HOW GOVERNMENT AND PRIVATE DEBTS AFFECT ECONOMIC GROWTH

A comparison between Japan and Mexico

Gallo Luigi e Capelletti Thomas

OBJECTIVE

With this paper we want to analyse the impact that debts has on economic growth between two countries.

The idea is to consider one developed and one developing, with a very similar population and a sufficiently large sample of data, based on these conditions we have chosen to conduct an analysis precisely between Japan and Mexico.

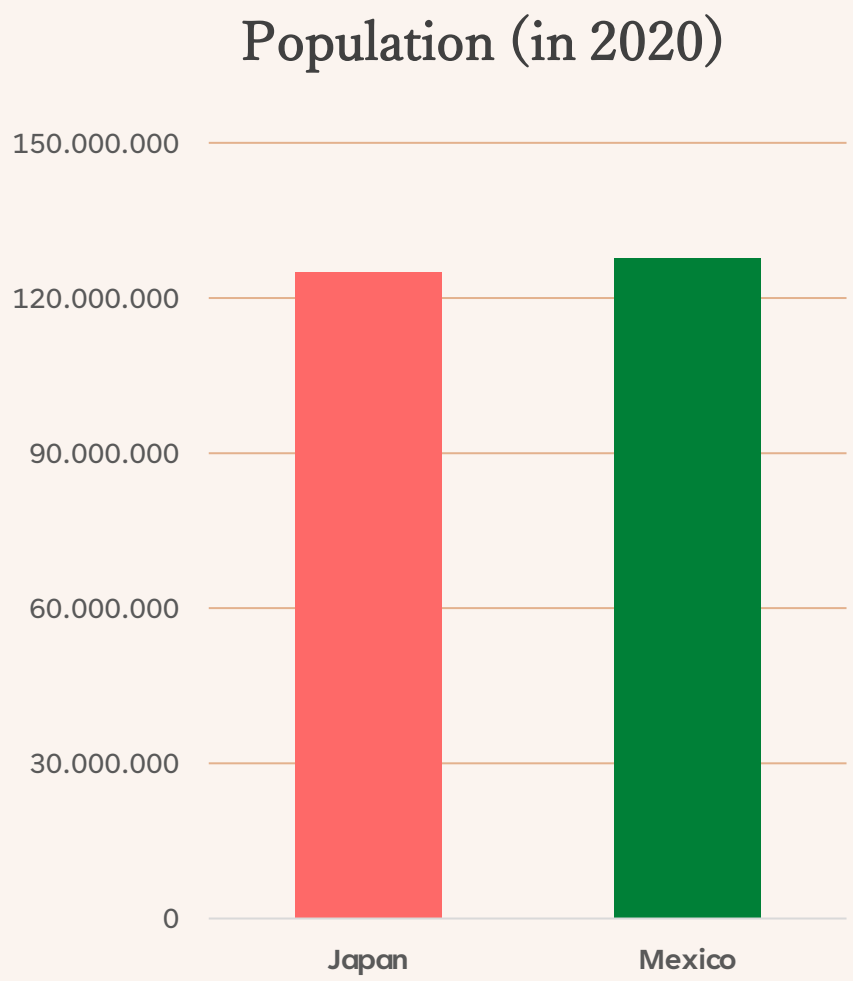
COMPARISON BETWEEN COUNTRIES

Japan

Japan is the third largest economy in the world with a GDP of 5 trillion US dollars in 2020, a value that represented 4.22% of the global economy, has a very high debt / GDP ratio, the highest among advanced economies, equal to 266.20%

Mexico

Mexico is the second largest economy in Latin America, it began to be part of the G20 even before its birth, it ranks 11th among the largest economies on the planet in terms of gross domestic product, which is equal to one thousand billion. of US dollars and has a debt / GDP ratio of 52.10%



THE DATA SET

Our dataset is composed of three main data: Real GDP in US dollars for both our countries, and debt, separated into government and private, using these data again as a function of real GDP.

Clearly we realize that we are considering two countries with different currencies, for convenience we have chosen to use the US dollar as a common currency.

