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# A Comparative Analysis of Causality Between Institutional Structure and Economic Performance for Developed and Developing Countries

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ABSTRACT

The aim of the present study is to investigate the relation between countries' structural transformation and institutional factors. The causality relationship between 'economic complexity level' representing structural transformation and six institutional indicators revealed by the World Bank (government effectiveness, political stability, control of corruption, rule of law, regulation quality, voive and accountability) was investigated via Dumitrescu-Hurlin causality test for both E-7 and G-7 countries for the period of 1996-2017. The research question of the study is that whether there is a difference among developed and developing countries in terms of the interaction and causal relationship among institutional indicators and economic performance. On this purpose, E-7 country group is selected to represent developing countries whereas G-7 community is selected to represent developed one. As a result of the analysis, it was determined that institutional factors in E-7 countries comprised of developing countries displayed greater causality relationships with economic complexity level representing structural transformation in comparison with G-7 countries. Besides, causal relationships among institutional indicators themselves are also greater in E-7 countries than G-7 countries. This finding suggests that economic performance of developing countries are more sensitive to institutional structure in comparison to developed ones. That's why developing countries are required to pay more attention to institutional factors with greater rigorously.

## INTRODUCTION

The reasons for varying development levels among countries have been point of interest for a long time. Along the recent years, it has been frequently remarked that the economic perspective is not sufficient alone to address this question; and the subject is required to be addressed from multi-disciplinary perspective. D. Acemoğlu and J. Robinson(2018) 's well-known books, 'Why Nations Fail: the Origins of Power, Prosperity and Poverty', indicates that institutions are largely responsible for emergence of this developmental difference. While authors emphasize significance of institutional structure, they also suggest transition from exploitative institutions to inclusive institutions.

Current theories available in the literature do not include institutions into their models as an endogeneous variable. D. Rodrik (1999) exampled this status with Arrow-Debreu model. The model is built upon an assumption in which property rights are well-described; and contractual practices and regulations perfectly function. Accordingly, the models founded on the assumption that there is no problem with institutional structure in order to explain economic structure. Nevertheless, market economy is related with numbers of institutions from outside the market. Similar explanation is suggested by D. Acemoğlu et al. (2005); Standard neo-classical growth model explains the differences in per capita GDP of countries based on different factor accumulation. In these models, factor accumulation differences among countries are associated with differences in various external parameters such as saving rates and preferences. Property rights are well-defined in these models and exchange of goods and services is well-functioned. Therefore, institutional differences are disregarded in consideration of differences in income and growth.

Due to inter-disciplinary characteristic of economics, relationship between institutional structure and economic performance has recently been a subject gained frequent attention. In this study, the relationship between indicators of institutional structure and economic performance was investigated by causality analysis for E-7 and G-7 countries in a comparative fashion. To that end, the relationship between institutional structure and economic transformation was explained in the second section, whereas the literature summary was explained in the third section. The hypothesis and the dataset of the study were introduced in the fourth section, while econometrical methodology was explained in the fifth section. Obtained findings and conclusions were summarized in the sixth and seventh sections, respectively.

# 1. THE RELATIONSHIP BETWEEN INSTITUTIONAL STRUCTURE AND ECONOMIC TRANSFORMATION

There are various perspectives explaining differences in developmental and income levels of countries. Rodrik and Subramanian (2003) classified these various perspectives in three different approaches. The first is oriented on “geographical” factor while explaining development differences among countries, which led by J. Diamond. Pursuant to this approach, geographical characteristics are effective on climate and natural resources of countries as well as on factors such as dispersion of technology, transportation costs and etc. Thus, they carry deterministic characteristics on countries’ income levels. The second approach is referred as ‘integration’ denoting role of international trade. This approach fundamentally asserts that inclusion of a country into global economy has positive impact on its income and development levels. The third and the last approach are founded on ‘institutions’. Studies of D. North and D. Acemoğlu have been concentrated on this approach (Rodrik and Subramanian, 2003).

The question of why some countries face greater income disadvantage with respect to others was addressed by D. Acemoğlu et al. (2005) as that more explanatory answers have been given since the conventional neo-classical growth model; but as stated by North and Thomas, factors such as economies of scale, innovation, education, capital accumulation are not cause of growth; rather, they are growth itself. Authors emphasized that the main explanation of comparative differences of North and Thomas on growth differences is the differences in institutions.

North's (1991) definition of “institution”, which also inspired Acemoğlu and Robinson, is as 'constraints that structure political, economical and social interactions and that are created by human beings’. These institutions could be in informal qualities such as endorsement, taboo, customs, and ethics as well as formal qualities like laws, property rights, and constitutions. North emphasized that fundamental problem of economic history and economic development is to explain evolution of political and economical institutions that could create an economic environment that could stimulate increase in productivity (North, 1991). From North's description, Acemoğlu and Robinson (2008) imply three substantial characteristics of institutions: human-made structure, their nature introducing various limitations on human behavior, and their incentive-based influence. Authors, from the point that if institutions are main determinants of incentives, then, these institutions are required to have primer impact on various economic consequences such as economic development, growth, poverty and inequalities, studied primary and secondary effects of these institutions on economic consequences (Acemoğlu and Robinson, 2008). Finally, authors reported the relationship between institutions and economic performance as in Figure 1.

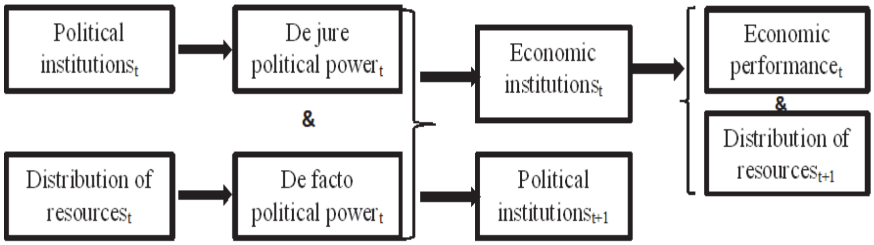


Figure 1: Interaction between Institutions – Economic Performance

Source: Acemoğlu, Johnson and Robinson, 2005, p. 392.

