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Investigating the Correlation Between Income Inequality and Economic Growth

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Abstract: ***The relationship between income inequality and economic growth has been the subject of extensive theoretical debate, with varying predictions on whether inequality fosters or hinders growth. This study investigates the relationship between income inequality and economic growth using a fixed-effects model, estimated on cross-country data spanning from 1963 to 2015. The findings suggest a robust negative correlation between income inequality and economic growth, with stronger effects observed in more developed countries.***

Keywords: income inequality, economic growth, Gini coefficient, fixed effects

1. Introduction

Income inequality has become a central issue in economic discourse, particularly in its potential impact on economic growth. The relationship between inequality and growth has been widely debated, with some theories suggesting that inequality can stimulate growth by providing incentives for investment and innovation, while others argue that high levels of inequality can hinder growth by creating social and economic instability. This study aims to contribute to this debate by examining the correlation between income inequality, as measured by the Gini coefficient, and GDP growth, across a broad range of countries over 52 years. .

The empirical results of this analysis reveal a negative correlation between income inequality and GDP growth, which strengthens when conditioning on the level of development and country-specific fixed effects. This negative correlation is further shown to be stronger within developed countries. These findings align with the literature that suggests inequality can be detrimental to economic growth, particularly in more developed economies, where the marginal benefits of inequality may be outweighed by its social and economic costs.

This paper contributes to the existing literature by utilising a more reliable Gini coefficient dataset, which offers enhanced accuracy and consistency relative to those used in comparable empirical studies. By conducting a cross-country analysis over a period of over half a century, and through employing rigorous econometric methods such as fixed effects models, this study not only provides novel estimates of the correlation between inequality and economic growth, but is also able to examine the robustness of this result to time and country trends. A sub-sample analysis is also conducted, to understand which countries drive the negative correlation.

This introduction section will be followed by a literature review discussing the various theories related to the impact of inequality on growth. Ensuingly, an examination of the data collection process, including a discussion on the methodology employed will be introduced. Finally, the results of the analysis will be presented and interpreted in the context of the existing literature.

2. Literature Review

2.1 Positive Effect of Inequality on Growth

This section will examine theoretical explanations, in addition to empirical evidence, on how economic inequality positively affects economic growth.

Incentives Approach

The incentives approach posits that income inequality can positively affect economic growth, by creating a system where rewards and punishments drive productivity. In a simplified model of moral hazard, individuals are motivated to work harder if they are compensated in proportion to their efforts. Conversely, if everyone receives a fixed wage regardless of their performance, there is no incentive to exert additional effort.

In this framework, income differences therefore play a crucial role in incentivizing investments into education, physical capital, labour, and risk-taking. Higher earnings potential for high performers can motivate people to pursue advanced skills and invest in their personal development. This investment in human capital and entrepreneurship can foster innovation and drive economic expansion.

Furthermore, governmental policies like progressive taxation and regulation, aimed at reducing income inequality, may inadvertently hamper growth. According to the neoclassical growth model, taxing capital reduces the return on savings, prompting individuals to consume more and save less, which in turn lowers investment and growth. Regulatory policies, such as minimum wage laws, labour market regulations, and trade restrictions, can similarly diminish expected profits, leading those with capital to reduce investment and increase consumption, which slows economic growth (Mendes, 2013).

As Persson & Tabellini (1991) point out, economic growth hinges on the accumulation of physical capital, human capital, and knowledge, all of which depend on individuals' ability to reap the benefits of their efforts. Tax and regulatory policies directly influence these incentives. A planner focused solely on maximising growth would avoid redistributive policies, as they reduce income and wealth differences at the cost of diminishing the incentives to accumulate wealth.