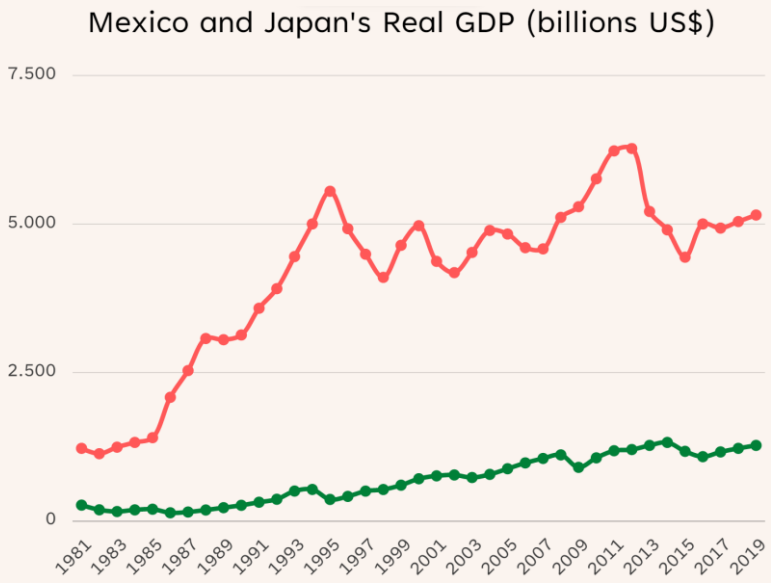
Data sources:

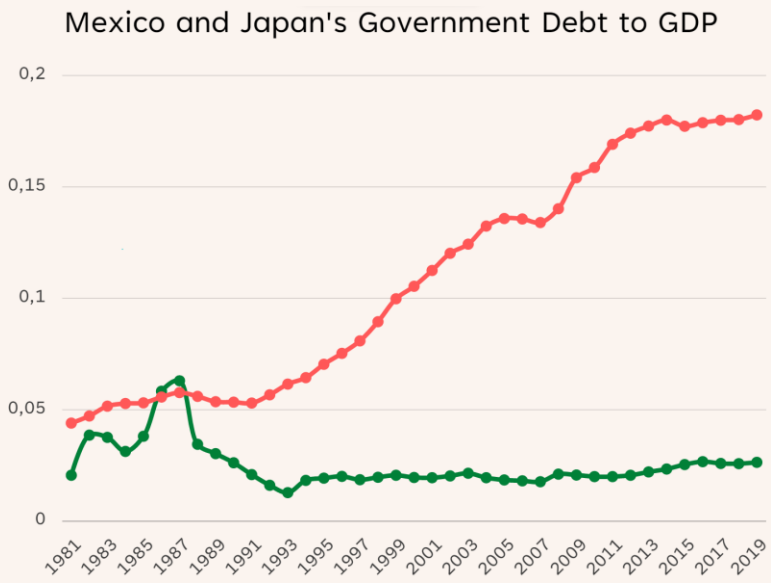
https://debt-economics.org/review-data.php

