

THE EFFECT OF RESEARCH AND DEVELOPMENT, FINAL CONSUMPTION EXPENDITURE, AND GOVERNANCE INDICATORS ON ECONOMIC GROWTH IN HIGH-INCOME COUNTRIES: A PANEL DATA ANALYSIS

Ana Amelia Janah¹, Angelica Amelia Valenty², Cintya Dinda Naura³,
Putra Andagayaksa⁴, Salsa Pebiola⁵, Sherli Natasya⁶
^{1,2,3,4,5,6} University Of Lampung

E-mail: anamaliaj07@gmail.com¹, amelia229@gmail.com², cintyanaura432@gmail.com³,
putraandaga@gmail.com⁴, olasalsa09@gmail.com⁵, natasyasherli04@gmail.com⁶

Copyright © 2026 The Author



This is an open access article

Under the Creative Commons Attribution Share Alike 4.0 International License

Abstract:

This study examines the effect of Research and Development (R&D), Final Consumption Expenditure (FCE), and governance indicators on economic growth in 25 high-income countries over the period 2000–2024 using a panel data approach. Economic growth is influenced not only by capital accumulation and market activity, but also by innovation, domestic demand, and institutional quality. This study employs the Random Effects Model (REM) with robust standard errors to address heteroskedasticity and autocorrelation in the panel data. Governance indicators, comprising Voice and Accountability, Political Stability, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption, are incorporated as moderating variables in the interaction terms with R&D and FCE. The empirical results show that R&D has a negative and statistically significant effect on economic growth, suggesting that the benefits of R&D investment in high-income countries may require time to materialize and depend on supporting institutional conditions. Final Consumption Expenditure has a positive effect on economic growth, consistent with the Keynesian view that domestic demand stimulates output, although the result is weakly significant at the 10 percent level. Regarding the moderating role of governance, Voice and Accountability significantly weakens the effect of R&D on growth, while Regulatory Quality shows a weakly positive moderating effect on R&D. On the consumption side, Political Stability and Control of Corruption negatively moderate the relationship between FCE and growth, while Rule of Law significantly strengthens it. Overall, the findings indicate that the relationship between innovation, consumption, and economic growth in high-income countries is shaped by the quality of specific governance dimensions, highlighting the importance of institutional context in determining the effectiveness of economic policies.

Keywords: Economic Growth; Research And Development; Final Consumption Expenditure; Governance Indicators; Panel Data Analysis

Abstrak:

Penelitian ini bertujuan untuk menganalisis pengaruh research and development (R&D), final consumption expenditure, dan governance indicators terhadap pertumbuhan ekonomi dengan menggunakan pendekatan data panel. Pertumbuhan ekonomi tidak hanya dipengaruhi oleh akumulasi modal dan aktivitas pasar, tetapi juga oleh inovasi teknologi serta kualitas institusi. R&D dianggap mampu meningkatkan produktivitas dan kemajuan teknologi, sedangkan final consumption expenditure mencerminkan permintaan domestik yang dapat mendorong aktivitas ekonomi. Governance indicators menunjukkan kualitas tata kelola pemerintahan yang memengaruhi efisiensi ekonomi dan iklim investasi. Metode penelitian yang digunakan adalah analisis data panel dengan pertumbuhan ekonomi sebagai variabel dependen, sementara R&D, final consumption expenditure, dan governance indicators sebagai variabel independen. Model Random Effects (REM) dengan robust standard errors digunakan untuk mengatasi heteroskedastisitas dan autokorelasi dalam data panel antarnegara yang tidak dapat diamati secara langsung, seperti sistem inovasi, kualitas institusi, dan pola konsumsi. Pendekatan ini memungkinkan analisis variasi data antarwaktu dan antarnegara secara lebih akurat. Hasil penelitian menunjukkan bahwa pengeluaran R&D berpengaruh negatif dan signifikan terhadap pertumbuhan ekonomi, mengindikasikan bahwa manfaat investasi R&D di negara-negara berpendapatan tinggi

