The Finance-Growth Nexus in the High Performance Asian Economies: A Bootstrap Panel Causality Analysis

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Abstract: This study examines the causal link between financial development and economic growth in the High Performance Asian Economies (HPAEs). The newly developed panel causality testing approach of Emirmahmutoglu and Kose (2011) which controls for both cross-sectional dependency and heterogeneity across countries is applied to the 7 HPAEs for the period 1989-2017. In order to capture the relationship between real sector development and both credit and stock market development, two different indicators are used. The panel findings indicate that while there is two-way causal relationship between stock market development and economic growth, the causality exist only one-way from growth to credit market development. This implies that the demand-following hypothesis is supported in the panel of HPAEs. Moreover, the results show that the existence and direction of causality vary among the different HPAEs. These various evidences lead to country specific policy implications and recommendations.

***Keywords*:** Economic Growth, Financial Development, Cross-Section Dependency, Panel Data Models

Yüksek Performanslı Asya Ekonomilerinde Finans-Büyüme İlişkisi: Panel Bootstrap Nedensellik Analizi

Öz: *Bu çalışma Yüksek Performanslı Asya Ekonomileri'nde (HPAE) finansal gelişme ve ekonomik büyüme arasındaki nedensellik ilişkisini analiz etmektedir. Bu doğrultuda Emirmahmutoglu ve Kose (2011) tarafından geliştirilmiş olan yatay kesit bağımlılığı ve heterojenliği dikkate alan panel nedensellik testi yaklaşımı 1989-2017 dönemi için 7 HPAE ülkesine uygulanmıştır. Reel sektör gelişmesi ile hem kredi piyasası hem de hisse senedi piyasası gelişmişliği ilişkisinin ayrı bir biçimde değerlendirilebilmesi için iki farklı gösterge kullanılmıştır. Panel sonuçları hisse senedi piyasası ile büyüme arasında karşılıklı bir ilişki olduğunu, kredi piyasası gelişimi ile ekonomik büyüme arasında ise kredi piyasasından büyümeye tek-yönlü olduğunu göstermektedir. Bu da HPAE ülkelerinin paneli için talep-itişli hipotezinin desteklendiği anlamına gelmektedir. Bireysel sonuçlar ise hem ilişkinin varlığı hem de yönü hakkında farklı bulgular ortaya koymaktadır. Bu farklı sonuçlar ise ülkeye-özgü politika önerileri gerektiğine işaret etmektedir.*

Anahtar Kelimeler: *Ekonomik Büyüme, Finansal Gelişme, Yatay-kesit Bağımlılığı, Panel Veri Modelleri*

I.Introduction

The financial development and economic growth nexus has been comprehensively examined by a great number of researchers. Although the theoretical discussion can be traced back to the seminal paper of Schumpeter (1911), the rapid integration and development of financial markets with the globalization process has increased the interest of researches in this issue since the 1980s. In this process, one of the most interesting economic stories is the success of the several Asian countries. The eight countries –Hong Kong,

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Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan and Thailand- are designated as the High-Performance Asian Economies (HPAE) by the World Bank which presented a rapid economic growth during the 1960s and the late 1990s. The striking impact of financial development on economic growth in Asian economies was first expressed in the World Bank (1989, p.11-30) report. It is stated that "…in East Asia the newly industrialized economies and several others have pursued sound macroeconomic policies. Faster growth, more investment and greater financial depth all come partly from higher saving. In its own right, however, greater financial depth also contributes to growth by improving in the productivity of investment. Investment productivity is significantly higher in the faster growing countries, which also have deeper financial systems. This suggests a link between financial development and growth". The key factors of the high performance of these countries may be listed as follows (i) stable macroeconomic environment, (ii) export promotion policy, (iii) rapid accumulation of savings and high rates of investment, (iv) rapid increase in human capital and (v) falling inequality. Although this success was interrupted by the 1997 Asian Crisis, many of them are still seem to be the world's most prosperous and stable economies.

Along with their fast economic development, these countries have also experienced a financial liberalization and thereby a financial development process. In these countries, to provide an efficient mobilization and allocation of resources, governments have created some rules on such as property rights, contracts, bureaucratic procedure and access to information. These institutional regulations have ensured more efficient financial intermediation in the credit and stock markets of the HPAEs. As can be seen from Table 1, there is a considerable increase in the domestic credit to private sector to gross domestic product (GDP) data (one of the most used credit market indicator) of Hong Kong, South Korea and Thailand between the period 1989-2017. Among other countries, Japan always has an advanced credit market historically while the opposite is true for Indonesia. According to the stock market total value traded to GDP data, which is one of the most used proxy for stock market development, significant improvements can also be seen for all countries, excluding Indonesia. These progresses in both the real and financial sector have led to the question of whether there is a causal relationship between financial development and economic growth. However, the empirical evidence on this issue for Asian countries is rather very limited. Although many of these countries have experienced crucial developments in their stock markets, previous causality analysis on Asian countries have been mainly focused on the relationship between banking sector development and economic growth (e.g. Fase and Abma, 2003; Hsueh et al., 2013). These studies show that financial development matters for economic growth and it is sensitive to the proxy of financial development.