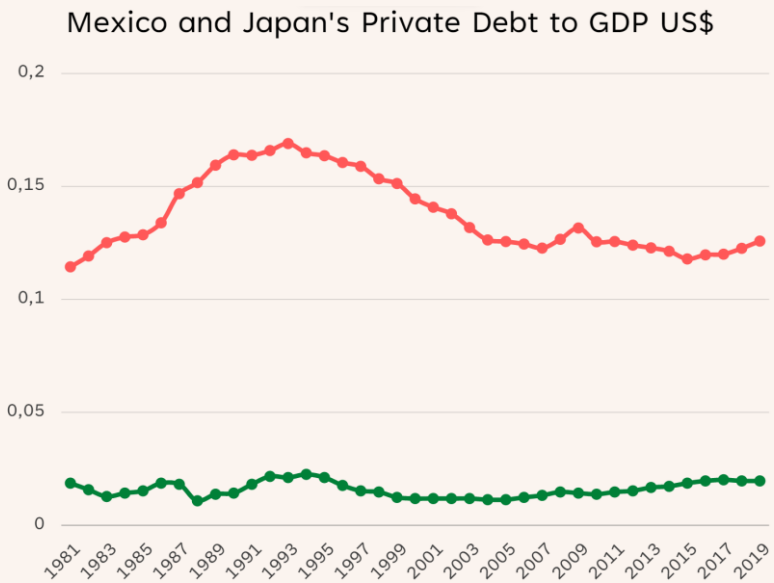
https://www.worldbank.org/en/home

STATIONARITY TESTS

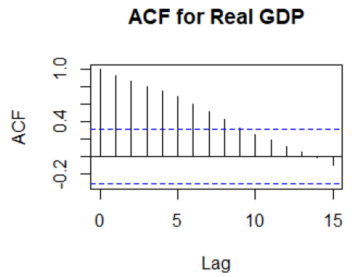
GRAPHICAL REPRESENTATION







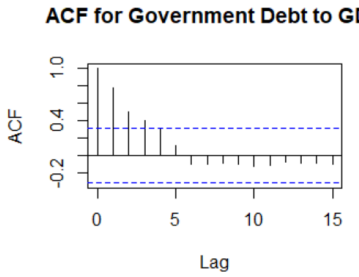
STATIONARITY TEST



Box-Ljung test: p-value < 1.278e-09

Augmented Dickey-Fuller Test: p-value = 0.1346

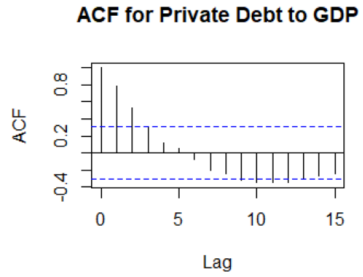
Phillips-Perron Unit Root Test: p-value = 0.1344



Box-Ljung test: p-value < 5.146e-07

Augmented Dickey-Fuller Test: p-value = 0.5899

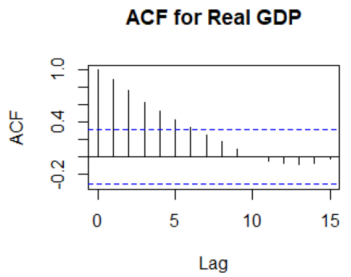
Phillips-Perron Unit Root Test: p-value = 0.3299



Box-Ljung test: p-value < 3.66e-07

Augmented Dickey-Fuller Test: p-value = 0.6147

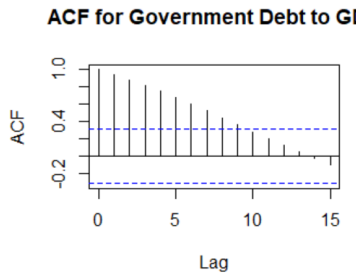
Phillips-Perron Unit Root Test: p-value = 0.5306



Box-Ljung test: p-value < 6.291e-09

Augmented Dickey-Fuller Test: p-value = 0.6582

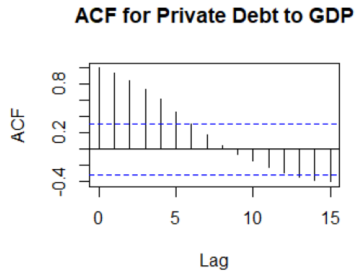
Phillips-Perron Unit Root Test: p-value =0.805



