

Macroeconomic determinants of economic growth. An international perspective

Yashasvi PANDEY

IIS (Deemed to be University), Jaipur, India
msyashasvipandey@gmail.com

C.R. BISHNOI

IIS (Deemed to be University), Jaipur, India
cr.bishnoi@iisuniv.ac.in

Abstract. *The objective of this study is to analyse the effect of selected macroeconomic determinants on economic growth of 40 countries taken 10 each from four income groups of countries as classified by World Bank – low income, lower-middle income, upper-middle income and high income group for the time period 2000-2019 by estimating two panel growth models – the basic growth model and the extended growth model. In the basic growth model, only five real factors affecting economic growth have been considered, namely, private consumption expenditure, capital formation, government expenditure, exports and imports and in the extended growth model, additional factors-inflation rate, FDI inflows and population growth have been also included to obtain a more detailed analysis of the various determinants of economic growth. Separate panel growth models are estimated for all four income groups as well as taking all data as a whole by three conventional methods (POLS, FEM and REM) of panel model. After estimating models, diagnostic tests were conducted to check the problems of cross-section dependence, heteroscedasticity and autocorrelation. To correct these problems PCSE/FGLS model was used, depending upon the number of cross-sectional units and number of time periods. The estimated final model suggests that capital formation and FDI inflows have positive significant impact on economic growth, whereas government spending significantly negatively impacts economic growth. Private consumption expenditure also plays a significant role in positively affecting growth rate for low income as well as high income group. Thus, countries should focus on capital formation and developing a more conducive environment for promotion of domestic as well as foreign investment.*

Keywords: economic growth, PCSE/FGLS, growth determinants.

JEL Classification: O4, C4, C51, O5.

1. Introduction

Economic growth is a complex phenomenon, which is affected by a variety of factors-both economic and non-economic. Taking the economic factors into consideration, there are real variables affecting economic growth. These real determinants of growth can be easily deduced from the national income identity:

$$Y = C + I + G + X - M$$

Thus, as suggested by Ristanović et al. (2018) private consumption expenditure, investment expenditure or capital formation, government expenditure, export earnings and imports can be considered the real determinants of economic growth. Then there are monetary factors-most notably, money supply, inflation rate and interest rate, which impact economic growth. Inflation rate is also an indicator of macroeconomic stability. Additional factors like population or labour force growth and human capital formation also affect economic growth. Population growth is an important indicator of demographic development.

Thus, the determinants of economic growth, in this paper, were examined in two separate models- a basic one and the other being extended one. The basic growth model describes explicitly about the real determinants and the extended growth model includes additional factors which determine the rate of economic growth. Thus, these two growth models were estimated in this paper to determine the impact and significance of domestic consumption, investment in physical capital, public consumption, external trade, macroeconomic stability, foreign investments and demographic development on the real per capita GDP growth rate in respect of different income groups of countries. It is generally expected that all above mentioned determinants have positive impact on economic growth, except interest rate, inflation rate and imports. However, the results might vary depending upon the time period and the macroeconomic structure of the economies. For example, if the share of non-productive expenditure in government expenditure is high, it retards the growth process.

The remaining paper proceeds as follows. Section 2 gives selected literature review. Section 3 describes the data and methodology, while Section 4 presents empirical findings. Finally, Section 5 gives the summary and policy implications.

2. Selected literature review

This section reviews empirical studies that are based on panel data analysis of the macroeconomic determinants of economic growth, pertaining to countries selected from different regions or economic classifications.

Barro (1996) investigated the determinants of economic growth through data of around 100 countries for the time period 1960-1990 by estimating the panel regression model with the help of three-stage least squares method. The author concluded that for a given initial level of per capita real GDP, economic growth is positively related to high levels of initial schooling, higher life expectancy, low fertility rate, lesser government spending, low levels of inflation, improvements in terms of trade and better maintenance of rule of law. In

another study, Barro (2003) has analysed the determinants of economic growth of 87 countries, pertaining to low income and high income groups by using the technique of panel regression analysis. He found that economic growth is positively related to investment ratio, rule of law, favorable terms of trade and increased openness but negatively related to government expenditure, fertility rate and inflation.

Dewan and Hussein (2001) have conducted an empirical analysis of the determinants of economic growth using panel data for 41 middle-income developing countries for the period 1965-1997 by estimating the Fixed Effects Model (FEM) and Random Effects Model (REM). The authors found that labour force growth, investment in physical and human capital, low level of inflation, open trade policies and improved technique of production affect economic growth positively, but adverse supply shocks in agricultural sector have a negative effect on economic growth. Cancado (2005) has analysed different determinants of economic growth for 17 Latin American countries for the time period 1952-2000 by using pooled ordinary least squares (POLS) model, FEM, REM and Hausman-Taylor model. The study found that trade openness, investment and life expectancy have positive effects on economic growth, while initial per capita GDP level, government expenditure and polity score have a negative effect on the growth rate of per capita GDP.

Trpkova and Tashev (2011) examined the major determinants of economic growth for seven South-East European countries for the time period 1995-2007 by using FEM. The authors concluded that government expenditure, consumer price index, current account deficit (as share of GDP), exchange rate, population, price liberalization and privatization are the major factors affecting economic growth. Also, current account deficit (as share of GDP), exchange rate, net foreign direct investment (FDI), consumer price index and price liberalization have negative impact on real GDP growth rate, while all other factors have a positive impact.

Goel and Korhonen (2011) have studied economic growth in four BRIC (Brazil, Russia, India and China) countries over the period 2000-2007. The authors concluded that there is a positive relationship between corruption and economic growth. In other words, the greasing effects are supported over the sanding aspects of corruption. Greater extent of democracy has a negative impact on economic growth, which might be due to the fact that there is compromise of efficiency considerations at the expense of equity issues. However, there is no significant impact of the degree of patent protection on economic growth.

Wahyudi and Jantan (2012) have analysed major factors affecting economic growth of ASEAN-4 countries, namely, Malaysia, Thailand, Indonesia and Philippines, for the time period 1980-2004, using Solow-Swan and Mankiw-Romer-Weil models. FEM and REM were used to estimate the relationship between real GDP, real capital stock, labour force and adult literacy rate (as a proxy for human capital). The authors concluded that there is a significant impact of both capital and labour on the real GDP, but the effect of labour is more dominant. Also, as regards total factor productivity, it is positive for all countries except for Philippines. Also, there is a positive effect of human capital on economic growth.

Ndambiri et al. (2012) have examined the macroeconomic factors affecting economic growth of 19 sub-Saharan African countries for the time period 1982-2000 by using the technique of Generalized Method of Moments (GMM). It is found that physical and human capital formation, as well as exports have a significant contribution in economic growth, but the effect of government spending, foreign aid and nominal discount rate is negative and significant.

Lenka and Sharma (2014) have analysed the relationship between FDI inflows as the main determinant of economic growth, while also considering some other factors. They used data for 62 countries for the time period 1991-2010. FEM and REM, as well as the Panel Corrected Standard Errors (PCSE) model were used to analyse the panel data. PCSE method in GLS estimation was applied to remove the presence of multicollinearity, autocorrelation and heteroscedasticity in panel data set. From the results obtained, the authors concluded that FDI inflows lead to increase in economic growth. At the same time, savings, population and secondary school educational attainment are also the positive factors affecting growth, while inflation has a negative impact on economic growth.

Onyango (2015) assessed the main determinants of economic growth for five East African countries- Kenya, Tanzania, Uganda, Rwanda and Burundi in respect of capital formation, human capital, money supply, technological innovation, financial deepening and trade. The study considered the time period 2000-2013, and the FEM and REM were used to obtain the coefficients of various variables. The author concluded that FDI and money supply have a positive and significant impact on growth rate.

Upreti (2015) has explored the determinants of economic growth for 76 low-income and lower-middle income countries for the years 1995, 2000, 2005, 2010. The ordinary least squares (OLS) method is used to fit regression models for different years. It is concluded that high investment rates, exports, availability of abundant natural resources, and a longer life expectancy have a positive effect on per capita GDP growth for developing economies. As regards FDI, the impact is negative in some periods, whereas positive in other periods. Similarly, consistent results were not obtained in respect of government debt and foreign aid received.