Table 1. *Financial development of the HPAEs in the sample period.*

	Domestic credit to private sector (%of GDP)		Stock market total value traded (%of GDP)	
	1989	2017	1989	2017
Hong Kong	152.1	199.7	50.3	572.0
Indonesia	37.2	38.7	0.3	9.1
Japan	185.1	161.4	85.4	118.6
Malaysia	95.7	122.7	17.0	43.7
Singapore	79.6	128.2	46.4	67.8
South Korea	49.3	144.8	49.1	131.4
Thailand	71.9	144.5	17.6	74.6
World	103.2	128.9	44.6	118.0

Source: World Bank, World Development Indicators, 2018.

According to the Trade-off Theory which is one of the most remarkable finance theory, investment is financed externally with debt from credit markets and equity from stock markets. In a recent study of Durusu-Ciftci et al. (2017), it is theoretically proved that there is a long-run relationship between both of these markets and economic growth. Moreover, many works on this topic claim that credit markets and stock markets are substitutes e.g., Levine (1997), Demirguc-Kunt and Levine (2001), Arestis et al. (2011). The majority of previous empirical works used only one of these financial indicators to understand the link between financial development and economic growth. However, Demirguc-Kunt and Levine (2001) emphasized that financial structure of the economies differs from country to country and this leads to a change in finance-growth nexus depending on markets. Thus, it is valid to analyze finance-growth relation by taking into account both credit and stock markets to provide more accurate policy implications for the policy makers.

The aim of this study is to contribute to the debate on the causal link between financial development and economic growth in Asian countries by three aspects. First, unlike previous studies for Asian countries this paper analyzed two different strands of financial sector development, namely the credit market development and the stock market development to capture the relationship of both markets with economic growth. Second, unlike the previous works which used money supply variables as an indicator of credit market development, the ratio of domestic credit to private sector to GDP is used in this study. It is a prevailing measure of financial depth of credit market development by identifying credit to private sector as opposed to credit issued to governments (Levine and Zervos, 1998; Levine, 1998 and Beck et al. 2000). Third, to control for the regional integration within Asia the finance-growth nexus is tested by the bootstrap panel causality approach of Emirmahmutoglu and Kose (2011) which takes into account cross-sectional dependency and slope heterogeneity across the members.

The rest of the paper is structured as follows. Section 2 provides a literature review of financial development and economic growth nexus. Section 3 presents the data and the methodology. The empirical evidence is presented in Section 4 and Section 5 concludes with a summary and a discussion of the policy implications of the results.

II.Review of the Literature

Theoretical literature provides four different views on the direction of casual relationship between the development of financial markets and economic growth. The first one –which is commonly known as '*supply-leading hypothesis*'- supports that developed financial markets is an important factor for growth and causality runs from financial development to economic growth. In this perspective, Schumpeter (1911) argued that financial system can foster economic growth by transferring funds to the more innovative and productive investments. More recently, McKinnon (1973) and Shaw (1973) contributed to this view by emphasizing the key role of interest rate on the capital formation. The McKinnon-Shaw model claims that financial development is crucial for economic growth and financial repression of government on interest rate ceilings hinders development of financial systems and thereby economic growth.

The theoretical contributions to the finance-led growth hypothesis was considerably increased with the emergence of the endogenous growth theory. These studies attempted to provide the route of how financial markets affect savings and investment decisions and thus growth (Greenwood and Jovanovic, 1990; Bencivenga and Smith, 1991; Levine, 1991; Saint-Paul, 1992; King and Levine, 1993a; Pagano, 1993; Berthelemy and Varoudakis, 1996; Greenwood et al. 1997; Rousseau and Watchel, 2000; Deidda, 2006). According to these studies, financial intermediaries can solve the allocation and diversification problem of savings through providing information and risk sharing mechanism thereby enhance capital accumulation and growth. Furthermore, financial markets also foster adoption of new technologies and productivity of growth. Another group of studies which support this argument benefited from the Neo-Classical growth theory (e.g. Atje and Jovanovic, 1993 and Cooray, 2010). In these studies, an augmented Mankiw-Romer-Weil (1992) growth model with a financial development indicator was used to show it is an important determinant for the economic growth.

