^{N} X_i'\phi_i^{-1} Z_i (Z_i'\phi_i^{-1} Z_i)^{-1} Z'\phi_i^{-1} X_i]^{-1} [\sum_{i=1}^{N} X_i'\phi_i^{-1} Y_i - \sum_{i=1}^{N} X_i'\phi_i^{-1} Z_i (Z_i'\phi_i^{-1} Z_i)^{-1} Z'\phi_i^{-1} Y_i] \quad (3.15)$$

which is the GLS estimate of θ_1 under MFR coefficients assumption. Here

$$\phi_i = (X_i \Delta_r X_i' + \hat{\sigma}_i^2 I_{T-1}) \quad (3.16)$$

9 For the purpose of orthogonalization of the lagged casual candidate variable, we regress the lagged causal candidate variable upon constant, lagged dependent variable and all other explanatory variables. We use errors of this regression as orthogonalized (lagged) causal candidate variable.

10 Weinhold (1999) explains why to model this particular combination of fixed individual specific coefficients on the lagged dependent variable and random coefficients on the lagged independent variables

and $\hat{\sigma}_i^2$ is OLS estimate of error variance of individual regression of Y_i upon W_i, i.e. $Y_i = W_i\theta_i + error$, and Δ_r is the covariance matrix which is sub-matrix for random coefficients from

$$\Delta = \frac{1}{N-1}\sum_{i=1}^{N}(\hat{\theta}_i - \bar{\hat{\theta}})(\hat{\theta}_i - \bar{\hat{\theta}})' \tag{3.17}$$

where $\hat{\theta}_i$ is the OLS estimate from individual regression of Y_i upon W_i, i.e. $Y_i = W_i\theta_i + error$ and $\bar{\hat{\theta}}$ is the average of such $\hat{\theta}_i$s for the individuals countries in the panel.

We estimate individual coefficients under MFR effects approach by

$$\tilde{\theta}_{1i} = [\frac{1}{\hat{\sigma}_i^2}\{X_i'X_i - X_i'Z_i(Z_i'Z_i)^{-1}Z_i'X_i\} + \Delta_r^{-1}]^{-1}[\frac{1}{\hat{\sigma}_i^2}\{X_i'X_i - X_i'Z_i(Z_i'Z_i)^{-1}Z_i'X_i\}\hat{\theta}_{1i} + \Delta_r^{-1}\tilde{\theta}_1] \tag{3.18}$$

and

$$\tilde{\theta}_{2i} = (Z_i'Z_i)\{Z_i'(Y_i - X_i\tilde{\theta}_{1i})\} \tag{3.19}$$

We have

$$\tilde{u}_{it} = Y_{it} - \tilde{\theta}_{2i}Z_{it} - \tilde{\theta}_1 X_{it}$$

and mean square error is

$$\tilde{\sigma}^2 = (\sum u_{it}^2)\big/\{\sum T_i - (f * N + r)\}$$

and

$Var(\tilde{\theta}) = \tilde{\sigma}^2 (W'W)^{-1}$ from which we can have standard errors ($\tilde{\sigma}_{\tilde{\theta}}$) of the MFR effects estimates.

For causality testing, we have to build confidence interval around zero[11] (here we will use the first element in the vector $\tilde{\theta}_1$ which is $\tilde{\theta}_{1[1]}$) for which the lower and upper bounds are given below:

Lower Bound (Confidence Interval): $\{(-2) * \sqrt{N}\tilde{\sigma}_{\tilde{\theta}_{1[1]}} - \tilde{\theta}_{1[1]}\} \big/ \Delta_{r_{11}}$

Upper Bound (Confidence Interval): $\{2 * \sqrt{N}\tilde{\sigma}_{\tilde{\theta}_{1[1]}} - \tilde{\theta}_{1[1]}\} \big/ \Delta_{r_{11}}$

The area that falls within this interval is interpreted to correspond to observations that are not significantly different from zero[12].

4. Empirical Analysis

4.1 Statistical properties of the data

Table 4.1A shows summary statistics of various variables we have used in this study. The most important analysis from this table relates to the comparison of within-country standard deviation and between-country standard deviation for all the variables we have. This analysis reveals that for all the variables most of the variability in the data occurs between countries which shows the heterogeneity between the countries for all these variables.

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[11] Theoretically speaking; for population parameter under the null hypothesis that $\theta_{1[1]}$ is zero.