Crepin (2016) has analysed the determinants of economic growth for six CEMAC (Economic and Monetary Community of Central Africa) countries for the time period 2000-2013. The author used POLS, FEM and REM and GMM models for the panel data analysis. The author carried out different model diagnostic tests and found that the FEM is the best model. The study concluded that there is a positive and significant effect of FDI on economic growth, owing to efficacy of policies adopted for attracting foreign investment. But the effect of loans lending to the economy is negative and insignificant because interest payments on public debt are relatively high, these loans were used to finance unproductive projects or they were diverted from their original purpose. The author found that human capital negatively affected economic growth in some CEMAC member states. Similarly, the trade openness, inflation and country's maritime accessibility have no influence on economic growth observed in the countries of the CEMAC.

Fetai et al. (2017) explored the major determinants of economic growth in seven countries in Western Balkan region, over the time period 1994-2015. To estimate the effects of various factors, POLS, FEM and REM, and Hausman-Taylor model with instrumental variables techniques have been used. The authors find that the factors which have positive impact on economic growth are: gross saving, FDI and domestic credit to private sector, whereas, government spending, unemployment, corruption and initial per capita growth level have negative effects. Thus, policies for increase in FDI and reduction in corruption would enhance the economic growth of the Western Balkans.

Ristanović et al. (2018) have investigated the major determinants of economic growth in 61 countries for the period 1953-2007 using GMM. The results obtained suggested that household consumption, trade openness, exports and depreciation of real effective exchange rate have a positive effect on economic growth in different model specifications, whereas, government spending, imports, inflation, FDI and real interest rate have a negative impact on economic growth.

Samsuddin and Amar (2020) analysed the dependence of economic growth on four factors—namely, FDI (as share of GDP), inflation rate (GDP deflator), population growth and exchange rate for ten developing economies of the G20 members. POLS, FEM and REM were used to analyze the panel data for period 2013-2018. The authors found that the effect of FDI on economic growth is positive but insignificant, whereas inflation has negative and significant effect on real GDP growth rate. Also, the impact of population growth is positive but not significant, while the effect of exchange rate on economic growth is positive and significant.

Omosanya and Lawal (2020) investigated the relationship between the GDP and certain macroeconomic determinants of growth, namely, FDI, inflation, imports, total investment, gross national savings, general government revenue, government expenditure and government gross debt for 11 sub-Saharan African Countries. The time period considered was 1980-2018 and the techniques of OLS model, Least Squares Dummy Variable (LSDV) model, FEM and REM were used to analyze the dependence on GDP on the selected variables. Further diagnostic tests were also carried out on the models to ensure the robustness of the results. The authors concluded that FDI and government expenditure have positive and significant impact, while inflation rate and government revenue have negative effect on GDP for the selected countries.

Nasir et al. (2021) analysed the effects of corruption, FDI, population growth and government expenditure on the growth rate of 10 Asia Pacific countries for the time period 2009-2018. They used POLS, FEM and REM to obtain results. The authors concluded that FDI, population growth and government spending have positive and significant impact on economic growth, but effect of corruption is negative and insignificant. Bătrancea et al. (2021) examined the relationship between GDP growth rate, gross domestic savings, gross capital formation, imports, exports, net FDI inflows and net FDI outflows for 34 African countries, over the time period 2001-2019. The countries were selected from different income groups as well as from different levels of human development. The techniques of FEM and REM, as well as GMM estimators were used to estimate different models. The

study concluded that capital formation, savings, exports and imports have substantial effect on economic growth.

In the present study 40 countries of the world were selected taking 10 countries from four income groups of countries as classified by World Bank. These income groups of countries are: low income, lower-middle income, upper-middle income and high income group. The time period covered is from 2000 to 2019. The purpose of the study is to obtain a detailed analysis of the major macroeconomic factors affecting the growth process for different income groups of countries of the world.

3. Data and methodology

3.1. Model selection

To analyze in details, the determinants of economic growth for different income groups of countries, two panel regression models are used- one is the basic growth model and other is the extended growth model. In the basic growth model, only five real factors affecting economic growth have been considered, namely, private consumption expenditure, capital formation, government expenditure, exports and imports. Then, in the extended growth model, additional factors-inflation rate, FDI inflows and population growth have been also included to obtain a more detailed analysis of the various determinants of economic growth. The two regression models have been described below.

Basic growth model:

$$RGDP_{it} = \beta_0 + \beta_1 CONS_{it} + \beta_2 CF_{it} + \beta_3 GE_{it} + \beta_4 EX_{it} + \beta_5 IMP_{it} + \mu_{it}$$

Extended growth model:

$$RGDP_{it} = \beta_0 + \beta_1 CONS_{it} + \beta_2 CF_{it} + \beta_3 GE_{it} + \beta_4 TR_{it} + \beta_5 FDI_{it} + \beta_6 INF_{it} + \beta_7 POP_{it} + \mu_{it}$$

where, RGDP, dependent variable, is real gross domestic product per capita growth, and independent variables are: CONS is households and Non-profit institutions serving households (NPISHs) final consumption expenditure (percentage of GDP); CF is gross capital formation (percentage of GDP); GE is general government final consumption expenditure (percentage of GDP); EX is exports of goods and services (percentage of GDP); IMP is imports of goods and services (percentage of GDP); TR is total trade (exports + imports) (percentage of GDP); FDI is foreign direct investment, net inflows (percentage of GDP); INF is inflation, GDP deflator (annual per cent) and POP is population growth (annual per cent).

3.2. Data sources and countries selected

All data has been collected from World Development Indicators (WDI) database of World Bank. Variables have been taken in percentage form (as percentage of GDP) to do away with absolute values, which vary highly across different countries and income groups, so that comparison can be made in relative terms or in other words, comparable results can be obtained. For studying the determinants of economic growth in the cross-country perspective, 40 countries have been selected, depending on data availability. These

countries belong to four different income groups, as per the World Bank classification, based on their Gross National Income (GNI) per capita in 2021, calculated using the Atlas method. The income limits (in GNI per capita in US\$) are: 1085 or less for low income countries (LIC); 1,086-4,255 for lower-middle income countries (LMIC); 4,256-13,205 for upper-middle income countries (UMIC) and more than 13,205 for high income countries (HIC).

In each of the above categories, countries were arranged in descending order according to their GDP in current US dollars in 2020. Then, top 10 countries from each group have been selected, depending on the data availability of different variables for the specified time period, 2000-2019. These countries are: Sudan, Burkina Faso, Guinea, Mozambique, Niger, Chad, Rwanda, Togo, Sierra Leone and Burundi from LIC group; India, Indonesia, Nigeria, Egypt, Arab Rep., Philippines, Iran, Islamic Rep., Ukraine, Morocco, Kenya and Sri Lanka from LMIC group; China, Russian Federation, Brazil, Mexico, Turkey, Thailand, Argentina, Malaysia, South Africa and Colombia from UMIC group, and United States, Japan, Germany, United Kingdom, France, Italy, Canada, Korea, Rep., Australia and Spain from HIC.

3.3. Descriptive statistics

Table 1 depicts the descriptive statistics of the selected variables for different income groups of countries.