The second view, -which is generally referred to as '*demand-following hypothesis*'- argue that financial development is led by economic growth and finance has a little effect on economic growth (Robinson, 1952). The logic behind this argument is that as the real side of the economy develops, the demand for financial intermediation increases, which in turn has a positive effect on financial development. Some other studies are even harsher on the impact of financial markets. For example, while Lucas (1988: 6) contends that "the importance of financial matters on economic growth is very badly over-stressed", Chandavarkar

(1992: 134) states that “none of the pioneers of development economics … even list finance as a factor of development”.

In contrast to the above two, there are some studies such as Blackburn and Hung (1998), Greenwood and Smith (1997) and Blackburn et al. (2005) which support the bi-directional relationship between financial development and economic growth. This approach is generally known as ‘*feed-back hypotheses’*. Another hypothesis on the relationship between financial development and economic growth is the ‘*stage of development hypothesis*’ which is proposed by Patrick (1966). This argument claim that the direction of causality depends on the level of the development of an economy. In the early developmental stage, the supply-leading hypothesis holds in an economy by providing new, innovative financial services to the economic agents. As economy grows, this characteristics of financial intermediation diminish and demand-following relationship prevails in the later stage.[1]

Likewise the theoretical literature, empirical literature does not provide a general consensus on the finance-growth nexus. It can be expressed from a general point of view, differences in the quality and quantity of the financial sectors are crucial factors in explaining why countries grew at different rates. However, many factors such as the empirical methodology, the selected indicators for financial development and the financial structure of the economies may lead to different results. Several empirical studies showed the positive impact of financial development on economic growth by using either stock market (Atje and Jovanovic, 1993; Levine and Zervos; 1996) or credit market variables (King and Levine, 1993b; Berthelemy and Varoudakis; 1996). Besides, some other works analyzed the simultaneous impact of both markets on economic growth. It seems that the magnitude of the positive effect of different financial indicators varies among these studies (e.g. Benhabib and Spiegel, 2000; Arestis et al., 2001; Durusu-Ciftci et al. 2017).

Some other recent studies showed insignificant or negative effect of financial development on economic growth. These studies argued that this lack of relationship may be linked to the underdeveloped financial and/or economic systems or the financial structure (credit market based/stock market based) of these economies (Nili and Rastad, 2007; Naceur and Ghazouani; 2007; Narayan and Narayan, 2013; Chen et al. 2013; Beck et al. 2014; Rioja and Valev, 2014).

The empirical evidences of causality analysis on the relationship between financial development and economic growth are also seem to be ambiguous. Table 2 demonstrates the empirical results of some causality studies for both developed and developing countries. The findings of this growing literature can be summarized as follows: (i) Most of the studies support the supply-leading hypothesis which claim that there is a unidirectional causality from finance to growth. (ii) Few studies are in favor of the demand-following hypothesis that

[1] See for more detail, Patrick, 1966.

confirms only the existence of causality from economic growth to finance. (iii) Many other studies find bi-directional causal link between finance and growth. (iv) Some of those indicate that the causality may differ with the income level of the country groups. (v) Some others emphasize the direction of the causality is sensitive to the proxy of financial development.

Table 2: *Summary of the selected studies on the casual link between financial development and economic growth*

Author(s)	Sample	Main Finding(s)
Studies support the supply-leading hypothesis		
Jung (1986)	56 countries	F→G (Unidirectional causality from finance to growth for LDCs and Unidirectional causality from growth to finance for DCs)
Ahmed and Ansari (1998)	India, Pakistani Sri Lanka	F→G
Darrat (1999)	Saudi Arabia, Turkey and UAE	F→G
Xu (2000)	41 countries	F→G
Fase and Abma (2003)	9 South-East Asia countries	F→G
Christopoulos and Tsionas (2004)	10 developed countries	F→G
Yang and Yi (2008)	Kenya	F→G
Colombage (2009)	5 developed countries	F→G (except Canada)
Hsueh et al. (2013)	10 Asian countries	F→G (Direction of causality depends on the financial development variables.)
Studies support the demand-following hypothesis		
Liang and Teng (2006)	China	G→F
Odhiambo (2008)	Kenya	G→F
Adeyeye et al. (2015)	Nigeria	G→F
Studies support bi-directional causality		
Demetriades and Hussein (1996)	16 countries	F↔G (Considerable evidence of bi-directionality but some evidence of reverse causation)
Luintel and Khan (1999)	10 developing countries	F↔G
Al-Yousif (2002)	30 developing countries	F↔G
Calderon and Liu (2003)	109 countries	F↔G
Abu-Bader and Abu-Quan (2008)	Egypt	F↔G
Wolde-Rufael (2009)	Kenya	F↔G
Bangake and Eggoh (2011)	71 countries	F↔G (Findings are country group specific)
Kar et al. (2011)	MENA	F↔G (The direction of causality is country and financial development indicator specific.)