Savings Rate Approach

Keynesian growth models, such as Kaldor (1957), assume that wealthier individuals have a higher marginal propensity to save compared to poorer individuals. This implies that increased income inequality can result in greater aggregate savings, higher accumulation of physical capital, and thereby economic growth. This viewpoint is also supported by classical economic theory. While increased division of labour does raise productivity, savings govern capital accumulation, which ultimately drives production growth (Smith, 1776). However, the Kaldor model requires the assumption that workers consume the entirety of their income, and leave behind no savings. It implies that aggregate savings would be greater if wealth accrued to those who saved – in this model, to the capitalists (Mendes, 2013).

The idea that income inequality can lead to higher aggregate savings is considered conventional wisdom and justified by the fact that individuals with higher incomes can save more of their excess income, after fulfilling their consumption needs. These higher savings can then be utilised for investments that spur economic growth. Therefore, it must be assumed that the savings curve is not linear but rather convex, as greater income inequality results in greater capital intensity through higher aggregate savings which in turn promotes income inequality.

Further, certain investments may only provide impactful returns after substantial set-up costs have been incurred, such as in the case of education (Barro, 1997). Therefore, it follows that an unequal economy would facilitate greater growth as opposed to an economy with an unconcentrated share of wealth. This is also corroborated by the neoclassical Solow growth model, wherein higher rates of saving lead to higher steady-state capital stock and output, thereby benefiting economic growth in the long run (Solow, 1956). This idea has similarly been explored extensively within endogenous growth models such as the Harrod-Domar model (Hagemann, 2009).

Credit Market Imperfections Approach

Theoretical analysis suggests that credit market imperfections may explain a short-term positive relationship between inequality and economic growth. Credit market imperfections often result from asymmetric information and weak legal institutions. Limited access to credit means that investment opportunities are often dependent on an individual's existing assets and income levels. In this context, poor households may forgo high-return human capital investments due to an inability to borrow in imperfect markets. Wealthier households accumulate human capital, seen as complementary to physical capital leading to them enjoying high positive returns on physical capital investments, which can dominate economic growth in the short term (Majeed, 2010).

The savings rate approach places emphasis on the effect of income inequality on savings rates and physical capital accumulation. In contrast, the credit market imperfections approach, as outlined by Galor & Zeira (1993), focuses on how inequality affects human capital development. As economies advance, economic growth evolves from being driven primarily by physical capital to incorporating both physical and human capital. This is considered to have two distinct 'phases' (Galor & Moav, 2004). The first of these phases is characterised as being in the early stage of economic development, with limited aggregate physical capital and lower returns on human capital. There is a significant split between the poor and the wealthy, with the former consuming their entire income without leaving room for savings, and being stuck in a poverty trap. With economic progress, the accumulation of physical capital by the wealthy raises the returns on human capital, encouraging its development. In this transition phase, measurements of income inequality will appear to be spurring growth.

Ultimately, both types of capital are crucial for economic growth. In order to maximise returns on human capital (due to its diminishing nature), widespread investment is needed. Beyond the initial phase, a more equitable income distribution is essential for optimal human capital investment. As incomes rise, credit becomes less constrained, and the impact of inequality on growth may actually diminish, perhaps even becoming negative.

Empirical Evidence

Numerous empirical studies have explored the relationship between income inequality and economic growth, some yielding results of a positive relationship.

Partridge (1997, 2005) investigated whether inequality benefited or hindered growth in the United States from 1960 to 1990. Using Ordinary Least Squares (OLS) analysis, Partridge found that states with higher levels of inequality experienced faster economic growth. Additionally, the study suggested that the well-being of the median voter positively impacted growth, indicating that an unequal distribution of income and resources spurred economic activity and, consequently, economic growth.

Frank (2009) further investigated economic development and the concentration of income at the top of the distribution, using comprehensive state-level panel data from the United States for the post-war period of 1945 to 2004. His analysis showed that the share of income held by the top decile remained stable post-World War II, but saw significant increases during the 1980s and 1990s. His findings suggested a long-run positive relationship between inequality and growth, largely driven by income concentration at the upper end of the distribution.