memerlukan waktu untuk terwujud dan bergantung pada kondisi kelembagaan yang mendukung. Final consumption expenditure berpengaruh positif terhadap pertumbuhan ekonomi, meskipun signifikansinya lemah pada taraf 10 persen. Governance indicators berperan sebagai moderator parsial: Voice and Accountability memperlemah pengaruh R&D terhadap pertumbuhan, sementara Political Stability dan Control of Corruption memperlemah pengaruh FCE terhadap pertumbuhan. Sebaliknya, Rule of Law memperkuat pengaruh FCE terhadap pertumbuhan ekonomi secara signifikan. Temuan ini menegaskan bahwa efektivitas inovasi dan konsumsi dalam mendorong pertumbuhan ekonomi sangat bergantung pada kualitas dimensi tata kelola pemerintahan yang spesifik.

Kata Kunci: Pertumbuhan Ekonomi; Penelitian Dan Pengembangan; Pengeluaran Konsumsi Akhir; Indikator Tata Kelola; Analisis Data Panel

1. Introduction

The ability of an economy to increase output, improve living standards, and create long-term welfare. Understanding the factors that drive economic growth is therefore a central concern in development economics. Among the many determinants of growth, research and development (R&D), final consumption expenditure, and governance indicators are increasingly recognized as key variables that may influence growth performance in both developed and developing economies. Recent empirical Economic growth remains one of the most important indicators of a country's development, as it reflects studies suggest that economic growth is not driven by capital accumulation alone, but also by innovation, domestic demand, and institutional quality.

Research and development plays a crucial role in promoting innovation, improving productivity, and encouraging technological progress. Growth theory argues that technological development is one of the main engines of long-run economic expansion, and R&D spending is a measurable proxy for that process. Empirical evidence from selected developing and newly developed economies shows that R&D expenditure has a significant and positive effect on GDP per capita, with a 1 percent increase in R&D spending associated with a 0.27 percent increase in income per capita. Similar findings from earlier panel studies also indicate that R&D expenditure contributes positively to economic growth over both the short and long run, especially when countries are able to sustain innovation investment consistently. These results suggest that countries seeking faster growth should pay greater attention to innovation-oriented policies and research investment.

Final consumption expenditure is another important component of economic activity because it reflects household demand and overall market dynamism. In many economies, consumption represents a large share of gross domestic product and serves as a major driver of short-term growth. Recent panel evidence shows that final consumption expenditure has a positive and statistically significant relationship with economic growth, indicating that strong domestic demand can stimulate output expansion. This relationship is especially relevant in emerging and developing countries where consumer spending often supports production, investment, and employment. However, the growth effect of consumption may vary depending on whether expenditure is productive or driven by inflationary pressure and external dependency.

Governance indicators also matter because the institutional environment shapes how effectively resources are allocated and how efficiently economic policies are implemented. Good governance can reduce corruption, improve public administration, strengthen legal systems, and create a more predictable business climate. Empirical studies on governance quality and growth show that better institutional performance, especially in areas such as government effectiveness and control of corruption, is associated with higher economic growth. Other research also emphasizes that governance quality influences investor confidence, policy credibility, and economic stability, which are all essential for sustained development. For this reason, governance is increasingly treated as a structural factor that affects both the supply side and demand side of the economy.

Although each of these variables has been studied separately, fewer studies combine R&D expenditure, final consumption expenditure, and governance indicators in a single panel framework. This gap is important because the relationship between growth and its determinants may be interactive rather than isolated. For example, the positive effect of R&D may be stronger in countries with better governance, while the impact of final consumption expenditure may depend on the quality of institutions and macroeconomic stability. A panel data approach is therefore appropriate because it allows researchers to observe both cross-country differences and time-series dynamics simultaneously. By examining these variables together, the study can provide a more comprehensive understanding of how innovation, demand, and governance jointly shape economic growth.

In addition, this topic is highly relevant for policy formulation in developing economies.

Governments need evidence on whether allocating more resources to R&D, supporting domestic consumption, and strengthening governance can accelerate growth. Previous studies indicate that policy support for innovation and institutional improvement can produce measurable gains in GDP growth. Likewise, maintaining healthy consumption levels may help stabilize economic activity, especially during periods of external shock or weak investment. Therefore, studying the combined effect of these variables can offer useful insights for designing balanced and sustainable growth strategies.

