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Economic growth and public debt: patterns and lessons between advanced, emerging, and declining growth economies

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ECONOMIC GROWTH AND PUBLIC DEBT:

PATTERNS AND LESSONS BETWEEN ADVANCED, EMERGING, AND DECLINING GROWTH ECONOMIES.

A Master's Thesis submitted in fulfilment of the Degree of

Master of Commerce (Economics) in the School of Economics and Finance, University of the Witwatersrand

by

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ABSTRACT

This research investigates the causal relationship between economic growth and public debt for economies in different growth categories: advanced, emerging and declining-growth economies, the latter being a new category introduced by this study. The study aims to answer the question: Does the level of economic growth affect public debt accumulation? The results reveal that in advanced economies growth is not a significant explanatory variable for public debt accumulation nor is there a significant long-run relationship between growth and public debt. For emerging and declining growth economies, the opposite holds- economic growth is a significant explanatory variable for public debt accumulation.

1. INTRODUCTION

Economies in the current era are said to be confronting a peacetime surge in public debt, levels of which were last observed during the great depression of the 1930s (Reinhart & Rogoff, 2010). In this same period, some economies have managed to grow, while others have experienced declining economic growth. Following the seminal contribution by (Reinhart & Rogoff, 2010) titled "*Growth in a Time of Debt*", much of the literature is dominated by studies analyzing the relationship between the two real variables as running from debt to growth (either directly or indirectly) and only a handful of empirical studies point to the bi-directional or reverse causality between the two real variables. This therefore has informed the objective of this study, which is three-fold. The first objective is to investigate the statistical strength of the causal effect when causality runs from growth to debt. At the basic level, the main argument that this study presents is that when revenues fall short governments are obliged to borrow to fill the gap between the expenditures and the revenues during fiscal periods, and the shortfalls can occur even in the absence of fiscal or financial crises. That is, periods of low growth result in the accumulation of public debt. This was true during the great depression where governments were forced to borrow in order to stimulate economic activity. The same applied during the financial crisis of 2008/2009. However, public debt accumulation due to declining growth can occur even outside crisis periods.

The second objective of this study is to look at the important but neglected category of countries- declining- growth economies. In addition to advanced and emerging economies, this study looks at the causal effect of growth on public debt accumulation in these countries. Declining growth economies can be defined as economies that have experienced close to zero or negative growth rates for sustained periods of time based on the data available. Examples of such countries would include Haiti and Kuwait to mention a few.

The third objective of this study is to use statistically robust methodologies not used in past literature due to the implicit assumptions made about the statistical nature of the variables in question. For instance, the existing body of literature which argues that high public debt levels

hamper economic growth is based on the negative correlation between public debt and economic growth in both advanced and emerging economies (Reinhart & Rogoff, 2009), (Reinhart & Rogoff, 2010), (Reinhart & Rogoff, 2010); (Reinhart, et al., 2012); (Kumar & Woo, 2010); (Cecchetti, et al., 2011); (Cecchetti-Westphal & Rother, 2012); (Furceri & Zdzienicka, 2012). Statistically, however, correlation does not necessarily imply causation. Therefore, the strong correlation between public debt (as a percentage of gdp) and economic growth (measured by annual gdp growth) could also be driven by that low economic growth can lead to the accumulation of public debt (Reinhart, et al., 2012).

The hypothesis of this empirical study is thus formulated as follows: Does economic growth have a significant causal effect on the accumulation of public debt? How does the effect vary across advanced, emerging, and declining growth economies? Finally, this analysis identifies the channels through which the effect is transmitted and the cross-category patterns and lessons that may aid in policymaking.

2. A LITERATURE REVIEW ON THE DEBT-GROWTH NEXUS

The question "why do governments borrow?" may appear trivial and redundant, but this study illustrates that it is an important, yet missing piece of the debt-growth nexus.

2.1 From Debt to Growth

High public debt levels imply higher future taxes or lower future government spending, leading to low economic growth in the future, ceteris paribus (Viega, et al., 2014). This points to a long-run relationship between growth and debt where causality runs from debt to growth. In their seminal paper (Reinhart & Rogoff, 2010) investigate the contemporaneous (short-run) link between debt, growth, and inflation for the world's most wealthy economies.

Using a sample of 44 countries, advanced and emerging, Reinhart & Rogoff discovered thresholds and nonlinearities in the debt-growth relation. Their results suggest that the relationship between public debt and real gdp growth is weak for debt-to-gdp ratios below a specific threshold and strong, but negative beyond the threshold. For advanced economies, median growth rates fall by 1% when the debt level is above 90% of gdp, and mean growth falls by significantly more. emerging economies have a lower threshold of 60% of gdp beyond which annual growth rates were found to decline by approximately 2%. For higher levels of debt, growth rates are reduced in half. The caveat to these results, however, is that they are based on correlations, which for the sake of statistical robustness do not imply causation.

The literature that dates before the Global Financial Crisis of 2007/8 such as (Modigliani, 1961), (Diamond, 1965), and later (Saint Paul, 1992), based on a sample of advanced economies also argued that an increase in public debt will always decrease the growth rate of the economy. In contrast, authors who looked at mixed samples such as (Shclarek, 2004), concluded that, for

emerging economies, there is always a significant and negative relationship between public debt and economic growth. However, for advanced countries, no robust evidence of a relationship between the two variables was found, suggesting that high levels of public debt are not necessarily associated with low gdp growth for this coutntry-category. This evidence suggests that there is a clear distinction in the debt-growth relation between countries in different growth categories.

2.2 From Growth to Debt

Severe economic downturns can lead to the accumulation of high public debt and have a negative impact on growth contemporaneously and or with a lag (Reinhart & Rogoff, 2014). Crises such as banking crises weaken fiscal positions, which results in the contraction of government revenues. The effect of economic growth on public debt becomes pronounced and significant only during or as an aftereffect of crises and cyclical downturns (Reinhart & Rogoff, 2008). However, in contrast to the argument presented by Reinhart & Rogoff, government revenues do not only contract during crisis times. All else constant, there are several reasons why governments borrow: Investment, to stimulate economic activity, to cover fiscal deficits.

In the wake of the Global Financial Crisis, many economies responded to the crisis with an exceptionally large debt-financed fiscal stimulus. In the United States, for instance, the Obama administration in 2009 approved the American Recovery and Reinvestment Act, a plan of USD 831 billion—about 5.5 percent of GDP— which was aimed at creating jobs and boosting investment. Post the crisis, government debt increased significantly from 64 percent of GDP in 2007 to above 100 percent in 2012. In advanced economies the average debt-to-GDP ratio rose from about 60 percent in 2007 to over 90 percent in 2016. Stimulus spending and cyclically-lower revenues also resulted in higher public debt in many emerging markets as well. With China being a case in point- the government embarked on a massive infrastructure and public investment program, spending more than 6 percent of GDP in discretionary stimulus measures and allowing public debt to increase from 29 percent of GDP in 2007 to 44 percent of GDP by 2016. More recently, the big infrastructure push associated with the China's Belt and Road Initiative is also contributing to growing public debts and possibly to sustainability risks in some emerging market and developing countries ((Fatas, et al., 2019) .

Panizza & Presbitero (2014) & Donayre & Taivan (2017) present the argument that there is no robust empirical evidence that public debt has a *causal* effect on economic growth in the light of the fact that it is a negative correlation between debt and gdp growth that is used in the literature to arrive at the conclusion. In their approach, Panizza & Presbitero (2014) employ an instrumental variable approach, the results of which indicate that the negative correlation between debt and growth disappears once the results are corrected for endogeneity. Albeit this result, Panizza & Presbitero (2014) do not proceed to test whether growth has a *causal* effect on public debt. This is the gap that this study aims to fill.

Donayre & Taivan (2017) on the other hand analyze the direction of causality in a sample of 20 OECD countries for 40 years starting in 1970 employing both Granger tests and VAR-based tests. The authors found that while modern welfare states tend to face low real growth following increases in public debt, more traditional welfare states and those with larger governments typically exhibit either causality from low growth to debt accumulation or bidirectional causality. Thus, the heterogeneity of the results suggests caution when making general statements about the relationship between these variables. In particular, the causal link is intrinsic to each country, and it cannot be inferred that higher debt always leads to lower economic growth.

