

FINANCIAL DEVELOPMENT AND GROWTH: Theory and time series evidence from 26 countries

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Abstract

In this paper, we first establish a theoretical positive relationship between financial development and growth. Then, we empirically investigate the issue of causality, using time series analysis over 26 countries. To this end we use both financial intermediary and stock market development indicators to measure the overall financial development. Unit root, cointegration tests, and causality tests based on Error Correction Models and first difference VARs models are performed. The results reveal that both aspects of financial development boost growth and thereby overall economic development. The results also show that the causal relationship is either unidirectional or bi-directional. Interestingly, there are more cases where independent stock market indicators cause growth than cases where financial intermediary indicator is used. Thus, stock market can be a positive financial instrument in countries with liberalized economies. Otherwise, in liberalized economies, the accelerator effect of stock markets on growth is higher than that of financial intermediaries.

Key words: Financial development; growth; cointegration; causality.

1. Introduction

The debate on the relationship between financial development and overall economic development persists. The issue of causality between financial development and growth – does finance contribute positively to growth? - has been at the center of this debate. The theoretical underpinnings of the issue can be traced back to the work of Schumpeter (1912) and, more recently, to McKinnon (1973), and Shaw (1973). The main policy implication of the Mckinnon-Shaw school is that government restrictions on the banking system (such as interest rate ceilings, high reserves requirements, and directed credit programs) hinder financial development and, consequently, reduce growth.

Endogenous growth literature has explicitly modeled the services provided by financial sector to the real sector. These models suggest that financial development has a positive effect on steady-state growth rate¹.

¹ See Greenwood and Javanovic (1990), Saint Paul (1992), Bencivenga and Smith (1991), Pagano (1993).

But, alternative view exists. Many influential economists give a very minor role to the financial system. Robinson (1952) argues that financial system does not spur economic growth ; financial system simply reply to the development in the real sector and the engines of growth must be sought elsewhere². Lucas (1988) argues that economists frequently exaggerate the role of financial factors in economic development.

Empirically, the positive association between financial development and economic development has been established by numerous studies (Gelb, 1989; Roubini and Sala-i-Martin, 1992; King and Levine, 1993a; 1993b). However these studies used banking or financial intermediary development indicators to measure financial development (e.g. broad money stock M2/GDP, domestic credit to private sector /GDP, banks assets/GDP). The approach involved averaging out variables over long time periods and used them in cross-section regressions. This approach suffers from shortcomings. First, authors agree that the results are sensitive to the conditioning information set. Second, Evans (1995) discusses econometric problems, which stem from heterogeneity of slope coefficients across countries. Thus, the notion of “ representative country” assumed by the cross-section technique is not sufficiently informative in the framework of causality testing. Third, the indicators employed did not take into account stock market side of financial development. Thus there were omitted variables problems that biased the results.

Without disagreeing with previous studies that established a robust correlation between financial development and growth, we think that the issue of causality may be more satisfactory if addressed in a time series framework. Gupta (1984) was the first attempt on causality issue. He utilized data on industrial output to measure the level of economic development and the level of broad money stock, M2, to proxy financial development³. In Demetriades and Hussein (1996), causality tests are carried out for 16 countries, and results suggest that causality between financial development and growth varies across countries. However, this study excluded stock market aspect of financial development and used financial intermediary indicators to proxy financial development. There is very little empirical evidence despite of the expanding theoretical literature on the links between stock markets and long-run growth⁴. The need of empirical investigations between growth and stock markets is more than ever necessary since the boom of the latter.

This paper reexamines the issue of causality between financial development and economic development using time series data over 26 countries and has recourse to recent econometric techniques. It extends the study of Demetriades and Hussein (1996) by utilizing

² See Patrick (1966) and Greenwood and Javanovic (1990).

³ Jung (1986) conducted causality tests in level Vector Autoregressive (VAR) framework without examining the integration properties of variables of interest.

⁴ See Levine (1991), Bencivenga, Smith (1991), Saint-Paul (1992), Bencivenga, Smith and Star (1996),

various indicators of stock market and financial intermediary development. New results are presented.

Unit roots tests that precede cointegration tests show that, with few exceptions, series under consideration are $I(1)$ and therefore are candidates for cointegration. Causality tests based on Error Correction Model (if cointegration between a pair of variables that measure financial development and economic development is accepted) and first difference VARs (if cointegration is rejected) reveal that the direction of causation runs either from financial development to economic development or in reverse order. The results also suggest that the number of cases where the relationship runs from finance to economic development dominates the reverse cases. Moreover, there are more cases where stock market development, as measured independently by three indicators, causes economic development than cases where financial intermediation development foster growth. Among countries that show this evidence are Greece, India, Korea, Malaysia and Thailand. These countries have recently reform their financial systems. That may reflect the fact that in liberalized economies, stock markets development progressively supplants financial intermediation in providing financial services.

We organize the remainder of the paper as follows. Section 2 presents a simple model of endogenous growth that takes into account financial development sector. Section 3 discusses the empirical model and estimation strategy. Section 4 deals with measures of stock market and financial intermediation development, as well as economic development indicator. Section 5 analyses the results, whilst section 6 concludes.

2. Financial development and growth: a simple endogenous growth model

In this section, we develop a simple theoretical model of the links between financial development and growth. We begin by modeling firm behavior. Next, we describe household behavior. Finally, we determine the equilibrium of the model.

2.1 Firm behavior

Firms produce consumption goods and pay rents for capital use. The aggregate production function is a modified « AK » model defined by

$$Y_t = F(K_t) = f(A)K_t, \quad f'(A) > 0 \quad (1)^5$$

where Y is output and K is a broad measure of capital stock. Since we are interpreting K broadly as an aggregate of different sorts of capital goods, we might as well suppose that technological knowledge and physical private capital are included in this aggregate. The

⁵ This specification is from Roubini and Sala-i-Martin 1992.

change in the interpretation of K allows us to relax the crucial assumption of diminishing returns, and avoid a zero growth rate at the steady state, as in neoclassical growth model. The parameter A indicates the level of financial development. Otherwise, by improving financial services provided to real sector (mobilizing savings, acquiring information about investments and allocating resources, monitoring managers and exerting corporate control, facilitating risk amelioration, facilitating exchange) the microeconomic efficiency of financial sector development has a positive impact on the whole macroeconomy.

The aggregate production function, Y , is an increasing function of A . It means that an economy with more developed financial system will be able to transform a given amount of inputs, K , into a larger amount of output, Y .

We assume that the representative firm behaves competitively and maximizes the present value of all future cash flows. The firm's program is

$$\max \int_0^{\infty} [F(K_t) - I_t] e^{-\int_0^t r_v dv} dt \quad (2)$$

$$s.c \quad \dot{K}_t = I_t - \tilde{d} K_t \quad (3)$$

I_t stands for investment, r_t is the interest rate, \tilde{d} represents the rate of capital depreciation.

The present value of the Hamiltonian of the program is the following:

$$H_1 = [F(K_t) - I_t] e^{-\int_0^t r_v dv} + \mathbf{m}_t [I_t - \tilde{d} K_t] \quad (4)$$

The first order conditions for this maximization are:

$$\partial H_1 / \partial I_t = 0 \quad \Rightarrow \quad -e^{-\int_0^t r_v dv} + \mathbf{m}_t = 0 \quad (5)$$

$$\partial H_1 / \partial K_t = -\dot{\mathbf{m}}_t \quad \Rightarrow \quad F_K e^{-\int_0^t r_v dv} - \mathbf{m}_t \tilde{d} = -\dot{\mathbf{m}}_t \quad (6)$$

Using the first order conditions, the optimal behavior of the representative firm is governed by the following relation:

$$r = f(A) - \tilde{d} \quad (7)^6$$

2.2 Household behavior

We suppose a representative infinitely lived individual whose lifetime utility function is

$$U_t = \int_0^{\infty} e^{-rt} u(c) dt, \quad (8)$$

where c_t is the time path consumption per person, $u(\bullet)$ is an instantaneous utility function such that $u'(c_t) > 0$, $u''(c_t) < 0$, and r is the personal discount rate. Moreover, household in

⁶ Notice that by assumption there is no labor in the model, thus the wage rate equals to zero.

this model does not work. She is assumed to hold b_t units of assets in the form of ownership claims on capital that pay the real interest rate r_t . The representative household is assumed to maximize utility subject to the budget constraint

$$\dot{b}_t = r_t b_t - c_t \quad (9)$$

The theory of optimal control allows us to set up the present-value Hamiltonian as follows:

$$H_2 = u(c_t)e^{-rt} + \mathbf{I}_t[r_t b_t - c_t], \quad (10)$$

where \mathbf{I}_t is the present-value shadow price of financial income.