In a different context, Bhorat & Van der Westhuizen (2009) examined the relationship between economic growth, poverty, and inequality in South Africa from 1995 to 2005. Employing a distribution-neutral measure, poverty inequality elasticity estimates, and the marginal proportional rate of substitution, they discovered that periods of economic growth were accompanied by shifts in the income distribution towards increased inequality. This finding aligns with observations in other studies that growth can exacerbate income disparities.

Shahbaz (2010) and Majeed (2016) focused on Pakistan, utilising an Autoregressive Distributed Lag (ARDL) model to analyse the income inequality-growth relationship between 1971–2005 and 1975–2013, respectively. Both studies identified a positive correlation between income inequality and economic growth. Majeed (2016) further argued that the

lack of participation by the poor in the growth process renders growth unsustainable.

Expanding the scope of the research question, Li & Zou (1998) re-examined the inequality-growth relationship from 1947–1994 across a mix of developed and developing countries. Utilising fixed-effects and random-effects methods, their study found that higher income inequality was associated with increased economic growth. Forbes (2000) extended this analysis to 45 countries from 1966–1995, employing Chamberlain's π matrix procedure and Arellano & Bond's Generalised Method of Moments (GMM). Forbes (2000) found that, in the short to medium term, increased income inequality positively correlates with economic growth.

Scholl & Klasen (2019) re-explored the inequality-growth relationship with a particular focus on post-Soviet transition countries. Using a sample of 122 countries from 1961–2012 and applying FE, GMM, and Instrumental Variables (IV) estimation techniques, they found a positive association between inequality and growth, driven primarily by transition economies.

2.2 Negative Effect of Inequality on Growth

This section will examine theoretical explanations in addition to empirical evidence on how economic inequality negatively affects economic growth.

Capital and Credit Market Imperfections

Economic inequality can sometimes undermine economic growth in various ways. One concern is that rather than contributing to productive activities, wealthy individuals often invest in assets that don't generate broader economic benefits and are unproductive, such as real estate and luxury goods, therefore undermining Kaldor's hypothesis. This trend has been more pronounced since the 2007-08 financial crisis, leading to inflated asset prices and potentially creating more bubbles rather than fostering job creation or enhancing productivity (Stiglitz, 2016).

Another factor is the role of imperfect capital markets. These markets, characterised by issues like asymmetric information and weak legal systems (Piketty, 1997), can worsen the impact of inequality on growth. For instance, Galor and Zeira (1993) argue that when economic inequality hampers equitable access to education, it leads to suboptimal investments in human capital. This, in turn, stifles economic growth by failing to fully leverage the potential of the workforce.

Banerjee & Newman (1993) explored how income inequality negatively affects economic growth through imperfections in credit markets. Their findings suggest that while short-term effects of inequality might lead to some positive growth, in the long run, greater income disparity typically undermines economic growth. This occurs because the poor often cannot provide sufficient collateral to secure loans, limiting their opportunities for high quality education and entrepreneurial activities. Consequently, nations with high levels of poverty or unequal wealth distribution fail to fully harness their economic potential compared to countries with more balanced wealth distribution.

Further research links wealth inequality and inefficient credit markets to diminished economic growth. Entrepreneurs who lack personal capital or access to credit are less likely to invest, leading to overall slower growth (Blanchflower & Oswald, 1998). Imperfect credit markets, often characterised by asymmetric information and rationing, exacerbate this problem. Theoretical models often assume that while wealth is visible to lenders, entrepreneurial ability is not. These models suggest that wealth is used as a screening tool, resulting in suboptimal investment levels for capable but less wealthy entrepreneurs (Coco, 2000). For instance, Coco & Pignatoro (2010) propose that talented yet poorer entrepreneurs may be sidelined compared to wealthier, less competent individuals. Their model indicates that banks' inability to fully observe wealth and the increased risk tolerance of wealthier individuals contribute to less efficient investment and growth. They put forward the argument that targeting lower-wealth individuals for credit could lead to a more effective allocation of resources and enhanced economic growth.

