Government Debt and its Macroeconomic Determinants – An Empirical Investigation

Swamy, Vighneswara

Institute of Economic Growth, Delhi

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Vighneswara Swamy
vs@iegindia.org

Abstract

In the context of rising government debt levels in advanced economies and the ongoing euro zone debt crisis, there has been a revival of academic and policy debate on the impact of growing government debt on economic growth. This data-rich study offers an econometric investigation of the macroeconomic determinants of government debt and answers the much-debated question – *What factors influence the government debt in a sovereign country*? The study provides analyses for economy groupings, political governance groupings and income groupings of countries in addition to the full sample. Panel Granger causality testing is employed to establish causality running from the determinants of debt. The results of the full sample analysis reveal that real GDP growth, foreign direct investment, government expenditure, inflation and population growth have negative effect on debt. Gross fixed capital formation, final consumption expenditure, and trade openness have positive effect on debt. The results for different country groupings bring out some interesting implications.

Keywords: Government Debt, economic growth, panel data, nonlinearity, country groupings

JEL Classification: C33, C36, E62, O5, O40, H63

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1. Introduction

In the aftermath of global financial crisis, government debt of sovereign countries has risen by $25 trillion, of which the advanced economies account for $19 trillion – a direct result of severe recession, fiscal-stimulus programs, and bank bailouts. The government debt trajectories in some advanced economies have touched unsustainable levels[1]. Many countries in the euro zone are struggling with a combination of high levels of indebtedness, budget deficits and frail growth. While much of this debt upsurge was perhaps driven by efforts to support economic growth in the face of deflationary headwinds in the post-crisis scenario, there is a need for thorough econometric investigation to know what causes the government debt to rise. There is a rising concern to comprehensively analyse debt dynamics and debt overhang. While the much-debated question has been - 'do sovereign countries with high government debt tend to grow slowly', the associated issue has been – 'what macroeconomic factors cause the debt of sovereign countries to rise'. The discussion on government debt levels and related economic growth has thus gained sudden attention for many researchers.

Reinhart and Rogoff (RR), in some of their influential articles, argue that higher levels of government debt are negatively correlated with economic growth, but that there is no link between debt and growth when government debt is below 90% of GDP (Reinhart and Rogoff, 2010a; Reinhart, Reinhart and Rogoff 2012). RR's findings have sparked a new literature seeking to assess whether their results were robust to allow for non-arbitrary debt brackets, control variables in a multivariate regression setup, reverse causality, and cross-country heterogeneity. After the publication of the (critique) article by Herndon, Ash, and Pollin (2014) challenging some of RR's findings, the discussion on the relationship between debt and growth in advanced economies has become more animated. Krugman (2010), citing the case of Japan, argues that the link between debt and growth could be driven by the fact that it is low economic growth that leads to high levels of government debt.

The evolving empirical literature reveals a negative correlation between government debt and economic growth. This correlation becomes particularly strong when government debt approaches 100% of GDP (Reinhart and Rogoff 2010a; 2010b; Kumar and Woo 2010;

[1] For instance, the United States' debt level which was 75 percent of GDP in 2008 has risen to 109 in 2013; the United Kingdom' debt level has scaled from 58 to 108 during the same period. Australia's debt level has surged from 12 to 23 percent of GDP. In the case of Japan, the debt level has moved from 192 to 241. In the case of euro zone economies, the surge in debt levels is still higher. For the Italy, the debt level has surged from 117 to 144. France's debt has moved from 79 to 114 and similarly, Portugal's debt has risen from 72 to 115.

Cecchetti *et al.* 2011). Empirical research, of late, has begun to focus on possibilities of non-linearities within the debt-growth nexus, with specific attention to high government debt levels. The empirical literature on this issue remains sparse as very few studies employ non-linear impact analysis. Cecchetti *et al.,* (2011) employ non-linear panel threshold approach for non-dynamic panels. However, the available literature does not provide an examination of the cause-effect relationship to reveal the dynamics of government debt-economic growth nexus.

We notice four inadequacies in the empirical literature on debt-growth nexus. First, there is a need to expand the horizon of the data sample, as averaging across OECD / advanced countries alone would make such inferences difficult. Second, none of the studies has focused on the different groupings of economies based on their political governance structures, economy groupings and income groupings in addition to the full sample. Third, we do not find studies that diagnose government debt-growth nexus in terms of the macroeconomic determinants of government debt. Fourth, none of the studies has offered an analysis based on causality testing to ascertain the direction of causality between debt and growth.

This study endeavours to fill the above research gap providing a sound empirical investigation based on well-established theoretical considerations. We identify the macroeconomic determinants government debt in the context of debt-growth nexus by employing panel GMM regressions for balanced-panel data. This study is unique as it overcomes the issues related to data adequacy, coverage of countries, heterogeneity, endogeneity, and non-linearities. We contribute to the current strand of literature on government debt and economic growth by extending the horizon of analysis by exploring considerably a large worldwide full sample covering 46 countries for the period 1980-2009. We cover 82 countries under economy groupings, 50 countries under income groupings and 58 countries under political governance groupings in our analysis. We provide a thorough econometric estimation including specification that allows for IV approach. Our data-intensive approach offers stylized facts, well beyond selective anecdotal evidence. This paper makes a distinct contribution to the debate by offering new empirical evidence based on a sizeable dataset.

The paper is organised as follows. We present our data in section 2. We provide in section 3, a detailed econometric analysis of the macroeconomic determinants of government debt for different country groupings and for the full sample and a discussion on the results. Section 4 describes the causality testing and we conclude in section 5.

2. Data

Our dataset comprises annual macroeconomic data on 252 countries, over the period 1980-2009. To maintain homogeneity in as much as it is for a large sample of countries over the course of five decades, we employ as a primarily source – World Development Indicators (WDI) database 2014 of World Bank. We strengthen our data with the use of supplementary data sourced from International Monetary Fund, World Economic Outlook 2014 database, International Financial Statistics and data files, and Reinhart and Rogoff dataset on Debt-to-GDP ratios.

We arrange our sample data into five broad categories: (i) economy groupings, (ii) income groupings, and (iii) political governance groupings. We place each of the countries in the WDI list into its relevant category of country groupings. However, each country's entry into the group is dependent on the data adequacy. Exclusion of any country of the WDI list from our sampling is solely due to data considerations (either non-availability or inadequacy of data.). Some of the countries could not make into the detailed econometric analyses, for lack of complete data for the stated variables for the required period in executing the panel GMM IV approach based regressions. The list of countries covered in detail under different groupings and sub-groupings is provided in *annexure 1 to 3*.

Economy Groupings

The World Economic Outlook April 2011 of IMF[2]guides our classification of countries into advanced, emerging and developing economies. We consider two more broad groupings: BRICS (Brazil, Russia, India, China and South Africa) and OECD[3] (Organisation for Economic Co-operation and Development). Table 1 provides sample description for economy groupings.

