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Granger Causality Between Gross Domestic Product and Economic Sectors in Developing Countries: A Panel Co-integration Approach

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ABSTRACT

The purpose of this article is to explore the causal relationship between gross domestic product (GDP) and economic sectors including agricultural, industrial, and services growth and oil price using a balanced panel data of 62 developing countries observed over the period of 1990-2014. The results of multiple regressions show that industrial and services value-added share of GDP and oil price are the positive influencing factor of the GDP of developing countries. In contrast, agricultural value-added share of GDP identifies as a negative influencing factor of the GDP. To examine the Granger causal relationship between variables, the vector error correction model (VECM) and Wald tests statistics are applied. The findings show a long run relationship of Granger causality between variables and show a short run bi-directional Granger causality between GDP and agriculture and service value added share of GDP and oil price and a short run unidirectional Granger-causality from industry value added (% of GDP) to GDP.

Keywords: Economic Sectors, Oil Price, Developing Countries, Panel Co-integration, Granger-causality
JEL Classifications: O1, O13, O14, C33

1. INTRODUCTION

Agriculture is the main source of national income for most developing countries. Besides of providing opportunities for employment of the people who lives in the rural areas of these countries, this sector is the primary source of livelihood, and food security for all people. It also provides raw material to the other economic sectors, and contributes to the country's export. Then any policy or strategy in agricultural sector will affect the economic growth of the countries (Alam, 2008). Along with the current level of development, as developing countries pursue the structural adjustment program, the agriculture sector has been neglected all the times. However, analyzing the role of agriculture in the economies of developing countries and its relationship with gross domestic product (GDP) is very important for policymakers.

On the other hand, manufacturing is the key engine of economic growth for economies as industrial goods have a higher-income elasticity of demand (Kaldor, 1967; Cornwall, 1977). For countries who are concentrated on the primary sectors, the development and diffusion of manufacturing led to an increase in variety (Cornwall, 1977). Also, service sector growing at fastest pace since 1997 has played a major role in the GDP of countries around the world, where the sector has accounted for about two third of the global service trade (Wing et al., 2007). Then the aim of this article is to study how the economic sectors are influencing the GDP of developing countries. A panel co-integration approach is used for investigating the Granger - causality between the GDP, and three major economic sectors including agriculture, industry, and service sectors, and at the same time investigate the effect of oil price on the economic expansion of developing countries.

This article is organized as follows. The next section briefly presents a review of the empirical literature. Then data description and methods including model specification is presented in subsequent section. I analyzed the empirical results of estimation in the next section. For this purpose, I first check whether variables are stationary or not, and test whether variables form a co-integrating set using panel co-integration, and therefore explore the long-run and short-run causality between GDP and economic sectors, and at the end i conclude with the direction of future works.

2. EMPIRICAL LITERATURE REVIEW

Over the last decades, there have been many research studies about the growth theory and its relationship with input production. Some research studies have been analyzed the relationship between GDP and gross value added by a specific country or a region or a group of countries like oil producing countries. Gross value added or GVA is the measure of the value of goods and services produced in an area, industry or sector of an economy. The results were strengthened in some cases. This article analyzes the relationship between GDP, and three major economic sectors including agricultural, industry, service sectors along with oil price. The latter variable considers for analyzing the exogenous shocks to developing countries as they are price takers. This section briefly refers to some empirical evidence.

Andzio-Bika and Kamitewoko (2004) found that agriculture has a significant effect on GDP of China and three Sub-Saharan Africa countries. This effect was positive for China and Congo and Burkina Faso, and negative in Cameroon where negative effect can be described by the vigorous economic recovery. Katircioglu (2006) studied the impact of agricultural sector on the economy of North Cyprus by using annual data for the period from 1975 to 2002, and found a long run equilibrium relationship between agricultural growth and economic growth.

