

**ECONOMIC GROWTH AND PUBLIC DEBT IN THE ECONOMIC GLOBALIZATION ERA:
AN EMPIRICAL INVESTIGATION OF DEVELOPING COUNTRIES**Barış KABLAMACI¹¹Istanbul University, The School of Economics, Department of Economics, İstanbul
bkablamaci@istanbul.edu.tr**Abstract**

This paper empirically examines the causal relationship between public debt and economic growth in a sample of the 72 countries consisting of less developed and developing, country-by-country, in the period of 1970–2015. I apply the Toda-Yamamoto augmented Granger non-causality testing procedure. I observe a significant causality from economic growth to the public debt of a country in twenty-one countries. In fifteen countries, there is a unidirectional causality running from the public debt to economic growth. I find bi-directional causality in only nine countries and no causal relation in twenty-seven economies.

Keywords: Public debt, Economic growth, Causality analysis.

**KÜRESELLEŞME ÇAĞINDA EKONOMİK BÜYÜME VE KAMU BORCU:
GELİŞMEKTE OLAN ÜLKELERE DAİR BİR İNCELEME****Özet**

Bu çalışma, 1970-2015 yılları arasını kapsamak üzere 72 az gelişmiş ve gelişmekte olan ülkenin, kamu borcu ve ekonomik büyüme arasındaki nedensellik ilişkisini ampirik olarak incelemektedir. Toda-Yamamoto genişletilmiş Granger nedensellik analiz testi uygulanmıştır. Yapılan analize göre, 21 ülkede ekonomik büyümeden kamu borçlanmasına doğru, 15 ülkede kamu borçlanmasından ekonomik büyümeye doğru, 9 ülkede karşılıklı bir nedensellik ilişkisi tespit edilmiş ve 27 ülke ekonomisi için kamu borçlanması ile ekonomik büyüme arasında herhangi bir nedensellik ilişkisi gözlemlenmemiştir.

Anahtar Kelimeler: Kamu borcu, Ekonomik büyüme, Nedensellik analizi.

1. INTRODUCTION

In the 1980s, many developing countries experienced major macroeconomic problems regarding increasing fiscal deficits and realized the importance of the fiscal balance in their economies. Since then, the sustainability of public debt became an important issue in the global economy according to the adjustment programs that profoundly affect potential interactions of monetary and fiscal policies.

Many scholars have investigated the relationship between public debt and economic growth to determine the influence of fiscal and monetary policies on the sustainability of debt and growth in various economies with different development levels. In a pioneering study, Barro (1979) presented the importance of fiscal

policies, considering taxes and government spending for achieving the debt sustainability. According to his analysis, public debt is also vulnerable to high inflation and the structure of debt generates its effects depending on whether the country is in war or peacetime.

The empirical analysis between public debt and economic growth has been examined with regards to the effects of fiscal policies on macroeconomic variables in the current literature. However, these analyses applied correlation techniques with ambiguous results and lack of evidence for various countries related to their different economic levels. This paper empirically investigates the causal relationship between public debt and economic growth in 72 countries given their level of economic level. This study contributes to the existing body of literature by analyzing the causal linkage between public debt and economic growth in less developed and developing countries for the period of 1970–2015, country-by-country. Therefore, the econometric methodology applied in this work provides additional empirical evidence on the causal relationship between public debt and economic growth in a global point of view for policymakers.

I observe a significant causality from public debt to economic growth in fifteen countries. In twenty-one economies, there is unidirectional causality from economic growth to public debt. I also find bidirectional causality in only nine countries.

The remainder of the paper is organized as follows. Section 2 summarizes the literature on economic growth and public debt. Section 3 describes data and presents the model and methodology of the Toda-Yamamoto Modified Wald causality framework. Section 4 provides the empirical findings. Section 5 presents concluding remarks.

2. LITERATURE REVIEW

The existence and the direction of the causal relationship between public debt and economic growth identify the influence of fiscal and monetary policies on the macroeconomic environment of a country. While the causality running from public debt to economic growth presents the change of aggregate demand, capital inflows, interest rates that could cause either a reduction or a boost in the GDP (UN, 2002; Kim et al., 2017). On the other side, economic growth could generate public debt according to the pace of growth rate whether it is persistent or transitory. According to Alesina and Perotti (1997) expansionary fiscal adjustments are generally conducted with spending cuts, especially on government wages and transfers, while contractionary fiscal adjustments are denoted by tax increases.

While expansionary fiscal policies improve the economic growth in the short run, also lead to a reduction in the growth by increasing the level of debt in the long run. These policies could become contractionary if they are applied in the recession period of the economy.

Public debt can restrain the growth in the long run through the weakening of the market economy by choice of increasing taxes by the government may lead to a reduction in the disposable income and saving. In order to compete with private financial borrowers for a fixed supply of savings in the market the significant necessary of borrowing of the government cause crowding out of the private investment

that finally public debt generates spiking interest rates associated with the rising cost of capital and reduce total investment in the economy (Egert, 2013). However, these conditions could easily evolve to currency risk and turn into a financial crisis (Hemming et al., 2003).

The increase of the public debt generate a negative impact on capital stock, productivity and finally reduce economic growth related to the high-interest rates (Gale and Orszag, 2003; Baldacci and Kumar, 2010; Kumar and Woo, 2010), disruptive tax policies (Barro, 1979; Dotsey, 1994), high inflation rates (Barro, 2013), uncertainty and vulnerability to economic shocks and political risks of the country. Further, the failure in the financial markets associated with the outflow of capital from the country and the probability of currency risk spill over into the real sector and trade markets resulting with a fall in economic growth. Panizza and Presbitero (2014) show that while there is no causal effect of the public to economic growth in the sample of OECD countries. The current literature provides that high debt/GDP levels, which is around 90 percent and above, implies a turning point of an economy that begins the slowdown of the economic growth (Reinhart and Rogoff, 2010; Kumar and Woo, 2010; Cecchetti et al., 2011) for both emerging and advanced economies. In addition, Reinhart et al. (2003) find that having much lower external debt/GDP levels are associated with adverse outcomes for the growth of emerging countries. As economies reach their ceilings of debt tolerance, interest rates could make a sudden increase, which may cause to a painful adjustment.

Although the budget deficits of governments also have major fiscal consequences that could turn into a debt crisis in order to correct macroeconomic disturbance of the economy, the change in the economic growth either positive or negative, induce public debt through both positive and negative fiscal policies associated with a macroeconomic imbalance. According to Easterly (2001), the permanent reduction of economic growth has the same influence of a negative fiscal shock leading to the budget deficit and higher public debt. On the other hand, the increase in the growth leads to a budget surplus and reduction in the public debt.

3. DATA, MODEL AND METHODOLOGY

3.1. Data

This paper empirically examines the causal relationship between economic growth and public debt, focusing on 72 selected less developed and developing countries from 1970-2015, individually. The determination of countries is based on continuous data availability for the period under consideration. The selected countries considered in the paper are listed in Table 4 in the appendix. I employ data on public debt, which presents the gross government debt-to-GDP ratios. Data is obtained from the Historical Public Debt Database, IMF, 2018. Economic growth is calculated from natural logarithm of GDP per capita data and is obtained from World Bank Indicators, World Bank, 2018. Besides, I also utilize the KOF economic globalization—an overall index that involves trade and financial globalization. Data is obtained from the Swiss Federal Institute of Technology Zurich (Dreher, 2006; Dreher et al. 2008) and denoted by *Ecog*. Tables 1 to 3 show the descriptive statistics of the series, which are employed in the study.

Country	Time Interval	Mean	Std. Dev.	Minimum	Maximum	Obs.
Algeria	1970-2015	32.836	5.214	21.575	42.345	46
Albania	1970-2015	38.629	12.294	28.720	64.161	45
Angola	1970-2015	48.152	8.209	36.246	62.274	41
Argentina	1970-2015	39.685	7.485	27.262	53.002	46
Burundi	1970-2015	20.747	4.255	14.760	28.566	46
Benin	1970-2015	30.662	5.184	20.912	39.985	46
Burkina Faso	1970-2015	30.932	4.546	26.087	44.485	46
Bangladesh	1972-2015	18.455	5.127	10.219	26.910	44
Bolivia	1970-2015	47.460	6.978	37.570	58.804	46
Brazil	1970-2015	35.251	7.054	25.563	46.692	38
Barbados	1970-2015	51.827	1.780	47.980	56.527	46
Bhutan	1970-2015	34.182	3.387	30.360	44.364	46
Botswana	1970-2015	64.302	4.202	55.358	70.455	46
Bulgaria	1970-2015	57.898	10.035	44.529	78.057	46
Cape Verde	1970-2015	48.872	4.820	38.294	57.988	41
Cameroon	1970-2015	32.282	3.048	25.541	37.725	46
Central African Republic	1970-2015	24.291	3.285	18.791	31.561	46
Chad	1970-2015	23.865	7.288	10.488	36.560	46
Chile	1970-2015	51.498	13.693	29.229	74.766	46
China	1970-2015	32.900	8.093	18.901	44.289	32
Dem.R.Congo	1970-2015	25.280	7.075	15.115	36.811	46
Rep. of Congo	1970-2015	45.316	8.135	33.177	55.559	45
Colombia	1970-2015	34.439	6.488	25.355	46.383	44
Comoros	1970-2015	40.769	1.792	37.069	43.808	34
Costa Rica	1970-2015	55.800	9.001	44.069	72.436	46
Dominican Republic	1970-2015	40.376	11.260	24.779	59.353	46
Ecuador	1970-2015	40.540	5.933	30.580	52.777	45
Egypt	1970-2015	46.288	7.239	32.322	60.613	46
El Salvador	1970-2015	51.166	8.108	41.501	64.566	44
Ethiopia	1970-2015	21.094	4.156	15.074	29.273	35
Fiji	1970-2015	46.709	2.372	42.373	52.043	46
Gabon	1970-2015	46.420	2.589	40.058	51.545	46
Ghana	1970-2015	36.904	8.939	23.572	52.495	46
Gambia	1970-2015	48.882	5.094	39.681	57.934	42
Equatorial G.	1980-2015	59.019	3.695	51.502	66.543	36
Guatemala	1970-2015	40.883	11.068	25.127	59.783	46