2. Literature Review

2.1 Economic Growth

Economic growth refers to the increase in a country's productive capacity as reflected by rising real GDP over time. It serves as a primary indicator of national development, encompassing improvements in welfare, employment, and economic stability. Growth is influenced not only by capital accumulation and market activity, but also by innovation and institutional quality (Mankiw, 2019). Kaufmann and Kraay (2002) argue that governance quality shapes market efficiency by reducing transaction costs and strengthening investor confidence, creating a more predictable economic environment.

2.2 Theoretical Framework

Classical theory (Smith, Ricardo, Malthus) attributes economic growth to land, labor, and capital, emphasizing that free market mechanisms naturally create equilibrium. Neoclassical theory (Solow-Swan) adds technology as an exogenous driver, noting that capital alone yields diminishing returns and that long-run growth ultimately depends on technological progress and efficiency. Endogenous growth theory (Romer, Lucas) internalizes technology, arguing that R&D investment, human capital, and institutional quality are the true engines of sustained long-run growth not external forces, but outcomes of deliberate economic decisions and policy.

2.3 Research and Development (R&D)

Research and Development (R&D) encompasses systematic creative activities aimed at generating new knowledge and technological innovation. Under endogenous growth theory, R&D is considered the primary source of long-run productivity gains. Empirical evidence confirms that a 1% increase in R&D spending is associated with approximately a 0.27% increase in GDP per capita. Countries sustaining consistent R&D investment tend to achieve higher productivity and stronger economic competitiveness. Barro (1996) highlights that technological development and innovation positively affect growth by increasing the efficiency of factor utilization, while Romer (1990) emphasizes that knowledge accumulation from R&D creates increasing returns that drive sustained expansion.

2.4 Final Consumption Expenditure

Final consumption expenditure comprising household, government, and non-profit institution spending is one of the most important components of GDP. Keynesian theory holds that higher consumption raises aggregate demand, which in turn stimulates production, investment, and national income. Panel data evidence confirms a positive and statistically significant relationship between consumption expenditure and economic growth, particularly in developing economies where domestic demand underpins employment and output. Panjaitan et al. (2023) further show that government expenditure allocated to productive sectors such as education and health enhances human capital quality and national productivity, amplifying the growth effect of public consumption.

2.5 Governance Indicators

The World Bank's Worldwide Governance Indicators (WGI) measure institutional quality across six dimensions: Voice and Accountability, Political Stability, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption. Good governance reduces corruption, strengthens legal systems, and creates a predictable investment climate that encourages economic activity. Widjanarko (2021) finds that governance quality particularly freedom of expression and political stability positively affects economic growth in ASEAN countries. Liu et al. (2018) confirm that better institutional performance improves economic efficiency and drives investment. Kaufmann and Kraay (2002) further argue that the rule of law and control of corruption are among the strongest institutional predictors of sustainable economic growth.

2.5 Hypotheses

Based on the theoretical framework and prior research that has been reviewed, the hypotheses proposed in this study are as follows:

H1: Research and Development (R&D) has a positive effect on economic growth. H2: Final Consumption Expenditure has a positive effect on economic growth.

H3: Governance Indicators simultaneously affect economic growth.

H4: Voice and Accountability has a positive effect on economic growth. H5: Political Stability has a

positive effect on economic growth.

H6: Government Effectiveness has a positive effect on economic growth. H7: Regulatory Quality has a positive effect on economic growth.

H8: Rule of Law has a positive effect on economic growth.

H9: Control of Corruption has a positive effect on economic growth.

H10: Research and Development (R&D), Final Consumption Expenditure, and Governance Indicators simultaneously affect economic growth.

H11: Research and Development (R&D) and Final Consumption Expenditure simultaneously have a positive effect on economic growth.

H12: Research and Development (R&D) and Governance Indicators simultaneously have a positive effect on economic growth.

H13: Final Consumption Expenditure and Governance Indicators simultaneously have a positive effect on economic growth.

H14: Governance Indicators are the most dominant variables affecting economic growth.

