

EQUITABLE PROSPERITY: EXAMINING THE DYNAMICS OF PER CAPITA INCOME GROWTH AND INCLUSIVE DEVELOPMENT

Rajneesh Kler ¹, Abu Bakar Bin Abdul Hamid ²,
Noor Inayah Binti Ya'akub ³, Shobhit ⁴, Sanober Khan ⁵ and
Danish Ather ^{6*}

^{1,6} Post-Doctoral Research Fellow, Infrastructure University Kuala Lumpur, Malaysia.

^{1,6,4,5} Amity University in Tashkent, Uzbekistan.

^{2,3} Infrastructure University Kuala Lumpur, Malaysia.

Emails: ¹klerrajneesh@gmail.com, ²abubakarhamid@iukl.edu.my, ³inayah@iukl.edu.my,
⁴shobhit@amity.uz, ⁵skhan@amity.uz, ⁶danishather@gmail.com (*Corresponding Author)

DOI: [10.5281/zenodo.12624173](https://doi.org/10.5281/zenodo.12624173)

Abstract

This paper aims to reveal the correlations between the annual average growth rates for populations and the living conditions in terms of equality as well as the environmental standpoint in different countries grouped by their level of development. These dimensions clearly depict the basic differences in the background of the developed and the developing countries. By performing ACMC and AUGPCAR tests, we are able to pinpoint non-linearities in the data and heteroscedasticity and auto correlation problems. To mitigate this, we introduce a couple of models and use the following approaches to answer them; First, we apply the quantile regression model since it is more robust than the ordinary Least Square regression. These assumptions evidence that, the rise in living standards and environmental quality have a positive impact on growth rates, however developed nations show convergence when growth rates are slow. Policy implications are focused on the investment in social wellbeing, environmental preservation, reducing inequity, and heteroscedasticity appropriate statistical analysis. These strategies are important for the cause of improving the global economy, with focus on the Keynesian principles of inclusiveness and sustainability.

Keywords: Economic Growth, Living Conditions, Environmental Sustainability, Equality Developed Countries, Developing Countries, Quantile Regression, Heteroscedasticity, Autocorrelation.

INTRODUCTION

The enhancement of per capita income is a core standard for most governments. The per capita income commonly described as the average income of the total population in a given area in a specific year is a measure that is important in assessing economic results. It gives the indicate of the level of comfort available to the people as well as their financial position. This makes it very crucial for any country to aim at increasing its per capita income per capital through growth in its economy. But again, it's not the increase in per capita income only that has a bearing but the rate at which the increase is taking place and the sections of a society enjoying the increase. This takes us to the perimeters of inclusive growth, whereby everyone is equally entitled to the fruits of economic growth, which is effective in enhancing social stability. The growth of per capita income is one of the most vital elements to consider in the process of development across the globe.

Increase in living standard through per capita income has the following importance. Firstly, it defines an improvement in the levels of income and output of an economy. More per capita income means that people have more income than before and it also gives evidence to the authorities of the overall economic growth as far as infrastructure, health services as well as education is concerned. Secondly, it causes higher standards of living prevalent in communities where people engage in the above

activities. This is because the higher the income earning capacity of the people, the more money they will spend acquiring such goods and or services, thus improving their standards of living. Thirdly, it reduces poverty. The advancement of economic growth that leads to increase in per capita income can also bring many poor people out of the rank of the underprivileged and create more job opportunities for the less privileged in society.

Also, increase in per capita income is crucial for economic development is another predominant consideration for economic stability. As the economy grows, more finances from domestic and international investors are spurred, thus generating employment opportunities, and offering incentives for invention. It also allows for higher tax receipts without having to increase tax rate which can be useful to support other government activities in areas such as public works and social services. Thus, increasing and sustaining the per capita income, therefore economic development, ought to be of paramount importance to any government that wants to enhance the wellbeing of its citizens.

The following are the forces that determine the per capita income and its rate of change:

Human Capital: Education is one of those essential aspects in the human capital together with healthcare. Education and health, particularly of the country's human capital, contributes more to economic development for example a healthy and educated workforce is more productive. This will in turn increase investments in a country that enhances human capital resulting into better earnings and job opportunities thus improving the per capita income.

Physical Capital: There are fixed facilities for example the transport network, communication, and power that are crucial for business operations. Physical capital in the form of infrastructure enhances the productivity levels of output and also the per capita income levels.

Technological Innovation: Technology has an impact on the economy through investing on enhance productivity that in turn boosts the economy. The various implication that has been highlighted above therefore means that those country's that invest in R & D and those who adopts new technologies usually record higher per capita income grow rates.

Institutional Quality: Legal and regulatory structures, forms of property rights and governance structures on the other create the necessary backgrounds that can underpin economic functions. It enlightens the country on how to exercise good governance to avoid the cases of corruption & misuse of resources affecting the growth of the economy.

Natural Resources: Available and controlled Natural Resources can help to fuel more per capita income in a country especially those countries that are rich in the Natural resource capital. Nonetheless, it is important to use these resources efficiently to avert contract and amplify the resource curse.

Trade and Globalization: Internationalization or liberalization of trade means that nations get to realize the strengths or advantages that they cannot exploit on their own midst enhanced market access plus attraction of foreign investment which all leads to increased economic growth.

Macroeconomic Stability: Post-reform sustainable policies comprising of fiscal and monetary policies are prerequisite for a conducive business environment. Stability guarantees that there will be less risk and thus the rate of investment increases hence economic growth is enhanced.

Importance of Inclusive Growth

While growth is desirable, it must be understood that growth is not the end to itself when its fruits are not forthcoming to most people in a society. Inclusive growth helps to ensure that different dimensions of economic advancement, enhance living standards within developing countries, especially for the less privileged populace. This approach also focuses on eradicating income disparity while ensuring equal availability of resources necessary for a better existence. As the world progresses towards sustainable development, there are numerous reasons why increasing inclusion is crucial. It firstly fosters social cohesiveness since it offers individuals within a society something that is legitimate to aspire, work for, and cherish. This is because when the gains are spread out to all parties there is limited strife and people become more tolerant thus creating a more peaceful society. Secondly, it improves the aspect of economic sustainability. In this respect, there is a consensus that measures that encourage productivity are more sustainable in the long run since they entail a larger number of people in support of economic growth and development. Third is poverty and inequality as a key issue because it hinders the socioeconomic growth of a nation. The inclusive growth empowers the potency of poverty eradication and decrease income inequality thus leading to the fairness of the economic differences.