[12] For panel causality analysis, we use SAS version of the program (which calculates estimate of the coefficient of the causal variable, its standard error, the confidence interval and the estimate of the variance of the estimated random coefficient) developed by Diana Weinhold and available on her site linked with that of London School of Economics, UK. This SAS program does not orthogonalize the candidate casual variable, however, we did it.

The pair-wise correlations matrix is presented in the Tables 4.1B. The growth in real per capita GDP correlates positively with secondary school enrollment ratio in addition to all the indicators of financial development. In accordance with the Barro (1997)'s finding that big government is bad for growth, government consumption to GDP ratio is negatively correlated to real GDP per capita growth. Similarly, in line with the Barro's results, the rate of inflation has negative correlation with real GDP growth rates. Only unexpected sign is that of the correlation between openness (proxy by TRGR) and real per capita GDP growth and that may be because either the trade in the low income countries is not fully liberalized or the initial conditions for trade liberalizations were not met when the liberalization process started in such countries. Finally, inflation rate is negatively correlated with all the measure of financial development except MCGR which is very near to zero. An interesting feature is that the (absolute) correlation coefficients between inflation and financial development, in most of the proxies of financial development, are higher if we compare them the correlation coefficients between financial development and economic growth.

4.2 Im-Pesaran-Shin Panel Unit Root Test

In the Table 4.2 we present the results of Im-Pesaran-Shin (2002) panel unit root (IPS PUR) test on all variables used in this study. It is evident that all the variables are stationary at level except LLGR which is nonstationary and becomes stationary after first differencing[13].

While testing for panel unit roots at level we take both unobserved effects and heterogeneous time trend in our equation as in equation (3.7) in Section 3. One may

[13] We will be using first differences of LLGR in the panel causality analysis in next section

argue, particularly in the case of growth rate of real GDP per capita and inflation, that there is no reason to include the heterogeneous time trend while testing for unit root but it is observed while doing analysis that the orders of integration of growth and inflation are insensitive to whether or not we include the heterogeneous time trend.

4.3 Contemporaneous Fixed Effects Model Estimation

In order to explore the relationship between financial development indicators and economic growth, we start with the estimation of contemporaneous non dynamic fixed effects panel estimation of the most general form which relates growth rate of GDP per capita to inflation, government consumption to GDP ratio, overall trade to GDP ratio, (initial) secondary school enrollment ratio and the (initial) level of per capita GDP[14]. We drop the variables with insignificant coefficients and arrive at the basic model. To the basic model we include the proxy for financial development and have intermediate model. Our final model is one where we have inflation and financial development both individually and in product form included in the basic model.

4.3.1 Indirect Finance and Economic Growth

Table 4.3.1 gives the results of simple contemporaneous non dynamic fixed effects panel estimation. The results show that all the four explanatory variables in the basic model have appropriate sign. These results are consistent with standard growth theory. Inflation depresses growth due to its adverse implications for working markets like rising price variability which makes the log term planning difficult. Government consumption is observed to affect growth negatively. It may be because of well know inefficiencies associated with the larger size of the government. Negative significant coefficient of

[14] All the variables are in log form.

initial level of per capita GDP is in accordance with the conditional convergence growth theories. Initial secondary school enrollment has positive effect on growth rate of GDP per capita.

As regard to impact of financial development on growth, the results show that coefficients of the proxies of both the size and the activity of financial sector are negative and statistically insignificant. However, when the interaction of finance with inflation is introduced, then the coefficients of the proxies of both the size and the activity of the financial sector become positive but remain insignificant.

From here we observe that for the LIC finance does not matter for growth and the data we use support the Lucas view and our results are in line with the most recent findings of Barro and Sala-i-Martin (2004). It is interesting to note that both the interaction variables are highly significant and have negative sign. It implies economic growth returns of financial sector development actually declines with the increased inflation for LIC. In other words a negative significant coefficient on the interaction term means that financial development accelerates the negative effect of inflation on growth rate of GDP per capita. Another important observation is that the magnitude of the partial effect of inflation on growth rate of GDP per capita is much larger in the final model as compared to that in the basic model which shows that inflation may be a much serious issue in financially developed stage of economy as its impact is larger than that can be at the lesser (financially) developed stage of the economy in case of Low Income Countries.

