Finance and Growth: Evidence from the ARF Countries

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Highlights

- We assess the causal relationship between economic growth, and four different types of financial development.
- The empirical investigation follows ASEAN Regional Forum countries between 1991 and 2012.
- We use a panel vector autoregressive model for detecting the direction of causality between these variables.
- The study demonstrates both unidirectional and bidirectional causality between these variables.

Abstract

This paper examines the relationships between economic growth and four different types of financial development in ASEAN Regional Forum (ARF) countries over the period 1991-2011. Using principal component analysis (PCA) to construct development indices, and a panel vector auto-regressive model to test for Granger causalities, the study demonstrates unidirectional and bidirectional causality between the variables. The study enhances understanding of the interrelationship between the variables, combining different strands of the literature, and investigating countries previously neglected in this context. The paper recommends making banking more accessible to residents without bank accounts in ARF countries and promoting stock market development to facilitate access to investment capital in order to enhance economic growth.

Keywords: Financial development, economic growth, PCA, Granger causality, ARF countries

JEL Classification: O43, O16, E44, E31

1. Background of the Study

In the last twenty years or so, most countries have adopted new development strategies that prioritize the modernization of their financial sector and the link of that sector to economic growth. The ASEAN[1] regional forum countries (commonly known as the ARF countries) are no exception. Since the end of the 1980s, most ARF countries have promoted their own financial development, for instance, by reducing government intervention in national financial sectors, by privatizing banks, or by increasing the level of financial globalization[2] (financial openness). In order to increase financial globalization, these countries have increased capital account liberalization and increased openness to capital flows. Financial globalization has significantly enhanced stability among industrialized countries. Clearly, financial globalization is a matter of considerable policy relevance, especially for major economies that have recently been taking steps to open up their capital accounts. Among developing economies, several are in the early stages of financial globalization and they are facing numerous on-going policy decisions about the timing and pace of further integration. The stakes for such policy decisions are high because financial globalization is often blamed for many damaging economic crises. When it comes to the policy implications of financial globalization, there is enormous variation of approaches and experiences across countries.

It is anticipated that financial development policies would promote economic growth through, inter alia, higher mobilization of savings or increased home and foreign investment (Reinhart and Tokatlidis, 2003). However, if such policies are to be effective, there needs to be a proven causal relationship between financial and real sectors (Gries *et al*., 2009).

The present paper focuses on whether financial development has actually influenced economic growth in a sample of seventeen ARF countries, and whether a policy focus on financial sector development is conducive to fostering economic development. Hence, we test the causality between financial development and economic growth, capturing different linkages by disaggregating financial sector development into four sub-

[1] ASEAN stands for the Association of South East Asian Nations.

[2] Financial globalization is an effective tool for achieving high outward-oriented development (see, for instance, Khan and Khan, 2003). Financial globalization has taken place in these countries in different forms over time. The two most important dimensions of this process are diversification and offshoring. The first one refers to the increase in foreign assets and liabilities in countries' portfolios, while the second one relates to the allocation of financial activities to the international markets, namely, to where transactions take place regardless of who holds the assets (see Ceballos et al., 2012; Hoekman and Kostecki, 2001).

categories: banking sector development, stock market development, bond market development, and insurance market development.

Our study makes four contributions to the existing literature on the finance-growth nexus. Firstly, we combine different strands of the finance literature. Secondly, we deploy four composite indices of financial sector development, namely the composite index of banking sector development (CBSD), the composite index of stock market development (CSMD), the composite index of bond market development (CBMD), and the composite index of insurance market development (CIMD). Thirdly, we test for panel Granger causality, which is less prone to the misspecifications that often occur when testing causality between different subsectors of financial development and economic growth. Fourthly, we distinguish between the short-run and long-run causalities between various financial development indices and per capita economic growth.

The remainder of this paper is structured as follows: Section 2 provides an overview of financial development and economic growth; Section 3 provides a literature review on the connection between banking sector development, stock market development, bond market development, insurance market development, and economic growth; Section 4 highlights the research questions and the proposed hypotheses; Section 5 presents the data structure, sample selection, and the variables, followed by Section 6 which outlines our empirical model. The results are presented in Section 7, and the final section, Section 8, concludes with a summary and a discussion of the policy implications of our results.

2. An overview of Financial Development and Economic Growth

The level of financial development is one of the most important variables identified by the empirical growth literature as being correlated with economic growth performance across countries (see, for instance, Levine and Zervos, 1998; Graff, 2003; Calderon and Liu, 2003; Beck and Levine, 2004; Boulila and Trabelsi, 2004; Naceur and Ghazouani, 2007; Ang, 2008; Banos et al., 2011; Bojanic, 2012; Gochoco-Bautista *et al*., 2014; Jedidia *et al.*, 2014; Ngare *et al*., 2014; Peia and Roszbach, 2015; Pradhan *et al.*, 2015; Samargandi *et al*., 2015). The rate and level of financial development is a challenge for developing countries, as slow development can prevent such countries from taking full advantage of technology transfers, causing some of these countries to diverge from the growth rate of the world production frontier (Aghion *et al*., 2005; Menyah *et al*., 2014). Fung (2009) contends that poor countries with a weakened financial system are trapped in a vicious cycle, where low levels of financial development lead to low economic

performance, and, conversely, low economic performance leads to low financial development. An inadequately supervised financial system may be crisis-prone, with potentially devastating effects (Moshirian and Wu, 2012). The inverse is also true: an efficient financial system provides better financial services, which enables an economy to increase its growth rate (King and Levine, 1993a; Bencivenga *et al*., 1995; Esso, 2010). Financial development is not only pro-growth, but it is also pro-poor, suggesting that financial development helps poor citizens to catch up with the rest of the economy as it grows (Demirguc-Kunt and Levine, 2009). Furthermore, the endogenous growth theory, as articulated by Greenwood and Jovanovic (1990) and Bencivenga and Smith (1991) and others, stresses that financial development is a strategic factor that fosters long-run economic growth, because financial development, along with advancement, is able to facilitate economic growth through various channels. These channels are (a) supplying information about possible investments, so as to allocate capital efficiently; (b) supervising firms and exerting corporate governance; (c) diversifying risk; (d) mobilizing/pooling savings; (e) facilitating an exchange of goods and services; and (f) managing technology transfer (Garcia and Liu, 1999; Levine, 2005; Zhang *et al*., 2012).

Not surprisingly, the relationship between financial development[3] and economic growth has been an important area of discussion among researchers and policy-makers (see, for instance, King and Levine, 1993a, 1993b; Thornton, 1994; Beck *et al*., 2000; Levine *et al*., 2000; Levine, 2003; Wachtel, 2003; Nieuwerburgh et al., 2006; Rashid, 2008; Tsouma, 2009; Bangake and Eggoh, 2011; Chow and Fung, 2011; Herwartz and Walle, 2014). However, it is still unclear what the roles and levels of cointegration and causality are among various subsectors of financial development, such as development in the banking sector, stock market, bond market and insurance market.

Development economics studies four types of relationships: firstly, the link between banking sector development and economic growth (Christopoulos and Tsionas, 2004; Tang, 2005; Moshirian and Wu, 2012; Menyah *et al*., 2014; Pradhan *et al.*, 2014b); secondly, the link between stock market development and economic growth (Akinlo and Akinlo, 2009; Kar *et al*., 2011; Pradhan *et al.*, 2013a; Pradhan *et al.*, 2014a), thirdly, the

[3] Financial development is defined in terms of the aggregate size of the financial sector, its sectorial composition, and a range of attributes of individual sectors that determine their effectiveness in meeting users' requirements. The evaluation of financial structure should cover the roles of the key institutional players, including the central bank, commercial and merchant banks, saving institutions, development financial institutions, insurance companies, mortgage entities, pension funds, the stock market, and other financial market institutions (International Monetary Fund, 2005). Hence, financial development includes development in the banking sector, stock market, bond market and insurance market.

link between bond market development and economic growth (Fink *et al*., 2006a, 2006b; Matei, 2013; Puente-Ajovin and Sanso-Navarro, 2015; Pradhan et al., 2016), and fourthly, the link between insurance market development and economic growth (Avram *et al*., 2010; Han *et al*., 2010; Chen *et al*., 2012; Lee *et al*., 2013; Pradhan et al., 2015).