3. Research Methods

3.1. Object, time and Place

This study uses a quantitative approach with panel data analysis to examine the influence of Research and Development (R&D), Final Consumption Expenditure (FCE), and governance indicators on Economic Growth in High Income Countries. Governance indicators used in this study consist of Voice and Accountability (VA), Political Stability (PV), Government Effectiveness (GE), Regulatory Quality (RQ), Rule of Law (RL), and Control of Corruption (CC) as moderating variables.

This study uses secondary data covering the period 2000–2024 from countries categorized as High Income Countries. All data were obtained from the World Bank database, particularly the World Development Indicators (WDI) and Worldwide Governance Indicators (WGI).

3.2. Data Collection Techniques

This study uses secondary data collected through documentation and literature study techniques. The data were obtained from official publications and databases provided by the World Bank. The variables used include Economic Growth (GDP Growth), Research and Development (R&D), Final Consumption Expenditure (FCE), Voice and Accountability (VA), Political Stability (PV), Government Effectiveness (GE), Regulatory Quality (RQ), Rule of Law (RL), and Control of Corruption (CC).

The data are panel data consisting of time series data from 2000–2024 and cross-section data from High Income Countries. All variables were adjusted to ensure consistency in units and observation periods.

Variable	Source	Unit
Economic Growth	World Bank	%
Research and Development	World Bank	% of GDP
Final Consumption Expenditure	World Bank	% of GDP
Voice and Accountability	World Bank	Index
Political Stability	World Bank	Index
Government Effectiveness	World Bank	Index
Regulatory Quality	World Bank	Index
Rule of Law	World Bank	Index
Control of Corruption	World Bank	Index

3.3. Data Analysis Techniques

The data analysis method used in this study is panel data regression analysis. The regression model is estimated using three approaches, namely Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM). The most appropriate model is selected through the Chow Test, Hausman Test, and Lagrange Multiplier (LM) Test.

The panel data regression model used in this study is formulated as follows:

$$GDP_{it} = \beta_0 + \beta_1 RD_{it} + \beta_2 FCE_{it} + \beta_3 (RD \times PV)_{it} + \beta_4 (RD \times GE)_{it} + \beta_5 (RD \times CC)_{it} + \beta_6 (RD \times VA)_{it} + \beta_7 (RD \times RQ)_{it} + \beta_8 (RD \times RL)_{it} + \beta_9 (FCE \times PV)_{it} + \beta_{10} (FCE \times GE)_{it} + \beta_{11} (FCE \times CC)_{it} + \beta_{12} (FCE \times VA)_{it} + \beta_{13} (FCE \times RQ)_{it} + \beta_{14} (FCE \times RL)_{it} + \epsilon_{it}$$

Where GDP represents Economic Growth, RD represents Research and Development, FCE represents Final Consumption Expenditure, PV represents Political Stability, GE represents Government Effectiveness, CC represents Control of Corruption, VA represents Voice and Accountability, RQ represents Regulatory Quality, RL represents Rule of Law, and ϵ represents the error term.

Hypothesis testing in this study consists of the t-test to examine the partial effect of independent variables, the F-test to examine the simultaneous effect of all independent variables, and the coefficient

of determination (R^2) to measure the explanatory ability of the regression model. The significance level used in this study is 5% ($\alpha = 0.05$).

4. Results and Discussion

4.1. Research Results

This study uses panel data from 25 high-income countries over the period 2000–2024, resulting in 624 observations. The estimation is conducted using the Random Effects Model (REM) with robust standard errors. The robust option is applied to obtain standard errors that are more reliable in the presence of heteroskedasticity and autocorrelation; however, multicollinearity must still be tested separately using an appropriate diagnostic measure such as VIF.

The estimation results show that the model is statistically significant overall. The Wald chi-square statistic is 522.14 with a probability value of 0.0000, indicating that the explanatory variables are jointly significant in explaining economic growth. The R-squared values are 0.0550 within, 0.6931 between, and 0.1320 overall. These results suggest that the model explains cross-country variation better than within-country variation over time.