Sultan (2008) found that industry value-added growth can contribute more than the export and import growth in increasing economic growth in Bangladesh. Subramaniam and Reed (2009) estimated the linkage between agriculture, manufacturing, service and trade sectors by using a vector error correction model (VECM) for Poland and Romania. They found that the industrial sector has a positive role to the agriculture sector at the same time growing service sector reveals a mixed effect in Poland. In Romania, they found that the industrial sector is detrimental to the primary sector but the contribution of the service sector is positive.

Wang et al. (2010) found that there is a positive link between agriculture sector and economic growth, and analyzed how this sector contributes to economic growth. Their results showed that although the share of agriculture in GDP has reduced over time, but the contribution of agriculture growth has hold upward trend, also it has made an important market, foreign exchange and output contributions to non-agricultural growth and remains an exceptional driving force for economic growth.

Jatuporn et al. (2011) investigated the causality between agriculture and economic growth in Thailand over the period of 1961-2009. The results showed that agriculture is existed in a long-term stable in economic growth while economic development encourages the growth of agriculture. Ilyani et al. (2016) examined the relationship between manufacturing, agriculture, services sectors and GDP per capita of Malaysia by using annual data from the 2000 until 2010, and found that manufacturing and service sectors are related to GDP per capita while agriculture sector did not have a significant relation towards GDP per capita.

About the economic importance of oil price shocks on the GDP of developing countries, some related empirical studies started by finding a linear negative relationship between oil prices and real activity in oil importing countries (Rasche and Tatom, 1981; Darby, 1982; Hamilton, 1983; Burbidge and Harrison, 1984; Gisser and Goodwin, 1986).

Ghalayini (2011) investigated the effect of oil price on economic growth among G7 countries, OPEC countries in addition to Russia, China and India. He found that the relation is negatively/positively correlated for oil importer/exporter countries. Also, a unidirectional relation from oil price to GDP was proved for the G7 countries. Bouzid (2012) found that a change in real crude oil prices negatively influences the real GDP, and suggested that a rising oil price can cause the economic growth to decrease since it affects the daily consumption pattern of households. Shaari et al. (2013) explored oil price effects on different economic sectors in Malaysia by using quarterly time series data from 2000 to 2011. They found that agriculture and construction sector are relies on oil prices.

3. DATA

In this article, annual data for a sample of 62 developing countries[1] over the period of 1990-2014 is used, which all of them have been taken from the data published by World Bank in the World Development Indicators. I collected information on the GDP (constant 2005 US$); agricultural value-added share of GDP (AGR), industry's value-added share of GDP (IND), service value added share of GDP (SER), and oil price (OILP).

Table 1 presents descriptive statistics of the variables in the study. As shown in Table 1, the log of real GDP stood at the average of $23.7290 (or $20201 million after taking antilog), the log of agriculture has been on the average of 2.8 (or 16.44% after taking antilog), the log of industry has been on the average of 3.3369 (or 28.13% after taking antilog), the log of services has been on the average of 3.8787 (or 48.36% after antilog), the log of oil price stood at the average of 3.5988 (or $36.55 after taking antilog) for the period of 1990-2014.

4. METHODS

This section specifies the general functional form of the model for investigating the contribution of economic sectors to GDP in developing countries. The general equation for the multiple regression analysis is below:

1 The developing countries (by the World Bank three-letter country codes) included in this article are: ARG, ARM, AZE, BGD, BLR, BOL, BWA, BRA, BGR, BFA, BDI, CAF, CHL, CHN, COL, CRI, CIV, DOM, ECU, EGY, SLV, ETH, GEO, GHA, GIN, HND, IND, IDN, JOR, KEN, KGZ, LAO, LSO, MKD, MDG, MWI, MYS, MRT, MEX, MDA, MNG, MAR, NAM, NPL, NER, NGA, PAK, PRY, PHL, RWA, SEN, ZAF, LKA, TZA, THA, TUN, TUR, UKR, URY, UZB,VNM, ZMB.