3. DATA AND METHODOLOGY

3.1. Data Sample and Sources

The sample consists of 22 countries over the period 1980-2019. The sample is made up of 8 advanced economies (AEs), 6 emerging market economies (EMEs), and 8 declining growth economies (DGEs). A significant challenge that limited the sample size was data availability. In addition to meeting the country-group definition criteria, the countries included in the sample were chosen based on having data points available for at least half of the sample period. The International Monetary Fund (IMF) defines advanced economies as the most advanced countries in the world. Although there is no established numerical convention to determine whether an economy is advanced or not advanced economies are generally defined as having *sustained* positive GDP growth, high levels of per capita income, a varied export base, and financial sectors that are integrated into the global financial system. Conversely, since emerging market economies are diverse and do not conform to a uniform definition the IMF identifies and classifies emerging markets based on attributes such as sustained market access, *progress* in positive economic growth rates, reaching middle-income levels, and greater global economic relevance. This study employs the classification criteria of the IMF to define the third category-declining growth economies. This category includes economies that are the least advanced, have experienced sustained low and negative GDP growth rates, have low levels of per capita income and have lower global relevance.

3.2 Variables

For the purpose of this investigation, the economic growth rate is measured by the percentage change in real annual GDP. Public debt is measured by the debt-to-GDP ratio in percentages. The data for both variables and all countries are derived from the comprehensive (International Monetary Fund, 2021) Database. The sample period spans from 1980 to 2019.

3.3. Unit Root Tests

The majority of past empirical studies on the growth-debt nexus have ignored the times series properties of the GDP growth and public debt and series (De Vita, Trachanas, & Luo, 2018). Testing for the presence of unit roots before any regression is performed is crucial for determining the statistical methods to be employed and to

avoid obtaining spurious regressions which provide misleading results such as significant coefficients and high explanatory power of models where a relationship between the variables in question may be non-existent (Ventosa-Santaularia, 2009). To informally test for the presence of unit roots we study the line plots of the individual time series. Formally, we employ the *advanced* Augmented Dickey-Fuller (ADF) test that can detect the presence of a structural break under the null hypothesis, which makes this approach considerably more advanced than the conventional ADF and KPSS tests. Structural breaks are intermittent shocks that have a permanent effect on time series. If not taken into consideration the basic unit root tests may detect them as unit-roots.

3.4. Cointegration Tests

Once the stationarity of the unit-roots has been established, we proceed to answer the question: Is there a long-run relationship (cointegration) between public debt and growth? The most widely used method to test for cointegration and the direction of causality between the time series is the Granger Causality test. The disadvantage of the test lies in that it requires both series to be level stationary. Thus, for this analysis, we employ the Autoregressive Distributive Lags (ARDL) approach to investigate the existence of a long-run relationship between debt and growth. The advantage of the ARDL approach is that it allows for causality tests to be conducted even when the order of integration of the time series is unknown or not the same (Pesaran, Shin, & Smith, 2001). Additionally, the ARDL approach also addresses potential endogeneity (Pesaran, Shin, & Smith, 2001).

The ARDL(*p*,*q*) model specification is given by:

$$\Delta D_t = \mu + \rho D_{t-1} + \theta Y_t + \sum \Delta D\, t - j + \sum \Delta Y t - j + e_t$$

$$\Delta Y_t = \mu + \rho D_{t-1} + \theta Y_t + \sum \Delta Y\, t - j + \sum \Delta D t - j + e_t$$

where

et ~ IID (0, $\sigma^{2)}$

μ- Mean.

θ- Coefficient of significance.

p- Order of Integration for the D_t time series.

q- Order of Integration for the Y_t time series.

ΔY_{t-j} – Annual % change in GDP at time t-j.

ΔD_{t-j} - Public debt-to-GDP ratio at time t-j.

To verify the results of the ARDL test, we use the modified *F*-test (*F*PSS) advanced by (Pesaran, Shin, & Smith, 2001) where the null hypothesis is the joint null hypothesis of no cointegration $\rho = \theta = 0$ (Vita, Trachanas, & Luo, 2018).

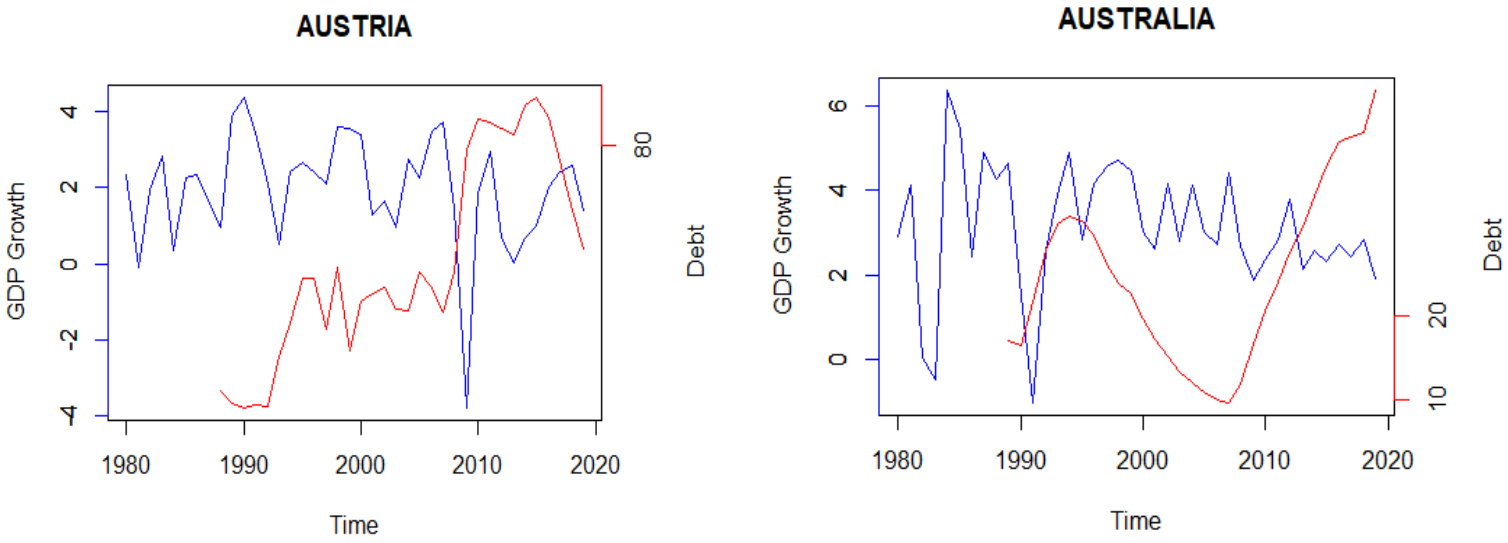
4. DISCUSSION OF EMPIRICAL RESULTS

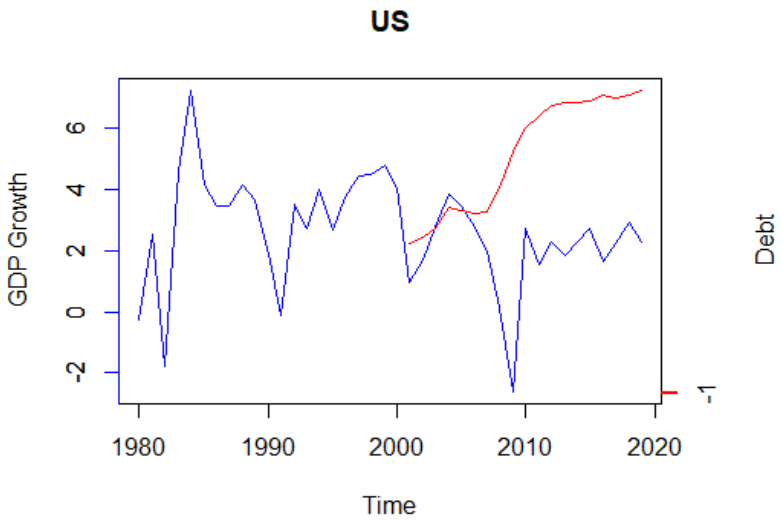
The analysis of the relationship between growth and debt begins by studying the patterns displayed by individual line plots of both time series for each country. The combined line plots in Figure 1 below illustrate that on average the growth rate series is mean-reverting. The average growth rate ranges between 2% and 6%. Figure 1 also illustrates the pattern for the debt series across the advanced economies. In contrast to the growth series, the public debt series does not exhibit a mean-reverting tendency but a combination of upward and downward trends indicating potential structural breaks. Based on Figure 1 it can be informally inferred that for advanced economies, periods of high economic growth are usually succeeded by periods of low public debt, ceteris paribus. Similarly, debt levels tend to rise when growth rates begin to fall. A sharp decline in the growth rate for Austria in 2009 was succeeded by a steep increase in public debt. A similar trend is observable in other economies including Canada and Iceland. This trend, however, coincides with the 2008/9 Global Financial Crisis, following which economies globally experienced sharp declines in economic activity, weak economic growth, and weak fiscal positions, prompting the accumulation of public debt.