In brief consideration of relationship reported by Acemoğlu et al. as given in Figure 1, economic institutions do not only affect economic growth potential, but also future distribution of resources within a society. That is, economic institutions at time t are determinant on economic performance at time t as well as distribution of resources at time (t+1). On the other hand, economic institutions are endogeneous, which are determined as result of collective choices of society. However, it is not for sure that all units or groups in a society to choose the same economic institution. Yet, different economic institutions would eventually cause different resource distribution and conflict of interest would arise among different groups in terms of their economic institution preferences. Among the groups with different economic institution preferences, the one that would dominate the others would be determined by their political power. That is, the group with greater political power would be able to establish its own economic institutions. Distribution of political power across that society is also endogeneous. Political power in a society has two constituents: legal (de jure) political power and de facto political power. Legal political power is based on political institutions in a society. On the other hand, political power could emerge outside of political institutions as well. Although a group is not equipped with political institutions, it could have political power. This impact referred as de facto political power is determined by resource distribution in society. These relationships accordingly reveal two main state variables within the concerned dynamic structure: "political institutions" and "resource distribution". These variables are regarded as state variables in aforesaid dynamic system because they change slowly and more importantly they influence economic institutions and economic performance directly. In this structure, as it could be seen with Figure 1, institutional hierarchy occurs (Acemoğlu et al., 2005). Thus, political institutions influence economic institutions determining economic consequences.

Afterwards of these explanations concerning determinant role of economic and political institutions on economic performance, it is necessary to put some emphasis on how to describe institutions. D. Rodrik and a. Subramanian (2003) describe institutions in groups of market creating institutions (property right, contractual right), market regulating institutions (regulative institutions handling with externalities, economies of scale and imperfect information), market stabilizing institutions (decreasing macroeconomic volatility, preventing crises, currency regime, budget and financial regulations and etc.) and market legitimizing institutions (retirement system, unemployment insurance and other social funds for redistribution).

On the other hand, D. Kaufmann et al. (2010) describe six different indicators with extensive perspective covering political and economic institutions. These six indicators are taken into consideration under three essential subjects. Accordingly, “accountability” and “political stability and lack of violence” indicators of governments are important in elections, monitoring, and replacement processes. Accountability refers eligibility of citizens of a country to elect their administrators, freedom of speech, and free media conditions. Political stability and lack of violence and collapse of governments through violence against the constitution are indicators measuring political violence and terrorism status. There are also ‘government efficiency’ and ‘regulatory quality’ indicators to assess governments’ capacity for enacting and administrating efficient policies. Government efficiency represents quality of public services, independence of these services from political pressure, quality of policy making and administration, and trust towards government policies. Regulatory quality refers status of government to apply policies and regulations to support development of private sector. ‘Rule of law’ and ‘control of corruption’ indicators represent institutional reputation effective on economic and social interactions between citizens and government. Rule of law refers economic agents’ trust towards regulations such as qualities of contractual right, property right, security and jurisdiction. Control of corruption is an indicator measuring the perception toward public practices to prevent unjust distribution of public interests among certain groups.

## 2. LITERATURE REVIEW

There are numbers of studies available in the literature, which investigate the impact of institutional structure on economic performance. While part of these studies is in the form of literature review, some are in empirical form. Our study evaluates the latter ones. In one of them, S. Knack and P. Keefer (1995) measured the impact of property rights on economic growth by employing the indicators such as contractual sustainability and expropriation risk representing country risk assessment in terms of investors. Obtained results showed that property rights have greater impact on freedom of investment and growth than breach frequency, and military coup and political assassination. In another study, B. Eichengreen and T. Iversen (1999) studied institutional determinants of economic performance within the framework of European labor market. The authors report that European economic growth was based on the Fordist technologies afterwards of the World War II; and collaborative wage negotiations were structured in the continent in this line, conflicts were eliminated, and thus significant investments were attracted to the region. On the other hand, while Fordism paved the way for highly qualified and diversified production which required skilled labor, centralized wage negotiations and pressures on wages were preventive rather than facilitative for growth. Therefore, authors concluded that countries with central labor market institutions are required to gain progress in terms of human-centered structure of institutions.

V. Corbo et al. (2005) studied the argument that Chile, one of the Latin American countries with poor economic and social indicators along 1990s, was exhibiting extraordinary appearance which was result of reforms accomplished in institutional structures. As a result of the analysis they conducted for the period of 1960-2000, the authors concluded that Chile’s economic performance was subject to foundation of established institutions and practices of better policies. Estimations results revealed that if other Latin American countries should be developed their individual institutional structure likewise Chile, their GDPs would rise about 1.6%. A. Kilishi et al. (2013) analyzed institutional indicators to determine the most effective one on economic growth of Sub-Saharan Africa including 36 countries for the period of 1996-2010. Obtained results revealed that accountability, government efficiency, regulatory quality, political stability and rule of law were important; but of these variables, regulatory quality and rule of law indicators were determined as the most effective indicators on economic performance in Sub-Saharan Africa. Furthermore, when openness is included into the model, all institutional indicators have turned to be statistically significant. Authors explained this finding as Sub-Saharan countries were required to advance their institutional structures to ensure their integration with the global economy.

B. Tarek and Z. Ahmed (2013) studied 30 developing countries for the period of 1998-2011 to reveal interaction between political institutions and economic growth through empirical methods. Their results suggested that enhancement in quality of political institutions in developing countries was related with decreasing corruption level and sustainable economic growth. Accordingly, institutional failures, fundamental characteristics of developing countries, were deteriorating impact on these countries' long term growths. S. Artan and P. Hayaloğlu (2014) analyzed the relationship between institutional structure and economic growth in Turkey for the period of 1972-2009. As a result of the cointegration analysis conducted in the study, authors reported that no relationship was existed between institutional structure and economic growth in the short term, whereas there was positive impact of political freedom, one of the institutional structure indicators, on economic growth on the long term. A. Kacho and N. Dahmardeh (2017) analyzed the effect of financial development and institutional quality on economic growth for OECD countries for the period of 2002-2014. Authors concluded that there was positive and statistically significant effect of financial development and institutional quality on economic growth for the concerned group of countries. Kane et al. (2019) studied Central African countries for the impact of political and economic institutions on their economic performance for the period of 1996-2013. Authors concluded that institutions were hindering economic performance of Central Africa both individually and as group.