Table 1. *Descriptive statistics*

	RGDP	CONS	CF	GE	EX	IMP	FDI	INF	POP
Low Income Group									
Mean	2.13	77.11	22.83	14.31	20.59	35.14	4.73	8.64	2.87
Median	2.26	76.36	21.61	14.78	17.85	32.78	2.92	5.31	2.79
Max	28.68	133.11	60.17	27.25	51.01	113.66	46.28	100.61	5.61
Min	-22.31	38.88	1.10	3.59	0.61	0.59	-4.85	-9.56	1.43
Std. Dev.	4.69	11.90	10.02	5.18	11.40	16.63	7.32	12.38	0.60
Skewness	0.54	0.24	1.17	0.17	0.44	0.99	2.97	3.58	0.80
Kurtosis	12.34	5.93	5.28	2.81	2.42	5.42	13.02	22.09	4.46
J.-Bera	736.74	73.73	88.71	1.29	9.27	81.50	1131.08	3463.50	38.88
Pro.	0.00	0.00	0.00	0.53	0.01	0.00	0.00	0.00	0.00
Lower-middle Income Group									
Mean	3.20	64.99	26.09	12.16	27.56	30.73	1.85	9.29	1.43
Median	3.38	66.17	25.42	11.32	25.27	29.28	1.58	7.28	1.36
Max	12.65	88.12	45.10	20.77	60.30	56.22	9.35	38.88	2.77
Min	-14.76	40.72	13.40	0.95	9.22	10.67	-2.76	-0.74	-1.05
Std. Dev.	3.15	10.09	7.77	4.21	10.05	11.28	1.60	7.81	0.90
Skewness	-1.20	-0.34	0.30	0.14	0.79	0.48	1.78	1.28	-0.70
Kurtosis	9.18	2.61	1.99	2.61	3.31	2.37	8.73	4.43	3.42
J.-Bera	363.98	5.18	11.41	1.92	21.52	10.86	378.04	70.97	17.56
Pro.	0.000	0.08	0.00	0.38	0.00	0.00	0.00	0.00	0.00
Upper-middle Income Group									
Mean	2.90	57.86	23.62	15.23	34.28	31.27	2.60	8.63	1.03
Median	3.04	61.87	22.37	15.28	25.99	23.96	2.60	6.03	1.13
Max	13.64	70.53	46.66	20.79	119.81	100.60	7.03	52.98	2.33
Min	-11.86	34.33	10.85	9.52	10.19	10.27	0.06	-5.99	-0.46
Std. Dev.	3.85	9.36	7.29	2.68	24.63	20.31	1.26	9.49	0.55
Skewness	-0.39	-0.84	1.61	0.01	1.71	1.56	0.14	2.51	-0.65
Kurtosis	4.02	2.70	5.44	2.04	5.23	4.55	2.69	9.96	3.25
J.-Bera	13.82	24.12	136.38	7.69	138.23	101.13	1.47	612.64	14.45
Pro.	0.00	0.00	0.00	0.02	0.00	0.00	0.48	0.00	0.00

	RGDP	CONS	CF	GE	EX	IMP	FDI	INF	POP
High Income Group									
Mean	1.33	57.94	23.16	18.60	27.58	27.27	2.30	1.61	0.61
Median	1.47	56.86	22.60	19.03	27.90	28.44	1.83	1.68	0.61
Max	8.15	68.58	33.67	24.13	54.09	52.23	12.73	6.21	2.06
Min	-5.71	47.55	14.93	10.90	9.04	9.10	-3.61	-2.31	-1.85
Std. Dev.	2.00	4.91	4.26	2.67	10.20	8.31	2.16	1.46	0.56
Skewness	-0.63	0.60	0.58	-0.33	0.22	0.02	1.88	0.00	-0.15
Kurtosis	6.05	2.68	2.75	3.16	2.66	2.99	8.63	3.29	4.50
J.-Bera	91.06	12.92	11.55	3.82	2.62	0.01	381.55	0.69	19.54
Pro.	0.00	0.00	0.00	0.15	0.27	0.99	0.00	0.71	0.00

Source: Calculated by authors.

It can be observed from Table 1 that the lower-middle income group recorded the highest average per capita real GDP growth rate of around 3 per cent for the time period 2000-2019, followed by upper-middle income group. High income countries had the lowest average growth rate. Average private consumption expenditure was highest of 77 per cent of GDP for the low income group, while for upper-middle income and high income countries, this figure is around 58 per cent. Lower-middle income group had the highest average rate of capital formation, being 26 per cent of GDP, while for all other income groups, it was around 23 per cent of GDP. The highest average government expenditure was 18.5 per cent of GDP for the high income economies, while for the other income groups, it was in the range of around 12 to 15 per cent of GDP. Average exports as a per cent of GDP is highest for upper-middle income group, 34 per cent of GDP, while it is lowest for low income group, around 21 per cent of GDP. Low income group had the highest average share of imports in GDP, being 35 per cent, whereas high income economies had the least average share of imports in GDP (27 per cent). However, it can be noted that for all income groups, the share of exports and imports in GDP is 20 per cent or more. As far as share of FDI inflows in GDP is concerned, low income group recorded the highest figure of 4.7 per cent, followed by upper-middle income group. The average inflation rate in terms of GDP deflator was highest of 9 per cent for lower-middle income economies, while it was around 8.6 per cent for lower-middle and upper-middle income groups. High income countries recorded the lowest average inflation rate of 1.6 per cent. Low income group had the highest average population growth rate of 2.8 per cent, followed by lower-middle income group, while high income economies recorded the lowest rate of 0.6 per cent.

As far as trade openness is concerned (trade openness can be obtained from the above tables as the sum of shares of exports and imports), the average value is highest for the upper-middle income group (65.5 per cent), followed by the lower-middle income group (58.2 per cent). The ratio is almost same, for low income (55.7 per cent) and high income (54.8 per cent) groups.

It can be also seen that some countries in each of the four income groups recorded negative growth rate of real per capita GDP, inflation rate and population growth rate, and also had negative net FDI inflows. All variables are positively skewed in the case of low income group, while real per capita GDP growth rate is negatively skewed for all other three income groups. Population growth rate is also negatively skewed for all three income groups, while consumption share is negatively skewed in the case of lower-middle and

upper-middle income groups. As regards normality, not all variables are normally distributed in the four income groups. However, government expenditure as a percentage of GDP is normally distributed for all income groups.

3.4. Correlation analysis

To examine the degree of association between different variables, correlation coefficients are obtained for all income groups, as shown in Table 2.

Table 2. Correlation matrix

	RGDP	CONS	CF	GE	EX	IMP	FDI	INF	POP
Low Income Group									
RGDP	1.0000								
CONS	0.0518	1.0000							
CF	0.1286	-0.4150	1.0000						
GE	-0.1100	-0.2111	0.0792	1.0000					
EX	0.1699	-0.0931	0.2534	-0.3433	1.0000				
IMP	0.1810	0.3385	0.4897	-0.0390	0.6784	1.0000			
FDI	0.1836	0.1123	0.6826	0.0853	0.2175	0.6632	1.0000		
INF	-0.2031	-0.1097	0.0196	-0.0328	-0.2190	-0.2327	-0.0628	1.0000	
POP	0.0583	0.0060	0.0318	0.1084	-0.0833	0.0011	0.0380	-0.2303	1.0000
Lower-middle Income Group									
RGDP	1.0000								
CONS	-0.1935	1.0000							
CF	0.2612	-0.8091	1.0000						
GE	-0.1445	-0.0894	-0.0389	1.0000					
EX	0.0807	-0.1698	-0.1368	0.4679	1.0000				
IMP	0.0210	0.1241	-0.1515	0.6875	0.8186	1.0000			
FDI	0.2277	-0.0139	-0.0217	0.2856	0.3030	0.3624	1.0000		
INF	-0.0953	-0.2288	0.0166	-0.0590	0.1901	-0.0148	0.0203	1.0000	
POP	-0.1862	0.3506	-0.2202	-0.4917	-0.6438	-0.6073	-0.3066	-0.1737	1.0000
Upper-middle Income Group									
RGDP	1.0000								
CONS	-0.5117	1.0000							
CF	0.5698	-0.7323	1.0000						
GE	-0.1398	-0.0601	-0.1635	1.0000					
EX	0.1090	-0.4752	0.0893	-0.3844	1.0000				
IMP	0.0823	-0.3804	0.1069	-0.4312	0.9787	1.0000			
FDI	0.2230	-0.0939	0.1895	-0.1580	0.1091	0.1345	1.0000		
INF	-0.1293	0.2345	-0.2967	0.0344	-0.2627	-0.3185	-0.2633	1.0000	
POP	-0.2642	0.4156	-0.2313	-0.4190	0.1711	0.2658	-0.0022	-0.0489	1.0000
High Income Group									
RGDP	1.0000								
CONS	-0.1744	1.0000							
CF	0.3805	-0.5993	1.0000						
GE	-0.4178	-0.1610	-0.4762	1.0000					
EX	0.2068	-0.5769	0.0860	0.1113	1.0000				
IMP	0.2110	-0.4762	0.1100	0.1199	0.9666	1.0000			
FDI	0.1681	0.1495	-0.1207	0.0773	0.0576	0.1221	1.0000		
INF	0.1491	0.1305	0.1198	-0.2133	0.0686	0.1538	0.2747	1.0000	
POP	-0.0455	0.1061	0.2458	-0.0955	-0.1740	-0.0557	0.2773	0.4692	1.0000

Source: Calculated by authors.