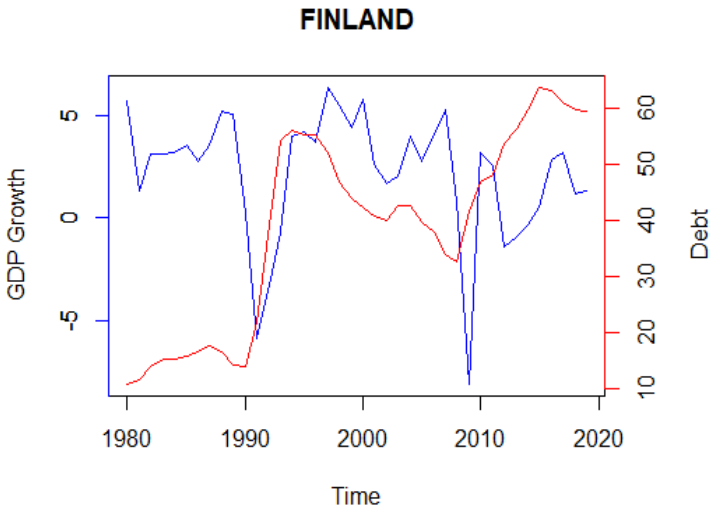
However, it is important to note that the negative relationship between growth and debt prevails beyond crisis periods. Before the crisis of 2008/9, countries such as Austria, Australia, Canada, Iceland and Finland experienced relatively high growth rates with low public debt levels. The above results however are based on an informal graphical analysis, which has no inferential power on the strength of the relationship nor the direction of causality between the two variables.

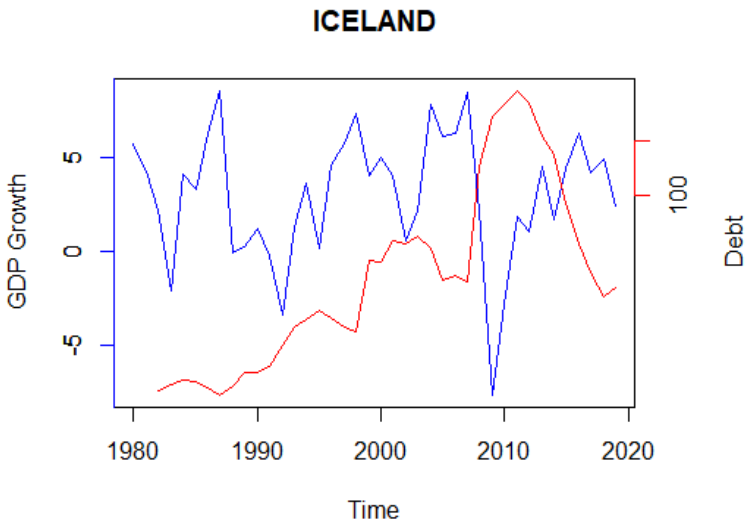
Figure 1: Line plots for the *Annual GDP Growth Rate & Public Debt* Time Series.