Guyana	1970-2015	61.219	7.268	48.209	72.366	46
Honduras	1970-2015	48.624	10.981	33.286	64.520	46
Indonesia	1970-2015	47.687	7.935	35.978	65.998	40
India	1970-2015	21.174	8.286	12.337	37.453	46
Iran	1970-2015	24.836	5.623	16.051	36.203	37
Jamaica	1970-2015	56.041	5.684	43.822	67.895	46
Kenya	1970-2015	42.529	3.216	37.732	49.529	46
Lesotho	1970-2015	53.753	3.716	44.763	59.626	46
Madagascar	1970-2015	29.040	10.514	14.358	45.066	46
Malawi	1970-2015	41.704	6.525	28.281	50.711	46
Malaysia	1970-2015	62.653	6.486	49.792	71.156	46
Morocco	1970-2015	39.133	7.361	28.455	55.300	46
Mali	1970-2015	35.030	5.240	24.410	43.299	46
Mexico	1970-2015	42.419	6.234	33.515	55.398	46
Mauritania	1970-2015	46.526	4.216	36.887	54.494	46
Mauritius	1970-2015	57.665	12.341	44.331	82.376	46
Nepal	1970-2015	19.834	5.239	12.391	30.886	46
Nicaragua	1970-2015	52.517	9.481	36.645	66.214	46
Niger	1970-2015	30.714	6.014	18.206	41.931	46
Nigeria	1970-2015	43.163	8.880	27.090	59.387	46
Panama	1970-2015	64.340	8.247	54.715	78.947	46
Paraguay	1970-2015	42.967	9.638	29.078	58.114	46
Peru	1970-2015	48.746	9.411	33.119	65.211	46
Rwanda	1970-2015	28.310	10.047	17.516	53.431	46
Senegal	1970-2015	38.241	6.715	28.002	51.702	46
Sierra Leone	1970-2015	33.412	7.264	24.405	52.277	46
South Africa	1970-2015	44.550	5.453	35.265	53.822	46
South Korea	1970-2015	41.191	13.181	24.041	64.670	46
Thailand	1970-2015	45.965	12.363	27.960	61.994	46
Trinidad and Tobago	1970-2015	59.153	4.629	49.392	66.457	46
Togo	1970-2015	45.085	7.415	28.529	58.164	46
Tunisia	1970-2015	44.447	5.390	34.295	53.599	46
Turkey	1970-2015	41.426	9.992	25.899	54.056	46
Uruguay	1970-2015	52.442	8.281	34.897	64.051	46
Zambia	1970-2015	53.407	2.999	48.037	59.019	46
Zimbabwe	1970-2015	31.281	4.825	22.712	39.470	36

Table 1. Summary of Descriptive Statistics for the Economic Globalization

Country	Time Interval	Mean	Std. Dev.	Minimum	Maximum	Obs.
Algeria	1970-2015	8.202	0.155	7.749	8.467	46
Albania	1970-2015	7.821	0.360	7.161	8.417	36
Angola	1970-2015	7.840	0.263	7.411	8.228	31
Argentina	1970-2015	8.979	0.153	8.689	9.285	46
Burundi	1970-2015	5.576	0.139	5.389	5.822	46
Benin	1970-2015	6.481	0.119	6.301	6.725	46
Burkina Faso	1970-2015	5.975	0.265	5.599	6.469	46
Bangladesh	1972-2015	6.163	0.320	5.761	6.878	44
Bolivia	1970-2015	7.391	0.154	7.157	7.780	46
Brazil	1970-2015	9.097	0.144	8.885	9.385	38
Barbados	1970-2015	9.600	0.093	9.429	9.724	26
Bhutan	1970-2015	6.981	0.562	6.000	7.874	36
Botswana	1970-2015	8.092	0.652	6.510	8.932	46
Bulgaria	1970-2015	8.446	0.276	8.078	8.937	36
Cape Verde	1970-2015	7.393	0.584	6.512	8.133	36
Cameroon	1970-2015	7.144	0.173	6.834	7.514	46
Central African Republic	1970-2015	6.150	0.183	5.705	6.437	46
Chad	1970-2015	6.379	0.250	6.006	6.874	46
Chile	1970-2015	8.897	0.431	8.272	9.609	46
China	1970-2015	7.476	0.804	6.176	8.779	32
Dem.R.Congo	1970-2015	6.245	0.501	5.572	6.984	46
Rep. of Congo	1970-2015	7.809	0.162	7.441	8.099	45
Colombia	1970-2015	8.423	0.243	8.006	8.915	44
Comoros	1970-2015	6.705	0.071	6.614	6.843	34
Costa Rica	1970-2015	8.636	0.259	8.218	9.149	46
Dominican Republic	1970-2015	8.071	0.361	7.400	8.787	46
Ecuador	1970-2015	8.261	0.160	7.851	8.599	45
Egypt	1970-2015	7.354	0.376	6.668	7.888	46
El Salvador	1970-2015	7.934	0.195	7.627	8.225	44
Ethiopia	1970-2015	5.465	0.289	5.097	6.188	35
Fiji	1970-2015	8.032	0.157	7.699	8.345	46
Gabon	1970-2015	9.273	0.185	8.880	9.877	46
Ghana	1970-2015	6.903	0.221	6.553	7.430	46
Gambia	1970-2015	6.262	0.038	6.154	6.332	42
Equatorial G.	1980-2015	7.989	1.537	6.188	9.920	36
Guatemala	1970-2015	7.784	0.127	7.534	8.029	46

Guyana	1970-2015	7.679	0.246	7.300	8.211	46
Honduras	1970-2015	7.400	0.122	7.177	7.648	46
Indonesia	1970-2015	7.591	0.376	6.896	8.249	40
India	1970-2015	6.452	0.494	5.862	7.471	46
Iran	1970-2015	8.512	0.177	8.167	8.798	46
Jamaica	1970-2015	8.401	0.114	8.150	8.588	46
Kenya	1970-2015	6.771	0.099	6.398	7.010	46
Lesotho	1970-2015	6.587	0.375	5.852	7.199	46
Madagascar	1970-2015	6.189	0.199	5.925	6.626	46
Malawi	1970-2015	5.941	0.113	5.702	6.182	46
Malaysia	1970-2015	8.525	0.498	7.597	9.282	46
Morocco	1970-2015	7.484	0.332	6.927	8.072	46
Mali	1970-2015	6.249	0.220	5.871	6.587	46
Mexico	1970-2015	8.933	0.165	8.558	9.171	46
Mauritania	1970-2015	7.016	0.095	6.873	7.190	46
Mauritius	1970-2015	8.427	0.469	7.725	9.192	41
Nepal	1970-2015	6.043	0.548	5.608	9.192	46
Nicaragua	1970-2015	7.343	0.251	6.969	7.849	46
Niger	1970-2015	5.982	0.190	5.775	6.434	46
Nigeria	1970-2015	7.412	0.242	7.048	7.848	46
Panama	1970-2015	8.544	0.308	8.132	9.272	46
Paraguay	1970-2015	7.810	0.266	7.168	8.248	46
Peru	1970-2015	8.211	0.205	7.869	8.688	46
Rwanda	1970-2015	5.978	0.247	5.321	6.571	46
Senegal	1970-2015	6.817	0.074	6.672	6.959	46
Sierra Leone	1970-2015	6.015	0.188	5.604	6.333	46
South Africa	1970-2015	8.764	0.093	8.615	8.939	46
South Korea	1970-2015	9.046	0.822	7.503	10.121	46
Thailand	1970-2015	7.822	0.592	6.834	8.654	46
Trinidad and Tobago	1970-2015	9.172	0.344	8.762	9.744	46
Togo	1970-2015	6.285	0.104	6.019	6.527	46
Tunisia	1970-2015	7.828	0.339	7.134	8.358	46
Turkey	1970-2015	8.872	0.328	8.347	9.539	46
Uruguay	1970-2015	8.980	0.266	8.623	9.536	46
Zambia	1970-2015	7.096	0.197	6.806	7.390	46
Zimbabwe	1970-2015	6.994	0.211	6.385	7.206	46

Table 2. Summary of Descriptive Statistics for Natural Logarithmic of GDP per capita.

Country	Time Interval	Mean	Std. Dev.	Minimum	Maximum	Obs.
Algeria	1970-2015	48.206	26.707	7.744	97.969	46
Albania	1970-2015	65.444	8.954	53.550	85.168	22
Angola	1970-2015	72.302	57.585	16.065	222.085	21
Argentina	1970-2015	43.602	29.231	9.347	152.111	46
Burundi	1970-2015	68.379	50.064	6.922	172.738	46
Benin	1970-2015	44.665	26.349	5.406	101.261	46
Burkina Faso	1970-2015	33.955	13.284	10.886	61.797	40
Bangladesh	1972-2015	36.877	10.205	16.342	55.688	42
Bolivia	1970-2015	80.632	39.803	7.157	7.780	46
Brazil	1970-2015	59.217	17.270	29.912	102.90	38
Barbados	1970-2015	53.487	18.619	28.508	105.482	39
Bhutan	1970-2015	50.194	26.916	1.722	94.800	34
Botswana	1970-2015	21.774	11.306	6.440	45.800	44
Bulgaria	1970-2015	67.232	67.890	14.275	289.554	24
Cape Verde	1970-2015	71.427	17.688	36.298	120.541	35
Cameroon	1970-2015	41.837	31.085	9.715	114.162	46
Central African Republic	1970-2015	52.343	29.266	20.267	108.770	46
Chad	1970-2015	38.839	18.855	12.809	83.651	46
Chile	1970-2015	47.373	43.291	3.889	165.546	46
China	1970-2015	20.162	12.421	0.971	42.919	32
Dem.R.Congo	1970-2015	85.511	59.820	16.802	262.843	46
Rep. of Congo	1970-2015	120.479	69.442	22.888	264.443	45
Colombia	1970-2015	30.476	10.083	12.444	50.569	44
Comoros	1970-2015	77.046	26.198	18.145	115.873	34
Costa Rica	1970-2015	47.302	25.610	19.206	110.252	46
Dominican Republic	1970-2015	31.364	12.312	17.518	60.690	46
Ecuador	1970-2015	47.546	28.326	14.623	100.815	45
Egypt	1970-2015	90.407	24.405	51.294	136.573	46
El Salvador	1970-2015	43.823	24.442	10.226	108.274	44
Ethiopia	1970-2015	79.063	31.903	31.572	150.678	35
Fiji	1970-2015	36.507	15.715	7.963	58.639	46
Gabon	1970-2015	51.157	25.602	13.601	99.703	46
Ghana	1970-2015	41.860	26.466	5.042	111.94	46
Gambia	1970-2015	89.468	41.729	8.474	156.014	42
Equatorial G.	1980-2015	107.356	109.983	0.474	325.570	36
Guatemala	1970-2015	26.689	12.832	10.137	55.649	46