## 3. HYPOTHESIS AND THE DATA

As it could be seen with the literature review, economic development is not only influenced by economic factors, but also political and economic institutions. In this regard, the present study aims to investigate the interaction between the transformation in production and export structures of economy and various institutional indicators for 7 emerging countries (E-7) comprised of Brazil, Mexico, China, India, Indonesia, Russia and Turkey and the Group of Seven countries (G-7) which represent the 7 largest economies of the world, namely Germany, the U.S., the United Kingdom, France, Italy, Japan, and Canada. The fundamental orientation of the study is to explore the causality relationship between structural transformation of economy and institutional indicators for both E-7 and G-7 countries; and to make a comparative evaluation for these country groups. Thus, it would be determined whether there is significant difference in terms of explanation of relationship with institutional factors among country groups.

Our study utilized 'Economic Complexity Index (ECI)' which has recently gained popularity to reflect transformation in export and production structures to represent economic performance. In the foundation of the economic complexity concept introduced by C. Hidalgo and R. Hausmann (2009), the consideration of knowledge level of a society is composed of diversity of personal knowledge across individuals and their capability of utilization from these personal knowledge in exchange and coordination rather than aggregate knowledge levels of individual within a society. This takes place in a complex interaction network. In this structure, the aggregate amount is greater than the total of individual units. This fundamental characteristic of modern society distinguishing from conventional one refers that individuals possess deeper knowledge in more specific area of expertise and their capability to utilize from these knowledge collectively instead of possessing greater amount of knowledge. It is reported that economic complexity levels of societies who could accomplish this is advanced (Hausmann et al., 2011). C. Hidalgo (2009) states that countries' current production structures are effective on their future production structures; accordingly economies with more complex structure would be more effective on taking advantage of potentials in comparison with economies with less complex structure. In this scope, R. Hausmann et al. (2011) report existence of strong relationship between economic complexity level and countries' welfare levels. At the income level, growth tendency of economies with greater economic complexity level show greater advantageous position with respect to the ones with lower economic complexity level. Accordingly, economic complexity is suggested as driving force of welfare rather than sign of welfare. Therefore, economic complexity index was preferred as economic performance indicator in the present study. R. Hausmann et al. (2011), who developed economic complexity index, employed international trade data in estimation of this index. From this point, authors concluded that economic complexity level of a country is related with complexity level of that country's export goods. Therefore, countries could develop their economic complexity levels through strengthening their competitiveness in industries covering complex/ sophisticated goods.

As institutional indicator, the ones developed by D. Kaufmann and A. Kraay and published by the World Bank were employed. These indicators range between -2.5 and 2.5; proximity to -2.5 denotes institutional deterioration while proximity to 2.5 denotes institutional advancement (World Bank, 29.05.2019). Table 1 summarizes detailed information about the data employed in the analysis.

Table 1. Variables and the Data Source

| *Variable* | *Data Source* |
|---|---|
| ECI (Economic Complexity Index) | MIT - OEC |
| VA (Voice and Accountability) | The World Bank |
| PS (Political Stability and Absence of Violence) | The World Bank |
| GE (Government Effectiveness) | The World Bank |
| RQ (Regulatory Quality) | The World Bank |
| RL (Rule of Law) | The World Bank |
| CC (Control of Corruption) | The World Bank |

The analysis period was restricted with 1996 – 2017 subject to data availability. Within the scope of the aforesaid period and country groups, the causality relationship between variables was investigated by means of the Dumitrescu – Hurlin causality test. First, cross-sectional dependency test was conducted; then, variables with no cross sectional dependency were applied the IPS unit root test, one of the first generation unit Root Tests, developed by Im, Pesaran and Shin, whereas the ones with cross sectional dependency were applied the MADF test. Causality test was applied to non-stationary variables after their stationarity was ensured through taking the first difference. Before presentation of the obtained findings, it would be best to explain the econometrical methodology pursued in the study.

## 4. ECONOMETRICAL METHODOLOGY

Unit root tests used in the panel data analysis differ according to whether there is cross sectional dependency in the series. Therefore, it was first necessary to test cross sectional dependency in the data set. In panel data analysis, various tests were developed in order to investigate cross sectional dependency in series. The first one of these was the Lagrange Multiplier (LM) test developed by Breusch and Pagan, which is employed when time dimension of panel data is greater than cross-sectional dimension (T>N); and the relevant test statistic ($CDLM_1$) was given in Equation (1) (Pesaran, 2004):

$$CDLM_1 = T \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij}^2 \tag{1}$$

Where, $\hat{\rho}_{ij}^2$ denotes estimation of pairwise correlation of residuals. Breusch and Pagan, under the basic hypothesis assuming no cross sectional dependency, showed that test statistic of $CDLM_1$ was distributed asymptotically $\chi^2$. However, applicability of this test decreases when $N \to \infty$. Pesaran introduced a new test that could be applied for high values of N and T. Test statistic of this test ($CDLM_2$) is scaled version of $CDLM_1$ (Pesaran, 2004):

$$CDLM_2 = \sqrt{\frac{1}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} (T\hat{\rho}_{ij}^2 - 1) \tag{2}$$

Pesaran et al., then, developed a test, another version of LM test. This test's LM test statistic ($LM_{adj}$) with corrected deviation was shown as Equation (3) (Pan et al., 2015):

$$LM_{adj} = \sqrt{\left(\frac{2T}{N(N-1)}\right)} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij} \frac{(T-k)\hat{\rho}_{ij}^2 - \mu_{Tij}}{\sqrt{v_{Tij}^2}} \tag{3}$$

Where, $\mu_{Tij}$ and $v_{Tij}^2$ denote mean and variance of $(T-k)\hat{\rho}_{ij}^2$ term, respectively.