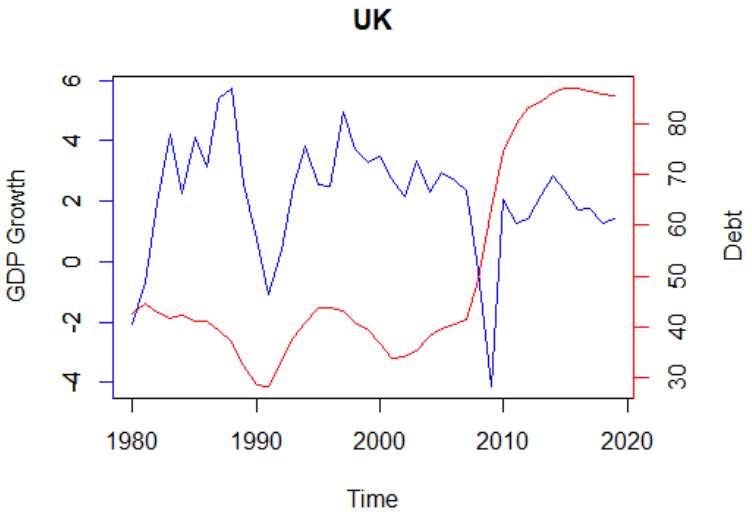
<u>**P**anel A: Advanced Economies</u>

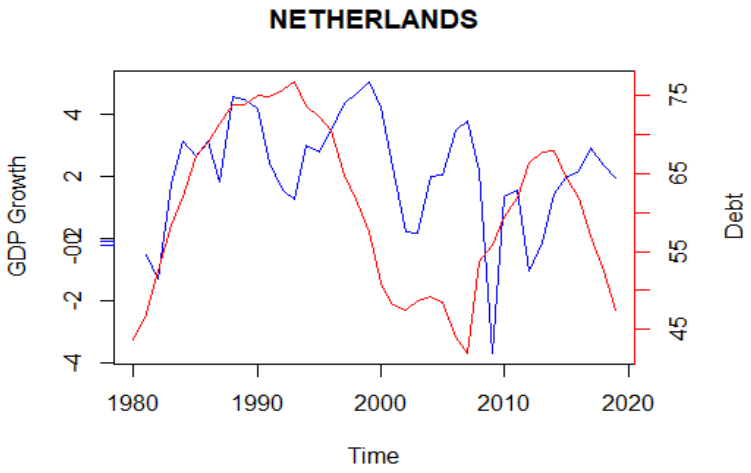


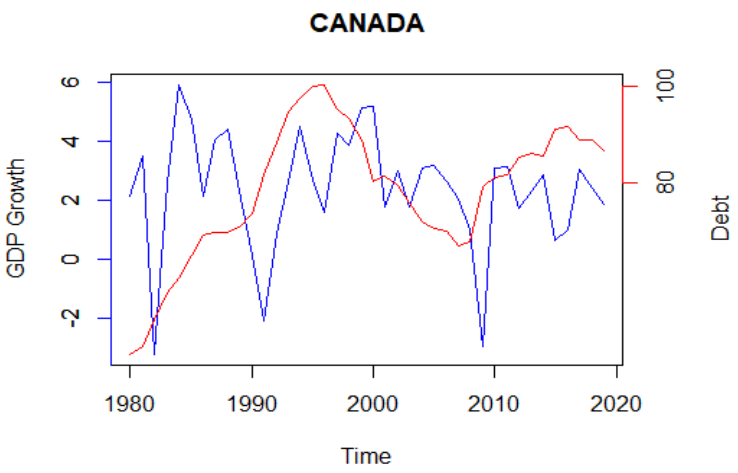

US
GDP Growth
Debt
Time
1980
1990
2000
2010
2020
-2
0
2
4
6
-1


FINLAND
GDP Growth
Debt
Time
1980
1990
2000
2010
2020
-5
0
5
10
20
30
40
50
60

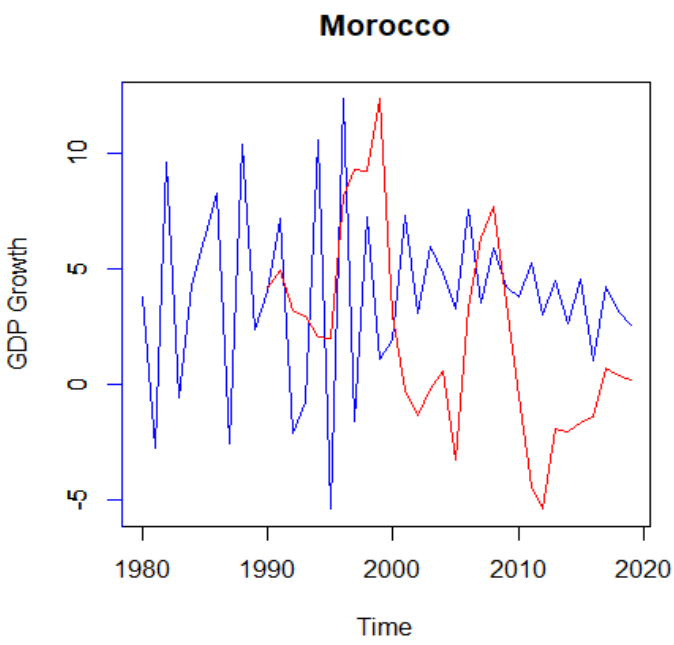

ICELAND
GDP Growth
Debt
Time
1980
1990
2000
2010
2020
-5
0
5
100

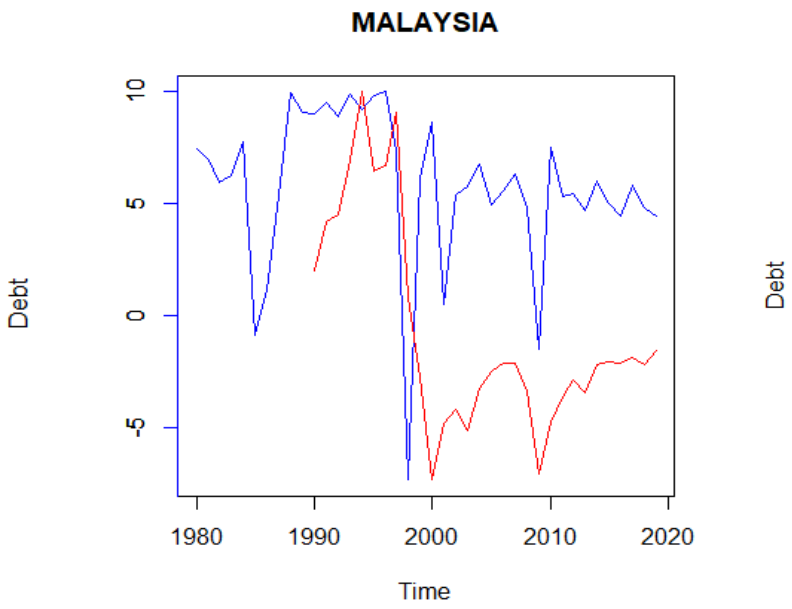

UK
GDP Growth
Debt
Time
1980
1990
2000
2010
2020
-4
-2
0
2
4
6
30
40
50
60
70
80

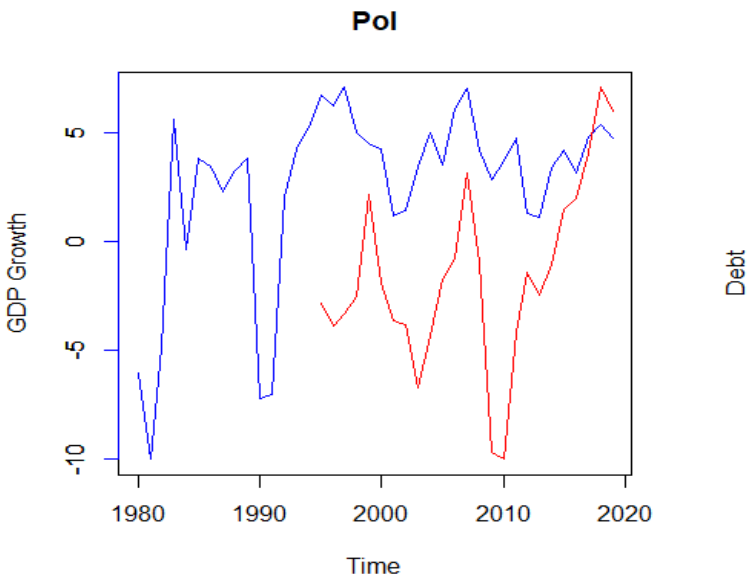

NETHERLANDS
GDP Growth
Debt
Time
1980
1990
2000
2010
2020
-4
-2
0
2
4
45
55
65
75