It can be observed from Table 2 that for the low income countries except share of government expenditure and inflation rate, all other variables are positively correlated with per capita real GDP growth rate, though the values of these correlation coefficients are quite low. Share of investment is positively correlated with all variables except share of

private consumption. Inflation rate is negatively correlated with all variables except capital formation. Table 2 also shows that for the lower-middle income countries, the real per capita GDP growth rate is negatively correlated with shares of private and public consumption expenditures, as well as inflation rate and population growth rate. In fact, population growth rate is negatively correlated with all variables, except share of private consumption expenditure. It can be seen from Table 2 that as in the case of upper-middle income group, the real per capita GDP growth rate is negatively correlated with shares of private and public consumption expenditures, as well as inflation rate and population growth rate. Share of private consumption expenditure is negatively correlated with all variables except inflation rate and population growth rate. Table 2 also shows that in the case of high income group, the real per capita GDP growth rate is negatively correlated with shares of private and public consumption expenditures, and population growth rate.

3.5. Model estimation

The selected model has been estimated in this study by using panel data. Since panel data model combines the elements of both cross-section and time series, it enhances the quality and quantity of data, increases the precision of parameter estimates, leads to more information, more variability, lesser degree of collinearity among explanatory variables, more efficiency and more degrees of freedom and it can also control unobserved individual and/or time specific heterogeneity (Gujarati and Porter, 2021). In this paper three conventional methods of panel model fitting (POLS, FEM and REM) have been used. After estimating a model F test was used to choose between POLS and FEM models with the null hypothesis that POLS model is valid. To choose between POLS and REM Breusch-Pagan Lagrange Multiplier Test was used with the null hypothesis that there is no panel effect. Finally, to choose between FEM and REM, Hausman test was used with the null hypothesis that REM estimators are more consistent and efficient. Once a particular model is selected, the next step is to apply diagnostic tests, to check whether or not that model suffers from the problems of cross-section dependence, heteroscedasticity and autocorrelation. Cross-section dependence was checked by using Pesaran test and Breusch-Pagan LM test of independence, heteroskedasticity was checked with help of modified Wald test for Group Wise Heteroskedasticity and Wooldridge test was used to test autocorrelation. If that model suffers from all/any of these problems, PCSE model as suggested by Beck and Katz (1995) is used if the number of cross-sectional units (N) is greater than the number of time periods (T). This model takes into account the non-spherical errors, resulting from heteroscedasticity and contemporaneous correlation and thus provide better inference for the estimated models. On the other hand, if the number of cross-sectional units (N) is less than the number of time periods (T), then Feasible Generalised Least Squares (FGLS) model as suggested by Parks (1967) is used. This method results in efficient and consistent estimators since it allows for the problems of cross-sectional dependence, heteroscedasticity across panels and autocorrelation.

4. Empirical findings

In this section results based on the basic growth model and the extended growth model are presented.

4.1. Results for basic growth model

The basic growth model is estimated for all income groups as well as for all data as a whole. The estimation results are presented in the sections below.

4.1.1. Results of basic growth model based on all data

Before proceeding with the estimation of the basic growth model for the four income groups, the basic growth model estimation is done in respect of all 40 countries as a whole, i.e., for the complete data. The results obtained using POLS, FEM and REM are shown in Table 3.

Table 3. Results of basic model under different methods for all data

Dependent Variable: Real GDP Per Capita Growth				
	POLS	FEM	REM	PCSE
CONS	0.2698*** (0.0941)	0.1208 (0.1021)	0.1833* (0.0976)	0.2953** (0.1266)
CF	0.3988*** (0.0946)	0.3109*** (0.1037)	0.3240*** (0.0983)	0.4243*** (0.1275)
GE	0.1177 (0.0962)	-0.1839* (0.1111)	-0.0138 (0.1016)	0.1333 (0.1303)
EX	0.2947*** (0.0942)	0.2292** (0.1020)	0.2294*** (0.0978)	0.3324*** (0.1242)
IMP	-0.2714*** (0.0936)	-0.1693** (0.1027)	-0.2003** (0.0976)	-0.3063*** (0.1227)
C	-25.9940*** (9.4042)	-11.1147 (10.0581)	-17.0577* (9.7121)	-28.4531** (12.6502)
N	800	800	800	800
R-squared	0.1459	0.1283	0.1419	
F value	27.13	16.29		
Prob > F	0.0000	0.0000		
Wald chi2			91.58	82.41
Prob > chi2			0.0000	0.0000

Note: Standard errors in parentheses.

* Significant at 10 per cent level of significance.

** Significant at 5 per cent level of significance.

*** Significant at 1 per cent level of significance.

Source: Calculated by authors.

To see which out of three models has to be selected for further analysis, the model selection tests are conducted, results of which are presented in Table 4. Similarly, this table contains results of model diagnostic tests.

Table 4. Selection of appropriate model and model diagnostic tests for all data

Test	Test statistic	p value	Selected Model/Conclusion
Model Selection Tests			
F test	F = 3.65	0.0000	FEM
Hausman Test	$\chi^2 = 21.99$	0.0005	FEM
Breusch-Pagan LM test	$\chi^2 = 60.55$	0.0000	REM
Model Diagnostic Tests			
Pesaran CSD Test	23.123	0.0000	Presence of Contemporaneous Correlation
Modified Wald Test	$\chi^2 = 4268.32$	0.0000	Presence of Heteroscedasticity
Woolridge test	F = 34.617	0.0000	Presence of Autocorrelation

Source: Calculated by authors.

It is clear from Table 4 that FEM is the appropriate model, and hence the diagnostic tests are conducted on it. The results of the diagnostic tests are also shown in Table 4. From the results of diagnostic tests, it is clear that the selected FEM suffers from the problems of cross-section dependence, heteroscedasticity and autocorrelation. Hence, it cannot be considered as the final model. Since in this case, the number of cross-section units (40 countries) is greater than the number of time periods (20 years), the PCSE model is used for final estimation, results for which are also presented in Table 3. From Table 3, it can be concluded on the basis of the PCSE model that, based on all data, all independent variables have a positive impact on the real per capita GDP growth, except for imports. In terms of statistical significance, all coefficients are significant at 1 per cent or 5 per cent levels of significance except the coefficient of general government expenditure.

The results of basic growth model estimated for different income group countries are given in Appendix in Tables A.1-A.8.

4.1.2. Results of basic growth model for low income group

The results of basic growth model estimated for the low income group, using the POLS, FEM and REM methods are shown in Table A.1. The results of model selection tests (Table A.2) suggest that REM is the appropriate model. From diagnostic tests conducted on REM it is clear that the selected REM suffers from cross-section dependence and autocorrelation (Table A.2). Thus, FGLS model is used for the final estimation. FGLS, results for which are also presented in Table A.3. Results show that, in the case of low income group, except for imports, all regressors have a positive impact on the real per capita GDP growth. Moreover, all coefficients are significant at 1 per cent or 5 per cent levels of significance. Private consumption, capital formation and exports have a positive and highly significant impact on economic growth in the low income countries.

4.1.3. Results of basic growth model for lower-middle income group

The results of basic growth model estimated using the POLS, FEM and REM methods for the lower-middle income group are presented in Table A.3. The results of model selection tests (Table A.4) suggests that FEM is the appropriate model. From diagnostic tests conducted on FEM it is clear that the selected FEM suffers from the problems of cross-section dependence, heteroscedasticity and autocorrelation (Table A.4). So the FGLS model is used for estimating the final model, results for which are also presented in Table A.3. From the results of FGLS method, it can be concluded that, all independent variables have a positive impact on the per capita real GDP growth, except for government expenditure, in the case of lower-middle income countries. But only the effects of capital formation and government spending are statistically significant at 5 per cent level of significance. Capital formation has a positive significant effect on economic growth for the lower-middle income countries, while government spending has a negative effect.

4.1.4. Results of basic growth model for upper-middle income group

The results of basic growth model estimated for the upper-middle income group, using the POLS, FEM and REM methods are presented in Table A.5. The results of model selection tests (Table A.6) suggests that FEM is the appropriate model. From diagnostic tests

conducted on FEM it is clear that in the selected FEM, there is no autocorrelation, but there is presence of cross-sectional dependence and heteroscedasticity (Table A.6). So the FGLS model is used for estimating the final model, results for which are also presented in Table A.5. The results of FGLS method suggests that, in the case of upper-middle income group, there are quite contrary results. All variables, except imports, have a negative impact on the per capita GDP growth. Moreover, only the coefficients of consumption expenditure and government expenditure are statistically significant.