In econometric analyses, when non-stationary series are employed, spurious regression status could be encountered. Accordingly, it is necessary to ensure stationarity of series before the analysis. In panel data analysis, unit root tests employed to determine stationarity are classified as the first and second generation tests. While the first generation tests are used in case of the non-cross sectional dependency of data set (that is, no correlation existed between units); the second generation tests are used in case of cross sectional dependency (existence of correlation between units) (Yerdelen Tatoğlu, 2013). In the present study, the data sets with no cross sectional dependency was applied the IPS unit root test, one of the first generation- second group test developed by Im, Pesaran and Shin, whereas MADF test which is one of the second generation tests was applied to the data set with cross sectional dependency.

In the first generation-the second group tests, instead of a common auto-correlation coefficient, each unit is allowed to have their individual auto-correlation coefficient. In the IPS test, unit root test is applied to all units individually. IPS test statistic is the average of ADF test statistics. $i = 1,2,\dots,N$ denotes number of cross-sections in panel whereas $t = 1,2,\dots,T$ denotes number of observation. In the IPS unit root test, the model below is employed (Yerdelen Tatoğlu, 2013):

$$\Delta Y_{it} = \rho_i Y_{it-1} + \sum_{L=1}^{Pi} \Phi_{iL} Y_{it-L} + \mu'_i \gamma + u_{it} \tag{4}$$

The null and alternative hypotheses for the IPS test were given below (Yerdelen Tatoğlu, 2013):

$H_0: \rho_i = 1$
$H_1: \rho_i < 1$

Accordingly, while the null hypothesis refers that no unit is stationary, alternative hypothesis refers that at least one unit is stationary. $t_{\rho i}$ denotes individual test statistics of units. IPS test statistic was given as in Equation (5):

$$\bar{t} = \frac{1}{N} \sum_{i=1}^{N} t_{\rho i} \tag{5}$$

MADF test is the second generation unit root test developed by Taylor and Sarno. This test is based on stochastic vector with dimension of Nx1 (Taylor and Sarno, 1998):

$$q_{it} = \mu_i + \sum_{j=1}^{k} p_{ij} q_{it-j} + u_{it} \tag{6}$$

In the test in which it was assumed that the error term of $u_t = (u_{1t} \dots \dots u_{Nt})$ was independent and normally distributed, Taylor and Sarno estimated Equation (6) for the cases root of the each auto-regressive process was close to but different than 1 by taking simultaneous correlation among error terms on the basis that single-variable ADF test was weak. The null hypothesis is given for N equations as in Equation (7) (Taylor and Sarno, 1998):

$$H_0: \sum_{j=1}^{k} \rho_{ij} - 1 = 0, \quad \forall i = 1, \dots, N \tag{7}$$

Wald test statistic obtained through this test is also called as MADF statistic. The SUR (Seemingly Unrelated Regression) method was used in the equation estimation given in Equation (6) (Taylor and Sarno, 1998).

Dumitrescu – Hurlin test is one of the varieties of the Granger causality test developed for heterogeneous panel data models. E. Dumitrescu and C. Hurlin (2012) is based on a linear model given by Equation (8):

$$y_{i,t} = \alpha_i + \sum_{k=1}^{K} \gamma_i^{(k)} y_{i,t-k} + \sum_{k=1}^{K} \beta_i^{(k)} x_{i,t-k} + \varepsilon_{i,t} \tag{8}$$

In this test, it is assumed that x and y are two stationary variables as well as $\alpha_i$ representing unit effect is statutory in temporal dimension. Additionally, it is assumed that K lag length was specific to cross sectional units and panel was well balanced. Although $\gamma_i^{(k)}$ autoregressive parameter and $\beta_i^{(k)}$ slope of regression coefficients remained stable over time, they were allowed to vary from one group to another. Accordingly, the null hypothesis which represent Homogeneous Non Causality (HNC) was given by Equation 9 below (Dumitrescu and Hurlin, 2012):

$$H_0: \beta_i = 0 \qquad \forall i = 1, \dots, N \tag{9}$$

In the Dumitrescu – Hurlin causality test, in comparison with alternative hypothesis in the standard Granger causality test, there is heterogeneous alternative hypothesis. In other words, Dumitrescu-Hurlin test is conducted on the null hypothesis in which there is no causality against the alternative hypothesis in which there is causality from X to Y for some cross sections. Aforesaid alternative hypothesis could be indicated as given in Equation (10) (Dumitrescu and Hurlin, 2012):

$$H_1: \beta_i = 0 \qquad \forall i = 1, \dots, N_1 \tag{10}$$
$$\beta_i \neq 0 \qquad \forall i = N_1 + 1, N_1 + 2, \dots, N$$

Where, $N_1$ denotes number of units with no causality relationship. When $N_1$=N, there is no causality relationship in the panel; when $N_1$=0, X will be reason for Y for all units; and homogenous causality result will be obtained. When $N_1$>0, heterogeneous causality relationship prevails. That is, causality relationship differs from one unit to another in the sampling.