Guyana	1970-2015	298.838	234.443	48.198	784.351	46
Honduras	1970-2015	54.234	27.733	13.317	116.557	46
Indonesia	1970-2015	38.019	18.568	16.430	95.893	40
India	1970-2015	57.965	17.785	32.695	84.243	46
Iran	1970-2015	25.579	14.537	8.874	59.701	46
Jamaica	1970-2015	99.045	44.097	14.156	181.281	46
Kenya	1970-2015	41.575	17.412	13.076	82.085	46
Lesotho	1970-2015	57.243	29.905	3.938	126.092	43
Madagascar	1970-2015	79.903	45.750	14.159	172.708	46
Malawi	1970-2015	85.030	38.995	36.704	174.251	46
Malaysia	1970-2015	52.614	19.145	30.041	109.035	46
Morocco	1970-2015	67.778	23.574	27.828	117.714	46
Mali	1970-2015	68.599	32.148	18.065	125.217	46
Mexico	1970-2015	42.572	13.871	17.023	78.144	46
Mauritania	1970-2015	136.073	47.904	66.150	234.394	39
Mauritius	1970-2015	47.068	12.968	17.917	71.757	41
Nepal	1970-2015	39.938	20.585	1.776	67.616	46
Nicaragua	1970-2015	209.759	319.934	26.481	2092.92	46
Niger	1970-2015	47.249	28.937	8.114	109.248	46
Nigeria	1970-2015	52.911	52.887	7.276	193.671	46
Panama	1970-2015	61.182	20.995	20.673	105.639	46
Paraguay	1970-2015	27.380	11.245	12.992	59.386	46
Peru	1970-2015	36.506	11.416	19.014	63.441	46
Rwanda	1970-2015	39.451	34.131	5.452	119.511	46
Senegal	1970-2015	52.178	23.015	17.590	94.417	46
Sierra Leone	1970-2015	101.532	64.864	21.081	241.415	46
South Africa	1970-2015	37.283	6.858	23.198	49.778	46
South Korea	1970-2015	19.146	8.414	6.821	37.888	45
Thailand	1970-2015	34.633	12.401	12.216	55.313	46
Trinidad and Tobago	1970-2015	34.843	17.994	8.000	62.000	46
Togo	1970-2015	84.754	22.725	32.248	122.48	41
Tunisia	1970-2015	48.010	9.970	30.392	62.501	46
Turkey	1970-2015	37.763	13.128	19.036	77.935	46
Uruguay	1970-2015	51.606	26.018	16.644	99.885	46
Zambia	1970-2015	117.716	77.907	16.718	244.523	46
Zimbabwe	1970-2015	46.653	17.178	17.743	87.958	46

Table 3. Summary of Descriptive Statistics for Public Debt.

3.2. Empirical Model and Methodology

To analyze the causal linkage between economic growth and public debt for long-run causality in equations (1) and (2), I employ the Toda and Yamamoto (1995) augmented Granger non-causality test, providing the robustness of the cointegration properties of the process. The Toda-Yamamoto method does not require the information on the cointegration features of the model and enables the implementation without pre-testing for cointegration and for any level of the integration (Zapata and Rambaldi, 1997). According to this method, I estimate an augmented vector autoregressive (VAR) model and a standard Wald test, even though the series of the variables are non-stationary. Because this procedure ensures the asymptotic distribution of the Wald statistic, in spite of the standard Granger causality test, which ensures a standard asymptotic distribution, I choose to employ the Toda-Yamamoto procedure. This method primarily necessitates two steps. The initial step is the selection of the optimal lag length (k), and the following step is the determination of the maximum order of integration (d_{\max}) for the variables in the model. The Toda-Yamamoto analysis also includes a modified Wald Test for constraints on the parameters of a VAR (k) and possesses an asymptotic χ^2 distribution while a VAR ($k+d_{\max}$) is estimated. This procedure is utilized in this study by estimating the following VAR models computed with the seemingly unrelated regression (SUR) technique to increase the efficiency of testing the Granger non-causality analysis (Rambaldi and Doran, 1996).

To determine white noise errors, I utilize the Akaike Information Criterion (AIC) to determine the optimal lag length of the VAR model. I employ the Augmented Dickey-Fuller (ADF) unit root test which is introduced by Dickey and Fuller (1981), for the selection of the maximum order of integration. Table 4 presents the ADF unit root test results.

			ADF Test Results				d_{\max}
Country	Years	Var.	Level		First difference		
			Without trend	With trend	Without trend	With trend	
Algeria	1970-2015	Public Debt	-1.131(-2.929)	-1.569(-3.515)	-4.667*(-2.929)	-4.869*(-3.515)	1
		ln GDPpc	-2.924(-2.929)	-2.736(-3.515)	-9.439*(-2.929)	-9.607*(-3.515)	1
		Economic Globalization	-2.330(-2.933)	-2.523(-3.520)	-5.422*(-2.929)	-5.380*(-3.515)	1
Albania	1971-2015	Public Debt	-2.290(-3.012)	-1.102(-3.644)	-4.468*(-3.020)	-5.185*(-3.658)	1
		ln GDPpc	-0.458(-2.951)	-2.046(-3.548)	-4.038*(-2.954)	-4.358*(-3.552)	1
		Economic Globalization	0.652(-2.929)	-1.538(-3.515)	-4.980*(-2.931)	-5.150*(-3.518)	1
Angola	1970-2015	Public Debt	-3.291**(-3.020)	0.295(-3.690)	-4.308*(-3.029)	-4.588*(-3.673)	0
		ln GDPpc	-1.327(-2.967)	-2.085(-3.574)	-2.970**(-2.967)	-3.023(-3.574)	1
		Economic Globalization	-1.426(-2.936)	-0.750(-3.526)	-7.699*(-2.938)	-8.054*(-3.529)	1
Argentina	1970-2015	Public Debt	-2.373(-2.928)	-2.572(-3.513)	-6.718*(-2.929)	-6.656*(-3.515)	1
		ln GDPpc	-0.724(-2.928)	-2.186(-3.515)	-5.625*(-2.929)	-5.651*(-3.515)	1
		Economic Globalization	-0.840(-2.928)	-0.314(-3.513)	-5.900*(-2.929)	-6.354*(-3.515)	1
Burundi	1970-2015	Public Debt	-1.372(-2.928)	-0.683(-3.513)	-6.089*(-2.929)	-6.307*(-3.515)	1
		ln GDPpc	-0.729(-2.928)	-2.399(-3.518)	-5.660*(-2.929)	-5.676*(-3.515)	1
		Economic Globalization	-1.735(-2.928)	-1.535(-3.513)	-6.105*(-2.929)	-6.137*(-3.515)	1