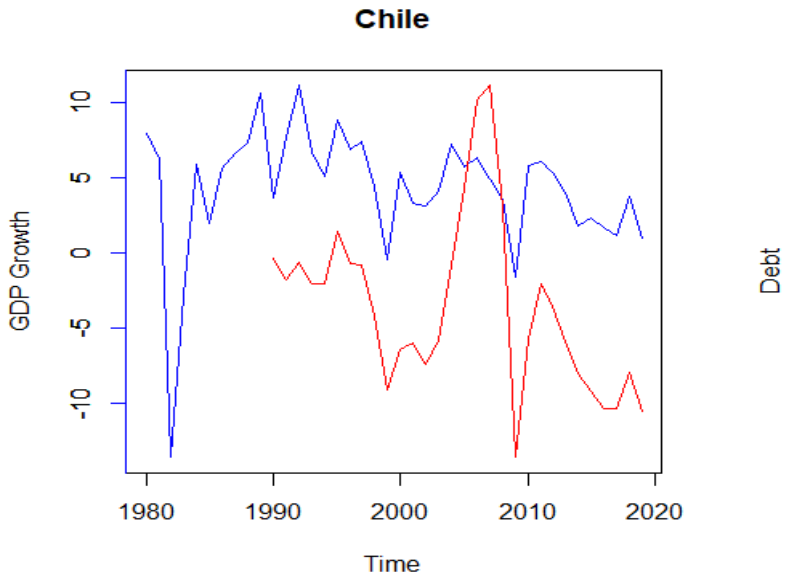

CANADA
GDP Growth
Debt
Time
1980
1990
2000
2010
2020
-2
0
2
4
6
80
100

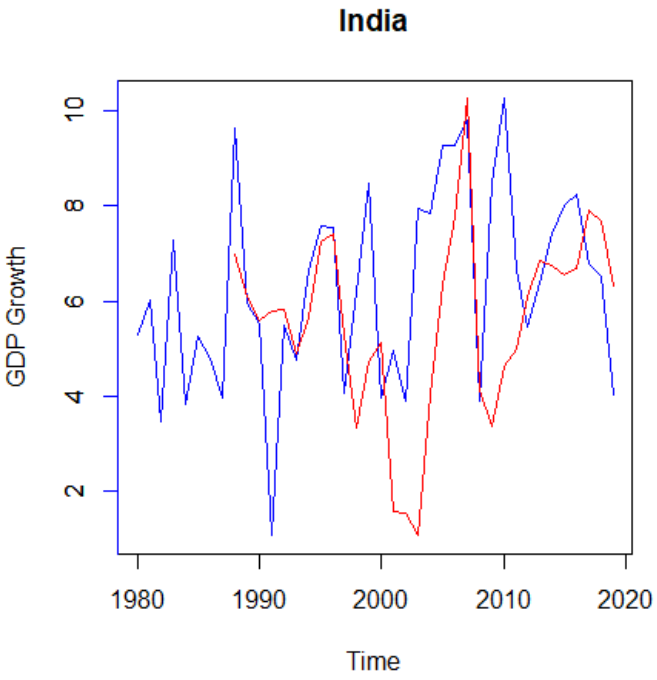
Panel B: Emerging Market Economies

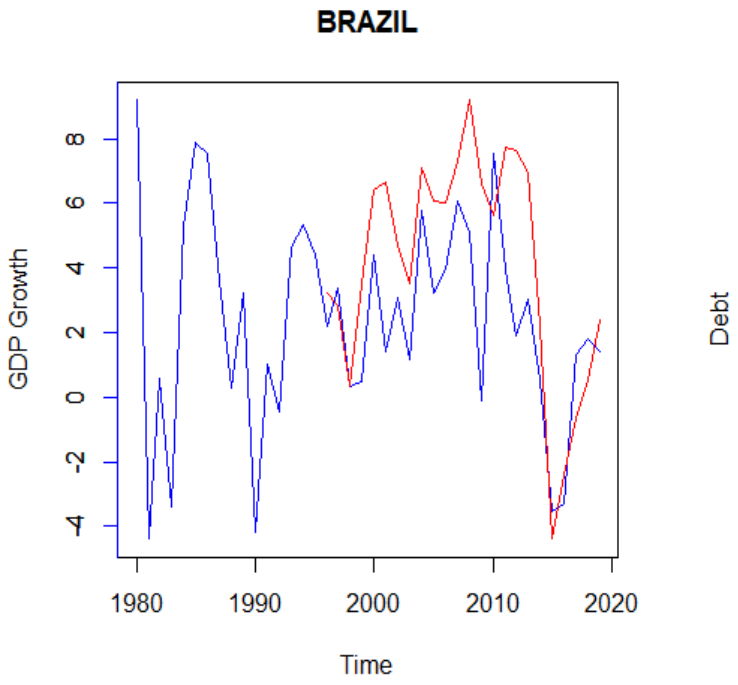




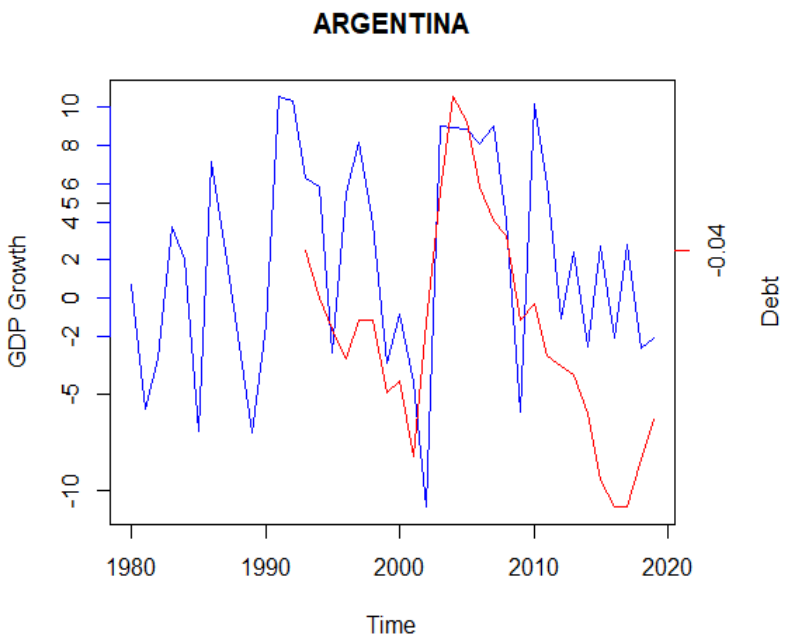


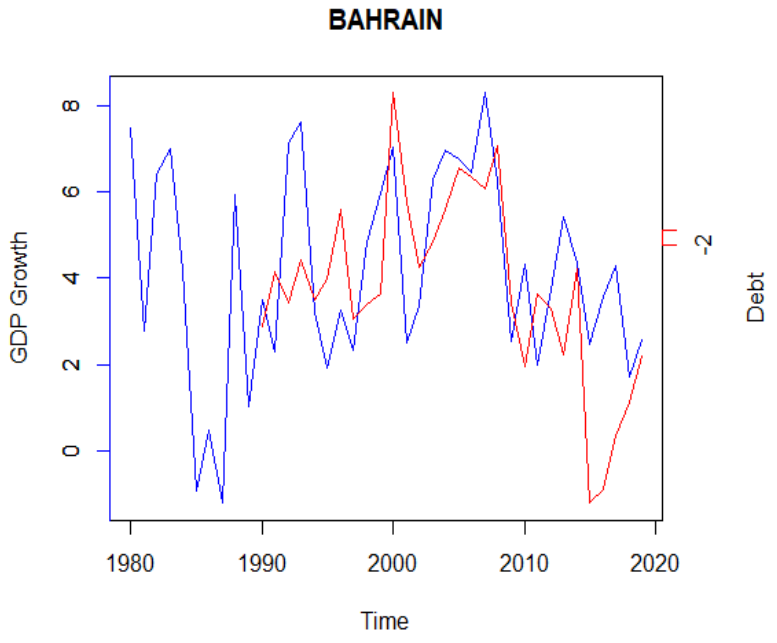


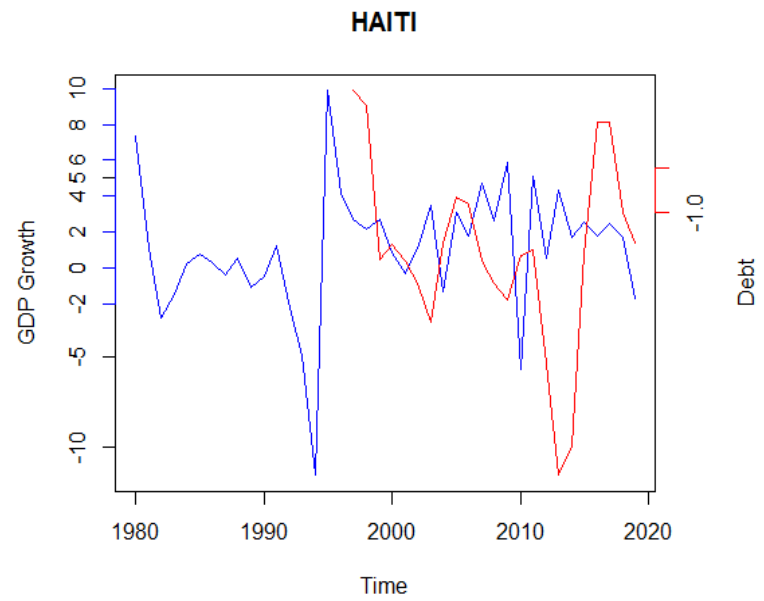

India
GDP Growth
Debt
2
4
6
8
10
1980
1990
2000
2010
2020
Time

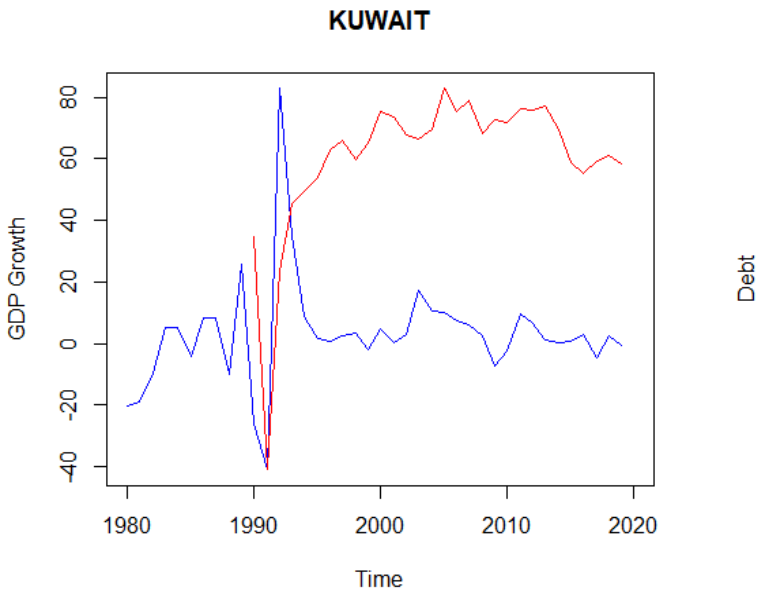

BRAZIL
GDP Growth
Debt
-4
-2
0
2
4
6
8
1980
1990
2000
2010
2020
Time

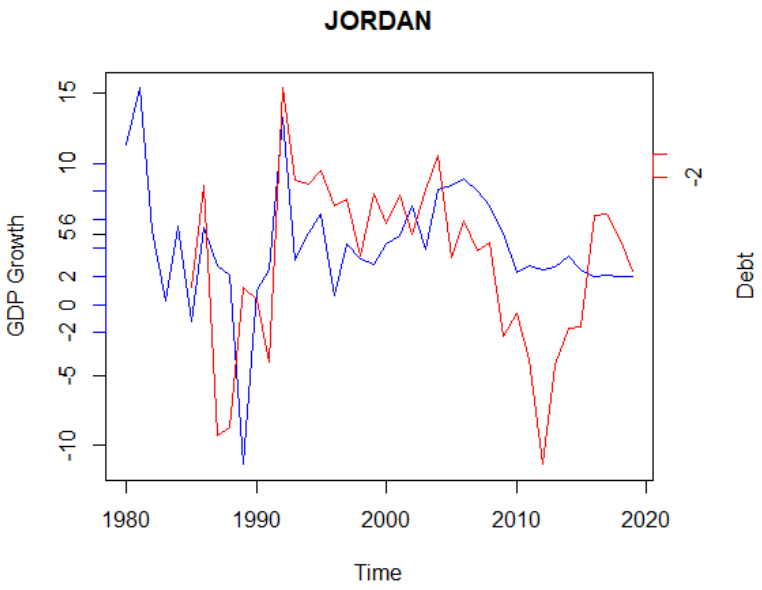
Panel C: Declining- Growth Economies

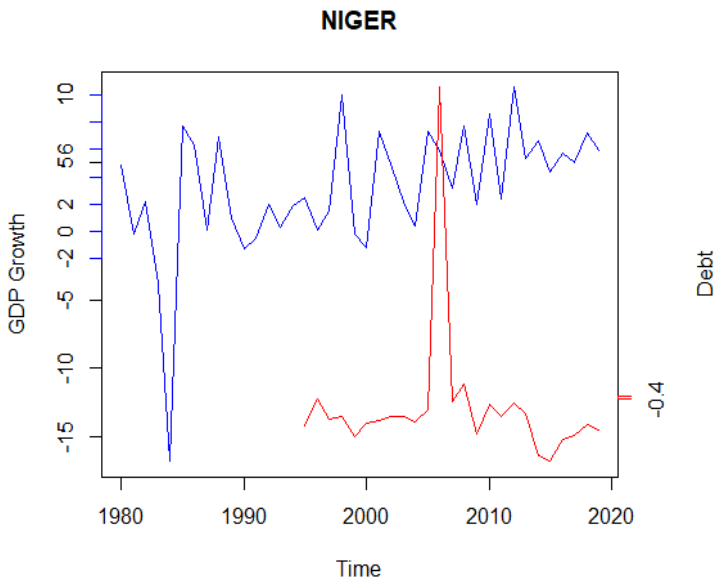


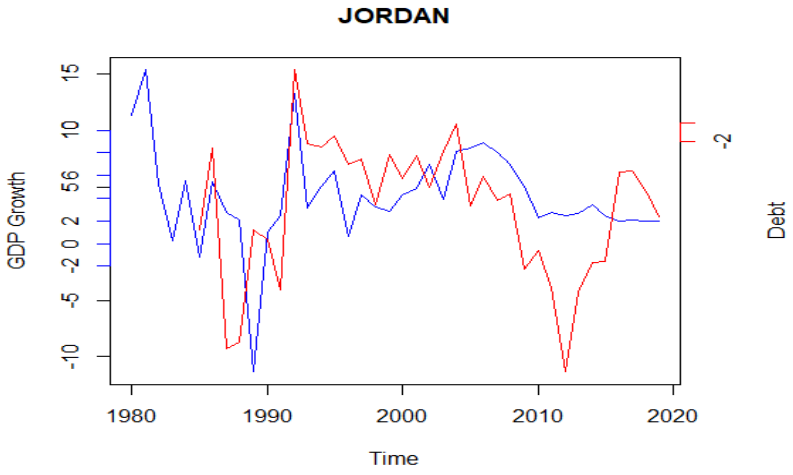












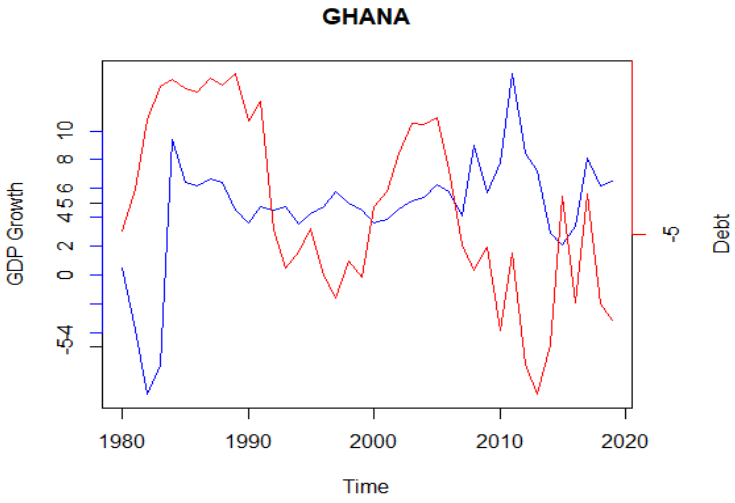


Figure 1 above graphically illustrates the relationship between growth and public debt. In advanced economies Figure 1 depicts an inverse temporaneous relationship between debt and growth where periods of low economic growth are succeeded by periods of rising public debt levels. In emerging market economies growth and debt appear to move parallel with each other, with the exception of Morocco where growth and debt appear to be inversely related to each other. Across the countries in the declining growth economies, the relationship between debt and growth varies. Overall, periods of high economic growth are followed by periods of low public debt in all countries except Niger and Jordan where periods of relatively high economic growth coincide or are succeeded by periods of high public debt.

Plausibly, (Nawaz, Qureshi, & Awan, 2012) explain that public debt can lead to economic growth when the debt is invested in capital accumulation. This emphasizes the argument presented by this current study that for economic growth to be stimulated, governments often acquire public debt. Such debt is injected into the economy through stimulus packages. Thus, the rate of economic growth is one of the explanatory variables for the accumulation of public debt. A further discussion on the channels through which growth affects debt is provided later.

Next, we establish whether there is cointegration (i.e. if there exists a long-run relationship) between economic growth and public debt. One of the requirements for cointegration analysis is that the series under question must be integrated either level stationary I(0) or difference stationary I(1), not higher. The results of the *advanced* ADF unit root test presented in Table 2 below indicate the order of integration for each series and the possible structural breakpoints.

Table 2: Advanced ADF unit root test

Panel A: *Advanced Economies*

Countries	**ADF t-stat**	**Break position (level, none)**	**ADF t-stat (level)**	**ADF t-stat (1st difference)**	**Break position**
Growth			**Public Debt**		
Austria	-6.588*** (<0.01)	2009	-3.325 (0.7686)	-6.388*** (<0.01)	2000, 2009
Australia	-5.664*** (<0.01)	1991	-7.641*** (<0.01)	-4.377* (0.06)	1996, 2007
Canada	-5.340*** (<0.01)	2009	-3.574 (0.779)	-5.041** (0.029)	1992, 2007
Finland	-4.951*** (<0.01)	2009	-8.038*** (<0.01)	-10.156*** (<0.01)	1999, 2016
Iceland	-4.576** (0.0353)	2009	-8.702*** (<0.01)	12.934*** (<0.01)	1993, 2003
Netherlands	-5.234*** (<0.01)	2008	-8.254*** (<0.01)	-12.169*** (<0.01)	1990, 2013