In the broad spectrum of 'financial development', banking sector development, stock market development, bond market development and insurance market development are the main forces that can lead to high economic growth in a country. It has been argued in a subset of the finance-growth literature that development of the banking sector, stock market, bond market, and insurance market can cause each other. While policy-makers may differ on the degree to which these financial-sector developments contribute to economic growth, they generally concur that all the sub-sectors do in fact matter. As a result, many countries have adopted development strategies that prioritize development in their banking sector, stock market, bond market, and insurance market. In the present paper, we follow these sub-categories of financial development and their links to economic growth in the context of ARF countries.

3. Review of the Literature

Financial development is one of the keys to economic growth (Levine, 1997). The connection between the two has been the focus of a vast body of theoretical and empirical research since the seminal work of Schumpeter (1911) first appeared. A number of studies have examined the effect of financial development and economic growth using an array of techniques, such as cross-sectional, time series, panel data, and firm-level studies (King and Levine, 1993a, 1993b; Demetriades and Luintel, 1996; Levine, 2003; Beck and Levine, 2004; Dritsakis and Adamopoulos, 2004; Beck *et al*., 2004; Fung, 2009; Hsueh *et al*., 2013; Pradhan *et al.*, 2013a; Chang *et al.*, 2013; Gochoco-Bautista *et al*., 2014; Herwartz and Walle, 2014; Jedidia *et al*., 2014; Ngare *et al*., 2014; Peia and Roszbach, 2015; Uddin *et al*., 2014; Samargandi *et al*., 2015).

Empirical evidence from previous studies has demonstrated the presence of a positive long-run association between the various indicators of financial development and economic growth. In general, all of these papers suggest that a well-developed financial system is growth-enhancing, and hence consistent with the proposition of "more finance, more growth" (Law and Singh, 2014). At the same time, focus on causality between financial development and economic growth (the finance-growth link) has elicited considerable interest amongst economists in recent years. Subsequently, there have been numerous, and similar, studies in this regard for both developed and developing countries.

While most of these studies have confirmed the existence of a causal relationship running from financial development to economic growth (Rousseau and Wachtel, 2000; Enisan and Olufisayo, 2009; Hassan *et al*., 2011; Pradhan *et al.*, 2013b; Menyah *et al*., 2014), a few studies have also failed to find evidence of causality from financial development to economic growth (Lucas, 1988; Stern, 1989; Eng and Habibullah, 2011; Mukhopadhyay *et al*., 2011). Hence, the existing empirical studies on the relationship between financial development and economic growth do not provide conclusive evidence on the nature and direction of this relationship, and currently there is no consensus among economists about the nature of this relationship. In sum, the four most important possible relationships that have been emphasized in the financial literature on the causal link between financial development and economic growth are the unidirectional financial development-led growth hypothesis (the SLH – supply-leading hypothesis of finance and growth), the unidirectional growth-led financial development hypothesis (the DFH – demand-following hypothesis of finance and growth), the bidirectional causality between finance and growth hypothesis (the FBH – feedback hypotheses between finance and growth, where both lead each other simultaneously), and the no causality between finance and growth hypothesis (the NEH – neutrality hypotheses between finance and growth, where neither is seen to cause the other). These four hypotheses are equally applicable to all four subsectors of finance and economic growth. Next, we address the literature focusing on these four hypotheses.

A number of studies have demonstrated the validity of the "*supply-leading hypothesis*" view, where unidirectional causality from financial development (development of the banking sector, the stock market, the bond market, or the insurance market or a combination of these) to economic growth is present, for example, studies by Enisan and Olufisayo (2009), Jalil *et al*. (2010), Wu *et al*. (2010), Kar *et al*. (2011), Chaiechi (2012), Chen *et al*. (2012), Hsueh *et al*. (2013), Lee *et al*. (2013), Matei (2013), Alhassan and Fiador (2014), Menyah *et al*. (2014), Pradhan *et al.* (2014a), Pradhan *et al*. (2014b), and Puente-Ajovin and Sanso-Navarro (2015). According to this view, financial development contributes to economic growth through two main channels: first, by raising the efficiency of capital accumulation and, in turn, the marginal productivity of capital (Goldsmith, 1969) and, second, by raising the savings rate, and thus the investment rate (Shaw, 1973).

In contrast to the "*supply-leading hypothesis*" view, Demetriades and Hussein (1996), Liang and Teng (2006), Ang and McKibbin (2007), Liu and Sinclair (2008), Odhiambo

(2008, 2010), Panopoulou (2009), Kar *et al*. (2011) and Puente-Ajovin and Sanso-Navarro (2015) claim evidence in favour of the "*demand-following hypothesis*" view, where causality runs from economic growth to financial development. According to this view, as the economy expands, the demand for financial services increases, leading to the growth of these services.

Studies such as those of Huang *et al*. (2000), Craigwell *et al*. (2001), Hassapis and Kalyvitis (2002), Al-Yousif (2002), Caporale *et al*. (2004), Dritsakis and Adamopoulos (2004), Wolde-Rufael (2009), Lee and Chang (2009), Hou and Cheng (2010), Cheng (2012), Pradhan *et al*. (2015) and Puente-Ajovin and Sanso-Navarro (2015) claim to have uncovered the "*feedback hypothesis*", whereby the causality runs in both directions.

Finally, studies such as those by Lucas (1988), Stern (1989), Fink *et al*. (2006 a,b), Mukhopadhyay *et al*. (2011), Pradhan *et al.* (2013b), and Puente-Ajovin and Sanso-Navarro (2015) claim to exhibit the "*neutrality hypothesis*", where financial market development and economic growth are seen as independent of each other. It is evident from the literature that the evidence on the direction of causality between these two variables needs more advanced statistical analysis than the literature has previously afforded it. Table 1 presents a synopsis of research on the causal nexus between various subsectors (aspects) of financial development and economic growth.

<< Insert Table 1 here>>

4. Research Questions and Proposed Hypotheses

The present paper is not intended to be a comprehensive study of all of the determinants of economic growth. Rather, it examines the nature of the relationship between economic growth, banking sector development, stock market development, bond market development, and insurance market development – all together, using a panel vector auto-regressive model to detect the direction of causality between the variables. Among other things, our study obviously combines several strands of the literature. We test whether banking sector development, stock market development, bond market development, and insurance market development Granger-cause economic growth, and whether they Granger-cause each other. In sum, we propose to test ten hypotheses, based upon the structure of our study. These hypotheses are summarized in Figure 1.

<< Insert Figure 1 here>>

5. Sample Selection, Data Structure, and Variables

Our study involves the ARF countries, a group of countries that have not yet been studied in this literature.[4] We consider three samples of countries, covering 17 countries in total. Our first sample consists of the eight countries among the ARF-26 that are recognized as ARF-members and observer countries (AMOC), namely Indonesia, Malaysia, Pakistan, the Philippines, Singapore, Sri Lanka, Thailand, and Vietnam. The second sample consists of the nine countries among the ARF-26 that are recognized as ARF-dialogue partner countries (ADPC)[5], namely Australia, Canada, China, India, Japan, the Korean Republic, New Zealand, the Russian Federation, and the United States. The third sample consists of all 17 ARF countries (TARC) that were included in AMOC and ADPC. Analyzing all 25 member nations is not possible due to unavailability of usable data on eight countries over the period of our study. We deploy annual time series data over the period from 1991 to 2011. The data are abstracted and adapted from two main sources, namely (a) *World Development Indicators*, the World Bank and (b) Sigma Economic Research & Consulting, Switzerland.

The variables used in the present study are banking sector development, stock market development, bond market development, insurance market development, and per capita economic growth.

