

# Stock Markets, Banks and Long Run Economic Growth: A Panel Cointegration-Based Analysis

Laurent Cavenaile<sup>a</sup>, Christian Gengenbach<sup>b</sup>, Franz Palm<sup>1c</sup>

<sup>a</sup>*New York University, USA*

<sup>b</sup>*Maastricht University, The Netherlands*

<sup>c</sup>*Maastricht University, The Netherlands*

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## Abstract

The aim of this paper is to investigate the long run relationship between the development of banks and stock markets and economic growth. We make use of a Johansen-based panel cointegration methodology allowing for cross-country dependence to test the number of cointegrating vectors among these three variables for 5 developing countries. In addition, we test the direction of potential causality between financial and economic development. Our results conclude to the existence of a single cointegrating vector between financial development and growth and of causality going from financial development to economic growth. We find little evidence of reverse causation as well as bi-directional causality. We interpret this as evidence supporting the significance of financial development for economic development.

*Keywords:* Banks, Stock Markets, Economic Growth, Panel Cointegration, Causality

*JEL:* E44, G20, O43

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## 1. Introduction

Almost one hundred years ago, Schumpeter (1912) already addressed the relation between financial development and economic growth. He asserted that a well-functioning financial system should promote economic growth

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<sup>1</sup>Corresponding author: School of Business and Economics, Maastricht University. Address: P.O.B 616, 6200 MD Maastricht, The Netherlands. Tel.: +31 43 3883833. Email: F.Palm@MaastrichtUniversity.nl

through the selection of the productive investments which are the most likely to be successful and the efficient allocation of resources (via bank credits) to these innovative technologies. Since then, the financial system has significantly evolved. Access of private companies to funding through financial markets has been improved and stock markets have been established in almost any part of the world. New financial products have also been created which allow better risk diversification and allocation. Although all these improvements may have had a positive impact on economic development in many countries through better resource allocation and risk diversification, recent events have also shown that misused financial innovations can have adverse effects on short run economic stability. Moreover, measures taken to reestablish systemic stability in the wake of the recent subprime crisis have important implications for economic development policies. If financial development facilitates long run economic development, expanding the banking system and stock markets in developing countries might help promote their long run economic growth. One central question is then to investigate whether financial development has had a positive impact on economic growth in the long run. In addition, it is also of prime importance to determine whether the structure of the financial system is relevant. In other words, we want to know whether banks and stock markets can both promote long run economic development.

The goal of this paper is to analyze the potential link between financial development and economic growth in the long run using data from 5 developing countries (Malaysia, Mexico, Nigeria, Philippines and Thailand) between 1977 and 2007. While this question has already been quite extensively investigated in the literature, the contribution of this paper with respect to existing studies is fourfold. First, this paper does not only focus on the development of the banking system or financial markets alone but integrates both aspects of financial development hence allowing to highlight potentially different roles and implications on the growth of financial intermediaries such as banks and financial markets. Second, the use of a panel-based cointegration analysis allows us to investigate the potential existence of a long run equilibrium and causality between both aspects of financial development and economic growth while reducing the well-known size and power distortions which arise in time series analyses with short time dimension. Third, while a few papers have already used cointegration analysis in panel data in the same context (for instance Christopoulos and Tsionas (2004) or Apergis et al. (2007)), our study is the first to apply these techniques to both banking

system and financial markets simultaneously. Fourth, our paper is also innovative in the sense that we use a Johansen system approach (in contrast with residual-based analysis used in the existing literature) which allows us to take into account and test for more than a single (assumed) cointegrating relation among all the variables. Besides, the Groen and Kleibergen (2003) procedure that we implement in the next sections of this paper accommodates contemporaneous cross-country correlation, which also represents an extension with respect to the existing literature.

The rest of this paper is structured as follows: in the first section, we propose a review of the literature which summarizes current theoretical and empirical research on the link between finance and growth. We then present our data and methodology as well as the results from our empirical investigation.

## 2. Literature review

In contrast with Schumpeter (1912), several authors argue that if a relationship exists between financial development and economic growth, it is of the reverse direction i.e. financial intermediation occurs in response to economic growth (see for instance Robinson (1952)). Patrick (1966) formalizes both approaches to the direction of causality between finance and economic growth. He suggests a demand-following process in which financial institutions develop in response to the increasing demand of the real side of the economy for these kind of institutions (which might be a consequence of economic growth). On the other hand, the supply-leading hypothesis supposes that the banking system develops in advance of the demand for banking services, provides efficient resource allocation and hence stimulates entrepreneurship and economic growth.<sup>2</sup>

The development of endogenous growth models in the 1980's provided a theoretical explanation of the impact of financial development on economic growth in the long run. There are mainly two channels through which finan-

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<sup>2</sup>We can define four hypotheses regarding the relationship between finance and growth. The supply-leading hypothesis argues that financial development causes economic growth. The demand-following hypothesis assumes the reverse causality. We might also consider a bi-directional causation where finance leads to growth and in turn growth supports the development of financial institutions. Possibly, there might be no causal relation between both variables.

cial development may influence long run economic growth i.e. by fostering capital accumulation and/or promoting technological innovation.<sup>3</sup>

From the increased savings perspective, the results are somewhat ambiguous. While the development of the financial system might positively influence the amount of savings through more efficient fund mobilization, Devereux and Smith (1994) show that risk mitigation through diversification may lead to a decrease in savings and hence economic growth. On the other hand, Pagano (1993) argues that financial development could influence the proportion of savings which are effectively invested. If financial development decreases the proportion of savings lost in the intermediation process through for instance increased competition, it can in turn result in higher long run economic growth.

Other models focus on the potential impact of financial intermediation on technological innovation and productivity improvement to derive a role for banks and stock markets in promoting long run economic growth. Financial intermediaries allow investors to decrease the idiosyncratic and liquidity risk that they would have to bear in the absence of financial institutions. The pooling of funds by financial intermediaries enables them to diversify risk and to direct a part of savings to less liquid but more productive investments (Greenwood and Jovanovic (1990), Bencivenga and Smith (1991), Levine (1991), Saint-Paul (1992) and Greenwood and Smith (1997)).

In addition to risk diversification, several studies highlight the ability of financial intermediaries to gather at a lower average cost and to efficiently use information about potential investments and their ensuing capacity to select the most profitable projects (King and Levine (1993b) and Berthelemy and Varoudakis (1996)).

Whereas this literature emphasizes the potential causal relation from financial development and economic growth, several studies have put forward a bi-directional causal relationship. While financial development may support economic growth, economic growth is a prerequisite for the formation of a financial system. Greenwood and Jovanovic (1990) and Greenwood and Smith (1997) define a process which goes from an early stage of low economic growth and inefficient financial system to well-developed financial intermediaries and higher growth rates. Berthelemy and Varoudakis (1996) find

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<sup>3</sup>For a deeper analysis of the financial system functions which might have an impact on capital accumulation and technological changes, see Levine (1997).

the same reciprocal relation between economic growth and banking system development.

