


A panel causality analysis of the relationship between financial development and economic growth in OECD countries

OECD üyesi ülkelerde finansal gelişme ve ekonomik büyüme ilişkisinin panel nedensellik analizi

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Abstract

This study examines the relationship between financial development and economic growth. Thus, this study aims to find empirical shreds of evidence for the direction of the causality between financial development proxied by domestic credit to the private sector and per capita GDP growth by using the panel granger causality test of the Dumitrescu-Hurlin Test. For this purpose, we used a panel of 16 OECD countries from 2008 to 2019 to provide evidence of whether the supply leading hypothesis or demand following hypothesis or both holds. All econometric exercises are carried out for whole countries and high-income countries, and upper-middle-income country groups in the sample. Due to cross-sectional dependence among the sample countries, we determine the degree of integration of each variable by employing the second-generation panel unit root tests of CIPS. We continue our analysis with the panel causality test developed by Dumitrescu and Hurlin (2012) to determine the direction of the causality between variables. For this purpose, we performed three sets of causality analyses. In the first one, we include all countries in the panel. We then divided the countries into two sub-groups based on the income classification and the level of financial development in these countries proxied by domestic credit to the private sector. The causality test results, including all countries in the sample, indicate that the hypothesis holds the supply leading hypothesis during the sample period. This means that even though this panel contains countries with a development level, financial development still seems to be a pre-condition for economic growth for these nations. We also obtain the same results when we include high-income countries in the sample. The study results provide compelling evidence for the relationship between economic growth and financial development since the sample includes countries with different levels of financial development with different degrees of per capita GDP growth.

Keywords: Financial Development, Economic Growth, Cross-sectional Dependence, Second Generation Panel Unit Root Tests, Panel Cointegration, Panel Causality

Jel Codes: C23, G15, O11, O16

Öz

Bu çalışma, finansal gelişme ile ekonomik büyüme arasındaki ilişkiyi incelemektedir. Çalışmada, Dumitrescu Hurlin Testinin panel granger nedensellik testini kullanarak, finansal gelişme ile kişi başına GSYİH büyümesi arasındaki nedenselliğin yönüne ilişkin ampirik kanıtlar bulmak amaçlanmıştır. Bu amaçla, 2008-2019 dönemi için 16 OECD ülkesinden oluşan bir panel kullanılmıştır. Analizler 16 OECD ülkesinin tamamı için yapıldığı gibi; bu grupta yer alan gelişmiş ve gelişmekte olan ülkeler için de tekrarlanmıştır. Bu sayede arz öncüllü hipotezin mi yoksa talep takipli hipotezin mi geçerliliği olduğu araştırılmıştır. Analizlerde önce ülkeler arasında hem değişkenler için hem de model bazında yatay kesit bağımlılığının varlığı araştırılmış ve yatay kesit bağımlılığı nedeniyle, ikinci nesil panel birim kök testlerinden CIPS yardımıyla değişkenlerin bütünlüşme dereceleri belirlenmiştir. Değişkenler arasındaki nedensel ilişkinin yönünü belirlemek için Dumitrescu-Hurlin (2012) tarafından geliştirilmiş panel nedensellik testi uygulanmıştır. Nedensellik test sonuçları alt ülke grupları itibarıyla iki değişken arasında çift yönlü nedensellik gösterirken; yüksek gelir grubuna sahip ülkeler için arz öncüllü hipotezin geçerli olduğunu göstermektedir. Test sonuçları farklı ülke grupları ve tüm ülkeler söz konusu olduğunda farklı sonuçlar gösterdiği için politika önerileri de buna göre farklılaşacaktır.