[2] World Economic Outlook April 2011 of IMF (Table 4.1: Economy groupings) is available at http://www.imf.org/external/pubs/ft/weo/2011/01/pdf/text.pdf

[3] The details about OECD members are available at http://www.oecd.org/about/membersandpartners/list-oecd-member-countries.htm

Table 1: Sample description for economy groupings

Panel A: Sample frame for economy groupings

Period	Advanced	Emerging	OECD	BRICS	Developing	Total
1980-2009	34	22	34	5	80	175

Panel B: Government Debt and GDP Growth in economy groupings

Countries	observations	Economies	GDP Growth		Government Debt	
			Mean	Median	Mean	Median
32	640	Advanced	2.39%	2.83%	57.12	53.38
5	100	BRICS	4.32%	4.70%	46.65	46.79
57	1140	Developing	3.36%	4.26%	71.63	56.67
21	420	Emerging	3.41%	4.70%	43.73	41.35
33	660	OECD	2.64%	2.90%	55.17	51.61
Total=148	2960					

Income Groupings

In arranging the data for income groupings, we follow the World Bank classification of economies[4]updated for the fiscal year 2015. We consider high-income economies (HIC), heavily indebted poor countries (HPC), least developed countries (LDC), low-income economies (LIC), and middle-income economies (MIC). Table 3 provides the description of our sample based on income groupings.

Table 2: Sample description for income groupings

Panel A: Sample frame for income groupings

Period	Middle-income (MIC)	High-income (HIC)	Heavily indebted poor (HPC)	Total
1980-2009	62	44	19	125

Panel B. Government Debt and GDP Growth in Income groupings

Countries	Observations	Economies	GDP Growth		Government Debt	
			Mean	Median	Mean	Median
38	760	High-income countries (HIC)	2.62%	3.10%	49.99	45.89
16	320	Heavily indebted poor countries (HPC)	3.12%	3.95%	124.10	103.87
34	680	Middle-income countries (MIC)	3.72%	4.56%	52.17	42.73
Total=88	1760					

[4] World Bank country classification is available at http://data.worldbank.org/about/country-and-lending-groups Accordingly, low income countries are those with gross national income (GNI) per capita of $1,045 or less; middle income countries, $1,046–12,745; high-income countries, $12,746 or more. The least developed countries (LDC) are classified as per the criteria set by the United Nations Economic and Social Council.
Details available at http://www.un.org/en/development/desa/policy/wesp/wesp_current/2014wesp_country_classification.pdf
Heavily indebted poor countries (HIPC) are classified according to the World Bank and IMF as part of their debt-relief initiative. These classifications are detailed in the World Economic Situation and Prospects (WESP) 2014 of the United Nations employed to delineate trends in various dimensions of the world economy. Also, refer Handbook on the Least Developed Country Category: Inclusion, Graduation and Special Support Measures (United Nations publication). Available from http://www.un.org/esa/analysis/devplan/cdppublications/2008cdphandbook.pdf

Political governance groupings

We consider seven well-acknowledged types of political governance systems: coalition-governments countries (CC), federal democracies (FD) and parliamentary democracies (PD). In doing so, we are guided by the World Factbook of CIA[5] and Encyclopedia Britannica. Table 3 provides the description of our sample based on political economy considerations.

Table 3: Sample description for political governance groupings

Panel A: Sample frame for political governance groupings

Period	Coalition Countries (CC)	Parliamentary Democracies (PD)	Federal Democracies (FD)	Total
1980-2009	54	45	21	120

Panel B: Government Debt and GDP Growth in political governance groupings

Countries	Observations	Countries	GDP Growth		Government Debt	
			Mean	Median	Mean	Median
31	620	Coalition Countries (CC)	3.10%	3.24%	66.24	61.59
14	280	Federal Democracies (FD)	3.11%	3.36%	54.26	54.83
16	320	Parliamentary Democracies (PD)	3.03%	3.15%	67.81	65.12
Total=61	1120					

Full sample

We explore the dimension of historical specificity by examining real GDP growth by government debt category for the period 1960-2009 (Table 4). We do not extend our dataset beyond 2009, in view of the sudden and significant rise in government debt levels consequent to the government interventions in response to global financial crisis[6].

Table 4: Sample description for full sample

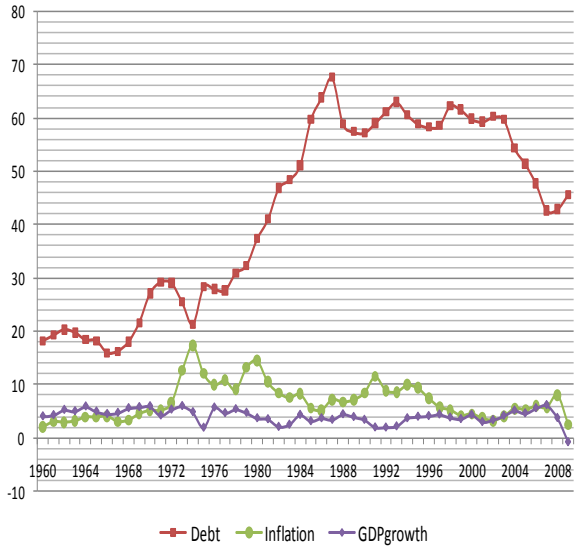
Period	Countries	observations	GDP growth		GGD	
			Mean	Median	Mean	Median
1960-2009	43	1380	3.59%	3.75%	48.36	44.41

[5] The World Factbook of The Central Intelligence Agency of United States provides information on the history, people, government, economy, geography, communications, transportation, military, and transnational issues for 267 world entities. Available at https://www.cia.gov/library/publications/the-world-factbook/
Encyclopedia Britannica | political system. Details available at http://www.britannica.com/print/topic/467746

[6] In industrial countries, government debt has risen significantly. In 2009, the net sovereign borrowing needs of the United Kingdom and the United States were five times larger than the average of the preceding five years (2002–07). The huge stimulus and bailout package adopted by the US government to deal with the crisis delivered by irresponsible financial agents in 2009 took the net government debt to GDP ratio in the U.S. from 42.6 in 2007 to 72.4 percent in 2011. In advanced economies as a whole, government debt to GDP ratios are expected to reach 110 percent by 2015—an increase of almost 40 percentage points over pre-crisis levels (IMF 2010). Many middle-income countries also witnessed a deterioration of their debt positions, although the trends are not as dramatic as those of advanced economies are. In low-income countries, in 2009–10 the present value of the government debt to GDP ratio has deteriorated by 5–7 percentage points compared with pre-crisis projections (IDA and IMF 2010).

Figure 1: Debt, Inflation and Growth

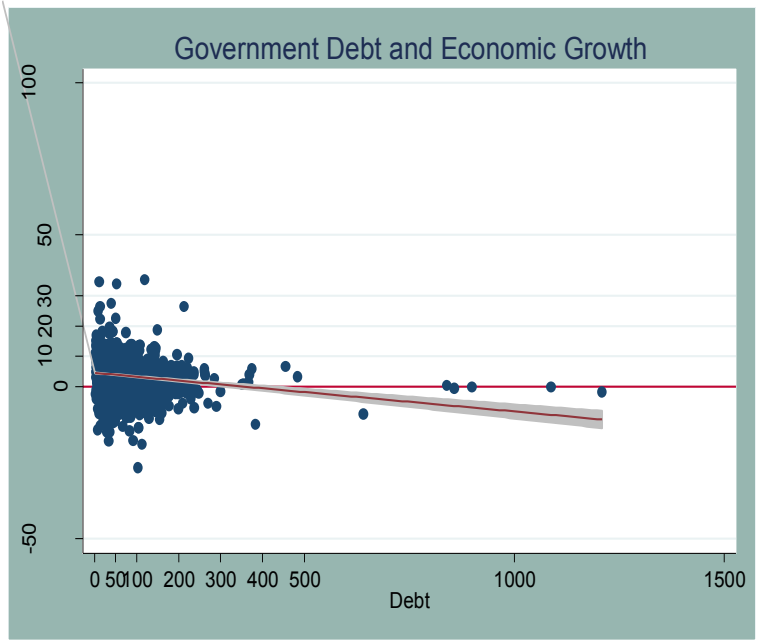
1. Debt, inflation and growth: 1960–2009



2. Inflation and growth in median debt levels

Before beginning the discussion on the macroeconomic determinants of government debt, we provide an overview of the interaction of debt inflation and growth. We find inflation not necessarily influencing high debt levels across countries (Figure 1). The median debt levels have soared particularly during 1980-2000. However, the inflation levels have not experienced drastic and noticeable rise during the corresponding period. Median inflation and median GDP growth have mostly moved in tandem during the corresponding debt levels during 1960-2009 (Figure 1.2). The interaction of government debt with growth in the full sample suggesting the negative relationship is presented in Figure 2.