From the empirical point of view, many studies have investigated the potential link and causality direction between financial development and economic growth by using varied econometric techniques. The empirical literature on finance and economic development has mainly developed around four econometric approaches: from cross-sectional regressions to panel cointegration through panel and time series estimations.

A large part of the cross-sectional literature focuses on the relation between the banking system and economic growth. To test whether banking development is a good predictor of long term economic performance, King and Levine (1993a) perform cross-sectional regressions using initial (beginning of period) values of financial development indicators and subsequent economic growth. Their results support the idea of a leading role of financial development on economic growth. King and Levine (1993b) confirm these findings by using a similar approach. Gregorio and Guidotti (1995) find a significantly positive relation between banking system development and growth although they find that the effect of financial development on economic growth is weaker in high income countries than in medium and low income countries. Deidda and Fattouh (2002) confirm the overall positive relation between finance and growth although they show that it holds only for high per capita income countries and that it is not significant for low income countries. To avoid potential simultaneity, Levine (1999) and Levine et al. (2000) use indicators of the regulatory and legal environment to extract the exogenous components of banking system development. Their results confirm a significant positive relationship between financial development and economic growth. McCaig and Stengos (2005) enlarge the set of instrumental variables and reach the same conclusion with respect to the positive link between financial development and economic growth.

While most of the cross-sectional literature focuses on the relationship between banking system development and economic growth, some authors also investigate the potential role of financial markets in promoting economic growth by using a cross-sectional approach. Atje and Jovanovic (1993) study both the effect of banks and financial markets on economic growth. They conclude to a significantly positive effect of stock market development on economic growth while their results regarding the banking system are not conclusive. Harris (1997) invalidates the results of Atje and Jovanovic (1993) and finds at best a weak relation between stock market development and eco-

conomic growth. Unlike Atje and Jovanovic (1993) Levine and Zervos (1998) allow both banking and stock market development to enter their regression. They find that both banking system development and stock market liquidity are significantly correlated with future economic growth, suggesting that financial intermediaries and equity markets may provide different and complementary services which eventually help to spur economic development.

Following the cross-sectional literature on finance and economic growth, panel-based analyses have attempted to solve potential bias of cross-sectional regression arising from unobservable country specific effects. In this context, Levine et al. (2000) use the dynamic panel estimators proposed by Arellano and Bond (1991) and Arellano and Bover (1995). Levine et al. (2000) find a positive correlation between financial intermediaries development and economic growth. Beck and Levine (2004) and Rousseau and Wachtel (2000) investigate the effect of stock market development in combination with financial intermediaries by using similar econometric procedures. They conclude that both stock markets and banks have a positive impact on growth. Unlike most of panel-based studies, Dawson (2003) finds no relationship between financial development and economic growth in a fixed and random effect panel estimator framework.

At the same time that the panel based approach developed, another part of the empirical literature started to make an extensive use of time series methodologies. This approach not only permits to test causality direction but it also allows to investigate the long run relationship between finance and economic growth by testing potential cointegration between these variables. In addition, it relaxes the hypothesis of a single and homogenous (across countries) relationship between financial development and economic development. On the other hand, the time series approach requires a sufficient number of observations to provide meaningful results, which may not be available for many countries. Demetriades and Hussein (1996) first test for potential cointegration between banking and economic development indicators that they report to be integrated of order one. They find little support of the supply-leading hypothesis. They indicate bi-directional links between finance and economic growth in most cases and even going from economic growth to finance in some cases. Neusser and Kugler (1998) confirm the ambiguity of the causality between finance and growth and the great variability of the results from one country to another. Luintel and Khan (1999) support the bi-directional hypothesis. On the other hand, Xu (2000) shows strong evidence that financial intermediaries development induces economic growth.

Arestis et al. (2001) study potential cointegration between economic growth, stock market and banking development. They show that both banks and stock markets have a positive impact on long run economic growth while the effect of the former is stronger. The results of Caporale et al. (2004) support the hypothesis that financial development fosters economic growth mainly through stock markets.

Recently, a few studies have investigated the relation between finance and growth using panel cointegration techniques. These techniques can notably solve the problem of the small size of samples that time series methodology faces while retaining the attractive features of the time series approach in testing potential long run relations between financial and economic variables. Using measures of banking and economic development, Christopoulos and Tsionas (2004) test for cointegrating vectors in a panel of 10 countries. They find a single cointegrating vector and conclude to a long run impact of financial development on economic growth. Apergis et al. (2007) enlarge the sample of countries and the set of banking development indicators used by Christopoulos and Tsionas (2004). In addition, they allow for coefficient heterogeneity across countries. They conclude to a bi-directional causality between financial intermediaries development and economic growth.

### **3. Data and methodology**

To test the potential link between financial development and economic growth, we use 2 different indicators of the banking system and 3 variables for financial markets. Following the existing empirical literature, we focus on the two main variables which are used for the development of financial intermediaries, that are liquid liabilities (LL) over GDP and private credit by deposit money banks over GDP (PRIV). While the relevance of liquid liabilities as a measure of the development of the banking system is questioned (see for instance Gregorio and Guidotti (1995) or Levine (1997) for a discussion of these financial indicators), we nevertheless choose to integrate it in our analysis because of its frequent use in the literature. For financial markets, we use 3 indicators which are the stock market capitalization over GDP (MKTCAP), the stock market turnover ratio (TURN) and the stock market value traded over GDP (VALTRAD). While MKTCAP is a measure of the size of the financial markets relative to the GDP, the other two indicators are measures of the liquidity of the markets. The turnover ratio is measured as the ratio of the value of the trades of domestic shares

divided by the value of listed domestic shares. VALTRAD is computed as the ratio of the value of the trades of domestic shares over GDP. In contrast with TURN which measures liquidity with respect to the size of the financial markets, VALTRAD captures liquidity on an economywide basis. Economic growth is measured as the logarithm of real GDP per capita in local currency (GDP). All financial development indicators are retrieved from Beck et al. (2009) database. Real GDP per capita comes from the World Development Indicator database of the World Bank. Countries are selected on the basis of data availability for all the 6 variables between 1977 and 2007 (31 yearly observations). Based on this selection criterion, our database is composed of five countries: Malaysia, Mexico, Nigeria, Philippines and Thailand. These countries share the additional characteristic of all being developing countries for which the question of the development of the financial system as a source of economic development is of crucial importance.