4.3.2 Direct Financial Development and Economic Growth

Now we examine the links between economic growth and financial development considering direct sources of finance, i.e. stock market. We will follow all the same step as we did for indirect finance.

Table 4.3.2 gives the results of simple contemporaneous non dynamic fixed effects panel estimation. The basic model is the same as we discussed above. By including proxies for direct finance as regressors we re-estimate the simple contemporaneous non dynamic fixed effects panel regression and results are shown in the column under intermediate model. The coefficients of the proxies of both the size and the activity of financial sector are statistically insignificant in the intermediate model which becomes significant in the final model when we include interaction variables. This shows that size and activity of direct finance has strong positive relationship with economic growth for LIC. The interaction of inflation with size of direct finance has a negative significant coefficient which has the interpretation that growth return of increase in the size of financial sector decreases with inflation. If we consider the positive significance of the size measure of direct finance we can not ignore the fact that the magnitude of the estimated coefficient of the interaction variable is larger than that of the size of the direct financial development and hence even with the low level of inflation the total impact of financial sector development has negative impact on growth rate of GDP per capita. The interaction of inflation with activity of direct finance has a negative significant coefficient at 10% level. All the other explanatory variables have expected signs in the final model as well as in basic and intermediate models which are consistent with the theory.

Here also, like in case of indirect finance, we observe that the magnitude of the partial effect of inflation on growth rate of GDP per capita is much larger in the final model as compared to that in the basic model. It again shows that inflation may be a much serious issue in financially developed stage of economy as its impact is larger than that can be at the lesser (financially) developed stage of the economy in case of Low Income Countries.

4.3.3 Overall Financial Development and Economic Growth

Table 4.3.3 gives the results of simple contemporaneous non dynamic fixed effects panel estimation for the panel. The basic model is the same as we have discussed already. By including proxies for overall finance as regressors we re-estimate the simple contemporaneous non dynamic fixed effects panel regression and results are shown in the column under intermediate model. The coefficients of the proxies of both the size and the activity of overall financial sector are statistically insignificant in the intermediate model. When the interaction of finance with inflation in introduced, then the coefficient of the proxy of the size turns to be positively significant and that of the activity of overall financial sector remain insignificant. It is interesting to note that both the interaction variables are highly significant and have negative sign. It implies that economic growth returns of further financial sector development actually declines with the increased inflation in the case of Low Income Countries.

Like in above cases of indirect and direct finance we observe that the magnitude of the partial effect of inflation on growth rate of GDP per capita is much larger in the final model as compared to the basic model. It again shows that inflation may be a much serious issue in financially developed stage of economy as its impact is larger than that can be at the lesser (financially) developed stage of the economy in case of Low Income Countries.

4.4 Panel Causality Analysis

Entire analysis of contemporaneous non-dynamic fixed effects panel estimation presented above is based on underlying assumption about the homogeneity of the relationships in questions across countries in the respective panels. Heterogeneity is restricted to the intercept but is not permitted in the slope coefficients. Now we will be moving to the causality analysis based on our dynamic model. We apply Reichert and Weinhold (2001) panel causality method to our final model in dynamic form in equation (3.5). In this model the coefficient on the lagged dependent variable is country specific and the coefficients on the other RHS variables are allowed to have normal distribution. We choose a lag length of one due to the large number of explanatory variables and relatively short time series for each country. The results are presented in Table 4.4 where we report the mean of the estimated coefficient, standard error of the mean of the estimated coefficient, and the variance estimate of the estimated coefficient on the causal variable.

For causality testing, we build confidence interval around zero (here we will use the first element in the estimated vector $\tilde{\theta}_1$ which is $\tilde{\theta}_{1[1]}$ which is to be tested to be zero) to test for mean of the estimated coefficient on the causal variable to be zero. The lower and upper bounds are given below:

LB (Confidence Interval): $\{(-2) * \sqrt{N}\tilde{\sigma}_{\tilde{\theta}_{1[1]}} - \tilde{\theta}_{1[1]}\} / \Delta_{r_{11}}$

UB (Confidence Interval): $\{2 * \sqrt{N}\tilde{\sigma}_{\tilde{\theta}_{1[1]}} - \tilde{\theta}_{1[1]}\} / \Delta_{r_{11}}$

The area that falls within this interval is interpreted to correspond to observations that are not significantly different from zero.