Anahtar Kelimeler: Finansal Gelişme, Ekonomik Büyüme, Yatay Kesit Bağımlılığı, İkinci Nesil Panel Birim Kök Testleri, Panel Eşbütünlüşme, Panel Nedensellik

JEL Kodları: C23, G15, O11, O16

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Introduction

Financial development can be defined simply as the continuous improvement of financial efficiency in financial markets, financial institutions, and financial instruments (Patrick, 1966; King and Levine, 1993a). Thus, it is one of the crucial determinants of economic growth. The breadth of the scope of even this simple definition shows how broad the impact of financial development on economic growth is. Therefore, the impact of financial development on economic growth is still uncertain. For this reason, empirical studies periodically reexamine the relationship between financial development and economic growth. Whether financial development promotes economic growth or economic growth causes financial development to be a widely investigated topic in economics. Schumpeter's well-known study in 1911 is considered as the starting point for the research of this topic. Following the critical papers of King and Levine (1993 a,b), there has been an increase in the number of studies implemented to search this relationship: Robinson (1952), Goldsmith (1969), McKinnon (1973), King and Levine (1993a,b), Obsfeld (1994), Levine (1997), Neusser and Kugler (1998), Levine and Zervos (1996), Levine, Loayza and Beck (2000), Beck, Levine and Loyaza (2000).

Studies related to this topic have an essential future so that the studies are repeated based on the development of new methods and the availability of the new data. Moreover, different methods such as time series, cross-section data, and panel data econometric techniques have increased the number of studies related to this relationship. Besides using the new techniques and the new data, the relationship between financial development and economic growth should be renewed following global developments such as the 2008-9 global crisis since this kind of development can change the direction of causality established by existing studies in the field.

For this purpose, we tried to find new evidence related to the causality direction between two variables. Thus, this study aims to find empirical shreds of evidence for the causality between financial development proxied by domestic credit to the private sector and per capita GDP growth by using the panel granger causality test, the Dumitrescu-Hurlin Test. We used a panel of 16 OECD countries from 2008 to 2019 to provide evidence of whether the supply leading hypothesis or demand following hypothesis or both holds. We performed three sets of causality analyses. In the first one, we include the whole countries in the panel. We then divided the countries into two sub-groups based on the income classification and the level of financial development in these countries proxied by domestic credit to the private sector. The causality test results, including all countries in the sample, indicate that the hypothesis holds the supply leading hypothesis during the sample period. It means that even though this panel contains countries with a development level, financial development still seems to be a pre-condition for economic growth for these nations. We also obtain the same results when we include high-income countries in the sample.

On the other hand, we obtain different results for the countries considered upper-middle-income countries or emerging markets. The result for these countries indicates that there is bi-directional causality between financial development and per capita income, implying that both the demand following and the supply leading hypothesis for these countries. Therefore, it is evident that we cannot employ or suggest one size fits all policies for these countries based on the interactions between financial development and economic growth.

The rest of the paper organized as follows: In the second section, we reviewed the existing literature. The third section introduces the data used in the study and summarizes the preliminary data analysis. The fourth section explains the methodology, the fifth section presents and discusses the empirical results, and the last section concludes.

Literature review

When the economics literature is examined, although the common point of many studies is that financial development positively impacts economic growth, there are also alternative views. When we group the studies according to their results, examples of studies showing the existence of a positive and significant relationship between financial development and economic growth are Schumpeter (1911), Goldsmith (1969), Bencivenga and Smith (1991), Roubini and Sala-i Martin (1992), Bencivenga, Smith and Starr (1995), Levine and Zervos (1996), Levine (1997), Greenwood and Smith (1997), Kargbo and Adamu (2009), Hassan, Sanchez and Yu (2011) and Adu, Marbuah and Mensah (2013). Besides, De Gregorio and Guidotti (1995), Ujunwa and Salami (2010), Nili and Rastad (2007), Naceur and Ghazouani (2007), and Narayan and Narayan (2013) found an insignificant or negative relationship between financial development and economic growth in their studies. Also, according to authors such as Robinson (1952), Ram (1999) and Opoku, Ibrahim and Sare (2019), there is no relationship between these two. In addition

to these, Rajan and Zingales (1998) and Manganelli and Popov (2013) found a nonlinear relation between financial development and economic growth.