The first order conditions for maximizing the Hamiltonian are

$$\partial H_2 / \partial c_t = 0 \quad \Rightarrow \quad u'(c_t)e^{-rt} = -\mathbf{I}_t \quad (11)$$

$$\partial H_2 / \partial b_t = -\dot{\mathbf{I}}_t \quad \Rightarrow \quad -\mathbf{I}_t r = -\dot{\mathbf{I}}_t \quad (12)$$

$$\lim_{t \rightarrow \infty} (\mathbf{I}_t b_t) = 0 \quad (\text{transversality condition}) \quad (13)$$

To characterize the optimal growth rate, suppose that the instantaneous utility function belongs to the isoelastic class defined by the condition:

$$u'(c_t) = c_t^{-s}, \quad s > 0, \quad (14)$$

The parameter s is the inverse of the intertemporal elasticity of substitution or the relative risk aversion coefficient.

We deduce from the first order conditions the well-known Euler equation:

$$\frac{1}{c_t} \frac{dc_t}{dt} = \frac{r - \mathbf{r}}{s} \quad (15)$$

2.3 Equilibrium growth rate

The markets equilibrium growth rate satisfies (7) and (15). Solving these equations yields

$$g = \frac{f(A) - \tilde{d} - \mathbf{r}}{s} \quad (16)$$

As in endogenous growth models with perfect competition, the equilibrium growth rate depends on preference parameters and technology. The higher the level of financial development, A , the more important is the growth rate. The growth rate is also high if individuals discount the future less (lower \mathbf{r}) or are more willing to substitute through time (lower s).

After presenting a theoretical link between finance and economic development, we expose in the remainder of this article the empirical time series investigation of the aforementioned link.

3. Empirical model and estimation strategy: unit roots, cointegration and causality

An economic time series x_{2t} is said to be Granger-caused by x_{1t} if x_{1t} helps in the prediction of x_{2t} , or equivalently if the coefficients on the lagged x_{1t} 's are statistically significant. The conventional Granger causality test involves specifying a bivariate k th order VAR as follows:

$$\begin{aligned} x_{1t} &= \mathbf{a}_0 + \sum_{i=1}^k \mathbf{a}_{1i} x_{1t-i} + \sum_{i=1}^k \mathbf{a}_{2i} x_{2t-i} + \mathbf{e}_{1t} \\ x_{2t} &= \mathbf{b}_0 + \sum_{i=1}^k \mathbf{b}_{1i} x_{1t-i} + \sum_{i=1}^k \mathbf{b}_{2i} x_{2t-i} + \mathbf{e}_{2t} \end{aligned} \quad (17)$$

where \mathbf{a}_0 and \mathbf{b}_0 are constant drifts; \mathbf{e}_{1t} and \mathbf{e}_{2t} are assumed to be serially uncorrelated with zero mean and finite covariance matrix.

When the null hypothesis $H_0: \mathbf{a}_{21} = \mathbf{a}_{22} = \dots = \mathbf{a}_{2k} = 0$ is accepted, it implies that x_{2t} does not Granger-cause x_{1t} . Conversely, if the null hypothesis $H_0: \mathbf{b}_{11} = \mathbf{b}_{12} = \dots = \mathbf{b}_{1k} = 0$ is not rejected, it suggests that x_{1t} does not Granger-cause x_{2t} .

The testing procedure becomes more complex if the variables have unit roots. In such case we need to re-parameterize the model in Error Correction Model (ECM) form as follows⁷

$$\begin{aligned} \Delta x_{1t} &= \mathbf{a}_0 + \mathbf{d}_1 (x_{1t-1} - \mathbf{g} x_{2t-1}) + \sum_{i=1}^k \mathbf{a}_{1i} \Delta x_{1t-i} + \sum_{i=1}^k \mathbf{a}_{2i} \Delta x_{2t-i} + \mathbf{e}_{1t} \\ \Delta x_{2t} &= \mathbf{b}_0 + \mathbf{d}_2 (x_{1t-1} - \mathbf{g} x_{2t-1}) + \sum_{i=1}^k \mathbf{b}_{1i} \Delta x_{1t-i} + \sum_{i=1}^k \mathbf{b}_{2i} \Delta x_{2t-i} + \mathbf{e}_{2t} \end{aligned} \quad (18)$$

where \mathbf{d}_1 and \mathbf{d}_2 reflect the speeds of adjustment to the equilibrium, and other specifications remain similar to equation (17).

The matrix form of the ECM is written as:

$$\Delta \mathbf{X}_t = \mathbf{m} + \Gamma(L) \Delta \mathbf{X}_{t-1} + \mathbf{P}_0 \mathbf{X}_{t-1} + \mathbf{e}_t, \quad (19)$$

where $\mathbf{X}_t = (x_{1t}, x_{2t})'$, $\mathbf{m} = (\mathbf{a}_0, \mathbf{b}_0)'$, $\Gamma(L) = (\mathbf{a}_{ji}(L), \mathbf{b}_{ji}(L))'$ with $j=1,2$; $\mathbf{a}_{ji}(L)$ and $\mathbf{b}_{ji}(L)$ are polynomials of order $k-1$; $\mathbf{e}_t = (\mathbf{e}_{1t}, \mathbf{e}_{2t})'$, and \mathbf{P}_0 represents the long-run response matrix.

In this context the number of unit roots in the characteristic polynomial is crucial in determining the stability of the system. If there are no unit roots, the VAR in equations (17) is

⁷ See Hendry et al., 1984 ; Engle and Granger, 1987 ; Johansen, 1988.

stable and $\{X_t\}$ is a stationary process. Hence the conventional Granger causality tests are valid in a levels VAR framework. If there are two unit roots, then the system is non-stationary. In such case causality tests are based on the following first difference bivariate VAR model:

$$\begin{aligned}\Delta x_{1t} &= \mathbf{a}_0 + \sum_{i=1}^k \mathbf{a}_{1i} \Delta x_{1t-i} + \sum_{i=1}^k \mathbf{a}_{2i} \Delta x_{2t-i} + \mathbf{e}_{1t} \\ \Delta x_{2t} &= \mathbf{b}_0 + \sum_{i=1}^k \mathbf{b}_{1i} \Delta x_{1t-i} + \sum_{i=1}^k \mathbf{b}_{2i} \Delta x_{2t-i} + \mathbf{e}_{2t}\end{aligned}\quad (20)$$

The most interesting case of one unit root corresponds to the definition given by Engle and Granger (1987), where x_{1t} and x_{2t} are integrated processes of order one, but where a linear combination, $z'X_t$, exists and is stationary. In such case $\mathbf{P}_0 = \mathbf{d}z'$ and the 2×1 vectors \mathbf{d} and z are both different from zero. Equation (19) can be rewritten in the following form:

$$\Delta X_t = \mathbf{m} + \Gamma(L) \Delta X_{t-1} + \mathbf{d}(z'X_{t-1}) + \mathbf{e}_t \quad (21)$$

Thus if x_{1t} and x_{2t} are $I(1)$, cointegrated causality tests can be carried out using ECM representation in equation (21). In this case, however, there are two sources of causation of x_{2t} by x_{1t} , either through the lagged dynamic terms (or short-run dynamics) Δx_{1t} if $\mathbf{b}_{1i} \neq 0$, or through the lagged cointegrating vector (or disequilibrium adjustment) $z'X_{t-1}$, if $\mathbf{d}_2 \neq 0$.

In this paper we perform a variety of causality tests between financial development and real GDP per capita using both the first difference VAR and the ECM representations. These tests are preceded by unit roots tests aiming to establish the order of integration of each variable, and cointegration testing as this has an important implication for causality testing.

Unit roots and cointegration tests are carried out using respectively the well-known Dickey-Fuller procedure (Dickey-Fuller, 1981) and Johansen procedure (Johansen, 1988)⁸.

⁸ There is also the Engle-Granger procedure that allows to detect cointegration between two variables. The Engle-Granger test involves testing the null hypothesis of non-cointegration between x_{1t} and x_{2t} as follows

$$H_0 : a = 1 \text{ against } H_1 : a < 1 \text{ where } \Delta u_t = a u_{t-1} + \sum_j^k \mathbf{g}_j \Delta u_{t-j} + \mathbf{u}_t \text{ and}$$

$$u_t = x_{1t} - \mathbf{k}_0^{LS} - \mathbf{k}_1^{LS} x_{2t}.$$

This test has some shortcomings because it omits the dynamic terms of variables and focuses on the error term. Moreover, the Engle-Granger technique suffers from poor finite sample properties, which may result in large

The Augmented Dickey-Fuller (ADF) procedure uses the following equation:

$$\Delta x_t = a + bt + (\mathbf{r}-1)x_{t-1} + \sum_{i=1}^{k-1} \mathbf{q}_i \Delta x_{t-i} + \mathbf{m}_t \quad (22)$$

Where $\Delta=1-L$, x_t represent each series, t is a trend, \mathbf{m}_t obeys white noise with the null hypothesis $H_0: \mathbf{r}-1=0$. The degree of augmentation is determined following the procedure suggested by Campbell and Perron (1991).

The Johansen test for the number of cointegrating vectors is based on the rank of the matrix \mathbf{P}_0 . Two likelihood ratio tests are described: the maximal eigenvalue test and the trace test.