Box-Ljung test: p-value < 8.705e-10

Augmented Dickey-Fuller Test: p-value = 0.2888

Phillips-Perron Unit Root Test: p-value = 0.7679



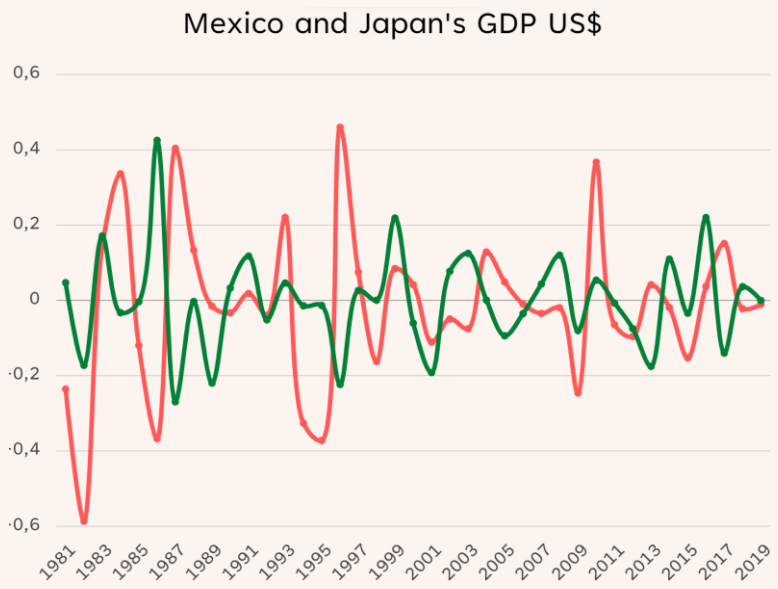
Box-Ljung test: p-value < 1.105e-09

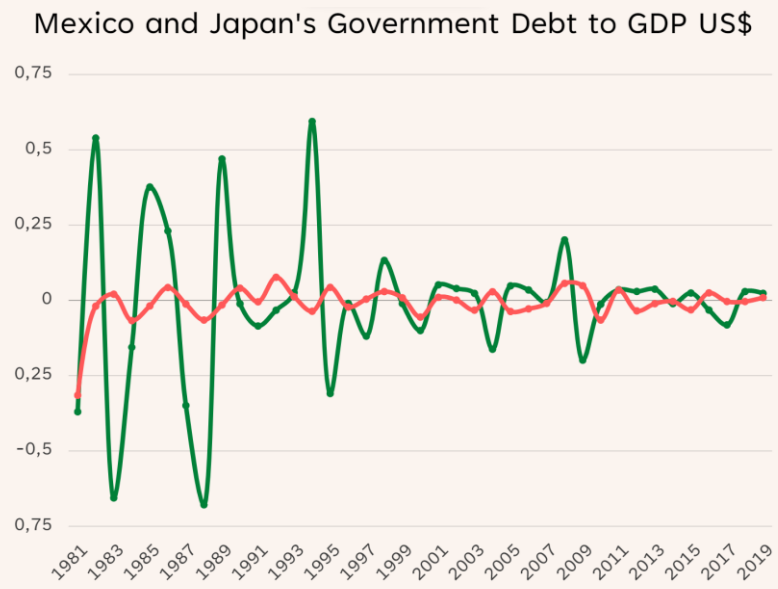
Augmented Dickey-Fuller Test: p-value = 0.1606

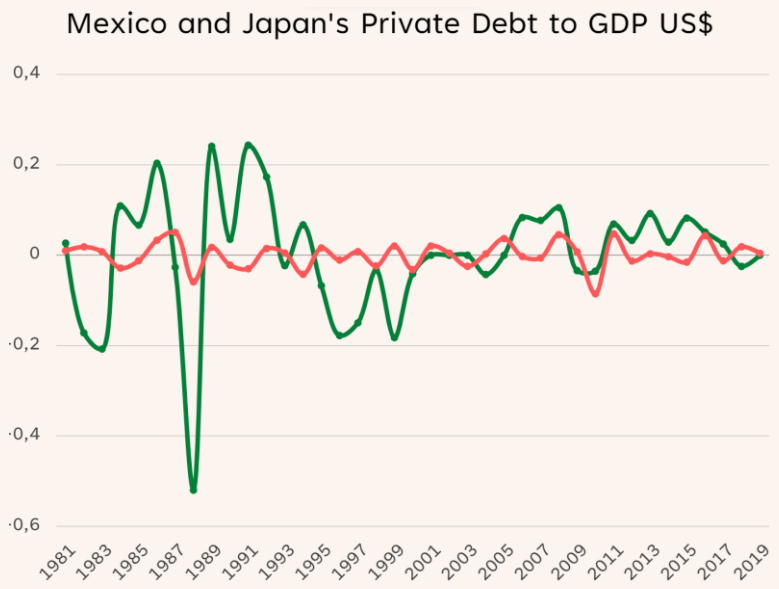
Phillips-Perron Unit Root Test: p-value = 0.7976

STANDARDIZED GRAPHS

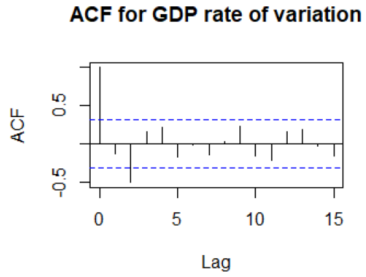
- First differences: $\Delta Y_t = Y_t - Y_{t-1}$
- Growth rate: $g_Y = \frac{Y_t - Y_{t-1}}{Y_{t-1}} \approx ln(Y_t) - ln(Y_{t-1}) = \Delta ln(Y_t)$