Schumpeter (1911) states in his study that financial intermediaries and savings are provided between economic units. They manage risk and support economic growth by performing financial transactions. As a result of the study, he found that financial development affects economic growth. Patrick (1966) states that modern financial institutions emerged with investor demand and that meeting these demands contributes to financial development by providing economic growth. Another study on the relationship between financial development and economic growth belongs to Levine (1997). According to Levine (1997), there is a robust relationship between growth, improvements in capital distribution efficiency, and physical capital accumulation. Besides, they determined that financial development indicators predict growth indicators.

We can also group the studies by supporting the hypothesis of their findings. Extensive empirical work on financial development and economic growth in different countries included in the sample has conflicting results. McKinnon (1973), Shaw (1973), King and Levine (1993 a,b), Neusser and Kugler (1998), Levine et al. (2000), Akinlo and Egbetunde (2010), Osuala, Okereke and Nwansi (2013), Bayar, Kaya and Yildirim (2014), Bist (2018) support the 'finance-led growth hypothesis' or the 'supply-leading hypothesis' with their studies' findings. Under this hypothesis, financial development is significant and leads to economic growth. On the other hand, according to the 'growth-led finance hypothesis', or the 'demand-following hypothesis', the improvement of the real sector leads to the development of the financial sector. Robinson (1952), Friedman and Schwartz (1963), Goldsmith (1969), Jung (1986), Greenwood and Jovanovic (1990), Ang and McKibbin (2007), Akinlo and Akinlo (2009), Athanasios and Antonios (2012) show in countries where economic growth occurs, financial sector development follows this situation.

Studies examining the relationship between financial development and economic growth used different indicators or proxies for financial development and economic growth. Most of the indicators used for financial development are the ratio of broad money to GDP, the ratio of the bank credit to the private sector to GDP, domestic credit to GDP, etc. Studies also use either GDP growth rate or per capita GDP growth rate. As King and Levine (1993 a) have argued in their study, this indicator has a clear advantage over other financial development measures such as broad money to GDP ratio since it represents the actual volume of funds transferred to the private sector more accurately. Therefore, the ratio of domestic credit to the private sector to GDP is more directly linked to investment and economic growth (De Gregorio and Guidotti, 1995). For this reason, in this study, we prefer to use the ratio of domestic credit to the private sector (% of GDP) to measure financial development.

Based on the literature review, it is evident that there is a need to examine the relationship of financial development to economic growth. Using the method that considers heterogeneity in the panel consists of countries with different developmental levels.

Data and preliminary analysis

This study analyses the relationship between financial development and economic growth for high-income countries and upper-middle-income countries between 2008-2019. In this context, OECD members eight high-income countries (Norway, Iceland, Australia, Japan, Denmark, USA, United Kingdom, Korea) and eight upper-middle-income countries (Czech Republic, Hungary, Israel, Mexico, Poland, Sweden, Turkey, Chile) were evaluated.

The empirical literature on the relationship between financial development and economic growth shows that studies have mainly used three different majors of financial development. These are the ratio of domestic credit to the private sector to GDP, IMF financial development index, the ratio of broad money such as M2 or M3 to GDP, the ratio of bank credit to the private sector to GDP. As De Gregorio and Guidotti (1995) mentioned, the ratio of domestic credit to the private sector to GDP has some advantages over other indicators among these three alternatives. Because this indicator is an accurate proxy for the actual volume of funds channelled to the private sector, it has more advantages than accurate interest rates or M1, M2, or M3 measures. Briefly, it is more directly linked to economic growth and investment. The growth indicator is the real per-capita GDP growth rate. In other words, the percentage increase in per capita national income representing economic growth was used as the dependent variable, and the share of the GDP% of the loans granted to the private sector as an independent variable. We obtain the data for both variables from the World Bank Database (WDI). Table 1 defines the variables, and Table 2 displays summary statistics about the data.

