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Permanent and Transitory Effect of Public Debt on Economic Growth: Evidence from OECD Countries

By

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Abstract

This study examines the effect of public debt on the economic growth of OECD countries by disentangling the effect into permanent and transitory components. The study covers 37 OECD countries.

The Mundlak decomposition was employed to decompose the effect of public debt into its transitory and permanent effect on economic growth. To account for potential endogeneity problem, the Hausman and Taylor estimator was employed to estimate the decomposed model. Further, the study disaggregated the OECD model into country group models for further analysis of the dynamics of the relationship between the variables.

The findings of the study reveals that in the full OECD model, public debt exerts a significant negative permanent and positive transitory effect on economic growth. This was robust to alternative model specifications. The magnitude of the negative permanent effect of debt was found to be larger than the positive transitory effect. Further, the estimates of the disaggregated models reveals that though public debt has a negative permanent effect across all the country groups, it was not the case for the transitory effect of debt. Also, a net public debt model was estimated and its effect on public debt was found to be largely insignificant, exhibiting a Ricardian-like behaviour.

To the best of our knowledge, this is the first study, particularly in the OECD context that employed the Mundlak transformation to examine the permanent versus transitory effect of public debt on economic growth.

Key Words: Public debt; economic growth; OECD; permanent; transitory; Mundlak

JEL Codes: E62, H63

1.0 Introduction

Arguably, the debate on the effect of public debt is still on due to multi-dimensional views among the experts in the area. These divergent views on the relationship between these factors in the literature can be categorized into five main strands. The first line of argument is that of a negative effect of public debt through the so-called crowding-out effect. This argument has as its basis the neoclassical theory of public debt. Crowding out effect occurs when public debt accumulation leads to an increase in interest rate. The increase in interest rate is thus accompanied by a decreasing level of investment which by extension translates to lower economic growth (Ferreira, 2009). As Bernheim (1989) noted, public debt accumulation leads to a shift of taxes to the future generations and this leads to a fall in savings. For the capital market to clear, the interest rate will need to rise. A rise in interest rate crowds out investment, leading to a fall in economic growth (Alagidede, Mensah and Ibrahim, 2018). Further, crowding out occurs because due to the diminishing effect of public debt on capital-output ratio caused by the unwillingness of people to hold public debt instruments at the prevailing rates, leading to an increase in interest rate (Diamond, 1965). The postulation of a negative effect of public debt on economic growth as argued by the neoclassical theory of debt is supported by evidence such as Apergis and Cooray (2016); Senadza et al (2017); Abdelkafi (2018); McLean and Charles (2018); Nwali and Nkwede (2016); and Ouhibi et al (2017).

The second school of thought argues that the effect of public debt on economic growth is positive. This is premised upon the view that when the government borrows and channels the funds towards economic-stimulating expenditure such as public investment, this leads to an increase in economic growth (Armstrong, 2018). This argument echoes the Keynesian theory of public debt. The theory holds that when investment is inadequate to ensure the attainment of full employment, borrowing and spending by the government leads to an increase in public investment which complements the inadequate private investment to stimulate economic growth (Brown-Collier and Collier, 1995). Moreover, an increase in public debt (particularly during an economic downturn) leads to a stimulation of aggregate demand through the wealth effect which ultimately leads to expansion of output and by extension economic growth (Hansen, 1959). Empirical studies that found evidence of a positive effect of public debt on economic growth hence supporting the Keynesian position include Owusu-Nantwi and Erickson (2016); Mohanty et al (2016); Uzun et al (2012); Akram (2017); and Tan and Chin (2017).

In contrast to this view is the argument that public debt has a neutral effect on economic growth. This view is pushed forward by the Ricardian theory of public debt. The theory is based on the argument that due to the foresight of individuals; government borrowing is seen as a postponement of taxation because the government will impose higher taxes in the future to pay back the debt. As a result, individuals do not increase their consumption following government borrowing; they increase their savings which will be used to pay the future tax increase. And since macroeconomic variables like consumption remain unaffected following an increase in government borrowing, economic growth also becomes unaffected (see Barro, 1974, 1989). Empirical studies that found evidence of a neutral effect of public debt on economic growth, in line with the Ricardian theory includes Kourtellos (2013); Panizza and Presbitero (2014); Dar and Amirkhalkhali (2014); and more recently Guei (2019); as well as Festus and Saibu (2019).

The fourth line of argument is given by the so-called conventional theory which argues that the effect of public debt on economic growth is positive in the short run, however, the effect becomes negative in the long run due to crowding-out effect of capital (Elmendorf and Mankiw, 1998). The theory holds that the short-run positive effects are a subject of a decrease in taxes which leads to the widening of the deficits. This, in turn, creates more disposable income which by extension stimulates aggregate demand and economic growth (Ferreira, 2014). Further, in the long run, the sticky prices and wages that made aggregate demand to increase are less important, this gives room for the crowding-out effect on capital to occur, signifying a negative relationship between public debt and economic growth (Elmendorf and Mankiw, 1998). Another channel of the long-run negative effect of public debt on economic growth is tax hikes which can stifle growth (Ferreira, 2014; Esteve and Tamarit, 2018). The conventional theory of debt is supported by empirical studies such as Mhlaba and Phiri (2017); and Bal and Rath (2014, 2017).