UK	-5.326*** (<0.01)	2009	-7504*** (<0.01)	-10.483*** (<0.01)	2013
US	-5.633*** (<0.01)	2009	-6.566*** (<0.01)	-6.089*** (<0.01)	1991

Panel B: *Emerging Market Economies*

Countries	ADF t-stat	Break date (level, intercept)	ADF t-stat (Level)	ADF t-stat (1st difference)	Break position
Growth			**Public Debt**		
Brazil	-6.181*** (<0.01)	1985	-3.528 (0.6764)	-4.696*** (0.078)	2014
Chile	-5.321*** (<0.01)	1984	-4.249 (0.3648)	-5.577*** (<0.01)	2002, 2010
India	-6.297*** (<0.01)	2002	-4.030 (0.5001)	-5.577*** (<0.01)	2010
Malaysia	-5.474*** (<0.01)	1996	-8.617 *** (<0.01)	-5.635*** (<0.01)	1997, 2008
Morocco	-14.170*** (<0.01)	1986	-5.838*** (<0.01)	-9.491*** (<0.01)	2006, 2010
Poland	-7.402*** (<0.01)	1993	-5.633*** (<0.01)	-5.634*** (<0.01)	2001, 2005

Panel C: Declining Growth Economies

Country	ADF t-stat	Break position (level, none)	ADF t-stat (Level)	ADF t-stat (1st difference)	Break position
Growth			**Debt**		
Argentina	-5.315*** (<0.01)	2002	-2.759 (0.9854)	-10.911*** (<0.01)	2001, 2002
Bahrain	-4.964*** (<0.01)	1987	-4.273 (0.3511)	-4.725* (0.072)	2008, 2014
Fiji	-9.716*** (<0.01)	1989	-4.434 (0.2683)	-6.603*** (<0.01)	1998, 2008
Ghana	-6.909*** (<0.01)	1983	-6.208*** (<0.01)	-5.361*** (<0.01)	2000, 2005
Haiti	-11.495*** (<0.01)	1994	-3.948 (0.5577)	-7.752*** (<0.01)	2003, 2008
Jordan	-5.903*** (<0.01)	1989	-9.8373*** (<0.01)	-6.567*** (<0.01)	1992, 2007
Kuwait	-6.861*** (<0.01)	1991	-4.156 (0.4218)	-11.536*** (<0.01)	2001, 2017
Niger	-9.194*** (<0.01)	1984	-11.047*** (<0.01)	-6.416*** (<0.01)	2012

The results above suggest that the growth rate time series across the country categories are integrated I(0). Furthermore, the results indicate that the public debt time series is also level stationary across the advanced economies, with the exception of Austria and Canada. However, it is important to note the possible structural break dates flagged by the ADF unit root test. In Austria, the structural break coincides with the 2000 political decline and uncertainty (Marhold, et al., 2014), which subsequently led to weak economic growth post the year 2000. For Canada, the structural break in 1996 coincides with the then introduction of a new $2 coin, the *'toonie'* which replaced the $2 note.

The results show that for emerging market economies and declining growth economies the Public debt series is first difference stationary and the structural breaks are accounted for by the ADF unit root test. The 2014 structural break detected for Brazil coincides with the 2014 Brazilian economic recession. For Morocco, the economy suffered a decline in real GDP growth of approximately 2.1% in 2005, which was followed by a 2% decline in public debt. For the remainder of the countries in the emerging market group, the 2010 structural break detected coincides with the recovery period following the 2008/9 Global Financial Crisis.

Now that the order of integration of the *growth* and *public debt* series for each country has been determined, we apply the Auto Regressive Distributed Lag (ARDL) model to determine short-run cointegration, the Bounds Test to test for the long-run cointegration, the Error Correction Model to test for the direction of causality in the long-run. The results are presented in Table 3 below.