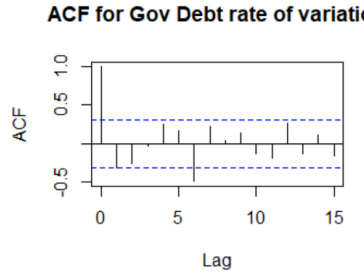
STATIONARITY TEST



Box-Ljung test: p-value < 0.4058

Augmented Dickey-Fuller Test: p-value < 0.01

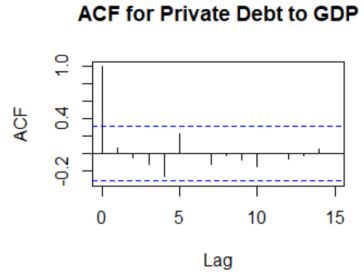
Phillips-Perron Unit Root Test: p-value < 0.01



Box-Ljung test: p-value < 0.03383

Augmented Dickey-Fuller Test: p-value < 0.01

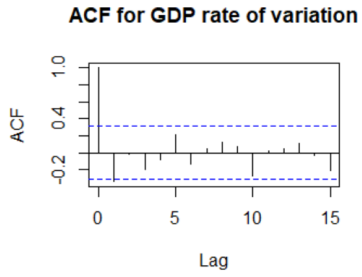
Phillips-Perron Unit Root Test: p-value < 0.01



Box-Ljung test: p-value < 0.6907

Augmented Dickey-Fuller Test: p-value = 0.0194

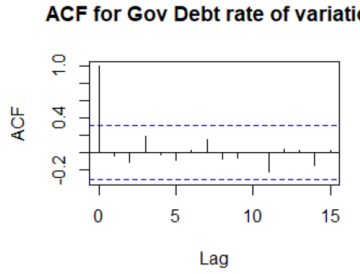
Phillips-Perron Unit Root Test: p-value < 0.01



Box-Ljung test: p-value < 0.02612

Augmented Dickey-Fuller Test: p-value < 0.01

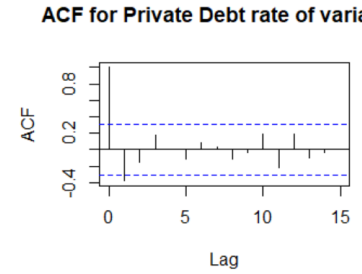
Phillips-Perron Unit Root Test: p-value < 0.01



Box-Ljung test: p-value < 0.8365

Augmented Dickey-Fuller Test: p-value = 0.0464

Phillips-Perron Unit Root Test: p-value < 0.01



Box-Ljung test: p-value < 0.01305

Augmented Dickey-Fuller Test: p-value = 0.0633

Phillips-Perron Unit Root Test: p-value < 0.01

VAR MODEL

$$Yt = B0 + B1Yt-1 + \cdots + BpYt-p + ut$$

At this point we have created our VAR model, we calculated the Akaike Information Criterion (AIC) and The Bayes-Schwartz Information Criterion (SC) in order to obtain the lag number on which to conduct our analysis.

```
$selection
AIC(n)  HQ(n)  SC(n) FPE(n)
     8      8      8      7
```

```
VAReq1 = dynlm(data = Mexico_ts, formula =  `GDP rate of variation` ~
                L( `GDP rate of variation`, 1:8) + L( `Rate of variation as the second difference Gov Debt`, 1:8) + L(`DIFF Log Private Debt to GDP`, 1:8))
VAReq2 = dynlm(data = Mexico_ts, formula =  `Rate of variation as the second difference Gov Debt` ~
                L( `GDP rate of variation`, 1:8) + L( `Rate of variation as the second difference Gov Debt`, 1:8) + L(`DIFF Log Private Debt to GDP`, 1:8))
VAReq3 = dynlm(data = Mexico_ts, formula =  `DIFF Log Private Debt to GDP` ~
                L( `GDP rate of variation`, 1:8) + L( `Rate of variation as the second difference Gov Debt`, 1:8) + L(`DIFF Log Private Debt to GDP`, 1:8))
```

```
$selection
AIC(n)  HQ(n)  SC(n) FPE(n)
     8      8      8      8
```

```
VAReq1 = dynlm(data = Japan_ts, formula = `GDP rate of variation`  ~
               L(`GDP rate of variation`, 1:8) + L(`Rate of variation as the second difference Gov Debt`, 1:8) + L(`Rate of variation as the second difference Private Debt`, 1:8))
VAReq2 = dynlm(data = Japan_ts, formula = `Rate of variation as the second difference Gov Debt` ~
               L(`GDP rate of variation`, 1:8) + L(`Rate of variation as the second difference Gov Debt`, 1:8) + L(`Rate of variation as the second difference Private Debt`, 1:8))
VAReq3 = dynlm(data = Japan_ts, formula = `Rate of variation as the second difference Private Debt`  ~
               L(`GDP rate of variation`, 1:8) + L(`Rate of variation as the second difference Gov Debt`, 1:8) + L(`Rate of variation as the second difference Private Debt`, 1:8))
```