Inefficient Government Policy Response

Critics argue that both governments and the private financial sector, in aims of curtailing inequality, have contributed to unsustainable credit growth, which exacerbates poverty. For example, Raghuram (2009) notes that the US government's efforts to ease credit access for poorer households, aiming to increase homeownership, led to greater household debt. This expansion of credit can negatively impact future consumption and economic growth.

Persson & Tabellini (1994) supports a related perspective, arguing that the adverse impact of inequality on economic growth is indirect. They assert that high levels of inequality result in tax and regulatory policies that hinder growth. Their model suggests that since economic growth relies heavily on the accumulation of physical capital, human capital, and knowledge for production, if skewed distribution of wealth leads to redistributive policies, then they can be detrimental to economic growth.

The political-economy model discussed in Alesina & Rodrik (1994) indicates that preferences for redistribution vary based on individuals' capital and labour ownership. Since capital taxation is believed to adversely affect growth, those who earn from capital tend to favour lower taxes to boost growth, whereas those who earn from labour support higher taxes, which reduce growth. Therefore, a more equitable distribution of capital would result in a median voter with higher capital ownership, leading to lower capital taxes and enhanced growth in contrast to concentrated ownership of capital.

Social and Institutional Instability

One significant mechanism through which inequality negatively affects economic growth is the social and political unrest that can accompany pronounced inequality. In societies where wealth is concentrated among a few, the less privileged may resort to crime, riots, and other disruptive activities as a form of protest or survival (Benhabib & Rustichini, 1996). These disruptions divert resources from productive activities to security measures and can undermine the stability of political institutions, deterring investment and economic progress. Conversely, efforts to reduce socio-political unrest

through redistributive policies, such as transfers from the rich to the poor, can create safety nets, restore trust in government, and ultimately foster investment and growth.

Income inequality can also undermine growth through its impact on institutions. Strong institutions are crucial for long-term economic growth and development, as they ensure efficient resource distribution and create a stable environment for economic activities. High inequality can lead to the development of poor institutions that exacerbate inequality and inefficiency, resulting in low growth rates. Political decisions in such contexts often favour the wealthy minority, leading to poor policies, resource wastage, social dissatisfaction, and political instability. Conversely, good institutions are associated with lower inequality, higher productivity, and robust economic growth.

Further, phenomena such as the "Hello magazine effect" highlights how media visibility of the affluent lifestyle drives the less wealthy to emulate similar consumption patterns, leading to "trickle-down consumption" (OECD, 2008). This phenomenon can exacerbate economic instability, and deter growth, as it encourages debt accumulation and shifts social norms regarding acceptable levels of personal debt.

Empirical Evidence

Extensive empirical research has also, in some instances, identified a negative relationship between income inequality and economic growth.

Alesina & Rodrik (1994) and Persson & Tabellini (1994) estimated convergence equations with income inequality as an explanatory variable. Despite data limitations, their analyses showed that higher inequality in 1960 negatively affected the average growth rate of per capita income over the subsequent three decades (1960-1990). The former study tested a theoretical model linking greater inequality with higher redistribution, which they hypothesised to be harmful to growth. Their findings indicated that higher economic inequality in income and land ownership was correlated with lower subsequent economic growth. Similarly, Persson & Tabellini (1994) identified a negative impact of inequality on growth in 56 countries over the same period, corroborating the results, and showed that greater inequality led to lower economic growth due to tax and regulatory policies.

Several multi-country studies provided additional evidence. Malinen (2011) used panel dynamic OLS and panel dynamic Seemingly Unrelated Regression (SUR) on a sample of 60 countries, demonstrating a negative steady-state correlation between income distribution and economic development, particularly in developed countries.

Cingano (2014) focused on OECD countries from 1980 to 2012, using GMM to show that income inequality negatively affected growth, with human capital as the transmission channel. Dabla-Norris et al. (2015) provided cross-country evidence that an increase in the income share of the top quintile group led to a decline in GDP growth over the medium term. They emphasised that higher income shares for the poor and middle class boost growth due to higher marginal propensities to consume, enhancing aggregate demand.