Similar to this argument is the view that the relationship between public debt and economic growth can be presented in an inverted u-shaped curve. This is the so-called debt overhang hypothesis which is the fifth strand of argument. This view holds that public debt initially produces an expansionary effect on the economy, however, if public debt accumulation exceeds a certain level, investors fear that the gains from their investment will be "taxed" away by the government and used to pay its debt obligation (Cordella, Ricci, & Ruiz-Arranz, 2010; Pattillo, Poirson, & Ricci, 2004), as a result, investment declines leading to lower economic growth (Krugman, 1988; Sachs, 1989). This is because the debt level in the economy is so

massive that without a large reduction, investment is discouraged (Deshpande, 1997). Another channel through which debt overhang affects a country is the reluctance of government to direct its resources from consumption to investment spending, out of concern that benefits therefrom will be channelled to creditors (Arnone, Bandiera, and Presbitero, 2005; Toktas, Altiner and Bozkurt, 2018). Empirical evidence in support of the debt overhang hypothesis includes Mupunga and Roux (2015); Patillo et al (2002); Baaziz et al (2015); and Checherita and Rother (2010).

Empirical research on the effect of public debt on economic growth in recent times is largely geared towards examining the turning point of the public debt-economic growth relationship. Chiefly among this research is the claim by Reinhart and Rogoff (2010) that public debt accumulation beyond a threshold of 90% debt to GDP ratio is associated with declining economic growth. This claim led to further research whose findings produced mixed results. For instance, Kumar and Woo (2010); Baum et al (Baum, Checherita-westphal and Rother, 2013); Combes et al (2017); Cecchetti et al (2011); Baglan and Yoldas (2015); and Brida et al (2017) found a threshold value of about 90% debt to GDP ratio. On the other hand, studies such as Ahlborn and Schweickert (2018); Swamy (2015); Tourinho and Sangoi (2017); Gomez-Puig and Sisvilla-Rivero (2017); Taher (2017); and Shahor (2018) did not find evidence to support the arguments that a threshold value of about 90% debt to GDP ratio exists because they found threshold values either significantly lower or higher than the purported 90% debt to GDP ratio. One of the main criticisms to the findings of Reinhart and Rogoff was posed by Herndon et al (2014) who discovered some errors in the excel spreadsheet and noted that if corrections were made, economic growth beyond the 90% threshold value remains positive, unlike the negative value that was found by Reinhart and Rogoff.

Although there has been much empirical research on examining the relationship between public debt and economic growth, little attention has been given to the examination of temporary and transitory effects of public debt on economic growth, more so in a panel setting of OECD countries. This is despite the argument for the existence of this kind of relationship among the variables as noted by the Conventional theory of public debt. This research aims to fill the gap in the literature by employing the Mundlak approach to disentangle the effect of public debt on economic growth into the temporary and permanent effect. To the best of our knowledge, this is the first study, particularly in the OECD context that employed the Mundlak transformation to examine the permanent versus transitory effect of public debt on economic growth. More

so, in examining this relationship, the study employed techniques that accounts for endogeneity in panel data analysis.

Examining the temporary versus the permanent effect of public debt on economic growth will go a long way in improving our understanding of the public debt-economic growth dynamics and also extend the body of the extant literature on the public debt-economic growth relationship. Similarly, it will provide policymakers with additional insights that can be useful for making policy decisions.

The remaining part of the paper is organized as follows: section two discusses the study model, methods and data employed for the study. Chapter three presents the results obtained from the estimated models and also a discussion of findings. Chapter four concludes the study and provides policy recommendations.

2.0 Model, Data and Methods

2.1 Empirical Model

Our analytical approach begins by specifying a generic production function that takes the form of a Cobb-Douglas type function. Therefore, the production function is specified as:

$$Y_t = A_t L_t^{\alpha} K_t^{\beta} \qquad (1)$$

Where Y depicts the level of output (GDP); A is the total factor productivity; L represents the labour force employed in the production process, and K stands for the physical capital stock employed for production. α, β are elasticities of labour and capital respectively.

Following the approach of Gomez et al (2017), Eberhart (2015), Afonso and Alves (2015), Dar and Amirkhalkali (2014), the production function in equation (1) is augmented to account for the effect of public debt. Therefore, equation (1) when modified takes the form of:

$$Y_t = A_t L_t^{\alpha} K_t^{\beta} D_t^{\delta} \qquad (2)$$

Where D is the public debt variable.

Mankiw, Romer and Weil (1992) emphasized the role played by human capital in the production process. The authors propounded a human capital version of the Solow Model by including the human capital variable. The model argued that the accumulation of human capital in conjunction with physical capital is instrumental in explaining economic growth. Following

this argument, we modify equation (2) by including a human capital variable. Therefore, the equation becomes:

$$Y_t = (A_t L_t)^{\alpha} K_t^{\beta} H_t^{\varphi} D_t^{\delta} \qquad (3)$$

Where H is the human capital variable and AL is a composite component known as effective labour. Equation 3 was further transformed to a logarithmic function to obtain the linearized version of the equation.

$$LogY_t = \alpha LogA_t L_t + \beta LogK_t + \varphi LogH_t + \delta LogD_t \qquad (4)$$

The literature on economic convergence argues for the need to capture economic convergence in estimating production function or economic growth models. Following the existence of different steady states equilibrium level of income of countries occasioned by heterogeneity that comes about due to factors such as the difference in institutional setup, quality of labour, etc., the need for capturing convergence is important (Islam, 2005; Pandya and Maind, 2017). The convergence literature argues that a country with a lower initial per capita GDP grows at a faster rate than its counterpart with a higher initial level of national income, in the end, it is expected that all countries converge to their steady states (Barro and Sala-i-Martin, 1992; Haider, Hameed and Wajid, 2010). To capture the convergence, we included the initial level of per capita GDP as a right-hand side variable of equation (4), this is in line with Barro (1991), Afonso and Alves (2015), Panizza and Presbitero (2014), and Checchetti et al (2011). Consequently, equation (4) is modified to take the form of:

$$LogY_t = \theta Y_{t-T} + \alpha LogA_t L_t + \beta LogK_t + \varphi LogH_t + \delta LogD_t \qquad (5)$$

With θ being the parameter that measures convergence or otherwise. A negative and significant θ illustrates the presence of convergence and vice versa.