Table 1: Descriptive statistics

Variables	Observed	Mean	Maximum	Minimum	SD
lnGDP	1550	23.7290	29.2938	20.5197	1.8151
lnAGR	1550	2.800	4.1892	0.7092	0.7184
lnIND	1550	3.3369	4.2517	1.8403	0.3370
lnSER	1550	3.8787	4.3191	2.8668	0.2451
lnOILP	1550	3.5988	4.7151	2.5424	0.7240

$$lnGDP_{it} = \alpha_0+\alpha_1 lnAGR_{it}+\alpha_2 lnIND_{it}+\alpha_3 lnSER_{it}+\alpha_4 lnOILP_{it}+\varepsilon_{it} \quad (1)$$

Where $lnGDP_{it}$ is the logarithm of GDP, $lnAGR_{it}$ is the logarithm of agriculture value added (% of GDP), $lnIND_{it}$ is the logarithm of industry value added (% of GDP), $lnSER_{it}$ is the logarithm of services value added (% of GDP), $lnOILP_{it}$ is the logarithm of oil price, and ε_{it} is the residual of the equation. The subscript i and t denote country and time, respectively.

As a first step of estimation methodology, time series properties of the variables both stationary and non-stationary processes are considered, where the latter could be made stationary by differencing. Asa second step, I use panel co-integration test to show the existence of long run relationships between variables, and therefore VECM are constructed to estimate the parameters of long run equilibrium relationships between variables as well as the short run adjustment coefficients as a third step. To test for Granger - causality, VECM framework for five variables are employed as below

$$D(\ln GDP_{i,t}) = \mu_{1,i} + \varnothing_{1,i}ECT_{i,t} + \sum_{j=1}^{k}\gamma_{1,j,i}D(\ln AGR_{i,t-j}) + \sum_{j=1}^{k}\delta_{1,j,i}D(\ln IND_{i,t-j}) + \sum_{j=1}^{k}\varphi_{1,j,i}D(\ln SER_{i,t-j}) + \sum_{j=1}^{k}\omega_{1,j,i}D(\ln OILP_{i,t-j}) + \sum_{j=1}^{k}\theta_{1,j,i}D(\ln GDP_{i,t-j}) + \varepsilon_{1,i,t} \quad (2)$$

$$D(\ln AGR_{i,t}) = \mu_{2,i} + \varnothing_{2,i}ECT_{i,t} + \sum_{j=1}^{k}\gamma_{2,j,i}D(\ln AGR_{i,t-j}) + \sum_{j=1}^{k}\delta_{2,j,i}D(\ln IND_{i,t-j}) + \sum_{j=1}^{k}\varphi_{2,j,i}D(\ln SER_{i,t-j}) + \sum_{j=1}^{k}\omega_{2,j,i}D(\ln OILP_{i,t-j}) + \sum_{j=1}^{k}\theta_{2,j,i}D(\ln GDP_{i,t-j}) + \varepsilon_{2,i,t} \quad (3)$$

$$D(\ln IND_{i,t}) = \mu_{3,i} + \varnothing_{3,i}ECT_{i,t} + \sum_{j=1}^{k}\gamma_{3,j,i}D(\ln AGR_{i,t-j}) + \sum_{j=1}^{k}\delta_{3,j,i}D(\ln IND_{i,t-j}) + \sum_{j=1}^{k}\varphi_{3,j,i}D(\ln SER_{i,t-j}) + \sum_{j=1}^{k}\omega_{3,j,i}D(\ln OILP_{i,t-j}) + \sum_{j=1}^{k}\theta_{3,j,i}D(\ln GDP_{i,t-j}) + \varepsilon_{3,i,t} \quad (4)$$

$$D(\ln SER_{i,t}) = \mu_{4,i} + \varnothing_{4,i}ECT_{i,t} + \sum_{j=1}^{k}\gamma_{4,j,i}D(\ln AGR_{i,t-j}) + \sum_{j=1}^{k}\delta_{4,j,i}D(\ln IND_{i,t-j}) + \sum_{j=1}^{k}\varphi_{4,j,i}D(\ln SER_{i,t-j}) + \sum_{j=1}^{k}\omega_{4,j,i}D(\ln OILP_{i,t-j}) + \sum_{j=1}^{k}\theta_{4,j,i}D(\ln GDP_{i,t-j}) + \varepsilon_{4,i,t} \quad (5)$$

