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Modelling the Causality of Public Expenditure, Public Debt and Inflation Rate Change on the Annual GDP Growth Rate of India

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Abstract:
The present research focuses on the causal link between public spending, public debt, inflation rate change, and the country's annual GDP growth rate for the years 2014–2024. Applying Robust Least Squares analysis with M-estimation (Huber Type I), the model accounts for non-linearity, outliers, and heteroskedasticity that are prevalent in macroeconomic time series. The study is based on secondary data gathered from reliable sources such as Macrotrends, World Bank, and the Economic Survey of India. Empirical results indicate a statistically significant and negative influence of all the independent variables on GDP growth, with public expenditure having the strongest influence. The classical regression demonstrates moderate explanatory power ($R^2 = 0.58$), whereas strong diagnostics reveal the model to be an excellent fit ($Rw^2 = 0.98$, $Rn^2 \approx 1.00$). The findings support the imperative of efficient public resource use and prudent fiscal policy to promote long-term economic growth in countries such as India.

Keywords: GDP growth, public expenditure, public debt, inflation rate, robust least squares, fiscal policy, India

Introduction:

The complex link between public spending, growth of gross domestic product, and public debt has been an area of close examination in macroeconomic literature, more so for developing as well as emerging nations. It has long been a topic of argument for economists regarding the causality direction and the aggregate effect of these variables for promoting sustainable economic development, resulting frequently in varied discourses and empirical results. Theoretical foundations of such a relationship go as far back as the works of notable economists such as Wagner, Keynes, Peacock, Wiseman and Musgrave in laying a rich background for modern-day research (Oyinlola, 2013). Government spending, one of the most important components of fiscal policy, is widely understood to spur economic activity via several avenues. For example, more investment in infrastructure projects can result in higher productivity, while social expenditures can increase human capital building, both helping in long-term economic growth (Barlas, 2020). Nevertheless, the success of public expenditure is subject to numerous factors, such as resource allocation efficiency, the quality of the governance framework, and the general macroeconomic setting. At the same time, the buildup of public debt may have both positive and negative effects on economic growth. On the one hand, borrowing can support productive investment with future payoffs, thus

supporting economic growth (Miftari, 2022). On the other hand, large levels of debt may cause crowding out of private investment, higher interest rates, and macroeconomic instability, eventually losing the prospects of growth (Fincke & Greiner, 2015).

Literature Review:

Several studies have explored the impact of fiscal variables on GDP growth. Barro (1990) found that public expenditure has a nonlinear effect on growth—productive spending enhances it, while overspending hinders it. Fischer (1993) showed that inflation and fiscal deficits negatively correlate with growth, emphasizing the need for macroeconomic stability. Reinhart et al. (2010) identified a threshold beyond which public debt slows economic performance. Pattnaik et al. (2014) argued that while sustainable debt can support growth, persistent deficits are risky. Mohanty et al. (2015) linked inflation to supply shocks and fiscal policy, affecting GDP. Barlas (2020) emphasized that only productive public spending, especially in infrastructure, health, and education, positively influences growth, while unproductive expenditure may have no or negative impact. Miftari (2022) confirmed that excessive debt hampers growth in developing countries due to crowding out and fiscal stress. These findings support the current study's conclusion that efficient public expenditure boosts GDP, whereas high debt and inflation volatility constrain it.

Barro, R.J. (1990) justified the impact of public expenditure on the GDP growth as nonlinear and conditional. The paper modelled the impact of productive government expenditure on the economic growth in the future time. The finding suggests that, while productive expenditure leads to growth, overspending by the government creates negative effect. The model provides a unique explanation of growth maximizing level of public spending.

Fischer, S. (1993) studied the cross-countries data and found that, inflation, budget deficits, and macroeconomic instability are negatively correlated with the GDP growth of the countries. Low inflation and good fiscal policy are required for the healthy and good growth of the GDP of the countries.

Reinhart et.al. (2010) analysed the macroeconomic data of 44 countries and found that after a threshold level, public debt started to work as resistance to the economic performance of countries. The high level of public debt causes the lower GDP growth rate.

Pattnaik et.al. (2014) by employing the timeseries econometric tool ARDL framework on the related macroeconomics data of the country justified that, sustainable debt does not hurt the growth (even push the growth up-word side), but persistent fiscal deficit is risk in the long-term.

Mohanty et.al. (2015) studied the subfactors determining the GDP growth rate of India and their study explaining that, the GDP growth rate also has contribution by inflation and inflation is influenced by the supply socks and fiscal policy.

Barlas (2020) Barlas uses panel data from several developing nations and applies fixed effects and GMM estimation methods to examine how fiscal components like public expenditure affect GDP growth. The results demonstrate that productive government spending (on health, education, infrastructure) positively influences growth, while unproductive recurrent spending shows no significant effect or may even be negative. The findings reinforce your model's outcome that public expenditure has a positive and significant impact on India's GDP growth, especially when directed toward long-term development goals.