Wald statistic is estimated for $W_{i,T}$ which corresponds to $H_0: \beta_i = 0$ hypothesis test for each unit. While this test statistic is $T \rightarrow \infty$ for each unit under null hypothesis, it converges to $\chi^2$ distribution at K degree of freedom. Then, arithmetic average of this individual Wald statistics are calculated to obtain Wald statistic, $W_{N,T}^{HNC} = (\frac{1}{N}) \sum_{i=1}^{N} W_{i,T}$, for the panel (Saraçoğlu and Songur, 2017). In Dumitrescu – Hurlin causality test, two test statistics are estimated (Zeren and Arı, 2013): for $T, N \rightarrow \infty$, standardized test statistic of $Z_{N,T}^{HNC}$ and for fixed T sample, standardized test statistic of $\tilde{Z}_N^{HNC}$. These test statistics were exhibited in Equations (11) and (12), respectively (Dumitrescu and Hurlin, 2012):

$$Z_{N,T}^{Hnc} = \sqrt{\frac{N}{2K}}\left(W_{N,T}^{Hnc} - K\right) \; \frac{d}{T,N \to \infty} \to N(0,1) \tag{11}$$

Where, $T, N \to \infty$ is accepted. If this test statistic is greater than the critical value, the null hypothesis indicating no causality is rejected. Other test statistic is $\tilde{Z}_N^{Hnc}$ statistic with semi-asymptotic distribution:

$$\tilde{Z}_N^{Hnc} = \frac{\sqrt{N}\left[W_{N,T}^{Hnc} - E(\widetilde{W}_{i,T})\right]}{\sqrt{Var(\widetilde{W}_{i,T})}} \tag{12}$$

Dumitrescu and Hurlin (2012) suggest application of asymptotically-distributed $Z_{N,T}^{Hnc}$ test statistic when T>N, or application of semi-asymptotically-distributed $\tilde{Z}_N^{Hnc}$ test statistic when T<N (Dumitrescu and Hurlin, 2012).

## 5. FINDINGS

As explained with econometric methodology, the precondition of the Dumitrescu-Hurlin causality test is stationarity of series. In order to investigate stationarity of series, first of all, it is necessary to investigate cross sectional dependency to determine which unit root test needs to be applied. To that end, results of cross sectional dependency test applied to variables were exhibited in Table 2.

**Table 2.** Cross Sectional Dependency Test Results

| *Country Group* | *Variables* | *$CDLM_1$* | *p-value* | *$CDLM_2$* | *p-value* | *$LM_{adj}$* | *p-value* |
|---|---|---|---|---|---|---|---|
| E-7 Countries | ECI | 124.617 | 0.000 | 14.908 | 0.000 | 14.742 | 0.000 |
| | CC | 77.139 | 0.000 | 7.582 | 0.000 | 7.416 | 0.000 |
| | GE | 111.279 | 0.000 | 12.850 | 0.000 | 12.684 | 0.000 |
| | PS | 76.053 | 0.000 | 7.415 | 0.000 | 7.248 | 0.000 |
| | RL | 89.436 | 0.000 | 9.480 | 0.000 | 9.313 | 0.000 |
| | RQ | 40.048 | 0.007 | 1.859 | 0.063 | 1.692 | 0.091 |
| | VA | 117.932 | 0.000 | 13.877 | 0.000 | 13.710 | 0.000 |
| G-7 Countries | ECI | 235.392 | 0.000 | 32.001 | 0.000 | 31.835 | 0.000 |
| | CC | 167.203 | 0.000 | 21.480 | 0.000 | 21.313 | 0.000 |
| | GE | 145.525 | 0.000 | 18.134 | 0.000 | 17.968 | 0.000 |
| | PS | 186.562 | 0.000 | 24.467 | 0.000 | 24.300 | 0.000 |
| | RL | 110.447 | 0.000 | 12.722 | 0.000 | 12.555 | 0.000 |
| | RQ | 110.764 | 0.000 | 12.771 | 0.000 | 12.604 | 0.000 |
| | VA | 72.934 | 0.000 | 6.933 | 0.000 | 6.767 | 0.000 |

According to the results summarized in Table 2, regarding E-7 countries, all three test statistics revealed cross sectional dependency for all variables except RQ. Accordingly, stationarity of RQ variable for E-7 is required to be tested by the first generation unit root test, stationarity of other variables than RQ are required to be tested by the second generation unit root test. On the other hand, regarding G-7 countries, obtained results revealed that there was cross sectional dependency for all variables. That is, there was cross sectional dependency with all variables belong to this country group and stationarity of these variables was to be tested by the second generation unit root tests. On the basis of these findings, IPS test, one of the first generation tests and the MADF test, one of the second generation tests, were conducted. The common characteristic of these tests was that they allow changing of autoregressive parameter from one unit to another. Table 3 exhibits results obtained from the unit root test.

**Table 3.** Unit Root Test Results

*E-7 countries* – *MADF unit root test*

| *Variables* | *MADF statistics* | *Critical value (5%)* | *AIC* | *BIC* |
|---|---|---|---|---|
| ECI | 30.43 (1) | 36.62 | -351.75 | -337.12 |
| GE | 26.24 (1) | 36.62 | -299.87 | -285.25 |
| PS | 51.24 (2) | 38.9 | -152.68 | -131.77 |
| RL | 24.05 (1) | 36.62 | -380.07 | -365.45 |
| VA | 52.36 (1) | 36.62 | -439.01 | -424.38 |
| CC | 10.58 (1) | 36.62 | -300.8 | -286.18 |
| Δ ECI | 166.62 (1) | 38.9 | -324.35 | -310.41 |
| Δ GE | 148.66 (1) | 38.9 | -276.3 | -262.36 |
| Δ RL | 107.46 (1) | 38.9 | -350.1 | -336.16 |
| Δ CC | 119.12 (1) | 38.9 | -279.31 | -265.37 |

*E-7 countries* – IPS unit root test

| Variable | Constant | | Constant - trend | |
|---|---|---|---|---|
| | Test statistics | p-value | Test statistics | p-value |
| RQ | -2.23 | 0.01 | -1.53 | 0.06 |

*G-7 countries* – *MADF unit root test*

| *Variables* | *MADF statistics* | *Critical value (5%)* | *AIC* | *BIC* |
|---|---|---|---|---|
| ECI | 29.16 (1) | 36.62 | -480.59 | -465.96 |
| GE | 24.97 (1) | 36.62 | -343.11 | -328.49 |
| PS | 32.51 (1) | 36.62 | -203.22 | -188.6 |
| RL | 57.34 (1) | 36.62 | -487.42 | -472.8 |
| VA | 49.04 (1) | 36.62 | -525 | -510.38 |
| CC | 23.89 (1) | 36.62 | -376.67 | -362.05 |
| RQ | 16.43 (1) | 36.62 | -324.81 | -310.18 |
| Δ ECI | 152.25 (1) | 38.9 | -438.09 | -424.15 |
| Δ GE | 156.87 (2) | 41.7 | -327.63 | -307.8 |
| Δ PS | 191.51 (1) | 38.9 | -171.81 | -157.87 |
| Δ CC | 127.69 (1) | 38.9 | -349.22 | -335.28 |
| Δ RQ | 170.65 (1) | 38.9 | -297.41 | -283.47 |

Values in bracket denote appropriate lag length selected according to the AIC and BIC criterions.