Figure 2: Government debt and economic growth



Variables

We provide in Table 5 the description of variables and data sources.

Table 5: Description of variables and data sources

Variable	Description
adr Age dependency ratio (% of working-age population)	Age dependency ratio is the ratio of dependents--people younger than 15 or older than 64--to the working-age population--those ages 15-64. Data are shown as the proportion of dependents per 100 working-age population. Source: World Development Indicators (WDI)
fce Final consumption expenditure (% of GDP)	Final consumption expenditure is the sum of household final consumption expenditure (private consumption) and general government final consumption expenditure (general government consumption). Source: WDI
fdi Foreign direct investment, net inflows (% of GDP)	Foreign direct investments are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. Source: WDI
gdpgr *(GDPgrowth)* Real GDP growth (annual %)	Annual percentage growth rate of GDP at market prices based on constant local currency. Source: WDI
gfc General government final consumption expenditure (annual % growth)	Annual percentage growth of general government final consumption expenditure based on constant local currency. Source: WDI
gfcf Gross fixed capital formation (annual % growth)	Average annual growth of gross fixed capital formation based on constant local currency. Source: WDI
ggd *(debt)* General government gross debt	Gross debt consists of all liabilities that require payment or payments of interest and/or principal by the debtor to the creditor at a date or dates in the future. This includes debt liabilities in the form of SDRs, currency and deposits, debt securities, loans, insurance, pensions and standardized guarantee schemes, and other accounts payable. Source: World Economic Outlook (WEO) April 2012; Reinhart and Rogoff (RR) data set
infl Inflation (annual %)	Inflation as measured by the annual growth rate of the GDP implicit deflator shows the rate of price change in the economy as a whole. Source: WDI
pg Population growth (annual %)	Annual population growth rate for year t is the exponential rate of growth of midyear population from year t-1 to t, expressed as a percentage. Source: WDI
rir Real interest rate (%)	Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator. Source: WDI
tgdp *(openness)* Trade (% of GDP)	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product. Source: WDI
ulf Unemployed labour force	Unemployment, total (% of total labor force) (national estimate). Unemployment refers to the share of the labor force that is without work but available for and seeking employment. Definitions of labor force and unemployment differ by country. Source: WDI

3. Macroeconomic Determinants of Government Debt

In this section, we undertake an econometric investigation for identifying the determinants of government debt and attempt to answer the much-debated question – What factors influence government debt in a sovereign country? Stable macroeconomic environment, political stability, and credible institutional stability not only facilitate the debt

market but also the level of government debt. Unstable economic environment impelled by volatility of output growth, hyperinflation, and lack of trade openness tend to affect the level of government debt.

On the macroeconomic front, monetary policy credibility is one of the important factors that determine the level of government debt. When monetary policy credibility is low, interest rates tend to be very high. Interest rates might explicate much about government's decisions to issue debt and the nature of debt. Interest rates influence the rate at which new debt can be raised and hence affect the interest expenditure as well. Another monetary policy credibility proxy is the level of inflation. Countries with high and very high levels of inflation are less able to borrow on easy terms. Guscina (2008) shows that low and stable inflation is associated with higher domestic debt share in total central government debt. On the other hand, Forslund *et al.,* (2011) find that inflationary history has no statistically significant effect on the composition of government debt.

The Keynesian School of economic thought justifies government debt, as a repercussion of government's spending that is required to boost up the economy. The size of government's final consumption has a bearing on government's borrowings. Accordingly, general government final consumption expenditure significantly influences the borrowing decisions of the government, which in turn affects the government debt level. Governments raise debt to support public and profitable investment (in both physical infrastructures and human resources) by public spending. As the government seeks to boost the economy by undertaking fixed capital formation activity for enabling speedier growth of economy, the extent of growth of gross fixed capital formation affects the level of government debt.

Trade openness of countries should have a positive impact on the government debt on two counts: (i) more open countries suffer less from balance sheets effects associated with external borrowing (Calvo *et al.,* 2003), and (ii) open countries may be more successful in attracting foreign investors into the domestic market. Further, in a recent post-crisis research, Aizenman *et al.,* (2013) find that trade openness was the biggest factor behind Asia's lower sovereign spreads before the crisis, and inflation during and after the crisis. They also show that trade and financial openness, as well as foreign direct investment drove Asian emerging markets. We consider trade to GDP ratio as a proxy for the level of openness of the economy.

Investment openness denoted by foreign direct investment level of a country suggests the ability of its economy to attract foreign investments. Greater levels of direct investment flows into the economy reduce the burden on the government's external borrowings for its investment needs. Hence, higher levels of FDI flows affect the government debt negatively.

Theoretical possibilities include a rigorous application of optimal taxation theory to public debt determination. We attempt this by introducing final consumption expenditure as a much broader macroeconomic variable to proxy for fiscal policy. We consider final consumption expenditure as a measure of macroeconomic consumption of the economy. Final consumption expenditure is the sum of household final consumption expenditure (private consumption) and general government final consumption expenditure (government consumption).

We extend the theoretical foundations and introduce government final consumption expenditure as a macroeconomic variable for an explicit treatment of government spending. Final consumption expenditure can explain much of the trend in direct government spending (Egert, 2015). Direct government spending includes government final consumption expenditure, other payments by general government and net government fixed capital formation.

As Barro (1979) observes, existence of developed social safety nets partially financed by public deficits has a vital role as economic automatic stabilizers in responding to the increase of the unemployment rate. As a result, debt can grow in such circumstances to avoid distorting tax fluctuations. We assume that a large national government has jurisdiction over a population of exogenous size and hence ignore any effects of public debt policy on migration, which would otherwise be an important consideration for a local government. We consider population growth as a control variable in the country groupings. The proportion of dependents on working-age population is another macroeconomic factor that affects the level of debt. In theory, increasing burden on working population affects the fiscal position of the government negatively. Consequently, the increasing age dependency ratio would be associated negatively with public debt. Hence, we introduce age dependency ratio as a control variable in our specification.

Estimation strategy

We use the data sets detailed in Section 2. We consider three broad country groupings based on the availability of complete data for all the variables under consideration. Economy groupings include advanced economies, emerging economies, developing economies, OECD countries, and BRICS. Income groupings include high-income countries, highly indebted poor countries, and middle-income countries. Political governance groupings include coalition countries, federal countries and parliamentary countries. Full sample for analysis includes 43 countries. Our econometric analysis based on specific country groupings helps in broadly identifying the country specific nature of the macroeconomic determinants of government debt in those countries. We have chosen our full sample and sub samples based on the availability of authentic data for all the required variables. Table 5 provides the description of variables and data sources.