In the coming sections, we proceed as follow. First, we test the order of integration of our 6 variables. We use the Pesaran (2007) approach to panel unit root testing. This method allows heterogeneity in autoregressive coefficients across individuals and cross-section dependence through a single common factor which can be appropriately proxied by the cross-sectional mean of the endogenous variables  $y_{it}$ <sup>4</sup> and its lagged values. Individual test statistics  $t_{\phi_i=0}$  can be computed on the basis of the following cross-sectionally augmented Dickey Fuller (CADF) regression for an AR(p) error structure ( $\Delta$  denotes first differences):

$$\Delta y_{it} = a_i + \phi_i y_{it-1} + c_i \bar{y}_{t-1} + \sum_{j=0}^p d_{ij} \Delta \bar{y}_{t-j} + \sum_{j=1}^p \delta_{ij} \Delta y_{it-j} + e_{it}. \quad (1)$$

Panel unit root tests can then be implemented on the basis of the individual CADF test statistics. The cross-sectionally augmented version of the Im et al. (2003) test (CIPS) can simply be computed as:

$$CIPS = \frac{1}{N} \sum_{i=1}^N t_{\phi_i=0} \quad (2)$$

where  $t_{\phi_i}$  are the individual CADF statistics.

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<sup>4</sup>He defines  $\bar{y}_t = \frac{1}{N} \sum_{j=1}^N y_{jt}$ .

To avoid too strong an influence of extreme values, Pesaran (2007) proposes to use a truncated version of the CIPS statistics (*CIPS\**) where  $t_{\phi_i=0}$  is replaced by  $t_{\phi_i=0}^*$ <sup>5</sup>:

$$\begin{cases} t_{\phi_i=0}^* = t_{\phi_i=0} & \text{if } -K_1 < t_{\phi_i=0} < K_2 \\ t_{\phi_i=0}^* = -K_1 & \text{if } t_{\phi_i=0} \leq -K_1 \\ t_{\phi_i=0}^* = K_2 & \text{if } t_{\phi_i=0} \geq K_2 \end{cases} \quad (3)$$

Pesaran (2007) reports tables with simulated critical values for CIPS and *CIPS\**.

The small sample properties of several common factor unit root tests have been studied by Gengenbach et al. (2010) who show that the power and size of the Pesaran (2007) test are satisfactory but might be distorted if more than one factor generates the cross-country dependence. We nevertheless keep this method as a sufficient approximation to guide our decision regarding degree of integration of the variables used in our analysis. Evidence of non-zero orders of integration would lead us to apply a cointegration analysis to our variables. We then perform the Groen and Kleibergen (2003) cointegration test and estimation using all potential combinations of banking, stock markets and economic development indicators.<sup>6</sup> This allows us to test for the potential number of long run relationships between them in contrast to the residual-based tests which assume a single cointegration vector. In addition, the Groen and Kleibergen (2003) methodology is a panel Johansen-based approach which also takes into account potential cross-country contemporaneous correlation. Groen and Kleibergen (2003) define a full-system VECM model with unrestricted constant and higher order dynamics as:

$$\Delta Y_t = \lambda + \begin{pmatrix} \Pi_{11} & \dots & \Pi_{1N} \\ \vdots & \ddots & \vdots \\ \Pi_{N1} & \dots & \Pi_{NN} \end{pmatrix} Y_{t-1} + \Gamma W_t + \epsilon_t = \lambda + \Pi Y_{t-1} + \Gamma W_t + \epsilon_t$$

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<sup>5</sup>The values of  $K_1$  and  $K_2$  are chosen such that the probability that individual test statistics lie within the interval  $[-K_1, K_2]$  is high (Pesaran (2007) uses 99.99%)

<sup>6</sup>We decide to work in tri-variate systems instead of including all variables in the analysis for mainly two reasons. First, some financial variables show high levels of correlations which may result in collinearity problems. In addition, we see respectively the two banking and the three stock market series as different indicators of a same variable. We use several indicators for each variable as a robustness check of our results.

where  $Y_{t-1} = (y'_{1t-1} \dots y'_{Nt-1})'$ ,  $\Pi_{ur}$  is  $Nk \times Nk$  ( $k$  is the number of variables),  $\lambda$  is a vector of constants,  $W_t$  contains lagged differences of  $Y_t$  and  $\epsilon_t$  is assumed to be IID  $N(0, \Omega)$ .

Their test is based on the restricted version of the model with  $\Pi$  being restricted to be a block-diagonal matrix denoted by  $\Pi_A$  and in which cross-unit cointegration is ruled out.

$$\Delta Y_t = \lambda + \begin{pmatrix} \Pi_1 & 0 & \dots & 0 & 0 \\ 0 & \ddots & & & 0 \\ 0 & 0 & \dots & 0 & \Pi_N \end{pmatrix} Y_{t-1} + \Gamma W_t + \epsilon_t = \lambda + \Pi_A Y_{t-1} + \Gamma W_t + \epsilon_t,$$

where in our context,  $Y_t$  is composed of GDP and one indicator of both banking and financial market development (in this order).

In the presence of within country cointegration, the blocks on the main diagonal of  $\Pi_A$  have reduced rank  $r$  ( $< k$ ) and can be expressed as  $\Pi_i = \alpha_i \beta_i'$ , with  $\alpha_i$  and  $\beta_i$  being  $k \times r$  matrices. The matrix with  $\alpha_i \beta_i'$  on the main diagonal has rank  $N \times r$  and will be denoted by  $\Pi_B$ . In addition, the homogeneous condition  $\beta_i = \beta, \forall i$  can also be considered. With this additional restriction imposed, the matrix  $\Pi_B$  will be denoted by  $\Pi_C$ . Groen and Kleibergen (2003) show that the restriction  $\beta_i = \beta$  for  $i = 1 \dots N$  can be tested by using the following likelihood ratio test:

$$LR(\Pi_C | \Pi_B) = 2[l_{max}(\Pi_B, \Omega) - l_{max}(\Pi_C, \Omega)] \Rightarrow \chi^2((N-1)r(k-r))$$

where  $\Omega$  is the covariance matrix of  $\epsilon_t$ .

In order to test the potential number of cointegrating vectors among the  $N$  variables by using a likelihood-ratio test as in Johansen's framework, we need estimates of the matrices  $\Pi_A$ ,  $\Pi_B$  (and  $\Pi_C$  if we are interested in the hypothesis of common cointegrating vectors) as well as estimates of  $\Omega$  under the rank restriction from 0 to  $k-1$ . Groen and Kleibergen (2003) propose a GMM-based procedure to obtain such consistent maximum-likelihood estimates. This procedure consists in applying a stepwise maximization of the log-likelihood given in turn a consistent estimate of the matrix  $\Pi$  (for the imposed restriction on its rank) and  $\Omega$ . Once maximum-likelihood estimates are obtained from the iterative procedure described by Groen and Kleibergen (2003), the (common-to-all-units) number of cointegrating vectors can

be tested using the likelihood ratio statistics:

$$LR(\Pi_B|\Pi_A) = T \left[ \ln|\hat{\Omega}(\hat{\Pi}_B)| - \ln|\hat{\Omega}(\hat{\Pi}_A)| \right]$$

Groen and Kleibergen (2003) prove that this test statistics is asymptotically distributed as (for  $T \rightarrow \infty$ ):

$$LR(\Pi_B|\Pi_A) \Rightarrow \sum_{i=1}^N tr \left( \int dB_{k-r,i} S'_i \left[ \int S_i S'_i \right]^{-1} \int S_i dB'_{k-r,i} \right),$$

where  $B_{k-r,i}$  is a (k-r)-dimensional Brownian motion for individual (country)  $i$  with identity covariance matrix and  $S_i$  is (k-r)-dimensional for each individual  $i$  ( $S_i(t) = (B_{k-r,i}(t) - \int_0^1 B_{k-r,i}(t) dt, t - \int_0^1 t dt)$ ).