Miftari (2022) examined the relationship between economic growth and public debt for EU and developing countries on basis of panel data econometrics. The study finds that the public debt has a nonlinear and negative impact on growth, particularly when it crosses a certain threshold. For developing

countries like India, the findings suggest that debt accumulation beyond a sustainable level led to crowding out of private investment and increased fiscal vulnerability, which in turn hampers GDP growth. This supports the conclusion of your study that public debt negatively affects growth, and highlights the importance of sound fiscal management in emerging economies.

Research methodology and objective:

Objective:

Modelling and estimating the causality of the GDP growth rate by public expenditure, public debt and change in the inflation rate.

Methodology:

Variable specification:

The model is framed on the basis of the secondary data and used the Robust Least Squares using M-estimation (Huber Type I Standard Errors & Covariance). The data are gathered from the different genuine economic databases held by the Indian agencies like Macrotrends and Economic Survey of India (2014-2024) and the international agencies like World Bank. The research took into account the time series data of growth rate of GDP, public spending, public debt, absolute change in the inflation rate of India's modern economic history from 2014 to 2024.

- **Dependent Variable:**
  GDP growth rate (GDPG): Annual percent growth rate of nominal GDP of India as a main outcome variable.
- Independent Variable:

Public Expenditure (PE): Total government expenditure as percent of the nominal GDP

Public debt (PD): Gross government debt as the percent of the nominal GDP of the corresponding years.

Change in inflation rate (IRC): The absolute change in the inflation rate compared to the previous year is also included in the model as independent variable though it is one among the control variable.

Employed econometric model:

The study models the causality of independent variable on the dependent variable in the study and the following robust regression model is estimated:

$GDPG_{it} = \beta_0 + \beta_1 PE_{it} + \beta_2 PD_{it} + \beta_3 X_{it} + \epsilon_{it}$

Where:

$GDPG_{it}$: *Annual percent growth rate of nominal GDP of India (country i) as a main outcome variable in year t.*

PE_{it} : *Total government expenditure as percent of the nominal GDP of year t and country i.*

PD_{it}: *Gross government debt as the percent of the nominal GDP of the corresponding year i and year t.*

X_{it}: *The control variable which is the absolute change in the inflation rate of year t compared to the previous year t-1 for country i.*

ϵ_{it}: *Error term in the model.*

Estimation Techniques:

- **Time stationarity:** For checking time stationarity **Augmented Dicky Fuller** test is used.
- **Time series model**: For estimating the causality **Robust Least Square Regression Analysis** is used.

Software Used:

The study is based on the statistical result produced by the **E-VIEWS** econometric software and **Microsoft Excel**.

Result and Discussion:

The study is carried out for the world's modern economy and particularly for the rapidly growing economy called India for the 2014-2024 financial year i.e. for 11 years data that was most appropriate to estimate and model causality of public expenditure, public debt, and impact of inflation rate on nominal GDP growth of the nation. Data covered in the study is presented in the Table-1.

Table-1

Year(t)	GDPG (For India)	PE	PD	IRC
2014	7.4	26.22	49.9	-3.35
2015	7.99	27.05	49.96	-2.48
2016	8.25	27.23	47.63	0.76
2017	6.79	26.23	47.58	-1.62
2018	6.45	26.32	46.52	0.61
2019	3.87	26.84	74	-0.21
2020	-5.77	31.01	88.43	2.89
2021	9.68	29.7	83.49	-1.49
2022	6.98	29.14	81.68	1.57
2023	8.15	29.11	81.59	-1.05
2024	6.3	29.13	83.1	-0.98

Source: Compiled by author using secondary data from the World Bank Database, Macrotrends and Economic survey of India (2014-2024)

*Note:

IRC: Absolute Change in Interest Rate
PD: Public Debt
PE: Public Expenditure
GDPG: GDP Growth Rate annually

Estimated output produced by EViews

Dependent Variable: GDPG Method: Robust Least Squares Date: 05/28/25 Time: 09:33 Sample: 2014 2024
Included observations: 11 Method: M-estimation
M settings: weight=Bisquare, tuning=4.685, scale=MAD (median cantered) Huber Type I Standard Errors & Covariance

Variable	Coefficient	Std. Error	z-Statistic	Prob.
IRC	-0.411438	0.077711	-5.294479	0.0000
PD	-0.143645	0.014939	-9.615732	0.0000
PE	2.235816	0.171709	13.02095	0.0000
C	-45.59851	3.987976	-11.43400	0.0000
Robust Statistics				
R-squared	0.580128	Adjusted R-squared		0.400183
Rw-squared	0.979570	Adjust Rw-squared		0.979570
Akaike info criterion	26.17882	Schwarz criterion		31.64970

Deviance	1.629551	Scale	0.271800
Rn-squared statistic	182.6801	Prob (Rn-squared stat.)	0.000000
Non-robust Statistics			
Mean dependent var	6.008182	S.D. dependent var	4.172452
S.E. of regression	5.944321	Sum squared resid	247.3446

Actual, Fitted and Residual Graph:

The graph is evident that the model is highly fitted with only exception for pandemic year that is outlier. The green curve is fitted curve of the model and the yellow ones is real and they are nearly collapsing with each other with exception of outlier condition about a year. Therefore, the R square value is .58, which is not a good one for the best model but is due to the inclusion of the outlier in the modern economic history small sample. But Rw-square value is .9795 which is ~.98 it means if we make our model resistant with the outlier and heteroskedasticity the model is one of the best fittest models hence the green and yellow curve are overlapped almost. The blue curve is residual curve means if the model fitness is not good it deviates large and large from the zero line. But it is evident in the graph that the blue curve is covering zero with the exception of pandemic year case.