Benin	1970-2015	Public Debt	-1.681(-2.928)	-1.444(-3.513)	-6.582*(-2.929)	-6.748*(-3.515)	1
		ln GDPpc	0.046(-2.928)	-2.702(-3.513)	-6.777*(-2.929)	-6.758*(-3.515)	1
		Economic Globalization	-2.501(-2.928)	-2.904(-3.513)	-6.541*(-2.931)	-6.538*(-3.518)	1
Burkina Faso	1970-2015	Public Debt	-1.973(-2.938)	-1.612(-3.529)	-6.024*(-2.941)	-6.170*(-3.533)	1
		ln GDPpc	0.748(-2.928)	-1.744(-3.513)	-7.803*(-2.929)	-7.954*(-3.515)	1
		Economic Globalization	0.172(-2.928)	-1.271(-3.513)	-5.976*(-2.929)	-6.130*(-3.515)	1
Bangladesh	1972-2015	Public Debt	-2.181(-2.936)	-1.576(-3.526)	-4.003*(-2.936)	-5.360*(-3.533)	1
		ln GDPpc	4.298(-2.931)	0.639(-3.518)	-1.329(-2.936)	-9.630*(-3.520)	1
		Economic Globalization	-1.342(-2.931)	-3.164(-3.520)	-5.384*(-2.933)	-5.371*(-3.520)	1
Bolivia	1970-2015	Public Debt	-1.091(-2.928)	-1.891(-3.513)	-6.355*(-2.929)	-6.433*(-3.515)	1
		ln GDPpc	-0.310(-2.929)	-1.231(-3.515)	-2.515(-2.929)	-2.847(-3.515)	2
		Economic Globalization	-1.466(-2.928)	-0.839(-3.513)	-6.641*(-2.929)	-6.818*(-3.515)	1
Brazil	1970-2015	Public Debt	-2.629(-2.960)	-3.444(-3.568)	-6.607*(-2.948)	-6.572*(-3.544)	1
		ln GDPpc	-3.386**(-2.928)	-3.829**(-3.513)	-4.267*(-2.929)	-3.060(-3.526)	0
		Economic Globalization	-1.328(-2.928)	-0.589(-3.513)	-5.359*(-2.929)	-5.456*(-3.515)	1
Barbados	1970-2015	Public Debt	-0.321(-2.943)	-1.254(-3.536)	-3.539**(-2.943)	-3.691**(-3.536)	1
		ln GDPpc	-0.649(-2.986)	-1.804(-3.603)	-3.405**(-2.991)	-3.333(-3.612)	1
		Economic Globalization	-2.848(-2.928)	-2.929(-3.513)	-6.551*(-2.933)	-6.561*(-3.520)	1
Bhutan	1970-2015	Public Debt	-1.015(-2.954)	-3.251(-3.557)	-4.122*(-2.957)	-4.057**(-3.557)	1
		ln GDPpc	-0.865(-2.948)	-3.097(-3.544)	-6.817*(-2.951)	-6.733*(-3.548)	1
		Economic Globalization	1.826(-2.931)	-2.234(-3.513)	-8.659*(-2.929)	-6.887*(-3.518)	1
Botswana	1970-2015	Public Debt	-2.295(-2.931)	-2.159(-3.518)	-5.052*(-2.933)	-5.114*(-3.520)	1
		ln GDPpc	-5.718*(-2.928)	-3.618**(-3.513)	-4.212*(-2.929)	-5.080(-3.515)	0
		Economic Globalization	-1.838(-2.928)	-2.959(-3.513)	-7.165*(-2.929)	-7.091*(-3.515)	1
Bulgaria	1970-2015	Public Debt	-6.710*(-3.004)	-3.914**(-3.644)	-8.526*(-3.004)	-5.486*(-3.710)	0
		ln GDPpc	-0.292(-2.951)	-1.925(-3.548)	-3.040**(-2.951)	-3.077(-3.548)	1
		Economic Globalization	0.021(2.928)	-1.873(-3.513)	-6.864*(-2.929)	-6.590*(-3.189)	1
Cape Verde	1970-2015	Public Debt	-0.544(-2.951)	-1.308(-3.548)	-4.404*(-2.954)	-4.433*(-3.552)	1
		ln GDPpc	-0.883(-2.951)	-1.237(-3.548)	-3.472**(-2.951)	-3.548**(-3.548)	1
		Economic Globalization	-2.188(-2.936)	-2.203(-3.526)	-6.388*(-2.938)	-6.379*(-3.529)	1
Cameroon	1970-2015	Public Debt	-1.311(-2.928)	-1.101(-3.513)	-5.274*(-2.929)	-5.304*(-3.515)	1
		ln GDPpc	-3.208**(-2.933)	-3.160(-3.520)	-1.883(-2.933)	-1.848(-3.520)	0
		Economic Globalization	-2.398(-2.928)	-2.364(-3.513)	-6.866*(-2.927)	-6.969*(-3.515)	1
Central African Republic	1970-2015	Public Debt	-1.638(-2.928)	-1.429(-3.513)	-7.003*(-2.929)	-7.028*(-3.515)	1
		ln GDPpc	-0.949(-2.928)	-2.889(-3.513)	-7.392*(-2.929)	-7.357*(-3.515)	1
		Economic Globalization	-2.036(-2.928)	-1.984(-3.513)	-6.593*(-2.929)	-6.651*(-3.515)	1

Chad	1970-2015	Public Debt	-2.040(-2.929)	-1.984(-3.515)	-4.565*(-2.929)	-4.535*(-3.515)	1
		In GDPpc	-0.349(-2.928)	-1.785(-3.513)	-5.681*(-2.929)	-5.906*(-3.515)	1
		Economic Globalization	-1.254(-2.928)	-2.185(-3.513)	-6.225*(-2.929)	-6.187*(-3.515)	1
Chile	1970-2015	Public Debt	-2.934**(-2.931)	-2.885(-3.515)	-2.843(-2.931)	-2.777(-3.518)	0
		In GDPpc	0.406(-2.929)	-3.744**(-3.515)	-4.779*(-2.929)	-4.986*(-3.515)	0
		Economic Globalization	-1.243(-2.928)	-1.218(-3.513)	-5.261*(-2.929)	-5.312*(-3.515)	1
China	1970-2015	Public Debt	-0.316(-2.960)	-2.988(-3.562)	-6.516*(-2.963)	-6.447*(-3.568)	1
		In GDPpc	0.733(-2.931)	-3.635**(-3.515)	-3.217**(-2.931)	-3.254(-3.518)	0
		Economic Globalization	-0.561(-2.928)	-1.508(-3.513)	-6.321*(-2.929)	-6.204*(-3.515)	1
Democratic Rep. Congo	1970-2015	Public Debt	-1.958(-2.928)	-0.329(-3.518)	-7.264*(-2.931)	-7.733*(-3.518)	1
		In GDPpc	-1.777(-2.929)	-1.095(-3.515)	-2.522(-2.929)	-2.843(-3.515)	2
		Economic Globalization	-1.520(-2.928)	-1.437(-3.513)	-7.857*(-2.929)	-8.042*(-3.515)	1
Republic of Congo	1970-2015	Public Debt	-1.265(-2.929)	-0.906(-3.515)	-5.894*(-2.931)	-6.236*(-3.518)	1
		In GDPpc	-2.467(-2.929)	-2.514(-3.515)	-3.846*(-2.929)	-3.842**(-3.515)	1
		Economic Globalization	-1.523(-2.928)	-2.257(-3.513)	-8.922*(-2.929)	-8.908*(-3.515)	1
Colombia	1970-2015	Public Debt	-1.056(-2.933)	-2.677(-3.520)	-3.874*(-2.933)	-3.876**(-3.520)	1
		In GDPpc	0.180(-2.928)	-1.161(-3.513)	-4.658*(-2.929)	-4.631*(-3.515)	1
		Economic Globalization	-0.459(-2.928)	-3.264(-3.513)	-6.510*(-2.929)	-6.448*(-3.515)	1
Comoros	1970-2015	Public Debt	-0.518(-2.954)	-2.308(-3.552)	-5.480*(-2.957)	-5.717*(-3.557)	1
		In GDPpc	-1.254(-2.948)	-2.086(-3.544)	-7.350*(-2.951)	-7.237*(-3.548)	1
		Economic Globalization	-2.489(-2.936)	-1.974(-3.526)	-5.099*(-2.938)	-5.267*(-3.529)	1
Costa Rica	1970-2015	Public Debt	-2.528(-2.931)	-2.770(-3.518)	-2.453(-2.931)	-2.434(-3.518)	2
		In GDPpc	0.198(-2.929)	-0.938(-3.513)	-4.170*(-2.929)	-4.210*(-3.515)	1
		Economic Globalization	-1.184(-2.928)	-1.895(-3.515)	-4.928*(-2.929)	-4.923*(-3.515)	1
Dominican Republic	1970-2015	Public Debt	-1.758(-2.928)	-2.351(-3.520)	-8.661*(-2.929)	-8.560*(-3.515)	1
		In GDPpc	0.056(-2.928)	-1.226(-3.513)	-4.858*(-2.929)	-4.960*(-3.518)	1
		Economic Globalization	-0.905(-2.928)	-2.963(-3.513)	-8.148*(-2.929)	-8.052*(-3.515)	1
Ecuador	1970-2015	Public Debt	-1.325(-2.929)	-1.275(-3.515)	-5.237*(-2.931)	-5.277*(-3.518)	1
		In GDPpc	-1.822(-2.928)	-2.247(-3.513)	-4.375*(-2.929)	-4.372*(-3.515)	1
		Economic Globalization	-1.724(-2.931)	-0.019(-3.518)	-7.122*(-2.931)	-7.635*(-3.518)	1
Egypt	1970-2015	Public Debt	-2.612(-2.929)	-2.738(-3.515)	-4.614*(-2.929)	-4.624*(-3.515)	1
		In GDPpc	-1.648(-2.928)	-2.514(-3.518)	-3.525**(-2.935)	-4.496*(-3.523)	1
		Economic Globalization	-1.694(-2.929)	0.488(-3.513)	-5.012*(-2.929)	-5.740*(-3.515)	1
El Salvador	1970-2015	Public Debt	-1.951(-2.933)	-3.279(-3.529)	-4.790*(-2.933)	-4.764*(-3.520)	1
		In GDPpc	-0.677(-2.931)	-6.786*(-3.540)	-2.517(-2.929)	-2.580(-3.515)	0
		Economic Globalization	-0.866(-2.928)	-1.443(-3.513)	-5.168*(-2.929)	-5.087*(-3.515)	1