Pradhan et al. (2014)	34 OECD countries	F↔G (G→F causality is hold for only one measure of financial development)
Pradhan et al. (2017)	ARF countries	F↔G (G→F causality is hold only for one measure of financial development)

III.Data and Methodology

This study aims to show the direction of causal relationship between development of financial sector, namely the credit market and stock market, and economic growth for 7 HPAE countries: Hong Kong, Indonesia, Japan, South Korea, Malaysia, Singapore and Thailand over the period 1989-2017.[2] Following common practice in the empirical literature economic growth is measured by real per capita gross domestic product (GDP). Financial development is proxied by two commonly used variables in order to capture the way of channels between finance and growth. For stock market development (SM), the ratio of the total value of all traded domestic shares in a stock market exchange to GDP and for the credit market development (CM) the ratio of domestic credit to private sector to GDP are used. The data are taken from the World Development Indicators (WDI), World Bank and all variables are used in natural logarithms.

The empirical examination is based on the Granger causality technique which tests whether the past value of one variable (X) can forecast the future values of another variable (Y). According to the previous literature, there are four ways of analyzing panel data Granger causality. The first approach is based on GMM estimation of a panel vector error correction model (VECM) which does not take into account cross-sectional dependency and heterogeneity. The second approach of Hurlin (2008) takes into account heterogeneity but ignores the cross-sectional dependency. However, the third approach proposed by Kónya (2006) controls both for heterogeneity and cross-sectional dependency simultaneously. This method is based on seemingly unrelated regressions (SUR) estimation and test the causality by using country-specific bootstrap critical values. Because this approach does not require imposing the joint restriction for the whole panel, it does not require the pre-testing for the panel unit roots and cointegration. This is an important advantage since the unit root and cointegration tests may have low testing power problems and may lead to conflicting results. Finally, Emirmahmutoglu and Kose (2011) proposed a new bootstrap panel causality approach based on Meta-analysis. This method extend the lag augmented VAR (LA-VAR) approach of Toda and Yamamoto (1995) and test Granger causality between variables in cross-sectionally dependent and heterogeneous mixed panels. Likewise Konya (2006), this testing procedure does not require pre-

[2] It is worth nothing that Taiwan is excluded from the sample due to the lack of data on variables.

testing panel cointegration. The only prior information needed for this approach is the maximum order of integration of the processes. In addition, another advantage of this approach is that it is very powerful even if N and T are small (Emirmahmutoglu and Kose, 2011).

Following Emirmahmutoglu and Kose (2011), I consider heterogeneous panel VAR model with two variables as follows:

$$y_{it} = a_{1i} + \sum_{j=1}^{k_i+d_{max_i}} \beta_{1ij} y_{i,t-j} + \sum_{j=1}^{k_i+dmax_i} \gamma_{1ij} x_{i,t-j} + \varepsilon_{1it} \quad (1)$$

$$x_{it} = a_{2i} + \sum_{j=1}^{k_i+d_{max_i}} \beta_{2ij} y_{i,t-j} + \sum_{j=1}^{k_i+dmax_i} \gamma_{2ij} x_{i,t-j} + \varepsilon_{2it} \quad (2)$$

where y denotes the economic growth variable (i.e., GDP) and x refers to the financial development indicators (i.e., CM and SM), i and t denotes individual cross-sectional units and time periods, respectively and $dmax_i$ is the maximal order of integration suspected to occur in the system for each i and k_i is the lag order of the process. For all time periods, the error term is independently and identically distributed ($i.i.d.$) across individuals. The steps of Emirmahmutoglu and Kose (2011) bootstrap Granger causality procedure can be summarized as follows:

Step 1: Determine the maximal optimal lag order of integration of two variables ($dmaxi$) in the VAR system for each cross-sectional unit based on the ADF unit root test and select the lag orders k_i's via Schwarz information criteria (SIC) by starting with $k_{max} = 3$.