Table 3: ARDL Causality (Short-Run) test

Panel A: Advanced Economies

Country	**ARDL Model**	**Model Specification**	**t-stat**	**F-Wald**
Austria	Growth → Debt	(1, 2)	-1.79* (0.085)	3.216* (0.085)
	Debt → Growth	(3,1)	-3.755*** (0.001)	14.097*** (0.001)
Australia	Growth → Debt	(4,3)	-2.267** (0.036)	5.141** (0.036)
	Debt → Growth	(3,1)	3.442*** (0.002)	9.780*** (0.005)

Canada	Growth → Debt	(4,2)	-3.583*** (0.0013)	12.837*** (0.0013)
	Debt → Growth	(2,4)	7.590*** (0.000)	25.159*** (0.000)
Finland	Growth → Debt	(1,2)	2.283** (0.029)	5.211** (0.029)
	Debt → Growth	(1,0)	-0.355 (0.725)	0.126 (0.725)
Iceland	Growth → Debt	(1,0)	1.047 (0.302)	1.097 (0.32)
	Debt → Growth	(4,3)	2.420** (0.0236)	5.809** (0.0236)
Netherlands	Growth → Debt	(1,4)	-2.922*** (0.0068)	8.539*** (0.0068)
	Debt → Growth	(1,0)	0.923 (0.362)	0.842 (0.362)
UK	Growth → Debt	(1,2)	-2.579** (0.015)	6.649 (0.015)
	Debt → Growth	(1,0)	1.427 (0.162)	2.037 (0.162)
US	Growth → Debt	(1,0)	0.119 (0.906)	0.014 (0.906)
	Debt → Growth	(1,0)	0.076 (0.940)	0.006 (0.940)

Panel B: Emerging Market Economies

ARDL model	**ARDL Model**	**Specification**	**t-stat**	**F-Wald**

Brazil	Growth → Debt	(1, 1)	-1.483 (0.156)	10.318*** (0.001)
	Debt → Growth	(1,1)	-2.969*** (0.0096)	8.814*** (0.0096)
Chile	Growth → Debt	(4,3)	-2.267** (0.036)	5.141 (0.036)
	Debt → Growth	(3,1)	3.442*** (0.002)	9.780 (0.005)
India	Growth → Debt	(4,4)	2.555** (0.022)	6.529 (0.022)
	Debt → Growth	(1,0)	-0.355 (0.725)	0.126 (0.725)
Malaysia	Growth → Debt	(1,3)	-2.99*** (0.0065)	8.961*** (0.0065)
	Debt → Growth	(3,1)	7.447*** (0.000)	55.452*** (0.000)
Morocco	Growth → Debt	(2,0)	-7.541*** (0.000)	56.872*** (0.000)
	Debt → Growth	(1,4)	2.580** (0.018)	6.657 ** (0.018)
Poland	Growth → Debt	(1,0)	-2.655** (0.015)	7.047** (0.015)
	Debt → Growth	(4,0)	-0.339 (0.738)	0.116 (0.738)

Panel C: Declining Growth Economies

ARDL model	**Specification**	**t-stat**	**F-Wald**
Argentina	(1, 0)	-4.050***	16.405***

		(0.0005)	(0.0005)
	(1,1)	4.536***	20.579***
		(0.0001)	(0.0001)
Bahrain	(1,1)	-1.614	2.606
		(0.1190)	(0.1190)
	(4,4)	1.880*	3.536*
		(0.078)	(0.078)
Fiji	(1,0)	-1.578	2.490
		(0.128)	(0.128)
	(1,4)	1.526	2.328
		(0.146)	(0.146)
Ghana	(4,0)	-1.711	2.929
		(0.103)	(0.103)
	(1, 0)	-1.037	1.075
		(0.309)	(0.309)
Haiti	(4,3)	-1.698	2.884
		(0.120)	(0.120)
	(1,1)	1.653	2.733
		(0.116)	(0.116)
Jordan	(4,2)	-1.907*	3.637*
		(0.071)	(0.071)
	(1,1)	8.306***	68.982***
		(0.000)	(0.000)
Kuwait	(3,2)	-0.299	0.089
		(0.768)	(0.768)
	(1,1)	3.676***	13.511***
		(0.0012)	(0.0012)
Niger	(4,1)	-2.692**	7.247**

		(0.018)	(0.018)
	(4,4)	-2.594** (0.025)	6.727** (0.025)

The results of the short-run cointegration test indicate that in the advanced economies group, there is significant evidence for the existence of short-run cointegration between public debt and growth for Austria, Australia and Canada running from growth to debt and also from debt to growth. For Finland and Netherlands, short-run cointegration only runs unidirectionally from growth to debt. The opposite holds for Iceland, whereas there is no evidence for short-run cointegration for the UK, and the US.

In the emerging market group, results indicate that there is significant evidence for the existence of short-run cointegration between public debt and growth for all countries. In Brazil, Chile, Malaysia and Morocco short-run cointegration runs from growth to debt and also from debt to growth. For Poland and India, short-run cointegration only runs unidirectionally from growth to debt.

The results of the short-run cointegration test indicate that in the declining-growth economies group, there is significant evidence for the existence of short-run cointegration between public debt and growth for Argentina, Jordan, and Niger running from growth to debt and also from debt to growth. For Bahrain and Kuwait, short-run cointegration only runs unidirectionally from debt to growth. For Ghana, Fiji and Haiti there is no evidence for short-run cointegration.

Overall, the results in Table 3 above indicate that there exists cointegrated between growth and debt in the short run, where the direction of cointegration runs mostly from both directions. To establish the existence of long-run cointegration and the direction of causality the Bounds test and Error Correction Model results are found in Table 4 below.

Table 4: Bounds Cointegration (Long-Run) test: Growth-to-Debt.

Panel A: Advanced Economies

Country	**F-Stat**	**Lower- bound**	**Upper- bound**	**t-stat (ECM)**
Austria	9.990 ***	4.04	4.78	-4.562*** (0.0001)
Australia	5.789**	4.94	5.73	-3.496*** (0.0026)
Canada	20.5435***	6.84	7.84	-6.523*** (0.0000)

Finland	19.579***	4.04	4.78	-6.352*** (0.0000)
Iceland	21.593***	6.84	7.84	-6.667*** (0.0000)
Netherlands	32.922***	6.84	7.84	-8.258*** (0.0000)
United Kingdom	23.888***	6.84	7.84	-7.016*** (0.0000)
United States	6.858**	4.94	5.73	-3.825*** (0.0017)

Panel B: Emerging Market Economies

Country	**F-Stat**	**Lower- bound**	**Upper- bound**	**t-stat (ECM)**
Brazil	8.147***	6.84	7.84	-3.405*** (0.0039)
Chile	1.736**	4.94	5.73	-4.538*** (0.000)
India	4.388 (inconcl.)	4.04	4.78	-3.059*** (0.008)
Malaysia	5.791**	4.94	5.73	-3.487*** (0.002)
Morocco	30.158***	6.84	7.84	-7.926*** (0.000)
Poland	4.557 (inconcl.)	4.94	5.73	-3.090*** (0.006)

Panel C: Declining Growth Economies

Country	**F-Stat**	**Lower- bound**	**Upper- bound**	**t-stat (ECM)**

Argentina	11.24***	6.84	7.84	-4.839*** (0.0001)
Bahrain	5.562**	5.59	6.26	-3.414*** (0.002)
Fiji	4.941**	5.59	6.26	-3.211*** (0.004)
Ghana	4.384**	5.59	6.26	-3.038*** (0.007)
Haiti	4.999**	5.59	6.26	-3.249*** (0.005)
Jordan	27.539***	8.74	9.63	-7.638*** (0.000)
Kuwait	3.526**	5.59	6.26	-2.728** (0.014)
Niger	8.609***	6.84	7.84	-4.3063*** (0.001)

A significant F-statistic indicates the existence of long-run cointegration (Pesaran, Shin, & Smith, 2001). Based on Table 4 there is statistically significant evidence for the existence of long-run cointegration across all economies in the advanced economies group based on the F-statistic of the Bounds test. Also included in Table 4 are the results of the Error Correction Model (ECM) which indicates the direction of causality based on the long-run cointegration results. With the model specified with debt as the dependent variable, the results of the ECM indicate that for all the advanced economies in the sample, growth is a significant explanatory variable for debt in the long run.