Ethiopia	1970-2015	Public Debt	-1.863(-2.929)	-1.107(-3.513)	-4.772*(-2.929)	-4.844*(-3.515)	1
		ln GDPpc	1.914(-2.951)	-0.341(-3.548)	-3.965*(-2.954)	-3.722*(-3.568)	1
		Economic Globalization	-1.273(-2.928)	-0.986(-3.513)	-5.387*(-2.929)	-5.408*(-3.515)	1
Fiji	1970-2015	Public Debt	-1.723(-2.928)	-2.020(-3.513)	-7.452*(-2.929)	-7.585*(-3.515)	1
		ln GDPpc	-0.727(-2.929)	-2.776(-3.513)	-8.126*(-2.929)	-8.023*(-3.515)	1
		Economic Globalization	-2.179(-2.928)	-3.447(-3.513)	-6.901*(-2.931)	-6.902*(-3.518)	1
Gabon	1970-2015	Public Debt	-2.089(-2.928)	-2.016(-3.513)	-5.844*(-2.929)	-5.857*(-3.515)	1
		ln GDPpc	-2.504(-2.928)	-3.594*(-3.513)	-4.770*(-2.929)	-4.809*(-3.515)	0
		Economic Globalization	-2.629(-2.928)	-3.504(-3.513)	-8.422*(-2.929)	-8.453*(-3.513)	1
Ghana	1970-2015	Public Debt	-1.202(-2.928)	-1.772(-3.523)	-5.228*(-2.929)	-5.167*(-3.515)	1
		ln GDPpc	0.316(-2.929)	-1.485(-3.515)	-4.275*(-2.929)	-5.766*(-3.515)	1
		Economic Globalization	-1.120(-2.928)	-1.866(-3.513)	-7.811*(-2.929)	-7.719*(-3.515)	1
Gambia	1970-2015	Public Debt	-2.085(-2.935)	-1.707(-3.523)	-6.748*(2.936)	-6.953*(-3.526)	1
		ln GDPpc	-2.583(-2.928)	-2.493(-3.513)	-5.267*(-2.931)	-5.486*(-3.518)	1
		Economic Globalization	-2.556(-2.928)	-3.043(-3.513)	-6.366*(-2.929)	-6.302*(-3.515)	1
Equatorial Guinea	1980-2015	Public Debt	-0.828(-2.948)	-2.576(-3.544)	-5.752*(-2.951)	-5.683*(-3.548)	1
		ln GDPpc	-0.809(-2.951)	-1.517(-3.548)	-3.215*(-2.951)	-3.140(-3.548)	1
		Economic Globalization	-2.345(-2.948)	-2.416(-3.544)	-6.622*(-2.951)	-6.558*(-3.548)	1
Guatemala	1970-2015	Public Debt	-1.720(-2.929)	-1.630(-3.515)	-3.710*(-2.929)	-3.775*(-3.515)	1
		ln GDPpc	-1.031(-2.929)	-2.655(-3.520)	-2.961*(-2.929)	-3.111(-3.518)	1
		Economic Globalization	-0.869(-2.929)	-1.753(-3.515)	-4.760*(-2.929)	-4.694*(-3.515)	1
Guyana	1970-2015	Public Debt	-1.165(-2.929)	-1.766(-3.515)	-3.927*(-2.929)	-4.127*(-3.515)	1
		ln GDPpc	0.107(-2.929)	-1.452(-3.515)	-3.785*(-2.929)	-4.193*(-3.515)	1
		Economic Globalization	-1.165(2.931)	1.017(-3.513)	-2.226(-2.931)	-6.239*(-3.515)	1
Honduras	1970-2015	Public Debt	-1.643(-2.928)	-1.399(-3.513)	-6.409*(-2.929)	-6.598*(-3.515)	1
		ln GDPpc	-0.564(-2.928)	-1.678(-3.513)	-5.083*(-2.929)	-5.027*(-3.515)	1
		Economic Globalization	-1.197(-2.929)	-1.605(-3.515)	-4.112*(-2.929)	-4.097*(-3.515)	1
Indonesia	1970-2015	Public Debt	-2.823(-3.615)	-2.734(-3.33)	-4.501*(-2.943)	-4.452*(-3.536)	1
		ln GDPpc	-0.811(-2.928)	-2.559(-3.515)	-4.957*(-2.929)	-4.919*(-3.515)	1
		Economic Globalization	-1.970(-2.928)	-1.243(-3.513)	-5.585*(-2.929)	-5.730*(-3.515)	1
India	1970-2015	Public Debt	-1.130(-2.928)	-1.361(-3.513)	-5.540*(-2.929)	-5.510*(-3.515)	1
		ln GDPpc	4.217(-2.928)	-1.387(-3.513)	-5.347*(-2.929)	-7.847*(-3.515)	1
		Economic Globalization	-0.857(-2.929)	-1.720(-3.515)	-4.438*(-2.929)	-4.361*(-3.515)	1
Iran	1970-2015	Public Debt	-2.897(-2.929)	-3.018(-3.515)	-5.479*(-2.929)	-5.431*(-3.515)	1
		ln GDPpc	-2.094(-2.929)	-1.940(-3.515)	-4.284*(-2.931)	-4.440*(-3.518)	1
		Economic Globalization	-1.448(-2.945)	-2.163(-3.540)	-4.705*(-2.948)	-4.624*(-3.544)	1

Jamaica	1970-2015	Public Debt	-2.361(-2.929)	-2.163(-3.515)	-3.883*(-2.929)	-3.982**(-3.515)	1
		In GDPpc	-1.445(-2.929)	-1.921(-3.515)	-5.215*(-2.929)	-5.196*(-3.515)	1
		Economic Globalization	-1.782(-2.928)	-2.507(-3.513)	-6.123*(-2.929)	-6.085*(-3.515)	1
Kenya	1970-2015	Public Debt	-1.639(-2.928)	-1.433(-3.513)	-6.163*(-2.929)	-6.198*(-3.515)	1
		In GDPpc	-0.660(-2.929)	-1.880(-3.515)	-5.354*(-2.929)	-5.112*(-3.515)	1
		Economic Globalization	-2.173(-2.928)	-2.538(-3.513)	-7.873*(-2.929)	-7.832*(-3.515)	1
Lesotho	1970-2015	Public Debt	-1.885(-2.933)	-1.466(-3.520)	-5.004*(-2.935)	-5.136*(-3.523)	1
		In GDPpc	-1.125(-2.928)	-3.413(-3.513)	-6.144*(-2.929)	-6.119*(-3.515)	1
		Economic Globalization	-2.520(-2.928)	-2.751(-3.513)	-7.319*(-2.929)	-7.412*(-3.515)	1
Madagascar	1970-2015	Public Debt	-1.051(-2.929)	-1.057(-3.515)	-5.726*(-2.931)	-5.976*(-3.518)	1
		In GDPpc	-2.156(-2.928)	-1.608(-3.513)	-7.135*(-2.929)	-7.640*(-3.515)	1
		Economic Globalization	-0.750(-2.928)	-2.202(-3.513)	-7.782*(-2.929)	-7.685*(-3.515)	1
Malawi	1970-2015	Public Debt	-2.254(-2.928)	-2.133(-3.513)	-6.013*(-2.929)	-6.004*(-3.515)	1
		In GDPpc	-1.535(-2.928)	-1.829(-3.513)	-7.515*(-2.929)	-7.467*(-3.515)	1
		Economic Globalization	-1.619(-2.928)	-2.668(-3.513)	-7.662*(-2.929)	-7.647*(-3.515)	1
Malaysia	1970-2015	Public Debt	-2.675(-2.933)	-2.764(-3.520)	-3.428**(-2.929)	-3.377(-3.515)	1
		In GDPpc	-1.518(-2.928)	-2.072(-3.513)	-5.736*(-2.929)	-5.885*(-3.515)	1
		Economic Globalization	-1.461(-2.928)	-1.503(-3.513)	-6.455*(-2.929)	-6.631*(-3.515)	1
Morocco	1970-2015	Public Debt	-2.161(-2.931)	-2.183(-3.518)	-2.820(-2.931)	-3.014(-3.518)	2
		In GDPpc	0.495(-2.936)	-2.887(-3.520)	-3.962*(-2.936)	-3.976*(-3.526)	1
		Economic Globalization	-0.654(-2.928)	-3.174(-3.513)	-7.098*(-2.929)	-7.020*(-3.515)	1
Mali	1972-2015	Public Debt	-0.855(-2.928)	-1.229(-3.513)	-6.477*(-2.929)	-6.484*(-3.515)	1
		In GDPpc	-0.879(-2.928)	-3.180(-3.513)	-7.729*(-2.929)	-7.642*(-3.515)	1
		Economic Globalization	-1.616(-2.928)	-3.162(-3.513)	-7.139*(-2.931)	-7.066*(-3.518)	1
Mexico	1971-2015	Public Debt	-2.264(-2.928)	-2.185(-3.513)	-5.968*(-2.929)	-5.932*(-3.515)	1
		In GDPpc	-1.922(-2.928)	-3.312(-3.515)	-5.245*(-2.929)	-5.334*(-3.515)	1
		Economic Globalization	-0.505(-2.928)	-3.402(-3.513)	-6.609*(-2.929)	-6.177*(-3.518)	1
Mauritania	1970-2015	Public Debt	-1.743(-2.943)	-1.962(-3.536)	-4.261*(-2.943)	-4.298*(-3.536)	1
		In GDPpc	-1.553(-2.928)	-1.533(-3.513)	-7.549*(-2.929)	-8.277*(-3.515)	1
		Economic Globalization	-2.485(-2.928)	-2.460(-3.513)	-7.076*(-2.929)	-7.005*(-3.515)	1
Mauritius	1970-2015	Public Debt	-2.329(-2.929)	-2.254(-3.515)	-5.611*(-2.929)	-5.609*(-3.515)	1
		In GDPpc	0.539(-2.936)	-2.625(-3.526)	-5.561*(-2.938)	-5.612*(-3.529)	1
		Economic Globalization	0.110(-2.928)	-1.757(-3.513)	-5.487*(-2.929)	-5.504*(-3.515)	1
Nepal	1970-2015	Public Debt	-1.751(-2.929)	0.266(-3.513)	-4.514*(-2.929)	-5.775*(-3.515)	1
		In GDPpc	2.191(-2.926)	1.604(-3.510)	-0.438(-2.928)	-1.194(-3.513)	2
		Economic Globalization	-1.281(-2.928)	-1.697(-3.513)	-6.871*(-2.929)	-6.793*(-3.515)	1