We do not find evidence that the mean of the estimated coefficient of the orthogonalized causal candidate variable is significantly different from zero. Thus the results of the tests of causality from indirect finance to growth as well as that of causality from growth to indirect finance show that both are independent of each other and hence we find support for Lucas view that the economists overstress the role of finance.

In cases of direct finance and overall financial development also we do not find any evidence of causal effect of financial development on economic growth as the estimated coefficient of the orthogonalized causal candidate variables are significantly insignificant.

However, when we conduct the reverse causality analysis we find that economic growth has negative impact upon the activity in financial sector in the cases of direct finance and overall financial development.

5. Conclusion

This study examines empirical relationship between financial development and economic growth while incorporating the inflation rate effect on financial development highlighted in the literature by Huybens and Smith (1999); De Gregorio and Sturzenegger (1994a, b); Boyd, Levine, and Smith (2001); and Khan, Senhadji, and Smith (2003). We present evidence using panel data of Low Income Countries. We apply most advanced and appropriate econometric methodology of panel causality analysis for heterogeneous panel data given by Weinhold (1999) and Nair-Reichert and Weinhold (2001). Our study focuses both indirect finance and direct finance, separately as well as collectively. Simple statistical analysis made in Section 4, with the comparison of within-country standard deviation and between-country standard deviation for all the variables we have, revealed that for all the variables most of the variability in the data occurs between countries which shows the heterogeneity between the countries for all these variables. None of the variables have larger within-country variation. This justifies our use of heterogeneous panel methodology for causality analysis.

The evidence of the relationship between financial development and economic growth from contemporaneous non-dynamic fixed effects panel estimation can at best be interpreted as mixed. We do not find any positive significant relationship between indirect finance and economic growth. We do find that the direct finance is significantly positively related to economic growth. It is interesting, however, to note that we find significant and positive relationship between size of the overall financial development and economic growth against the evidence of no relationship between activity of the overall financial development and economic.

Negative significant estimates of coefficient of the inflation and financial development interaction variable indicate that financial sector development is actually more harmful for economic growth with the increased inflation in such countries or putting in a simple way: *higher inflation is more harmful for economic growth for these countries at more developed stage of the financial system as compared to the less developed financial system.* Monetary authorities of such countries have to take care of this possible threat while their countries' financial sector grows. In cases where we find the interaction term to be significant, the magnitude of the partial effect of inflation on growth rate of GDP per capita is found to be larger in the final model as compared to that in the basic model which shows that inflation may be a much serious issue in financially developed stage of economy as its impact is larger than that can be at the lesser (financially) developed stage of the economy.

The contemporaneous analysis is based on underlying assumption about the homogeneity of the relationships in questions across countries in the respective panels. However, it is reasonable to expect quite a bit of heterogeneity in such relationships as we discussed in chapter 4. Reichert and Weinhold (2001) exploits MFR coefficients approach of Hsiao et al (1989) to develop a panel causality method allowing for heterogeneous dynamics across countries and for a distribution over the coefficients on the other explanatory variables. We apply panel Reichert and Weinhold (2001) panel causality method to our final model in dynamic form for various panels of the countries.

In contrast with the recent evidence of Beck and Levine (2003), use of more appropriate econometric methodology of dynamic heterogeneous panel for causality analysis and a refined model reveal that there is no indication that financial development spurs economic growth or growth spurs financial development. Our findings are in line with the Lucas view on finance that the importance of financial matters is very badly over-stressed in popular and even much professional discussion.

The empirical proxies of the financial development, which most of the past empirical studies have used, and following these we have used in this study, may not measure accurately the concepts emerging from theoretical models. Theories focus on particular functions provided by the financial sector, like producing information, exerting corporate governance, facilitating risk management, pooling savings, and easing exchange – and how these functions influence recourse allocation decisions and economic growth. Future research that concretely links the concepts from theory with the data may substantially improve further our understanding of the finance growth link.

In this study we have not touched upon the issues related to research on the relationship between financial development and economic growth employing the industry-level and firm-level data. However, to further improve our understanding of the finance growth relation future research work may focus to model this relationship while incorporating the inflation effect on financial development using the industry-level and firm-level data while applying heterogeneous dynamic panel methodology for causality analysis. We may hope some interesting outcomes from such research.