Banking sector development is defined as a process of improvements in the quantity, quality, and efficiency of banking services. This process involves the interaction of many activities, and consequently cannot be captured by a single measure (Gregorio and Guidotti, 1995; Levine and Zervos, 1996; Rousseau and Wachtel, 1998; Beck and Levine, 2004; Liang and Teng, 2006; Naceur and Ghazouani, 2007; Abu-Bader and Abu-Qarn, 2008; Gries *et al*., 2009; Banos *et al*., 2011; Pradhan *et al*., 2013b). Hence, the present study employs four commonly used measures of banking sector development, namely broad money supply (BBRM), domestic credit provided by the banking sector (BDCB),

[4] The 26 ARF countries comprise of 25 member nations plus the European Union, which is represented by the President of the European Council and by the European Central Bank. The member countries are Australia, Bangladesh, Brunei, Burma, Cambodia, Canada, China, East Timor, the European Union, India, Indonesia, Japan, the Korean Republic, Laos, Malaysia, Mongolia, New Zealand, Pakistan, Papua New Guinea, the Philippines, the Russian Federation, Singapore, Sri Lanka, Thailand, the United States, and Vietnam.

[5] In this sub-category we observe only nine countries, which are used for our analysis. The European Union, the tenth member of this group, is excluded because it is not a country.

domestic credit provided by the financial sector (BDCF) and domestic credit provided to the private sector (BDCP).

Stock market development is defined as a process of improvements in the quantity, quality and efficiency of stock market services. It also involves the interaction of many activities and cannot be captured by a single measure (Rousseau and Wachtel, 1998; Wongbangpo and Sharma, 2002; Caporale *et al*., 2004; Zhu *et al*., 2004; Darrat *et al*., 2006; Rousseau and Xiao, 2007; Rousseau, 2009; Cooray, 2010; Hou and Cheng, 2010; Kar *et al*., 2011; Cheng, 2012; Pradhan *et al*., 2013a). The present study deploys four commonly used measures of stock market development, namely stock market capitalization (SMAC), stocks traded (STRA), stocks turnover ratio (STUR), and the number of listed companies in the stock market (SNLC).

Bond market development is defined as a process of improvements in the quantity, quality, and efficiency of debt services. This process involves the interaction of many activities, and consequently cannot be captured by a single measure (Fink *et al*., 2006a, 2006b; Matei, 2013; Puente-Ajovin and Sanso-Navarro, 2015). Hence, the present study employs four commonly-used measures of bond market development, namely domestic private debt securities (BDPT), domestic public debt securities (BDPU), international private debt securities (IDPT), and international public debt securities (IDPU).

Insurance market development is defined as a process of improvements in the quantity, quality and efficiency of insurance services. It also involves the interaction of many activities and cannot be captured by a single measure (Webb *et al*., 2005; Arena, 2008; Han *et al*., 2010; Chen *et al.*, 2013; Lee *et al*., 2013; Pradhan *et al*., 2015). The present study deploys four commonly used measures of insurance market development, namely life insurance density (ILID), non-life insurance density (INID), life insurance premium (ILIP), and non-life insurance premium (INIP).

Table 2 presents a detailed definition of these variables.

<< Insert Table 2 here>>

Our analysis is based on the use of four composite indices of financial development, namely the composite index of banking sector development (CBSD), the composite index of stock market development (CSMD), the composite index of bond market development (CBMD), and the composite index of insurance market development (CIMD). Principal component analysis (PCA) has been used to arrive at these four indices. PCA is based on a linear transformation of the individual variables so that they are orthogonal to each other

(Lewis-Beck, 1994). This kind of analysis is ideally suited for the purposes of the present study as it maximizes the variance, rather than minimizes the least square distance.

In general, PCA transforms data into new variables (principal components) that are not correlated. The PCA entails a few structured steps: constructing a data matrix, creating standardized variables, calculating a correlation matrix, determining eigen values (to rank principal components) and eigenvectors, selecting principal components (based on stopping rules), and interpreting the results (Hosseini and Kaneko, 2012).

The use of PCA to construct a composite index, as in our analysis, is well-documented in several papers (see, for instance, Gries *et al*., 2009; Herwartz and Walle, 2014; Menyah *et al*., 2014; Pradhan *et al*., 2014a).[6] For the present study, the eigen vectors and principal components of these four indices are shown in Table 3.

<< Insert Table 3 here>>

We define economic growth as the growth rate of per capita income (denoted by PGDP) – with income defined as real gross domestic product. All four indices and the economic growth rate were converted into their natural logarithms for estimation purposes.

6. Analytical Framework and Estimation Procedure

This study uses a multivariate framework to explore the finance-growth nexus for a panel of 17 ARF countries. We utilize the following regression model to describe the long-run relationship among CBSD, CSMD, CBMD, CIMD, and PGDP:

$$PGDP_{it} = \mu_0 CBSD_{it}^{\mu 1i} CSMD_{it}^{\mu 2i} CBMD_{it}^{\mu 3i} CIMD_{it}^{\mu_{4i}} e^{\varepsilon_{it}} \quad \textbf{[1]}$$

The logarithmic transformation of equation (1) is given by

$$PGDP_{it} = \mu_{0PGDPit} + \mu_{1PGDPi} CBSD_{it} + \mu_{2PGDPi} CSMD_{it} + \mu_{3PGDPi} CBMD_{it} + \mu_{4PGDPi} CIMD_{it} + \varepsilon_{PGDPit} \quad \textbf{[2]}$$

where i = 1, 2..., N represents each country in the panel; t = 1, 2...., T refers to the time period; and ε_{it} refers to the independently and normally distributed random variables for all i and t with zero means and finite heterogeneous variances (σ_i^2).

The parameters β_1, β_2, β_3, and β_4 represent the long-run elasticity estimates of PGDP in respect of CBSD, CSMD, CBMD and CIMD, respectively. The task is to estimate the

[6] Hosseini and Kaneko (2012) and Pradhan *et al.* (2014a) discuss the procedural details of the use of PCA.

parameters in Equation (2) and conduct some panel tests on the causal nexus between these five variables. The study postulates that increases in banking sector, stock market, bond market, and insurance market activities can increase economic growth.

We deploy the following panel vector error-correction model (VECM) to consider the possible causal nexus among these five variables:

$$\begin{bmatrix} \Delta \ln PGDP_{it} \\ \Delta \ln CBSD_{it} \\ \Delta \ln CSMD_{it} \\ \Delta \ln CBMD_{it} \\ \Delta \ln CIMD_{it} \end{bmatrix} = \begin{bmatrix} \eta_{1j} \\ \eta_{2j} \\ \eta_{3j} \\ \eta_{4j} \\ \eta_{5j} \end{bmatrix} + \sum_{k=1}^{q} \begin{bmatrix} \mu_{11ik}(L)\mu_{12ik}(L)\mu_{13ik}(L)\mu_{14ik}(L)\mu_{15ik}(L) \\ \mu_{21ik}(L)\mu_{22ik}(L)\mu_{23ik}(L)\mu_{24ik}(L)\mu_{25ik}(L) \\ \mu_{31ik}(L)\mu_{32ik}(L)\mu_{33ik}(L)\mu_{34ik}(L)\mu_{35ik}(L) \\ \mu_{41ik}(L)\mu_{42ik}(L)\mu_{43ik}(L)\mu_{44ik}(L)\mu_{45ik}(L) \\ \mu_{51ik}(L)\mu_{52ik}(L)\mu_{53ik}(L)\mu_{54ik}(L)\mu_{55ik}(L) \end{bmatrix} \begin{bmatrix} \Delta \ln PGDP_{it-k} \\ \Delta \ln CBSD_{it-k} \\ \Delta \ln CSMD_{it-k} \\ \Delta \ln CBMD_{it-k} \\ \Delta \ln CIMD_{it-k} \end{bmatrix} + \begin{bmatrix} \gamma_{1i} ECT_{it-1} \\ \gamma_{2i} ECT_{it-1} \\ \gamma_{3i} ECT_{it-1} \\ \gamma_{4i} ECT_{it-1} \\ \gamma_{5i} ECT_{it-j} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1it} \\ \varepsilon_{2it} \\ \varepsilon_{3it} \\ \varepsilon_{4it} \\ \varepsilon_{5it} \end{bmatrix} \quad \textbf{[3]}$$

where Δ is the first difference filter (I – L); *i* represents country in the panel; *t* represents time period; and ε_{jit} (j = 1,…, 5) represents the random variable.