At its core, the Inclusive Growth Index involves the evaluation of the state of both income and wealth distribution in a given country, and this particular aspect falls perfectly in line with what the concept of the Index is all about.

The inclusive Growth Index (IGI) is an index with details; it measures how pro-poor growth is and how everyone in the society is empowered. Key features of the IGI include: Key features of the IGI include:

Income and Employment: The IGI also concerns the income levels and the employment indicators to comprehend the degree of economic growth and its impact on the job market and increase in earnings per capita.

Access to Services: It considers the availability of basic needs and a range of services, including health, education, and social protection, to make certain that beneficiaries affirm benefits from growth.

Equality of Opportunity: Issues like gender equity or equity for minorities, and availability of economic opportunities for all at any given population bracket are some of the factors pegged in the IGI.

Sustainability: The index indicates the sustainability of the growth considering the influences that can affect it with reference to the environment and using natural resources that will enable the generation after us to experience the same.

Governance and Institutions: To make it easier, the IGI has drawn indicators that include the quality of governance such as the rule of law, levels of corruption and institution effectiveness for inclusive growth to occur.

Infrastructure and Innovation: It also measures out the state of infrastructure and technological advancement which is very essential in the growth and development of the economy.

The recalculated IGI helps elaborate on how each country's economic growth by incorporating these features a definitive approach to which policies should be undertaken in order to stimulate balanced and sustainable growth. As shown in this paper, the level of per capita income is central to the process of development, yet it is necessary to guarantee that this process incorporates as many people as possible for the further stable formation of prospering society.

LITERATURE REVIEW

Analyzing the pointers that contribute toward growth in per capita income, it is useful to review some theoretical literature.

The idea of the growth in per capita income has its theoretical origin from the classical/neoclassical economic growth model. The classical economists such as Adam Smith and David Ricardo postulated that the key elements of economic growth included capital accumulation labor force augmentation productivity raise. Smith' "invisible hand" theory and division of labor provides information that through specialization, the markets conditions could result in an increase in production and incomes.

In the twentieth century, the Solow-Swan model, which is based on the principles of neoclassical economics, paved the way towards a new approach in growth theory. This model posits that economic growth results from three main factors: employee relations, assets such as money and other equipment, and technological advancement. In Solow model of Growth, it is holding that long-run growth is mainly explained by technological changes as labor and capital are assumed to be not growing and experiencing law of diminishing returns. While the model supports the idea of savings and investment in physical capital, it also indicates that an economy has limitation and without technological advance, the economy will reach a state of equilibrium where annual average income per capita will decline. The Solow model outlines several factors for sustained economic development that were criticized for having diminishing returns and replaced by new theories such as the theory of endogenous growth, supported by economists such as Paul Romer and Robert Lucas. As this theory highlights, human capital, innovation, and knowledge spillovers are essential ingredients that have to be employed in the right combination to achieve success. For example, Romer's model incorporates technological change as an endogenous variable resulting from research and development and technology acquisition where policy makers recommended increased educational attainment and innovation and trade openness can substantially affect per capita income growth.

Recent Empirical Studies on Factors Influencing Growth in Per Capita Income

Theoretical and empirical analysis of growth in per capita income has identified numerous factors that play a significant role in the increased understanding of the phenomena and validation of theories among them. The first noteworthy aspect that might be considered is the notion of human capital. Mankiw, Romer and Weil (1992) supplemented Solow's model by human capital that indicated that the effect from human capital made the countries with greater investment in education received greater rates of increase in per capita income. Similarly, Barro (2001) found that higher levels of educational attainment and health improvements contribute significantly to

economic growth. Other necessities of life include physical capital and infrastructure also has its importance in the determination of human development. Aschauer (1989), for instance, offered statistics which revealed that tangible investments in infrastructures like transport and utilities increase productivity and economic growth. Subsequent research supports such conclusions, noting the significance of contemporary infrastructure to economic activities and to boost performance.

Technological innovation and R&D are consistently identified as key drivers of growth. Among the related works in this area, Aghion and Howitt (1992) constructed a model that illustrated that innovation investments result in technological advances, that is, the propulsive force of growth. This is testified by Coe & Helpman (1995) Coe & Helpman (1995) and Griffith, Redding, & Van Reenen (2004), which show that both research and development outlay and international technology transmission have a significant influence on per capita income growth. Institutional quality and governance are also essential to the network; they will enhance economic growth, steady financial markets, improve international investment environment though risky, and encourage middle-income foreign investment. Acemoglu, Johnson, and Robinson (2001) demonstrated that institutions, particularly property rights and the rule of law, are fundamental determinants of economic performance. According to their study they found out that countries with accreditation to good institutions therefore the per capita income gains recorded are high. Similar to this, other empirical studies such as Rodrik, Subramanian, and Trebbi (2004) also concluded that, while controlling for geography and trade, institutional quality is arguably one of the most important determinants of economic growth for countries.

Trade openness, as has been demonstrated in the section, does affect growth, as does globalization. Frankel and Romer (1999) provided empirical evidence that trade openness correlates positively with per capita income growth. Some of the articles suggested that the advantages of openness include ability to access bigger markets, technology transfer and improved resource allocation. Some of the Latest Research Done on Inclusive Growth and its Impact on Per capita income. The idea of the intensity of growth which indicated that the positive effects of growth development have been properly distributed within a society has received much attention in the current society. This concept goes beyond mere income growth, emphasizing the need for broad-based participation in economic opportunities and access to resources.

Several studies have been carried out with the aim of advancing the understanding of inclusive growth. For example, Dollar & Kraay, (2002), attempted to analyze the empirical view that captures the effects of growth, indicating a positive correlation between growth and poverty reduction suggesting that the poor benefit equally as the average income earner through reducing income inequality. Based on their research, they argue that procedures enhancing economic growth are likely to encourage inclusiveness if growth is not predominantly occurred due to structures. According to the World Bank, inclusive growth, as described in the Inclusive Growth Analytics (2010), is not a simple Hegelian enactment, as it is related with more aspects, apart from employment, education, health, and social protection. Works based on this framework, as Ianchovichina and Lundstrom's (2009), seem to underline that policies and investments that are inclusive are likely to increase per capita income growth through making sure that those with productivity deficiencies within the labor force are provided for through inclusive growth policies such as investments in human capital and subsidizing programs that provide for social support.