Taking into account the fact that the study is in a panel set up, the econometric form of the empirical model to be estimated takes the form of:

$$Pc\_RGDP_{it} = \alpha + \theta InPc\_RGDP_i + \beta_1 Debt_{it} + \beta_2 Inv_{it} + \beta_3 Lab_{it} + \beta_4 Edu_{it} + \gamma_i Z_{it} + \varepsilon_{it} \quad (6)$$

Where Z is a vector of control variables that includes inflation, trade openness and population growth (Baum, Checherita-westphal and Rother, 2013; Mohamed, 2013; Daud and Podivinsky, 2014; Fincke and Greiner, 2015; Baharumshah, Soon and Lau, 2017; Bal and Rath, 2017; Gómez-Puig and Sosvilla-Rivero, 2017; Fofana, 2018) and Ɛ is the white noise error term.

Since the objective of the study is to examine the permanent and transitory effect of public debt on economic growth, the public debt variable is split into its temporary and transitory component[1], therefore, by including the control variables and a dummy variable to control for the recent global economic crises (Panizza and Presbitero, 2014; Afonso and Alves, 2015), equation (6) is modified to take the form of:

$$Pc\_RGDP_{it} = \alpha + \theta InPc\_RGDP_i + \beta_1 TDebt_{it} + \beta_2 PDebt_{it} + \beta_3 Inv_{it} + \beta_4 Lab_{it} + \beta_5 Edu_{it} + \gamma_i Z_{it} + \pi Dum_{it} + \varepsilon_{it} \quad (7)$$

The study takes note of the argument that perhaps the effect of public debt on economic growth operates in such a way that it is past public debt that affects present economic growth (see Ash, Basu, & Dube, 2017; Baum, Checherita-westphal, & Rother, 2012; Woo & Kumar, 2015), implying that public debt has a lag effect on economic growth. As a result, the study also builds a model of first lag public debt effect on economic growth. The study thus estimates both a contemporaneous and lag public debt model. The lag model is specified as:

$$Pc\_RGDP_{it} = \alpha + \theta InPc\_RGDP_i + \beta_1 TDebt_{it-1} + \beta_2 PDebt_{it-1} + \beta_3 Inv_{it} + \beta_4 Lab_{it} + \beta_5 Edu_{it} + \gamma_i Z_{it} + \pi Dum_{it} + \varepsilon_{it} \quad (8)$$

Where Dum is the dummy for financial crises.

The description of the study variables is given in Table 1.

Table 1 Variable Description

Variable (Code)	Definition	Source
Economic Growth (RGDP)	Real GDP per capita at constant US Dollar was used as a proxy for economic growth.	World Bank's World Development Indicators.
Public Debt (Debt)	General government gross debt as a ratio of GDP.	IMF World Economic Outlook, 2019.
Net Debt	General government net debt as a ratio of GDP. The net debt is derived by subtracting the assets of debt instruments of a country from its gross debt.	IMF World Economic Outlook, 2019.
Investment (Inv)	Gross fixed capital formation (GFCF) in constant US Dollar used as a proxy for investment.	World Bank's World Development Indicators.
Labour (Lab)	Labour force participation rate was used as a proxy for labour.	World Bank's World Development Indicators.

[1] Discussion on how to split the variable into the temporary and permanent component is made under the estimation technique section (2.3).

Education (Edu)	Secondary school gross enrolment was used as a proxy for human capital.	World Bank's World Development Indicators.
Population growth	The growth rate of the population.	World Bank's World Development Indicators.
Trade openness	This is derived from the summation of exports and imports of goods and services as a percentage of GDP.	World Bank's World Development Indicators.
Inflation	Inflation rate in percentage form.	World Bank's World Development Indicators.
Exchange rate	This is the real effective exchange rate.	World Bank's World Development Indicators.
Domestic Credit	Domestic credit to the private sector as a percentage of GDP.	World Bank's World Development Indicators.
Financial Crises (Dum)	This is a dummy variable that takes the form of 1 in the global financial crises years and if otherwise, 0.	Author's construction.

2.2 Data

Data on all the study variables were collected for the period 1980 to 2018, this period was selected due to the unavailability of data for most of the countries pre-1980. To reduce the potential effect of cyclical movement, a non-overlapping 4-year averaging of the data was done, therefore leaving us with 10 data periods for each country. This is in line with Checherita-Westphal and Rother (2012), Cecchetti et al (2011), and Panizza and Presbitero (2014). Further, all variables except population growth rate, inflation rate, and the dummy variable were converted to their logarithmic forms. The scope of the study is the OECD; therefore, data on all the study variables were collected for the 37 OECD countries. The countries are Australia, Austria, Belgium, Canada, Chile, Colombia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, and the United States.

Table 2 Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
Real GDP per capita	10.14	0.73	8.27	11.58
Initial GDP per capita	9.91	0.71	8.27	10.91
Public Debt	3.81	0.71	1.52	5.46
Net Debt	3.51	0.85	-0.52	5.03
Investment	24.95	1.62	21.00	28.91
Labour Participation	4.09	0.12	3.79	4.42
Population Growth	0.62	0.75	-2.08	3.12
Education	4.58	0.20	3.65	5.06
Trade Openness	4.10	0.65	1.54	5.96
Inflation	11.48	38.87	-0.65	536.78
Exchange Rate	4.58	0.18	3.81	5.13
Domestic Credit	4.26	0.65	2.54	5.48

2.3 Estimation Techniques

The study began by estimating a fixed (within) effect model. The fixed effect estimator assumes an unobserved heterogeneity between the cross-sectional units. To account for this, an individual specific constant term is added to the model. This can be illustrated using a two-variable case as specified below:

$$Y_t = \alpha_i + \beta X_{it} + e_{it} \qquad (7)$$

Where $\alpha_i, \beta \; and \; e_{it}$ are the individual specific effect term, vector of parameters to be estimated, and error term respectively.