Our econometric estimation employs eight proxies for macroeconomic explanatory variables: (i) *Real GDP growth* - measure of economic growth, (ii) *final consumption expenditure* - measure of macroeconomic consumption, (iii) *general government final consumption expenditure* - measure of government size, (iv) *gross fixed capital formation* - measure of the size of domestic investment, (v) *foreign direct investment* - measure of the size of foreign investment, (vi) *inflation* - measure of macroeconomic imbalance, (vi) *real interest rate* - measure of monetary policy credibility, (vii) *trade openness* - measure of macroeconomic openness, (viii) *population growth*, *age dependency ratio, and unemployed labour force* - measures of other socio-economic controls. Table 7 provides the correlations of the variables employed in the analysis.

Table 6: Summary statistics: Government debt to GDP ratio

This table presents the summary statistics of government debt (debt to GDP) variable across all country groupings.

Country groupings	Period	No. of countries	Mean (μ)	Standard deviation (σ)	Median	Min	Max	No. of Obs
Economy groupings								
1. Advanced economies	1980-2009	22	61.91	31.32	60.18	6.31	210.25	588
2. Emerging economies	1980-2009	11	46.37	21.60	44.64	3.89	154.90	214
3. Developing economies	1980-2009	19	58.52	29.91	52.22	6.69	229.33	362
4. OECD countries	1980-2009	25	59.05	31.50	57.20	3.89	210.25	546
5. BRICS	1980-2009	5	56.14	16.63	61.50	27.36	81.76	140
Income groupings								
1. High income countries	1980-2009	24	59.90	31.52	58.88	3.89	210.25	547
2. Highly-indebted poor countries	1980-2009	8	69.17	41.16	56.54	18.67	229.33	210
3. Middle income countries	1980-2009	18	57.95	30.40	51.30	6.69	229.33	343
Political governance groupings								
1. Coalition countries	1980-2009	27	59.44	33.63	57.20	3.89	210.25	546
2. Federal countries	1980-2009	17	55.32	23.37	53.35	9.71	154.90	314
3. Parliamentary countries	1980-2009	14	59.75	33.26	57.58	6.31	131.80	250
Full sample	1960-2009	43	59.14	31.07	55.95	3.89	229.33	891

Table 7: Correlations for determinants of government debt

	RIR	ADR	PG	ULF	GGD	FDI	GDPGR	GFCF	GFC	TGDP	FCE	INFL
Real interest rate (RIR)	1.000											
Age dependency ratio (ADR)	0.054	1.000										
Population growth (PG)	-0.031	0.707	1.000									
Unemployed labour force (ULF)	0.079	0.114	0.178	1.000								
General government gross debt (GGD)	0.050	-0.174	-0.400	-0.025	1.000							
Foreign direct investment (FDI)	0.067	-0.005	0.023	0.024	-0.213	1.000						
Real GDP growth (GDPGR)	-0.085	0.081	0.109	0.046	-0.132	0.160	1.000					
Gross fixed capital formation (GFCF)	-0.090	0.058	0.132	-0.004	-0.136	0.175	0.756	1.000				
Government final consumption (GFC)	-0.034	-0.054	0.094	0.003	-0.159	0.110	0.264	0.452	1.000			
Openness (TGDP)	-0.172	0.110	-0.019	0.125	-0.059	0.218	0.142	0.043	0.033	1.000		
Final consumption expenditure (FCE)	0.320	0.458	0.199	0.101	0.084	-0.017	-0.056	-0.153	-0.219	-0.105	1.000	
Inflation (INFL)	-0.045	0.103	0.087	0.000	0.043	-0.043	-0.127	0.029	0.076	-0.053	0.043	1.000

Note: The correlations presented here are for the full sample of countries employed in the panel data analysis.

We employ balanced-panel data for the analysis as it allows controlling for heterogeneity between countries. It is less likely to be plagued by collinearity between variables. As panel data provides information on variation between countries and within countries, the analysis can produce more reliable parameter estimates, with higher degrees of freedom and efficiency. Our specification assumes that the government debt for country '*j*' conforms to a linear relationship over a period '*t*' and is common across the panel of countries.

$$Debt_t^j = \hat{\beta} X_t^j + \mu_j + \nu_t + \varepsilon_{jt} \text{ ------- Eqn (1)}$$

X_t^j is a vector of regressors including *lagged GDP, gfcf, gfc, tgdp, fce, fdi* and *infl*. It also includes the constant. μ_j is country-specific fixed effects; ν_t is time-fixed effects; ε_{jt} is the unobservable error term.

$$Debt_t^j = GDPgrowth_{t-1}^{\ j} + gfc_t^j + fce_t^j + gfcf_t^j + tgdp_t^j + INFL_t^j + fdi_t^j + \\ + rir_t^j + \mu_j + \nu_t + \varepsilon_{jt}$$

---- Eqn (2)

Given the strong potential for endogeneity of the debt variable, we use instrumental variable (IV) estimation technique. In our instrumental variables model, we instrument the Solow variables using their lagged variables. In Eqn (6.3), we introduce the control variables - *adr*, *pg*, and *ulf*.

$$Debt_t^j = GDPgrowth_{t-1}^{\ j} + gfc_t^j + fce_t^j + gfcf_t^j + tgdp_t^j + INFL_t^j + fdi_t^j + \\ + rir_t^j + adr_t^j + pg_t^j + ulf_t^j + \mu_j + \nu_t + \varepsilon_{jt}$$

---- Eqn (3)

We use fixed period effects generalized methods of moments regressions with IV estimation for panel data. The unique feature of GMM estimation is that it provides a straightforward way to test the specification in models for which there are moment conditions than model parameters. We use White period GMM weights with cross-section weights (PCSE) standard errors & covariance. Many studies exploring panel data have made use of IV approach to deal with the issue of simultaneity bias Hiebert *et al.,* (2002). With the use of GMM estimator, we seek to correct for the possible heteroskedasticity and autocorrelation in the error structure by using the consistent estimator. The two-step GMM provides some efficiency gains over the traditional IV/2-SLS estimator derived from the use of the optimal weighting matrix, the over identifying restrictions of the model (Baum *et al.,* 2013).

We use panel-based unit root tests that are believed to have higher power than unit root tests based on individual time series for testing the unit roots. We compute the summary panel unit root test, using individual fixed effects as regressors, and automatic lag difference term and bandwidth selection (using the Schwarz criterion for the lag differences, and the Newey-West method and the Bartlett kernel for the bandwidth). The null of a unit root is tested using Levin, Lin & Chu test, Im, Pesaran and Shin W-stat test, ADF - Fisher Chi-square test, and PP - Fisher Chi-square test. In case the variable/s is/are found to be stationary at the first difference, in such cases we bring in the differenced variable for analysis.

Table 8: Macroeconomic Determinants of Government Debt

This table presents the results of the Panel Generalized Method of Moments (GMM) regressions for identifying the determinants of government debt in the full sample of countries for the period 1960-2009. Our dependent variable is the government debt. Column (1) presents the results of the regressions with macroeconomic determinants. Column (2) presents the results of the regressions with other control variables in addition to macroeconomic determinants. We use instrumental variables techniques with fixed effects and employ cross-section weights (PCSE) standard errors & covariance. We report the coefficient values marked with significance levels in the first row followed by the standard errors (in the parenthesis) in the second row. Asterisks ***, ** indicate levels of significance at 1%, and 5% respectively.