Studies on gender inclusion also demonstrate the economic benefits of inclusivity. Klasen and Lamanna (2009) found that gender inequality in education and employment negatively affects economic growth. It is connected with the qualitative increase in growth rates due to the utilization of labor potential of the whole population, (including) women employment. Infrastructure development that was targeted for improving the overall inhabitants' quality of life also has positive effects. According to Ali and Zhuang (2007), physical infrastructures that provide basic services to excluded population help boost up economic growth proportional to total factor productivity adjustment and have a positive effect on the distribution of benefits.

In recent research, Aiyar and Ebeke (2019) analyzed the relationship between inclusive growth and macroeconomic stability. The studies identified that the strategies that foster inclusive growth planning for succession that decreases inequality and increases social harmony positively impacts on economic stability. This research underscores the accounting profession revelations that the policy of inclusion is not only stringently altruistic, but it is also essential for the global economy to expand exponentially. In essence, the various works establish that increasing outreach is sustainable in the context of promoting inclusive growth with a view to improving per capita income. This creates an environment where as much as possible is done to ensure that everyone benefits from the economy hence making growth tolerant thus ending up improving the quality of life note that inclusive growth provides for sustainable development.

METHODOLOGY

For the studies on the growth in per capita income, data is drawn from the World Bank's source – World Development Indicators (henceforth, WDI). The inclusive growth index and its components are sourced from various international organizations and databases, including: The inclusive growth index and its components are sourced from various international organizations and databases, including:

Economy: The multinational institutions which can be relied upon include World Bank, International Monetary Fund (IMF), and the United Nations (UN).

Living Conditions: According to the World Health Organization (WHO), United Nations Educational, Scientific and Cultural Organization (UNESCO), and national statistical agencies as seen in Table 1.

Equality: International sources like UNDP and WEF and other products generated from these or similar sources.

Environment: UNEP data, WRI data, as well as other resources related to environmental database.

Variables and Measurements

Growth in Per Capita Income (Annual Average): This variable is defined as a change in per capita income in a particular year expressed in percentage. It is calculated using the formula: It is calculated using the formula:

$$\text{Growth Rate} = \left(\frac{\text{Per Capita Income}_{t+1} - \text{Per Capita Income}_t}{\text{Per Capita Income}_t} \right) \times 100$$

Inclusive Growth Index (IGI): The IGI is a composite index calculated as a weighted average of its four components (Economy, Living Conditions, Equality, and Environment). Each component is normalized and scaled to ensure comparability across countries.

$$IGI = w_1 \cdot \text{Economy} + w_2 \cdot \text{Living Conditions} + w_3 \cdot \text{Equality} + w_4 \cdot \text{Environment}$$

where w_1, w_2, w_3, w_4 are the weights assigned to each component based on their relative importance.

Regression Model

Growth in Per Capita Income

$$= \beta_0 + \beta_1 d.Growth + \beta_2 Living + \beta_3 Equality + \beta_4 Envi + \beta_5 DummyEurope + \varepsilon$$

Where:

β_0 is the constant term.

d.Growth represents the first lag of the Growth Rate in Per Capita income.

Living Represents Living Conditions is the inclusive growth value related to living conditions index.

Equality is the inclusive growth index related to equality.

Envi is the inclusive growth index related to environmental sustainability.

Dummy Developed is a binary variable indicating whether the country is developed or not (1 if developed, 0 otherwise)

$\beta_1 \beta_2 \beta_3 \beta_4$ and β_5 are the Coefficients of the independent variables.

ε is the error term.

RESULTS AND ANALYSIS

Data Characteristics

The dataset presents various countries' performance in terms of annual average growth rate per capita, inclusive growth in the economy, living conditions, equality, and environmental sustainability, alongside a binary indicator of whether the country is developed. The annual average growth rates per capita vary significantly, with some countries like the Maldives and Moldova experiencing exceptionally high growth rates (35.83% and 14.77% respectively), whereas countries like Mongolia and Burundi show minimal growth. Developed countries like the United States, Germany, and Denmark exhibit relatively high economic inclusiveness and living conditions but moderate environmental inclusivity.

In terms of living conditions, Nordic countries such as Denmark, Finland, and Norway rank very high, reflecting robust social welfare systems. These countries also score well in equality and environmental sustainability. Contrastingly, many developing nations, particularly in Africa and parts of Asia, show lower scores across these dimensions. For example, Burkina Faso, Burundi, and Nigeria have low scores in living conditions and equality, indicating significant room for improvement in these areas.

Lastly, the environmental inclusiveness values highlight a global challenge, with many countries scoring below 50. Notably, developed nations like Luxembourg and Denmark are leading with scores of 100 and 64.8, respectively. However, countries such as the Russian Federation and Mongolia lag with significantly lower scores. The dataset provides a comprehensive overview, reflecting disparities in development and sustainability across different regions, with developed nations generally performing better across the measured indicators.