An assumption made by the fixed effect model is that of the absence of correlation between the effects and the explanatory variables. This can be depicted as:

$$E\ (\alpha_i X_{it}) = 0 \qquad (8)$$

Mundlak (1978) criticized the model for ignoring the correlation between the effects and explanatory variables as illustrated by equation (8). He argued that doing that can lead to biased estimates. This is because as Hsiao (2003), there are reasons to believe that in many circumstances, the correlation between them exists. Although the standard alternative to the fixed effect model is the random effect model, Mundlak (1978) argued that there is fundamentally no difference between the random effect and fixed effect model if the model is correctly specified. He noted that the imaginary difference is as a result of the wrong

specification, however, when the explanatory variables are not correlated with the effects, the fixed effect is identical to the random effect model.

To account for the correlation between the effect and explanatory variables, Mundlak includes the mean values of the regressors that are fixed for each cross-sectional unit to the model (Bender and Theodossiou, 2015a). To illustrate this, consider the model in equation (7) which is augmented to include the mean values. Therefore, the transformed model takes the form of:

$$Y_t = \alpha + \beta \check{X}_{it} + \pi \overline{X}_{it} + e_{it} \qquad (9)$$

From equation (9), $\overline{X}_{it}$ is the average value of the explanatory variable X across time. The coefficient π captures the permanent effect. Under this specification, $\check{X}_{it}$ is derived by subtracting the average value from the level value (i.e. $\check{X}_{it} = X_{it} - \overline{X}_{it}$). The coefficient β captures the temporary effect (Ferrer-i-Carbonnel, Van Praag and Bernard, 2003; Bender and Theodossiou, 2015b). The model in equation (9), when estimated, provides the Mundlak approach which disentangles the permanent from transitory effect.

Despite the attempt by Mundlak to account for the shortcomings of the fixed effect and random effect model by bridging them, there is the possibility of obtaining biased estimates due to the potential endogeneity problem that may arise as a result of the correlation between some explanatory variables and individual latent effect or as a result of reverse causality (Bender and Theodossiou, 2015a). To account for the endogeneity problem, Hausman and Taylor (1981) developed an estimator that uses time-varying variables to serve as instruments for endogenous time-invariant variables. They noted that this method performs better than other instrumental variable regression methods that employ excluded exogenous variables as instruments. Further, to determine the validity of instruments, a Sargan-Hansen test of overidentifying restriction is conducted. The Hausman-Taylor method can be employed on Stata by using the command *xthtaylor*.

3.0 Results and Discussion

This section presents the results of the estimated models. The section begins by presenting the correlation matrix which presents the cross-correlation between the study variables. This will guide the empirical model specification by avoiding estimating models that suffer from multicollinearity. The correlation matrix is presented in Table 3.

Table 3 Correlation Matrix

	GDPPC	In_GDPPC	Debt	Inv	Lab_Part	Pop_Grt	Edu	Trade	Inf	Exr	Cred	**VIF**
GDPPC	1											
In_GDPPC	0.90*	1										1.49
Debt	0.26*	0.22*	1									1.57
Inv	0.32*	0.07	0.46*	1								2.09
Lab_Part	0.29*	0.24*	-0.14*	-0.02	1							1.50
Pop_Grt	0.07*	-0.34*	-0.06	0.14*	0.12*	1						1.51
Edu	0.58*	0.49*	0.17*	0.13*	0.26*	-0.25*	1					1.56
Trade	0.30*	0.30*	-0.18	-0.46*	0.04	-0.23*	0.42*	1				1.72
Inf	-0.29*	-0.29*	-0.22*	-0.23*	-0.06	-0.01	-0.26*	-0.27*	1			1.66
Exr	0.24*	-0.05	-0.01	0.11	0.08	0.19*	0.05	-0.01	-0.20*	1		1.24
Credit	0.68*	0.47*	0.15*	0.37*	0.29*	-0.11	-0.57	0.14*	-0.40*	0.18*	1	1.58

*Indicates statistical significance at 5%.

Table 3 presents the result of the pairwise correlation test. From the test result, aside from initial GDP per capita which is highly correlated with GDP per capita, there is no significantly strong correlation between any of the variables that are up to 70% correlation level. Further, Most of the correlation coefficients between the variables have values depicting below 50% correlation levels. The other variables with coefficients above 50% are credit and education in their correlation with GDP per capita which takes the value of 68% and 58% respectively. From the results presented in Table 3, it appears that the multicollinearity problem might not emanate in model estimations. To be sure this is the case, the study estimated the variance inflation factor (VIF) of the variables. The VIF values are presented in the last column of Table 3. The VIF values all appear to be less than the rule of thumb value of 10, therefore, we can conclude that there is no multicollinearity among the variables.

3.1 Findings of the Fixed Effect Model

Under this section, we present the result of the estimated fixed (within) effect model. As highlighted in the methodology section, we estimated two models, one with a contemporaneous public debt variable and the second with a lag public debt variable. Both estimates are presented in Table 4.