The ECTs are error-correction terms representing the long-run dynamics, while differenced variables represent the short-run dynamics between the variables. The model is meaningful only if the time series variables are integrated of order one, I (1) (i.e. if they achieve stationarity after being differenced once), and are cointegrated. If the variables used in Equation (2) are not cointegrated, the ECTs are removed in the estimation process. The study investigates short-run and long-run causal relationships among PGDP, CBSD, CSMD, CBMD and CIMD. The short-run causal relationship is detected through *F*-statistics and the significance of the changing lagged independent variables; the long-run causal relationship is measured through the significance of the *t*-statistics of the lagged ECTs. The first step under the VECM framework is determining the order of integration and nature of cointegration among the five variables.

Hence, the testing procedures involve a total of four steps. The first is checking the unit root of each variable in order to determine the order of integration when a particular variable reaches its stationarity. The study uses five sets of unit root tests[7] for this purpose.

The second step is checking the cointegration (identifying long-run cointegration relationships among these five variables). We use Pedroni's panel cointegration test[8] (Pedroni, 2000) for this purpose.

Having confirmed the existence of cointegration of our panel, the next step is to estimate the associated long-run cointegration parameters. Although the ordinary least squares (OLS) estimators of the cointegrated vectors are super-convergent, their distribution is asymptotically biased and depends on nuisance parameters associated with the presence of serial correlation in the data (Pedroni, 2001). Many types of problems in time series analysis may also arise in panel data analysis. These problems tend to be more marked even in the presence of heterogeneity (Kao and Chiang, 2001). Hence, we used two different panel cointegration estimators, namely between-group fully modified OLS (FMOLS[9]) and dynamic OLS (DOLS[10]). Both of these estimators provide consistent estimates of standard errors that can be used for inferences. According to Kao and Chiang (2000), both FMOLS and DOLS estimators have normal limiting properties. Consequently, in order to carry out tests on the cointegrated vectors, it is necessary to apply both FMOLS and DOLS to work out the estimates of cointegrating parameters.

Finally, on the basis of both unit root and cointegration findings, the last step is to estimate the panel VECM in order to infer the Granger causal relationship among the five variables – PGDP, CBSD, CSMD, CBMD and CIMD.

It should be noted that VECM estimation is very sensitive to lag selection. The Akaike Information Criterion (AIC) and the Schwartz-Bayes Information Criterion (SBC) have

[7] These include the Levine-Lin-Chu '*t*-stat' (LLC; Levine *et al*., 2002), the Breitung '*t*-stat' (BR; Breitung, 2000), Im-Pesaran-Shin '*W*-stat' (IPS: Im *et al*., 2003), Augmented Dickey Fuller (ADF)-Fisher 'Chi-Square' and Phillips Perron (PP)-Fisher 'Chi-Square' panel unit root tests (Choi, 2001). These tests are detailed in several advanced econometric textbooks (see, for example, Enders, 2009) and are not described here due to space constraints.

[8] This test follows seven different cointegration statistics, which includes four individual panel statistics, namely the panel *v*-statistic, panel ρ-statistic, panel *t*-statistic (non-parametric) and panel *t*-statistic (parametric), and also three group statistics, namely the group ρ-statistic, group *t*-statistic (non-parametric) and group *t*-statistic (parametric). This test is discussed in several advanced econometric textbooks such as Enders (2009).

[9] FMOLS is a non-parametric approach that takes into account the possible correlation between the error term and the first differences of the regressor, as well as the presence of a constant term to deal with corrections for serial correlation (Pedroni, 2001).

[10] DOLS is a parametric approach that adjusts the errors by augmenting the static regression with leads, lags, and contemporaneous values of the regressor in first differences (Kao and Chiang, 2000).

been used to fix the optimum lag selection. These criteria are widely used in advanced applied econometric studies.

7. Empirical Results and Discussion

The empirical investigation begins with unit root and cointegration between the five variables, namely, PGDP, CBSD, CSMD, CBMD, and CIMD. We present the results of our panel unit roots tests and panel cointegration tests in Tables 4 and 5, respectively.

The results of five panel unit root tests reveal that all five variables in this study (PGDP, CBSD, CSMD, CBMD, and CIMD) are non-stationary at their levels. However, all variables become stationary at their first differences. Therefore, we can conclude that all these time series variables are integrated of order one, I (1), over the period from 1991 to 2011. This finding is true for all three samples that we consider in this study, namely AMOC, ADPC, and TARC.

<< Insert Table 4 here>>

After assessing the stationarity of the series by determining the order of integration I (d), we use co-integration testing to determine the presence or absence of a long-run equilibrium relationship among the variables. The null hypothesis of no cointegration is examined, based on seven different cointegration test statistics (as mentioned above).

From the seven test statistics of the Pedroni panel cointegration test, it can be seen that two statistics are statistically significant at a 1% level (Case 1 and Case 2 in Table 5). Hence, the null hypothesis of no cointegration can be rejected. It can thus be concluded that these variables are cointegrated, indicating the presence of a long-run equilibrium relationship between banking sector development, stock market development, bond market development, insurance market development, and per capita economic growth. This finding holds for all three samples we considered.

<< Insert Table 5 here>>

Having established the status of the unit root and cointegration, the next step is to estimate the associated long-run cointegration parameters. Here, we are most interested in checking the nature of the relationship among these variables, more specifically,

whether it is positive or negative. The findings show that all four financial indicators (CBSD, CSMD, CBMD and CIMD) exercise a significant positive impact on PGDP in the long run. The presence of a highly significant positive impact of CBSD, CSMD, CBMD and CIMD on PGDP for the 17 ARF countries implies that all financial indicators play a critical role in boosting per capita economic growth in the economies of ARF countries. The results of this section are not reported here due to space constraints, but are available upon request from the corresponding author.

Engle and Granger (1987) established that when variables are cointegrated, an error-correction model necessarily describes the data-generating process. Consequently, on the basis of the unit root test and cointegration test results, we deployed the panel Granger causality test, based on panel VECMs, to determine the causal relations amongst these five variables. We want to detect how these variables cause each other in this particular cointegration framework, especially in the short and long run. The results of the Granger causality tests for all three samples are summarized in Table 6.

<< Insert Table 6 here>>

We first describe the long-run results, which are ascertained through examining the statistical significance of the lagged error-correction term. Table 6 shows that when ΔPGDP is used as the dependent variable, the lagged error-correction terms (ECTs) are statistically significant at a 5% level. This implies that economic growth tends to converge to its long-run equilibrium path in response to changes in its regressors: CBSD, CSMD, CBMD and CIMD. The significance of the ECT_{-1} coefficient in the ΔPGDP equation in each of the three samples confirms the presence of a long-run equilibrium between PGDP and its determinants, namely banking sector development, stock market development, bond market development, and insurance market development. In other words, we can generally conclude that development in the financial sector Granger-causes per capita economic growth in the long run. This is true for all three samples that we consider (AMOC, ADPC, and TARC) from 1991 to 2011.

Therefore, the overall conclusion is that per capita economic growth is key in ARF countries and is significantly influenced by financial development through all its subsectors, namely the development of these countries' stock markets, banking sectors, bond markets and insurance markets. In addition to this finding, we also identify another fundamental long-run Granger causal relationship between these variables. Thus, when

ΔCBMD serves as the dependent variable, the lagged ECTs are statistically significant at a 5% level. This indicates that per capita economic growth, and development in the banking sector, stock market, and insurance market Granger-cause bond market development in the long run. This is also true for all three samples that we considered (AMOC, ADPC, and TARC) over the period 1991 to 2011.

In contrast to the long-run Granger causality results, the second part of our discussion deals with the question of short-run Granger causality amongst these five sets of variables. These results, based on the values presented in Table 6, are summarized in Table 7 and are discussed below.

<< Insert Table 7 here>>

The overall findings are the presence of unidirectional causality from per capita economic growth to banking sector development, and bidirectional causality between stock market development and per capita economic growth, between bond market development and per capita economic growth, and between insurance market development and per capita economic growth. However, in other situations, the results differ from sample to sample.

In ARF Member and Observer Countries (AMC), we have found evidence of unidirectional causality from banking sector development to bond market development [CBSD => CBMD], insurance market development to banking sector development [CIMD => CBSD], bond market development to stock market development [CBMD => CSMD], and insurance market development to both stock market development and bond market development [CIMD => CSMD; CIMD => CBMD].