Appendix

Table 3.1: Countries Included in Study

Country	Time Span and Number of Observations		
	From	To	
Bangladesh	1987	2001	15
Cote d'Ivoire	1981	2001	21
India	1977	2001	25
Indonesia	1977	2000	24
Kenya	1976	2001	26
Korea, South	1974	2002	29
Nigeria	1978	2001	24
Pakistan	1984	2001	18
Zimbabwe	1981	1999	19
Total Observations			**201**

Table 3.2: Data Description and Sources

Variable	Data Description and Source
CPIa	Annual Consumer Price Index from IFS (Line 64)
CPIe	End-of-year CPI from IFS (Line 64M, or 64Q where 64M is not available)
GDP	Gross Domestic Product from IFS (Line 99B)
LLB	Liquid Liabilities from IFS (Line 55L or 35L, if 55L is not available)
MCP	Market Capitalization from Global Financial Data Base
PCR	Claims of Private Sector from IFS [Lines 22D.MZF, 22D.TZF, 22D.ZF, 42D.FZF, 42D.GZF, 42D.LZF, 42D.NZF, and 42D.SZF are included]
POP	Population (Line 99Z)
VTD	Value Traded from Global Financial Data Base
GCE	Government Consumption Expenditures from IFS (Line 91F)
TRD	Sum of Exports and Import (Line 90C+98C from IFS) of Goods and Services
GRGPC	Annual percentage growth rate of GDP per capita based on constant local currency from WDI-2004. (Dependent Variable)
LLGR	Liquid Liabilities to GDP ratio
PCGR	Private sector credit to GDP ratio
MCGR	Stock market capitalization to GDP ratio
VTGR	Stock market total value traded to GDP ratio
FDGR	(Overall) financial depth to GDP ratio
FAGR	(Overall) financial activity to GDP ratio
INFL	Inflation Rate Calculated from CPIa
GCGR	Government Consumption Expenditures to GDP ratio
TRGR	International Trade (sum of Exports and Import of Goods and Services) to GDP ratio
SSER	Gross Secondary School Enrollment Ratio from UNESCO
RGPC	GDP per capita based on purchasing power parity from WDI-2004

Table 4.3.1: Indirect Finance and Economic Growth

Contemporaneous "Fixed Effects" Panel Regressions: Dependent Variable= GRGPC: Heteroscedasticity Consistent t-statistics in parentheses

Variable	General Model	Basic Model	Intermediate Model		Final Model	
			Size	Activity	Size	Activity
INFL	-0.2114 (-2.69**)	-0.2117 (-2.55**)	-0.2117 (-2.55**)	-0.2097 (-2.59**)	-0.6255 (-3.22**)	-0.5867 (-4.19**)
GCGR	-0.0474 (-2.52**)	-0.0456 (-2.68**)	-0.0427 (-2.35**)	-0.0408 (-2.39**)	-0.0381 (-2.17**)	-0.0377 (-2.09**)
TRGR	0.0094 (0.74)					
SSER	0.0249 (3.10**)	0.0246 (3.03**)	0.0225 (3.11**)	0.0238 (2.79**)	0.0260 (2.83**)	0.0284 (3.24**)
RGPC	-0.0299 (-2.97**)	-0.0311 (-2.95**)	-0.0243 (-2.00**)	-0.0223 (-1.64**)	-0.0321 (-2.34**)	-0.0317 (-1.94*)
LLGR			-0.0148 (-1.14)		**0.0293** **(1.58)**	
PCGR				-0.0153 (-1.52)		**0.0116** **(0.61)**
INFL.LLGR					-0.3414 (-2.82**)	
INFL.PCGR						-0.2400 (-3.61**)
NT	199	199	199	199	199	199
R^2	0.2229	0.2195	0.2246	0.2307	0.2903	0.3152

**Significant at 5% size;*Significant at 10% size.

Table 4.3.2: Direct Finance and Economic Growth

Contemporaneous "Fixed Effects" Panel Regressions: Dependent Variable= GRGPC: Heteroscedasticity Consistent t-statistics in parentheses