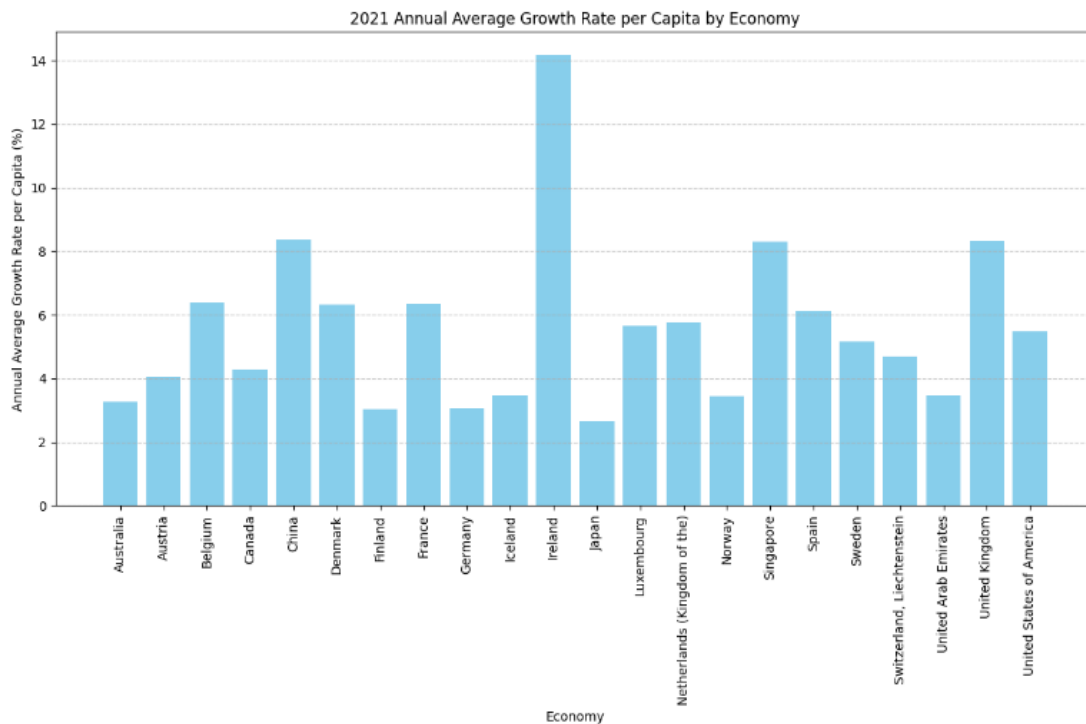


Figure 1: Growth Rate in Per capita Income: Selected Economies

Within the developing economies, different patterns may be observed for instance there is a bracket of high growth economies that stands out clearly. For instance, Ireland (14.19%) shows an exceptionally high growth rate, significantly outpacing other economies. This could be attributed to its strong tech and pharmaceutical sectors, which have seen robust performance and investment. China (8.37%) maintains a high growth rate, reflecting its ongoing economic expansion and industrial growth, despite the global challenges. Singapore’s (8.31%) growth rate is also very high, indicating strong economic performance, likely driven by its strategic position as a global financial hub and its robust technology sector. The United Kingdom’s (8.32%) high growth rate might be influenced by post-Brexit economic adjustments and recovery from the COVID-19 pandemic.

Moderate Growth Economies

Belgium (6.39%) and Denmark (6.32%): These countries show solid growth rates, likely due to strong industrial and service sectors. France (6.35%) and Spain (6.13%): France and Spain have similar growth rates, potentially driven by recovery efforts and increased economic activities post-pandemic. Luxembourg (5.67%) and Netherlands (5.78%): Both countries exhibit strong growth, possibly due to their robust financial services and trade sectors. United States (5.47%): The US maintains a strong growth rate, reflecting its diverse and resilient economy.

Lower Growth Economies

Japan (2.66%): Japan's relatively lower growth rate might reflect its mature economy and demographic challenges, including an aging population. Finland (3.05%) and Germany (3.07%): These economies show modest growth rates, possibly due to stable but slower industrial growth and external economic factors. Iceland (3.47%) and Norway (3.45%): Both countries have growth rates around 3.5%, which could be linked to their smaller, resource-dependent economies. Australia (3.26%) and Canada (4.28%): These resource-rich countries show moderate growth rates, likely influenced by global commodity prices and trade dynamics. United Arab Emirates (3.49%): The UAE's growth rate reflects its diversification efforts beyond oil, but it still faces challenges from fluctuating oil prices.

European Economies:

Many European economies, such as Belgium, Denmark, France, and Spain, have moderate to high growth rates, reflecting recovery from the pandemic and strong service sectors. Technologically Advanced Economies: Countries like Ireland, Singapore, and China, with significant investments in technology and innovation, exhibit higher growth rates.

Relationship Among the variables and Variable Characteristics

To explore the relationship between dependent and independent variables, augmented component-plus-residual plots (ACPR plots) are used. It provides a graphical way to examine the relationship between variables and provides good testing for linearity. The plots are represented in the figures below.

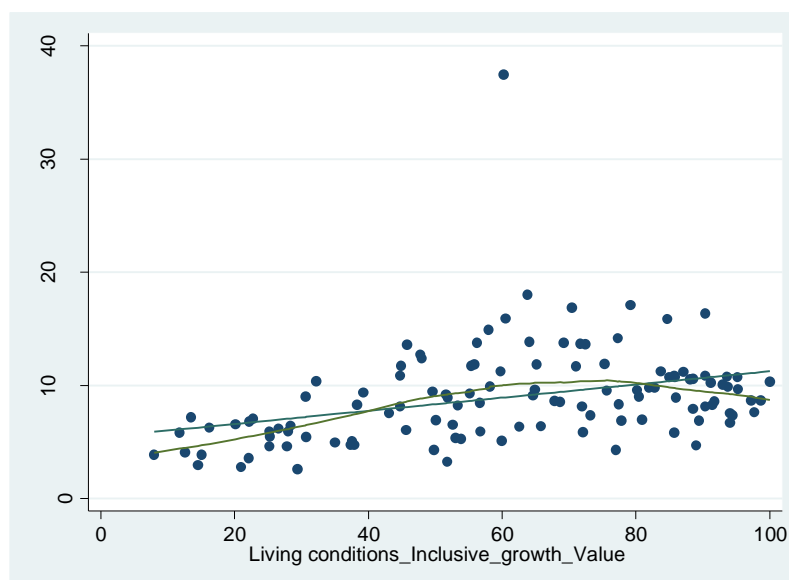


Figure 2: acprplot Living Conditions.

The ACPR plot for Living condition shows slight curvature in the trend line suggests a possible non-linear relationship between the predictor variable (Living conditions) and the response variable after accounting for other predictors. There is a noticeable outlier in the top right quadrant (with a high augmented component plus residual value around 40), which might be influential and could potentially affect the regression results. Overall, the plot indicates that as the Living conditions increases, the

augmented component plus residual shows some variation but generally follows a mild upward trend with a slight curve.



Figure 3: acprplot Equality

The plot for Equality index in figure 3 also shows slight curvature in the trend line suggests a possible non-linear relationship between the predictor variable and the response variable after accounting for other predictors. Again, there is a noticeable outlier above 30 on the y-axis, which might be influential and could potentially affect the regression results. Overall, the plot indicates that as the equality index Value increases, the augmented component plus residual shows a general downward trend with some slight curvature suggesting that higher values are associated with lower values of the response variable.