Table 1: Variables

Domestic Credit to Private Sector (% Of GDP)	DCPSGDP	World Development Indicators
Per Capita GDP Growth	PCGDPGROWTH	World Development Indicators

Table 2: Descriptive Statistics

	Group A		Group B		Group C	
	DCPSGDP	PCGDPGROWTH	DCPSGDP	PCGDPGROWTH	DCPSGDP	PCGDPGROWTH
Mean	108.158	1.356	149.714	0.866	66.603	1.847
Median	122.426	1.446	146.147	1.088	53.991	1.958
Maximum	201.258	9.509	201.258	6.274	132.679	9.509
Minimum	20.673	-7.094	84.902	-7.094	20.673	-6.674
Std. Dev.	51.445	2.461	27.991	2.000	32.364	2.774
Skewness	-0.039	-0.718	-0.2143	-1.410	0.791	-0.738
Kurtosis	1.701	5.424	2.412	7.117	2.383	4.732
Jarque-Bera	13.540	63.519	2.115	99.621	11.549	20.725
Probability	0.001	0.000	0.347	0.000	0.000	0.000
Observation	192	192	96	96	96	96

As shown in Table 2, domestic credit to the private sector to GDP shows more volatility than the per capita GDP growth during the sample period implied by standard deviation. Also, the volatility of the ratio of domestic credit private sector to GDP is higher for upper-middle-income countries than high-income countries. Figure 1 shows a scatter diagram between the per capita GDP growth rates and domestic credits to the private sector for the whole panel.

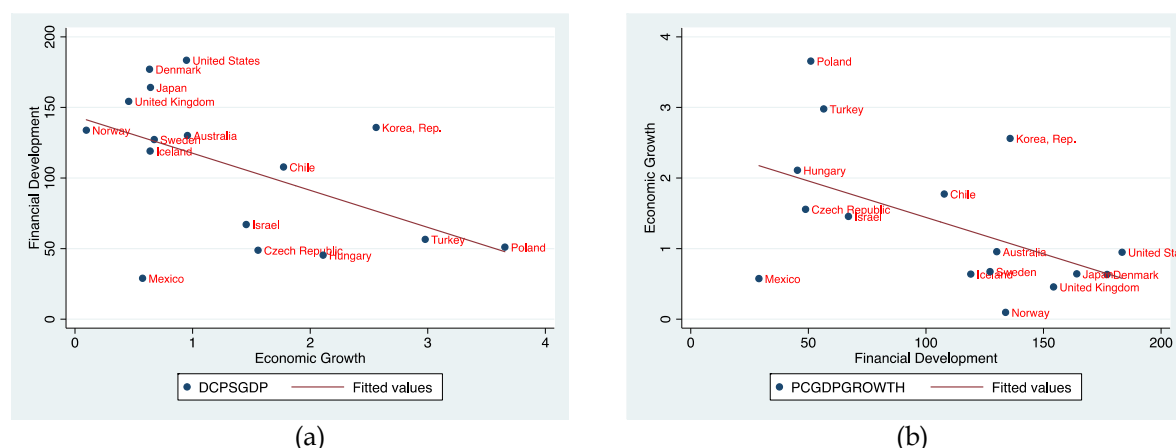


Figure 1: The Ratio of Domestic Credit to the Private Sector to GDP and per capita GDP Growth Rate for Whole Countries

Figure 1 shows that countries in the sample are divided into two groups in terms of financial development. In the first group, countries such as Norway, Iceland, Australia, Japan, Denmark, the USA, United Kingdom, and Korea show a high level of financial development but relatively low growth of per capita GDP except Korea Rep. On average they seem to be a homogenous relationship between economic growth and financial development for these countries. On the other hand, even though other countries seem to have an approximate level of financial development, there is high variability in

economic growth. Mexico seems to have the lowest level of financial development and economic growth.