Explanatory Variables	Mean/Std. Deviation (in italics)	(1)	(2)
Real GDP growth	3.11 *3.29*	-1.481*** (0.343)	-1.521* (0.341)
Final consumption expenditure	77.79 *6.96*	0.475*** (0.181)	0.512*** (0.180)
Foreign direct investment	2.54 *3.68*	-1.086*** (0.349)	-1.093*** (0.333)
Government expenditure	2.87 *5.22*	-0.425* (0.210)	-0.409* (0.203)
Inflation	30.73 *449.08*	-0.002 (0.002)	-0.002 (0.002)
Trade Openness	62.76 *31.65*	0.173*** (0.039)	0.150*** (0.037)
Gross fixed capital formation	4.22 *12.14*	0.252*** (0.095)	0.254*** (0.094)
Real interest rate	7.82 *12.76*	0.034 (0.084)	0.039 (0.081)
Age dependency ratio	56.39 *10.04*		-0.042 (0.151)
Population growth	1.09 *0.75*		-7.030*** (1.863)
Unemployment	8.34 *4.93*		0.172 (0.203)
Intercept		19.194 (15.750)	27.830 (15.035)
R-squared		0.147	0.163

Table 9: Determinants of Debt in Economy groupings

This table presents the results of the Panel Generalized Method of Moments regressions for identifying the determinants of government debt in economy groupings of countries. Our dependent variable is the government debt. Columns (1), (3), (5), (7) and (9) present the results of the regressions with macroeconomic determinants. Columns (2), (4), (6), (8) and (10) present the results of the regressions with other control variables in addition to macroeconomic determinants. We use instrumental variables techniques with fixed effects and employ cross-section weights (PCSE) standard errors & covariance. We report the coefficient values marked with significance levels in the first row followed by the standard errors (in the parenthesis) in the second row. Asterisks ***, ** indicate levels of significance at 1%, and 5% respectively.

	Advanced economies (AE)		Emerging economies (EE)		Developing economies (DE)		OECD countries (OECD)		BRICS	
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Real GDP growth	-0.64	-0.27	-1.03***	-1.31***	-1.63***	-1.43***	-0.698	-0.282	-0.783	-0.156
	(0.653)	(0.643)	(0.206)	(0.177)	(0.335)	(0.373)	(0.543)	(0.549)	(0.793)	(0.622)
Final consumption expenditure	0.99***	0.67**	0.52***	0.61***	0.41**	1.17***	0.50**	0.316*	2.85***	1.32**
	(0.298)	(0.268)	(0.143)	(0.174)	(0.204)	(0.231)	(0.239)	(0.232)	(0.456)	(0.433)
Foreign direct investment	-1.23**	-0.66**	-3.44***	-3.11***	-0.468	-0.017	-1.41***	-1.08***	1.84*	1.381
	(0.372)	(0.337)	(0.479)	(0.495)	(0.513)	(0.544)	(0.361)	(0.325)	(0.941)	(0.864)
Government expenditure	-2.78***	-2.61***	-0.104	-0.146	-0.093	-0.006	-1.53***	-1.65***	0.082	0.222
	(0.584)	(0.545)	(0.155)	(0.115)	(0.219)	(0.220)	(0.357)	(0.349)	(0.319)	(0.247)
Inflation	-1.86***	-1.38***	-0.004**	-0.003	-0.003	-0.003	-1.392***	-0.347	-0.623	-0.167
	(0.357)	(0.332)	(0.002)	(0.002)	(0.002)	(0.003)	(0.208)	(0.254)	(0.648)	(0.602)
Trade Openness	0.18***	0.14***	0.007*	0.031*	0.15***	0.17***	0.21***	0.13***	0.78***	
	(0.048)	(0.047)	(0.037)	(0.037)	(0.034)	(0.034)	(0.045)	(0.049)	(0.099)	
Gross fixed capital formation	0.04	0.0635	0.041	0.097	0.20**	0.24***	0.026	0.118	0.68*	0.51*
	(0.185)	(0.166)	(0.065)	(0.058)	(0.084)	(0.090)	(0.167)	(0.159)	(0.311)	(0.252)
Real interest rate	-0.648	-0.018***	0.23***	0.22**	0.114	0.065	-0.417	-0.083	-0.016	
	(0.450)	(0.412)	(0.063)	(0.068)	(0.074)	(0.086)	(0.282)	(0.280)	(0.093)	
Age dependency ratio		-1.3625		-0.099		-0.97***		-0.71***		-1.63***
		(0.270)		(0.240)		(0.221)		(0.229)		(0.429)
Population growth		-19.74***		2.288*		5.58*		-16.11***		-18.97***
		(2.726)		(4.477)		(2.946)		(2.657)		(5.276)
Unemployment		1.20***		-0.71***		-0.37**		1.03***		-1.88***
		(0.255)		(0.195)		(0.221)		(0.225)		(0.164)
Intercept	-3.7193	85.89***	15.112	7.573	18.818	15.813	23.785	76.03***	315.07***	254.3***
	(24.314)	(25.56)	(11.802)	(11.614)	(16.994)	17.189)	(20.035)	(23.094)	(38.115)	(48.227)
R-squared	0.2826	0.3997	0.634	0.750	0.379	0.321	0.240	0.334	0.950	0.966

Table 10: Determinants of Debt in Income groupings

This table presents the results of the Panel Generalized Method of Moments regressions for identifying the determinants of government debt in income groupings of countries. Our dependent variable is the government debt. Columns (1), (3), and (5) present the results of the regressions with macroeconomic determinants. Columns (2), (4) and (6) present the results of the regressions with other control variables in addition to macroeconomic determinants. We use instrumental variables techniques with fixed effects and employ cross-section weights (PCSE) standard errors & covariance. We report the coefficient values marked with significance levels in the first row followed by the standard errors (in the parenthesis) in the second row. Asterisks ***, ** indicate levels of significance at 1%, and 5% respectively.

	High income countries (HIC)		Highly-indebted poor countries (HPC)		Middle income countries (MIC)	
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)
Real GDP growth	-1.02**	-0.07	-4.91***	-4.75***	-1.27***	-1.67***
	(0.512)	(0.510)	(1.174)	(1.211)	(0.297)	(0.309)
Final consumption expenditure	0.33	0.34	0.03	1.50	0.51***	0.80***
	(0.289)	(0.268)	(0.615)	(1.066)	(0.163)	(0.180)
Foreign direct investment	-1.81***	-1.22***	-0.89	-3.56*	-0.85*	-0.54
	(0.403)	(0.360)	(1.712)	(1.820)	(0.504)	(0.461)
Government expenditure	-2.70***	-2.66***			-0.18	-0.44***
	0.516)	(0.490)			(0.140)	(0.127)
Inflation	(0.005	0.16*	-0.0003	0.0004	0.003	0.002
	0.081)	(0.088)	(0.0027)	(0.002)	(0.002)	(0.002)
Trade Openness	0.19***	0.17***	1.26***	0.83***	0.17***	0.15***
	(0.050)	(0.048)	(0.245)	(0.272)	(0.033)	(0.034)
Gross fixed capital formation	0.174	0.12			-0.014	0.12
	(0.158)	(0.146)			(0.076)	(0.079)
Real interest rate	-0.59***	-0.40***			0.32***	0.24***
	(0.157)	(0.148)			(0.076)	(0.082)
Age dependency ratio		-1.403***		-4.64***		-0.65***
		(0.262)		(1.667)		(0.210)
Population growth		-17.52***		8.93		-0.78
		(2.518)		(13.958)		(4.214)
Unemployment		0.96***				0.10
		(0.243)				(0.182)
Intercept	38.70	108.42***	15.82	279.73***	10.93	32.62***
	(24.363)	(25.267)	(60.948)	(111.663)	(13.281)	(12.912)
R-squared	0.2422	0.3582	0.7140	0.7612	0.5254	0.6926