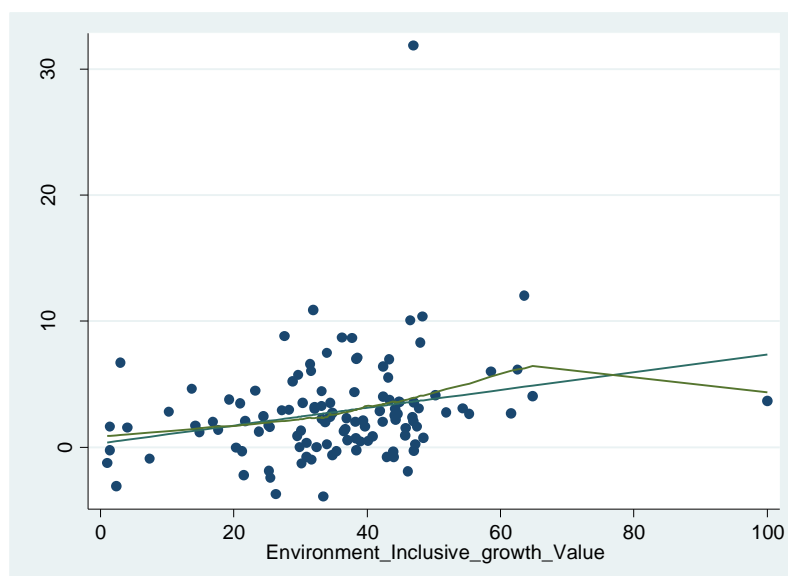


Figure 4: acprplot Environment.

The trend line for acpr plot of Environment in figure 4 also shows some curvature, suggesting a non-linear relationship between the predictor variable and the response variable after accounting for other predictors. It also has noticeable outlier above 30

on the y-axis, which might be influential and could potentially affect the regression results. Overall, the plot indicates that as the Environment index Value increases, the augmented component plus residual initially shows a mild upward trend. However, after a certain point, this trend appears to change direction, suggesting a more complex, potentially non-linear relationship.

Model Evaluation

The linear Regression model was tested with three major tests i.e. test for heteroscedasticity, test for Autocorrelation and test for multicollinearity. Following section discusses the results of each.

Testing Heteroskedasticity

Initially, it can be tested graphically. Figure 5 displays the residuals against the fitted values.

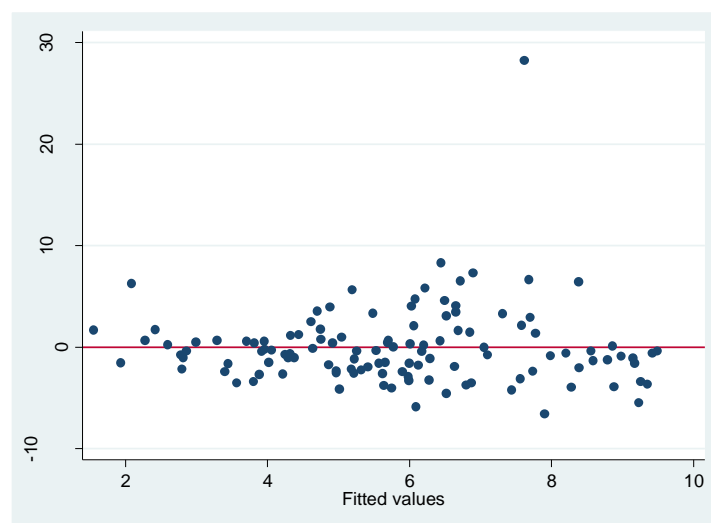


Figure 5: Testing Heteroskedasticity

Here, there is clear evidence that some of the residuals are far scattered. This indicates a strong presence of heteroskedasticity in the model. Further to confirm, the Breusch-Pagan / Cook-Weisberg test is to be conducted to evaluate the results. The results of are as follows:

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of _annual_average_growth_rate_per_

chi2(1) = 20.14

Prob > chi2 = 0.0000

The p-value is very small (0.0000), which is less than any common significance level (e.g., 0.05, 0.01, 0.001). The small p-value indicates strong evidence against the null hypothesis. Therefore, we reject the null hypothesis of constant variance and conclude that there is significant evidence of heteroskedasticity in the model. This means the variance of the errors is not constant and varies with the fitted values of the annual average growth rate.

Checking Autocorrelation

The Durbin-Watson test is a statistical test used to detect the presence of autocorrelation in the residuals of a regression analysis. Autocorrelation occurs when the residuals (errors) are not independent from each other, which can invalidate the results of the regression. The Durbin-Watson statistic ranges from 0 to 4, where a value of 2 indicates no autocorrelation, values less than 2 suggest positive autocorrelation, and values greater than 2 indicate negative autocorrelation. The results of the test are as follows:

Durbin-Watson d-statistic (5, 119) = 2.392011

In the given result, the Durbin-Watson d-statistic (5, 119) = 2.392011, "5" refers to the number of predictors in the regression model, and "119" is the number of observations. The d-statistic value of 2.392011 is close to 2 but slightly higher, suggesting a slight negative autocorrelation in the residuals. This means that the residuals tend to switch signs, where a positive residual is likely to be followed by a negative residual, and vice versa. However, since the value is relatively close to 2, the negative autocorrelation is not strong.

Checking Multicollinearity

Multicollinearity is tested with the Variance Inflation Factor (VIF) test which is a diagnostic tool used to detect the issue in regression analysis. Multicollinearity occurs when independent variables in a regression model are highly correlated, which can inflate the variance of the coefficient estimates and make the model unstable. VIF quantifies this by measuring how much the variance of a regression coefficient is inflated due to collinearity with other predictors. A VIF value greater than 10 typically indicates high multicollinearity, while values between 1 and 5 suggest moderate correlation that might not be problematic. The model test results are given below:

```
. vif
```

Variable	VIF	1/VIF
equality_index	2.70	0.371021
livingcondition_index	2.54	0.393014
dummydeveloped	1.81	0.551968
environmental_index	1.13	0.887901
Mean VIF	2.04	

In the obtained results, the VIF values for the variables "equality_index" (2.70), "livingcondition_index" (2.54), "dummydeveloped" (1.81), and "environmental_index" (1.13) are all below 10, indicating that multicollinearity is not a severe issue in this regression model. The 1/VIF values further confirm this, with none approaching zero. The mean VIF value of 2.04 also suggests that, on average, the variables in the model are not highly collinear. Therefore, the regression coefficients are likely to be reliable and the model stable.