Table 4 Estimates of Fixed Effect Model

Variables	Contemporaneous Model	Lag Model
Public_Debt	0.0554***	0.0265*
	(0.0147)	(0.0145)
Investment	0.427***	0.391***
	(0.0219)	(0.0221)
Labour_Participation	0.113	0.180*
	(0.0930)	(0.104)

Population_Growth	-0.0338**	-0.0463***
	(0.0148)	(0.0146)
School_Enrollment	-0.0685	0.00983
	(0.0544)	(0.0587)
Trade_Openness	0.213***	0.237***
	(0.0283)	(0.0296)
Inflation	-0.000462	0.00137
	(0.000944)	(0.00204)
Financial_Crises	0.00330	0.0104
	(0.0130)	(0.0123)
Intercept	-1.632***	-1.357**
	(0.546)	(0.596)
R-squared	0.916	0.903

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4 presents the result of the estimated fixed effect model of both the contemporaneous and first lag of public debt models. From the result of the contemporaneous debt model, public debt was found to have a positive and statistically significant effect on economic growth. The coefficient of the public debt variable signifies that a 1% increase in public debt to GDP ratio leads to about 0.06% increase in real GDP per capita. This finding is consistent with the theoretical postulations of the Keynesian theory which argues that an increase in public debt leads to an increase in economic growth.

Similarly, the first lag of public debt was also found to have a significant positive effect on real GDP per capita at a 10% significance level. The effect was found to be smaller than that of the contemporaneous debt model. The coefficient of the variable signifies that a 1% increase in the debt to GDP ratio leads to an increase in the subsequent year's real GDP per capita by about 0.03%. This finding also follows the argument of Keynesian theory, indicating that an increase in government borrowing in the OECD was found to stimulate the expansion of the economy.

Also, other explanatory variables of the model such as investment, trade openness, and labour force participation under the lag model were found to have a significant positive effect on economic growth in both models. This signifies the significant role of investment and trade in propelling economic growth. Conversely, population growth was found to significantly depress economic growth. Further, other independent variables such as education, inflation, and the dummy for financial crises were found to exert an insignificant effect on the economic growth of OECD countries.

However, as a result of the weaknesses of the fixed effect estimator as highlighted by Mundlak (1978) which was discussed in detail in section 3 of this paper, we cannot base our inferences on the results obtained from the fixed effect model.

3.2 Permanent and Transitory Effect (Mundlak Method)

Under this section, the study employed the Mundlak (1978) method to disentangle the effect of public debt on economic growth into the permanent and transitory effect. Results of the estimated contemporaneous and lag public debt models are presented in Table 5.

Table 5 Permanent and Transitory Effect Estimation Result

Variables	Contemporaneous Model	Lag Model
Permanent_Debt	-0.328***	-0.315***
	(0.0907)	(0.0885)
Transitory_Debt	0.0119	9.31e-05
	(0.0291)	(0.0267)
Initial_GDPPC	0.806***	0.794***
	(0.0652)	(0.0659)
Investment	0.271***	0.261***
	(0.0353)	(0.0298)
Labour_Participation	0.249**	0.282*
	(0.111)	(0.145)
Population_Growth	-0.00643	-0.0119
	(0.0241)	(0.0208)
School_Enrollment	0.00472	0.0984
	(0.0927)	(0.0875)
Trade_Openness	0.353***	0.351***
	(0.0438)	(0.0400)
Inflation	-0.00121	0.00164
	(0.00103)	(0.00295)
Financial_Crises	0.00624	0.00726
	(0.0110)	(0.0110)
Intercept	-5.701***	-5.931***
	(0.851)	(0.849)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5 presents the result of the estimated permanent and transitory effect of both contemporaneous and lag public debt models. From the result of both the contemporaneous and lag models, public debt was found to have a statistically insignificant positive transitory effect on economic growth. The coefficient of the contemporaneous model appeared to be larger than that of the lag model.

Interestingly, the coefficient of the permanent effect of public debt on economic growth was found to be negative and statistically significant in both the contemporaneous and lag models. The coefficient signifies that a 1% increase in public debt reduces GDP per capita by about 0.33% under the contemporaneous model. Under the lag model, the percentage decrease in GDP per capital as a result of a 1% increase in public debt amounts to about 0.32%, showing a marginal difference between the effects of public debt in the two models. The significant negative permanent effect of public debt, in the long run, aligns with the postulations of neoclassical public debt theory.

The coefficient of the initial GDP per capita which is meant to determine whether countries converge to their steady states was found to be positive and statistically significant. This signifies that there is no convergence of economies to their steady states. The other study variables such as investment, labour force, and trade openness were all found to exert a significant positive effect on economic growth. Further, the effects of inflation, school enrolment, population growth, and the dummy for the financial crises were found to be statistically insignificant in their effect on economic growth.

Due to the weaknesses of the Mundlak method of not taking into account the possible correlation between the individual specific effects and the explanatory variables of the model which lead to biased estimates due to endogeneity problem (Hausman and Taylor, 1981), we cannot base our inferences on the findings of this model.

3.3 Permanent and Transitory Effect (Hausman and Taylor Estimator)

Under this section, we present the result of the estimated permanent and transitory effect of public debt on economic growth by employing the Hausman and Taylor (1981) estimator that controls for the endogeneity problem that comes about as a result of the correlation between the explanatory variables and the individual-specific effects. The results for both contemporaneous and lag debt models are presented in Table 6.