For ARF Dialogue Partner Countries (ADPC), we have uncovered evidence of bidirectional causality between insurance market development and bond market development [CIMD <=> CBMD], and unidirectional causality from banking sector development to both bond market development and insurance market development [CBSD => CSMD; CBSD => CIMD], from stock market development to bond market development [CBMD <= CSMD], and insurance market development to stock market development [CIMD => CSMD].

For ARF Countries combined (ATC), we have confirmed bidirectional causality between insurance market development and bond market development [CIMD <=> CBMD] and between stock market development and bond market development [CBMD <= CSMD]. In addition to these results, we also note unidirectional causality from

banking sector development to insurance market development [CBSD => CIMD], and from insurance market development to stock market development [CIMD => CSMD].

In line with prior studies, our study distinguishes clearly between short-run and long-run causal relationships, and between financial development and per capita economic growth. The long-run causal results display a causal link between the two relationships in the long run, whereas short-run causal results show the adjustment dynamics between the variables in the short run.

We found uniform and robust results for the long-run equilibrium relationship amongst the variables, when per capita economic growth and bond market development serve as the dependent variable. Thus, it appears that in order to stimulate long-run per capita economic growth, it is important to stimulate development in the banking sector, stock market, bond market, and insurance market in the ARF countries. Similarly, to stimulate long-run bond market development, development in the banking sector, stock market, and insurance market as well as per capita economic growth should be encouraged in the ARF countries.

For short-run causal relationships, we find remarkable variations in results which are nonetheless consistent with earlier work in the different strands of this literature. We highlight some of these short-run results below.

Firstly, our result relating to whether per capita economic growth Granger-causes banking sector development supports the "*demand-following hypothesis (DFH)*" of the finance-growth nexus. This result appears in three of our samples (ADOC, ADPC, and TARC) and is consistent with the findings of Colombage (2009), Panopoulou (2009), Odhiambo (2010), Kar *et al*. (2011) and Pradhan *et al.* (2013b).

Secondly, our result relating to bidirectional causality between stock market development and per capita economic growth, bond market development and per capita economic growth, and insurance market development and per capita economic growth, supports the "*feedback hypothesis (FBH)*" of the finance-growth nexus. This result appears in all three samples of our study and is consistent with the findings of Ward and Zurbruegg (2000), Fink *et al*. (2003), Zhu *et al*. (2004), Cheng (2012), Guochen and Wei (2012), and Puente-Ajovin and Sanso-Navarro (2015).

Thirdly, our findings relating to both unidirectional and bidirectional Granger causality between various financial development indicators (banking sector development, stock market development, bond market development, and insurance market development), support the "*supply-leading hypothesis (SLH)*", the "*demand-following*

hypothesis (DFH)" and the "*feedback hypothesis (FBH)*" view between two particular sub-sectors of financial development. These results hold true in all three samples, consistent with the findings of Levine and Zervos (1998), Beck and Levine (2004), Hou and Cheng (2010), Cheng (2012) and Pradhan *et al.*, (2014a). This case ensures the possibility of complementary (and/or substitute) roles between two sub-financial sectors in the process of achieving high economic growth.

8. Conclusion and Policy Implications

Understanding the policy implications of the nexus between banking sector development, stock market development, bond market development, insurance market development and per capita economic growth is important in both financial economics and in forming economic policies. We have established that more needs to be learned about the various connections among these five sets of variables. Earlier studies have examined the causal link amongst just a few of these variables. By contrast, our study examined the causal relationships between *all* these variables, studied simultaneously. That is, the causal link between two variables is considered in the presence of the residual variables.

This study has found that banking sector development, stock market development, bond market development, insurance market development, and per capita economic growth are cointegrated in the ARF countries. Most importantly, there is evidence that development in the banking sector, stock market, bond market, and insurance market matter in the determination of long-run per capita economic growth, although the set of statistically significant independent variables varies slightly by sample, due to the heterogeneity of the countries in each panel. Our results carry four policy implications.

Firstly, with regard to the relationship between banking sector development and economic growth nexus, the recommendation is that attention must be paid to policies that promote banking sector development. This calls for efficient allocation of financial resources, combined with sound regulation of the banking system. A sound banking system instils confidence among savers so that resources can be effectively mobilized to increase productivity in the economy. The banking system should be simplified and banking fees should be reduced for qualifying clients, so that barriers to entry of the banking sector are lowered, making banking activities more accessible to those members of a country's population who are currently excluded from engaging in banking and financial transactions. Moreover, banking products should be diversified in such a way

that non-banking financial companies and non-financial institutions can enter the banking sector

Secondly, with regard to the relationship between stock market development and economic growth nexus, we recommend that a well-developed stock market is necessary in the ARF countries. A credible and reliable stock market system is indispensable in ensuring the smooth functioning of the financial system and in increasing the productivity of the economy, in line with the arguments presented by Levine (1991) and Yartey (2008). A well-developed stock market facilitates firms' raising debt and equity capital for investment, thereby enhancing economic growth and attracting foreign direct investment by multi-national corporations.

Thirdly, with regard to the relationship between bond market development and economic growth nexus, bond market development is desirable to facilitate more economic growth in these ARF countries. This, in turn, requires an efficient allocation of financial resources combined with sound assurances to bond market development (Felman *et al*., 2014; Gray *et al*., 2011). The development of the bond market can also be used to obtain more development in the banking sector, stock market, insurance market, and to achieve sustainable economic growth in the ARF countries.

Lastly, with regard to the relationship between insurance market development and economic growth nexus, insurance market development is desirable to facilitate more economic growth in the ARF countries. The development of the insurance sector can also be used to encourage greater development in the banking sector, stock market and bond market, and to achieve sustainable economic growth in the ARF countries. For instance, an active and competitive insurance sector can help these economies to stimulate savings, provide an alternate source of investment, reinforce the development of the banks, the stock market and the bond market, mitigate risks associated with volatility in capital inflows, and shift government burdens to support large pension schemes to employee insurance-supported retirement schemes.

If policy-makers want to stimulate per capita economic growth, they should stimulate development in the financial markets, while simultaneously fostering growth in the banking sector, stock market, bond market and insurance market. All the subsectors of financial market development should be considered as drivers of per capita economic growth given the significance of their respective roles.

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Table 1. Summary of Studies on the Links between Different Aspect of Financial Development and Economic Growth

Study	Sample	Type of Market	Period studied	Main finding(s)
Alhassan and Fiador (2014)	Ghana	d	1990-2010	SLH
Ang (2008)	Malaysia	b	1960-2001	DFH
Boon (2005)	Singapore	d	1991-2002	SLH
Chen *et al*. (2012)	60 countries	d	1976-2005	SLH
Cheng (2012)	Taiwan	b	1973-2007	FBH
Chow and Fung (2011)	69 countries	a	1970-2004	FBH
Enisan and Olufisayo (2009)	7 Sub-Saharan Africa	b	1980-2004	SLH
Esho *et al*. (2004)	44 countries	d	1984-1998	DFH
Fink *et al*. (2003)	10 European countries	c	1994-2003	SLH, FBH
Fink *et al*. (2006a, b)	15 European countries	c	1994-2003	SLH, DFH
Guochen and Wei (2012)	China	d	2006-2011	SLH, DFH, FBH, NLH
Hou and Cheng (2010)	Taiwan	b	1971-2007	FBH
Hsueh *et al*. (2013)	10 Asian countries	a	1980-2007	SLH
Jalil *et al*. (2010)	China	a	1977-2006	SLH
Kar *et al*. (2011)	15 MENA countries	a, b	1980-2007	SLH, DFH
Kolapo and Adaramola (2012)	Nigeria	b	1990-2010	SLH
Kugler and Ofoghi (2005)	United Kingdom	d	1966-2003	DFH, FBH
Lee *et al*. (2013)	6 Developed countries	d	1979-2007	SLH
Liu and Sinclair (2008)	China	b	1973-2003	DFH
Matei (2013)	14 ENEMU countries	c	2002-2012	SLH
Menyah *et al*. (2014)	21 African countries	a	1965-2008	SLH
Odhiambo (2010)	South Africa	a	1969-2006	DFH
Owusu and Odhiambo (2014)	Nigeria	a, b	1969-2008	SLH
Panopoulou (2009)	5 countries	a, b	1995-2007	DFH
Pradhan *et al*. (2015)	34 OECD countries	d	1988- 2012	FBH
Pradhan, Arvin et al. (2013)	16 Asian countries	b	1988-2012	SLH
Pradhan, Arvin, Norman and Hall (2014)	Asian countries	a	1960-2011	FBH
Pradhan, Arvin, Norman and Nshigaki (20	15 Asian countries	b	2011	DFH
Pradhan, Dasgupta and Samadhan (2013)	16 Asian countries	b	1988-2012	SLH
Puente-Ajovin and Sanso-Navarro (2015)	16 OECD countries	c	1980-2009	SLH, DFH, FBH
Ward and Zurbruegg (2000)	9 OECD countries	d	1961-1996	DFH, FBH
Webb *et al*. (2005)	55 countries	d	1980-1996	SLH
Wolde-Rufael (2009)	Kenya	a	1966-2005	FBH
Zhu *et al*. (2004)	14 countries	b	1995-2009	FBH