$$D(\ln OIL_{i,t}) = \mu_{5,i} + \varnothing_{5,i}ECT_{i,t} + \sum_{j=1}^{k}\gamma_{5,j,i}D(\ln AGR_{i,t-j}) + \sum_{j=1}^{k}\delta_{5,j,i}D(\ln IND_{i,t-j}) + \sum_{j=1}^{k}\varphi_{5,j,i}D(\ln SER_{i,t-j}) + \sum_{j=1}^{k}\omega_{5,j,i}D(\ln OILP_{i,t-j}) + \sum_{j=1}^{k}\theta_{5,j,i}D(\ln GDP_{i,t-j}) + \varepsilon_{5,i,t} \quad (6)$$

Where D refers to the first difference of variables, i refers to the country (i = 1,2,…,N) and t is the time trend (t = 1,2,…,T) j is the optimum lag considering SIC criteria. Also, ECT is the lagged error correction term derived from the long run co-integrating relationship equal to $lnGDP_{it} = \alpha_0+\alpha_1 lnAGR_{it}+\alpha_2 lnIND_{it}+\alpha_3 lnSER_{it}+\alpha_4 lnOILP_{it}$, $\varnothing_{1,i}$, $\varnothing_{2,i}$, $\varnothing_{3,i}$, $\varnothing_{4,i}$ and $\varnothing_{5,i}$ are adjustment coefficients that measure how $lnGDP_{i,t}$, $lnAGR_{i,t}$, $lnIND_{i,t}$, $lnSER_{i,t}$ and $lnOILP_{i,t}$ react to deviation from long-run equilibrium, and $\varepsilon_{1,i,t}$, $\varepsilon_{2,i,t}$, $\varepsilon_{3,i,t}$, $\varepsilon_{4,i,t}$ and $\varepsilon_{5,i,t}$ are disturbance terms assumed to be white-noise and uncorrelated.

As a fourth step, I determine the sources of causation by testing for significance of the coefficients on the lagged variables through equations (2-6). First of all, I evaluate Granger short run causality using a Wald test for testing null hypothesis (H_0: $\gamma_{1,j,i} = 0$, $\delta_{1,j,i} = 0$, $\varphi_{1,j,i} = 0$, $\omega_{1,j,i} = 0$) in equation (2), (H_0: $\delta_{2,j,i} = 0$, $\varphi_{2,j,i} = 0$, $\omega_{2,j,i} = 0$, $\theta_{2,j,i} = 0$) in equation (3), (H_0: $\gamma_{3,j,i} = 0$, $\varphi_{3,j,i} = 0$, $\omega_{3,j,i} = 0$, $\theta_{3,j,i}=0$) in equation (4), (H_0: $\gamma_{4,j,i} = 0$, $\delta_{4,j,i} = 0$, $\omega_{4,j,i} = 0$, $\theta_{4,j,i} = 0$) in equation (5), (H_0: $\gamma_{5,j,i} = 0$, $\delta_{5,j,i} = 0$, $\varphi_{5,j,i} = 0$, $\theta_{5,j,i} = 0$) in equation (6). If the null hypothesis is rejected, then the existence of Granger short-run causality is confirmed. Second, I identify Granger long run causality using the ECT coefficients in above equations. The coefficients on the ECTs represent how fast deviations from the long run equilibrium are eliminated following changes in each variable. If the ECTs coefficients are zero ($\varnothing_{1,i} = 0$ or $\varnothing_{2,i} = 0$, or $\varnothing_{3,i} = 0$ or $\varnothing_{4,i} = 0$ or $\varnothing_{5,i} = 0$) through equations (2-6), then there is no Granger long run causality from explanatory variable to dependent variable. Final, I can jointly check the existence of both Granger short run and long run causalities using F-statistic by testing null hypothesis includes: (H_0: $\varnothing_{1,i} = 0$, $\gamma_{1,j,i} = 0$, $\delta_{1,j,i} = 0$, $\varphi_{1,j,i} = 0$, $\omega_{1,j,i} = 0$) in equation (2), (H_0: $\varnothing_{2,i} = 0$, $\delta_{2,j,i} = 0$, $\varphi_{2,j,i} = 0$, $\omega_{2,j,i} = 0$, $\theta_{2,j,i} = 0$) in equation (3), (H_0: $\varnothing_{3,i} = 0$, $\gamma_{3,j,i} = 0$, $\varphi_{3,j,i} = 0$, $\omega_{3,j,i} = 0$, $\theta_{3,j,i} = 0$) in equation (4), (H_0: $\varnothing_{4,i} = 0$, $\gamma_{4,j,i} = 0$, $\delta_{4,j,i} = 0$, $\omega_{4,j,i} = 0$, $\theta_{4,j,i} = 0$) in equation (5), (H_0: $\varnothing_{5,i} = 0$, $\gamma_{5,j,i} = 0$, $\delta_{5,j,i} = 0$, $\varphi_{5,j,i} = 0$, $\theta_{5,j,i} = 0$) in equation (6). This is referred to as a strong Granger causality test.