Table 6 Permanent and Transitory Effect Estimates (Hausman and Taylor)

Variables	Contemporaneous Model	Lag Model
Permanent_Debt	-1.146***	-0.968***
	(0.380)	(0.330)
Transitory_Debt	0.0525***	0.0243*
	(0.0144)	(0.0142)
Initial_GDPPC	1.042***	0.979***
	(0.211)	(0.185)

Investment	0.416***	0.379***
	(0.0211)	(0.0211)
Labour_Participation	0.123	0.192*
	(0.0910)	(0.101)
Population_Growth	-0.0326**	-0.0436***
	(0.0145)	(0.0142)
School_Enrollment	-0.0629	0.0189
	(0.0533)	(0.0571)
Trade_Openness	0.222***	0.248***
	(0.0275)	(0.0285)
Inflation	-0.000489	0.00146
	(0.000927)	(0.00200)
Financial_Crises	0.00350	0.0102
	(0.0128)	(0.0120)
Intercept	-7.124***	-7.017***
	(2.070)	(1.849)
Sargan-Hansen Stat.	7.179	7.983
Prob.	[0.208]	[0.239]

Standard errors in parentheses and probability value in the bracket.
*** p<0.01, ** p<0.05, * p<0.1

Table 6 presents the result of the estimated permanent and transitory effect of public debt on economic growth by employing the Hausman and Taylor estimator. From the result of the contemporaneous public debt model, public debt was found to have a significantly positive transitory effect on public debt. The coefficient of the variable indicates that a 1% increase in public debt leads to a transitory or short-run positive effect on GDP per capital with a value of about 0.05%. Under the lag model. A 1% increase in public debt increases GDP per capita by about 0.02% in the short run. This finding differs from that of the Mundlak result obtained in Table 5 where the transitory effect was found to be insignificant. This significant effect obtained in this model could be attributed to the fact that the Hausman and Taylor control for potential endogeneity problems. The significant positive transitory effect of public debt on economic growth follows the argument of the Keynesian theory of public debt.

Conversely, public debt was found to have a significant permanent negative effect on economic growth in both the contemporaneous and lag models. Under the contemporaneous model, the coefficient indicates that a 1% increase in public debt reduces GDP per capita by about 1.15%. In the lag model, a 1% increase in last year's public debt reduces the economic growth of the present year by about 0.98%. The negative permanent effect of public debt on economic growth is in tandem with the arguments of the neoclassical debt theory which states that public debt exerts a long-run negative effect on economic growth. It could also be noticed that the

coefficient of the negative long-run effect of debt on economic growth outweighs the positive short-run effect of debt on economic growth. Further, the effect of debt in the contemporaneous model appears higher than that of the lag model. The combined negative long run and positive short-run effect of public debt on economic growth identified in these analytics conform to the argument of the Conventional Theory of Public Debt propounded by Elmendorf and Makiw (1998).

Also, the coefficient of the initial level of GDP per capita in both the contemporaneous and lag models showed the absence of convergence of the OECD countries to their steady states. Investment and trade openness were found to produce a significant positive effect on economic growth thereby underscoring the importance of investment and international trade in propelling economic growth. Similarly, labour force participation was found to positively impact growth though the effect under the contemporaneous model was found to be insignificant.

On the other hand, population growth was found to exert a significant negative effect on economic growth in both the contemporaneous and lag models. Further, the effects of school enrolment, inflation, and the dummy for financial crises were found to be statistically insignificant in both the contemporaneous and lag models.

Since the estimator employs the time-varying exogenous variables in the model as instruments (Hausman and Taylor, 1981), the diagnostic test of the validity of instruments employed becomes necessary. To do this, the Sargan-Hansen test of overidentifying restrictions was carried out. The result is presented in the last row of Table 6. The Sargan-Hansen test has the null hypothesis that the instruments obtained are valid. To reject this hypothesis, the test statistic needs to be statistically significant. From the result obtained, we cannot reject the null hypothesis, therefore, we can conclude that the instruments employed are valid.

3.3.1 Disaggregated Permanent and Transitory Effect (Hausman and Taylor Estimator)

Under section 3.3, the result of the estimated permanent and transitory effect model for the OECD countries was presented and discussed, in this section, we disaggregate the OECD into country groups such as the Eurozone and non-Eurozone countries as well as G20 and non-G20 member countries. The permanent and transitory effect of public debt on economic growth for these groups is estimated, this is done to provide a deeper examination of the relationship between the variables based on countries that share some common features such as same monetary union in the case of the Eurozone and size of their economy in the case of G20.

Table 7 Permanent and Transitory Effect (Eurozone versus Non-Eurozone Countries)

Variables	Euro Zone Contemporaneous	Euro Zone Lag Model	Non-Euro Zone Contemporaneous	Non-Euro Zone Lag Model
Permanent_Debt	-0.866***	-0.881***	-1.235**	-1.026**
	(0.314)	(0.309)	(0.563)	(0.492)
Transitory_Debt	-0.0282	-0.0303*	0.108***	0.0586***
	(0.0179)	(0.0184)	(0.0201)	(0.0205)
Initial_GDPPC	0.0766	0.0459	1.086***	1.014***
	(0.508)	(0.494)	(0.264)	(0.233)
Investment	0.362***	0.357***	0.427***	0.386***
	(0.0286)	(0.0269)	(0.0288)	(0.0308)
Labour_Participation	-0.0581	-0.143	0.186	0.321**
	(0.121)	(0.135)	(0.129)	(0.163)
Population_Growth	-0.0447***	-0.05***	-0.0199	-0.0441*
	(0.0150)	(0.0136)	(0.0226)	(0.0238)
School_Enrollment	0.0536	0.0302	-0.140*	-0.0101
	(0.0547)	(0.0632)	(0.0813)	(0.0851)
Trade_Openness	0.313***	0.345***	0.257***	0.282***
	(0.0319)	(0.0336)	(0.0450)	(0.0485)
Inflation	0.00234	0.0052**	-0.000971	0.00110
	(0.00205)	(0.00223)	(0.00115)	(0.00328)
Financial_Crises	0.0104	0.000625	0.000768	0.0125
	(0.0137)	(0.0127)	(0.0185)	(0.0182)
Intercept	2.798	3.584	-7.650***	-7.947***
	(5.949)	(5.796)	(2.277)	(2.075)
Sargan-Hansen Stat.	2.882	2.175	5.042	4.979
Prob.	[0.2366]	[0.3370]	[0.5384]	[0.5465]

Standard errors in parentheses. Probability values in the bracket.
*** p<0.01, ** p<0.05, * p<0.1

Table 7 presents the result of the estimated permanent and transitory effect of public debt on the economic growth of the Eurozone and non-Eurozone OECD countries. For the Eurozone nations, public debt was found to have a significant permanent negative effect on economic growth just like in the case of the OECD model. Further, the transitory effect was found to be negative and insignificant in the case of the contemporaneous model, but marginally significant in the case of the lag model. This finding is a departure from the OECD model where public debt though having a negative long-run effect was found to have a positive short-run effect on economic growth.