Note 1: MENA: Middle East and North Africa region; OECD: Organization for Economic Co-operation and Development; ENEMU: European Non-EMU countries.

Note 2: As is evident, different studies focus on different aspects of financial development. a: signifies that results relate to the link between banking sector development and economic growth; b: signifies that results relate to the link between stock market development and economic growth; c: signifies that results relate to the link between bond market development and economic growth; d: signifies that results relate to the link between insurance market development and economic growth.

Note 3: DFH: results support the demand-following hypothesis; SLH: results support the supply-leading hypothesis; FBH: results support the feedback hypothesis; NLH: results support the neutrality hypothesis.

Table 2. Definition of Financial Development Variables and Indices

Variable	Definition
Definition of Banking Sector Development Variables	
BBRM	**Broad money supply**, expressed as a percentage of gross domestic product.
BDCB	**Domestic credit provided by the banking sector**, expressed as a percentage of gross domestic product.
BDCF	**Domestic credit provided by the financial sector**, expressed as a percentage of gross domestic product.
BDCP	**Domestic credit to the private sector**, expressed as a percentage of gross domestic product.
CBSD	**Composite index of banking sector development**, using BBRM, BDCB, BDCF, and BDCP.
Definition of Stock Market Development Variables	
SMAC	**Market capitalization of listed companies**, expressed as a percentage of gross domestic product.
STRA	S**tocks traded (total value)**, expressed as a percentage of gross domestic product.
STUR	**Stocks traded (turnover ratio)**, expressed as a percentage change in the turnover ratio in the stock market.
SNLC	**Number of listed companies in the stock market**, expressed per 10,000 population.
CSMD	**Composite index of stock market development**, using SMAC, STRA, STUR, and SNLC.
Definition of Bond Market Development Variables	
BDPT	**Domestic private debt securities**, expressed as a percentage of gross domestic product.
BDPU	**Domestic public debt securities**, expressed as a percentage of gross domestic product.
BIPT	**International private debt securities**, expressed as a percentage of gross domestic product.
BIPU	**International public debt securities**, expressed as a percentage of gross domestic product.
CBMD	**Composite index of bond market development**, using BDPT, BDPU, BIPT, and BIPU.
Definition of Insurance Market Development Variables	
ILID	**Life insurance density,** expressed as direct domestic life premiums per capita.
INID	**Non-life insurance density**, expressed as direct domestic non-life premiums per capita.
ILIP	**Life insurance penetration**, expressed as direct domestic life premiums (as a % of gross domestic product).
INIP	**Non-life insurance penetration**, expressed as direct domestic non-life premiums (as a % of gross domestic product).
CIMD	**Composite index of insurance market development**, using ILID, INID, ILIP, and INIP.

Note 1: All monetary measures are in constant price US dollars.
Note 2: All variables above are defined in the *World Development Indicators* and are published by the World Bank.
Note 3: We use the natural log of these variables in our estimation.
Note 4: Principal component Analysis is used to derive the four composite indices (detailed in the text).

Table 3. Construction of Financial Development Indices

Principal Components / Variables				
Composite index of banking sector development				
	Eigenvalues	**% Variation**	**% Cumulative**	
PC1	3.469	0.867	0.867	
PC2	0.329	0.082	0.959	
PC3	0.178	0.044	0.993	
PC4	0.025	0.007	1.000	
	PC1	**PC2**	**PC3**	**PC4**
BBRM	0.502	0.179	0.797	0.283
BDCB	0.501	-0.601	0.040	-0.621
BDCF	0.516	-0.271	-0.493	0.646
BDCP	0.480	0.730	-0.346	0.341
Composite index of stock market development				
	Eigenvalues	**% Variation**	**% Cumulative**	
PC1	2.071	0.518	0.518	
PC2	1.046	0.261	0.779	
PC3	0.728	0.182	0.961	
PC4	0.156	0.039	1.000	
	PC1	**PC2**	**PC3**	**PC4**
SMAC	0.418	0.740	0.198	-0.488
STRA	0.652	0.050	0.221	0.723
STUR	0.439	-0.661	0.388	-0.469
SNLC	0.455	-0.113	-0.873	-0.136
Composite index of bond market development				
	Eigenvalues	**% Variation**	**% Cumulative**	
PC1	1.689	0.422	0.422	
PC2	1.023	0.256	0.678	
PC3	0.953	0.238	0.916	
PC4	0.333	0.084	1.000	
	PC1	**PC2**	**PC3**	**PC4**
BDPT	0.701	-0.028	0.001	-0.712
BDPU	0.318	0.586	0.686	0.291
BIPT	0.537	0.194	-0.635	0.521
BIPU	0.344	0.787	-0.355	-0.370
Composite index of insurance market development				
	Eigenvalues	**% Variation**	**% Cumulative**	
PC1	2.835	0.709	0.709	
PC2	0.890	0.222	0.931	
PC3	0.236	0.059	0.990	
PC4	0.039	0.010	1.000	
	PC1	**PC2**	**PC3**	**PC4**
ILID	0.469	-0.584	0.527	-0.400
INID	0.487	0.538	0.512	0.460
ILIP	0.520	-0.418	-0.528	0.525
INIP	0.521	0.441	-0.426	-0.594

Note 1: All variables are defined in Table 2.

Note 2: PC1: Principal Component 1; PC2: Principal Component 2; PC3: Principal Component 3; and PC4: Principal Component 4.

Table 4. Results from Panel Unit Root Test

Methods	Variables: PGDP		CBSD		CSMD		CBMD		CIMD	
Sample 1: ARF member and observer countries (AMOC)										
Group 1- Null: Unit root (assumes common unit root process)										
LLC	-7.40*	[0.00]	-2.36*	[0.00]	-4.57*	[0.00]	-5.53*	[0.00]	-2.54*	[0.00]
BR	-6.89*	[0.00]	-1.93**	[0.05]	-4.73*	[0.00]	-3.43*	[0.00]	-3.53*	[0.00]
Group 2- Null: Unit root (assumes individual unit root process)										
IPS	-4.64*	[0.00]	-1.25***	[0.10]	-2.68*	[0.00]	-2.98*	[0.00]	-2.29*	[0.00]
ADF	64.78*	[0.00]	22.1***	[0.10]	40.0*	[0.00]	39.0*	[0.00]	23.47*	[0.00]
PP	268.9*	[0.00]	35.8*	[0.00]	85.1*	[0.00]	110.4*	[0.00]	41.73*	[0.00]
Inference:	I (1)		I (1)		I (1)		I (1)		I (1)	
Sample 2: ARF dialogue partner countries (ADPC)										
Group 1- Null: Unit root (assumes common unit root process)										
LLC	-4.62*	[0.00]	-2.28*	[0.00]	-8.17*	[0.00]	-9.72*	[0.00]	-1.44***	[0.10]
BR	-3.81*	[0.00]	-2.17**	[0.00]	-2.58*	[0.00]	-1.51***	[0.10]	-1.23***	[0.10]
Group 2- Null: Unit root (assumes individual unit root process)										
IPS	-6.89*	[0.00]	-1.92**	[0.05]	-7.74*	[0.00]	-6.66*	[0.00]	-1.29***	[0.10]
ADF	77.4*	[0.00]	29.59***	[0.10]	79.95*	[0.00]	66.34*	[0.00]	23.89**	[0.05]
PP	593.0*	[0.00]	77.30*	[0.00]	133.1*	[0.00]	96.44*	[0.00]	47.77*	[0.00]
Inference:	I (1)		I (1)		I (1)		I (1)		I (1)	
Sample 3: All (total) ARF countries (TARC)										
Group 1- Null: Unit root (assumes common unit root process)										
LLC	-8.37*	[0.00]	-3.37*	[0.00]	-9.90*	[0.00]	-10.3*	[0.00]	-2.87*	[0.00]
BR	-6.76*	[0.00]	-2.87*	[0.00]	-4.77*	[0.00]	-1.38***	[0.10]	-2.74*	[0.00]
Group 2- Null: Unit root (assumes individual unit root process)										
IPS	-9.71*	[0.00]	-2.73*	[0.00]	-8.37*	[0.00]	-5.13*	[0.00]	-2.22*	[0.00]
ADF	145.2*	[0.00]	54.2*	[0.00]	121.50*	[0.00]	98.7*	[0.00]	47.82*	[0.00]
PP	874.2*	[0.00]	113.2*	[0.00]	217.7*	[0.00]	209.5*	[0.00]	88.48*	[0.00]
Inference:	I (1)		I (1)		I (1)		I (1)		I (1)	