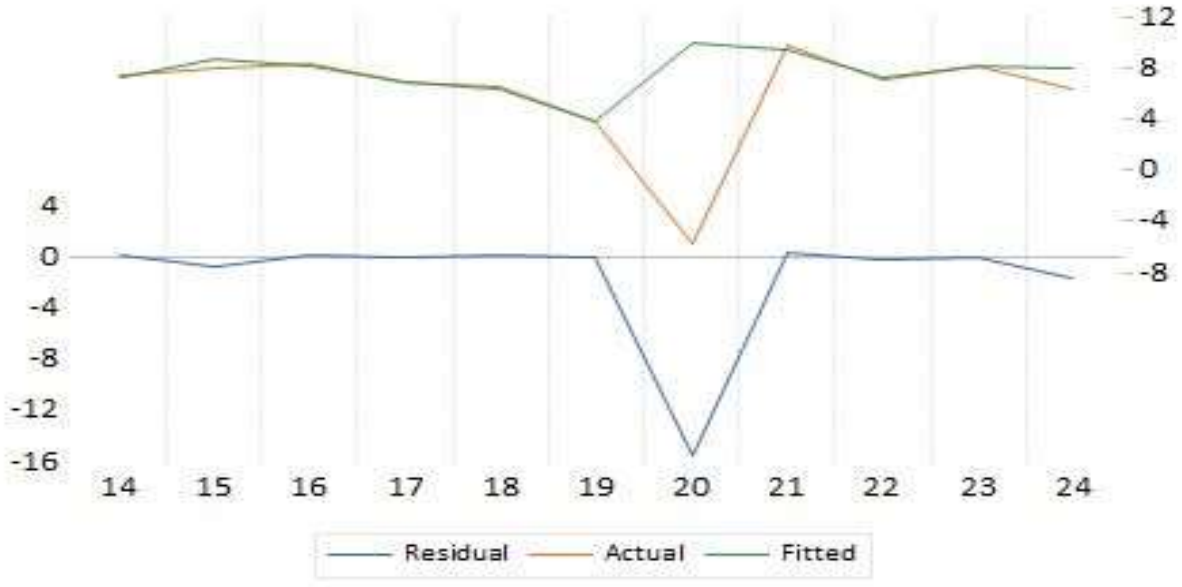

Fig- 1
Graph - 1

Estimated equation:

GDPG = C (1) + C (2) *PE+ C (3) *PD+ C (4) *IRC

*GDPG = - 45.5985143351 + 2.23581562019*PE - 0.143644731283*PD -0.411438358697*IRC*

Findings:

Classical R^2 is fairly high (0.58), but strong diagnostics are outstanding, $Rw^2 = 0.98$, indicating that the model is properly fitted to the data and immune to outliers or heteroskedasticity.

The model is statistically valid and credible for inference and policy guidance. Significance of Predictors: All predictors (PE, PD, IRC) are significant and have negative effects on GDP growth. Public Expenditure (PE): Positive and strongly significant effect on GDP growth. The outcome suggests that higher government debt is growth-stimulating in this situation. This agrees with Keynesian economics, which endorses expansionary fiscal policy when the economy overreacts or experiences sluggish growth over time. Public Debt (PD): Negative and highly significant effect on GDP growth. Agrees with literature (e.g., Reinhart & Rogoff, 2010) that too much debt kills growth, perhaps through crowding out or concerns about fiscal sustainability. Inflation Rate Change (IRC): Negative and statistically significant, suggesting that unpredictability or volatility of inflation hurts GDP growth. This points to the necessity of macroeconomic stability in favor of economic growth.

Suggestions:

Government must emphasize raising the investment in productive and return-yielding long-term health and education and infrastructure and eschew excessive growth in unproductive or recurring expenditures (e.g., unreformed subsidies, administrative overheads). Government must introduce performance-based budgeting to enhance the efficiency of government expenditure.

Conclusion:

The results of this study yield strong empirical evidence that public expenditure, public debt, and inflationary changes have statistically significant negative impacts on Indian GDP growth between 2014 and 2024. Significantly, public expenditure is found to have the strongest negative correlation, which could potentially be due to inefficiency or misallocation of government spending. Even though the classical model provides moderate explanatory power, the enhanced performance of the robust regression testifies to its robustness under heteroskedasticity and outliers. These findings enrich the general macroeconomic policy debate by emphasizing the significance of maximizing the efficiency and design of fiscal expenditure and keeping cautionary levels of public debt. Subsequent work can help by separating the types of expenditures (capital and revenue) and investigating lag effects in order to further sharpen policy recommendations. In summary, the study recommends a disciplined and strategic fiscal approach to facilitate sustainable economic growth in India.

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