In the case of the non-Euro area countries, public debt was found to have a significant negative permanent effect on economic growth in both the contemporaneous and lag models. However, the effect of public debt on economic growth in the short run was found to be positive and statistically significant thereby mimicking the results obtained from the OECD model. This is

however a departure from the findings of the Euro area countries where the transitory effect was not positive. The effect of the other variables of the model in the case of both the Eurozone and non-Eurozone countries largely mimics those obtained from the OECD model discussed under Table 6. The Sargan-Hansen statistic also showed the instruments employed to be valid.

Table 8 Permanent and Transitory Effect (G20 versus G20 Countries)

Variables	G20 Contemporaneous	G20 Lag Model	Non-G20 Contemporaneous	Non-G20 Lag Model
Permanent_Debt	-0.476**	-0.454**	-0.910**	-0.612*
	(0.232)	(0.211)	(0.463)	(0.343)
Transitory_Debt	0.177***	0.0953**	0.0230	0.00608
	(0.0415)	(0.0410)	(0.0153)	(0.0147)
Initial_GDPPC	0.648***	0.689***	0.888***	0.847***
	(0.165)	(0.149)	(0.239)	(0.196)
Investment	0.424***	0.371***	0.390***	0.373***
	(0.0456)	(0.0493)	(0.0230)	(0.0225)
Labour_Participation	0.930**	0.605	0.111	0.177*
	(0.393)	(0.494)	(0.0924)	(0.0968)
Population_Growth	-0.0330	-0.0393	-0.0257*	-0.0380***
	(0.0361)	(0.0381)	(0.0148)	(0.0147)
School_Enrollment	-0.187	0.00686	-0.0110	0.0247
	(0.113)	(0.125)	(0.0579)	(0.0636)
Trade_Openness	0.127**	0.198***	0.218***	0.237***
	(0.0592)	(0.0702)	(0.0298)	(0.0309)
Inflation	-0.00246	-0.000905	-0.00148	0.000212
	(0.00237)	(0.00956)	(0.000997)	(0.00193)
Financial_Crises	-0.0164	0.00168	0.0153	0.0149
	(0.0235)	(0.0237)	(0.0144)	(0.0135)
Intercept	-8.883***	-7.775***	-5.848**	-6.645***
	(1.757)	(1.847)	(2.754)	(2.298)
Sargan-Hansen Stat.	7.114	5.339	4.583	5.609
Prob.	[0.3104]	[0.5012]	[0.5982]	[0.3462]

Standard errors in parentheses. Probability value in brackets.
*** p<0.01, ** p<0.05, * p<0.1

Table 8 presents the result of the estimated permanent and transitory effect of public debt on economic growth in the G20 OECD member countries and the non-G20 member countries. From the estimation result of the G20 countries, public debt was found to have a significant negative long-run effect and positive short-run effect in both the contemporaneous and lag models. This finding is consistent with that obtained from the OECD model result presented in Table 6. In the same vein, the long-run negative effect appeared to be stronger than the short-run positive effect.

In the case of the non-G20 countries, public debt was found to exert a significant negative permanent or long-run effect on economic growth. This finding was the case for both the contemporaneous and lag models. However, the transitory effect of public debt on economic growth in the case of the non-G20 countries, though positive was found to be statistically insignificant. This is a departure from the OECD model where the variable was found to be statistically significant. The coefficient of the other variables of the model largely behaved like those obtained under the OECD model. The Sargan-Hansen test statistic also showed the instruments employed to be valid.

3.4 Robustness Check

The robustness check strategy of this study is in two folds. In the first level, additional control variables are added to the empirical model estimated using the Hausman and Taylor estimator to see if the result is robust to alternative model specifications. The variables included are credit to private sector and exchange rate (see Afonso and Alves, 2015; Fincke and Greiner, 2015; Bal and Rath, 2017). In the second step, the gross debt variable is replaced with the net public debt variable and the permanent and transitory effect of net public debt on economic growth is estimated. The results of the robustness check are presented in Tables 9 and 10.

Table 9 Permanent and Transitory Effect (More Variables)

Variables	Contemporaneous Model	Lag Model	Contemporaneous Model	Lag Model
Permanent_Debt	-1.131***	-1.013***	-1.001***	-0.907***
	(0.371)	(0.342)	(0.379)	(0.336)
Transitory_Debt	0.0424***	0.0194	0.0682***	0.0407**
	(0.0137)	(0.0138)	(0.0161)	(0.0164)
Initial_GDPPC	1.035***	0.992***	0.975***	0.945***
	(0.223)	(0.207)	(0.235)	(0.210)
Investment	0.407***	0.388***	0.395***	0.373***
	(0.0203)	(0.0207)	(0.0233)	(0.0237)
Labour_Participation	0.114	0.149	0.0268	0.0388
	(0.0879)	(0.0988)	(0.113)	(0.135)
Population_Growth	-0.0274**	-0.041***	-0.0300**	-0.0387***
	(0.0136)	(0.0137)	(0.0150)	(0.0150)
School_Enrollment	-0.0533	-0.0178	-0.123	-0.0578
	(0.0506)	(0.0556)	(0.0657)	(0.0660)
Trade_Openness	0.212***	0.234***	0.200***	0.228***
	(0.0260)	(0.0279)	(0.0378)	(0.0392)
Inflation	-0.000972	-0.000181	-0.00168	-0.00284
	(0.000976)	(0.00197)	(0.00115)	(0.00284)
Financial_Crises	0.00711	0.0122	-0.00293	0.0106
	(0.0121)	(0.0117)	(0.0127)	(0.0125)
Exchange_Rate	-0.140***	-0.165***	-0.0920*	-0.116**