Note 1: PGDP is the per capita economic growth rate; CBSD is the composite index of banking sector development; CSMD is the composite index of stock market development; CBMD is the composite index of bond market development; CIMD is the composite index of insurance market development.

***Note 2*:** LLC: Levine-Lin-Chu t-statistics; BR: Breitung t-statistics; IPS: Im-Pesaran and Shin W-statistics; ADF: Augmented Dickey Fuller Fisher Chi-square-statistics; and PP: Phillips Perron Chi-square- statistics.

Note 3: The null hypothesis is that the variable follows a unit root process.

***Note 4*:** The statistics are reported at the first difference of the variables only.

Note 5: We have tested the unit root at three levels (no intercept and no trend; deterministic intercept only; and deterministic intercept and trend only); but the reported statistics are for deterministic intercept and trend only.

Note 6: ** indicates significance at a 1% level, ** indicates significance at a 5% level, and *** indicates significance at a 10% level.

Table 5. Results of Pedroni Panel Cointegration Test

Test	No Intercept & No Trend		Deterministic Intercept Only		Deterministic Statistics Intercept & Trend	
Sample 1: ARF member and observer countries (AMOC)						
Case 1:						
Panel v- Statistics	-1.55	[0.94]	-0.03	[0.51]	-1.41	[0.92]
Panel ρ- Statistics	0.32	[0.62]	-0.04	[0.48]	0.98	[0.84]
Panel PP- Statistics	-1.40***	[0.08]	-9.58*	[0.00]	-11.9*	[0.00]
Panel ADF- Statistics	-1.38***	[0.08]	-3.40*	[0.00]	-4.28*	[0.00]
Case 2:						
Group ρ- Statistics	1.55	[0.93]	1.33	[0.91]	1.93	[0.97]
Group PP- Statistics	-3.31*	[0.00]	-12.3*	[0.00]	-20.6*	[0.00]
Group ADF- Statistics	-0.37	[0.36]	-3.05*	[0.00]	-4.59*	[0.00]
Inference: Cointegrated						
Sample 2: ARF dialogue partner countries (ADPC)						
Case 1:						
Panel v- Statistics	-2.91	[0.99]	0.13	[0.44]	-0.33	[0.62]
Panel ρ- Statistics	2.59	[0.99]	-0.31	[0.38]	1.05	[0.84]
Panel PP- Statistics	2.35*	[0.99]	-7.68*	[0.00]	-9.83*	[0.00]
Panel ADF- Statistics	1.48	[0.93]	-4.06*	[0.00]	-4.08*	[0.00]
Case 2:						
Group ρ- Statistics	1.53	[0.93]	0.57	[0.72]	1.39	[0.92]
Group PP- Statistics	-0.83	[0.20]	-10.1*	[0.00]	-13.3*	[0.00]
Group ADF- Statistics	0.18	[0.57]	-4.98	[0.00]	-4.34*	[0.00]
Inference: Cointegrated						
Sample 3: All (total) ARF countries (TARC)						
Case 1:						
Panel v- Statistics	-3.60	[0.99]	-0.01	[0.50]	-1.67	[0.95]
Panel ρ- Statistics	2.73	[0.99]	-0.18	[0.43]	1.46	[0.93]
Panel PP- Statistics	1.60	[0.94]	-12.4*	[0.00]	-16.4*	[0.00]
Panel ADF- Statistics	1.03	[0.85]	-5.43*	[0.00]	-6.15	[0.00]
Case 2:						
Group ρ- Statistics	2.07	[0.98]	1.34	[0.90]	2.33	[0.99]
Group PP- Statistics	-2.79*	[0.00]	-15.8*	[0.00]	-23.2*	[0.00]
Group ADF- Statistics	0.01	[0.50]	-5.79*	[0.00]	-6.19*	[0.00]
Inference: Cointegrated						

Note 1: Variables and regions shown above are defined in the text.

Note 2: The null hypothesis is that the variables are not cointegrated.

Note 3: Figures in square brackets are the probability levels indicating significance.

***Note 4*:** * indicates significance at a 1% level; *** indicates significance at a 10% level.

Note 5: ADF: Augmented Dickey Fuller statistics; and PP: Phillips Perron statistics. Details on these statistics are available in Pedroni (2004).

Table 6. Granger Causality Test Results

Dependent Variable	Independent variables					Lagged ECT
Sample 1: ARF member and observer countries (AMOC)						
	ΔPGDP	**ΔCBSD**	**ΔCSMD**	**ΔCBMD**	**ΔCIMD**	**ECT$_{-1}$**
ΔPGDP	------ [-----]	2.73 [0.23]	8.79* [0.00]	5.14** [0.05]	5.83** [0.05]	-1.04* (-6.15)
ΔCBSD	3.50*** [0.10]	------ [-----]	4.48*** [0.10]	2.49 [0.27]	5.89** [0.05]	-0.11 (-1.69)
ΔCSMD	3.88*** [0.10]	6.41* [0.01]	------ [-----]	7.25* [0.01]	11.0* [0.00]	-0.15 (-0.84)
ΔCBMD	3.97*** [0.10]	3.82*** [0.10]	1.72 [0.53]	------ [-----]	3.78*** [0.10]	-0.08** (-5.49)
ΔCIMD	10.3* [0.00]	2.00 [0.27]	2.56 [0.16]	2.36 [0.28]	------ [-----]	-0.04 (-1.10)
Sample 2: ARF dialogue partner Countries (ADPC)						
	ΔPGDP	**ΔCBSD**	**ΔCSMD**	**ΔCBMD**	**ΔCIMD**	**ECT$_{-1}$**
ΔPGDP	------ [-----]	3.11 [0.13]	12.2* [0.00]	15.0* [0.00]	3.72*** [0.10]	-0.49** (-5.62)
ΔCBSD	4.05*** [0.10]	------ [-----]	5.68** [0.05]	2.01 [0.23]	0.51 [0.71]	-0.09 (-1.96)
ΔCSMD	2.34 [0.25]	3.49*** [0.10]	------ [-----]	2.68 [0.22]	3.94*** [0.10]	-0.01 (-0.04)
ΔCBMD	38.0* [0.00]	4.07*** [0.10]	5.66** [0.05]	------ [-----]	9.00* [0.01]	-0.72** (-5.55)
ΔCIMD	4.54*** [0.10]	3.98*** [0.10]	0.98 [0.80]	10.4* [0.00]	------ [-----]	-0.02 (-0.54)
Sample 3: All (total) ARF countries (TARC)						
	ΔPGDP	**ΔCBSD**	**ΔCSMD**	**ΔCBMD**	**ΔCIMD**	**ECT$_{-1}$**
ΔPGDP	------ [-----]	2.39 [0.23]	14.4* [0.00]	4.06*** [0.10]	4.28*** [0.10]	-0.70* (-7.73)
ΔCBSD	3.73*** [0.10]	------ [-----]	3.71*** [0.10]	3.89*** [0.10]	1.71 [0.33]	-0.10 (-1.68)
ΔCSMD	3.91*** [0.10]	3.95*** [0.10]	------ [-----]	3.47*** [0.10]	12.4* [0.00]	-0.08 (-0.77)
ΔCBMD	17.6* [0.00]	4.57*** [0.10]	6.10* [0.01]	------ [-----]	7.62* [0.01]	-0.38** (-5.15)
ΔCIMD	9.19* [0.01]	4.17*** [0.10]	0.35 [0.84]	8.74* [0.01]	------ [-----]	-0.99 (-0.03)

Note 1: PGDP is the per capita economic growth rate; CBSD is the composite index of banking sector development; CSMD is the composite index of stock market development; CBMD is the composite index of bond market development; CIMD is the composite index of insurance market development, ECT$_{-1}$ is the lagged error-correction term.