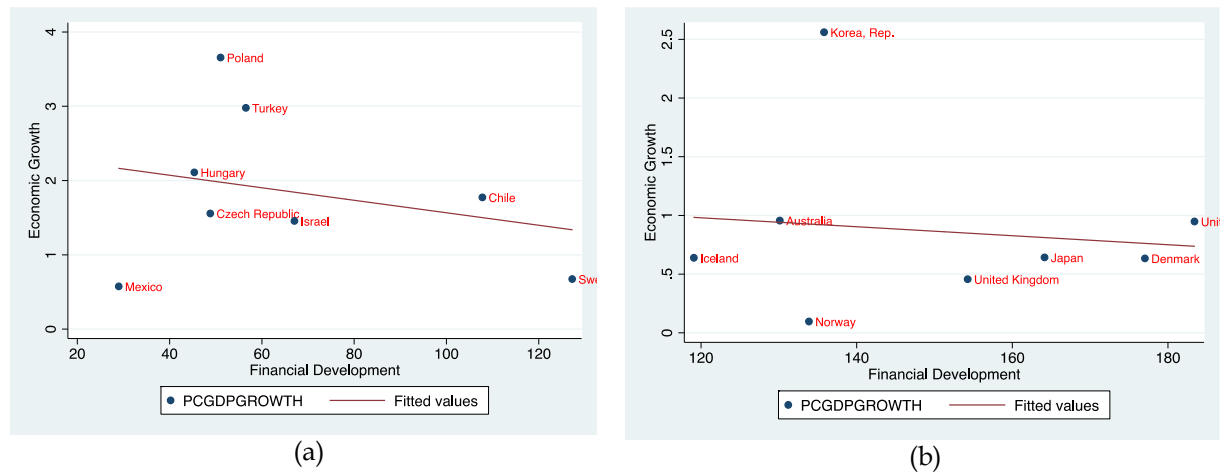


Figure 2: The Ratio of Domestic Credit to the Private Sector to GDP and per capita GDP growth rate for High Income and Upper Middle-Income Countries

Figure 2 includes two scatter diagrams of subgroups of the countries in the sample. Figure 2 part (a) displays the scatter diagram between economic and financial development of countries with a relatively lower financial development level than part b representing the scatter diagrams of the countries with a relatively high level of financial development. Moreover, both scatter diagrams show an inverse relationship between financial development and economic growth.

Countries after reaching a certain level of financial development have a negative impact when the level of financial development increases. It causes the financial fragility. Since the sample countries have different levels of financial development and growth rates, the period averages show such an inverse relationship (Ductor and Grechyna, 2015). In other words, the impact of financial development on economic growth weakens as the financial market grows (Rajan and Zingales, 1996). Also, most of the sample countries during the sample period affected worst by the global financial crises of 2008 and European Debt crises. Therefore, it is not surprising to have the adverse effects of the financial system struggling with many problems on economic growth.

Methodology

To analyze the causal relationships between financial development and economic growth panel causality test developed by Dumitrescu and Hurlin (2012) was used. Before carrying out this test, we first tested the existence of cross-sectional dependence between variables employing Breusch-Pagan (1980) (Lagrange Multiplier-LM) and Pesaran (2004) (Cross-section Dependence-CD) and Pesaran, Ullah and Yamagata (2008) (Bias-Adjusted Cross Sectionally Dependence Lagrange Multiplier- CD_{LM}) tests. And then, based on the results of the cross-sectional dependence tests, we performed second generation panel unit root tests of CIPS stands for Cross sectionally-augmented IPS (2003) test, to investigate the long-run relationship between financial development and economic growth. Before implementing the causality test, we carry out Westerlund error-correction-based panel cointegration tests developed by Westerlund (2007) to get evidence supporting the results of the panel causality tests. Finally, we applied the Dumitrescu-Hurlin (2012) Panel Causality Test.

As is well known, the Dumitrescu-Hurlin panel causality test is a simple adaptation of the Granger non-causality test for constant-coefficient non-homogeneous panel data models. In Dumitrescu and Hurlin (2012), the authors considered heterogeneity in terms of two dimensions, which are the heterogeneity of the regression model used to test Granger causality and the heterogeneity of causality relationships. In order to do this test, the series must be stationary at the same level. This method considers the cross-sectional dependence among the countries in the sample (Dumitrescu and Hurlin, 2012).

The Dumitrescu-Hurlin test can predict cross-section dependence and cross-section independence situations. When we examine the traditional panel Granger causality tests, it can be seen that if there is a causal relationship in a sub-group of the variable, due to the lack of cross-sectional information, that is because of the homogeneous null hypothesis. The null hypothesis means that there is no Granger causality relationship in cross-sections, and the alternative hypothesis expresses a Granger causality relationship for at least one cross-section (Dumitrescu and Hurlin, 2012).