Post Estimation Tests

Augmented Partial Residual Plots (Avplots)

Figure 6 presents augmented partial residual plots (avplots) for a regression analysis, showcasing the relationships between the dependent variable (annual average growth rate) and four independent variables: living conditions, equality, environment, and a dummy variable indicating development status. Each plot includes a scatter plot of the

residuals of the dependent variable against the residuals of the corresponding independent variable, controlling for the other variables in the model. Additionally, a fitted line is included to highlight the linear relationship, with the coefficient, standard error, and t-value displayed for each independent variable.

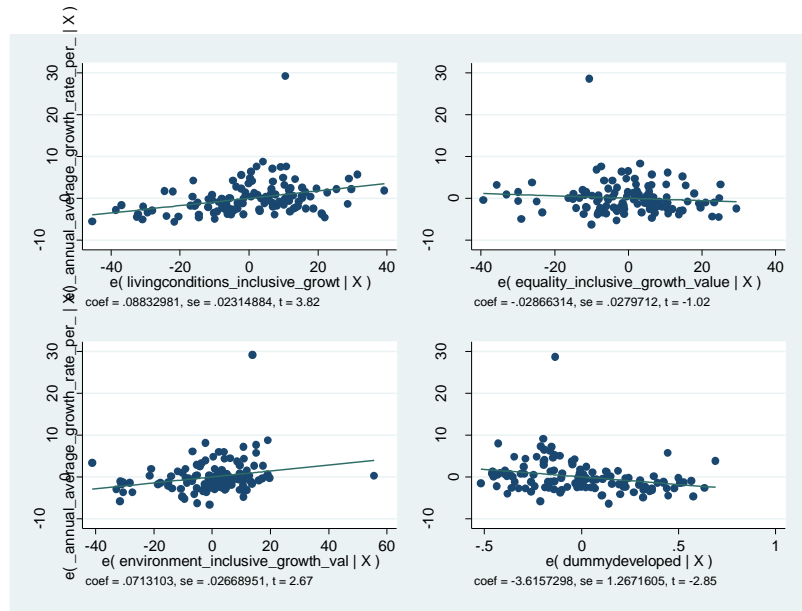


Figure 6: Avplots Residuals

From the analysis of the avplots, we observe the following:

Living Conditions (Top-Left Plot): The positive coefficient (0.0883) with a significant t-value (3.82) indicates a positive and statistically significant relationship between improved living conditions and the annual average growth rate. This suggests that as living conditions improve, there is a corresponding increase in the growth rate.

Equality (Top-Right Plot): The coefficient for equality (-0.0287) is negative but not statistically significant, given the t-value (-1.02).

This implies that changes in equality, as measured by the inclusive growth value, do not have a significant impact on the annual average growth rate within this dataset.

Environment (Bottom-Left Plot): The environment variable shows a positive and statistically significant relationship with the growth rate, with a coefficient of 0.0713 and a t-value of 2.67. This indicates that improvements in environmental factors are associated with higher growth rates.

Development Status (Bottom-Right Plot): The dummy variable for developed status has a negative coefficient (-3.6157) with a significant t-value (-2.85), suggesting that being a developed country, as defined by the dummy variable, is associated with a lower annual average growth rate compared to developing countries.

Overall, the avplots highlight that living conditions and environmental factors are significant predictors of growth rates, while equality does not show a significant effect. Additionally, development status, as a dummy variable, negatively impacts growth rates, possibly indicating a convergence effect where developing countries grow faster than developed ones.

Kernel Density Plot

A kernel density plot produces a kind of histogram for the residuals; the option normal overlays a normal distribution to compare. Here residuals seem to follow a normal distribution. Figure 7 shows the histogram.

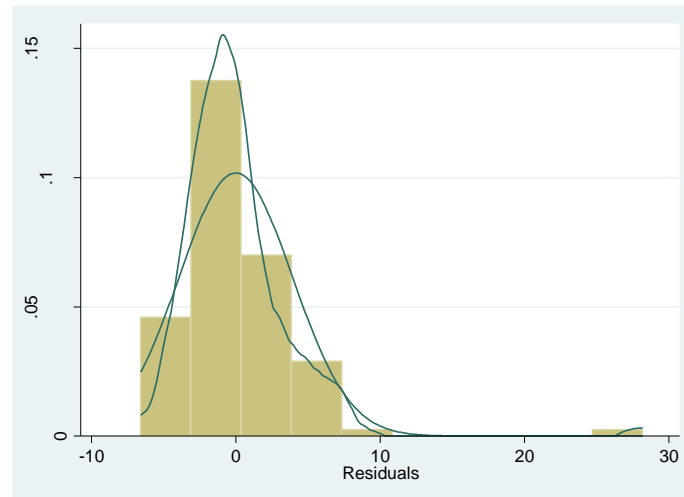


Figure 7: K Density Plot for Residuals

The figure displays histogram of the residuals from the regression model, overlaid with a density plot. This plot is used to assess the distribution of the residuals, which is a crucial diagnostic tool in regression analysis. The key points to consider when interpreting this plot are the shape of the distribution, the presence of any skewness, and any deviations from normality.

Distribution Shape and Normality: The histogram and density plot indicate that the residuals are not perfectly normally distributed. The residuals show a peak around zero, but the distribution is right-skewed, with a long tail extending towards positive residual values. Ideally, for the assumptions of ordinary least squares (OLS) regression to hold, the residuals should be normally distributed. The skewness observed here suggests a departure from normality.

Potential Issues: The right skewness in the residuals implies that there may be some outliers or influential points with higher residual values, which could affect the reliability and validity of the regression results. This non-normal distribution can lead to inefficiencies in the estimates and might require transformation of the dependent variable or the application of robust regression techniques.

Model Revision

Considering the model evaluation above of the linear regression model following model revisions are carried out:

Addressing Skewness and Non-Normality: The Dependent and Independent Variables are transformed in the logarithmic form that may help to normalize the residuals and reduce skewness.