4.1.5. Results of basic growth model for high income group

The results of basic growth model estimated for the high income group, using the POLS, FEM and REM methods are presented in Table A.7. The results of model selection tests (Table A.8) suggests that FEM is the appropriate model. From diagnostic tests conducted on FEM it is clear that the selected FEM suffers from the problems of cross-section dependence, heteroscedasticity and autocorrelation (Table A.8). So, the final model has to be estimated using the FGLS model, results for which are also presented in Table A.7. From the results of FGLS method it is evident that on applying the FGLS method, none of the coefficients turn out to be statistically significant. Hence, the basic model does not give satisfactory results in the case of high income group.

4.2. Results for extended growth model

To take into account other macroeconomic determinants affecting the economic growth in respect of the four income groups, the extended growth model is estimated for all groups as well as the whole data, results of which are presented in the sections below.

4.2.1. Results for extended growth model based on all data

Before analyzing the various determinants of economic growth in respect of different income groups, the extended growth model is estimated taking the complete data into account. The estimation results from POLS, FEM and REM are presented in Table 5.

Table 5. Results of extended model under different methods for all data

Dependent Variable: Real GDP per capita Growth				
	POLS Model	FEM	REM	PCSE
CONS	-0.0105 (0.0169)	-0.1151*** (0.0279)	-0.0537*** (0.0217)	-0.0254 (0.0272)
CF	0.0993*** (0.0233)	0.0548* (0.0334)	0.0667*** (0.0284)	0.0850*** (0.0332)
GE	-0.2084*** (0.0312)	-0.4042*** (0.0598)	-0.2802*** (0.0426)	-0.2386*** (0.0495)
TR	0.0055 (0.0043)	0.0230** (0.0106)	0.0080 (0.0066)	0.0056 (0.0046)
POP	-0.3172** (0.1459)	-0.1840 (0.3697)	-0.1766 (0.2101)	-0.2952 (0.2515)
INF	-0.0398*** (0.0131)	-0.0556*** (0.1564)	-0.0479*** (0.0145)	-0.0599*** (0.0222)
FDI	0.0805** (0.0389)	0.1323*** (0.0468)	0.1172*** (0.0432)	0.0820* (0.0609)
C	4.020** (1.7240)	13.5214*** (2.6195)	8.2695*** (2.1305)	5.8721** (2.845)
Number of obs.	800	800	800	800
R-squared	0.1555	0.1317	0.1419	
F value	20.83	14.34		

Dependent Variable: Real GDP per capita Growth				
	POLS Model	FEM	REM	PCSE
Prob > F	0.0000	0.0000		
Wald chi2			105.18	90.40
Prob > chi2			0.0000	0.0000

Note: Standard errors in parentheses.

* Significant at 10 per cent level of significance.

** Significant at 5 per cent level of significance.

*** Significant at 1 per cent level of significance.

Source: Calculated by authors.

To determine which of the three models has to be selected for further analysis, the model selection tests are conducted, results of which are shown in Table 6.

Table 6. Model selection & model diagnostic tests for all data

Test	Test statistic	p value	Selected Model/Conclusion
Model Selection Tests			
F test	F = 3.91	0.0000	FEM
Hausman Test	$\chi^2 = 20.86$	0.0040	FEM
Breusch-Pagan LM test	$\chi^2 = 70.87$	0.0000	REM
Model Diagnostic Tests			
Pesaran CSD Test	25.279	0.0000	Presence of Contemporaneous Correlation
Modified Wald Test	$\chi^2 = 7450.34$	0.0000	Presence of Heteroscedasticity
Woolridge test	F = 46.408	0.0022	Presence of Autocorrelation

Source: Calculated by authors.

It is evident from Table 6 that FEM is the appropriate one, so the diagnostic tests are carried out on it, results of which are also shown in Table 6. The results suggest that the selected FEM suffers from the problems of cross-section dependence, heteroscedasticity and autocorrelation. Hence, it cannot be considered as the final model. Since, in the present case the number of cross-sectional units is greater than the number of time periods, the PCSE model is used for estimation of final model, results for which are also presented in Table 5. From the results of PCSE model estimation, it can be concluded that private consumption, government expenditure, inflation rate and population growth have a negative effect on the real per capita GDP growth, and investment, trade openness and FDI are having a positive impact. However, in terms of significance, the coefficients for capital formation, government spending and inflation rate are highly significant, and the coefficient for FDI is significant at 10 per cent level of significance. Thus, in respect of all data, capital formation has a positive and highly significant impact on the per capita real GDP growth rate. But government spending and inflation negatively and significantly affect economic growth.

The results of extended growth model estimated for different income group countries are given in Appendix in Tables A.9-A.16.

4.2.2. Results of extended growth model for low income group

The extended growth model is estimated for the low income group, using all three techniques, results of which are presented in Table A.9. The results of model selection tests (Table A.10) suggest that FEM is the appropriate model. From diagnostic tests conducted on FEM it is clear that FEM is suffering from the problems of contemporaneous correlation, heteroscedasticity and autocorrelation (Table 10). Thus, FGLS model is used for the final

estimation, results for which are also presented in Table A.9. The results of FGLS reveals that government expenditure and inflation rate have a highly significant negative impact on the growth rate of real per capita GDP, whereas none of the other variables has significant impact on economic growth in the case of low income group.

4.2.3. Results of extended growth model for lower-middle income group

The results for the extended growth model in the case of lower-middle income group, based on POLS, FEM and REM methods are shown in Table A.11. The model selection tests (Table A.12) suggests that FEM is appropriate model. From diagnostic tests conducted on FEM it is clear that there are problems of cross-section dependence and autocorrelation in FEM (Table A.12). Hence the FGLS method is used for estimating the final model, results for which are also presented in Table A.11. The results of FGLS reveals that except domestic consumption and inflation rate, all variables have a significant impact on the growth rate of real per capita GDP. However, in terms of direction of the impact, investment, trade openness and FDI inflows have a positive effect on economic growth, whereas government spending and population growth negatively impact GDP growth.

4.2.4. Results of extended growth model for upper-middle income group

For the extended growth model in the case of upper-middle income group, the estimation results of POLS, FEM and REM methods are shown in Table A.13. The model selection tests (A.14) indicates that FEM is the appropriate one. The diagnostic tests conducted on FEM suggest that FEM is suffering from the problems of cross-section dependence, heteroscedasticity and autocorrelation (Table A.14). Hence FGLS was used, results for which are also presented in Table A.13. The results of FGLS reveals that all coefficients being statistically significant. However, except in cases of capital formation, inflation rate and FDI inflows, all variables are having a negative impact on the growth rate of real per capita GDP in the case of upper-middle income group.

4.2.5. Results of extended growth model for high income group

The results for the extended growth model in the case of high income group, based on POLS, FEM and REM methods are shown in Table A.15. The model selection tests (Table A.16) indicates that FEM is the appropriate one. The diagnostic tests conducted on FEM suggest that FEM is suffering from the problems of cross-section dependence, heteroscedasticity and autocorrelation (Table A.16). Hence FGLS was used, results for which are also presented in Table A.15. From the results of the final estimated model using FGLS, it can be concluded that all coefficients, except for inflation rate, are statistically significant at 1 per cent, 5 per cent or 10 per cent level of significance. Moreover, all regressors have a positive impact on the per capita real GDP growth rate, except for government spending and population growth.

5. Summary and policy implications

The objective of this study is to analyse the effect of selected macroeconomic determinants on economic growth of 40 countries taken 10 countries each from four income groups of countries as classified by World Bank – low income, lower-middle income, upper-middle

income and high income group for the time period 2000-2019 by estimating two panel growth models – the basic growth model and the extended growth model.

In basic growth model main determinants of economic growth included were: household final consumption expenditure, gross capital formation, government expenditure, exports and imports. In extended growth model the determinants of economic growth included were: household final consumption expenditure, gross capital formation, government expenditure, trade openness, net FDI inflows, inflation rate and population growth rate. In both the models, the dependent variable was real per capita GDP growth rate, and all the independent variables, except inflation rate and population growth rate, were taken in form of percentage of GDP. These two models have been estimated by POLS, FEM and REM to obtain a detailed analysis of the major macroeconomic factors affecting the growth process for four income groups of countries. The final models were estimated using the FGLS and PCSE depending upon number of cross-sectional units and number of time periods, since the preliminary models suffered from all/any of the problems of cross-section dependence, heteroscedasticity and autocorrelation.