5. EMPIRICAL RESULTS

The estimation results are presented in several following steps.

5.1. Panel Unit Roots Tests

In this section, I analyze the properties of panel-based unit root tests for the variables of the model. A panel data is denoted I (0) when it is stationary at level, and I (1) when it should be difference first time to achieve stationarity. Table 2 shows the panel unit root test results for the variables by Levin et al. test (2002), Breitung's unbiased tests (2000), Im et al. test (2003), ADF-Fisher Chi-square panel unit root test (Madala and Wu, 1999), Fisher-PP tests defined

Table 2: Panel unit root tests

Variables	Methods											
	H_0: Unit root										H_0: Stationarity	
	LLC t*		Breitung (t-stat)		Im, Pesaran and Shin (W-stat)		ADF-Fisher (Chi-square)		PP-Fisher (Chi-square)		Hadri (Z-Stat)	
	Level	Stationary	Level	Stationary	Level	Stationary	Level	Stationary	Level	Stationary	Level	Stationary
lnAGR	−11.029 (0.0000)	I (0)	−0.5588 (0.2881)	I (1) *	−11.507 (0.0000)	I (0)	700.503 (0.0000)	I (0)	788.270 (0.0000)	I (0)	13.8175 (0.0000)	I (0)
lnGDP	−62.303 (0.0000)	I (0)	1.4464 (0.9260)	I (1) *	−47.222 (0.0000)	I (0)	1814.44 (0.0000)	I (0)	2606.99 (0.0000)	I (0)	17.4827 (0.0000)	I (0)
lnGRO	−19.594 (0.0000)	I (0)	−8.0198 (0.0000)	I (0)	−17.445 (0.0000)	I (0)	526.762 (0.0000)	I (0)	668.968 (0.0000)	I (0)	8.7762 (0.0000)	I (0)
lnIND	−11.569 (0.0000)	I (0)	−1.6025 (0.0545)	I (0)	−11.272 (0.0000)	I (0)	841.337 (0.0000)	I (0)	548.365 (0.0000)	I (0)	12.6214 (0.0000)	I (0)
lnOILP	−10.989 (0.0000)	I (0)	−3.0381 (0.0012)	I (0)	−5.9762 (0.0000)	I (0)	195.619 (0.0000)	I (0)	199.602 (0.0000)	I (0)	15.8187 (0.0000)	I (0)
lnSER	−6.0199 (0.000)	I (0)	−2.8999 (0.0019)	I (0)	−11.349 (0.0000)	I (0)	417.738 (0.0000)	I (0)	351.357 (0.0000)	I (0)	11.5241 (0.0000)	I (0)

Probability values are in parenthesis. *Stationary at first difference

by Maddala and Wu (1999) and Choi (2001), and Hadri test (1999; 2000). As shown in Table 2, time series data for all variables are denoted I (0) based on the majority of given unit root tests. Then I can use all variables in level as they are stationary.

