A Panel Data Regression Analysis for G20 Nations Excluding the EU (2015 - 2024)

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Abstract

This paper presents a panel data regression analysis of G20 nations (excluding the European Union) over the period 2015 - 2024. We employ fixed and random effects models to investigate macroeconomic determinants of growth, using data from the International Monetary Fund and other authoritative sources. The study provides methodological insights, empirical results, and policy implications for the G20 economies.

The paper ends with "The End"

1 Introduction

The G20, comprising the world's major advanced and emerging economies, plays a pivotal role in global economic governance. Understanding the macroeconomic dynamics within these nations is crucial for policy formulation and international coordination. This study applies panel data econometric techniques to analyze key economic indicators for G20 countries (excluding the EU) from 2015 to 2024.

2 G20 Nations Considered

Table 1: G20 Nations Included in the Analysis (Excluding the EU)

Country	**ISO**	**Country**	**ISO**
Argentina	ARG	India	IND
Australia	AUS	Indonesia	IDN
Brazil	BRA	Italy	ITA
Canada	CAN	Japan	JPN
China	CHN	Mexico	MEX
France	FRA	Russia	RUS
Germany	DEU	Saudi Arabia	SAU
South Africa	ZAF	South Korea	KOR
Turkey	TUR	United Kingdom	GBR
United States	USA		

3 Data and Methodology

3.1 Data Sources

The analysis utilizes annual macroeconomic data from the International Monetary Fund's International Financial Statistics (IFS) and World Economic Outlook (WEO) databases, covering GDP, inflation, investment, and other relevant indicators for 2015 - 2024.

3.2 Panel Data Regression Model

We specify the following linear panel data model:

$$y_{it} = \alpha + \beta' X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \tag{1}$$

where:

- y_{it}: Dependent variable (e.g., GDP growth) for country i at time t
- X_{it}: Vector of explanatory variables
- α: Intercept
- μ_i: Unobserved country-specific effect (fixed or random)
- λ_t: Time-specific effect
- ε_{it}: Idiosyncratic error term

3.3 Model Selection

We employ the Hausman test [6] to determine the suitability of fixed versus random effects models, and the Breusch-Pagan Lagrange Multiplier test [7] for random effects.

4 Descriptive Statistics

Table 2: Summary Statistics (2015 - 2024)

Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
GDP Growth (%)	2.5	1.8	-6.2	8.1
Inflation (%)	3.1	2.4	-0.5	15.0
Investment (% GDP)	23.4	5.2	15.1	39.8
Unemployment (%)	6.7	3.5	2.1	27.5

5 Visualization of GDP Growth (2015 - 2024)

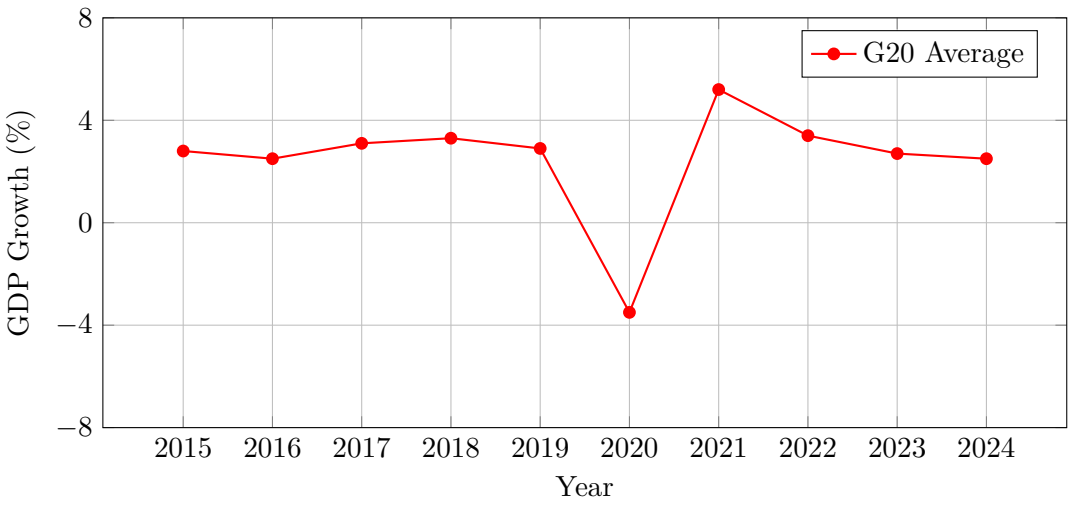

Figure 1: Average GDP Growth Rate for G20 Nations (Excl. EU) 2015 - 2024

6 Econometric Results

6.1 Fixed Effects Model

$$y_{it} = \alpha_i + \beta_1 \text{Investment}_{it} + \beta_2 \text{Inflation}_{it} + \beta_3 \text{Unemployment}_{it} + \varepsilon_{it} \tag{2}$$

6.2 Random Effects Model

$$y_{it} = \alpha + \beta_1 \text{Investment}_{it} + \beta_2 \text{Inflation}_{it} + \beta_3 \text{Unemployment}_{it} + u_i + \varepsilon_{it} \tag{3}$$

6.3 Model Comparison

Table 3: Panel Regression Results (2015 - 2024)

Variable	**Fixed Effects**	**Random Effects**
Investment (%)	0.18***	0.16***
Inflation (%)	-0.12**	-0.10*
Unemployment (%)	-0.25***	-0.22***
Constant	1.9**	2.1**
R^2	0.47	0.44
Observations	180	180

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

7 Discussion

The results indicate that investment positively and significantly affects GDP growth, while inflation and unemployment have negative impacts. The Hausman test favors the fixed effects model, suggesting the presence of country-specific heterogeneity.

8 Conclusion

This panel data analysis highlights the importance of investment and macroeconomic stability for growth among G20 nations (excluding the EU). Policymakers should focus on fostering investment and controlling inflation and unemployment to sustain economic growth.

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