The test based on maximum eigenvalue is designed to test the hypothesis $H(r): \text{Rang}(\mathbf{P}_0)=r-1$ against the alternative $H(r-1)$. The maximal eigenvalue test is given by

$$EV_{\max} = -T \log(1 - \hat{\mathbf{I}}_{q+1}), \quad (23)$$

where T is the number of observations and $\hat{\mathbf{I}}_{q+1}$ is the maximal eigenvalue.

The trace test is based on the trace of the stochastic matrix and is defined as

$$TR = -T \sum_{i=q+1}^N \log(1 - \hat{\mathbf{I}}_i) \text{ for } q=0,1,2,\dots,N-1 \quad (24)$$

In a bivariate system such as the case we study in this paper, the maximum number of cointegrating vectors is one so that the null hypothesis is that there is no cointegrating vector against the alternative of one cointegrating vector.

Where cointegration is detected, we use the cointegrated vector in ECM based causality tests. Three types of causality tests are then performed depending on the source of causation. The first test is the statistical significance of the lagged dynamic terms (i.e. Δx_{1t-1} in the Δx_2 equation and Δx_{2t-1} in the Δx_1 equation). The second test focuses on the significance of the speed of adjustment to the equilibrium in each of the two equations (i.e. $\mathbf{d}_2=0$ in the Δx_2 equation and $\mathbf{d}_1=0$ in the Δx_1 equation); this is a test for weak exogeneity. The last test is the combination of the two firsts, that is the joint significance of the lagged dynamic and the error correction terms. This is a test for strong exogeneity.

bias in the LS estimate of integration, vectors (Banerjee et al., 1986; Inder, 1993). This has motivated our choice of Johansen procedure.

4. Measurement and data sources

To proxy financial development, most of past empirical studies on the relationship between financial development and growth used indicators of financial intermediary, such as the ratio of liquid liabilities of financial intermediaries to GDP or the ratio of domestic credit to private firms to GDP. Since the boom of stock markets, the attention of analysts and economists is more attracted by stock market indicators.

In the following, to assess the effect of the financial development on overall economic development, we use one indicator of financial intermediary development and three indicators of stock markets development, called indicators of size and liquidity.

Stock market development indicators

Indicator of size: the market capitalization, CAP, measures the size of the stock market and equals the ratio of the value of listed domestic shares to GDP. This indicator is assumed to be positively correlated with the ability to mobilize capital and diversify risk.

Indicators of liquidity: the first indicator of liquidity is the value traded ratio, STR, which equals the total value of domestic shares traded on the stock markets exchange divided by GDP. The second indicator of liquidity, the turnover ratio, TUR, equals the total value of domestic shares traded divided by market capitalization. High turnover is often used as an indicator of low transaction costs.

The traded value ratio measures trading relative to the size of the economy, whilst turnover measures trading relative to the size of the stock market. Thus, a small, liquid market will have a high turnover ratio but a small value traded ratio (Demirgüç-Kunt and Levine, 1996)⁹.

Financial intermediary development indicator

Despite of a wide range of financial intermediary development indicators, we are interested in only one. That is the ratio of domestic credit to private firms to GDP, denoted CRD¹⁰. Our choice is motivated by the fact that, according to Mckinnon/Shaw, it is the supply of credit to the private sector, which is responsible for the quantity and the quality of investment and, in turn, for economic growth.

Following past studies, we proxy economic development by the gross domestic product per capita, GDP; and all variables in our data set are transformed into natural logarithms for usual statistical reasons.

⁹ Other stock market development indicators exist, such as volatility, international integration measures and concentration. For more details see Demirgüç-Kunt and Levine, 1996.

¹⁰ Other indicators exist. There are M3/GDP equals liquid liabilities/GDP, BY/GDP equals total claims of deposit money banks to GDP, etc. See Demirgüç-Kunt and Levine (1996) for more details.

We expect to have a causal influence of these four financial indicators on economic development, measured by GDP per capita.

The data source of stock markets indicators is 'Ash Demirgüç-Kunt and Thorsten Beck and Ross Levine, 1999 "A New Database on Financial Development and Structure" World Bank n° 2146. This database can be downloaded on Internet. And the series of GDP and CRD are from the IMF publication International Financial Statistics (CD-ROM, 2001).

5. Results

In this section we present the results of empirical time series analysis on the relationship between financial development and economic development. The first subsection presents tests for the existence of unit root in the level and first difference of (the logarithm of) each of the variable. In the second subsection, cointegration results are discussed. The third subsection concerns causality tests based on ECM. Finally, the fourth subsection examines causality tests based on first difference VARs.

5.1 Unit roots tests

The first step in determining whether there are common stochastic trends present among the variables is the detection of a unit root in each series using the well-known Augmented Dickey-Fuller (ADF) procedure (Dickey and Fuller, 1981). The results of the tests for the variables in level and in first differences are reported respectively in tables 2 and 3. The ADF test fails to reject the hypothesis of unit root in GDP except for the case of Denmark, Greece, South Africa, United States. However, the ADF test strongly rejects the hypothesis of a unit root in its first difference in all countries except Spanish and Singapore. It seems that GDP is $I(2)$ ¹¹ in these countries. The hypothesis of a unit root in the financial intermediary indicator CRD can be rejected in the cases of Brazil, Colombia, Denmark, France, Italy, Korea, Philippines, Spain, and Thailand. The same hypothesis is rejected in all countries in the case of the first difference of CRD. According to the same ADF statistic, the first stock market development indicator, CAP, appears to be $I(0)$ in Austria, Korea, Malaysia and South Africa. Whilst it appears to be $I(2)$ in Belgium, France, Mexico, Philippines and Thailand. The second stock market development indicator, STR, seems to be $I(0)$ in Singapore, India, Indonesia and Japan, and $I(2)$ in Belgium, France, India, Italy, and Korea. The last stock

¹¹ $I(0)$ means that the serie under consideration is stationary in level.

$I(1)$ means that the serie under consideration is stationary in first difference.

$I(2)$ means that the serie under consideration is stationary in second order difference.

market development indicator, TUR, is $I(0)$ in Argentina, France, India and Japan; it appears to be $I(2)$ in India.

Thus, except in few cases, the ADF test statistics suggest that all four variables are $I(1)$ and candidates for cointegration.

5.2 Cointegration tests

Cointegration methodology helps to test for the existence of stable relationship between the level of economic development, GDP, and the state of financial development, measured by each of the four financial indicators. The Johansen tests are based on the maximum likelihood estimates of a vector autoregression of order 1 to 4. The null hypothesis is that there is zero cointegration vector against the alternative of one cointegration vector. The trace statistics of the cointegration tests based on the Johansen method are reported in tables 4 and 5¹². Our choice of the trace statistics is motivated by the fact that they are more used than eigenvalue statistics. Tables 4 and 5 show that the results are sensitive to the lag length of the VAR, but we place more emphasis on the statistics obtained from the longer lag lengths¹³. Table 4 reveals that the hypothesis of non-cointegration between the financial intermediary indicator, CRD, and real GDP per capita is rejected in at least for one countries out of 26, at lag lengths greater than two. Results are similar in the case where the first stock market development indicator, CAP, is utilized. According to table 5, the non-cointegration hypothesis between the second stock market development indicator, STR, and the real GDP per capita, is rejected in 19 countries out of 26, at lag lengths greater to two. In the case where the third stock market indicator, TUR, is used, table 5 reveals 21cases of cointegration out of 26. Country that shows no evidence of cointegration between the level of real GDP and the degree of development of financial system, as measured by each of the four financial indicators, is Colombia.

Given the Johansen tests, with the few exceptions mentioned above, for each country, there is a stable relationship between at least one of the four financial development indicators and the real GDP. Three interesting points need to be focused on. First, we can note that the number of cointegration between each stock market development indicator and economic development indicator is greater than the number of cointegration between financial intermediary indicator and the real GDP. This probably reflects the fact that the contribution of financial intermediation to growth decline as the economy develops and is replaced by the contribution of stock market. Causality tests will shed light on this

¹² One must interpret with causation the cointegration tests for cases where the evidence on the order of integration of variables is not clear.

¹³ The Johansen test statistics are more sensitive to under-parameterization than over-parameterization (Cheug and Lai, 1993)

assumption. Second, among countries that show evidence of cointegration between stock market development indicators and growth, there are Greece, India, Thailand, Korea and Malaysia. These countries, in their recent history, have reformed their financial systems. Thus stock market appears to be a productive financial instrument in countries with liberalized economies. Third, country that shows no evidence of cointegration is Colombia. This result does not necessary mean there is not a stable relationship between financial development and growth for two raisons. First, the relationship may exist, but it may be more complex to be appreciated as a linear one (Demetriades and Hussein, 1996). Second, this country is among developing countries in which financial systems are undeveloped. We know that in the third world in general, there is no denying that informal financial markets are widely developed and play an important role in the financing of economic activities. These informal financial markets are not taken into account by our four measures of financial development. Thus, the definition of the financial system for this country may be too restrictive to reflect the cointegration relationship between financial development and growth that we are interested in.