Furthermore, recent research by Breunig & Majeed (2020) investigated the impact of inequality on growth in 152 countries from 1956 to 2011 using GMM. They found that inequality had a negative effect on growth, particularly in countries with high rates of poverty.

The IMF studies by Berg & Ostry (2011) and Ostry, Berg, & Tsangarides (2014) highlighted that lower inequality helps sustain growth. They found that a rise in inequality increases the risk of a growth spell ending. Berg, Ostry, & Zettelmeyer (2012) also concluded that equality promotes and sustains growth, and that redistribution is generally benign unless it is extensive. Their findings suggest that lower inequality correlates with faster and more durable growth, potentially by reducing social unrest and political instability.

2.3 Explanations Accounting for Both Positive and Negative Relationships

Certain theories propose explanations for both a positive and a negative relationship between income inequality and economic growth. Some theories additionally suggest a non-linear relationship, wherein the impact of inequality on growth varies at different levels of inequality and stages of economic development.

Empirical research on the relationship between income inequality and economic growth began in 1955 when Simon Kuznets published his seminal study. Kuznets utilised data from the USA, Germany, and Britain to hypothesise that income inequality initially increases during the early stages of economic development, but decreases as development progresses. This relationship is often depicted as an inverted U-shape, known as the Kuznets curve (Figure 1).

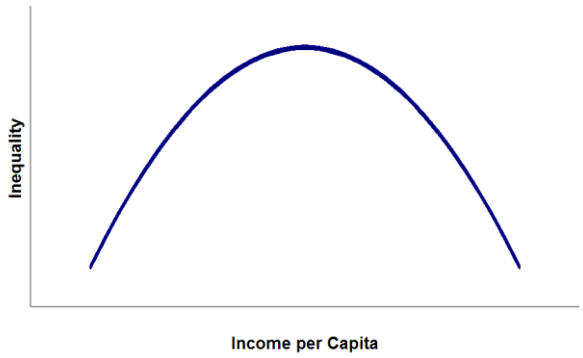

Figure 1: The Kuznets Inequality Curve
Note. From *Kuznets curve* [Photograph], by en:User:Princess Tiswas, Wikimedia Commons (https://commons.wikimedia.org/wiki/File:Kuznets_curve.png). CC BY-SA 3.0.

Kuznets (1955) argued that in the early development stage, labour shifts from the low-productivity agricultural sector to the more productive industrial sector, causing income inequality to rise. As the economy continues to develop, further labour shifts and agricultural modernization lead to increased agricultural productivity and a decline in income inequality. This inverted U-hypothesis suggests that inequality tends to increase during the early stages of economic development and decrease during later stages.

Cornia, Addison, & Kiitsi (2003) suggest that the relationship between economic growth and economic inequality might be concave. Inequality that is 'too low' or 'too high' can be detrimental to growth, but between these extremes exists a growth-maximising range, which varies across countries. Their econometric tests use data for 73 countries from 1980 to 1998 to show that a quadratic function fits the data better than a linear function, and they uncover a statistically significant concave relationship. This implies that countries experiencing an increase in inequality are likely to experience a slowdown in economic growth.

Galor & Moav (2004) propose a unified growth model that posits that the impact of income inequality on economic growth changes according to the level of a country's development. In the early stages of development, inequality promotes growth because returns on physical capital are greater than those on human capital. As development progresses, the importance of human capital increases, and inequality begins to hinder growth due to credit constraints. In advanced stages of development, credit constraints are eliminated, making the distribution of income less consequential for growth.

Empirical Evidence

Barro (2000) conducted a comprehensive analysis, using data from 84 countries sourced from the Deininger and Squire (1996) dataset. His study revealed that the relationship between income inequality and economic growth is sensitive to the choice of countries included in the sample. Specifically, in transition economies, there is robust evidence indicating that income inequality has a statistically significant negative effect on growth. Barro's results, which have since been found to be consistent across various data sources and estimation methods, also highlighted that the relationship varies depending on the level of economic development.