Nicaragua	1970-2015	Public Debt	-2.572(-2.929)	-4.512*(-3.513)	-12.110*(-2.929)	-12.009*(-3.515)	1
		ln GDPpc	-1.814(-2.945)	-0.223(-3.513)	-4.792*(-2.929)	-5.210*(-3.515)	1
		Economic Globalization	-1.253(-2.928)	-3.144(-3.513)	-6.974*(-2.929)	-6.890*(-3.515)	1
Niger	1970-2015	Public Debt	-1.816(-2.929)	-1.225(-3.513)	-4.901*(-2.929)	-4.921*(-3.515)	1
		ln GDPpc	-2.343(-2.928)	-1.502(-3.513)	-6.334*(-2.929)	-6.846*(-3.515)	1
		Economic Globalization	-1.397(-2.928)	-2.066(-3.513)	-5.893*(-2.931)	-5.820*(-3.518)	1
Nigeria	1970-2015	Public Debt	-1.877(-2.928)	-1.861(-3.513)	-7.972*(-2.929)	-8.008*(-3.515)	1
		ln GDPpc	-0.088(-2.928)	-0.411(-3.513)	-5.718*(-2.929)	-6.173*(-3.515)	1
		Economic Globalization	-1.921(-2.928)	-1.051(-3.513)	-7.935*(-2.929)	2-8.429*(-3.515)	1
Panama	1970-2015	Public Debt	-2.584(-2.929)	-3.224(-3.515)	-3.247**(-2.929)	-3.510*(-3.515)	1
		ln GDPpc	0.774(-2.929)	-1.403(-3.515)	-4.152*(-2.931)	-4.551*(-3.518)	1
		Economic Globalization	-0.510(-2.928)	-1.420(-3.513)	-6.237*(-2.929)	-6.188*(-3.515)	1
Paraguay	1970-2015	Public Debt	-2.274(-2.928)	-2.247(-3.513)	-7.706*(-2.929)	-7.617*(-3.515)	1
		ln GDPpc	-2.180(-2.928)	-2.138(-3.513)	-4.691*(-2.929)	-4.781*(-3.515)	1
		Economic Globalization	-1.194(-2.928)	-1.931(-3.513)	-6.070*(-2.929)	-6.024*(-3.515)	1
Peru	1970-2015	Public Debt	-1.252(-2.935)	-2.727(-3.523)	-6.623*(-2.935)	-8.152*(-3.523)	1
		ln GDPpc	-0.476(-2.929)	-1.114(-3.515)	-3.950*(-2.929)	-4.196*(-3.515)	1
		Economic Globalization	-0.813(-2.928)	-2.813(-3.513)	-6.751*(-2.929)	-6.660*(-3.515)	1
Rwanda	1970-2015	Public Debt	-2.305(-2.928)	-2.321(-3.513)	-8.349*(-2.929)	-8.304*(-3.515)	1
		ln GDPpc	-0.803(-2.928)	-1.699(-3.513)	-8.086*(-2.929)	-8.186*(-3.515)	1
		Economic Globalization	0.592(-2.928)	-1.250(-3.513)	-6.239*(-2.929)	-6.464*(-3.515)	1
Senegal	1970-2015	Public Debt	-1.664(-2.928)	-1.468(-3.513)	-5.815*(-2.929)	-5.863*(-3.515)	1
		ln GDPpc	-1.129(-2.928)	-1.455(-3.513)	-7.919*(-2.929)	-8.353*(-3.515)	1
		Economic Globalization	-1.255(-2.928)	-2.793(-3.513)	-7.227*(-2.929)	-7.132*(-3.515)	1
Sierra Leone	1970-2015	Public Debt	-1.524(-2.928)	-1.204(-3.513)	-7.433*(-2.929)	-7.716*(-3.515)	1
		ln GDPpc	-1.451(-2.928)	-1.177(-3.513)	-5.758*(-2.929)	-5.792*(-3.515)	1
		Economic Globalization	-1.779(-2.928)	-3.041(-3.513)	-7.071*(-2.931)	-7.095*(-3.518)	1
South Africa	1970-2015	Public Debt	-2.409(-2.929)	-2.420(-3.515)	-4.594*(-2.929)	-4.655*(-3.515)	1
		ln GDPpc	-0.695(-2.929)	-1.265(-3.515)	-4.210*(-2.929)	-4.348*(-3.515)	1
		Economic Globalization	-1.449(-2.929)	-2.066(-3.515)	-4.781*(-2.929)	-4.724*(-3.515)	1
South Korea	1970-2015	Public Debt	0.126(-2.931)	-0.974(-3.518)	-4.549*(-2.931)	-4.952*(-3.518)	1
		ln GDPpc	-3.730*(-2.928)	0.151(-3.513)	-4.925*(-2.929)	-6.276*(-3.515)	1
		Economic Globalization	-0.439(-2.928)	-1.733(-3.513)	-6.722*(-2.929)	-6.642*(-3.515)	1
Thailand	1970-2015	Public Debt	-2.824(-2.929)	-3.283(-3.515)	-3.768*(-2.929)	-3.722**(-3.515)	1
		ln GDPpc	-1.235(-2.929)	-1.672(-3.515)	-3.968*(-2.929)	-4.074**(-3.515)	1
		Economic Globalization	-0.930(-2.928)	-1.378(-3.513)	-6.452*(-2.929)	-6.450*(-3.515)	1

Trinidad and Tobago	1970-2015	Public Debt	-1.115(-2.928)	-1.239(-3.513)	-5.576*(-2.929)	-5.526*(-3.515)	1
		ln GDPpc	-0.841(-2.929)	-2.725(-3.523)	-2.978**(-2.929)	-2.954(-3.515)	1
		Economic Globalization	-1.279(-2.928)	-1.769(-3.513)	-6.254*(-2.929)	-6.185*(-3.515)	1
Togo	1970-2015	Public Debt	-2.675(-2.936)	-3.158(-3.526)	-5.323*(-2.938)	-5.464*(-3.529)	1
		ln GDPpc	-1.858(-2.928)	-2.261(-3.513)	-6.700*(-2.929)	-6.634*(-3.515)	1
		Economic Globalization	-1.788(-2.928)	-1.944(-3.513)	-6.585*(-2.929)	-6.645*(-3.515)	1
Tunisia	1970-2015	Public Debt	-1.187(-2.928)	-1.438(-3.513)	-6.792*(-2.929)	-6.712*(-3.515)	1
		ln GDPpc	-1.820(-2.928)	-2.805(-3.513)	-6.754*(-2.929)	-6.832*(-3.515)	1
		Economic Globalization	-1.995(-2.928)	-3.255(-3.513)	-8.218*(-2.929)	-8.336*(-3.515)	1
Turkey	1970-2015	Public Debt	-1.657(-2.928)	-1.896(-3.513)	-5.953*(-2.929)	-5.892*(-3.515)	1
		ln GDPpc	0.569(-2.928)	-1.806(-3.513)	-6.322*(-2.929)	-6.380*(-3.515)	1
		Economic Globalization	-1.140(-2.928)	-1.703(-3.513)	-8.097*(-2.929)	-8.060*(-3.515)	1
Uruguay	1970-2015	Public Debt	-2.495(-2.929)	-2.735(-3.515)	-4.579*(-2.929)	-4.534*(-3.515)	1
		ln GDPpc	-0.629(-2.929)	-3.069(-3.515)	-3.526**(-2.929)	-3.509**(-3.515)	1
		Economic Globalization	-1.428(-2.928)	-2.350(-3.515)	-5.840*(-2.929)	-5.939*(-3.515)	1
Zambia	1970-2015	Public Debt	-1.524(-2.928)	-1.646(-3.513)	-6.708*(-2.929)	-6.777*(-3.513)	1
		ln GDPpc	-1.656(-2.933)	0.270(-3.513)	-5.339*(-2.929)	-7.035*(-3.515)	1
		Economic Globalization	-3.768*(-2.928)	-3.946**(-3.513)	-9.163*(-2.929)	-9.054*(-3.515)	0
Zimbabwe	1970-2015	Public Debt	-1.919(-2.928)	-2.505(-3.513)	-5.583*(-2.929)	-5.519*(-3.515)	1
		ln GDPpc	-1.743(-2.929)	-2.342(-3.515)	-4.381*(-2.929)	-4.23*(-3.515)	1
		Economic Globalization	-1.597(-2.948)	-2.481(-3.544)	-6.089*(-2.951)	-6.032*(-3.548)	1

* Indicates significance at the 5 percent level. Numbers in the Table are the pseudo t-statistics for testing the null hypothesis that the series is non-stationary. Critical values at 0.05 are in parenthesis. $I(1)$ $d_{max}=1$.

Table 4. Unit Root Test Results.

As discussed in the first section, public debt can significantly influence economic growth, and growth can be affected by public debt. Following the current literature, I focus on the causal linkage between debt and growth of a country in the models to have the causal relation and the direction of causality running among considered variables with the control variable, economic globalization. Accordingly, the models can be specified as follows:

Public Debt equation (1):

$$\begin{aligned}
 PD_t = & \alpha_0 + \sum_{i=1}^k \beta_{1i} PD_{t-i} + \sum_{j=k+1}^{d_{max}} \beta_{2j} PD_{t-j} + \sum_{i=1}^k \gamma_{1i} \ln GDP_{t-i} + \sum_{j=k+1}^{d_{max}} \gamma_{2j} \ln GDP_{t-j} \\
 & + \sum_{i=1}^k \theta_{1i} Ecog_{t-i} + \sum_{j=k+1}^{d_{max}} \theta_{2j} Ecog_{t-j} + \varepsilon_{1t}
 \end{aligned}$$

Economic Growth equation (2):

$$\ln GDP_t = \tilde{\alpha}_0 + \sum_{i=1}^k \tilde{\beta}_{1i} PD_{t-i} + \sum_{j=k+1}^{d_{max}} \tilde{\beta}_{2j} PD_{t-j} + \sum_{i=1}^k \tilde{\gamma}_{1j} \ln GDP_{t-i} + \sum_{j=k+1}^{d_{max}} \tilde{\gamma}_{2j} \ln GDP_{t-j} + \sum_{i=1}^k \tilde{\theta}_{1i} EcoG_{t-i} + \sum_{j=k+1}^{d_{max}} \tilde{\theta}_{2j} EcoG_{t-j} + \varepsilon_{2t}$$

where PD_t and $\ln PD_{t-1}$ are the current and lagged levels of public debt of a country at periods t and $t-1$; $\ln GDP_{t-1}$ is the lagged natural logarithm of real per capita GDP of a country at time $t-1$. k is the optimal lag order, d_{max} is the maximal order of integration of the series in the system and $\varepsilon_1, \varepsilon_2$ are the error terms that are assumed to be white noise. Conventional Wald tests were then applied to the first k coefficient matrices using the standard χ^2 - statistics. To test the hypothesis that I have from equation (1), 'Public Debt does not Granger cause Economic Growth' if $H_0: \gamma_{1i} = 0$ against $H_1: \gamma_{1i} \neq 0$, and in equation (2), 'Economic Growth does not Granger cause Public Debt' if $H_0: \gamma_{2i} = 0$ against $H_1: \gamma_{2i} \neq 0$, for every $i=1, 2, \dots, k$.

4. EMPIRICAL RESULTS

In this section, I report the results of unit root tests in Table 4 and Toda-Yamamoto (1995) augmented Granger non-causality tests for the VAR models (1) and (2) for each country in Table 5. I also present summarized results in Table 6.