Given the results of cointegration tests we carry out two types of causality tests. The first type is ECM based causality tests using pairs of variables for which evidence of cointegration is detected at the 10% level. The second type of tests is based on first difference VARs for countries and pairs of variables for which evidence of cointegration is rejected.

5.3 Causality tests based on ECM

In table 6 we report the causality tests including the indicators of financial intermediation and growth. Table 6 reveals that the error correction term is negative and statistically significant for Brazil, Denmark, Greece, Italy, South Africa, Spain and United States. There exist for these countries a causal relationship running from finance to growth, through the error correction term¹⁴. In the case Spain and Italy, there is a causal relationship through the dynamic terms. The relationship appears to be bi-directional in Canada, India and Spain.

In table 7 where the first stock market development indicator is utilized, we notice that the relationship is bi-directional in Mexico, Netherlands, Philippines and South Africa. However, the causal relationship is unidirectional; and it runs from finance to growth in Belgium, Singapore, Malaysia and Thailand.

In tables 8¹⁵ and 9¹⁶ we report the results associated with the second and the third stock market development indicator respectively. The results are similar to the previous.

¹⁴ In the case of Japan and Netherlands, the error term is positively significant, that is difficult to interpret.

¹⁵ In the case of Spain the error term is positively significant, that is difficult to interpret

¹⁶ In the case of United Kingdom the error term is positively significant, that is difficult to interpret

5.4 Causality tests based on first difference VARs

The results of the tests based on first difference VARs approach are reported in tables 10, 11, 12 and 13. Table 10 shows that finance measured by CRD Granger-causes economic development in Colombia, Malaysia, whilst finance follows economic development in Australia, Indonesia and Philippines. Table 11 reveals that in France and Netherlands, finance, measured by CAP, Granger-causes growth; but the reverse causation appears in Philippines. In table 12 where the second indicator of stock market development, STR, is used, it appears that finance boosts growth in France and Japan. Table 13 shows that finance foster growth in the case of Argentina.

In sum, the results obtained from the tests based on first difference VARs are broadly consistent with those obtained from ECM based tests, in the sense that the causal relationship is either unidirectional or bi-directional. There are more cases in which finance boosts economic development than the contrary. But this argument is not sufficient to choose between the assertion « It is financial development that causes growth » and the alternative « It is growth that boosts finance ». Table 1 summarizes the results from cointegration and causality test for each case.

Finally, there are 53.85 % cases where financial intermediation causes growth; and 61.54, 53.85 and 61.54 % cases where stock market development, measured respectively by CAP, STR and TUR, stimulates growth. These results are consistent with our view that the contribution of stock markets development to growth progressively replaces that of financial intermediaries.

6. Conclusion

This article first established a theoretical positive linkage between financial development and overall economic development. Then, using time series analysis, the paper studied the empirical relationship between various measures of stock market development, financial intermediation and economic development. We find that both aspects of financial development (stock market and financial intermediary) foster growth, and thereby economic development.

The evidence presented in this paper do not provides a cut answer to the question « Financial development and growth: which one causes the other? ». Causality tests reveals that results are sensitive to the indicator of financial development for a given country. The results also suggest that the causal relationship is either unidirectional or bi-directional. Interestingly, there are more cases in which causality runs from stock market development indicators to economic development than from financial intermediation indicator to growth. These cases include countries such as Greece, India, Thailand, Korea and Malaysia, which have recently reform their financial systems.

Thus, stock market can be a productive financial instrument in countries with liberalized economies. Furthermore, stock market contribution to the overall economic development progressively supplants that of financial intermediary in liberalized economies. Otherwise, the accelerator effect of stock market development on growth dominates that of financial intermediation in liberalized economies.

However, given the small size of the sample and short length of the series, one must consider these results with causation.

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Appendix

Table 1: Summary of cointegration and causality tests

Countries	Tests using GDP and CRD			Tests using GDP and CAP			Tests using GDP and STR			Test using GDP and TUR		
	Cointegration	Finance causes growth	Growth Causes finance	Cointegration	Finance causes growth	Growth Causes finance	Cointegration	Finance causes growth	Growth Causes finance	Cointegration	Finance causes growth	Growth Causes finance
Argentina	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes
Australia	No	No	Yes	No	No	No	Yes	No	Yes	Yes	No	Yes
Austria	No	No	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
Belgium	No	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes
Brasilia	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
Canada	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	No	Yes
Colombia	No	Yes	No	No	No	No	No	No	No	No	No	No
Denmark	Yes	Yes	No	Yes	Yes	No	Yes	No	No	Yes	Yes	No
Singapore	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
France	Yes	No	Yes	No	Yes	No	No	No	No	Yes	Yes	Yes
Greece	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes
India	Yes	Yes	Yes	No	No	No	Yes	Yes	No	Yes	Yes	No
Indonesia	No	No	Yes	No	No	No	No	No	No	Yes	No	No
Italy	Yes	Yes	No	No	No	No	Yes	Yes	No	Yes	Yes	Yes
Japan	Yes	Yes	No	No	No	No	No	Yes	No	Yes	Yes	No
Korea	No	No	No	No	No	Yes	Yes	No	No	Yes	No	Yes
Malaysia	No	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
Mexico	No	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes
Netherlands	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No
Philippines	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
South Africa	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
Spain	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	Yes	No
Switzerland	No	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No
Thailand	No	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
United Kingdom	No	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes
United States	Yes	Yes	No	No	No	No	Yes	Yes	No	Yes	Yes	No

Notes: GPD = $\log(\text{Gross Domestic Product per capita})$ CRD = $\log(\text{Domestic Credit to private sector}/\text{Gross Domestic Product})$, CAP = $\log(\text{Total value listed domestic shares}/\text{Gross Domestic Product})$, STR = $\log(\text{Total value of domestic shares traded}/\text{Gross Domestic Product})$; TUR = $\log(\text{Total value of domestic shares traded} / \text{Total value listed domestic shares})$

Table 2 : Unit root tests for GDP, CRED, CAP, STR and TUR

Countries	GDP			CRD			CAP			STR			TUR		
	r_{-1}	ADF	k	r_{-1}	ADF	k	r_{-1}	ADF	k	r_{-1}	ADF	k	r_{-1}	ADF	k
Argentina	0.779	-2.17	0	0.602	-2.90	0	0.75	-1.80	0	0.50	-2.427	0	-0.17	-4.446**	0
Australia	0.738	-2.12	0	0.902	-1.54	1	0.57	-2.57	1	0.42	-2.213	0	0.39	-2.289	0
Austria	0.943	-1.08	0	0.839	-1.69	0	0.20	-3.89*	1	0.39	-2.201	0	0.35	-2.326	0
Belgium	0.915	-1.35	0	0.804	-1.73	0	0.77	-1.89	1	0.74	-1.298	0	0.60	-1.762	0
Brasilia	0.937	-1.42	1	0.610	-3.00*	1	0.58	-1.87	0	0.49	-2.41	0	0.07	-3.14	0
Canada	0.762	-2.46	1	0.850	-1.91	0	0.59	-2.52	1	0.30	-2.420	0	0.22	-2.714	0
Colombia	0.938	-0.72	1	0.416	-3.21*	3	0.83	-2.27	1	0.91	-0.563	0	0.53	-1.575	0
Denmark	0.679	-2.95*	0	0.606	-4.00**	3	0.56	-2.21	0	0.39	-2.199	0	0.30	-2.536	0
Singapore	0.893	-2.45	1	0.884	-1.23	0	0.64	-2.10	0	0.12	-3.816*	3	0.52	-1.659	2
France	0.921	-1.83	0	0.143	-4.73**	0	0.65	-2.39	1	0.53	-2.069	0	0.04	-3.093*	1
Greece	0.877	-3.16*	0	0.904	-1.64	1	0.60	-2.44	1	0.70	-1.378	0	0.47	-1.895	3
India	1.016	0.203	4	0.938	-1.20	0	0.87	-1.45	0	0.26	-3.398*	3	0.30	-3.108*	1
Indonesia	0.339	-2.35	1	0.761	-1.43	0	0.77	-2.12	0	0.04	-3.847*	0	0.32	-2.709	0
Italy	0.789	-2.22	0	0.715	-3.74**	4	0.83	-1.72	0	0.74	-1.373	0	0.64	-1.644	0
Japan	0.910	-1.98	1	0.978	-0.17	0	0.85	-1.93	1	-0.29	-4.692**	3	-0.26	-3.778*	3
Korea	0.756	-1.80	0	0.688	-5.37**	2	0.75	-3.23*	1	0.54	-2.121	0	0.21	-2.732	0
Malaysia	0.539	-3.01	3	0.714	-2.26	0	0.30	-3.22*	3	0.50	-1.814	0	0.26	-2.541	0
Mexico	0.882	-1.65	0	0.833	-1.71	0	0.79	-2.84	1	0.37	-2.914	0	0.39	-2.292	0
Netherlands	0.856	-2.33	0	0.818	-1.81	0	0.47	-2.99	1	0.37	-2.370	0	0.24	-2.748	0
Philippines	0.861	-2.36	1	0.759	-3.22*	2	0.76	-2.30	1	0.34	-2.739	0	0.18	-3.031	0
South Africa	0.681	-2.98*	1	0.922	-1.05	0	0.47	-3.53*	0	0.43	-2.190	0	0.43	-2.131	0
Spain	0.869	-2.84	1	0.818	-2.83	1	0.74	-2.65	1	0.20	-2.87	3	0.55	-2.20	0
Switzerland	0.849	-2.18	1	0.696	-2.46	2	0.77	-1.56	0	-0.32	-2.690	3	-0.42	-2.900	3
Thailand	0.795	-2.51	1	0.615	-3.12*	1	0.72	-2.79	1	0.38	-2.189	0	-0.36	-2.428	0
United Kingdom	0.549	-3.74**	1	0.809	-2.19	1	0.39	-3.17	2	0.49	-3.41	1	0.23	-3.52	1
United States	0.367	-4.68**	1	0.910	-0.856	1	0.45	-2.32	0	0.42	-2.331	0	0.51	-1.992	0