Early empirical studies of the Kuznets hypothesis, such as those by Paukert (1973) and Ahluwalia (1976), corroborated the existence of the inverted U-shaped relationship between income inequality and economic development. Contrastingly, Gallup (2012), using panel data from 87 countries, did not confirm the Kuznets hypothesis and instead identified an empirical anti-Kuznets curve, which suggests a U-shaped relationship between income inequality and economic growth.

2.4 Non-Relationship Between Inequality and Growth

Several studies have examined the relationship between income inequality and economic growth, with mixed findings that suggest a lack of a strong or significant connection.

Deininger & Squire (1996) conducted a comprehensive analysis using data from 108 countries covering the period from 1960 to 1974. Their study found no systematic connection between economic growth and changes in aggregate inequality. Specifically, their results indicated that periods of economic growth were associated with increased inequality in 43 instances and decreased inequality in 45 instances. Similarly, economic declines were associated with increased inequality in five cases and decreased inequality in two. The lack of a significant relationship was consistent across various sub-samples, categorised by factors such as economic development level and growth rate, suggesting that aggregate inequality does not have a strong, predictable effect on economic growth.

Niyimbanira (2017) further explored the impact of economic growth on income inequality in South Africa from 1996 to 2014. Using fixed effects and pooled regression models, Niyimbanira found that while economic growth led to poverty reduction, it did not significantly affect income inequality. This suggests that, at least in the context of South Africa, economic growth and income inequality do not exhibit a clear relationship. Benos & Karagiannis (2018) also investigated the effect of top income inequality on growth in the United States, employing 2SLS and GMM techniques on state-level data from 1929 to 2013. Their findings similarly indicated that changes in income inequality did not significantly impact economic growth, reinforcing the idea that the relationship between these variables might be negligible.

2.5 Literature Gaps and Contribution

Despite extensive research on the relationship between income inequality and economic growth, there remains a lack of consensus in both the theoretical and empirical literature. Theoretical perspectives diverge, with some arguing that inequality fosters growth by incentivizing innovation and investment (Kaldor, 1957), while others contend that it hinders growth by limiting access to opportunities and fostering social unrest (Galor and Zeira, 1993). Empirical studies similarly produce mixed results, with some identifying a positive correlation between inequality and growth, particularly in developed economies, while others find a negative or non-linear relationship.

While there have been several cross-country panel analyses in the past, this study stands out by utilising a dataset with improved Gini coefficient measures and applying a methodical approach that includes both time and country fixed effects. This study hypothesises that the impact of inequality on growth may vary depending on a country's level of development, with more developed economies possibly experiencing different effects compared to less developed ones.

3. Data

3.1 Data Collection and Processing

The dataset used for this study consists of three variables, at the country-level: real GDP per capita growth, real GDP per capita, and the Gini coefficient (EHII 2.1). Real GDP per capita growth, sourced from the World Bank's World Development Indicators (WDI), is used to measure economic growth because it reflects the increase in economic output on a per-person basis, capturing average improvements in living standards. Real GDP per capita, also from the WDI, serves as a control variable, and is used as a proxy for a country's level of economic development.

Many previous studies examining the relationship between income inequality and economic growth have utilised the Gini index constructed by Deininger & Squire (1996). This index has been widely adopted due to its perceived high quality.

However, Atkinson & Brandolini (2001) highlighted that Deininger & Squire's dataset comprises multiple sources, which can lead to misleading results when these disparate datasets are treated as a continuous series. The lack of comparability, both between country-specific datasets and across time, within Deininger & Squire (1996)'s compilation poses significant challenges for statistical analysis.