***Note 2*:** The figures in round brackets are *t*-statistics; the figures in square brackets contain the level of probability.

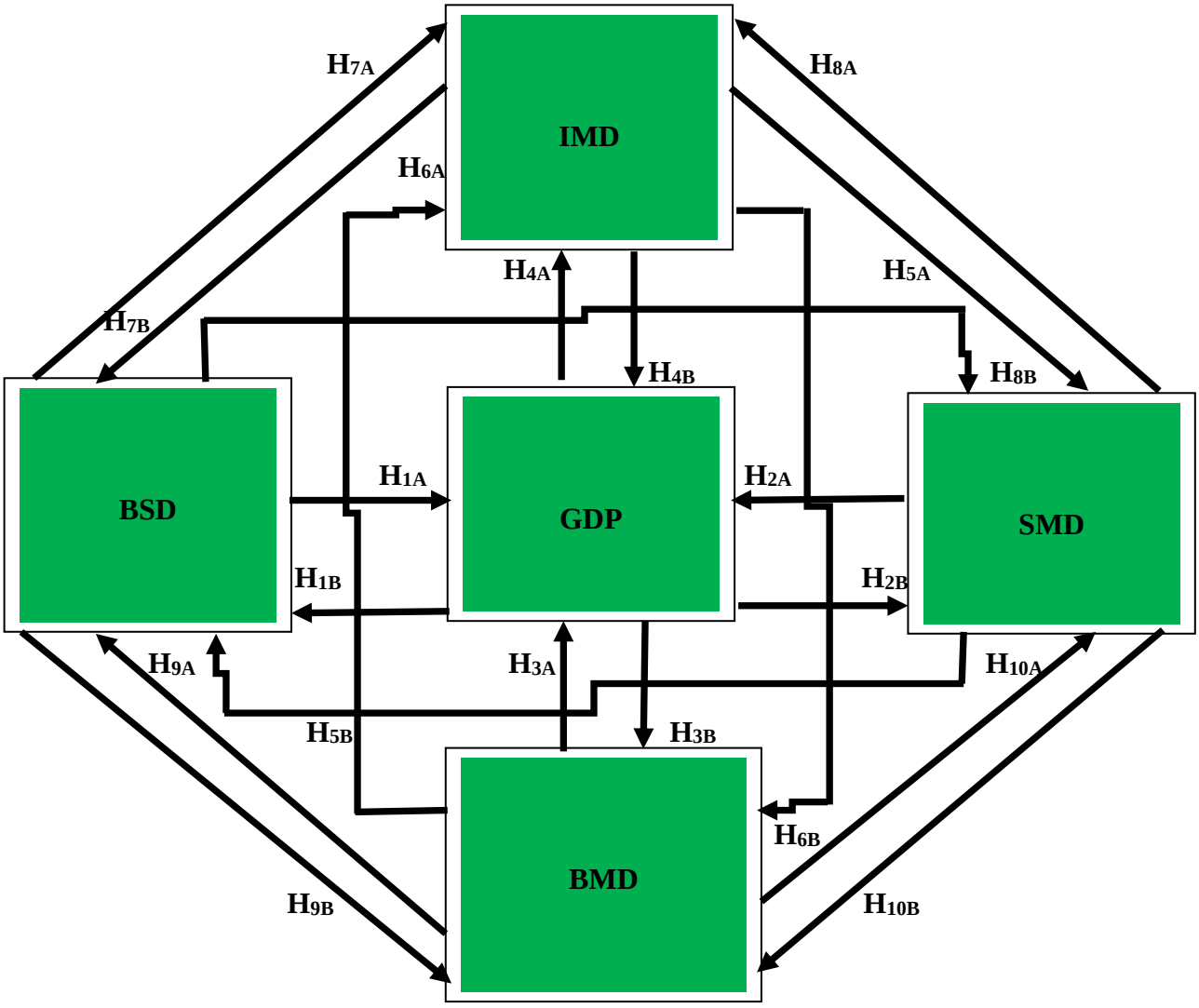
***Note 3*:** *, ** and *** indicate that the parameter estimates are significant at 1%, 5% and 10% levels, respectively.

Table 7. Summary of Short-run Granger Causality Results

Causal Relationships Tested in the Model	Direction of Relationships in ARF Member and Observer Countries	Direction of Relationships in ARF Dialogue Partner Countries	Direction of Relationships in ARF Countries – Combined
CBSD vs. PGDP	CBSD < = PGDP	CBSD < = PGDP	CBSD < = PGDP
CSMD vs. PGDP	CSMD < = > PGDP	CSMD < = > PGDP	CSMD < = > PGDP
CBMD vs. PGDP	CBMD < = > PGDP	CBMD < = > PGDP	CBMD < = > PGDP
CIMD vs. PGDP	CIMD < = > PGDP	CIMD < = > PGDP	CIMD < = > PGDP
CSMD vs. CBSD	CSMD < = > CBSD	CSMD < = > CBSD	CSMD < = > CBSD
CBMD vs. CBSD	CBMD < = CBSD	CBMD < = CBSD	CBMD < = > CBSD
CIMD vs. CBSD	CIMD = > CBSD	CIMD < = CBSD	CIMD < = CBSD
CBMD vs. CSMD	CBMD = > CSMD	CBMD < = CSMD	CBMD < = > CSMD
CIMD vs. CSMD	CIMD = > CSMD	CIMD = > CSMD	CIMD = > CSMD
CIMD vs. CBMD	CIMD = > CBMD	CIMD < = > CBMD	CIMD < = > CBMD

Note 1: PGDP is the per capita economic growth rate; CBSD is the composite index of banking sector development; CSMD is the composite index of stock market development; CBMD is the composite index of bond market development; CIMD is the composite index of insurance market development. Variables are defined more precisely in Table 2.

***Note 2*:** X = > Y means variable X Granger-causes Variable Y, X < = Y means variable Y Granger-causes Variable X, and X < = > Y means both variables Granger-cause each other.



Note 1: PGDP is the per capita economic growth rate; CBSD is banking sector development; CSMD is stock market development; CBMD is bond market development; CIMD is insurance market development.

Note 2:

$H_{1A, B}$: Banking sector development Granger-causes economic growth and vice versa.

$H_{2A, B}$: Stock market development Granger-causes economic growth and vice versa.

$H_{3A, B}$: Bond market development Granger-causes economic growth and vice versa.

$H_{4A, B}$: Insurance market development Granger-causes economic growth and vice versa.

$H_{5A, B}$: Banking sector development Granger-causes stock market development and vice versa.

$H_{6A, B}$: Bond market development Granger-causes insurance market development and vice versa.

$H_{7A, B}$: Banking sector development Granger-causes insurance market development and vice versa.

$H_{8A, B}$: Stock market development Granger-causes insurance market development and vice versa.

$H_{9A, B}$: Bond market development Granger-causes banking sector development and vice versa.

$H_{10A, B}$: Bond market development Granger-causes stock market development and vice versa.

Figure 1. Various Hypotheses on the Possible Causal Flows between Different Aspects of Financial Development and Economic Growth