Critical values are obtained following the Monte Carlo simulation procedure proposed by Johansen (1995) as suggested by Groen and Kleibergen (2003). For each individual  $i$ ,  $tr \left( \int dB_{k-r,i} S'_i \left[ \int S_i S'_i \right]^{-1} \int S_i dB'_{k-r,i} \right)$  is approximated by  $tr \left( \sum_{t=1}^T \epsilon_t Z'_t \left[ \sum_{t=1}^T Z_t Z'_t \right]^{-1} \sum_{t=1}^T Z_t \epsilon'_t \right)$  where  $\epsilon_t$  are independent  $N_{k-r}(0, I)$ .  $Z_t$  is defined as  $(X'_{t-1} - \bar{X}', t - \frac{1}{2}(T+1))'$  where  $X_t$  is a  $(k-r-1)$  dimensional random walk ( $X_t = X_{t-1} + \epsilon_t$ ). Simulated random walks are independent "within" each individual but are correlated "between" individuals according to the covariance matrix  $\Omega$  obtained in the test and estimation procedure. We use  $T=400$  and repeat the procedure 5000 times to obtain critical values.

Once the number of cointegrating vectors is determined, we test (long-run) causality using the framework proposed by Toda and Phillips (1993, 1994) to determine whether financial development has an impact on economic growth in the long run and to discriminate between potentially different impacts of financial intermediaries and financial markets. The reverse causality from economic growth to financial development is also tested. If the variables are not stationary, Sims et al. (1990) and Toda and Phillips (1993) show that Wald test statistics for causality from level a VAR have nonstandard asymptotic distributions which are functions of nuisance parameters. It is shown that test statistics are chi-square distributed under a set of assumptions in terms of the number of cointegrating vectors and rank of submatrices, which renders causality tests almost unpracticable in VAR in level with integrated

variables. In an ECM framework, Mosconi and Giannini (1992) and Toda and Phillips (1993, 1994) show that, under a set of hypotheses, causality likelihood ratio and Wald tests in a cointegrated system are chi-square distributed and more tractable than under a VAR in level setting. Toda and Phillips (1994) propose a test procedure for causality in this context. They start with the following ECM representation where  $J(L)$  denotes a p-th order matrix lag polynomial:

$$\Delta Y_t = J(L)\Delta Y_{t-1} + \alpha\beta'Y_{t-1} + u_t.$$

If for instance the purpose is to test the causality from the last  $n_3$  variables on the first  $n_1$  variables, they partition  $Y_t$  into three subvectors  $Y_{1t}$ ,  $Y_{2t}$  and  $Y_{3t}$  of respective sizes  $n_1$ ,  $n_2$  and  $n_3$ . The null hypothesis of no causality from the last  $n_3$  variables on the first  $n_1$  variables given the  $n_2$  variables  $Y_{2t}$  can be written as:

$$H_0 : J_{1,13} = \dots = J_{p,13} = 0 \quad \text{and} \quad \alpha_1\beta_3' = 0,$$

where  $J_{i,13}$  corresponds to the coefficients on the  $i$  times lagged differences of  $Y_3$  in the first  $n_1$  equations,  $\alpha_1$  are the first  $n_1$  rows of  $\alpha$  and  $\beta_3$  are the last  $n_3$  rows of  $\beta$ .

The first half of the hypothesis refers to short-run causality while the second half is related to long-run causality. Toda and Phillips (1993, 1994) prove that the test statistics related to both sides of the null hypothesis are chi-square distributed provided  $rank(\alpha_1) = n_1$  and  $rank(\beta_3) = n_3$ . Under these conditions (which are easily tested if  $n_1 = n_3 = 1$ ), Toda and Phillips (1994) propose a sequential procedure to test for causality. This procedure is based on the decomposition of the null hypothesis in three different hypotheses on short run dynamic parameters,  $\alpha_1$  and  $\beta_3$  which can be sequentially tested. In this paper, we focus on the long run causality part of this test procedure.

## 4. Results

### 4.1. Panel unit root tests

For each of the 6 variables of interest, we test the order of integration. We apply the Pesaran (2007) individual CADF tests and panel CIPS tests. More particularly, we first test the presence of a unit root in twice differenced series. If this hypothesis is rejected, we then conclude that second differences are

stationary. In a second step, we perform the same test on differenced series. If the null hypothesis of a unit root is rejected<sup>7</sup>, we eventually test level series which are  $I(1)$  if the null hypothesis is not rejected and  $I(0)$  otherwise. We allow for a linear trend and intercept in level series, for an intercept in first differences and for no deterministic component for second differences. Lag selection is based on the BIC information criteria. The results of these sequential tests are reported in Table 1. Starting with second differences, panel unit root tests reject the null of a unit root for almost all variables and countries in our panel as well as for the panel. Regarding first differences, the panel statistics reject the null hypothesis of a unit root at the 5% level for all the variables. The results related to the individual countries are less clear-cut but might be affected by the relatively low test power which characterizes unit root tests in small samples.<sup>8</sup>

Eventually, level series are shown to have a unit root since none of the panel statistics (and few of the individual ones) is rejected even at the 10% level. Consequently, the results from our panel unit root tests conclude to the presence of a unit root in all level series but not in their difference so that they are shown to be  $I(1)$ . As a result, we apply in the next section a cointegration analysis which enables us to determine whether there exists one or more long run relationships among the different variables in our panel.

#### *4.2. Panel cointegration tests and estimation*

Since all the series in our data set have been shown to be  $I(1)$ , we test within-country cointegration for all possible combinations of the economic development indicator plus an indicator of bank and stock market development (6 combinations). We follow the Groen and Kleibergen (2003) methodology which allows us to test the number of cointegrating relationships among each triplet (Johansen-like approach) while taking into account potential cross-country contemporaneous correlation.<sup>9</sup> Indeed, residual-based tests which are based on the assumption of a single known cointegration relation might

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<sup>7</sup>Otherwise, the series is shown to be  $I(2)$ .

<sup>8</sup>Which is one of the main reasons why we use panel statistics instead of individual unit root tests.

<sup>9</sup>Cross-country cointegration is not permitted in this context which is nevertheless not a strong restriction given our topic of interest. Indeed, long run relationships between financial development and economic growth of different countries are not expected to be significant given the domestic nature of all the variables in our data set.