5.2. Panel Co-integration Test

As shown in Table 3, the Pedroni and Kao residual co-integration test for variables of the model reject the null hypothesis of no co-integration panel data, because the associated P < 5% level of significant. Then, there is a long-run relationship between the variables of the model. The only except are for the cases of panel rho-statistic and group rho-statistic test, but as the majority of the Pedroni residual co-integration test reject the null hypothesis, then I conclude that there is a long run equilibrium relationship among the variables in the model. On the other hand, the results of Kao residual panel co-integration test showed that there is a long run relationship between variables in the model at the 10% significance level.

Table 3: The panel co-integration test

Kao residual co-integration test	
H_0: No Co-integration	
H_A: Common AR coefficient (within-dimension)	
Panel v-statistic	8.424781 (0.0000)
Panel rho-statistic	−0.169021 (0.4329)**
Panel PP-statistic	−16.57111 (0.0000)
Panel ADF-statistic	−4.819629 (0.0000)
H_0: No co-integration	
H_A: Individual AR coefficient (between-dimension)	
Group rho-statistic	6.720959 (1.0000)**
Group PP-statistic	−2.367766 (0.0089)
Group ADF-statistic	−4.580444 (0.0000)
Kao residual co-integration test	
H_0: No co-integration	
ADF	−1.340687 (0.0900) *

Probability values are in parenthesis. *This test rejects the null hypothesis of no co-integration at the 10% significance level, **This test cannot reject the null hypothesis of no co-integration at the 10% significance level

5.3. The Results of Multiple Regressions

The results of multiple regressions for all independent variables towards dependent variable, namely GDP, is presented in Table 4. As shown in Table 4, the log agriculture value added (% GDP) has negative effect on GDP in developing countries, but oil price and other economic sectors have positive effect on GDP. If the log industry and service value -added (% GDP) increase by 1%, then the log GDP increase by 31% and 16%, respectively. But if the log agriculture value added (% GDP) increases by 1%, then the log of GDP decrease by 34.39%. Then for future works, I can explore why the share of agriculture has negative effect on GDP in developing countries. Furthermore, if the log oil price increase by 1%, then the log of GDP increase by 28.45%.

Table 4: Model summary of the multiple regressions

Model	Coefficient	Standard error	t-statistics	P value
Intercept term	21.97572	0.3512	62.579	0.0000
lnAGR	−0.343915	0.0259	−13.2661	0.0000
lnIND	0.310342	0.0360	8.6132	0.0000
lnSER	0.169330	0.0527	3.2108	0.0014
lnOILP	0.284508	0.0061	46.3742	0.0000

Dependent variable: lnGDP

5.4. The Results of Panel Granger-causality Test Based on VECM Approach

The results of the Wald test (F-test) for both short- and long-run causality are reported in Table 5. The findings indicate that there is a short run bi-directional Granger causality between lnGDP and lnAGR, a short run bi-directional Granger causality between lnGDP and lnSER, and a short run bi-directional Granger causality between lnGDP and lnOILP, but there is only a short run unidirectional Granger-causality running from lnIND to lnGDP, and the reverse is not true. Also, there is only a short run unidirectional Granger-causality running from lnAGR to lnIND, a short run unidirectional Granger-causality running from lnOILP to lnIND, and a short run unidirectional Granger-causality running from lnOILP to lnSER and the reverse is not true.