When obtained MADF unit root test results for E-7 countries are taken into consideration, PS and VA variables were found to be stationary; on the other hand, ECI, GE, RL and CC variables were to become stationary after the first difference. The result of the IPS test conducted on RQ series of E-7 countries yielded stationarity for the constant model at 0.05 significance level, whereas yielded stationarity for the constant and trend model at 0.10 significance level.

In consideration of unit root test results in Table 3 for G-7 countries, it was seen that RL and VA series were stationary, whereas ECI, GE, PS, CC and RQ series became stationary at their first difference.

Before Dumitrescu – Hurlin causality test, differences of obtained results from unit root tests were taken so that their stationarity is ensured. However, before conducting the causality test, it was necessary to determine whether there was cross sectional dependency with residuals in models, which represents causal relationship. Yet, application of Dumitrescu – Hurlin test differs with respect to two different statuses. Table 4 exhibits results of the cross sectional dependency test applied to residuals of the model representing causal relationship for E-7 and G-7 countries.

Table 4: Cross Sectional Dependency Test Results for Models Representing Causal Relationship

| *Direction of the Causality* | *E-7 Countries* | | | | *G-7 Countries* | | | |
|---|---|---|---|---|---|---|---|---|
| | *CDLM 1* | *p value* | *LMadj* | *p value* | *CDLM1* | *p value* | *LMadj* | *p value* |
| VA => ECI | 150.6 | 0.000 | 49.92 | 0.000 | 164.400 | 0.000 | 55.570 | 0.000 |
| PS => ECI | 142.4 | 0.000 | 47.05 | 0.000 | 151.800 | 0.000 | 50.680 | 0.000 |
| GE => ECI | 114.8 | 0.000 | 36.35 | 0.000 | 153.400 | 0.000 | 51.420 | 0.000 |
| RQ => ECI | 141.2 | 0.000 | 46.61 | 0.000 | 133.100 | 0.000 | 43.520 | 0.000 |
| RL => ECI | 143.8 | 0.000 | 47.68 | 0.000 | 158.800 | 0.000 | 53.370 | 0.000 |
| CC => ECI | 151.4 | 0.000 | 50.65 | 0.000 | 138.700 | 0.000 | 45.690 | 0.000 |
| ECI => VA | 122.6 | 0.000 | 38.91 | 0.000 | 73.930 | 0.000 | 19.990 | 0.000 |
| PS => VA | 80.48 | 0.000 | 22.8 | 0.000 | 72.300 | 0.000 | 19.610 | 0.000 |
| GE => VA | 130 | 0.000 | 42.29 | 0.000 | 74.420 | 0.000 | 20.500 | 0.000 |
| RQ => VA | 103 | 0.000 | 31.65 | 0.000 | 75.820 | 0.000 | 21.060 | 0.000 |
| RL => VA | 115.5 | 0.000 | 36.62 | 0.000 | 69.460 | 0.000 | 18.440 | 0.000 |
| CC => VA | 127.7 | 0.000 | 41.37 | 0.000 | 74.680 | 0.000 | 20.600 | 0.000 |
| ECI => PS | 73.62 | 0.000 | 20.02 | 0.000 | 70.500 | 0.000 | 18.650 | 0.000 |
| VA => PS | 32.47 | 0.052 | 3.928 | 0.000 | 64.340 | 0.000 | 16.480 | 0.000 |
| GE => PS | 79.55 | 0.000 | 22.53 | 0.000 | 62.930 | 0.000 | 16.000 | 0.000 |
| RQ => PS | 57.1 | 0.000 | 13.67 | 0.000 | 57.060 | 0.000 | 13.710 | 0.000 |
| RL => PS | 68.48 | 0.000 | 18.19 | 0.000 | 76.980 | 0.000 | 21.400 | 0.000 |
| CC => PS | 58.44 | 0.000 | 14.24 | 0.000 | 77.340 | 0.000 | 21.650 | 0.000 |
| ECI => GE | 17.5 | 0.681 | -1.936 | 0.053 | 34.840 | 0.029 | 4.813 | 0.000 |
| VA => GE | 19.5 | 0.553 | -1.117 | 0.264 | 29.600 | 0.100 | 2.904 | 0.004 |
| PS => GE | 25.83 | 0.213 | 1.415 | 0.157 | 31.990 | 0.059 | 3.842 | 0.000 |
| RQ => GE | 19.84 | 0.531 | -0.885 | 0.376 | 30.800 | 0.077 | 3.424 | 0.001 |
| RL => GE | 18.64 | 0.609 | -1.341 | 0.180 | 31.770 | 0.062 | 3.714 | 0.000 |
| CC => GE | 19.35 | 0.563 | -1.066 | 0.286 | 39.080 | 0.010 | 6.652 | 0.000 |
| ECI => RQ | 45.36 | 0.002 | 8.929 | 0.000 | 23.440 | 0.321 | 0.435 | 0.663 |
| VA => RQ | 42.83 | 0.003 | 7.939 | 0.000 | 30.510 | 0.082 | 3.264 | 0.001 |
| PS => RQ | 50.67 | 0.000 | 11.09 | 0.000 | 23.090 | 0.339 | 0.357 | 0.721 |
| GE => RQ | 43.77 | 0.003 | 8.516 | 0.000 | 33.680 | 0.039 | 4.539 | 0.000 |
| RL => RQ | 43.28 | 0.003 | 8.318 | 0.000 | 27.200 | 0.164 | 1.924 | 0.054 |
| CC => RQ | 41.5 | 0.005 | 7.612 | 0.000 | 28.280 | 0.132 | 2.426 | 0.015 |
| ECI => RL | 21.93 | 0.404 | -0.19 | 0.849 | 104.100 | 0.000 | 31.780 | 0.000 |
| VA => RL | 25.85 | 0.212 | 1.374 | 0.169 | 82.530 | 0.000 | 23.590 | 0.000 |
| PS => RL | 22.28 | 0.383 | 0.0343 | 0.973 | 100.800 | 0.000 | 30.780 | 0.000 |
| GE => RL | 24.33 | 0.277 | 0.8971 | 0.370 | 102.100 | 0.000 | 31.340 | 0.000 |
| RQ => RL | 28.68 | 0.122 | 2.58 | 0.010 | 91.820 | 0.000 | 27.330 | 0.000 |
| CC => RL | 27 | 0.171 | 1.932 | 0.053 | 101.300 | 0.000 | 31.030 | 0.000 |
| ECI => CC | 29.9 | 0.094 | 2.933 | 0.003 | 36.960 | 0.017 | 5.605 | 0.000 |
| VA => CC | 39.71 | 0.008 | 6.797 | 0.000 | 35.760 | 0.023 | 5.302 | 0.000 |
| PS => CC | 31.4 | 0.067 | 3.593 | 0.000 | 30.490 | 0.083 | 3.251 | 0.001 |
| GE => CC | 27.54 | 0.154 | 2.156 | 0.031 | 36.380 | 0.020 | 5.594 | 0.000 |
| RL => CC | 25.79 | 0.215 | 1.464 | 0.143 | 37.180 | 0.016 | 5.824 | 0.000 |
| RQ => CC | 28.5 | 0.127 | 2.505 | 0.012 | 26.400 | 0.192 | 1.697 | 0.090 |