Dumitrescu and Hurlin (2012) used the following equation for panel causality test considering the linear heterogeneous model:

$$y_{it} = \alpha_i + \sum_{k=1}^L \gamma_i^k y_{it-k} + \sum_{k=1}^L \beta_i^k x_{it-k} + \varepsilon_{it} \quad , i=1, 2, \dots, N; t=1, 2, \dots, T$$

Where α_i denotes individual effects, γ_i^k and β_i^k represents the lag and slope parameters, and L supposed to be the lag orders. We can summarize the model's assumptions as; the individual effects are constant, besides the same lag length in cross-section, the coefficients of slope and lag parameters vary across units and especially a balance panel must be required for the Dumitrescu-Hurlin test. The null and alternative hypotheses equation are as follows:

$$H_0: \beta_{i1} = \dots = \beta_{iK} = 0 \quad \forall i = 1, \dots, N$$

$$H_1 = \beta_{i1} = \dots = \beta_{iK} = 0 \quad \forall i = 1, \dots, N_1$$

$$\beta_{i1} \neq 0 \text{ or } \beta_{iK} \neq 0 \quad \forall i = N_1 + 1, \dots, N$$

When we consider the null hypothesis, it can be seen that there is no Granger causality relationship between variables for all units. In contrast, the alternative hypothesis represents at least one unit that there is evidence of Granger causality between variables. Individual residues are independent for each cross-section unit. Therefore, while the alternative hypothesis supports heterogenous results, the null hypothesis is a heterogenous model providing homogenous results. This test is usually distributed and allows (Dumitrescu and Hurlin, 2012).

To determine the outcome of the Dumitrescu-Hurlin panel causality test hypotheses, one can use a test statistic, which is the mean of all test statistics of cross-sectional units.

$$W_{N,T}^{HNC} = \frac{1}{N} \sum_{i=1}^N W_{i,T} \quad (\text{HNC: Homogeneous Non-Causality})$$

Where $W_{i,T}$ represents the test statistics of each cross-sectional unit. In this test, one can obtain two different test statistics based on whether T is greater or less than N. These test statistics are $Z_{N,T}^{HNC}$ and Z_N^{HNC} obtained from $W_{N,T}^{HNC}$. When $T > N$, we use $Z_{N,T}^{HNC}$ statistics. On the otherhand if $T < N$ we use Z_N^{HNC} statistics. Furthermore, the following equations give these statistics.

$$Z_{N,T}^{HNC} = \sqrt{\frac{N}{2K}} (W_{N,T}^{HNC} - K) \quad T, N \rightarrow \infty, N(0,1)$$

$$Z_N^{HNC} = \frac{\sqrt{N}(W_{N,T}^{HNC} - N^{-1} \sum_{i=1}^N E(W_{i,T}))}{\sqrt{N^{-1} \sum_{i=1}^N \text{Var}(W_{i,T})}} \quad N \rightarrow \infty, N(0,1)$$

Where $E(W_{i,T})$ and $\text{Var}(W_{i,T})$ denotes the mean and the variance of $W_{i,T}$ respectively, if there is a cross-sectional dependence, we use the critical table values at a 5% level of significance obtained from 50000 iterations (Dumitrescu and Hurlin, 2012: 8-10).

Empirical results

We start testing cross-sectional dependence among the countries to analyze the causal relationship between economic growth and financial development. For this purpose, we use three different cross-sectional dependence tests, which are the Lagrange Multiplier-LM test of Breusch-Pagan (1980), Cross-section Dependence-CD test of Pesaran (2004) and Bias-Adjusted Cross Sectionally Dependence Lagrange Multiplier- CD_{LM} test of Pesaran et al. (2008). Table 3 presents the results of these tests.