The following results emerge from the basic growth model:

- Based on the results for all data, household consumption, capital formation and exports are the significant factors which positively affect the economic growth, whereas, imports have a negative and significant impact on economic growth.
- All the estimated coefficients are significant in the case of low income group, whereas none of them is significant in the case of high income group.
- In the case of low income group, household consumption, capital formation, government spending and exports have significant positive impact on the growth rate of real per capita GDP, but imports negatively impact the growth rate.
- Capital formation is having a positive and significant impact on economic growth for the lower-middle income group.
- Government expenditure significantly and negatively impacts the growth rate for both lower-middle and upper-middle income groups.

The following results emerge from the extended growth model:

- In respect of results obtained on the basis of all data, gross capital formation has a highly significant positive impact on the growth rate of real per capita GDP and inflation rate is having a highly significant and negative impact on the growth rate.
- For the low income group, both government spending and inflation rate are negatively and significantly affecting the growth rate. However, the result for government expenditure is contradictory to the result obtained from the basic growth model, where it was positively affecting the growth rate.
- Capital formation and FDI inflows have a positive and highly significant impact on the growth rate for the lower-middle income group, whereas government spending and population growth have a highly significant negative impact.
- In the case of upper-middle income group, all the estimated coefficients are significant. Gross capital formation, inflation rate, FDI inflows have a positive significant effect on the per capita real GDP growth rate, but household and government spending, trade openness and population growth are having a negative impact.

- For the high income group, household consumption, capital formation, trade openness, and FDI inflows have a positive and significant effect on economic growth, but government spending and population growth have a negative effect.
- Government spending is having negative impact on the growth rate of real per capita GDP in all cases. In quantitative terms, the most negative impact is in the case of upper-middle income group, and the least for the low income group.
- Inflation rate does not have any significant impact on the growth rate in the cases of lower-middle and high income groups.
- Except in the case of low income group, gross capital formation and FDI inflows have a positive and significant impact on the economic growth. Capital formation has highest positive impact for the high income group, whereas FDI inflows have the most positive impact in the case of upper-middle income group.

The main conclusions that can be made from the study are

- Gross capital formation is a significant factor, which positively affects the growth rate for all income groups.
- Government spending is having a significant negative effect on economic growth for all income groups.
- Except the low income group, population growth has a significant negative impact on growth rate of real per capita GDP.
- FDI inflows also significantly positively contribute to economic growth in all income groups, except the low income countries.

Thus, countries should focus on capital formation and developing a more conducive environment for promotion of domestic as well as foreign investment. Government expenditure should be on more productive uses, focusing on capital formation, development of infrastructural facilities, ease of doing business, otherwise it will continue to have negative impact on the growth process. Similarly, countries should focus on increasing the FDI inflows, since they have a very favourable impact on the economic growth. Low income and middle income countries need to focus on increasing the labour productivity, so that economic growth can be augmented.

References

- Barro, R.J., 1996. Determinants of economic growth: A Cross-country empirical study. *NBER Working Paper 5698*.
- Barro, R.J., 2003. Determinants of economic growth in a panel of countries. *Annals of Economics and Finance*, 4, 231-274.
- Bătrancea, L., Rathnaswamy, M.M., and Bătrancea, I., 2021. A panel data analysis of economic growth determinants in 34 African countries. *Journal of Risk and Financial Management*, 14(6), 1-15.
- Beck, N., and Katz, J.N., 1995. What to do (and not to do) with time-series cross-section data. *The American Political Science Review*, 89(3), 634-647.
- Cancado, L.P., 2005. *Economic Growth: Panel Data Evidence from Latin America*, Ohio University.

- Crepin, N., 2016. The determinants of economic growth in CEMAC through a panel data approach. *IRA-International Journal of Management & Social Sciences*, 4(2), 483-493.
- Dewan, E., and Hussein, S., 2001. *Determinants of Economic Growth (Panel Data Approach)*. Reserve Bank of Fiji, Working Paper.
- Fetai, B.T., Mustafi, B.F., and Fetai, A.B., 2017. An empirical analysis of the determinants of economic growth in the Western Balkans. *Scientific annals of economics and business*, 64(2), 245-254.
- Goel, R.K., and Korhonen, I., 2011. *Determinants of Economic Growth in BRIC countries*. Development Research Working Paper Series, No.05/2011, Institute for Advanced Development Studies, La Paz.
- Gujarati, D.N., Porter, D.C., 2021. *Basic Econometrics*. McGraw Hill, New York.
- Lenka, S.K., and Sharma, P., 2014. FDI as a main determinant of economic growth: a panel data analysis. *Annual Research Journal of Symbiosis Centre for Management Studies, Pune*, 1, 84-97.
- Nasir, M.S., Wibowo, A.R., and Yansyah, D., 2021. The determinants of economic growth: Empirical study of 10 Asia-Pacific countries. *Signifikan: Jurnal Ilmu Ekonomi*, 10(1), 149-160.
- Ndambiri, H.K., Ritho C., Ng'ang'a S.I., Kubowon, P.C., Mairura F.C., Nyangweso P.M., Muiruri E.M., and Cherotwo, F.H., 2012. Determinants of economic growth in Sub-Saharan Africa: A panel data approach. *International Journal of Economics and Management Sciences*, 2(2), 18-24.
- Omosanya, O., and Lawal, A.A., 2020. Determinants of economic growth in Sub-Saharan African countries: Panel data approach. *Royal Statistical Society Nigeria Local Group Annual Conference Proceedings*.
- Onyango, R.A., and Were, M., 2015. Determinants of economic growth in the East African Community. *International Journal of Economics, Commerce and Management*, 3(11), 1183-1196.
- Parks, R.W., 1967. Efficient estimation of a system of regression equations when disturbances are both serially and contemporaneously correlated. *Journal of the American Statistical Association*, 62(318), 500-509.
- Ristanovic, V., Tasic, N., and Nikolic, I., 2018. Determinants of economic growth in the pre-crisis period. *Industrija*, 46(3), 133-143.
- Samsuddin, M.A., and Amar, S., 2020. Determinants of economic growth in developing countries of G20 members. *Advances in Economics, Business and Management Research*. 152, 177-183.
- Trpkova, M., and Tashev, B., 2011. Determinants of economic growth in South-East Europe: A panel data approach. *Perspectives of Innovations, Economics & Business*, 7(1), 12-15.
- Upreti, P., 2015. Factors affecting economic growth in developing countries. *Major Themes in Economics*, 17(1), 37-54.
- Wahyudi, S.T., and Jantan, M.D., 2012. The determinants of economic growth in ASEAN-4 countries: An application of Solow-Swan and Mankiew-Romer-Weil models. *China-USA Business Review*, (11)4, 462-473.

Appendix

Table A.1. Results of basic model under different methods for low income group countries

Dependent Variable: Real GDP per capita Growth				
Independent Variables	POLS	FEM	REM	FGLS
CONS	0.4880*** (0.1928)	0.3350* (0.2046)	0.4051** (0.1963)	0.4556*** (0.1532)
CF	0.5015*** (0.1891)	0.3894* (0.2057)	0.4334** (0.1949)	0.4871*** (0.1491)
GE	0.3885** (0.2007)	0.1847 (0.2262)	0.2971* (0.2082)	0.3520** (0.1572)
EX	0.5083*** (0.1990)	0.4327** (0.2028)	0.4615** (0.1982)	0.4995*** (0.1575)
IMP	-0.4469** (0.1919)	-0.3172* (0.2063)	-0.3770** (0.1961)	-0.4364*** (0.1506)
C	-47.2856*** (19.1956)	-33.0117* (20.1327)	-39.5232** (19.4208)	-44.1967** (15.2182)
N	200	200	200	200
R-squared	0.0779	0.0621	0.0728	
F value	3.28	2.67		
Prob > F	0.0073	0.0236		
Wald chi2			13.56	23.34
Prob > chi2			0.0187	0.0003

Note: Standard errors in parentheses.

* Significant at 10 per cent level of significance.

** Significant at 5 per cent level of significance.

*** Significant at 1 per cent level of significance.

Source: Prepared by authors.

Table A.2. Model selection & model diagnostic tests for low income group countries

Test	Test statistic	p value	Selected Model/Conclusion
Model Selection Tests			
F test	F = 2.25	0.0206	FEM
Hausman Test	$\chi^2 = 2.25$	0.8143	REM
Breusch-Pagan LM test	$\chi^2 = 2.82$	0.0464	REM
Model Diagnostic Tests			
Pesaran CSD Test	2.588	0.0096	Presence of Contemporaneous Correlation
Woolridge test	F = 11.620	0.0078	Presence of Autocorrelation

Source: Prepared by authors.