Notes : GPD = log(Gross Domestic Product per capita) CRD = log(Domestic Credit to private sector/Gross Domestic Product),CAP = log(Total value listed domestic shares/ Gross Domestic Product), STR = log(Total value of domestic shares traded/ Gross Domestic Product) ; TUR = log (Total value of domestic shares traded / Total value listed domestic shares)

ADF is the augmented Dickey-Fuller statistic

*(**) Indicate statistical significance at the 5% (1%) level.

Tableau 3 : Unit root tests for Δ GDP, Δ CRD, Δ CAP, Δ STR et Δ TUR

Countries	Δ GDP			Δ CRD			Δ CAP			Δ STR			Δ TUR		
	$r-1$	ADF	k	$r-1$	ADF	k	$r-1$	ADF	k	$r-1$	ADF	k	$r-1$	ADF	k
Argentina	0.093	-4.74**	0	-0.183	-6.13**	0	0.11	-4.16**	0	-0.32	-5.200**	0	-0.38	-5.201**	0
Australia	-0.091	-5.65**	0	0.229	-4.14**	0	-0.21	-4.71**	1	0.07	-4.129**	0	-0.05	-4.856**	0
Austria	-0.044	-5.49**	0	-0.126	-5.78**	0	-0.48	-5.54**	1	-0.37	-5.058**	0	-0.49	-5.751**	0
Belgium	-0.260	-3.08*	4	-0.076	-5.44**	0	0.38	-2.78	0	0.29	-2.575	0	-0.22	-3.839*	1
Brasilia	0.322	-3.71**	0	-0.605	-7.44**	1	0.15	-3.26*	0	-0.06	-4.36*	0	-0.42	-5.65	0
Canada	0.272	-3.79**	0	0.155	-4.49**	0	-0.15	-4.64**	1	-0.08	-3.983**	0	-0.20	-4.632**	0
Colombia	0.186	-4.04**	2	-0.077	-5.487**	0	0.29	-3.05*	1	-0.16	-4.172**	0	-0.44	-5.315**	0
Denmark	-0.024	-4.85**	0	0.239	-3.905**	0	0.00	-4.32**	0	-0.20	-4.333**	0	-0.20	-4.443**	0
Singapore	0.615	-2.912	1	0.046	-3.91**	0	0.11	-3.73*	0	-0.11	-4.134**	0	-0.20	-4.742**	0
France	0.183	-4.20**	0	-0.474	-8.53**	0	0.32	-2.93	0	0.16	-2.937	0	0.07	-3.214*	0
Greece	0.069	-4.74**	0	0.004	-5.73**	0	0.23	-3.36*	0	-0.01	-3.535*	0	-0.21	-4.269**	0
India	-0.157	-6.21**	0	0.153	-4.62**	0	0.11	-4.98**	0	0.48	-1.843	0	0.33	-2.182	0
Indonesia	0.242	-3.93**	0	0.177	-3.42*	0	-0.01	-5.59**	0	-0.53	-6.596**	0	-0.60	-7.797**	0
Italy	-0.043	-5.41**	0	0.498	-3.04*	0	0.10	-5.12**	0	0.17	-2.979	0	-0.10	-3.812*	0
Japan	0.428	-3.31*	0	0.206	-4.13**	0	0.42	-3.69**	0	-0.34	-3.338*	3	-0.12	-4.004**	0
Korea	0.062	-4.93**	0	0.035	-4.27**	3	0.52	-3.07*	1	0.17	-3.033	0	-0.18	-4.271**	0
Malaysia	0.239	-3.97**	0	-1.012	-4.52**	3	0.29	-3.07*	0	-0.57	-6.262**	0	-0.70	-7.973**	0
Mexico	0.316	-3.63*	0	-0.008	-5.10**	0	0.65	-1.97	0	-0.18	-4.436**	0	-0.34	-5.010**	0
Netherlands	0.323	-3.59*	0	0.041	-4.89**	0	0.19	-3.35*	0	-0.08	-3.570*	0	-0.15	-3.906*	0
Philippines	0.351	-3.48*	1	0.428	-3.20*	0	0.38	-2.71	0	-0.23	-4.399**	0	-0.20	-4.200**	0
South Africa	0.136	-4.52**	0	-0.920	-4.20**	4	-0.20	-5.13**	0	-0.21	-4.412**	0	-0.30	-4.769**	0
Spain	0.514	-2.87	0	0.470	-3.05*	0	0.56	-2.42	0	-0.02	-4.33*	0	-0.13	-5.26**	0
Switzerland	-0.032	-4.35**	1	-0.095	-5.42**	0	0.30	-3.08*	0	0.39	-5.311**	3	0.19	-5.003**	3
Thailand	0.369	-3.47*	0	-0.229	-4.02**	3	0.58	-2.12	0	0.34	-5.002**	0	0.20	-3.368**	0
United Kingdom	0.031	-4.23**	1	0.206	-4.10**	0	0.08	-3.80*	0	-0.03	-4.01*	1	-0.35	-4.55**	1
United States	-0.094	-4.57**	0	0.161	-4.34**	0	-0.27	-5.55**	0	-0.28	-4.629**	0	-0.23	-4.369**	0

Note: Notes : GDP = $\log(\text{Gross Domestic Product per capita})$ CRD = $\log(\text{Domestic Credit to private sector}/\text{Gross Domestic Product})$, CAP = $\log(\text{Total value listed domestic shares}/\text{Gross Domestic Product})$, STR = $\log(\text{Total value of domestic shares traded}/\text{Gross Domestic Product})$; ADF is the augmented Dickey-Fuller statistic

*(**) indicate statistical significance at the 5% (1%) level

Table 4: Johansen cointegration tests

Countries	Variables : GDP et CRED				Variables : GDP et CAP			
	H0 : r = 0 vs H1 : r = 1				H0 : r = 0 vs H1 : r = 1			
	Trace statistic				Trace statistic			
	k =1	k =2	k =3	k =4	k =1	k =2	k =3	k =4
Argentina	27.61 *	19.07	19.53	17.53	16.96	16.28	20.45	23.59+
Australia	9.58	13.75	15.69	15.69	14.14	22.69	15.16	14.62
Austria	19.13	17.31	17.65	17.13	22.75	28.63*	23.77+	23.04
Belgium	14.02	13.33	10.77	12.69	26.11*	17.97	22.84	18.96
Brasilia	17.12	23.38+	16.41	15.58	24.16	18.66	35.12**	47.76**
Canada	35.38 **	22.10	18.20	16.24	9.89	13.20	24.00+	34.16**
Colombia	15.51	15.75	19.95	14.78	9.14	15.76	17.58	19.96
Denmark	20.46	20.93	24.02+	30.19 *	10.20	15.20	18.09	32.72**
Singapore	20.72*	17.70	12.62	20.52 +	34.29**	39.02**	35.46**	20.99**
France	43.94 **	29.42 *	23.80+	16.12	13.62	17.77	16.96	21.30
Greece	39.48 **	29.22 *	3.91 **	34.42 **	12.89	17.84	27.32*	22.93
India	15.83	19.65	26.59 *	20.93 *	14.20	12.74	14.98	18.39
Indonesia	17.49	21.54	19.26	19.61	7.43	12.73	12.85	13.39
Italy	15.57	21.02	26.97 *	12.69	15.72	13.94	17.65	18.62
Japan	39.32 **	30.95 **	31.41 **	34.20 **	33.38**	19.83	20.68	20.02
Korea	10.11	22.84	19.82	21.09	11.37	26.05*	16.00	19.28
Malaysia	19.79	23.43+	15.17	15.88	13.17	16.13	19.29	23.50+
Mexico	13.16	15.02	16.64	21.24	15.45	21.98	22.91	24.68+
Netherlands	23.85+	26.05 *	31.22 **	34.66 **	37.17**	24.82+	29.24*	39.44**
Philippines	5.34	11.94	15.57	24.73+	26.11*	24.66+	20.37	21.66
South Africa	18.09	20.13	17.31	20.10+	22.53	20.38+	30.00*	27.43*
Spain	23.80+	39.23 **	38.60 **	42.77 **	21.88	24.74+	41.94**	39.34**
Switzerland	15.44	12.82	16.22	19.77	39.36**	20.50	23.43+	31.39*
Thailand	9.95	13.02	13.07	12.62	33.23**	26.26*	27.64*	18.27
United Kingdom	10.73	19.15	15.35	20.05	20.43	26.09*	21.56	35.12**
United States	12.59	22.71	21.96	20.26+	9.91	11.51	18.96	17.77