Step 2: Re-estimate Equation (2) by using k_i and $dmax_i$ from Step 1, under the non-causality hypothesis. Then, obtain residuals for each individual.

$$\hat{\varepsilon}_{it}^{y} = y_{it} - \hat{\alpha}_{1i} - \sum_{j=1}^{k_i+d_{max_i}} \hat{\beta}_{1ij} y_{i,t-j} + \sum_{j=1}^{k_i+dmax_i} \hat{\gamma}_{1ij} x_{i,t-j} \quad (3)$$

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Step 3: Residuals are centered using Stine's (1987) suggestion as:

$$\tilde{\varepsilon}_t = \hat{\varepsilon}_t - (T-k-l-2)^{-1} \sum_{t=k+l+2}^{T} \hat{\varepsilon}_t \quad (4)$$

where $\hat{\varepsilon}_t = (\hat{\varepsilon}_{1t}, \hat{\varepsilon}_{2t}, \dots, \hat{\varepsilon}_{Nt})', k = \max(k_i)\ and\ l = \max(dmax_i)$. Select randomly a full column with replacement from the matrix $\left[\tilde{\varepsilon}_{i,t}\right]_{NxT}$ at a time to preserve the cross covariance structure of the errors and denote the bootstrap residuals as $\tilde{\varepsilon}_{i,t}^{*}$ where $t = 1,2,\dots,T$.

Step 4: A bootstrap sample of y is generated under the null hypothesis:

$$y_{i,t}^{*} = \hat{\alpha}_i^{y} + \sum_{j=1}^{k_i+d_{max_i}} \hat{\beta}_{1ij} y_{i,t-j} + \sum_{j=1}^{k_i+dmax_i} \hat{\gamma}_{1ij} x_{i,t-j} + \tilde{\varepsilon}_{i,t}^{*} \quad (5)$$

Step 5: Calculate the individual Wald statistics to test non-causality null hypothesis separately for each individual by substituting y_{it}^{*} for y_{it} and estimating Equation 2 without imposing any parameter restrictions. Lastly, the Fisher test statistic (λ) can be obtained by using individual p-values (p_i) that correspond to the Wald statistic of the i^th individual cross section.

$$\lambda = -2\sum_{i=1}^{N}\ln(p_i) \qquad\qquad i = 1,2,\ldots,N \qquad (6)$$

Step 6: The bootstrap empirical distribution of the Fisher test statistics is generated by repeating 3-5 steps of with 5000 replications and specifying the bootstrap critical values by selecting the appropriate percentiles of these sampling distributions.

The Granger causality analysis tests provide four alternative results under four null hypothesis: (i) there is one-way causality from x to y if not all $\gamma_{1ij}s$ are zero, but all $\beta_{2ij}s$ are zero, (ii) there is one-way causality from y to x if all $\gamma_{1ij}s$ are zero, but not all $\beta_{2ij}s$ are zero, (iii) there is two-way causality between x and y if neither $\gamma_{1ij}s$ nor $\beta_{2ij}s$ are zero and (iv) there is no causality between x and y if all $\gamma_{1ij}s$ $\beta_{2ij}s$ are zero.

In order to determine the maximal optimal lag order of integration of two variables ($dmaxi$) in the VAR system for each cross-sectional unit, I follow Emirmahmutoglu and Kose (2011) and use multiple unit root test proposed by Dickey and Pantula (1987). I then estimate the regression (1) by OLS for each individual and select the lag orders k_i's via Schwarz information criterion (SIC) by starting with $kmax = 3$. I generate the bootstrap empirical distribution of the Fisher test statistics repeating 3-5 steps of Emirmahmutoglu and Kose (2011: 872) with 5000 replications and specify the bootstrap critical values by selecting the appropriate percentiles of these sampling distributions.

A. Preliminary analysis: Cross-sectional dependency and homogeneity tests

Before proceeding to the identification of a possible relationship, the panel data causality analysis need to test whether there exists a cross-sectional dependency among countries. In a globalizing world, a high degree of economic and financial integration across Asian countries shocks affecting one country may likely to influence another country. If this spillover effect is ignored, it may result in misleading inference. In order to investigate the existence of the cross-sectional dependency I applied four different tests.

The most common cross-sectional dependency test of Breusch and Pagan (1980) LM test (hereafter, CD_{BP} test) can be computed by estimating the following panel data model:

$$y_{it} = \alpha_i + \beta_i' x_{it} + \varepsilon_{it} \quad \text{for } i = 1,2,\ldots,N; \quad t = 1,2,\ldots,T \qquad (7)$$

where i is the cross-section dimension, t is the time dimension, x_{it} is $kx1$ vector of explanatory variables, α_i and β_i are respectively individual intercepts and slope coefficients which are allowed to vary across countries. The null hypothesis of no cross-sectional dependence- $H_0: Cov(\varepsilon_{it}, \varepsilon_{ij}) = 0$ for all t and $i \neq j$ – is tested against the alternative hypothesis of cross sectional dependence- $H_1: Cov(\varepsilon_{it}, \varepsilon_{ij}) \neq 0$ for at least one pair of $i \neq j$. The CD_{BP} test can be calculated by:

$$CD_{BP} = T \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij}^2 \qquad (8)$$

where $\hat{\rho}_{ij}^2$ represents the estimated correlation coefficient among the residuals obtained from individual ordinary least squares (OLS) estimation of Eq. (7) for each i. It is important to note that CD_{BP} test is only valid for when N is relatively small and T is sufficiently large. To overcome this problem, Pesaran (2004) proposed a more general cross-sectional dependency test (the so-called CD_{LM} test).