Table 1: Individual CADF and CIPS unit root tests

2nd Difference						
D=0						
	GDP	LL	PRIV	MKTCAP	TURN	VALTRAD
Malaysia	-2.81**	-4.62***	-1.76	-2.42*	-6.19***	-7.41***
Mexico	-3.76***	-3.90***	-4.53***	-4.52***	-4.78***	-7.06***
Nigeria	-6.37***	-7.11***	-4.15***	-2.70**	-3.32**	2.98
Philippines	-4.79***	-2.39*	-3.16**	-3.58***	-7.41***	-7.40***
Thailand	-3.21**	-3.51***	-3.98***	-5.14***	-3.88***	-2.89**
Panel	-4.19***	-4.31***	-3.51***	-3.67***	-5.12***	-4.36***
Panel (trunc.)	-4.13***	-4.11***	-3.51***	-3.67***	-4.84***	-3.65***
1st Difference						
D=1						
	GDP	LL	PRIV	MKTCAP	TURN	VALTRAD
Malaysia	-2.57	-2.44	-2.29	-2.09	-5.10***	-4.68***
Mexico	-3.08*	-2.08	-2.64	-1.46	-4.27***	-5.04***
Nigeria	-3.66**	-4.29***	-2.90	-0.80	-0.28	3.08
Philippines	-2.36	-1.41	-2.50	-4.62***	-4.10**	-3.55**
Thailand	-1.98	-1.79	-2.56	-3.88**	-3.45**	-2.70
Panel	-2.73***	-2.40**	-2.58***	-2.57**	-3.44***	-2.58***
Panel (trunc.)	-2.73***	-2.40**	-2.58***	-2.57**	-3.44***	-2.67***
Level						
D=2						
	GDP	LL	PRIV	MKTCAP	TURN	VALTRAD
Malaysia	0.02	-1.94	-1.49	-0.39	-2.74	-2.88
Mexico	-1.67	-1.21	-3.53*	-2.98	-3.02*	-2.98*
Nigeria	-1.32	-1.76	-1.52	1.13	1.41	5.77
Philippines	-0.56	-1.45	-2.87	-2.57	-2.57	-2.25
Thailand	-1.24	-2.21	-1.96	-2.49	-3.11*	-3.62**
Panel	-0.95	-1.71	-2.27	-1.46	-2.01	-1.19
Panel (trunc.)	-0.95	-1.71	-2.27	-1.46	-2.01	-2.01

Note: \*\*\*,\*\* and \* respectively denote significance at the 1%, 5% and 10 % level. D=0, 1, 2 respectively mean without deterministic term, with an intercept only and with an intercept and a trend. Critical values are obtained from Pesaran (2007).

provide biased results if the number of cointegrating vectors is higher than one. This paper is the first attempt to apply Johansen-like panel cointegration approach to the link between banks, stock markets and economic growth. In addition, we must notice that the Groen and Kleibergen (2003) methodology makes the assumption of a common number of cointegrating vectors for each country. This is in line with our objective which is to determine a global relation between financial development and economic growth and not any country-specific effect. The number of lags is selected by using information criteria in country-by-country maximum likelihood estimation and is allowed to lie between 0 and 2.<sup>10</sup> Cointegration testing corresponds in this context to a test of the rank of the matrix  $\Pi$ . This can be done by using the likelihood ratio test methodology proposed by Johansen (1995) and extended to the panel framework by Groen and Kleibergen (2003). We start with a number of cointegrating vectors equal to zero ( $rank(\Pi) = 0$ ) and compute the likelihood ratio statistic against full rank. We then progressively increase the rank of matrix  $\Pi$  until non-rejection of the null hypothesis whose rank corresponds to the estimated number of cointegrating vectors. Cointegrating vectors are allowed to be heterogeneous across individual countries. The homogeneous hypothesis will nonetheless be tested. We report the results of Groen and Kleibergen (2003) cointegration tests in Table 2.

Cointegration test outcomes in Table 2 conclude to the existence of a single cointegrating vector among GDP, bank and financial market development except for the combination of GDP, LL and VALTRAD. On the whole, these results suggest that there exists a single long run relationship between financial developments and economic growth i.e. the process is driven by two stochastic trends. This might intuitively speak in favor of the hypothesis of the financial development indicators driving economic development since it may be somewhat counterintuitive to see GDP and one financial variable driving the other financial indicator. It is the purpose of the next sections to determine whether we can identify a causal linkage between financial development and economic growth and vice-versa. In the remainder of the paper, we focus on the 5 combinations growth-banks-stock markets for which panel cointegration tests provide evidence of the existence of a single cointegrating vector.

In addition to testing the number of cointegrating relations in a framework

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<sup>10</sup>Higher number of lags is not allowed because of the sample size.

Table 2: Panel cointegration tests

		Tstat	10%	Crit. Val.		
	Rank			5%	1%	
GDP-LL-MKTCAP	0	141,81*	133,75	147,02	175,51	
	1	54,87	66,50	76,74	99,10	
GDP-LL-TURN	Rank					
	0	161,24**	133,46	146,20	175,60	
	1	62,03	66,39	76,78	98,79	
GDP-LL-VALTRAD	Rank					
	0	173,99**	133,61	147,49	177,97	
	1	67,83*	66,65	77,09	98,06	
	2	1,26	13,49	18,97	34,20	
GDP-PRIV-MKTCAP	Rank					
	0	145,31*	133,80	147,01	174,44	
	1	42,19	66,43	76,53	98,63	
GDP-PRIV-TURN	Rank					
	0	145,38*	133,11	146,33	174,60	
	1	66,53	67,12	77,30	99,18	
GDP-PRIV-VALTRAD	Rank					
	0	150,36**	133,32	146,51	175,04	
	1	39,38	66,46	76,79	98,33	

Note: \*\*\*,\*\* and \* respectively denote significance at the 1%, 5% and 10 % level.

Table 3: Likelihood ratio test of the homogeneous restriction on the cointegrating vector

	Tstat	Rank	Crit. val.		
			10%	5%	1%
GDP-LL-MKTCAP	46,72	1	13,36	15,51	20,09
GDP-LL-TURN	84,73	1	13,36	15,51	20,09
GDP-PRIV-MKTCAP	52,27	1	13,36	15,51	20,09
GDP-PRIV-TURN	48,07	1	13,36	15,51	20,09
GDP-PRIV-VALTRAD	40,50	1	13,36	15,51	20,09

with heterogeneous cointegrating vectors, we can also test the homogeneous alternative. We report the results of the tests for the homogeneous restriction in Table 3. The homogeneous restriction is rejected for all triplets economic growth, banking system and financial market development for which the rank of matrix  $\Pi$  is equal to one. Beside providing a test for the number of cointegrating relationships, the Groen and Kleibergen (2003) methodology also computes maximum likelihood estimates of the cointegrating vector and adjustment coefficients. We report these estimates in Table 4.