Use Robust Regression Techniques: A robust regression methods, quantile regression, which is less sensitive to outliers and can provide more reliable estimates in the presence of non-normal residuals is adopted against the standard OLS method. Quantile regression is a type of regression analysis used to estimate the conditional

median or other quantiles of the response variable. Unlike ordinary least squares (OLS) regression, which estimates the mean of the dependent variable conditional on the independent variables, quantile regression provides a more comprehensive analysis of the relationship between variables by estimating the impact of the predictors on different points of the distribution of the dependent variable. This makes quantile regression particularly useful when the data exhibits heteroscedasticity or when the relationship between the variables differs across the distribution. The results of the model are displayed in table 1.

Table 1: Quantile Regression Results

loggrowthrate	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
log_living	.622	.148	4.19	0	.328	.915	***
log_env	.172	.099	1.73	.086	-.025	.368	*
dummydeveloped	-.491	.213	-2.31	.023	-.913	-.07	**
Constant	-1.354	.679	-1.99	.049	-2.699	-.009	**
Mean dependent var		1.466		SD dependent var		0.963	
*** $p < .01$, ** $p < .05$, * $p < .1$							

The results of the quantile regression for the log-transformed growth rate are presented in the table. The coefficient for log_living is 0.622, with a standard error of 0.148 and a t-value of 4.19, which is highly significant (p-value < 0.01). This indicates that a 1% increase in living conditions is associated with a 0.622% increase in the growth rate at the specified quantile, demonstrating a strong positive relationship. The coefficient for log_env is 0.172, with a t-value of 1.73 and a p-value of 0.086, indicating marginal significance (p-value < 0.1). This suggests that improvements in environmental conditions have a positive, albeit weaker, effect on the growth rate. The dummydeveloped variable has a negative coefficient of -0.491, with a standard error of 0.213 and a t-value of -2.31, which is significant at the 0.05 level (p-value = 0.023). This result implies that being a developed country is associated with a 0.491% lower growth rate at this quantile, reflecting potential convergence effects. The constant term is also significant, indicating the baseline log growth rate when all predictors are zero.

Avplots after Model Revision

After the revision of the model the avplots show much lesser scattered residuals as shown in figure 8 below

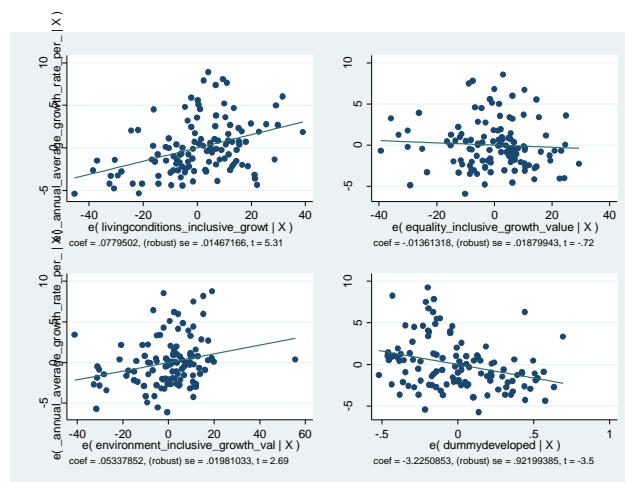


Figure 8: Avplots after Model Revision

In addition the residuals also show a distribution much closer to the normal distribution as compared to the linear regression model. This is shown in figure 9 below

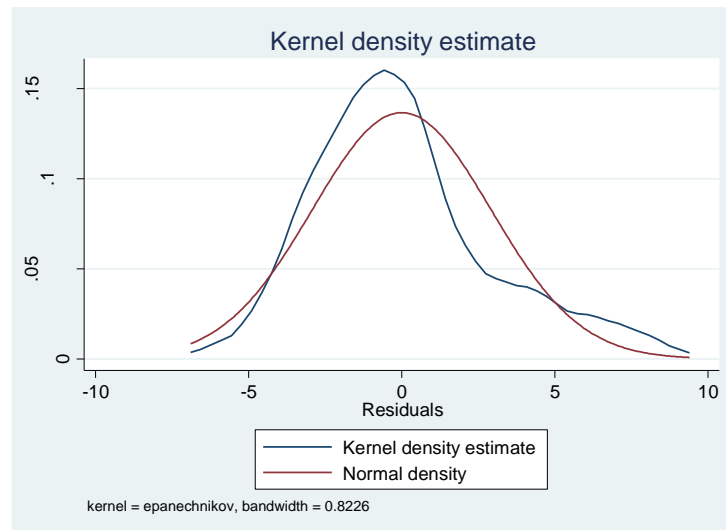


Figure 9: K Density of Residuals after Model Revision

CONCLUSION

In analyzing the data, the researcher was able to determine growth differentials, living standards, equity, and environmental impact sophistication in the developed and the developing world. As for the quality of living and the issues of equality, there is a visible difference and all the countries of the developed world perform way better; however, a major issue common to all nations is the consideration of environmental concerns. High economic growth differentiated and looks rather extreme: thus, while the Maldives and Moldova are experiencing growth rates of 9-10%, at least the Mongolian and Burundian growth rates are negligible. As the above analysis illustrates, developed countries such as USA, Germany and Denmark have reasonable scores on the economic and living condition inclusiveness indices but have relatively low ecological inclusiveness scores. The challenge demonstrated here is the fact that growth and development are complex processes that cannot be measured how it is done by most economists only by financial terms.

The obtained Augmented Component-Plus-Residual (ACPR) plots showed curved data points, indicating that direct linearity between the dependent and independent abstractions may not exist such that other forms of regression could offer a better model. However, in the case of both, the living conditions and environmental sustainability curves are slightly bent, which means that the growth rate does not grow alongside the improvements of these two factors. Outliers are also an issue because it creates doubts as to whether certain countries and/or conditions are really a part of this world's demographic or are they mere anomalies that distort the outcome. This underscores the importance of sound statistical practices that are designed to supplement where such deviations occur.

In the analysis process of model evaluation, heteroskedasticity was demonstrated to a great extent and there was little negative autocorrelation which suggested that perhaps some assumptions of ordinary least squares (OLS) regression may not have been met. Moreover, the multicollinearity problem occurred but not as serious as to

become a critical concern on multiple regression analysis. To this regard, a quantile regression was used as the analyzing technique since it is highly reliable in dealing with the non-normal residuals and heteroscedasticity. Estimation of the quantile regression also depicted that living condition and environmental sustainability had a positive relationship with tod growth rates, however being developed nation had negative relationship, which can be expected to some convergence effects where growth rates of developed nations are slower than developing nations.