$$CD_{LM} = \sqrt{\frac{1}{N(N-1)} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \left(T\hat{\rho}_{ij}^2 - 1\right)} \qquad (9)$$

CD_{LM} tests the null of zero correlations in the context with first $T \to \infty$ and then $N \to \infty$. However, this test is subject to size distortions when N is relatively larger than T. Due to this problem, Pesaran (2004) proposed a new test for cross-sectional dependency (hereafter, CD test) that can be used when N is large and T is small. The CD test is given as follows:

$$CD = \sqrt{\frac{2T}{N(N-1)} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij}} \qquad (10)$$

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Under the null hypothesis of no cross-sectional dependence with $T \to \infty$ and $N \to \infty$ in any order, CD test asymptotically follows a normal distribution. However, the CD test will have less power when the population average pair-wise correlations are zero but the underlying individual population pair-wise correlations are non-zero (Pesaran et al. 2008). In order to deal with this problem, Pesaran et al. (2008) developed a bias-adjusted test (hereafter, CD_{adj} test) which is a modified version of the LM test by adding the mean and variance of the CD statistic. CD_{adj} test is calculated as follows:

$$CD_{adj} = \sqrt{\frac{2T}{N(N-1)} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij} \frac{(T-k)\hat{\rho}_{ij}^2 - u_{Tij}}{\sqrt{v_{Tij}^2}}} \qquad (11)$$

where u_{Tij} and v_{Tij}^2 are the exact mean and variance of $(T-k)\hat{\rho}_{ij}^2$, which are provided in Pesaran et al. (2008, p.108). Under the null hypothesis of no cross-sectional dependency with first $T \to \infty$ and then $N \to \infty$, CD_{adj} test is asymptotically distributed as standard normal.

Another preliminary test of panel data analysis is the homogeneity test of the estimated coefficients. As stated by Granger (2003), the causality from one variable to another variable by imposing joint restriction for the whole panel is the strong null hypothesis. Moreover, the homogeneity assumption for the parameters is not able to capture the heterogeneity that may arise due to country specific characteristics (Breitung, 2005). To testing for slope homogeneity,- $H_0: \beta_i = \beta$ for all i- against the alternative hypothesis of slope heterogeneity- $H_1: \beta_i \neq \beta_j$ for a non-zero fraction of pair-wise slopes for $i \neq j$, a version of standard F test, so-called delta $(\tilde{\Delta})$ test is proposed by Pesaran and Yamagata (2008). The $\tilde{\Delta}$ test is valid when $(N, T) \to \infty$ without any restrictions on the relative expansion rates of N and T when the error terms are normally distributed. To calculate the $\tilde{\Delta}$ test, the first step is to compute the following modified version of Swamy (1970)'s statistics:

$$\tilde{S} = \sum_{i=1}^{N} \left(\hat{\beta}_i - \tilde{\beta}_{WFE}\right)' \frac{x_i' M_\tau x_i}{\tilde{\sigma}_i^2} \left(\hat{\beta}_i - \tilde{\beta}_{WFE}\right) \tag{12}$$

where $\hat{\beta}_i$ is the pooled OLS estimator, $\hat{\beta}_{WFE}$ is the weighted fixed effect pooled estimator, M_τ is the identity matrix, and $\tilde{\sigma}_i^2$ is the estimator of σ_i^2. The standardized dispersion statistic:

$$\tilde{\Delta} = \sqrt{N} \left(\frac{N^{-1}\tilde{S} - k}{\sqrt{2k}} \right) \tag{13}$$

under the null hypothesis with the condition of $(N, T) \to \infty$ and when the error terms are normally distributed, the $\tilde{\Delta}$ test has an asymptotic standard normal distribution. The small sample properties of the $\tilde{\Delta}$ test can be improved under normally distributed errors by using the following bias-adjusted version:

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$$\tilde{\Delta}_{adj} = \sqrt{N} \left(\frac{N^{-1}\tilde{S} - E(\tilde{z}_{it})}{\sqrt{var\,(\tilde{z}_{it})}} \right) \tag{14}$$

where the mean $E(\tilde{z}_{it}) = k$ and the variance $var(\tilde{z}_{it}) = 2k(T - k - 1)/(T + 1)$.