To provide the order of integration, I use the Augmented Dickey-Fuller (ADF) unit root test frequently used in the literature, to determine the stationarity of the series. The test is performed on a country-by-country basis. The results of the unit root test for the variables in their levels and first differences are reported in Table 4. The results show that the first differences of the economic growth, public debt, and economic globalization series are stationary, implying that these variables are integrated of order one, $I(1)$ at the 5 % significance level for all countries, except Bolivia, Democratic Republic of Congo, Costa Rica, Morocco and Nepal in which the variables are integrated of order two.

Furthermore, the Akaike information criterion (AIC) is applied for the selection of the optimal order of the lag length of the VAR model for each country. The results of the determination of the optimal lag length of each VAR models, out of a maximum of 4 lengths, are determined by AIC. Besides, the $\chi^2(1)$ statistics indicate that there is no serial correlation against order 1 for these lag lengths determined by AIC.

As suggested above, a Granger causality procedure developed by Toda and Yamamoto is employed to determine the direction of causality. Unit root test results and Table 4 report the optimal lag length (k), VAR order ($k+d_{max}$), MWald statistics, p-values and direction of causality in the VAR model for each country. The results in Table 5 show that both the null hypotheses of Granger non-causal relationship among Economic Globalization, Public Debt, and Economic Growth.

Country	Lags	Ecog>PD		GDPpc >PD		Ecog>GDPpc		PD>GDPpc		GDPpc>Ecog		PD>Ecog	
		Wald statistic	p-value	Wald statistic	p-value	Wald statistic	p-value	Wald statistic	p-value	Wald statistic	p-value	Wald statistic	p-value
Algeria	2(d=1, lag=1)	7.703*	0.005	1.328	0.249	12.900*	0.001	7.993*	0.004	2.685	0.101	1.690	0.193
Albania	2(d=1, lag=1)	4.096**	0.042	8.117*	0.004	2.368	0.123	8.473*	0.003	9.656*	0.001	2.298	0.129
Angola	2(d=1, lag=1)	2.656	0.103	0.030	0.862	7.068*	0.007	7.140*	0.007	0.887	0.346	2.576	0.108
Argentina	2(d=1, lag=1)	11.518*	0.001	2.927	0.087	0.947	0.330	5.216**	0.022	4.562**	0.032	1.260	0.261
Burundi	2(d=1, lag=1)	1.404	0.236	2.876	0.089	7.079*	0.007	1.417	0.233	5.630**	0.017	5.803**	0.015
Benin	2(d=1, lag=1)	1.816	0.177	9.024*	0.002	1.576	0.209	1.259	0.261	2.150	0.142	2.772	0.095
Burkina Faso	2(d=1, lag=1)	2.016	0.155	2.863	0.090	1.743	0.186	0.053	0.817	5.670**	0.017	2.125	0.144
Bangladesh	2(d=1, lag=1)	5.501**	0.019	3.170	0.075	8.849*	0.002	3.152	0.075	1.232	0.267	4.473**	0.034
Bolivia	5(d=2, lag=1)	15.518*	0.001	29.253*	0.001	4.801	0.090	15.828*	0.001	8.902**	0.011	15.518*	0.001
Brazil	2(d=1, lag=1)	0.504	0.477	3.667	0.055	11.670*	0.001	0.102	0.749	6.934*	0.008	1.281	0.257
Barbados	2(d=1, lag=1)	1.687	0.193	7.252*	0.007	0.676	0.410	1.655	0.198	7.045*	0.007	7.139*	0.007
Bhutan	2(d=1, lag=1)	1.160	0.281	5.582**	0.018	0.503	0.478	0.997	0.318	4.883**	0.027	2.086	0.148
Botswana	2(d=1, lag=1)	2.898	0.088	5.836**	0.015	0.079	0.778	0.345	0.556	3.636	0.056	0.962	0.326
Bulgaria	2(d=1, lag=1)	2.381	0.122	1.355	0.244	2.618	0.105	1.630	0.201	16.929*	0.001	9.072*	0.002
Cape Verde	2(d=1, lag=1)	4.566**	0.032	8.926*	0.002	4.782**	0.028	1.115	0.290	0.596	0.440	0.413	0.520
Cameroon	2(d=1, lag=1)	1.654	0.198	2.607	0.106	6.244**	0.012	4.263**	0.038	2.136	0.143	5.189**	0.022
Central Af. R.	2(d=1, lag=1)	2.126	0.144	2.737	0.098	0.079	0.778	0.720	0.396	4.379**	0.036	2.596	0.107
Chad	2(d=1, lag=1)	0.392	0.531	1.235	0.266	11.600*	0.001	7.536*	0.006	1.969	0.160	2.414	0.120
Chile	3(d=1, lag=2)	9.817*	0.007	10.363*	0.005	2.521	0.283	11.642*	0.002	2.454	0.293	0.845	0.655
China	2(d=1, lag=1)	3.477	0.062	6.249**	0.012	4.177**	0.040	1.451	0.228	3.634	0.056	4.309**	0.037
Dem.R.Congo	4(d=2, lag=2)	5.199	0.157	1.379	0.710	8.411**	0.038	16.986*	0.001	10.246**	0.016	1.791	0.616
Rep. of Congo	2(d=1, lag=1)	3.899**	0.048	2.153	0.142	2.668	0.102	2.531	0.111	0.587	0.443	2.636	0.104
Colombia	2(d=1, lag=1)	1.067	0.301	7.801*	0.005	1.799	0.179	0.313	0.575	8.117*	0.004	12.166*	0.001
Comoros	2(d=1, lag=1)	2.388	0.122	2.080	0.149	2.431	0.118	0.263	0.608	6.945*	0.008	0.168	0.681
Costa Rica	3(d=2, lag=1)	4.058	0.131	5.733	0.056	0.548	0.760	25.755*	0.001	0.928	0.628	1.069	0.585
Dominican R.	2(d=1, lag=1)	7.921*	0.004	7.478*	0.001	3.953**	0.046	1.579	0.208	6.557*	0.010	4.493**	0.034
Ecuador	2(d=1, lag=1)	7.542*	0.006	5.734**	0.016	3.230	0.072	7.960*	0.004	2.060	0.151	0.498	0.480
Egypt	2(d=1, lag=1)	2.388	0.122	2.272	0.131	3.262	0.070	2.468	0.116	1.497	0.221	3.004	0.083
El Salvador	3(d=1, lag=2)	9.491*	0.008	15.972*	0.001	3.386	0.183	2.023	0.363	2.843	0.241	1.160	0.559
Ethiopia	2(d=1, lag=1)	1.094	0.295	6.607*	0.010	7.396*	0.006	1.480	0.223	1.525	0.216	2.614	0.105
Fiji	2(d=1, lag=1)	3.326	0.068	1.420	0.233	8.778*	0.003	5.696**	0.017	0.389	0.532	4.816**	0.028
Gabon	2(d=1, lag=1)	0.039	0.843	2.940	0.086	6.266**	0.012	0.057	0.811	1.428	0.232	1.941	0.163
Ghana	2(d=1, lag=1)	0.333	0.563	2.122	0.145	4.693**	0.030	1.449	0.228	1.152	0.283	12.840*	0.001
Gambia	2(d=1, lag=1)	7.695*	0.005	7.897*	0.004	8.421*	0.003	12.915*	0.001	0.965	0.325	2.008	0.156
Equatorial G.	2(d=1, lag=1)	5.445**	0.019	4.191**	0.040	16.530*	0.001	2.426	0.119	6.276**	0.012	8.462*	0.003
Guatemala	3(d=1, lag=2)	5.330	0.069	5.691	0.058	18.165*	0.001	2.454	0.293	3.400	0.182	9.060	0.107