Table 1. Random Effects Regression Results (Robust Standard Errors)

Variable	Coefficient	P-value	Robust Std.Err	Result
R&D	-1.079156	0.031	0.500934	Significant
FCE	0.1411489	0.052	0.072674	Not significant
R&D × PV	-0.003554	0.988	0.228773	Not significant
R&D × GE	-0.181167	0.639	0.385679	Not significant
R&D × CC	0.011541	0.967	0.281068	
R&D × VA	-0.854771	0.015	0.350353	Significant Not
R&D × RQ				significant Not
R&D × RL	0.654541	0.088	0.383086	significant
FCE × PV				Significant Not
FCE × GE	0.716938	0.312	0.708736	significant
FCE × CC	-0.089195	0.041	0.043549	Significant Not
FCE × RQ				significant Not
FCE × RL	0.020800	0.585	0.038123	significant
Constant				Significant
	-0.081792	0.004	0.028762	Significant
	-0.069723	0.100	0.042338	
	-0.030691	0.523	0.048099	
	0.151162	0.001	0.043479	
	2.771016	0.000	0.416441	

Sources: *Stata output, processed by the authors.*

The results indicate that R&D has a negative and statistically significant effect on GDP. This suggests that, within the observed sample, higher R&D expenditure is associated with lower economic growth. Meanwhile, Final Consumption Expenditure (FCE) has a positive effect on GDP, and the relationship is weakly significant at the 10 percent level.

For the interaction terms, R&D × Voice and Accountability (VA) is negative and significant, implying that VA weakens the effect of R&D on economic growth. R&D × Regulatory Quality (RQ) is positive and weakly significant, indicating that better regulatory quality tends to strengthen the relationship between R&D and GDP, although the evidence is not strong.

On the consumption side, FCE × Political Stability (PV) and FCE × Control of Corruption (CC) are negative and significant, suggesting that these governance dimensions weaken the effect of consumption expenditure on economic growth. FCE × Voice and Accountability (VA) is also negative and weakly significant. In contrast, FCE × Rule of Law (RL) is positive and significant, meaning that stronger rule of law enhances the impact of FCE on GDP.

4.2. Discussion

The negative and significant coefficient of R&D is not fully consistent with endogenous growth theory, which generally argues that R&D stimulates innovation, productivity, and long-run economic

growth. However, this finding can be explained by the possibility that the economic benefits of R&D require time to materialize. In high-income countries, R&D spending may increase costs in the short run before generating measurable growth effects in the longer term. In addition, the effectiveness of R&D may depend on how efficiently it is allocated and supported by institutional conditions.

The positive effect of FCE is consistent with Keynesian theory, which emphasizes the role of aggregate demand in supporting economic activity. Higher consumption expenditure increases demand for goods and services, encourages production, and stimulates output growth. In high-income economies, domestic consumption remains an important driver of economic performance.

The moderating role of governance indicators shows that institutional quality does not operate uniformly across all dimensions. The negative and significant interaction between R&D and Voice and Accountability implies that greater public participation and accountability may slow the short-run transmission of R&D spending into growth. Meanwhile, the positive and weakly significant interaction between R&D and Regulatory Quality suggests that better regulation may support innovation, although the evidence is limited.

The negative and significant interactions between FCE and Political Stability and between FCE and Control of Corruption indicate that, in countries with stronger institutions, consumption may play a relatively smaller role in driving growth. In such economies, growth may be more strongly driven by investment, innovation, or productivity improvements. By contrast, the positive and significant interaction between FCE and Rule of Law suggests that legal certainty strengthens the effectiveness of consumption in supporting economic growth.

Overall, the findings suggest that governance indicators play a partial moderating role in the relationship between R&D, FCE, and economic growth. Not all governance dimensions are significant, which indicates that institutional effects vary depending on the specific indicator used.

4.3. Relevance to Research Objectives

The first research objective was to examine the effect of R&D on economic growth. The results show that R&D has a negative and significant effect on GDP, so this objective has been achieved empirically. The second objective was to analyze the role of governance indicators in economic growth. The results show that several governance indicators significantly moderate the relationship between the main explanatory variables and GDP, particularly Voice and Accountability, Political Stability, Control of Corruption, and Rule of Law. Therefore, governance is confirmed to be an important institutional factor in explaining growth differences across countries. The third objective was to analyze the simultaneous effect of R&D, Final Consumption Expenditure, and governance indicators on economic growth. The significant Wald chi-square statistic confirms that the variables are jointly significant in explaining GDP. Thus, the findings answer the research objectives and support the view that economic growth is influenced not only by innovation and consumption, but also by the quality of governance.