According to the results in Table 4, test results from Dumitrescu-Hurlin causality test applied for both E-7 and G-7 were presented in Table 5. Since time dimension of data employed in the study was greater than its cross sectional dimension, results of $Z_{N,T}^{Hnc}$ test statistic with asymptotic distribution were assessed.

**Table 5:** Dumitrescu – Hurlin Causality Analysis

| *Direction of the Causality* | *E-7 Countries* | | | *G-7 Countries* | | |
|---|---|---|---|---|---|---|
| | $W_{N,T}^{Hnc}$ | $Z_{N,T}^{Hnc}$ | *p değeri* | $W_{N,T}^{Hnc}$ | $Z_{N,T}^{Hnc}$ | *p değeri* |
| VA => ECI | 0.820 | -0.338 | 0.771 | 9.733 | 3.960 | 0.355 |
| PS => ECI | 1.441 | 0.825 | 0.479 | 0.611 | -0.728 | 0.584 |
| GE => ECI | 4.960 | 7.409*** | 0.004 | 0.633 | -0.686 | 0.600 |
| RQ => ECI | 8.577 | 2.993 | 0.402 | 1.429 | 0.802 | 0.461 |
| RL => ECI | 10.878 | 4.918 | 0.179 | 3.092 | 3.914* | 0.051 |
| CC => ECI | 23.524 | 15.498** | 0.013 | 1.520 | 0.972 | 0.356 |
| ECI => VA | 0.795 | -0.383 | 0.726 | 13.823 | 7.382 | 0.107 |
| PS => VA | 9.329 | 3.622 | 0.360 | 17.205 | 10.211* | 0.066 |
| GE => VA | 20.172 | 12.694** | 0.015 | 7.336 | 1.955 | 0.464 |
| RQ => VA | 29.230 | 20.272** | 0.011 | 11.096 | 5.100 | 0.145 |
| RL => VA | 1.311 | 0.581 | 0.615 | 12.506 | 6.280 | 0.172 |
| CC => VA | 14.092 | 7.607 | 0.113 | 1.091 | 0.170 | 0.876 |
| ECI => PS | 6.121 | 3.371 | 0.101 | 10.524 | 4.622 | 0.169 |
| VA => PS | 22.153 | 14.351** | 0.032 | 0.699 | -0.563 | 0.638 |
| GE => PS | 2.279 | 0.369 | 0.755 | 0.440 | -1.047 | 0.327 |
| RQ => PS | 15.155 | 8.496* | 0.076 | 10.743 | 4.805 | 0.160 |
| RL => PS | 15.510 | 8.794* | 0.058 | 1.456 | 0.853 | 0.447 |
| CC => PS | 8.981 | 9.235*** | 0.001 | 11.420 | 6.941** | 0.011 |
| ECI => GE | 6.411 | 1.181 | 0.238 | 0.267 | -1.372 | 0.246 |
| VA => GE | 0.217 | -1.466 | 0.143 | 10.280 | 4.417 | 0.242 |
| PS => GE | 1.013 | 0.024 | 0.981 | 0.876 | -0.231 | 0.840 |
| RQ => GE | 0.621 | -0.708 | 0.479 | 0.667 | -0.623 | 0.553 |
| RL => GE | 0.586 | -0.775 | 0.438 | 10.211 | 4.360 | 0.226 |
| CC => GE | 0.857 | -0.268 | 0.789 | 1.180 | 0.337 | 0.785 |
| ECI => RQ | 9.199 | 4.863** | 0.036 | 2.824 | 3.412*** | 0.001 |
| VA => RQ | 23.091 | 15.136** | 0.036 | 0.315 | -1.281 | 0.213 |
| PS => RQ | 15.531 | 8.811* | 0.094 | 0.782 | -0.407 | 0.684 |
| GE => RQ | 2.127 | 0.168 | 0.902 | 1.130 | 0.244 | 0.854 |
| RL => RQ | 6.015 | 0.849 | 0.743 | 2.543 | 2.886*** | 0.004 |
| CC => RQ | 1.304 | 0.568 | 0.600 | 16.197 | 11.409*** | 0.001 |
| ECI => RL | 1.127 | 0.238 | 0.812 | 0.729 | -0.507 | 0.734 |
| VA => RL | 0.774 | -0.424 | 0.672 | 2.954 | 3.655** | 0.043 |
| PS => RL | 20.213 | 12.728*** | 0.000 | 1.775 | 1.449 | 0.204 |
| GE => RL | 8.119 | 2.610*** | 0.009 | 0.476 | -0.980 | 0.368 |
| RQ => RL | 1.357 | 0.668 | 0.567 | 0.555 | -0.832 | 0.440 |
| CC => RL | 8.304 | 2.764*** | 0.006 | 0.808 | -0.358 | 0.768 |
| ECI => CC | 1.349 | 0.652 | 0.587 | 0.721 | -0.521 | 0.620 |
| VA => CC | 15.233 | 8.562* | 0.070 | 38.859 | 28.328*** | 0.003 |
| PS => CC | 18.694 | 11.457** | 0.036 | 0.662 | -0.633 | 0.586 |
| GE => CC | 8.186 | 2.665 | 0.273 | 1.707 | 1.322 | 0.233 |
| RL => CC | 10.578 | 4.667*** | 0.000 | 2.062 | 1.988 | 0.124 |
| RQ => CC | 15.148 | 10.428*** | 0.009 | 10.165 | 4.321*** | 0.000 |