Table 5: The results of panel granger – causality tests based on VECM approach

Equation	Short run					Long run	Joint (short run/long run)				
	D (lnGDP) (1)	D (lnAGR) (2)	D (lnIND) (3)	D (lnSER) (4)	D (lnOILP) (5)	ECT (−1) (6)	D (lnGDP), ECT (−1) (7)	D (lnAGR), ECT (−1) (8)	D (lnIND), ECT (−1) (9)	D (lnSER), ECT (−1) (10)	D (lnOILP), ECT (−1) (11)
D (lnGDP)	12.50703	1.725268	2.061743	3.796968	3.293289	0.000687	11.40503	1.573305	1.874922	3.472833	3.709113
	(0.0000)	(0.0710)	(0.0252)	(0.0001)	(0.0003)	(0.9791)	(0.0000)	(0.1015)	(0.0392)	(0.0001)	(0.0000)
D (lnAGR)	4.197319	2.626101	0.762424	1.182618	1.152498	0.007925	3.815974	2.388797	0.693713	1.080885	1.419542
	(0.0000)	(0.0038)	(0.6653)	(0.2988)	(0.3199)	(0.9291)	(0.0000)	(0.0065)	(0.7454)	(0.3736)	(0.1586)
D (lnIND)	1.045376	2.033783	1.666102	0.742098	3.772568	3.034625	1.391467	2.089825	1.805667	0.868696	4.118864
	(0.4029)	(0.0275)	(0.0843)	(0.6849)	(0.0001)	(0.0819)	(0.1714)	(0.0189)	(0.0491)	(0.5710)	(0.0000)
D (lnSER)	2.259200	0.790046	0.519874	0.727236	3.711347	2.671885	2.437896	0.933510	0.725679	0.825967	3.385277
	(0.0132)	(0.6385)	(0.8769)	(0.6992)	(0.0001)	(0.1025)	(0.0054)	(0.5071)	(0.7144)	(0.6140)	(0.0001)
D (lnOILP)	6.300152	1.332713	1.206371	1.215483	186.1254	98.21176	16.90389	10.54063	10.10493	10.65205	192.1452
	(0.0000)	(0.2082)	(0.2828)	(0.2768)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Probability values are in parenthesis

In addition, the F-statistic values for long run causality (the ECT coefficient) in column (6) for equation lnGDP, lnAGR, and lnSER are not significant, but the ECT coefficient are significant for equation lnIND, and lnOILP. Furthermore, the joint test in Table 5 indicates whenever a shock occurs in the system, the variables including lnGDP, lnAGR, lnIND, and lnOILP would make short run adjustments to restore long run equilibrium. Additionally, there is a jointly bi-directional causality between lnGDP and lnSER, a jointly bi-directional causality between lnGDP and lnOILP, a jointly bi-directional causality between lnIND and lnOILP, and a jointly bi-directional causality between lnOILP and lnSER. Also, there is a jointly unidirectional causality from lnIND to lnGDP, a jointly unidirectional causality from lnAGR to lnOILP.

6. CONCLUSION

In this article, I explored the association between GDP and economic sector in developing countries. Using a panel data of 62 developing countries, I studied the non-stationarity and co-integration properties of the variables. The findings of panel data unit root tests for time series data showed that they are stationary in level. In other word, all variables are integrated of order zero. The results of the panel co-integration test induced by Pedroni and Kao indicated that there is a co-integrated relationship between these variables in the long run. Therefore, I run panel VECM for analyzing the Granger causality between variables.

The results of multiple regressions for all independent variables towards dependent variable, namely GDP, indicates that the agriculture value added (% GDP) has negative effect on GDP in developing countries, but oil price and other economic sectors have positive effect on GDP. Then for future works, I can explore why the share of agriculture has negative effect on GDP in developing countries.

The findings of Granger causality indicate that there is a short run bi-directional Granger causality between lnGDP and lnAGR, a short run bi-directional Granger causality between lnGDP and lnSER, and a short run bi-directional Granger causality between lnGDP and lnOILP, but there is only a short run unidirectional Granger-causality running from lnIND to lnGDP, and the reverse is not true. In addition, the F-statistic values for long run causality (the ECT coefficient) for equation lnGDP, lnAGR, lnSER are not significant, but the ECT coefficients are significant for equation lnIND, and lnOILP. Furthermore, there is a jointly bi-directional causality between lnGDP and SER, a jointly bi-directional causality between lnGDP and lnOILP, a jointly bi-directional causality between lnIND and lnOILP, and a jointly bi-directional causality between lnOILP and lnSER. It means that oil price can affect both industry and service sector and therefore GDP in developing countries.

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