Table 11: Determinants of Debt in Political governance groupings

This table presents the results of the Panel Generalized Method of Moments regressions for identifying the determinants of government debt in political governance groupings of countries. Our dependent variable is the government debt. Columns (1), (3) and (5) present the results of the regressions with macroeconomic determinants. Columns (2), (4) and (6) present the results of the regressions with other control variables in addition to macroeconomic determinants. We use instrumental variables techniques with fixed effects and employ cross-section weights (PCSE) standard errors & covariance. We report the coefficient values marked with significance levels in the first row followed by the standard errors (in the parenthesis) in the second row. Asterisks ***, ** indicate levels of significance at 1%, and 5% respectively.

	Coalition countries (CC)		Federal countries (FC)		Parliamentary democracies (PD)	
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)
Real GDP growth	-1.25**	-0.95**	-0.75	-1.03**	-1.38	-0.89
	(0.509)	(0.499)	(0.468)	(0.470)	(0.848)	(0.707)
Final consumption expenditure	0.70**	0.05	0.63**	0.51**	1.24***	2.30***
	(0.302)	(0.277)	(0.253)	(0.259)	(0.320)	(0.267)
Foreign direct investment	-1.56***	-1.56***	0.39	0.66	-1.60***	-0.44***
	(0.367)	(0.318)	(0.453)	(0.460)	(0.442)	(0.329)
Government expenditure	-0.37	-0.36	-0.52	-0.54*	-0.86**	-0.12
	(0.352)	(0.356)	(0.323)	(0.327)	(0.385)	(0.262)
Inflation	-0.51**	-0.01	0.34***	0.27**	-0.86	-0.90***
	(0.240)	(0.228)	(0.103)	(0.123)	(0.417)	(0.33)
Trade Openness	0.17***	0.15***	0.28***	0.15**	0.38***	0.24***
	(0.040)	(0.048)	(0.075)	(0.063)	(0.069)	(0.069)
Gross fixed capital formation	0.31***	0.32***	0.40***	0.36**	-0.12	-0.038
	(0.118)	(0.120)	(0.158)	(0.163)	(0.254)	(0.176)
Real interest rate	-0.19	-0.01	0.28***	0.20**	-0.37	-0.80
	(0.136)	(0.136)	(0.103)	(0.097)	(0.704)	(0.565)
Age dependency ratio		-0.33		-0.10		-0.44
		(0.295)		(0.292)		(0.420)
Population growth		-13.68***		2.10		-12.71***
		(2.540)		(2.516)		(3.409)
Unemployment		1.83		-0.98**		4.03***
		(0.373)		(0.183)		(0.398)
Intercept	1.74	66.49***	-14.01	3.58	-41.62*	-124.18***
	(24.878)	(24.757)	(22.561)	(20.369)	(23.696)	(24.924)
R-squared	0.1925	0.2819	0.2866	0.2771	0.3041	0.5375

Robustness Checks

In order to ascertain whether the empirical results are robust, we explore three routes. First, we investigate the robustness of the results with respect to the presence of outliers, and find that outliers do not drive the main results. Second, we investigate the robustness of the results by performing various iterations of regression analysis. Results presented are robust to modifications after duly considering the potential biases resulting from the omitted variables. The recent literature suggests that panel-based unit root tests have higher power than unit root tests based on individual time series. We find that the results pass the tests of robustness checks.

Results and Discussion

The results of the analysis employing the full sample are presented in Table 8. We notice that real GDP growth has a significant negative effect on the debt. For every 1.0 percentage point growth in real GDP growth, there is a decline in government debt in the range of 1.48 to 1.52 percentage points. Trade openness has a significant positive effect on inflation. For every one-percentage point growth in trade openness, the rise in debt is in the range of 0.15 to 0.17 percent.

Gross fixed capital formation has a significant positive correlation with debt. For every percentage point rise in gross fixed capital formation, we notice a corresponding rise in the range of 0.252 to 0.254 percent in debt. We notice a significant positive relationship of final consumption expenditure with debt. For every percentage point increase in final consumption expenditure in the economy, there appears to be rise of debt in the range of 0.475 to 0.512 percent. However, government expenditure is found to have no positive relationship with debt. These results provide evidence to our hypothesis that while gross fixed capital formation and final consumption expenditure provide an enabling environment for investors, the rising government expenditure does not find favour with the investors.

Influx of capital through foreign direct investment contributes to decline debt. Accordingly, our results suggest a statistically significant negative effect of FDI on debt. For every percentage point increase in FDI, there appears to be reduction of debt in the range of 1.08 to 1.09 percent. The association of real interest rate with debt is found to be positive but not statistically significant. For every percentage rise in real interest rate, there appears to be a rise in debt in the range of 0.034% to 0.039%.

Population growth appears to have a negative association with debt. This supports the economic rationale that investors tend to desist in countries with very high growth in population. In theory, unemployment can be statistically insignificant in positively affecting debt when the governments are able to meet the social security and public safety needs met by public finance. Our results are in line with the expectations. Further, we notice a statistically significant negative effect of age dependency ratio on debt.

We present in Table 9, the results of the analysis of determinants of debt in economy groupings. In all economy groupings, we notice a statistically significant negative effect of real GDP growth on the debt. For every 1.0 percentage point growth in real GDP growth, there is a decline in government debt in the range of 0.27% – 0.64% for advanced economies (AE), 1.03% – 1.31% for emerging economies (EE), 1.43% – 1.63% for developing economies (DE), 0.28% – 0.69% for OECD countries and 0.15% – 0.78% for BRICS. In all the economy groupings, final consumption expenditure in the economy has a statistically significant positive association with debt. The positive association with debt is in the range of 0.99% – 0.67% for AE, 0.52% – 0.61% for EE, 0.41% – 1.17% for DE, 0.50% – 0.31% for OECD and 1.32% – 2.85% for BRICS for every percentage point rise in final consumption expenditure. Gross fixed capital formation has a positive effect on debt in all the economy groupings. The positive correlation with debt is in the range of 0.04% – 0.06% for AE, 0.04% – 0.09% for EE, 0.2% – 0.24% for DE, 0.02% – 0.11% for OECD and 0.68% – 0.51% for BRICS for every percentage point rise in gross fixed capital formation. Trade openness has a statistically significant positive association with debt. For every percentage point increase in trade openness, we find rise in debt in the range of 0.14% – 0.18% for AE, 0.007% – 0.03% for EE, 0.15% – 0.17% for DE, 0.13% – 0.21% for OECD and 0.68% – 0.78% for BRICS.