True to their defining characteristic, emerging market economies display varying results. In Table 4 the results across the emerging market group indicate significant evidence for the existence of long-run cointegration for all countries but India, Poland. The results are inconclusive for the former two and indicate no long-run cointegration for the latter two economies. The ECM results indicate that for all the emerging market economies in the sample, growth is a significant explanatory variable for debt in the long run. Lastly, the results across the declining-growth economies group indicate significant evidence for the existence of long-run

cointegration for all countries. The ECM results indicate that for all the economies in the sample, growth is a significant explanatory variable for debt in the long run.

5. CHANNELS OF TRANSMISSION

The reasons behind the accumulation of public debt vary across the different economies and the different country groups. Now that the existence of a long-run relationship between growth and debt has been established, the study offers a discussion of some of the reasons behind the accumulation of public debt. Underlying these reasons, is the economic growth rate, either directly or indirectly.

5.1. Deficit Funding

One of the recurrent reasons why governments acquire public debt is to fund budget deficits, Where the deficit is defined as the difference between government revenue and expenditure during a given fiscal period. When revenues fall short, governments are obliged to borrow to fund the gap between revenues and fiscal expenditures. The budget deficit widens when tax revenues decline and when fiscal expenditures rise independently or simultaneously. Tax revenue set consists of elements that are sensitive to the level of economic activity such as Sales Tax, Personal Income Tax (PIT), and Corporate Tax. Thus, all else constant, a decline in economic activity will lead to a decline in tax revenue. Similarly, fiscal expenditures are a function of the level of economic activity. In periods of subdued economic activity, i.e. recessionary environments, governments increase their debt holding to fill the budget deficit that may result from declining revenues.

5.2. Fiscal Stimulus Packages

Financial and economic crises are often followed by periods of low economic activity and subdued growth. Subsequently, governments employ a variety of tools to cushion economies against the effects of the crises and to stimulate economic activity. The customary tools in the government's toolbox are tax rebates, incentives, low interest rates and transfer spending. The latter is often funded using public debt, thus fiscal stimulus packages are one of the ways in which economic growth influences public debt.

5.3. Financing Public Sector Investment

The financing of public sector investments such as infrastructure often exceeds the capacity of fiscal budgets, thus, governments resort to acquiring public debt to fund such initiatives. Although debt-financed productive public investment raises a country's debt ratios in the short run, however, in the long run it can also generate higher growth, revenues, and exports, leading over time to lower debt ratios (Cavalcanti, Marrero, & Le, 2014). More significantly however, public sector investment is one of the tools governments use to stimulate economic growth.

6. ROBUSTNESS OF RESULTS

To conclude the analysis and offer the reader assurance about the robustness and reliability of the results presented. Table 5 above presents the results of the diagnostic tests conducted on the ARDL approach employed in the analysis. Table 5 contains the test results for serial correlation, heteroskedasticity and normality.

Table 5: Diagnostics Testing: Growth-to-Debt.

Panel A: Advanced Economies

Countries	**Breusch-Godfrey (serial correlation) F-stat**	**Breusch-Pagan-Godfrey (heteroskedasticity) F-stat**	**Jarque-Bera (Normality) JB-stat**
Austria	0.85 (0.509)	0.89 (0.500)	0.83 (0.662)
Australia	0.277 (0.889)	0.093 (0.911)	1.906 (0.385)
Canada	0.525 (0.719)	0.570 (0.774)	1.353 (0.508)
Finland	0.914 (0.469)	0.931 (0.458)	20.389*** (0.000)
Iceland	0.247 (0.909)	0.467 (0.631)	21.853*** (0.000)
Netherlands	1.878 (0.147)	1.644 (0.172)	7.472** (0.024)
United Kingdom	0.067 (0.935)	1.299 (0.291)	15.359*** (0.000)
United States	0.537	0.462	17.055***

	(0.711)	(0.638)	(0.000)

Panel B: Emerging Market Economies

Countries	**Breusch-Godfrey (serial correlation) F-stat**	**Breusch-Pagan-Godfrey (heteroskedasticity) F-stat**	**Jarque-Bera (Normality) JB-stat**
Brazil	0.383 (0.816)	0.174 (0.913)	2.909 (0.233)
Chile	0.209 (0.930)	0.155 (0.228)	2.356 (0.308)
India	0.960 (0.467)	2.028 (0.109)	0.877 (0.645)
Malaysia	0.302 (0.873)	3.385 (0.025)	4.887* (0.087)
Morocco	1.602 (0.213)	2.857* (0.058)	8.478** (0.014)
Poland	0.211 (0.929)	0.039 (0.9619)	1.408 (0.494)

Panel C: Declining-Growth Economies

Countries	**Breusch-Godfrey (serial correlation) F-stat**	**Breusch-Pagan-Godfrey (heteroskedasticity) F-stat**	**Jarque-Bera (Normality) JB-stat**
Argentina	1.495 (0.241)	5.7836*** (0.0089)	62.32 (0.000)
Bahrain	2.872 (0.055)	2.004 (0.103)	0.559 (0.756)

Fiji	0.687 (0.610)	2.852 (0.059)	42.83 (0.000)
Ghana	1.0196 (0.429)	1.116 (0.389)	4.81 (0.090)
Haiti	1.576 (0.235)	2.323 (0.109)	0.019 (0.990)
Jordan	1.565 (0.242)	0.699 (0.713)	0.529 (0.767)
Kuwait	1.453 (0.269)	0.798 (0.599)	5.087 (0.0786)
Niger	1.498 (0.282)	0.999 (0.474)	2.762 (0.251)

For serial correlation, the results of the Breusch-Godfrey indicate that across the advanced, emerging and declining growth economies there is statistically significant evidence to fail to reject the null hypothesis of *no serial correlation*. The results above provide the assurance that the estimated ARDL regression coefficients are unbiased, strengthening the reliability of the hypotheses test results obtained (Simon Fraser University, 2017).

In contrast, the results of the Breusch- Pagan-Godfrey heteroskedasticity test vary across countries and across country categories. Based on the F-statistic of the Breusch- Pagan-Godfrey test the results indicate that across the advanced economies in the sample, there is significant evidence to fail to reject the null hypothesis of *homoskedasticity*. Across emerging market economies, the results indicate the presence of heteroskedasticity only for the Morocco ARDL estimation. For declining-growth economies, the results indicate the presence of heteroskedasticity for the Argentina and Morocco ARDL estimations.

Lastly, Table 5 also contains the results of the Jarque-Bera Normality test which tests for the normality of the residuals. The results indicate that across the advanced economies group, the residuals are not normally distributed for Austria, Australia, and Canada. Across the emerging market economies, the residuals for Morocco and Malaysia are not normally distributed, and there is no significant evidence against normality across the growth-declining economies.

7. CONCLUSION

Using the ARDL estimation method, the study aimed to disentangle the bi-directional causality between public debt and economic growth to establish whether the growth rate of an economy is

a significant explanatory variable for the accumulation of public debt. This hypothesis offers an alternative diagnosis to the existing body of literature which treats causality as unidirectionally running from growth to debt, except during financial or economic crises where the impact of the economic conditions on public debt become more pronounced.

Beginning with the investigation of short-run cointegration, the results indicate that in most countries the growth rate of an economy and the level of public debt are cointegrated in the short run. In the advanced economies group, the evidence is found is mixed with Austria, Australia and Canada showing cointegration running bi-directionally. For Finland and Netherlands, short-run cointegration only runs unidirectionally from growth to debt. The opposite holds for Iceland, whereas there is no evidence for short-run cointegration for the UK, and the US.

For the emerging market category, significant evidence was found for the existence of short-run cointegration between public debt and growth for all countries. In Brazil, Chile, Malaysia and Morocco short-run cointegration runs from growth to debt and also from debt to growth. For Poland and India, short-run cointegration only runs unidirectionally from growth to debt. Similarly, the results of the short-run cointegration test indicate that in the declining-growth economies group, there is significant evidence for the existence of short-run cointegration between public debt and growth for Argentina, Jordan, and Niger running from growth to debt and also from debt to growth. For Bahrain and Kuwait, short-run cointegration only runs unidirectionally from debt to growth. For Ghana, Fiji and Haiti there is no evidence for short-run cointegration.

Overall, the results in Table 3 above indicate that there exists cointegrated between growth and debt in the short run, where the direction of cointegration runs mostly from both directions. The results of the Bounds test and the ECM also indicate that there is strong statistically significant evidence for the existence of a long-run relationship, and also that growth is a significant explanatory variable for public debt in the long run. This result appears to be consistent across the advanced, emerging and declining-growth economies.

Although the study successfully answered its initial hypothesis, further insights can be derived from analyses that distinguish between domestic and foreign debt and how these interact with the level of economic growth across the three country categories. Furthermore, subject to data availability, the sample size can be increased to conduct a relatively more comprehensive analysis for more comprehensive results.

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