Table A.3. Results of basic model under different methods for lower-middle income group

Dependent Variable: Real GDP per capita Growth				
Independent Variables	POLS	FEM	REM	FGLS
CONS	0.2021* (0.1126)	-0.7500 (0.1290)	0.1851* (0.1143)	0.0244 (0.0729)
CF	0.3280*** (0.1190)	0.2291* (0.1326)	0.3151*** (0.1209)	0.1507** (0.0766)
GE	0.0433 (0.1341)	-0.0573 (0.1653)	-0.0507 (0.1360)	-0.2079** (0.0910)
EX	0.2326*** (0.1158)	0.0952 (0.1258)	0.2219** (0.1172)	0.0118 (0.0701)
IMP	-0.1407 (0.1171)	-0.0823 (0.1255)	-0.1329 (0.1183)	0.0386 (0.0688)
C	-20.0694* (11.4146)	2.7365 (12.8041)	-18.4807* (11.5858)	-1.3310 (7.3994)
N	200	200	200	200
R-squared	0.1539	0.0695	0.1535	

Dependent Variable: Real GDP per capita Growth				
Independent Variables	POLS	FEM	REM	FGLS
F value	7.06	7.92		
Prob > F	0.0000	0.0000		
Wald chi2			33.20	43.48
Prob > chi2			0.0000	0.0000

Note: Standard errors in parentheses.

* Significant at 10 per cent level of significance.

** Significant at 5 per cent level of significance.

*** Significant at 1 per cent level of significance.

Source: Calculated by authors.

Table A.4. Model selection & model diagnostic tests for lower-middle income group countries

Test	Test statistic	p value	Selected Model/Conclusion
Model Selection Tests			
F test	F = 3.06	0.0020	FEM
Hausman Test	$\chi^2 = 23.29$	0.0003	FEM
Breusch-Pagan LM test	$\chi^2 = 0.01$	0.4524	POLS
Model Diagnostic Tests			
Pesaran CSD Test	23.123	0.0000	Presence of Contemporaneous Correlation
Modified Wald Test	$\chi^2 = 980.94$	0.0000	Presence of Heteroscedasticity
Woolridge test	F = 50.909	0.0001	Presence of Autocorrelation

Source: Calculated by authors.

Table A.5. Results of basic model under different methods for upper-middle income group

Dependent Variable: Real GDP per capita Growth				
Independent Variables	POLS	FEM	REM	FGLS
CONS	-0.3908 (0.2951)	-0.1879 (0.3454)	-0.3908 (0.2951)	-0.3562* (0.2223)
CF	-0.0850 (0.2934)	0.2143 (0.3394)	-0.0850 (0.2934)	-0.0792 (0.2211)
GE	-0.5010* (0.2955)	-1.1538*** (0.3221)	-0.5010* (0.2955)	-0.5474*** (0.2336)
EX	-0.2178 (0.2816)	-0.0917 (0.1020)	-0.2178 (0.2816)	-0.2052 (0.2164)
IMP	0.1804 (0.2790)	0.0858 (0.3237)	0.1804 (0.2790)	0.1635 (0.2170)
C	36.9876 (29.2821)	26.7540 (33.0940)	36.9876* (29.2821)	35.8913* (22.0799)
N	200	200	200	200
R-squared	0.3700	0.2462	0.3700	
F value	22.79	12.50		
Prob > F	0.0000	0.0000		
Wald chi2			113.94	129.90
Prob > chi2			0.0000	0.0000

Note: Standard errors in parentheses.

* Significant at 10 per cent level of significance.

** Significant at 5 per cent level of significance.

*** Significant at 1 per cent level of significance.

Source: Calculated prepared by authors.

Table A.6. Model selection & model diagnostic tests for upper-middle income group

Test	Test statistic	p value	Selected Model/Conclusion
Model Selection Tests			
F test	F = 4.50	0.0000	FEM
Hausman Test	$\chi^2 = 51.05$	0.0000	FEM

Test	Test statistic	p value	Selected Model/Conclusion
Model Selection Tests			
Breusch-Pagan LM test	$\chi^2 = 0.00$	1.0000	POLS
Model Diagnostic Tests			
Pesaran CSD Test	9.491	0.0000	Presence of Contemporaneous Correlation
Breusch-Pagan LM test	$\chi^2 = 170.916$	0.0000	Presence of Contemporaneous Correlation
Modified Wald Test	$\chi^2 = 82.68$	0.0000	Presence of Heteroscedasticity
Woolridge test	F = 4.435	0.0645	No Autocorrelation

Source: Calculated by authors.

Table A.7. Results of basic model under different methods for high income group

Dependent Variable: Real GDP per capita Growth				
Independent Variables	POLS	FEM	REM	FGLS
CONS	1.0738 (4.4046)	1.6852 (4.1403)	1.0466 (4.3558)	0.1416 (4.8845)
CF	1.1608 (0.0946)	1.7766 (4.1464)	1.1296 (4.3527)	0.2435 (4.8818)
GE	0.8079 (4.4120)	0.7350 (4.1517)	0.7165 (4.3604)	-0.1157 (4.8880)
EX	1.0891 (4.4085)	1.7863 (4.1518)	1.0801 (4.3571)	0.1171 (4.8861)
IMP	-1.0356 (4.4082)	-1.6768 (4.1440)	-1.0270 (4.3560)	-0.0485 (4.8863)
C	-104.5867 (440.7858)	-154.6568 (414.5642)	-100.5784 (435.6259)	-12.1932 (488.4475)
N	200	200	200	200
R-squared	0.2696	0.2521	0.2676	
F value	14.32	16.91		
Prob > F	0.0000	0.0000		
Wald chi2			60.43	54.64
Prob > chi2			0.0000	0.0000

Note: Standard errors in parentheses.

Source: Calculated by authors.

Table A.8. Model selection & model diagnostic tests for high income group

Test	Test statistic	p value	Selected Model/Conclusion
Model Selection Tests			
F test	F = 6.00	0.0000	FEM
Hausman Test	$\chi^2 = 48.22$	0.0000	FEM
Breusch-Pagan LM test	$\chi^2 = 0.39$	0.2670	POLS
Model Diagnostic Tests			
Pesaran CSD Test	15.546	0.0000	Presence of Contemporaneous Correlation
Breusch-Pagan LM test	$\chi^2 = 274.563$	0.0000	Presence of Contemporaneous Correlation
Modified Wald Test	$\chi^2 = 40.43$	0.0000	Presence of Heteroscedasticity
Woolridge test	F = 17.909	0.0022	Presence of Autocorrelation

Source: Calculated by authors.

Table A.9. Results of extended model under different methods for low income group

Dependent Variable: Real GDP per capita Growth				
Independent Variables	POLS	FEM	REM	FGLS
CONS	-0.0057 (0.0398)	-0.0787* (0.0510)	-0.0057 (0.0398)	-0.0055 (0.0319)
CF	0.0063 (0.0633)	-0.0238 (0.0660)	0.0063 (0.0633)	0.0366 (0.0470)
GE	-0.1165* (0.0671)	-0.2560** (0.1161)	-0.1165* (0.0671)	-0.1446*** (0.0607)

Dependent Variable: Real GDP per capita Growth				
Independent Variables	POLS	FEM	REM	FGLS
TR	0.0075 (0.0165)	0.0491* (0.0264)	0.0075 (0.0165)	0.0148 (0.0139)
POP	0.1978 (0.5590)	1.7603** (0.7637)	0.1978 (0.5590)	0.0100 (0.5577)
INF	-0.0695*** (0.0282)	-0.0610** (0.0296)	-0.0695*** (0.0282)	-0.0606*** (0.0196)
FDI	0.0979 (0.0779)	0.1068* (0.0811)	0.0979 (0.0779)	0.0360 (0.0610)
C	3.23957 (4.4306)	4.6275 (5.3094)	3.23957 (4.4306)	3.3003 (3.4040)
Number of obs	20	200	200	200
R-squared	0.0899	0.0674	0.0899	
F value	2.71	3.08		
Prob > F	0.0106	0.0043		
Wald chi2			18.97	26.44
Prob > chi2			0.0083	0.0004

Note: Standard errors in parentheses.