This study will utilise Galbraith & Kum (2005)'s Estimated Household Income Inequality dataset (EHII 2.1) for the Gini coefficient. This particular dataset utilises the Deininger & Squire (1996) index as a base, creating an alternative measure of inequality whilst addressing the aforementioned problems. This was done by regressing the Gini coefficients on a variety of explanatory variables, such as various income measures from the Deininger & Squire dataset, measures of pay dispersion in the manufacturing sector, and the manufacturing share of the population. Further, the dataset is expanded (containing 3000 high-quality estimates as opposed to 700), allowing for more observations, and therefore greater statistical power in the analysis of income inequality.

The dataset used in this study originally contained yearly observations spanning 1963 to 2015. However, due to the presence of numerous missing observations across various countries, and in order to increase the robustness of the analysis, the years were grouped into three-year intervals (e.g. 1963-65, 1966-68, etc.), and the average values for each variable within these intervals were calculated. This resulted in observations for 18 time periods, each three years long, spanning from 1963 to 2015. The advantage of this averaging approach is that it significantly reduces the number of missing observations, and reduces the noise from yearly fluctuations of GDP. Despite the averaging procedure though, there were still some countries which had observations in fewer than four time periods; these were excluded from the analysis, to ensure the results are not over-dependent on a small number of observations. This was the only sample selection criteria; the final data consists of 124 countries over 18 time periods.

3.2 Methodology

In this panel data study, the estimation strategy used to identify the correlation between income inequality and economic growth is Ordinary Least Squares (OLS). OLS is used to estimate the relationships between variables by minimising the sum of the squared differences between observed and predicted values.

To ensure consistent estimation of standard errors for the OLS estimates, clustered standard errors are employed. Clustering the standard errors by country allows for the possibility that observations for the same country might be correlated over time. This adjustment provides more reliable inference, by accounting for within-country correlations of the growth rate of real GDP per capita, thus avoiding the underestimation of standard errors that could lead to overconfident statistical conclusions.

In what follows, I discuss the four panel-data models used to estimate the correlation between inequality and growth.

Equation (1) is a pooled regression model, used to test the overall correlation between income inequality and GDP growth in the data.

$$GDP\ Growth_{it} = \alpha_1 + \beta_1 Gini\ Coefficient_{it} + \epsilon_{it} \quad \textbf{(1)}$$

In this model, $GDP\ Growth_{it}$ represents the growth rate of real GDP per capita, and $Gini\ Coefficient_{it}$ captures the level of income inequality, for country i at time t. In Equation (1), α_1 represents the intercept, while the coefficient β_1 measures the direct relationship between the two variables, indicating whether income inequality is associated with higher or lower GDP growth, without controlling for any other factors. This model will serve as a baseline for the more involved models that follow.

Given that a country's level of development has been demonstrated to influence the relationship between inequality and growth (Kuznets, 1955; Galor and Moav, 2004), the second regression model builds upon the first by controlling for the logarithm of real GDP per capita:

$$GDP\ Growth_{it} = \alpha_2 + \beta_2 Gini\ Coefficient_{it} + \gamma_2 Log(GDP\ per\ capita_{it}) + \varepsilon_{it} \quad \textbf{(2)}$$

The coefficient, β_2, now measures the association of income inequality with economic growth, after accounting for development. The log of GDP per capita is used to make it easier to compare and interpret changes of this variable over time by converting exponential growth into a linear relationship, as well as to attenuate potential noise that would be included if GDP per capita were included in levels.

To further explore how the relationship between inequality and growth might differ across countries at various stages of development, the next stage of the analysis will be to split the data into quartiles based on GDP per capita. Separate OLS regressions are then estimated for each quartile, allowing the analysis to compare the effects of inequality on growth across different economic contexts. This approach recognizes that the inequality-growth dynamic may not be uniform; for instance, the impact of inequality might be more pronounced in low-income countries compared to high-income ones. By stratifying the sample, the analysis can identify any differential effects that might otherwise be obscured in a pooled sample.