Notes: GPD = log(Gross Domestic Product per capita CRD = log(Domestic Credit to private sector/Gross Domestic Product), CAP = log(Total value listed domestic shares/ Gross Domestic Product),
+, *, ** indicate statistical significance at the 10%, 5%, 1% level respectively (the null hypothesis is rejected)

Table 5 : Johansen cointegration tests

Countries	Variables : GDP et STR				Variables : GDP et TUR			
	H0 : r = 0 vs H1 : r = 1				H0 : r = 0 vs H1 : r = 1			
	Trace statistic				Trace statistic			
	k=1	k=2	k=3	k=4	k=1	k=2	k=3	k=4
Argentina	14.19	14.60	14.09	14.14	17.24	26.42 *	16.50	19.18
Australia	29.23 *	31.19 **	31.63 **	29.29 *	27.38 *	28.10 *	27.65 *	32.66 **
Austria	22.33	24.26+	27.73 *	28.22 *	18.13	21.96	34.64 **	35.26 **
Belgium	28.24 *	23.48+	29.69 *	26.92 *	20.42	17.39	24.76+	31.99 **
Brasilia	28.39*	23.27	45.10**	31.73**	33.85**	27.94*	49.89**	28.19*
Canada	16.34	17.31	31.68 **	28.71 *	16.13	16.81	33.49 **	26.01 *
Colombia	16.64	24.33+	21.86	18.57	13.60	20.74	20.00	20.35
Denmark	7.42	10.13	10.72	27.56 *	21.42	21.39	20.77 *	50.91 **
Singapore	37.91 **	36.38 **	55.51 **	50.77 **	31.36 **	30.94 **	32.74 **	33.44 **
France	17.14	15.10	15.29	20.20	23.13	27.65 *	23.83+	24.51+
Greece	12.09	19.54	20.29	43.20 **	9.11	19.38	23.13	48.54 **
India	36.11 **	30.65 *	31.04 **	37.24 **	38.78 **	47.89 **	39.06 **	39.57 **
Indonesia	19.49	15.73	14.08	15.81	17.47	15.46	24.22+	29.76 *
Italy	20.78	19.64	27.76 *	21.53	17.36	20.30	28.95 *	71.66 **
Japan	23.91+	11.96	22.52	16.37	29.67 *	23.21	31.66 **	67.89 **
Korea	11.68	28.26 *	23.15	18.47	19.08	26.15 *	21.29	35.39 **
Malaysia	22.54	21.03	39.24 **	36.88 **	20.01+	18.85	30.64 *	31.99 **
Mexico	17.56	18.23	24.82+	28.87 *	13.17	27.66 *	23.93 +	27.19 *
Netherlands	39.99 **	21.74	20.60+	30.74 **	38.22 **	23.15	20.13 +	29.48 *
Philippines	29.79 *	20.60+	32.91 **	39.12 **	23.29	27.20 *	23.72 +	21.48
South Africa	14.45	14.24	13.03	17.88	12.93	11.13	10.07	17.69
Spain	23.52+	18.37	29.81*	22.24	22.86	17.51	32.43**	22.79
Switzerland	20.73	22.11	31.84 **	41.63 **	15.72	26.36 *	35.90 **	36.91 **
Thailand	37.60 **	34.30 **	42.48 **	36.81 **	36.39 **	32.41 **	39.47 **	38.49 **
United Kingdom	30.66*	34.17**	39.41**	35.91**	29.24*	35.91**	48.77**	36.41**
United States	15.71	15.20	24.83+	31.70 **	15.58	17.81	23.37+	30.86 **

Notes: GPD = log(Gross Domestic Product per capita); STR = log(Total value of domestic shares traded/ Gross Domestic Product) ; TUR = log (Total value of domestic shares traded / Total value listed domestic shares)
+, *, ** indicate statistical significance at the 10%, 5%, 1% level respectively (the null hypothesis is rejected)

Table 6 : ECM tests with Johansen cointegrating vectors

Countries	Null hypothesis						k	n
	GDP \nrightarrow CRED			CRED \nrightarrow GDP				
	$b_{11} = \dots = b_{1k} = 0$ $c^2(k)$	$d_2 = 0$ $c^2(k)$	$b_{11} = \dots = b_{1k} = d_2 = 0$ $c^2(k)$	$a_{21} = \dots = a_{2k} = 0$ $c^2(k)$	$d_1 = 0$ $c^2(k)$	$a_{21} = \dots = a_{2k} = d_1 = 0$ $c^2(k)$		
Brazil	1.310 [0.519]	1.95 [0.162]	3.41 [0.333]	4.33 [0.114]	9.23 [0.002]**	11.69 [0.008]**	2	39
Canada	0.71 [0.399]	12.27 [0.000]**	13.42 [0.001]**	3.35 [0.067]+	0.49 [0.482]	3.76 [0.152]	1	34
Denmark	0.839 [0.657]	0.14 [0.707]	1.05 [0.788]	1.53 [0.465]	8.66 [0.003]**	9.70 [0.021] *	2	39
Singapore	8.26 [0.041] *	7.60 [0.006]**	19.21 [0.001]**	2.81 [0.422]	2.44 [0.118]	5.24 [0.263]	3	39
France	20.00 [0.000]**	3.46 [0.063]	26.47 [0.000]**	1.49 [0.827]	2.34 [0.126]	5.29 [0.382]	4	37
Greece	3.09 [0.543]	6.47 [0.011] *	9.60 [0.087]	8.44 [0.077]	4.78 [0.029] *	14.03 [0.015] *	4	39
India	20.45 [0.000]**	22.97 [0.000]**	28.49 [0.000]**	13.41 [0.009]*	2.32 [0.128]	16.66 [0.005]**	4	39
Italy	3.07 [0.216]	0.48 [0.487]	3.07 [0.380]	4.94 [0.084]+	10.54 [0.001]**	19.80 [0.000]**	2	35
Japan	1.42 [0.841]	0.21 [0.647]	4.16 [0.527]	12.22 [0.016] *	5.20 [0.022] *	17.28 [0.004]**	4	39
Malaysia	2.77 [0.597]	0.00 [0.998]	5.46 [0.362]	3.33 [0.505]	0.16 [0.686]	3.39 [0.639]	4	39
Netherlands	6.64 [0.156]	4.18 [0.041]*	9.86 [0.079]+	8.96 [0.062]	4.16 [0.041] *	11.52 [0.042] *	4	37
Philippines	7.80 [0.020]*	2.51 [0.113]	12.75 [0.005]	1.96 [0.374]	0.01 [0.939]	2.21 [0.530]	2	39
South Africa	1.43 [0.838]	5.95 [0.015] *	6.07 [0.299]	3.01 [0.556]	5.71 [0.017] *	9.26 [0.099]	4	34
Spain	10.44 [0.015] *	0.01 [0.913]	13.01 [0.011] *	9.42 [0.024] *	5.42 [0.020] *	15.82 [0.003]**	4	39
United States	0.83 [0.841]	0.60 [0.438]	1.62 [0.804]	2.26 [0.521]	5.11 [0.024] *	8.55 [0.073]+	3	39

Notes: Notes : GPD = log(Gross Domestic Product per capita), CRD = log(Domestic Credit to private sector/Gross Domestic Product), n, number of observations ; k, number of lag in ECM. P-value in brackets.