We use the following normalization under the assumption of a single cointegrating vector:

$$\beta_i = \begin{pmatrix} 1 \\ -\beta_{2,i} \\ -\beta_{3,i} \end{pmatrix}$$

If economic growth is positively linked to financial development in the long, we should expect the sign of the cointegrating vector estimates ( $-\beta_2$  and  $-\beta_3$ ) to be negative.<sup>11</sup> Cointegrating vector estimates indicate that for almost all possible triplets and countries we can find a positive link between economic development and banking or stock market development but rarely with both banks and financial markets. This may be seen as a first indication of the impact of financial development in its widest sense (i.e. banks and financial markets) on economic growth since at least one source of fund provision and risk diversification a positive role with respect to long run eco-

<sup>11</sup>Indeed, the normalization allows us to rewrite the equilibrium relation as:

$$GDP = \beta_2 BANK + \beta_3 STOCKMARKETS$$

Table 4: Adjustment parameters and cointegrating vectors estimation

GDP-LL-MKTCAP					
	$\alpha_1$	$\alpha_2$	$\alpha_3$	$-\beta_2$	$-\beta_3$
Malaysia	0,007	0,097	0,090	-5,819	0,699
Mexico	-0,011	0,057	0,096	-7,975	0,263
Nigeria	-0,006	-0,005	0,003	71,543	42,957
Philippines	-0,079	-0,039	-0,034	2,158	-1,735
Thailand	0,054	0,089	1,025	-1,084	-0,636
GDP-LL-TURN					
	$\alpha_1$	$\alpha_2$	$\alpha_3$	$-\beta_2$	$-\beta_3$
Malaysia	0,020	0,087	-0,037	-3,716	0,749
Mexico	-0,017	0,041	-0,527	-5,604	0,407
Nigeria	-0,256	0,039	-0,030	1,644	-2,748
Philippines	-0,387	-0,114	0,046	-0,025	0,282
Thailand	-0,001	0,027	-0,597	-2,603	0,737
GDP-PRIV-MKTCAP					
	$\alpha_1$	$\alpha_2$	$\alpha_3$	$-\beta_2$	$-\beta_3$
Malaysia	0,034	0,108	-0,072	-2,498	0,618
Mexico	-0,469	-0,302	-0,138	1,781	-1,021
Nigeria	-0,148	-0,086	0,045	6,009	0,256
Philippines	-0,227	-0,172	-0,129	1,557	-0,488
Thailand	0,039	0,173	0,026	-1,830	0,697
GDP-PRIV-TURN					
	$\alpha_1$	$\alpha_2$	$\alpha_3$	$-\beta_2$	$-\beta_3$
Malaysia	-0,010	0,056	-0,598	-1,995	2,263
Mexico	-0,116	-0,028	-1,623	1,093	0,604
Nigeria	-0,295	0,011	0,005	7,428	-4,160
Philippines	-0,092	-0,173	0,018	0,909	-0,022
Thailand	0,002	0,000	0,044	7,392	-16,247
GDP-PRIV-VALTRAD					
	$\alpha_1$	$\alpha_2$	$\alpha_3$	$-\beta_2$	$-\beta_3$
Malaysia	0,010	0,041	-0,619	-3,421	1,301
Mexico	-0,079	-0,089	0,026	5,829	-6,511
Nigeria	-0,363	-0,026	-0,038	3,698	-18,709
Philippines	-0,022	-0,064	0,007	5,250	-2,335
Thailand	-0,001	0,307	0,540	-0,287	-1,648

conomic development. However, this does not support the idea that banks and financial markets offer different services with different impacts on economic growth. In addition, we need to check the significance of these long run relationships. The purpose of the next sections is to test the significance of long run causality between financial development and economic growth as well as the opposite causality from economic growth to financial development. Ljung-Box tests for serial correlation in the residuals are reported in Table 5.

#### *4.3. Does financial development foster long run economic growth?*

So far, we have found evidence in favor of the existence of a single long run relationship between economic growth, banking system and financial market development. We have also shown that the sign of financial development indicators in the cointegrating vectors supports the hypothesis of a positive impact of finance on growth in the long run.<sup>12</sup> Our final objective is now to test whether the causal link from finance to economic development and/or from economic development to finance is statistically significant. We follow the methodology proposed by Toda and Phillips (1993, 1994) to test for causality within a VECM framework. Their procedure consists in testing both short run and long run causality. Short run causality is based on a test of the coefficients on the lagged differences while long run causality requires a stepwise procedure where the corresponding  $\alpha$  and  $\beta$  significance is tested. Since our interest lies in the long run causal link between finance and growth, we focus on the long run causality part of the test. In addition, the specifications of our tests (the causal link between variables two by two, one cointegrating vector) are such that Toda and Phillips (1994) assumptions are fulfilled and we can start by testing the corresponding  $\alpha$  and, if it is significant, the corresponding  $\beta$  by using chi-square distributed test statistics.<sup>13</sup> The results of causality test from financial development to economic growth are reported in Table 6.

Joint tests of long run causality all support the hypothesis that finance causes economic growth in the long run. In two specifications (GDP-LLTURN and GDP-PRIV-MKTCAP), both banks and financial markets are

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<sup>12</sup>Even if we do not find that both segments of the financial system have a positive impact.

<sup>13</sup>Chi-square distribution of the test statistics is also confirmed by Groen and Kleibergen (2003) in their framework.

Table 5: P-values of Ljung-Box tests for autocorrelation in the residuals (up to 4 lags)

		LL- MKTCAP	LL- VALTRAD	PRIV- MKTCAP	PRIV- TURN	PRIV- VALTRAD
Malaysia	GDP	6.8%	68.9%	51.7%	41.9%	28.4%
	Bank	38.7%	29.1%	46.0%	27.9%	35.7%
	Mkt	28.0%	4.6%	21.2%	34.6%	8.5%
Mexico	GDP	89.6%	72.9%	18.2%	83.4%	52.0%
	Bank	55.5%	83.5%	7.7%	65.6%	7.1%
	Mkt	44.2%	85.4%	29.1%	56.4%	93.9%
Nigeria	GDP	31.9%	56.8%	9.6%	74.2%	0.0%
	Bank	94.4%	64.7%	44.8%	73.9%	12.0%
	Mkt	98.8%	24.2%	99.3%	42.1%	93.5%
Philippines	GDP	65.2%	9.5%	5.6%	73.4%	0.1%
	Bank	9.4%	42.7%	0.7%	10.7%	3.0%
	Mkt	16.8%	77.3%	20.4%	60.2%	38.5%
Thailand	GDP	28.4%	33.1%	30.3%	4.4%	49.8%
	Bank	51.4%	51.7%	9.5%	6.0%	27.2%
	Mkt	50.6%	90.9%	12.9%	45.4%	39.5%

shown to significantly affect economic growth in the long run. Results from country-by-country tests are less clear-cut. Evidence of causality from finance to growth is not present under all combinations of indicators (e.g. there is no evidence of causality in the triplet GDP-PRIV-VALTRAD) and does not have the expected sign in every case. Nevertheless, causality from finance to growth is supported by the data for all countries under at least one specification. We can also notice a slightly more preponderant role of banking system (9 significant causalities) than financial markets (7 significant causalities). As a result, even if there is no strong evidence of long run causality from financial development to economic growth, our results indicate a consistent impact of finance on growth when using joint tests and a less clear-cut but still present causality for individual tests.