Table 3: The Results of the Cross-Sectional Dependence Tests

Test/ Variables	Group A			Group B			Group C		
	PCGDP GROWTH	DCPS GDP	Model	PCGD PGRO WTH	DCPS GDP	Model	PCGD PGRO WTH	DCPS GDP	Model
CD_{BP}	541.852 (0.0000)	763.168 (0.0000)	532.169 (0.0000)	143.521 (0.0000)	133.657 (0.0000)	110.982 (0.0000)	122.189 (0.0000)	236.170 (0.0000)	129.513 (0.0000)
CD_{LM}	27.230 (0.0000)	41.516 (0.0000)	26.605 (0.0000)	15.437 (0.0000)	14.119 (0.0000)	11.088 (0.0000)	12.586 (0.0000)	27.817 (0.0000)	13.565 (0.0000)
LM_{adj}	26.503 (0.0000)	40.789 (0.0000)	25.878 (0.0000)	15.073 (0.0000)	13.755 (0.0000)	10.725 (0.0000)	12.222 (0.0000)	27.454 (0.0000)	13.201 (0.0000)
CD	21.047 (0.0000)	0.801 (0.4077)	21.182 (0.0000)	10.958 (0.0000)	1.129 (0.2589)	9.355 (0.0000)	10.042 (0.0000)	2.161 (0.0307)	10.507 (0.0000)

Note: Numbers in parenthesis are p-values of the test statistics.
 *Indicates the rejection of the null hypothesis of cross-sectional independence (CD test) and the null hypothesis of unit root at a 1% significance level. The test regression is fitted with a constant.
 Group A: Whole countries.
 Group B: High-Income Countries (Norway, Iceland, Australia, Japan, Denmark, USA, United Kingdom, Korea)
 Group C: Upper-middle-income Countries (Czech Republic, Hungary, Israel, Mexico, Poland, Sweden, Turkey, Chile)

The results of all cross-sectional dependence tests indicate a cross-sectional dependence among the countries in terms of both variables implying that shocks to any variable will have a potential spread to other countries. Because of the cross-sectional dependence, we carry out second-generation panel unit root tests of the cross-sectional augmented panel unit root IPS (CIPS) test developed by Pesaran, Smith and Yamagata (2013) to determine the degree of the integration of each variable. Table 4 shows these results.

Table 4: The Results of Panel Unit Root Test

Variables	Group A			Group B			Group C		
	CIPS (intercept)								
	Level	1st diff.	Result	level	1st diff.	Result	level	1st diff.	Result
DCPSGDP	-2.106	-3.024*	I(1)	-2.188	-3.241*	I(1)	-1.551	-2.697*	I(1)
PCGDPGROWTH	-2.695*	-4.147*	I(1)	-3.742*	-4.076*	I(1)	-2.011	-3.601*	I(1)

Note: *denotes rejection of the null hypothesis of no cointegration at 1% significance level.
 Table critical values at 10%, 5% and 1% significance level are: (for Group A)- 2.11, -2.22, -2.45 ; (for Group B and C)- 2.22, -2.37, -2.66 (Pesaran, 2007).
 Numbers in parenthesis are p-values of the test statistics.
 Group A: Whole countries.
 Group B: High-Income Countries (Norway, Iceland, Australia, Japan, Denmark, USA, United Kingdom, Korea)
 Group C: Upper-middle-income Countries (Czech Republic, Hungary, Israel, Mexico, Poland, Sweden, Turkey, Chile)

As is seen in Table 4, all test results indicate that domestic credit to private is the first difference stationary that is I(1). Nevertheless, the unit root test results regarding the level and first differences stationarity of variable provide mixed results. We reject the null hypotheses when we test both the series are level and first difference. Therefore, to determine the degree of the integration of the PCGDPGROWTH, we followed the suggestion of Granger (2010) and Iheonu, Asongu, Odo and Ojiem.

(2020). Also, to show the robustness of causality test results, we use the suggestion made by Andriansyah and Messinis (2019). Following their suggestion, we first test the existence of cointegration between two variables by using Westerlund error-correction-based panel cointegration tests, which considers cross-sectional dependence. Table 5 presents the results of this test.