Variable	General Model	Basic Model	Intermediate Model		Final Model	
			Size	Activity	Size	Activity
INFL	-0.2114 (-2.69**)	-0.2117 (-2.55**)	-0.2137 (-2.52**)	-0.2101 (-2.56**)	-0.5276 (-3.60**)	-0.4108 (-2.48**)
GCGR	-0.0474 (-2.52**)	-0.0456 (-2.68**)	-0.0446 (-2.57**)	-0.0440 (-2.70**)	-0.0444 (-2.87**)	-0.0430 (-2.74**)
TRGR	0.0094 (0.74)					
SSER	0.0249 (3.10**)	0.0246 (3.03**)	0.0235 (2.54**)	0.0244 (2.94**)	0.0289 (3.11**)	0.0257 (3.27**)
RGPC	-0.0299 (-2.97**)	-0.0311 (-2.95**)	-0.0359 (-3.30**)	-0.0339 (-2.54**)	-0.0417 (-4.66**)	-0.0387 (-2.87**)
MCGR			0.0028 (1.02)		**0.0166** **(6.59**)**	
VTGR				0.0010 (0.49)		**0.0052** **(1.82*)**
INFL.MCGR					-0.1306 (-3.13**)	
INFL.VTGR						-0.0388 (-1.78*)
NT	199	199	199	199	199	199
R^2	0.2229	0.2195	0.2227	0.2205	0.2893	0.2662

**Significant at 5% size;*Significant at 10% size

Table 4.3.3: Overall Finance and Economic Growth

Contemporaneous "Fixed Effects" Panel Regressions: Dependent Variable= GRGPC: Heteroscedasticity Consistent t-statistics in parentheses

Variable	General Model	Basic Model	Intermediate Model		Final Model	
			Size	Activity	Size	Activity
INFL	-0.2114 (-2.69**)	-0.2117 (-2.55**)	-0.2125 (-2.52**)	-0.2123 (-2.62**)	-0.4997 (-3.51**)	-0.4313 (-2.96**)
GCGR	-0.0474 (-2.52**)	-0.0456 (-2.68**)	-0.0462 (-2.47**)	-0.0418 (-2.30**)	-0.0435 (-2.44**)	-0.0401 (-2.23**)
TRGR	0.0094 (0.74)					
SSER	0.0249 (3.10**)	0.0246 (3.03**)	0.0247 (3.14**)	0.0244 (2.88**)	0.0297 (3.59**)	0.0269 (2.92**)
RGPC	-0.0299 (-2.97**)	-0.0311 (-2.95**)	-0.0339 (-2.63**)	-0.0206 (-1.44)	-0.0479 (-3.78**)	-0.0277 (-1.56)
FDGR			0.0043 (0.28)		**0.0499 (3.86**)**	
FAGR				-0.0111 (-1.46)		**0.0053 (0.37)**
INFL.FDGR					-0.3198 (-3.04**)	
INFL.FAGR						-0.1588 (-2.32**)
NT	199	199	199	199	199	199
R^2	0.2229	0.2195	0.2200	0.2275	0.3084	0.2896

**Significant at 5% size;*Significant at 10% size

Table 4.4: Reichert and Weinhold (2001) Panel Causality Analysis

		Causality		Reverse Causality	
		Size	Activity	Size	Activity
Indirect Finance	Estimated Coefficient	**0.0096**	**-0.0487**	**-0.0258**	**0.4119**
	Standard Error	0.0690	0.0762	0.7699	1.0222
	LB (Confidence Interval)	**-2.6839**	**-4.5154**	**-3.5272**	**-1.8752**
	UB (Confidence Interval)	**2.5626**	**5.5914**	**3.5668**	**1.6392**
	Est. Coefficient Variance	0.0249	0.0082	1.6962	12.1826
Direct Finance	Estimated Coefficient	**0.0047**	**0.0060**	**-0.3347**	**-2.0784****
	Standard Error	0.0097	0.0048	3.5707	4.5769
	LB (Confidence Interval)	**-2.6297**	**-4.3592**	**-3.4292**	**-1.4603**
	UB (Confidence Interval)	**2.2383**	**2.8596**	**3.5381**	**1.6994**
	Est. Coefficient Variance	0.0006	0.0001	37.8218	302.1487
Overall Finance	Estimated Coefficient	**0.0073**	**-0.0322**	**-0.1077**	**-1.4776****
	Standard Error	0.0727	0.0664	1.2469	1.1890
	LB (Confidence Interval)	**-3.0122**	**-4.5973**	**-4.4458**	**-1.1648**
	UB (Confidence Interval)	**2.9127**	**5.4047**	**4.5757**	**1.7733**
	Est. Coefficient Variance	0.0217	0.0063	2.7510	23.5830

**Significant at 5% size, *Significant at 10% size

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