We notice a statistically negative effect of FDI on debt. For every percentage point growth in FDI, we find upsurge of debt in the range of 0.66% – 1.23% for AE, 3.11% – 3.44% for EE, 0.017% – 0.46% for DE, 1.08% – 1.41% for OECD and 1.38% – 1.84% for BRICS. We are particularly pleased with the result that EE experience largest negative effect on debt amongst the groupings. It provides evidence to our argument that EE are attracting higher flows of FDI. Government expenditure has a statistically significant negative effect on debt. The results suggest that for every percentage point rise in government expenditure, debt experiences a decline in the range of 2.61% - 2.78% for AE, 0.10% - 0.14% for EE, 0.06%-0.09% for DE, 1.53% - 1.65% for OECD and 0.08% - 0.22% for BRICS.

Population growth has a statistically negative effect on debt in advanced, OECD and BRICS countries. Unemployment is observed to have a statistically negative effect on debt in EE, DE and BRICS countries. The results suggest that these countries need to step up their public finance for social safety requirements in order to offset the ill effects of unemployment. On the other hand, we notice a positive effect in the case of AE and OECD countries. Further, we notice a statistically significant negative effect of age dependency ratio on debt supporting our argument that mounting burden on working population negatively affects the fiscal position of the government, which in turn has a negative effect on public debt. Other determinants display the coefficients in line with our economic articulations of theory.

The results for the analysis of determinants of debt in income groupings are presented in Table 10. In all income groupings of countries, we notice a statistically significant negative effect of real GDP growth on the debt. For every percentage point growth in real GDP growth, there is a decline in government debt in the range of 0.07% – 1.02% for high-income countries (HIC), 4.75% – 4.91% for highly indebted poor countries (HPC), 1.27% – 1.67% for middle income countries (MIC). These results support our argument that higher growth tends to have a negative effect on debt. In all the income groupings, final consumption expenditure in the economy has a positive association with debt. The statistically significant effect in the case of MIC implies that these countries suffer from lower levels of consumption expenditure in their economies.

We notice a statistically negative effect of FDI on debt across all the income groupings. For every percentage point growth in FDI, we find upsurge of debt in the range of 1.22% – 1.81% for HIC, 0.89% – 3.56% for HPC, and 0.54% – 0.85% for MIC. The highest effect among the groups is observed in HIC, which supports our argument that these countries have been able to attract higher FDI flows. Trade openness has statistically significant positive effect on debt in line with our theoretical propositions. The range of effect is found to be higher in the case of highly indebted poor countries (0.83% to 1.26%).

One notable observation in the case of HPC is about the government final consumption expenditure. Since the governments of these countries suffer from highly imbalanced fiscal conditions, they suffer from insignificant consumption expenditure that has no relevance in the model.

We now analyse the results for the analysis of determinants of debt in political governance groupings presented in Table 11. In all sub-groupings of countries, we notice a negative effect of real GDP growth on the debt. However, we notice insignificance of the effect in parliamentary democracies (PDs). It suggests that real GDP growth in these countries is not significant enough to affect public debt negatively and offers evidence to our viewpoint that PDs experience lower GDP growth compared to coalition countries (CCs) and federal democracies (FDs) (refer Table 3). Therefore, PDs experience higher level of public debt compared to other groupings. For every percentage point growth in real GDP growth, there is a decline in government debt in the range of 0.95% – 1.25% in CCs, 0.75% – 1.03% in FCs, and 0.89% – 1.38% in PDs.

We notice an insignificant effect of FDI on debt in federal countries (FCs) which perhaps indicates that these countries experience lower levels of FDI compared to other groups of countries. Further, as the FCs experience high levels of inflation compared to other groups countries, inflation has a statistically significant negative effect on debt. Though other groups of countries also display similar effect, the statistical significance is lesser in those groups. This result provides empirical evidence to our argument that countries with inflation under control can attract debt on much convenient terms than those with higher levels of inflation.

A notable observation is that PDs experience statistically insignificant negative effect of gross fixed capital formation on debt. Since the governments of these countries suffer from highly imbalanced fiscal conditions, they undergo insignificant gross fixed capital formation that fails to attract sovereign debt creditors.

We notice an interesting phenomenon related to population growth in FCs. We find population growth not affecting the debt negatively contrary to the statistically significant negative effect observed in CCs and PDs. This is perhaps due to the reason that in FCs, population growth is not perceived as an economic problem for the lenders. We find an improved situation of unemployment in CCs compared to FCs and PDs. In line with our economic logic, unemployment has no statistically significant impact on debt in CCs. On the other hand, we notice its statistically significant negative effect in the case of FCs and PDs.

4. Testing for Causality

Our first caveat about our results concerns causality. Although we use lagged values of the explanatory variables and employ GMM IV instruments, we cannot make any claim that our estimations uncover a causal relationship going from the explanatory variables to debt.
In this section, we run panel data specific causality testing. We perform panel Granger causality that is computed by running bivariate regressions. In our setting to perform this causality testing, least squares regressions can take the below mentioned form of bivariate regression in a panel data:

$$y_{i,t} = \alpha_{0,i} + \alpha_1 y_{i,t-1} + \ldots + \alpha_l y_{i,t-1} + \beta_{1,i} x_{i,t-1} + \ldots + \beta_{1,i} x_{i,t-1} + \varepsilon_{i,t} \text{ ---- Eqn (6.4.1)}$$

$$x_{i,t} = \alpha_{0,i} + \alpha_1 x_{i,t-1} + \ldots + \alpha_l x_{i,t-1} + \beta_{1,i} y_{i,t-1} + \ldots + \beta_{1,i} y_{i,t-1} + \varepsilon_{i,t} \text{ ---- Eqn (6.4.2)}$$

for all possible pairs of series in the group. "*t"* denotes the time period dimension of the panel and "*i*" denotes the cross-sectional dimension of the panel. We pair each of the regressors employed in panel GMM with our focus variable debt. First, we run the Granger causality in the standard way and then adopt the one suggested by Demitrescu-Hurlin (2012) that makes an extreme opposite assumption, allowing all coefficients to be different across cross-sections. We produce here below the results of the panel Granger causality tests for the full sample analysis.

According to the results of panel granger causality tests (Table 12), the *p*-values are significant for (1), (2), (5), (6), (7), (8), (9), (10) and (11). Hence, we reject the null hypotheses of the tests. Accordingly, it is implied that: (i) GDP growth homogeneously granger cause debt (ii) final consumption expenditure homogeneously granger cause debt (iii) inflation homogeneously granger cause debt (iv) trade openness homogeneously granger cause debt (v) gross fixed capital formation homogeneously granger cause debt (vi) real interest rate homogeneously granger cause debt (vii) age dependency ratio homogeneously granger cause debt (viii) population growth homogeneously granger cause debt and (ix) Unemployment homogeneously granger cause debt. As the p-values are not significant for (3) and (4), we cannot reject the null hypothesis. Therefore, it appears that Granger causality runs one-way from: (i) debt to FDI and (ii) debt to government expenditure.

Table 12: Results of Pairwise Demitrescu-Hurlin Panel Causality Tests

This table presents the results of the analysis of panel data for the period 1960-2009 for the full sample employing the lag criterion of 2 lags.