RESULTS

Below are the results obtained only for the lag of the GDP differentiated by the two equations which they consider as a dependent variable (Government debt and Private debt) for both countries.

GOVERNMENT DEBT

L(`Rate of variation as the second difference Gov Debt`, 1:8)1	0.4747035	0.4601273	1.0317	0.3420032	
L(`Rate of variation as the second difference Gov Debt`, 1:8)2	-0.0947991	0.5953566	-0.1592	0.8787118	
L(`Rate of variation as the second difference Gov Debt`, 1:8)3	1.0466061	0.6303907	1.6603	0.1479320	
L(`Rate of variation as the second difference Gov Debt`, 1:8)4	-1.7478834	0.4259824	-4.1032	0.0063347	**
L(`Rate of variation as the second difference Gov Debt`, 1:8)5	-2.5354319	0.6365373	-3.9832	0.0072570	**
L(`Rate of variation as the second difference Gov Debt`, 1:8)6	-2.1815413	0.3261957	-6.6878	0.0005418	***
L(`Rate of variation as the second difference Gov Debt`, 1:8)7	0.3682602	0.4121832	0.8934	0.4060296	
L(`Rate of variation as the second difference Gov Debt`, 1:8)8	1.3452358	0.4489079	2.9967	0.0241111	*

PRIVATE DEBT

L(`Rate of variation as the second difference Private Debt`, 1:8)1	0.4365967	0.7631076	0.5721	0.5880129	
L(`Rate of variation as the second difference Private Debt`, 1:8)2	2.4969235	0.7244663	3.4466	0.0136903	*
L(`Rate of variation as the second difference Private Debt`, 1:8)3	0.2504502	0.5885822	0.4255	0.6853014	
L(`Rate of variation as the second difference Private Debt`, 1:8)4	0.4036106	0.4422478	0.9126	0.3966229	
L(`Rate of variation as the second difference Private Debt`, 1:8)5	0.7310833	0.4433488	1.6490	0.1502420	
L(`Rate of variation as the second difference Private Debt`, 1:8)6	1.0079695	0.3280877	3.0723	0.0218788	*
L(`Rate of variation as the second difference Private Debt`, 1:8)7	0.6955378	0.5177865	1.3433	0.2277544	
L(`Rate of variation as the second difference Private Debt`, 1:8)8	-0.7871427	0.4130179	-1.9058	0.1053148	

GOVERNMENT DEBT

L(`Rate of variation as the second difference Gov Debt`, 1:8)1	-1.03511440	0.09145797	-11.3179	2.848e-05	***
L(`Rate of variation as the second difference Gov Debt`, 1:8)2	-0.26856812	0.08921021	-3.0105	0.0236850	*
L(`Rate of variation as the second difference Gov Debt`, 1:8)3	-0.43204141	0.11202149	-3.8568	0.0083937	**
L(`Rate of variation as the second difference Gov Debt`, 1:8)4	-0.87009847	0.11505308	-7.5626	0.0002776	***
L(`Rate of variation as the second difference Gov Debt`, 1:8)5	-0.49951482	0.18014476	-2.7729	0.0323005	*
L(`Rate of variation as the second difference Gov Debt`, 1:8)6	-0.35325536	0.14369882	-2.4583	0.0492327	*
L(`Rate of variation as the second difference Gov Debt`, 1:8)7	-0.04817162	0.11618748	-0.4146	0.6928483	
L(`Rate of variation as the second difference Gov Debt`, 1:8)8	0.26458701	0.07813003	3.3865	0.0147392	*