Table 5: The Results of Cointegration Tests

Groups/ Statistic	G _T			G _a			P _T			P _a		
	Value	Z-value	P-value	Value	Z-value	P-value	Value	Z-value	P-value	Value	Z-value	P-value
Group A	-5.92	-18.45	0.000	-6.01	0.83	0.793	-16.87	-11.14	0.000	-7.75	-3.17	0.001
Group B	-7.72	-18.71	0.000	-3.47	1.90	0.977	-14.21	-10.18	0.000	-11.02	-4.33	0.000
Group C	-4.12	-7.38	0.000	-8.55	-0.73	0.231	-11.15	-7.10	0.000	-6.77	-1.62	0.053

Note: In Westerlund error-correction-based panel cointegration test, the null hypothesis states no cointegration. While G_T and G_a are groups mean statistics to test the null hypothesis of no cointegration against the alternative hypothesis of cointegration among some of the selected countries, P_T and P_a are the panel statistics to test the null of no cointegration against the alternative hypothesis of cointegration among whole countries.

Since there is cointegration between the variables, this should be considered an indication of causality between variables. Thus, regardless of the degree of the integration of the variables, one can rely on the results of the panel granger causality test of Dumitrescu-Hurlin and Table 6, including these tests' results.

Table 6: The Results of Dumitrescu-Hurlin Causality Tests

Null Hypothesis/Groups	Group A		Group B		Group C	
	Zbar-Stat	Probability	Zbar-Stat	Probability	Zbar-Stat	Probability
PCGDPGROWTH does not homogeneously cause DCPSGDP	1.956*	0.050	0.776	0.437	3.117*	0.001
DCPSGDP does not homogeneously cause PCGDPGROWTH	4.142*	0.003	2.740*	0.006	1.989**	0.046

Note: ***, **, * respectively denotes significance at the 10%, 5%, 1% level.
 Group A: Whole countries.
 Group B: High-Income Countries (Norway, Iceland, Australia, Japan, Denmark, USA, United Kingdom, Korea)
 Group C: Upper-Middle-Income Countries (Czech Republic, Hungary, Israel, Mexico, Poland, Sweden, Turkey, Chile)

Based on the test results, we conclude that there is bi-directional Granger causality between the economic growth and financial development for whole countries (Group A), implying that both supply leading and demand following hypothesis hold for these countries. Since we observe an apparent heterogeneity among the sample countries regarding financial development and economic growth, we repeat the same tests for the countries' subgroups. The results for high-income countries (Group B) with a high level of financial development show a unidirectional causality running from financial development to economic growth, implying that the supply leading hypothesis holds for these countries. Because except for the United States, all other countries have adopted a money market-led-development strategy. We obtained the same bi-directional causality for the upper-middle-income countries (Group C) as well. Therefore, we concluded that both supply leading and demand following hypothesis hold for these countries. Since the countries in these groups are using a mix of money and stock market-led development policies, these results should be seen as plausible results.

Conclusion

This paper examines the causal relationship between economic growth and financial development for some OECD countries using the panel causality test developed by Dumitrescu-Hurlin. The study results provide some interesting evidence for the relationship between economic growth and financial development since the sample includes countries with different levels of financial development with different degrees of per capita GDP growth. First of all, results show a cross-sectional dependence among the countries regarding both variables implying that shocks to any variable will potentially spread to other countries. Second, we found causality for the whole panel that there is bi-directional granger causality between the economic growth and financial development, implying that both supply leading and demand following hypothesis hold for the countries in the sample. Third, there is a unidirectional causality running from financial development to economic growth for the group of high-income countries, implying that the supply leading hypothesis holds for these countries. There is bi-directional causality between economic growth and financial development for the upper-middle-income countries, implying that both supply leading and demand following hypothesis hold for these countries.

Based on the results of the study, we can reach the following conclusions and make policy suggestions. To increase the per capita GDP to growth rates, these countries still need to adopt policies that organize the financial system, allowing domestic credits to the private sector. Second, since upper-middle-income countries in the sample are examples of the countries exhibited by the directional causality, these countries need to understand that aiming to policies most designed to increase economic growth will also promote financial development. For this purpose, the size and efficiency of the banking system can be increased to create more credit to the private sector. Because of this banking system in most of these countries should be carefully monitored and supported.

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