5. Conclusion

This study examines the effect of Research and Development (R&D), Final Consumption Expenditure (FCE), and governance indicators on economic growth in 25 high-income countries during the period 2000–2024 using the Random Effects Model (REM) with robust standard errors. The empirical findings demonstrate that R&D has a negative and statistically significant effect on economic growth, while Final Consumption Expenditure positively affects GDP. Furthermore, governance indicators play a partial moderating role in the relationship between R&D, FCE, and economic growth, particularly through the dimensions of Voice and Accountability, Political Stability, Control of Corruption, and Rule of Law. These findings indicate that economic growth in high-income countries is influenced not only by innovation and consumption factors, but also by the institutional environment that shapes the effectiveness of economic activities and policies. Therefore, policies aimed at promoting sustainable economic growth should not only focus on increasing R&D expenditure and domestic consumption, but also prioritize improvements in governance quality and institutional performance. Nevertheless, this study is limited to high-income countries and selected governance dimensions, so future research is encouraged to include broader country classifications, additional macroeconomic variables, and alternative estimation methods in order to obtain a more comprehensive understanding of the relationship between innovation, governance, and economic growth.

Bibliography

- Azam, M. (2021). Governance and economic growth: Evidence from Latin America and the Caribbean (LAC). *Journal of the Knowledge Economy*. <https://doi.org/10.1007/s13132-021-00781-2>
- Emara, N., & Chiu, I.-M. (2016). The impact of governance environment on economic growth: The case of Middle East and North African countries. *Journal of Economics Library*, 3(1), 24–37.

- Fisman, R., & Svensson, J. (2007). Corruption and growth: Causality or spuriousness? *Journal of Development Economics*, 83(1), 63–75. <https://doi.org/10.1016/j.jdeveco.2007.06.006>
- Haggard, S., & Tiede, L. (2011). The rule of law and economic growth: Where are we? *World Development*, 39(5), 673–685. <https://doi.org/10.1016/j.worlddev.2010.10.007>
- Hayati, J., Hanapia, A. Y., & Ramadhan, R. W. (2024). Pengaruh pengeluaran konsumsi pemerintah dan pengeluaran investasi terhadap pertumbuhan ekonomi di Indonesia. *Convergence: The Journal of Economic Development*, 6(1), 1–15.
- Kaufmann, D., Kraay, A., & Mastruzzi, M. (2010). *The worldwide governance indicators: Methodology and analytical issues* (Policy Research Working Paper No. 5430). World Bank. <https://doi.org/10.1596/1813-9450-5430>
- Kraipornsak, P. (2018). Good governance and economic growth: An investigation of Thailand and selected Asian countries. *Eurasian Journal of Economics and Finance*, 6(1), 93–106. <https://doi.org/10.15604/ejef.2018.06.01.009>
- Nugroho, P., Syahnur, S., & Suriani. (2022). The impact of real government spending in physical and social infrastructures on economic growth. *Indonesian Treasury Review: Jurnal Perbendaharaan, Keuangan Negara dan Kebijakan Publik*, 7(4), 287–300.
- Panjaitan, R. P., Sukmono, R., Fuady, M. S., Salsabila, N., & Hadianoro, F. (2026). How do government expenditures by function affect economic growth? Evidence from Indonesia. *Ekulibrium: Jurnal Ilmiah Bidang Ilmu Ekonomi*, 21(1), 127–149. <https://doi.org/10.24269/ekulibrium.v21i1.2026.pp127-149>
- Swaramarinda, D. R., & Indriani, S. (2011). Pengaruh pengeluaran konsumsi dan investasi pemerintah terhadap pertumbuhan ekonomi di Indonesia. *EconoSains*, 9(2), 95–105.
- Widjanarko. (2021). Analisis hubungan good governance dan pertumbuhan ekonomi Indonesia 2013–2019. *Jurnal Good Governance*, 17(2), 155–168.
- Zhang, Z., Almalki, S. M. O., Bashir, M., & Khan, S. (2020). Underlying the relationship between governance and economic growth in developed countries. *Journal of the Knowledge Economy*. <https://doi.org/10.1007/s13132-020-00658-w>