IV.Empirical findings

Before examining the causal relationship between financial development and economic growth among the HPAE countries, the first step of the empirical work is to control for cross-sectional dependency and homogeneity across the members of the panel. Table 3 presents the results of the cross-sectional dependency tests of Breusch and Pagan (1980), Pesaran (2004), and Pesaran et al. (2008). The findings show that the null of no cross-sectional dependency is strongly rejected by all test statistics. The cross-sectional dependency across the

Asian countries implies that a shock occurred in one of the Asian countries seems to be transmitted to other countries. Table 3 also reports the results from the slope homogeneity tests of both Swamy (1970) and Pesaran and Yamagata (2008). Both results reject the null hypothesis of homogenous slope and support the country-specific heterogeneity. This finding indicates that the direction of causal linkages among the variables of interest may differ across the HPAE countries.

The existence of the cross-sectional dependency and the slope heterogeneity across countries implies that the appropriate method is the bootstrap panel Granger causality analysis. As stated above, there are two different methodologies that analyze the causal-link between variables by taking into account both cross-sectional dependency and heterogeneity across states. In this study, I prefer to use the panel causality approach of Emirmahmutoglu and Kose (2011) which is a simple procedure for Granger causality test with LA-VAR approach of Toda and Yamamoto (1995) in heterogeneous mixed panels. Since the simulation results of the method of Emirmahmutoglu and Kose (2011) show that it is very powerful even if N and T are small, this method is appropriate for the sample which covers only 7 HPAE countries.

Table 3. *Results for Cross-sectional dependency and heterogeneity tests*

Test	CM	SM	GDP
CD_{BP}[a]	46.458**	29.632*	31.869*
CD_{LM}[b]	3.298***	1.332*	1.677**
CD[c]	-3.303***	-3.027***	-3.045***
CD_{adj}[d]	7.645***	5.073***	17.581***
$\tilde{\Delta}$	8.660***	8.301***	7.456***
$\tilde{\Delta}_{adj}$	9.186***	8.804***	7.859***

Notes: *** denotes rejection of the null hypothesis at the 1% significance levels, respectively.
[a] CD_{BP} test is developed by Breuch and Pagan (1980) and it is only valid for when N is relatively small and T is sufficiently large.
[b] CD_{LM} test is developed by Pesaran (2004) and it is subject to size distortions when N is relatively larger than T.
[c] CD test is developed by Pesaran (2004) and it can be used when N is large and T is small.
[d] CD_{adj} test is developed by Pesaran et al. (2008) and it is valid in the case of panel models with strictly exogenous regressors and normal errors.
The $\tilde{\Delta}_{adj}$ test is the modified version of $\tilde{\Delta}$ test for small sample properties under normally distributed errors.

The first step of the panel causality approach of Emirmahmutoglu and Kose is to investigate the integrated properties of the series of all countries. To do this, the Augmented Dickey Fuller (ADF) tests are carried out and reported in Table 4. According to these results, maximum order of integration in the VAR system is determined as 1 for the credit market development and economic growth nexus and it is determined as 1 for the stock market development and economic growth nexus of the HPAE countries, excluding Japan.

Table 4. *ADF test results*[a]

Country	CM		SM			GDP		CM-GDP	SM-GDP
	Levels	1st diff	Levels	1st diff	2nd diff	Levels	1st diff	d max_i	d max_i
Hong Kong	0.84	0.03**	0.74	0.04**		0.90	0.00*	1	1
Indonesia	0.54	0.00*	0.02**			0.85	0.01**	1	1
Japan	0.47	0.00*	0.45	0.18	0.00*	0.22	0.00*	1	2
Korea	0.81	0.02**	0.48	0.00*		0.14	0.00*	1	1
Malaysia	0.02*		0.08***			0.43	0.00*	1	1
Singapore	0.84	0.00*	0.07***			0.67	0.00*	1	1
Thailand	0.26	0.07***	0.06***			0.33	0.02**	1	1

[a] The values presented in Table are MacKinnon (1996) one-sided p-values.
*,**, and *** indicate significance at the 1,5 and 10% significance levels, respectively.

Table 5 presents the results for panel causality analysis between credit market development and economic growth. The findings show that a one-way Granger causality running from economic growth to credit market development in Hong Kong, Indonesia, Singapore, South Korea and Thailand. This result implies that while the level of income increase in these countries, the real sector will cause a development in the credit market. In other words, these countries support strong evidence on demand-following hypothesis. On the other hand, a neutral relationship holds for Japan and Malaysia indicating neither credit market development nor economic growth is sensitive to each other in these countries.