Specification	Null Hypothesis:	W-Stat.	Zbar-Stat.	Prob.
1	GDP growth does not homogeneously cause debt	5.3281	9.8215	0.0000
	Debt does not homogeneously cause GDP growth	4.0762	6.0041	0.0000
2	Final consumption expenditure does not homogeneously cause debt	3.5257	4.2742	0.0000
	Debt does not homogeneously cause final consumption expenditure	4.0881	5.9772	0.0000
3	FDI does not Granger cause Debt	1588.0	0.2773	0.7578
	Debt does not Granger cause FDI		4.3478	0.0131
4	Government expenditure does not Granger cause debt	1889.0	2.0187	0.1331
	Debt does not Granger cause Government expenditure		19.1206	0.0000
5	Inflation does not homogeneously cause debt	4.7936	8.1916	0.0000
	Debt does not homogeneously cause Inflation	8.4004	19.1906	0.0000
6	Trade Openness does not homogeneously cause debt	3.0693	2.9477	0.0032
	Debt does not homogeneously cause Trade Openness	4.7843	8.1901	0.0000
7	Gross fixed capital formation does not Granger cause debt	1783.0	7.4081	0.0006
	Debt does not Granger cause Gross fixed capital formation		16.7611	0.0000
8	Real interest rate does not Granger cause debt	1223.0	5.1074	0.0062
	Debt does not Granger cause Real interest rate		1.4189	0.2424
9	Age dependency ratio does not homogeneously cause debt	4.5297	7.4432	0.0000
	Debt does not homogeneously cause Age dependency ratio	12.975	33.3368	0.0000
10	Population growth does not homogeneously cause debt	3.0747	2.982	0.0029
	Debt does not homogeneously cause Population growth	5.2784	9.73773	0.0000
11	Unemployment does not Granger cause debt	981.0	12.9934	0.0000
	Debt does not Granger cause Unemployment		8.11758	0.0003

The above results of panel granger causality infer that the causation for growth of government debt runs from its macroeconomic determinants: real GDP growth, final consumption expenditure, inflation, trade openness, gross fixed capital formation, real interest rate, age dependency, population growth, and unemployment to debt. However, the direction of causation from FDI to debt and government expenditure to debt is statistically insignificant. In identifying the macroeconomic determinants of debt, these results provide econometric proof of causation to our panel GMM regression results. We have shown in this section that macroeconomic factors such as: real GDP growth, final consumption expenditure, inflation, trade openness, gross fixed capital formation, real interest rate, age dependency, population growth, and unemployment have statistically significant effect on the growth of government debt.

5. Conclusion

This study has presented a thorough data–rich analysis of macroeconomic determinants of government debt. It spans across different debt regimes and involves a worldwide sample of countries that is more representative. The sources on which the study draws are more authentic and well accepted. We do not claim that the results are infallible, but do state that they are based on widely accepted econometric tools and techniques besides sound economic logic. The study provides an original analysis of the debt and growth beyond the popular discourse mostly surrounding the advanced countries.

This study offers an econometric investigation for identifying the macroeconomic determinants of government debt and attempt to answer the much-debated question – *What factors influence government debt in a sovereign country*? First, we have analysed the full sample and then provided analyses for economy groupings, political governance groupings and income groupings. The results of the full sample analysis reveal that real GDP growth, foreign direct investment, government expenditure, inflation and population growth have negative effect on debt. Gross fixed capital formation, final consumption expenditure, and trade openness have positive effect on debt.

We find that parliamentary democracies experience higher level of government debt compared to other groupings as they suffer from low levels of real GDP growth. Parliamentary democracies experience negative effect of gross fixed capital formation on debt. Since the governments of these countries suffer from highly imbalanced fiscal conditions, they undergo insignificant gross fixed capital formation that fails to attract sovereign debt creditors. The study finds an interesting phenomenon related to population growth in federal countries. Population growth in these countries does not affect government debt negatively contrary to the negative effect observed in coalition countries and parliamentary democracies. This is perhaps due to the reason that in federal countries' population growth is not as high an economic problem for the lenders.

To establish causality running from the determinants of debt, we employed the panel Granger causality testing. The results infer that the causation for growth of government debt runs from its macroeconomic determinants: real GDP growth, final consumption expenditure, inflation, trade openness, gross fixed capital formation, real interest rate, age dependency, population growth, and unemployment to debt.

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Appendices

Annexure 1: Countries covered in Economy groupings		
1	Advanced Countries (27)	Australia, Austria, Belgium, Canada, Cyprus, Denmark, Finland, France, Germany, Greece, Hong Kong, Iceland, Ireland, Italy, Japan, Korea, Malta, Netherlands, New Zealand, Norway, Portugal, Slovenia, Spain, Sweden, Switzerland, United Kingdom, and United States.
2	BRICS (5)	Brazil, Russia, India, China, and South Africa
3	Developing Countries (57)	Albania, Argentina, Azerbaijan, Bahamas, Belize, Bolivia, Bulgaria, Burundi, Cameroon, China, Colombia, Congo, Congo Rep, Costa Rica, Cote d'Ivoire, Dominican Republic, Ecuador, Egypt, Guatemala, Honduras, India, Indonesia, Jordan, Kazakhstan, Kenya, Kyrgyz Republic, Lesotho, Madagascar, Malaysia, Mauritius, Mexico, Moldova, Morocco, Namibia, Nicaragua, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Romania, Russian Federation, Rwanda, Sierra Leone, South Africa, Sri Lanka, Sudan, Tajikistan, Thailand, Trinidad and Tobago, Tunisia, Uganda, Ukraine, Uruguay, Venezuela, and Zambia
4	Emerging economies (21)	Argentina, Brazil, Bulgaria, Chile, China, Colombia, India, Indonesia, Lithuania, Malaysia, Mexico, Peru, Philippines, Poland, Romania, Russian Federation, South Africa, Thailand, Turkey, Ukraine, and Venezuela.
5	OECD Countries (33)	Algeria, Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States.

Annexure 2: Countries covered in Income groupings		
1	High Income Countries *HIC* (38)	Australia, Austria, Bahamas, Bahrain, Belgium, Canada, Chile, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hong Kong SAR, China, Iceland, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Malta, Netherlands, New Zealand, Norway, Oman, Poland, Portugal, Russian Federation, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Trinidad and Tobago, United Kingdom, United States
2	Highly indebted Poor Countries *HPC* (16)	Bolivia, Burundi, Cameroon, Congo DR, Congo R, Cote d'Ivoire, Ethiopia, Gambia, Honduras, Madagascar, Nicaragua, Rwanda, Sierra Leone, Sudan, Uganda, and Zambia.
3	Middle Income Countries (34)	Albania, Argentina, Azerbaijan, Belize, Bhutan, Botswana, Brazil, Bulgaria, China, Colombia, Congo R, Dominican Republic, Ecuador, El Salvador, Guatemala, India, Indonesia, Kazakhstan, Malaysia, Mauritius, Mexico, Moldova, Namibia, Paraguay, Peru, Philippines, Romania, South Africa, Sudan, Thailand, Tunisia, Turkey, Ukraine, and Venezuela

Annexure 3: Countries covered in Political economy groupings		
1	Coalition Countries (31)	Austria, Belgium, Brazil, Bulgaria, Chile, Denmark, Dominican Republic, Finland, France, Germany, Greece, Iceland, India, Indonesia, Ireland, Italy, Japan, Kenya, Malaysia, Morocco, Netherlands, New Zealand, Norway, Pakistan, Panama, Portugal, Sri Lanka, Sweden, Switzerland, Thailand, and United Kingdom.
2	Federal Democracies (14)	Argentina, Australia, Austria, Brazil, Canada, Colombia, Costa Rica, France, India, Mexico, South Africa, United Kingdom, United States, and Venezuela.
3	Parliamentary Democracies (16)	Algeria, Australia, Austria, Belgium, Canada, Finland, Germany, Greece, Iceland, India, Ireland, Italy, New Zealand, Portugal, Singapore, and Turkey.