Guyana	2(d=1, lag=1)	3.775	0.052	2.822	0.092	0.988	0.320	0.142	0.706	5.503**	0.018	0.012	0.912
Honduras	3(d=1, lag=2)	15.968*	0.001	6.950**	0.030	6.237**	0.044	4.117	0.127	11.345*	0.003	10.569*	0.005
Indonesia	3(d=1, lag=2)	1.262	0.532	1.137	0.566	2.346	0.309	1.430	0.489	2.117	0.346	0.172	0.917
India	2(d=1, lag=1)	7.327*	0.006	8.091*	0.004	0.788	0.374	2.385	0.122	1.204	0.272	5.070**	0.024
Iran	2(d=1, lag=1)	1.925	0.165	10.614*	0.001	10.737*	0.001	1.417	0.233	5.581**	0.018	6.183**	0.012
Jamaica	3(d=1, lag=2)	4.960	0.083	3.862	0.145	2.818	0.244	15.540*	0.001	3.162	0.205	0.900	0.637
Kenya	2(d=1, lag=1)	5.920**	0.014	4.183**	0.040	4.747**	0.029	1.879	0.170	2.936	0.086	3.052	0.080
Lesotho	2(d=1, lag=1)	5.608**	0.017	0.451	0.501	2.543	0.110	0.350	0.554	4.944**	0.026	2.873	0.090
Madagascar	2(d=1, lag=1)	18.395*	0.001	6.039**	0.013	1.364	0.242	1.658	0.197	7.224*	0.007	0.127	0.721
Malawi	3(d=1, lag=2)	8.888**	0.017	4.431	0.109	16.701*	0.001	0.355	0.837	5.741	0.056	11.311*	0.003
Malaysia	3(d=1, lag=2)	0.159	0.923	4.139	0.126	1.456	0.482	4.748	0.093	3.695	0.157	1.411	0.493
Morocco	4(d=2, lag=2)	6.527	0.088	9.228**	0.026	10.035**	0.018	4.344	0.226	21.535*	0.001	6.992	0.072
Mali	2(d=1, lag=1)	8.510*	0.003	10.330*	0.001	6.755*	0.009	2.046	0.152	11.998*	0.001	8.873*	0.002
Mexico	2(d=1, lag=1)	8.989*	0.002	10.177*	0.001	10.046*	0.001	0.698	0.403	6.889*	0.008	5.313**	0.021
Mauritania	2(d=1, lag=1)	4.541**	0.330	0.962	0.326	1.884	0,169	3.573	0.058	1.578	0.209	3.681	0.055
Mauritius	2(d=1, lag=1)	4.139**	0.041	6.408**	0.011	2.987	0.083	6.113**	0.013	3.564	0.059	2.321	0.127
Nepal	2(d=1, lag=1)	2.165	0.141	4.893**	0.026	5.367*	0.020	10.360*	0.001	4.620**	0.031	6.438**	0.011
Nicaragua	2(d=1, lag=1)	21.846*	0.001	6.041**	0.013	4.078**	0.043	1.199	0.273	3.207	0.073	2.288	0.130
Niger	2(d=1, lag=1)	3.664	0.055	3.633	0.056	0.955	0.328	5.611**	0.017	3.824**	0.050	5.834**	0.015
Nigeria	2(d=1, lag=1)	1.290	0.256	8.716*	0.003	5.518**	0.018	3.469	0.062	3.003	0.083	0.102	0.749
Panama	3(d=1, lag=2)	4.402	0.110	0.247	0.883	7.858**	0.019	10.223*	0.006	1.790	0,48	0.967	0.616
Paraguay	2(d=1, lag=1)	4.730**	0.029	9.523*	0.002	2.930	0.086	1.207	0.271	4.047**	0.044	1.677	0.195
Peru	2(d=1, lag=1)	7.818*	0.005	7.041*	0.007	6.067**	0.013	3.925**	0.047	5.443**	0.019	4.564**	0.032
Rwanda	2(d=1, lag=1)	2.720	0.099	3.576	0.058	12.062*	0.001	3.350	0.067	7.282*	0.006	1.311	0.252
Senegal	2(d=1, lag=1)	10.429*	0.001	1.919	0.165	8.317*	0.003	3.862**	0.049	0.068	0.794	0.576	0.447
Sierra Leone	2(d=1, lag=1)	2.838	0.092	0.016	0.899	2.462	0.116	18.061*	0.001	6.576*	0.010	8.954*	0.002
South Africa	2(d=1, lag=1)	0.404	0.525	0.669	0.413	9.058*	0.002	3.602	0.057	1.524	0.217	2.429	0.119
South Korea	2(d=1, lag=1)	7.526*	0.006	3.595	0.057	3.829**	0.050	2.208	0.137	4.152**	0.041	3.306	0.069
Thailand	3(d=1, lag=2)	0.945	0.623	0.445	0.800	9.373*	0.009	20.873*	0.001	14.137*	0.001	11.476*	0.002
Trinidad and Tobago	3(d=1, lag=2)	6.004**	0.049	3.932	0.140	12.453*	0.001	1.367	0.504	3.441	0.178	21.814*	0.001
Togo	2(d=1, lag=1)	5.213**	0.022	1.726	0.188	0.270	0.603	1.171	0.279	3.544	0.059	1.677	0.195
Tunisia	3(d=1, lag=2)	4.655	0.097	0.448	0.799	3.813	0.148	3.486	0.174	14.567*	0.001	8.882**	0.011
Turkey	2(d=1, lag=1)	3.807**	0.050	2.086	0.148	0.278	0.598	2.252	0.133	0.569	0.450	1.246	0.264
Uruguay	3(d=1, lag=2)	1.279	0.527	10.016*	0.006	1.280	0.527	0.434	0.804	8.251**	0.016	6.653**	0.035
Zambia	2(d=1, lag=1)	6.575*	0.010	1.185	0.276	13.599*	0.001	16.321*	0.001	3.707	0.054	1.389	0.238
Zimbabwe	3(d=1, lag=2)	3.894	0.142	1.839	0.398	10.916*	0.004	19.962*	0.001	3.241	0.197	0.897	0.638

* Indicates rejection of the null at the 1 percent.

** Indicates rejection of the null at the 5 percent.

Table 5. Toda and Yamamoto non-causality test results.

The results in Table 4 shows that the Toda-Yamamoto augmented Granger causality is statistically significant in 45 countries. While there is unidirectional causality from economic growth to public debt in 21 countries, in 15 countries the causality is in the opposite direction. Only in 9 countries, there is the validity of feedback causality.

The causality is running from economic growth to public debt in 21 economies, which consist of 4 less developed (Ethiopia, Mali, Bhutan and Madagascar), 17 developing (Barbados, Cape Verde, Colombia, Dominican Republic, El Salvador, India, Mexico, Nigeria, Paraguay, Uruguay, Botswana, China, Equatorial Guinea, Honduras, Kenya, Morocco, Nicaragua). The empirical results provide evidence that either effective or ineffective economic policies, that influence economic growth in these economies lead to a change in government debt ratios in these economies.

Furthermore, the causality in opposite direction suggesting that public debt causes economic growth is valid in 15 countries, including 7 less developed (Angola, Chad, Democratic Republic of Congo, Niger, Senegal, Sierra Leone, and Zambia), 8 developing (Algeria, Argentina, Cameroon, Costa Rica, Fiji, Panama, Thailand, and Zimbabwe). These results reflect that these countries could apply fiscal policies, such as expansionary or contractionary, to change either the structure of aggregate demand or the long term interest rates in these economies. The change in the public debt ratio leads to a favorable or an adverse effect on capital inflows in these countries that could result in low or high economic growth rates.

In addition, I find feedback causality in 2 less developed countries (Gambia and Nepal) and 7 developing (Albania, Bolivia, Chile, Iran, Peru, Ecuador, Mauritius). There is no empirical evidence on the mutual relation between fiscal policies and growth in less developed countries.

The above results provide that in the major part of the statistically significant cases, every country in different economic development levels could confront problems with the public debt which could rely on unsustainable fiscal deficits leads to high real interest rates. According to Elmendorf and Mankiw (1998), the fiscal deficits make a reduction in the national savings and a rise in the aggregate demand in the economy. In addition, public debt may cause an adverse effect on labor supply and economic growth through lower investment levels. The results are summarized in Tables 6a and 6b.

	Statistically significant cases		Statistically insignificant cases
	1 %	5 %	
Economic growth → Public Debt	Barbados, Cape Verde, Colombia, Dominican Republic, El Salvador, Ethiopia, India, Mali, Mexico, Nigeria, Paraguay, Uruguay	Bhutan, Botswana, China, Equatorial Guinea, Honduras, Kenya, Madagascar, Morocco, Nicaragua	42
Public Debt → Economic Growth	Algeria, Angola, Chad, Democratic Republic of Congo, Costa Rica, Panama, Sierra Leone, Thailand, Zambia, Zimbabwe	Argentina, Cameroon, Fiji, Niger, Senegal	48
Economic Growth → Public Debt	Albania, Bolivia, Chile, Gambia, Iran, Peru, Ecuador, Mauritius, Nepal		

Table 6a. Summary of the Toda-Yamamoto augmented Granger Causality Test Results.

On the other hand, the causality is running from economic globalization to public debt in 22 economies, which consist of 7 less developed (Gambia, Madagascar, Mauritania, Lesotho, Senegal, Togo and Zambia), 15 developing (Algeria, Argentina, Chile, Dominican Republic, Ecuador, El Salvador, Nicaragua, South Korea, Albania, Cape Verde, Republic of Congo, Kenya, Mauritius, Paraguay and Turkey). The results suggest that the integration to either trade or financial global system leads to a higher government in these countries.

Furthermore, the causality in opposite direction suggesting public debt causes economic globalization is valid in 15 countries, including 4 less developed (Burundi, Nepal, Niger, and Sierra Leone), 11 developing (Bulgaria, Colombia, Ghana, Cameroon, China, Dominican Republic, Fiji, Iran, Thailand, Tunisia, and Uruguay). These empirical results indicate that the government debt in these countries could cause the level of economic relations between the domestic and global economy. This could be either coming from tax competitiveness or fiscal accountability and credibility of the governments of these countries.

In addition, I find feedback causality in 3 less developed countries (Bangladesh, Mali, and Malawi) and 7 developing (Bolivia, Equatorial Guinea, Honduras, India, Mexico, Peru and Trinidad, and Tobago). There is no empirical evidence on the mutual relation among fiscal policies and the integration to the world economic system in these economies.

	Statistically significant cases		Statistically insignificant cases
	1 %	5 %	
Ecog → Public Debt	Algeria, Argentina, Chile, Dominican Republic, Ecuador, El Salvador, Gambia, Madagascar, Nicaragua, Senegal, South Korea, Zambia	Albania, Cape Verde, Republic of Congo, Kenya, Lesotho, Mauritania, Mauritius, Paraguay, Togo, Turkey	40
Public Debt → Ecog	Bulgaria, Colombia, Ghana, Sierra Leone, Thailand	Burundi, Cameroon, China, Dominican Republic, Fiji, Iran, Nepal, Niger, Tunisia, Uruguay	47
Ecog → Public Debt	Bolivia, Honduras, India, Mali, Mexico, Peru, Bangladesh, Equatorial Guinea, Malawi, Trinidad and Tobago		

Table 6b. Summary of the Toda-Yamamoto augmented Granger Causality Test Results.

5. CONCLUSION

In this study, I empirically analyze the existence and directions of a causal relationship between public debt and economic growth in 72 countries having various income levels, for the period of 1970–2015, accordingly the data availability of the country. To this end, I utilize the Toda-Yamamoto augmented Granger non-causality test for our models. I find a significant causal relation running from public debt to economic growth in twenty-two countries and unidirectional causality from growth to public debt in fifteen countries. Furthermore, I observe mutual causal linkage in only nine countries.

The empirical results indicate that there is only twenty-three economies do not show any causal relationship between public debt ratios and their economic growth rates. It can be seen that in the other countries fiscal policies or the change in the structure of growth cause statistically significant changes between either unidirectional or bidirectional. The economic integration of these economies into the world economy affects mainly their adjustment programs. In order to be a significant economic partner in either international trade or financial system, policymakers, especially in less and developing countries should take the significance of public debt sustainability and strong economic conditions associated with stable political environments into account. According to that, a future study could address the quest for the relationship between public debt and economic growth taking the tendencies of developing and less developed countries into account for explaining the effectiveness of government policies.

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