#### 4.4. Does economic growth cause financial development?

While we have found some evidence of long run causality from finance to growth in the previous section, we can test the reverse causality: from economic growth to financial development. For instance, evidence of bi-directionality between finance and growth is provided in Luintel and Khan (1999), Calderon and Liu (2003) or Demetriades and Hussein (1996). As

Table 6: Long run causality test: Finance  $\rightarrow$  Growth

GDP-LL-MKTCAP	$\alpha_1$	$-\beta_2$	$-\beta_3$	Conclusion
Malaysia	0,007***	-5,819***	0,699	B
Mexico	-0,011	-7,975***	0,262	NC
Nigeria	-0,006*	71,543***	42,957	B
Philippines	-0,079**	2,158	-1,735	NC
Thailand	0,054	-1,084	-0,636	NC
Joint test (Tstat)	16,131***	28,993***	6,82	B
GDP-LL-TURN	$\alpha_1$	$-\beta_2$	$-\beta_3$	Conclusion
Malaysia	0,0199***	-3,716***	0,749*	B, M
Mexico	-0,017	-5,604	0,407	NC
Nigeria	-0,256***	1,644***	-2,748	B
Philippines	-0,387	-0,025	0,282	NC
Thailand	-0,001	-2,603***	0,737**	NC
Joint test (Tstat)	20,019***	16,166***	16,571***	B, M
GDP-PRIV-MKTCAP	$\alpha_1$	$-\beta_2$	$-\beta_3$	Conclusion
Malaysia	0,034***	-2,498***	0,618***	B, M
Mexico	-0,469***	1,781***	-1,021***	B, M
Nigeria	-0,148***	6,009***	0,256	B
Philippines	-0,227***	1,557***	-0,488***	B, M
Thailand	0,039***	-1,830*	0,697***	B, M
Joint test (Tstat)	54,252***	51,427***	62,476***	B, M
GDP-PRIV-TURN	$\alpha_1$	$-\beta_2$	$-\beta_3$	Conclusion
Malaysia	-0,010	-1,995***	2,263***	NC
Mexico	-0,116***	1,093	0,604***	M
Nigeria	-0,295	7,428	-4,160	NC
Philippines	-0,092	0,909	-0,022	NC
Thailand	0,002**	7,392	-16,247***	M
Joint test (Tstat)	17,856***	7,294	28,508***	M
GDP-PRIV-VALTRAD	$\alpha_1$	$-\beta_2$	$-\beta_3$	Conclusion
Malaysia	0,010	-3,421***	1,301***	NC
Mexico	-0,079***	5,829	-6,511	NC
Nigeria	-0,363	3,698***	-18,709***	NC
Philippines	-0,022	5,250***	-2,335	NC
Thailand	-0,001	-0,287	-1,648	NC
Joint test (Tstat)	19,893***	29,983***	1,408	B

Note: \*\*\*, \*\* and \* respectively denote significance at the 1%, 5% and 10 % level. B, M and NC respectively mean causality from banking development to economic growth, causality from financial markets to economic growth and no evidence of causality from finance to growth.

a consequence, we apply the same methodology as in the previous section to long run causality from economic growth to in turn banking system and financial market development. The results are reported in Tables 7 and 8. Starting with long run causality from economic growth to banking system development, our methodology does not support the demand-following hypothesis. Indeed, none of the joint tests but one rejects the null hypothesis of absence of causality. Individual country statistics do not provide more support to the hypothesis of a long run relation going from economic growth to banks since the absence of causality is rejected in only 5 (out of the 25) specifications. Turning to the results of causality tests from economic growth to financial markets, we reach the same conclusion of no strong evidence of causality from economic growth to finance in the long run. Once again, the joint tests reject the absence of causality only in one specification while individual tests rarely conclude to causality from economic growth to stock markets development. As a result, our tests support neither the bi-directional hypothesis under which finance would cause economic growth and vice-versa nor the demand-following hypothesis under which financial markets would simply respond to the need of the developing real economy for institutions able to efficiently allocate capital. Our results are in line with Xu (2000), Christopoulos and Tsionas (2004) (who also focus on developing countries) and Apergis et al. (2007) who support the supply-leading hypothesis using indicators of the banking sector only while Demetriades and Hussein (1996), Luintel and Khan (1999) and Calderon and Liu (2003) support the bi-directional hypothesis. Regarding the studies which consider both stock market and banking development, our results are consistent with those of Rousseau and Wachtel (2000), Arestis et al. (2001), Caporale et al. (2004) and Beck and Levine (2004).

#### *4.5. Robustness check: testing the absence of long run causality between finance and growth*

As an additional robustness check, we test the null hypothesis of the absence of long run causality from finance (banks and stock markets) to growth and from economic development to finance. Rejecting the absence of causality in both direction would reinforce our conclusions based on unidirectional causality tests. Indeed, if the absence of causality in both direction is rejected, this implies that there must exist at least one direction of causality which is significant. In this case, results from unidirectional tests support the causality going from finance to growth. This test corresponds to jointly

Table 7: Long run causality test: Growth  $\rightarrow$  Banks

GDP-LL-MKTCAP	$\alpha_2$	$-\beta_1$	Conclusion
Malaysia	-0.564**	-0.172	NC
Mexico	-0.457***	-0.125	NC
Nigeria	-0.351	0.0140	NC
Philippines	-0.084***	0.463	NC
Thailand	-0.097**	-0.922	NC
Joint test (Tstat)	19.958***	0.066	NC
GDP-LL-TURN	$\alpha_2$	$-\beta_1$	Conclusion
Malaysia	-0.325***	-0.269***	C
Mexico	-0.229	-0.178	NC
Nigeria	0.064	0.608***	NC
Philippines	0.003	-40.260	NC
Thailand	-0.070*	-0.384***	C
Joint test (Tstat)	22.519***	4.720	NC
GDP-PRIV-MKTCAP	$\alpha_2$	$-\beta_1$	Conclusion
Malaysia	-0.270***	-0.400**	C
Mexico	-0.538***	0.561**	C
Nigeria	-0.517	0.166***	NC
Philippines	-0.268***	0.642	NC
Thailand	-0.317***	-0.546	NC
Joint test (Tstat)	22.755***	11.317**	C
GDP-PRIV-TURN	$\alpha_2$	$-\beta_1$	Conclusion
Malaysia	-0.111	-0.501**	NC
Mexico	-0.031**	0.915	NC
Nigeria	0.082	0.135	NC
Philippines	-0.157***	1.100***	C
Thailand	-0.000	0.135	NC
Joint test (Tstat)	2.261	15.328***	NC
GDP-PRIV-VALTRAD	$\alpha_2$	$-\beta_1$	Conclusion
Malaysia	-0.140	-0.292	NC
Mexico	-0.519	0.172	NC
Nigeria	-0.097	0.270	NC
Philippines	-0.336	0.190	NC
Thailand	-0.088	-3.483	NC
Joint test (Tstat)	10.828*	0.106	NC

Note: \*\*\*, \*\* and \* respectively denote significance at the 1%, 5% and 10 % level. C and NC respectively mean causality from economic growth to bank development and absence of evidence of causality. Betas are based on normalization on the tested dependent variable.