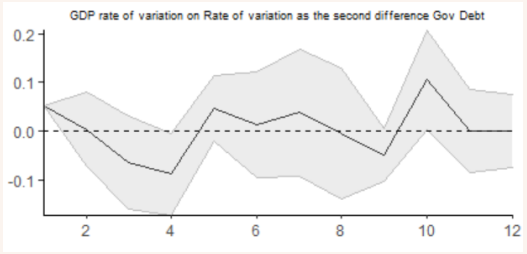
PRIVATE DEBT

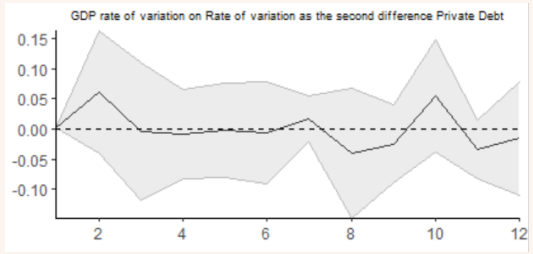
L(`DIFF Log Private Debt to GDP`, 1:8)1	-0.05717322	0.13666882	-0.4183	0.6902631	
L(`DIFF Log Private Debt to GDP`, 1:8)2	-0.45104085	0.14146245	-3.1884	0.0188741	*
L(`DIFF Log Private Debt to GDP`, 1:8)3	-0.06451856	0.15227905	-0.4237	0.6865630	
L(`DIFF Log Private Debt to GDP`, 1:8)4	0.61315052	0.07154633	8.5700	0.0001386	***
L(`DIFF Log Private Debt to GDP`, 1:8)5	-0.30819928	0.08176761	-3.7692	0.0092974	**
L(`DIFF Log Private Debt to GDP`, 1:8)6	0.41580351	0.07897800	5.2648	0.0018926	**
L(`DIFF Log Private Debt to GDP`, 1:8)7	0.06896827	0.08885271	0.7762	0.4671109	
L(`DIFF Log Private Debt to GDP`, 1:8)8	0.02289744	0.13783268	0.1661	0.8735153	

GRANGER'S CAUSALITY AND IMPULSE RESPONSE FUNCTION

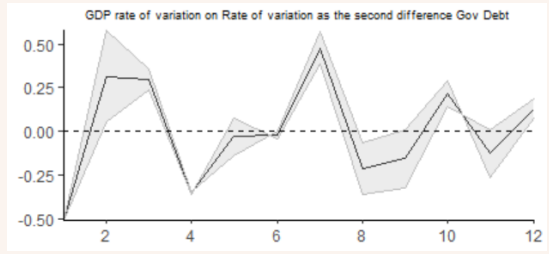
We then thought of carrying out the Granger causality test, this test is used to examine whether a time series can be used to predict another and subsequently we reported the analysis of the impulse-response function of our model.

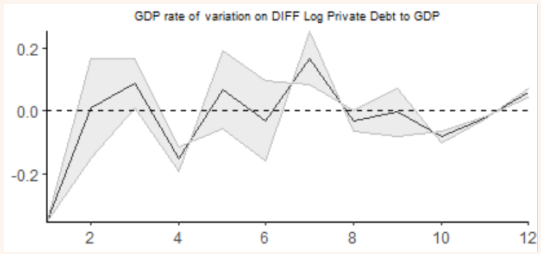
VARIABLES	P-VALUE
GOVERNMENT DEBT	0.4899
PRIVATE DEBT	0.02724 *





VARIABLES	P-VALUE
GOVERNMENT DEBT	1.357e-05 ***
PRIVATE DEBT	0.007322 **





CONCLUSIONS

Public debt appears to impact growth in both developed and developing countries, though not to the same extent. Otherwise, private debt seems to have a greater impact on developing countries.

We realize that drawing economic policy conclusions from this analysis is certainly not immediately easy. It is evident how there are many factors that influence this relationship, needles to say that such nuances are not captured by our model.

In fact, we have achieved results between the developed economy of Japan and the developing economy of Mexico.

Therefore, the local conditions of these states should be the key to fiscal and monetary policy that drives the amount of government and public debt.

RESOURCES

Sources of the data:

https://debt-economics.org/review-data.php

https://www.worldbank.org/en/home

References:

https://onlinelibrary.wiley.com/doi/epdf/10.1111/twec.12626

https://link.springer.com/content/pdf/10.1007/BF03399388.pdf

https://www.bis.org/publ/work352.pdf

https://www.sciencedirect.com/science/article/abs/pii/S0164070414000536

THANKS FOR THE ATTENTION