The maximum lag length was taken as 4, the optimal lag length was determined according to the AIC criterion. *, ** and *** denote .10, .05 and .01 significance levels, respectively.

When results in Table 5 were taken into consideration for E-7 countries, causal relationships from government efficiency at 0.01 significance level and from fight against corruption at 0.05 significance level to economic complexity level were determined. Additionally, there was a causal relationship from government efficiency and from regulatory quality to voice and accountability at 0.05 significance level; from control of corruption at 0.01 significance level, from voice and accountability at 0.05 significance level, from regulatory quality and rule of law at 0.10 significance level to political stability. The causal relationship was also determined from economic complexity level and voice and accountability at 0.05 significance level, and from political stability at 0.10 significance level to regulatory quality. Whereas a causal relationship from political stability, government effectiveness and control of corruption to rule of law at 0.10 significance level, it was also found from rule of law and regulatory quality at 0.01 significance level, from political stability at 0.05 significance level and from voice and accountability at 0.10 significance level to control of corruption. Of these causal relationships, in the model representing causal relationship from political stability, government effectiveness and control of corruption variables to rule of law, there is no cross sectional dependency. Moreover, in the model representing causality from political stability, rule of law and regulatory quality variables to control of corruption, there was no cross sectional dependency determined. This finding suggested that a shock that could arise in one of the countries would not affect other countries within the scope of concerned causal relationship. On the other hand, other causal relationships showed cross sectional dependency, which means that a shock that may arise in one of the countries would affect other countries.

In consideration of G-7 countries, causality was determined from rule of law at 0.10 significance level to economic complexity level. Additionally, causality was determined from political stability at 0.10 significance level to voice and accountability, from control of corruption at 0.05 significance level to political stability. Causality was also determined at 0.01 significance level from economic complexity level, rule of law and control of corruption variables to regulatory quality. Whereas causality was determined from voice and accountability to rule of law at 0.05 significance level, it existed from voice and accountability and regulatory quality to control of corruption at 0.01 significance level. Based on these results, the causality relationship from economic complexity level and from rule of law to regulatory quality and the one from regulatory quality to control of corruption were not exhibiting cross sectional dependency. That is, any shock that may arise in one of these countries would not affect another within the scope of this causal relationship.

Other causal relationships exhibit cross-sectional dependency meaning that shocks occur in any country will affect the other countries considered. These causal relationships for E-7 countries are from government effectiveness and control of corruption to economic complexity level; from government effectiveness and regulatory quality to voice and accountability; from voice and accountability, regulatory quality, rule of law and control of corruption to political stability; from economic complexity level, voice and accountability, political stability to regulatory quality; and finally from voice and accountability to control of corruption. These findings for E-7 countries indicate that any change in an institutional indicator of any country will affect the other countries. This structure reveals the interconnectedness of the E-7 countries.

In terms of G-7 countries, the causal relationships, which do exhibit cross-sectional dependency, are from rule of law to economic complexity level; from political stability to voice and accountability; from control of corruption to political stability; from economic complexity level, rule of law, control of corruption to regulatory quality; from voice and accountability to rule of law; finally, from voice and accountability and regulatory quality to control of corruption. These results also indicate that a shock that occurs in any G-7 country will also affect the other countries in the community.

## CONCLUSION

How to eliminate developmental and income level differences among countries has been extensively investigated across growth and development literature. However, such economic differences have been tried to be explained by various preferences, factors and characteristics of countries in the literature; institutional factors have been regarded as an external variable not interfering adversely with functionality of market economy.

On the other hand recently, studies investigating effect of political and economic institutions on development level differences among countries by influencing their economic performances have gained significance. In the present study, aforesaid relationship was considered through empirical methods. The causality relationship between institutional structure indicators and economic performances of E-7 developing economies and G-7 the most developed and prosperous countries of the world were investigated for the period of 1996-2017.

When causal relationship from institutional indicators to economic complexity level representing economic performance was considered, existence of causal relationship from government effectiveness and control of corruption to economic complexity level was revealed in E-7 countries; from rule of law to economic complexity level was seen with G-7 countries. This suggested that economic performance in developing countries was influenced by institutional factors at larger extent in developed countries. The similar characteristic was seen with the results concerning causality among institutional indicators. In E-7 countries, interaction among institutional indicators of government effectiveness, political stability, voice and accountability, regulatory quality, control of corruption and rule of law was found greater than G-7 countries. If this interaction is considered as rings of a chain, any problem that may occur with these rings could affect others as well; and therefore, developing countries are required to pay substantial interest to institutional structure to enhance economic performance.

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