The results for the causality relationship between stock market development and economic growth are reported in Table 6. For South Korea and Malaysia, the results show a one-way causality running from stock market development and economic growth and clearly support the supply-leading hypothesis. Furthermore, the reverse relationship running from economic growth to financial development is supported only in Japan. Among these countries, a two-way causality is found for Thailand. For the remaining two countries, Hong Kong, Indonesia and Singapore, there is no causality running in any direction which implies none of them has a prediction power on another.

Table 5. *Panel causality between credit market development and economic growth*

	CM development does not cause growth		Growth does not cause CM development		
Country	Wald	p-value	Wald	p-value	k_i
Hong Kong	1.897	0.593	6.615	0.085***	3
Indonesia	0.728	0.695	258.622	0.000*	2
Japan	0.028	0.866	0.013	0.998	1
Malaysia	2.212	0.696	4.705	0.318	4
Singapore	1.122	0.289	2.768	0.096***	1
South Korea	4.414	0.353	19.413	0.000*	4
Thailand	1.881	0.390	6.200	0.045**	2
Panel-Fisher	9.244	0.816	291.391	0.000*	

Lag orders k_i are selected by minimizing the Akaike Information Criteria.
*, **, and *** indicate significance at the 1, 5 and 10% significance levels, respectively.

Table 6. *Panel causality between stock market development and economic growth*

	SM development does not cause growth		Growth does not cause SM development		
Country	Wald	p-value	Wald	p-value	k_i
Hong Kong	4.134	0.388	3.872	0.425	4
Indonesia	0.707	0.950	7.265	0.122	4
Japan	3.515	0.172	4.454	0.096***	2
Malaysia	22.676	0.000*	6.894	0.141	4
Singapore	0.714	0.869	0.409	0.938	3
South Korea	6.893	0.031**	1.522	0.460	2
Thailand	11.758	0.019**	18.936	0.007*	4
Panel-Fisher	38.235	0.000*	30.200	0.007*	

Lag orders k_i are selected by minimizing the Akaike Information criteria.
*, **, and *** indicate significance at the 1,5 and 10% significance levels, respectively.

V.Conclusion

This study examines the causal relationship between financial development and economic growth for the HPAEs, during the 1989-2017. Earlier studies on Asian economies have analyzed the causal link amongst just credit market development by using only money supply proxies. By contrast, this study provides an application for both the credit market development and stock market development with two different financial development indicators. Since the existence of cross-sectional dependency among the countries is confirmed, the causal link between financial development and economic growth is analyzed by applying the recently proposed bootstrap panel Granger causality approach of Emirmahmutoglu and Kose (2011) which accounts for cross-sectional dependency and slope heterogeneity across countries.

The results of the panel bootstrap method indicate that while there is two-way causal relationship between stock market development and economic growth, the causality exist only one-way from growth to credit market development. Moreover, the findings indicate that the existence and direction of Granger causality differ among the different HPAEs. These various evidences lead to country-specific policy implications and recommendations.

Firstly, the results relating to whether economic growth causes credit market development supports the "demand-following hypothesis" of the finance-growth nexus. This results seems to be true for countries which have experienced a substantial development in their credit markets such as Hong Kong, South Korea, Singapore and Thailand. These findings indicate that economic policies should be focused on development of real sector which may result in credit market development and are consistent with the literature, e.g., Fase and Abma (2003) and Hsueh et al. (2013). There is no evidence of causality running in any direction between credit market development and economic growth in Japan and Malaysia. From these two economies, Japan is one of the largest economies in Asia in terms of GDP per capita and one of the financially-developed countries in the world. It has experienced a rapid improvement in both sectors between the 1950-1990. However, this lack of relationship can be attributed to the rapid decrease of the growing trend of the Japanese credit market especially since 2000s. In Malaysia, the result which is in line with Fase and Abma (2003) can be explained by the fact that the development of the credit market does not seem to keep pace with the fast-growing economy.

Secondly, with regard to the relationship between stock market development and economic growth nexus, the findings confirm the "supply-leading hypothesis" for South Korea and Malaysia, which implies that a well-developed stock market is necessary for economic growth. Policy makers in South Korea and Malaysia should ensure more flexible, liquid, deep and reliable stock market for encouraging economic growth. On the other hand, the empirical results show that "demand-following hypothesis" -which means that stock market development depends on economic growth- is supported only in Japan. Lastly, the two-way relationship is found in Thailand. This country was most affected from the late 1990s Asia crisis but it has recovered very quickly. Since the 2000s, it has been one of the most developed financial markets after Hong Kong and Japan in Asia. The recommendation for such a country is that attention must be paid to policies that contribute to the co-development of both sectors.

The main implication for the HPAE countries is that a general policy recommendation would not be appropriate since the financial development and economic growth relationship is country-specific. Therefore, individually-designed policies seem to be more convenient for development of the countries.

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