	(0.0451)	(0.0468)	(0.0521)	(0.0540)
Domestic_Credit			0.0401**	0.0363*
			(0.0173)	(0.0196)
Intercept	-6.191***	-6.026***	-5.499**	-5.338**
	(2.181)	(2.055)	(2.381)	(2.185)
Sargan-Hansen Stat.	7.570	8.049	8.348	9.218
Prob.	[0.370]	[0.2346]	[0.400]	[0.324]

Standard errors in parentheses. Probability value in the bracket.
*** p<0.01, ** p<0.05, * p<0.1

Table 9 presents the result of the permanent and transitory effect of public debt where more explanatory variables were added to the empirical model. Under columns 1 and 2 of Table 9, the result of the model where the exchange rate is added is presented. In the contemporaneous and lag models, public debt was found to have a permanent negative effect on economic growth while the transitory effect of debt was found to be positive, though the coefficient of the lag model was statistically insignificant.

Under columns 3 and 4, the result of the model where the additional variables of the exchange rate and domestic credit to the private sector were added to the model is presented. From the result, public debt was also found to have a significant negative long-run effect on the economic growth of OECD countries. Conversely, the transitory effect of public debt under both the contemporaneous and lag models was found to be positive and statistically significant. These findings largely mirror that obtained from the OECD model presented in Table 6, therefore, we could say that our findings as regards the permanent and transitory effect of debt are robust. The other variables of the model largely mimic the results presented under Table 6 and the Sargan-Hansen statistic confirms the validity of the instruments employed by the model.

Table 10 Permanent and Transitory Effect of Net Public Debt

Variables	Contemporaneous Model	Lag Model
Permanent_NetDebt	-0.360	-0.295
	(0.381)	(0.305)
Transitory_NetDebt	0.0129*	0.00320
	(0.00659)	(0.00571)
Initial_GDPPC	0.842**	0.805**
	(0.380)	(0.326)
Investment	0.389***	0.363***
	(0.0204)	(0.0209)
Labour_Participation	0.197**	0.189**
	(0.0783)	(0.0806)
Population_Growth	-0.0336**	-0.0292**
	(0.0133)	(0.0129)

School_Enrollment	0.00778	0.0410
	(0.0543)	(0.0542)
Trade_Openness	0.231***	0.238***
	(0.0237)	(0.0246)
Inflation	0.000174	6.33e-05
	(0.000570)	(0.000703)
Financial_Crises	-0.000180	0.000894
	(0.0115)	(0.0106)
Intercept	-8.409**	-7.757***
	(3.331)	(2.959)
Sargan-Hansen Stat.	7.179	7.983
Prob.	[0.208]	[0.239]

Standard errors in parentheses. Probability value in the bracket.
*** p<0.01, ** p<0.05, * p<0.1

Table 10 presents the result of the estimated permanent and transitory effect of the net public debt model. From the contemporaneous model, net public debt was found to have an insignificant negative long-run effect on economic growth. On the other hand, the transitory effect of net public debt on economic growth was found to be marginally significant at 10% significance level, though the coefficient is small. The finding is in contrast with the results obtained where gross debt was used as a measure of public debt and the coefficients were statistically significant.

Further, the results obtained from the estimated lag model showed net public debt as having an insignificant negative permanent effect and positive transitory effect on the economic growth of OECD countries. The insignificant effect of public debt is in line with the arguments postulated by the Ricardian theory of public debt which notes that debt has a neutral effect on economic growth. The finding of the net debt model indicates that when the debt assets of the OECD countries are taken into account in examining the effect of public debt on economic growth, the effect of its public debt stock (less its debt assets) largely does not significantly affect economic growth. This finding underscores the need for the government to consider both measures of public debt in making fiscal policy-related decisions. Focusing on one of the measures without exploring the effect of the other might be inadequate for informed decision making. The other variables of the model behaved similarly to the result obtained from the gross public debt model presented under Table 6. Similarly, the Sargan-Hansen test statistic indicates that the instruments employed are valid.

4.0 Conclusion

This study sought to disentangle the effect of public debt on economic growth into the permanent and transitory effect based on the approach of Mundlak (1978). The results of the study showed the presence of a positive transitory (short-run) effect and negative permanent (long run) effect of public debt on the economic growth of OECD countries. This finding conforms to the postulations of the Conventional Theory of public debt propounded by Elmendorf and Mankiw (1998) which argued that public debt has a positive short-run effect and negative long-run effect on economic growth. Further, the study disaggregated the OECD models into groups. The result of the country group models showed that although a negative permanent effect of debt was found in all the groups, the transitory effect differs with some being negative or statistically insignificant. Besides, it was also discovered that the negative long-run effect is larger than the positive short-run effect; and the effect of public debt on economic growth weakens with a time lag. Finally, the study estimated a net public debt model and the result obtained showed the effect of net public debt on economic growth to be largely insignificant, in line with the postulations of the Ricardian theory of public debt. Areas of future study could be the examination of the permanent and transitory effect of debt on economic growth in a time series setting for each of the countries. The determination of the turning point in the relationship between public debt and economic growth for each of the countries could also be of interest.

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