+, *, ** indicate statistical significance at the 10%, 5%, 1% level respectively (the null hypothesis is rejected)

\nrightarrow means « does not cause »

Table 7 : ECM tests with Johansen cointegrating vectors

Countries	Null hypothesis						k	n
	GDP \nrightarrow CAP			CAP \nrightarrow GDP				
	$\mathbf{b}_{11} = \dots = \mathbf{b}_{1k} = 0$ $\mathbf{c}^2(k)$	$\mathbf{d}_2 = 0$ $\mathbf{c}^2(k)$	$\mathbf{b}_{11} = \dots = \mathbf{b}_{1k} = \mathbf{d}_2 = 0$ $\mathbf{c}^2(k)$	$\mathbf{a}_{21} = \dots = \mathbf{a}_{2k} = 0$ $\mathbf{c}^2(k)$	$\mathbf{d}_1 = 0$ $\mathbf{c}^2(k)$	$\mathbf{a}_{21} = \dots = \mathbf{a}_{2k} = \mathbf{d}_1 = 0$ $\mathbf{c}^2(k)$		
Argentina	1.18 [0.554]	2.86 [0.091]	3.63 [0.304]	2.53 [0.281]	10.06 [0.001]**	11.92 [0.008]**	2	19
Austria	1.44 [0.487]	1.43 [0.232]	2.42 [0.490]	3.07 [0.216]	16.03 [0.000]**	17.94 [0.000]**	2	21
Belgium	1.77 [0.412]	2.61 [0.106]	0.11 [0.745]	3.96 [0.138]	13.90 [0.000]**	23.51 [0.000]**	2	20
Brasilia	2.68 [0.261]	0.20 [0.618]	2.89 [0.399]	5.74 [0.057]+	8.29 [0.012]*	14.80 [0.002]**	2	17
Canada	2.14 [0.343]	1.13 [0.288]	2.57 [0.463]	6.87 [0.032]*	0.77 [0.380]	7.26 [0.064]	2	21
Denmark	1.33 [0.514]	2.06 [0.151]	2.23 [0.522]	1.08 [0.583]	1.22 [0.269]	5.75 [0.016]*	2	21
Singapore	1.92 [0.382]	0.76 [0.384]	3.82 [0.281]	2.45 [0.002]**	52.78 [0.000]**	61.75 [0.000]**	2	19
Greece	0.09 [0.954]	1.61 [0.204]	1.76 [0.623]	0.30 [0.861]	3.27 [0.071]+	3.63 [0.305]	2	21
Malaysia	2.65 [0.448]	0.00 [0.993]	2.70 [0.609]	3.29 [0.349]	12.00 [0.000]**	12.53 [0.014]*	3	19
Mexico	0.91 [0.637]	2.20 [0.138]	8.46 [0.037]*	6.38 [0.041]*	11.39 [0.001]**	27.84 [0.000]**	2	19
Netherlands	3.73 [0.155]	0.28 [0.598]*	3.95 [0.267]	3.34 [0.188]	15.68 [0.000]**	16.74 [0.001]**	2	21
Philippines	3.49 [0.174]	7.01 [0.008]**	20.21 [0.000]**	2.45 [0.294]	5.90 [0.015]*	8.74 [0.033]*	2	21
South Africa	0.70 [0.703]	1290.04 [0.000]**	1347.39 [0.000]**	5.21 [0.074]+	5.14 [0.023]*	9.86 [0.020]*	2	21
Spain	0.56 [0.452]	3.49 [0.062]+	3.55 [0.169]	2.66 [0.103]	0.01 [0.931]	3.09 [0.212]	1	21
Switzerland	3.87 [0.144]	2.99 [0.084]+	4.02 [0.204]	0.86 [0.650]	0.01 [0.904]	39.07 [0.000]**	2	21
Thailand	1.65 [0.438]	1.62 [0.202]	2.90 [0.396]	5.20 [0.072]+	9.96 [0.002]**	45.61 [0.000]**	2	21
United Kingdom	9.35 [0.009]**	0.76 [0.382]	13.22 [0.004]**	1.38 [0.501]	0.38 [0.535]	4.36 [0.220]	2	21

Notes : GPD = log(Gross Domestic Product per capita), CAP = log(Total value listed domestic shares/ Gross Domestic Product), ; n, number of observations ; k, number of lag in ECM ; p-value in brackets.

+, *, ** indicate statistical significance at the 10%, 5%, 1% level respectively (the null hypothesis is rejected)

\nrightarrow means « does not cause »

Table 8 : ECM tests with Johansen cointegrating vectors

Countries	Null hypothesis						k	n
	GDP \nrightarrow STR			STR \nrightarrow GDP				
	$b_{11} = \dots = b_{1k} = 0$ $c^2(k)$	$d_2 = 0$ $c^2(k)$	$b_{11} = \dots = b_{1k} = d_2 = 0$ $c^2(k)$	$a_{21} = \dots = a_{2k} = 0$ $c^2(k)$	$d_1 = 0$ $c^2(k)$	$a_{21} = \dots = a_{2k} = d_1 = 0$ $c^2(k)$		
Australia	0.95 [0.622]	11.59 [0.001]**	12.78 [0.005]**	0.17 [0.917]	0.36 [0.547]	1.50 [0.682]	2	22
Austria	1.61 [0.448]	0.00 [0.946]	1.83 [0.609]	3.70 [0.157]	16.88 [0.000]**	17.95 [0.000]**	2	22
Belgium	0.21 [0.902]	11.80 [0.008]**	5.05 [0.020]*	4.67 [0.097]+	0.37 [0.541]	6.64 [0.084]+	2	22
Canada	0.39 [0.821]	3.51 [0.061]	3.76 [0.289]	2.65 [0.266]	1.04 [0.307]	4.60 [0.203]	2	22
Denmark	0.09 [0.764]	0.00 [0.952]	0.13 [0.936]	2.37 [0.124]	0.19 [0.662]	2.45 [0.293]	1	22
Singapore	9.54 [0.023]*	1.73 [0.188]	10.30 [0.036]*	5.59 [0.133]	24.88 [0.000]**	34.82 [0.000]**	3	22
Greece	0.54 [0.763]	0.13 [0.715]	0.54 [0.909]	4.51 [0.105]	0.38 [0.534]	6.73 [0.081]+	2	22
India	0.50 [0.777]	2.70 [0.100]	2.92 [0.395]	8.27 [0.016]*	1.00 [0.316]	10.17 [0.017]*	2	20
Italy	3.64 [0.162]	0.66 [0.417]	3.65 [0.302]	9.64 [0.008]**	18.00 [0.000]**	19.42 [0.000]**	2	22
Korea	0.00 [0.978]	0.03 [0.856]	0.83 [0.661]	0.45 [0.500]	1.01 [0.315]	1.86 [0.394]	1	22
Malaysia	1.73 [0.421]	0.03 [0.852]	2.07 [0.558]	7.39 [0.020]*	13.89 [0.000]**	16.04 [0.001]**	2	21
Mexico	3.12 [0.210]	6.48 [0.011]*	11.05 [0.011]*	0.00 [0.999]	0.08 [0.775]	0.16 [0.984]	2	22
Netherlands	1.34 [0.248]	0.03 [0.862]	4.32 [0.115]	0.58 [0.446]	2.82 [0.093]+	7.04 [0.029]*	1	22
Philippines	20.09 [0.000]**	2.11 [0.146]	20.12 [0.000]**	10.30 [0.016]*	1.42 [0.233]	11.59 [0.021]*	2	21
Switzerland	5.17 [0.075]+	11.41 [0.001]**	11.76 [0.008]**	0.67 [0.715]	0.09 [0.769]	2.47 [0.480]	2	22
Thailand	1.90 [0.593]	0.68 [0.399]	1.93 [0.749]	6.90 [0.075]+	0.63 [0.427]	9.30 [0.054]+	1	21
United States	0.45 [0.799]	1.16 [0.281]	1.71 [0.634]	2.47 [0.291]	9.00 [0.003]**	18.03 [0.000]**	2	22

Notes: GPD = log(Gross Domestic Product per capita) STR = log(Total value of domestic shares traded/ Gross Domestic Product) ; n, number of observations ; k, number of lag in ECM ; p-value in brackets

+, *, ** indicate statistical significance at the 10%, 5%, 1% level respectively (the null hypothesis is rejected)

\nrightarrow means « does not cause »