Table 8: Long run causality test: Growth  $\rightarrow$  Stock Markets

GDP-LL-MKTCAP	$\alpha_3$	$-\beta_1$	Conclusion
Malaysia	0.063	1.431	NC
Mexico	0.025	3.809	NC
Nigeria	0.116	0.023	NC
Philippines	0.059	-0.576	NC
Thailand	-0.652	-1.572	NC
Joint test (Tstat)	0.771	0.066	NC
GDP-LL-TURN	$\alpha_3$	$-\beta_1$	Conclusion
Malaysia	-0.028	1.336***	NC
Mexico	-0.214	2.458	NC
Nigeria	0.083	-0.364***	NC
Philippines	0.013	3.552	NC
Thailand	-0.440	1.356***	NC
Joint test (Tstat)	0.055	4.720	NC
GDP-PRIV-MKTCAP	$\alpha_3$	$-\beta_1$	Conclusion
Malaysia	-0.044***	1.619**	C
Mexico	0.141***	-0.979**	C
Nigeria	0.012**	3.909***	C
Philippines	0.063***	-2.048	NC
Thailand	0.018	1.434	NC
Joint test (Tstat)	4.056	11.317**	NC
GDP-PRIV-TURN	$\alpha_3$	$-\beta_1$	Conclusion
Malaysia	-1.353***	0.442**	C
Mexico	-0.980***	1.656	NC
Nigeria	-0.021	-0.240	NC
Philippines	-0.000	-45.285***	NC
Thailand	-0.714***	-0.062	NC
Joint test (Tstat)	54.622***	15.328***	C
GDP-PRIV-VALTRAD	$\alpha_3$	$-\beta_1$	Conclusion
Malaysia	-0.805***	0.769	NC
Mexico	-0.170	-0.154	NC
Nigeria	0.708**	-0.053	NC
Philippines	-0.016	-0.428	NC
Thailand	-0.890	-0.607	NC
Joint test (Tstat)	21.171***	0.106	NC

Note: \*\*\*,\*\* and \* respectively denote significance at the 1%, 5% and 10 % level. C and NC respectively mean causality from economic growth to stock markets and absence of evidence of causality. Betas are based on normalization on the tested dependent variable.

Table 9: Long run causality test: Growth  $\leftrightarrow$  Finance

	Malaysia	Mexico	Nigeria	Philippines	Thailand
GDP-LL-MKTCAP	C**	NC	C**	C***	NC
GDP-LL-TURN	C***	NC	C***	NC	C*
GDP-PRIV-MKTCAP	C***	C***	C***	C***	NC
GDP-PRIV-TURN	C**	C**	NC	C***	C*
GDP-PRIV-VALTRAD	NC	C*	NC	NC	NC

Note: \*\*\*,\*\* and \* respectively denote significance at the 1%, 5% and 10 % level. C and NC respectively mean rejection of the absence of long run causality between finance and growth and absence of evidence in favor of any causality between finance and growth.

testing  $\alpha_{1,i} = 0$  and  $\beta_{1,i} = 0$ . Results of this test can be found in Table 9. The existence of long run causality between economic development and finance is confirmed in most of the specifications. Based on these results, we can conclude that there must exist long run causality between finance and growth in at least one direction. Since unidirectional tests tend to favor the causality going from finance to growth, the results that we have obtained in this section somewhat strengthen our initial conclusions.

## 5. Conclusions and policy implications

While the debate on the role of financial development on the process of economic growth is far from being new, it has been receiving a renewed interest for several decades. Indeed, knowing whether financial development can promote long run economic growth is of prime importance in terms of development policy in developing countries and also for policies aimed at (re)shaping the financial sector at the global level. If there exists a positive linkage going from finance to economic growth, then developing countries should encourage the development of such institutions. A large body of theoretical literature has been developing since the early 1980's in which the role of financial intermediaries as efficient providers of capital and risk diversifiers to support economic development has been stressed. This supply-leading hypothesis is challenged by the reverse point of view under which

financial institutions grow in response to the demand of the real economy. In this case, financial development is a result of economic growth and may not be a requirement for it. In addition, the recent crisis which has affected the financial system and the real economy also accentuates the need to determine whether financial development and innovation promote real growth in the long run while the crisis has shown that misusing instruments intended to better diversify risk could lead to (short run?) destabilization of the real economy.

Given the importance of the question, many empirical works have tried to determine which of both alternatives is the most relevant. Starting with cross-sectional and panel based analyses, the empirical literature has progressively evolved to using time series techniques. While early findings tended to support the supply-leading hypothesis, more recent studies give a less clear-cut answer regarding the direction of the causality (in some cases, the relation is found to be bi-directional). Recent studies increasingly focus on time series techniques such as cointegration and causality tests. However, these techniques have been proven to be affected by power and size distortion in small samples. A potential answer to the weak results from time series analysis is to use dynamic panels. While these techniques have already been used in the current literature, our paper is the first (to the best of our knowledge) to use Johansen-like cointegration analysis in a panel context allowing for potential cross-dependence across countries (which seems quite realistic in macroeconomic panels). In addition, we also extend the analysis to the potentially different impact of two different segments of financial system i.e. banks and financial markets, which has never been studied in a panel-based cointegration context.

Our results indicate that there exists a single long run (cointegration) relationship between indicators of both financial development and economic growth. Focusing on the cointegrating vector with economic growth as the explained variable, we find that the long run equilibrium integrates in most cases at least one indicator of financial development with a positive impact on long run economic growth. Nevertheless, the positive impact is rarely coming from both segments of financial development. This is evidence in favor of a positive long run effect of financial development on economic growth but it does not support the idea according to which banks and financial markets do not fulfill the same role with respect to economic development. We also test long run causality. Joint tests support the hypothesis of a long run causality from financial development (once again we do not find strong

evidence in favor of banks rather than stock markets, stock markets rather than banks nor the combination of banks and stock markets). While country-by-country tests show less clear-cut results, they nevertheless tend to support the causal link going from financial development to economic growth. As a test of potential bi-directionality, we perform the same causality analysis from economic growth to financial development. These tests conclude to the absence of causality from growth to finance.

From our analysis, it then appears that, if a long run causality exists between financial development and economic growth, it should go from the former to the latter. In addition, the structure of the financial system (bank or market-oriented) does not seem to make a strong difference while banks and markets are not shown to provide different services as far as economic growth is concerned. From the analysis of our data set of developing countries, it seems that promoting the development of the financial system may support long run economic growth. In terms of policy implication our results suggest that developing countries could promote their long-run economic growth by supporting the development of their financial sectors, be they banks or stock markets.

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