* Significant at 10 per cent level of significance.

** Significant at 5 per cent level of significance.

*** Significant at 1 per cent level of significance.

Source: Calculated by authors.

Table A.10. Model selection & model diagnostic tests for low income group models

Test	Test statistic	p value	Selected Model/Conclusion
Model Selection Tests			
F test	F = 2.88	0.0033	FEM
Hausman Test	$\chi^2 = 25.69$	0.0006	FEM
Breusch-Pagan LM test	$\chi^2 = 0.00$	1.0000	POLS
Model Diagnostic Tests			
Pesaran CSD Test	2.041	0.0413	Presence of Contemporaneous Correlation
Breusch-Pagan LM test	$\chi^2 = 68.212$	0.0143	Presence of Contemporaneous Correlation
Modified Wald Test	$\chi^2 = 471.31$	0.0000	Presence of Heteroscedasticity
Woolridge test	F = 19.788	0.0016	Presence of Autocorrelation

Source: Calculated by authors.

Table A.11. Results of extended model under different methods for lower-middle income group

Dependent Variable: Real GDP per capita Growth				
Independent Variables	POLS	FEM	REM	FGLS
CONS	-0.0028 (0.0375)	-0.1159** (0.0568)	-0.0028 (0.0375)	0.0152 (0.0305)
CF	0.0901* (0.0478)	0.0766 (0.0668)	0.0901* (0.0478)	0.0993*** (0.0392)
GE	-0.2994*** (0.0260)	-0.1790* (0.1262)	-0.2994*** (0.0620)	-0.2568*** (0.0473)
TR	0.0197 (0.0942)	0.0196 (0.0211)	0.0197 (0.0156)	0.0159* (0.0102)
POP	-0.7127** (0.3383)	-3.9354*** (1.2085)	-0.7127** (0.3383)	-0.7357** (0.3812)
INF	-0.0753*** (0.0279)	-0.0505* (0.0346)	-0.0753*** (0.0976)	-0.0198 (0.0209)
FDI	0.4848*** (0.1344)	0.3749*** (0.1550)	0.4848*** (0.1344)	0.3682*** (0.0661)
C	4.3281 (3.9873)	15.1522 (5.6591)	4.3281 (3.9873)	2.3290 (3.0927)

Dependent Variable: Real GDP per capita Growth				
Independent Variables	POLS	FEM	REM	FGLS
Number of obs.	200	200	200	200
R-squared	0.2414	0.0910	0.2414	
F value	8.73	9.26		
Prob > F	0.0000	0.0000		
Wald chi2			61.10	101.38
Prob > chi2			0.0000	0.0000

Note: Standard errors in parentheses.

* Significant at 10 per cent level of significance.

** Significant at 5 per cent level of significance.

*** Significant at 1 per cent level of significance.

Source: Calculated by authors.

Table 12. Model selection & model diagnostic tests for lower-middle income group

Test	Test statistic	p value	Selected Model/Conclusion
Model Selection Tests			
F test	F = 3.03	0.0021	FEM
Hausman Test	$\chi^2 = 24.32$	0.0010	FEM
Breusch-Pagan LM test	$\chi^2 = 0.00$	1.0000	POLS
Model Diagnostic Tests			
Pesaran CSD Test	2.853	0.0043	Contemporaneous Correlation
Woolridge test	F = 53.374	0.0000	Presence of Autocorrelation

Source: Calculated by authors.

Table A.13. Results of extended model under different methods for upper-middle income group

Dependent Variable: Real GDP per capita Growth				
Independent Variables	POLS	FEM	REM	FGLS
CONS	-0.1498*** (0.0615)	-0.0642 (0.1136)	-0.15259** (0.06914)	-0.1442*** (0.0570)
CF	0.1249** (0.0653)	0.2800*** (0.0955)	0.1208* (0.0720)	0.1130* (0.0659)
GE	-0.3075*** (0.1200)	-1.0012*** (0.1746)	-0.4604*** (0.1330)	-0.2839** (0.1288)
TR	-0.0136* (0.0092)	0.0153 (0.0251)	-0.0153* (0.0108)	-0.0125* (0.0087)
POP	-0.7836* (0.5314)	-2.7025*** (1.1434)	-1.1776* (0.6523)	-0.7500* (0.5142)
INF	0.0072 (0.0267)	0.0065 (0.0292)	0.0047 (0.0277)	0.0656** (0.0306)
FDI	0.4091** (0.1823)	0.2532 (0.2135)	0.4315** (0.1935)	0.5502*** (0.1351)
C	13.8784** (6.5989)	16.3085* (9.1119)	16.9672*** (7.0807)	12.7448** (6.6481)
Number of obs.	200	200	200	200
R-squared	0.3934	0.2971	0.3880	
F value	17.79	10.28		
Prob > F	0.0000	0.0000		
Wald chi2			89.88	179.31
Prob > chi2			0.0000	0.0000

Note: Standard errors in parentheses.

* Significant at 10 per cent level of significance.

** Significant at 5 per cent level of significance.

*** Significant at 1 per cent level of significance.

Source: Calculated by authors.

Table A.14. Model selection & model diagnostic tests upper-middle income group

Test	Test statistic	p value	Selected Model/Conclusion
Model Selection Tests			
F test	F = 4.52	0.0000	FEM
Hausman Test	$\chi^2 = 32.37$	0.0000	FEM
Breusch-Pagan LM test	$\chi^2 = 1.03$	0.1552	POLS
Model Diagnostic Tests			
Pesaran CSD Test	10.237	0.0000	Presence of Contemporaneous Correlation
Breusch-Pagan LM test	$\chi^2 = 180.655$	0.0000	Presence of Contemporaneous Correlation
Modified Wald Test	$\chi^2 = 80.23$	0.0000	Presence of Heteroscedasticity
Woolridge test	F = 13.783	0.0048	Presence of Autocorrelation

Source: Calculated by authors.

Table A.15. Results of extended model under different methods for high income group

Dependent Variable: Real GDP per capita Growth				
Independent Variables	POLS	FEM	REM	FGLS
CONS	0.0243 (0.0568)	-0.0810 (0.0925)	0.0052 (0.0650)	0.0793* (0.0563)
CF	0.1593*** (0.0643)	0.1871*** (0.0710)	0.1357** (0.0683)	0.2404*** (0.0671)
GE	-0.2235*** (0.0729)	-0.9112*** (0.1235)	-0.3724*** (0.0888)	-0.1532** (0.0764)
TR	0.0202** (0.0090)	0.0471*** (0.0175)	0.0228** (0.0120)	0.0249*** (0.0097)
POP	-0.8588*** (0.2727)	-1.6040*** (0.3386)	-1.1173*** (0.3059)	-0.9738*** (0.2445)
INF	0.0805 (0.0976)	-0.0473 (0.0965)	0.0811 (0.0986)	0.0453 (0.0725)
FDI	0.2387*** (0.0594)	0.0999* (0.0600)	0.2110* (0.0599)	0.1911*** (0.0486)
C	-0.8725 (5.9265)	16.8792** (10.0581)	3.6287 (6.4409)	-7.1385 (6.0667)
Number of obs	200	200	200	200
R-squared	0.3454	0.2830	0.3317	
F value	14.47	17.78		
Prob > F	0.0000	0.0000		
Wald chi2			87.51	88.86
Prob > chi2			0.0000	0.0000

Note: Standard errors in parentheses.

* Significant at 10 per cent level of significance.

** Significant at 5 per cent level of significance.

*** Significant at 1 per cent level of significance.

Source: Calculated by authors.

Table A.16. Model selection & model diagnostic tests for high income group

Test	Test statistic	p value	Selected Model/Conclusion
Model Selection Tests			
F test	F = 6.81	0.0000	FEM
Hausman Test	$\chi^2 = 42.08$	0.0000	FEM
Breusch-Pagan LM test	$\chi^2 = 1.12$	0.1450	POLS
Model Diagnostic Tests			
Pesaran CSD Test	13.816	0.0000	Presence of Contemporaneous Correlation
Breusch-Pagan LM test	$\chi^2 = 250.231$	0.0000	Presence of Contemporaneous Correlation
Modified Wald Test	$\chi^2 = 197.60$	0.0000	Presence of Heteroscedasticity
Woolridge test	F = 36.471	0.0002	Presence of Autocorrelation

Source: Calculated by authors.