Table 9 : ECM tests with Johansen cointegrating vectors

Countries	Null hypothesis						k	n
	GDP \nrightarrow TUR			TUR \nrightarrow GDP				
	$b_{11} = \dots = b_{1k} = 0$ $c^2(k)$	$d_2 = 0$ $c^2(k)$	$b_{11} = \dots = b_{1k} = d_2 = 0$ $c^2(k)$	$a_{21} = \dots = a_{2k} = 0$ $c^2(k)$	$d_1 = 0$ $c^2(k)$	$a_{21} = \dots = a_{2k} = d_1 = 0$ $c^2(k)$		
Australia	3.82 [0.148]	14.56 [0.000]**	15.14 [0.002]**	1.67 [0.433]	0.73 [0.393]	1.68 [0.642]	2	21
Austria	3.67 [0.299]	0.21 [0.645]	3.68 [0.450]	7.52 [0.057]+	3.53 [0.000]**	15.14 [0.004]**	3	21
Belgium	0.07 [0.785]	8.57 [0.003]**	17.37 [0.000]**	0.36 [0.547]	0.63 [0.426]	0.67 [0.715]	1	20
Canada	0.17 [0.919]	4.34 [0.037]*	4.46 [0.216]	0.61 [0.737]	0.58 [0.455]	2.44 [0.486]	2	21
Denmark	0.43 [0.511]	0.62 [0.572]	0.90 [0.636]	0.23 [0.634]	6.53 [0.011]*	7.16 [0.028]*	1	21
Singapore	0.17 [0.918]	2.85 [0.091]+	4.78 [0.190]	3.53 [0.171]	0.59 [0.441]	3.81 [0.282]	2	19
France	4.24 [0.120]	1.42 [0.234]	11.71 [0.008]**	3.79 [0.150]	8.90 [0.003]**	11.72 [0.008]**	2	21
Greece	1.84 [0.606]	5.56 [0.018]*	6.66 [0.155]	6.26 [0.099]	6.86 [0.009]**	10.53 [0.032]*	3	21
India	1.44 [0.697]	1.94 [0.163]	4.10 [0.393]	3.30 [0.347]	4.01 [0.045]*	16.63 [0.002]**	2	19
Indonesia	0.14 [0.933]	3.05 [0.080]	3.36 [0.339]	2.84 [0.241]	0.00 [0.944]	3.41 [0.332]	2	19
Italy	4.98 [0.083]+	0.16 [0.686]	5.48 [0.139]	12.29 [0.002]**	20.49 [0.000]**	20.79 [0.000]**	2	21
Japan	0.56 [0.755]	3.05 [0.080]	4.59 [0.204]	3.27 [0.195]	15.68 [0.000]**	16.82 [0.001]**	2	21
Korea	1.57 [0.457]	17.01 [0.000]**	21.76 [0.000]**	1.95 [0.378]	0.08 [0.780]	1.96 [0.581]	2	21
Malaysia	0.31 [0.855]	2.30 [0.129]	3.31 [0.346]	5.48 [0.064]+	9.26 [0.002]**	10.57 [0.014]*	2	19
Mexico	6.14 [0.013]*	9.59 [0.020]**	13.96 [0.001]**	0.85 [0.355]	2.95 [0.086]	2.96 [0.228]	1	19
Netherlands	1.22 [0.542]	0.22 [0.639]	5.55 [0.136]	0.23 [0.893]	3.07 [0.080]+	5.64 [0.130]	2	21
Philippines	3.21 [0.361]	4.41 [0.036]*	21.63 [0.000]**	12.75 [0.005]**	2.56 [0.110]	13.31 [0.009]**	2	21
Switzerland	0.01 [0.995]	4.07 [0.044]*	4.94 [0.176]	2.92 [0.232]	7.68 [0.006]**	8.00 [0.046]*	2	21
Thailand	1.24 [0.536]	6.23 [0.012]*	6.59 [0.086]	5.13 [0.077]	9.32 [0.002]**	9.42 [0.024]*	2	21
United States	0.13 [0.934]	0.22 [0.638]	0.60 [0.897]	2.18 [0.336]	12.64 [0.000]**	21.86 [0.000]**	2	21

Notes: GPD = log(Gross Domestic Product per capita), TUR = log (Total value of domestic shares traded / Total value listed domestic shares). n, number of observations ; k, number of lags in ECM ; p-value in brackets. +, *, ** indicate statistical significance at the 10%, 5%, 1% level respectively (the null hypothesis is rejected). \nrightarrow means « does not cause »

Table 10 : First difference VARs based causality tests between GDP and CRD.

Countries	Null hypothesis		k	n
	$\Delta\text{GDP} \not\Rightarrow \Delta\text{CRD}$	$\Delta\text{CRD} \not\Rightarrow \Delta\text{GDP}$		
	$\mathbf{b}_{11} = \dots = \mathbf{b}_{1k} = 0$	$\mathbf{a}_{21} = \dots = \mathbf{a}_{2k} = 0$		
	$\mathbf{c}^2(k)$	$\mathbf{c}^2(k)$		
Argentina	5.03 [0.020]*	2.72 [0.099]+	1	39
Australia	3.85 [0.050] *	1.73 [0.189]	1	39
Austria	3.83 [0.147]	2.54 [0.280]	2	37
Belgium	1.39 [0.844]	2.07 [0.722]	4	37
Colombia	2.82 [0.244]	6.31 [0.043] *	2	39
Indonesia	12.82 [0.005] **	1.75 [0.620]	3	34
Korea	1.56 [0.816]	2.56 [0.634]	4	39
Malaysia	3.64 [0.162]	4.72 [0.094]+	2	39
Mexico	2.60 [0.627]	0.95 [0.917]	4	39
Philippines	8.81 [0.012] *	4.14 [0.126]	2	39
Switzerland	4.18 [0.382]	1.46 [0.834]	4	39
Thailand	1.02 [0.907]	0.96 [0.915]	4	39
United Kingdom	2.70 [0.609]	2.45 [0.654]	4	39

Notes: Notes : GPD = log(Gross Domestic Product per capita), CRD = log(Domestic Credit to private sector/Gross Domestic Product), n, number of observations ; k, number of lags in VAR P-value in brackets +, *, ** indicate statistical significance at the 10%, 5%, 1% level respectively (the null hypothesis is rejected)

$\not\Rightarrow$ means « does not cause »

Table 11 : First difference VARs based causality tests between CAP et GDP.

Countries	Null hypothesis		k	n
	$\Delta\text{GDP} \not\Rightarrow \Delta\text{CAP}$	$\Delta\text{CAP} \not\Rightarrow \Delta\text{GDP}$		
	$\mathbf{b}_{11} = \dots = \mathbf{b}_{1k} = 0$	$\mathbf{a}_{21} = \dots = \mathbf{a}_{2k} = 0$		
	$\mathbf{c}^2(k)$	$\mathbf{c}^2(k)$		
Australia	3.57 [0.168]	1.68 [0.432]	2	21
Colombia	2.06 [0.357]	0.60 [0.739]	2	19
Korea	9.35 [0.002]*	0.11 [0.742]	1	21
France	2.09 [0.554]	8.68 [0.034]*	3	21
India	4.58 [0.1015]	0.98 [0.806]	2	19
Indonesia	0.66 [0.888]	0.31 [0.985]	2	19
Italy	1.20 [0.752]	1.90 [0.594]	3	21
Japan	0.49 [0.485]	1.30 [0.254]	1	21
Netherlands	1.59 [0.661]	13.20 [0.004]**	3	21
Philippines	7.14 [0.067]+	2.33 [0.507]	3	21
United States	1.69 [0.648]	3.08 [0.380]	3	21

Notes: GPD = log(Gross Domestic Product per capita), CAP = log(Total value listed domestic shares/ Gross Domestic Product), ; n, number of observations ; k, number of lag in VARs ; p-value in brackets

+, *, ** indicate statistical significance at the 10%, 5%, 1% level respectively (the null hypothesis is rejected)

$\not\Rightarrow$ means « does not cause »

Table 12 : First difference VARs based causality tests between STR et GDP.

Countries	Null hypothesis		k	n
	$\Delta\text{GDP} \not\Rightarrow \Delta\text{STR}$	$\Delta\text{STR} \not\Rightarrow \Delta\text{GDP}$		
	$\mathbf{b}_{11} = \dots = \mathbf{b}_{1k} = 0$	$\mathbf{a}_{21} = \dots = \mathbf{a}_{2k} = 0$		
	$\mathbf{c}^2(k)$	$\mathbf{c}^2(k)$		
Argentina	0.53 [0.467]	0.05 [0.817]	1	21
Colombia	2.08 [0.149]	1.00 [0.317]	2	21
France	0.86 [0.355]	2.75 [0.098]+	1	22
Indonesia	1.22 [0.544]	3.21 [0.201]	2	20
Japan	2.91 [0.396]	8.51 [0.037] *	3	22
South Africa	0.10 [0.953]	1.79 [0.399]	2	22

Notes: GPD = log(Gross Domestic Product per capita) STR = log(Total value of domestic shares traded/ Gross Domestic Product) ; n, number of observations ; k, number of lag in VAR ; p-value in brackets
+, *, ** indicate statistical significance at the 10%, 5%, 1% level respectively (the null hypothesis is rejected)
 $\not\Rightarrow$ means « does not cause »

Table 13 : First difference VARs based causality tests between TUR et GDP.

Countries	Null hypothesis		k	n
	$\Delta\text{GDP} \not\Rightarrow \Delta\text{TUR}$	$\Delta\text{TUR} \not\Rightarrow \Delta\text{GDP}$		
	$\mathbf{b}_{11} = \dots = \mathbf{b}_{1k} = 0$	$\mathbf{a}_{21} = \dots = \mathbf{a}_{2k} = 0$		
	$\mathbf{c}^2(k)$	$\mathbf{c}^2(k)$		
Argentine	4.04 [0.132]	5.55 [0.062]	1	21
Colombia	3.13 [0.209]	2.56 [0.278]	2	19
South Africa	0.21 [0.649]	0.34 [0.559]	1	21

Notes: GPD = log(Gross Domestic Product per capita), TUR = log (Total value of domestic shares traded / Total value listed domestic shares). n, number of observations ; k, number of lags in VAR; p-value in brackets
+, *, ** indicate statistical significance at the 10%, 5%, 1% level respectively (the null hypothesis is rejected)
 $\not\Rightarrow$ means « does not cause »