The post-estimation diagnostics that supported the revised model, such as augmented partial residual plots and kernel density plots also provided more evidence on the appropriateness of the model. On checking the avplots after the model revision, the residuals were found to be less scattered and on plotting the kernel density plot, the data elaborated a distribution more like the normal curve; confirming the efficiency of the log-transformed variables and the quantile regression for better data fit. This has not only solved the problem of abnormal distribution as well as skewness but also provided a complex view on the association systems among the factors.

The following are the critical findings, which may inform policy interventions that seek to advocate for pluralistic, progressive and sustainable economic development. These implications are quite appropriate for both developed and developing countries. In order to ensure an inclusive and more sustainable growth paradigm, it is critical to put more emphasis on the 4 pillars of economic growth while stressing the importance of living conditions and equality, as well as putting more focus on environment in order to achieve more balanced growth.

Thus, it is imperative for teh countries to improve their living conditions significantly if they want to have improved growth rates since living conditions are strongly and positively related to the growth rates. The governments should focus on policies of improvement of the health care systems and standards to educate the public, provide adequate houses and social security to the people. The quality of life is an important factor that can contribute to overall economic growth of a country since the enhanced well being will lead to a healthy and educated population which translates to increased productivity. This is especially true for the developing countries, as it is revealed that these nations have a great potential for the progress in the indicated spheres. Advanced nations, and those nations that are already on a rise, should endeavor to add more stock to their status and implement more efficient and more extensive social welfare policies.

This confirms to some extent the hypothesis 1 that indicates that when growth rates depend on environmental sustainability, it has a marginally significant positive effect. It is almost evident that policies should be adopted that improve the extension, and development of green technologies, renewable energy and sustainability in industries. This encompasses offering inducements for adoption of green technologies among industries and enhancing the usage of resources that advance the environmental conservation cause. In developed and development countries, the process of mainstream sustainable environment in the planning of economic activities is very important for the future sustainable economic development and sustainability in the face of environmental shocks.

This paper did not find equality index to positively influence growth in the regression analysis even though cross sectional analysis suggest that high levels of inequality are detrimental to long term sustainable economic expansion. Measures that are still

considered crucial to fight inequality include fiscal measures like progressive taxation, better working conditions, social protection and welfare systems. Furthermore, reducing poverty and income inequality through policies that grant equal chances of the assets' accumulation to every population segment, including the poor and vulnerable groups, can result in a productive and united society. This is specific for third world countries where the disparity is more inclined.

The negative sign of the developed status means that growth potential is higher in the developing nations, which in many cases enjoy growth rates that are converging to those of developed states. There is a need for developed countries' policy makers to understand that the world is shifting to more sustainable growth model and thus having to rely on innovation, technology and education rather than to push for high and quick growth rates. On the other hand, the developed countries should encourage their high growth rate by pulling policies of liberal business environment, infrastructure, and people development. It is important to shift from an emphasis on domestic institutional development for enhancing efficiency and productivity to the convergence process, which is known to be fostered by international cooperation and knowledge transfer from developed to developing countries.

It hence suggests that a more suitable assessment of their interactions would involve utilising more statistically sound methods like the quantile regression. Policy-makers on their part should use quality data collection and data analytical resources to support their decision making. This involves embracing higher levels of analysis such as vector auto regression models and seasonal decomposition of time series that are capable of capturing non-linear dynamics and outliers such that policy adjustments are rooted on sound analysis. The use of such methods can help in more frequent and effective review of policies in order to develop poly In this way the policies can be more effective and responsive.

In future, research needs to built on this model where it is possible to add more variables that can encase the social – political and institutional environment of the countries under consideration. It is useful to include factors such as the quality of governance, political stability, and social capital – variables that are relevant to discern the specifics of development. Perhaps, the age, gender, and the length of time taken could be examined in a non-linear manner as well as through the use of machine learning techniques to fully understand the interaction between the variables. Longitudinal research on these determinants over time and their trend analysis will be useful in establishing dynamic changes and causal effects better. Finally, more case studies from individual countries could provide rich data about how particular countries have adopted the routes and confronted the obstacles concerning sustainable development and economic inclusiveness.

References

- 1) Acemoglu, D., Johnson, S., & Robinson, J. A. (2001). The colonial origins of comparative development: An empirical investigation. *American Economic Review*, 91(5), 1369-1401.
- 2) Aghion, P., & Howitt, P. (1992). A model of growth through creative destruction. *Econometrica*, 60(2), 323-351.
- 3) Aiyar, S., & Ebeke, C. (2019). Inequality of opportunity, inequality of income and economic growth. IMF Working Paper WP/19/34. International Monetary Fund.
- 4) Ali, I., & Zhuang, J. (2007). Inclusive growth toward a prosperous Asia: Policy implications. ERD Working Paper No. 97. Asian Development Bank.

- 5) Aschauer, D. A. (1989). Is public expenditure productive? *Journal of Monetary Economics*, 23(2), 177-200.
- 6) Coe, D. T., & Helpman, E. (1995). International R&D spillovers. *European Economic Review*, 39(5), 859-887.
- 7) Dollar, D., & Kraay, A. (2002). Growth is good for the poor. *Journal of Economic Growth*, 7(3), 195-225.
- 8) Frankel, J. A., & Romer, D. (1999). Does trade cause growth? *American Economic Review*, 89(3), 379-399.
- 9) Griffith, R., Redding, S., & Van Reenen, J. (2004). Mapping the two faces of R&D: Productivity growth in a panel of OECD industries. *Review of Economics and Statistics*, 86(4), 883-895.
- 10) Ianchovichina, E., & Lundstrom, S. (2009). Inclusive growth analytics: Framework and application. Policy Research Working Paper No. 4851. The World Bank.
- 11) Klasen, S., & Lamanna, F. (2009). The impact of gender inequality in education and employment on economic growth: New evidence for a panel of countries. *Feminist Economics*, 15(3), 91-132.
- 12) Rodrik, D., Subramanian, A., & Trebbi, F. (2004). Institutions rule: The primacy of institutions over geography and integration in economic development. *Journal of Economic Growth*, 9(2), 131-165.
- 13) World Bank. (2010). *Inclusive Growth Analytics: Framework and Application*. Washington, DC: World Bank.