One potential concern with the approach so far is that none of the aforementioned modelling approaches explicitly account for unobserved heterogeneity across countries, which could plausibly influence the relationship between inequality and growth. Thus, as a robustness check, country-fixed effects are included to control for these time-invariant factors. This controls for differences between countries that do not change over time, for instance cultural behaviour or institutional strength, providing a stronger estimate of the effects of inequality on growth. The fixed effects model used is:

$$GDP\ Growth_{it} = \alpha_3 + \beta_3 Gini\ Coefficient_{it} + \gamma_3 Log(GDP\ per\ capita_{it}) + \theta_i + \varepsilon_{it} \quad \textbf{(3)}$$

Here, θ_i represents the country-specific fixed effects. The objective is to test whether β_2 is robust to unobserved cross-country heterogeneity, which would imply it is similar to β_3.

Finally, to further probe the robustness of β_2, a model with time-fixed effects (but no country-fixed effects) will be introduced. This addresses the possibility that global shocks or trends, which affect all countries simultaneously, might have an effect on the observed relationship by acting as extraneous variables. A model with time fixed effects would isolate the effect of inequality on growth from other time-varying external influences, and is expressed as:

$$GDP\ Growth_{it} = \alpha_4 + \beta_4 Gini\ Coefficient_{it} + \gamma_4 Log(GDP\ per\ capita_{it}) + \delta_t + \varepsilon_{it} \quad \textbf{(4)}$$

Here, δ_t represents the time-specific fixed effects. Note, it is not possible to identify a correlation between inequality and growth with both country-fixed and time-fixed effects, since the data only contains 1 observation per country and time period.

The software *R* (Version 4.3.1) was used for conducting the analysis, with the *Estimatr* package employed for OLS regressions, and additionally the *Lfe* package for fixed effects regressions.

3.3 Results

Table 1: General Impact of Inequality on Growth and Accounting for Development

	GDP Growth	GDP Growth
Gini Coefficient	-0.0768** (0.0369)	-0.1602*** (0.0427)
Log (GDP per capita)	-	-0.0073*** (0.0017)
Constant	0.1040*** (0.0154)	0.1980*** (0.0282)
Adjusted R^2	0.0018	0.0116
Observations	1312	1312

Standard errors of the parameter estimates are presented in parentheses, with standard errors clustered by country to account for intra-country correlation.
** p < 0.1, ** p < 0.05, *** p < 0.01.*

The first column in Table 1 displays the estimated Equation (1). The coefficient on the Gini coefficient is -0.077, with a standard error of 0.037. This indicates that a 0.1 increase in the Gini Coefficient (whose scale ranges from 0 to 1) is associated with a 0.008 percentage point decrease in GDP growth. Especially in recent years, this magnitude of decrease in GDP growth is sizable, with 494 observations having a GDP growth lower than 0.8%. This association is statistically significant at the 5% level.

The adjusted R^2 is a measure of a model's explanatory power, adjusting for the number of predictors in the model. Unlike the regular R^2 measure, which can increase simply by adding more variables, the adjusted R^2 penalises the addition of unnecessary control variables. Here, the adjusted R^2 is 0.0018, indicating that the model explains only 0.18% of the variation in real GDP per capita growth. This suggests that other factors besides income inequality are influencing GDP growth.

The second column in Table 1 reports estimation results for Equation (2), which builds upon the first regression by introducing a second predictor variable, the level of development, measured by the natural logarithm of GDP per capita. In this regression, the coefficient on the Gini coefficient becomes more negative at -0.160, with a standard error of 0.043. This indicates that, when accounting for the level of development, the negative correlation between inequality and GDP growth is more pronounced. A 0.1 increase in the Gini coefficient is now associated with a 0.016 percentage point decrease in GDP growth, which is twice the effect observed in the simple pooled model. This association is statistically significant at the 1% level.

The coefficient on log GDP per capita is negative and statistically significant at the same significance level as well, indicating that countries with higher levels of development tend to experience slower GDP growth, which aligns with the idea of diminishing returns to growth as countries become wealthier (Galor & Moav, 2004). The adjusted R^2 value increases to 0.0116, showing that this model better explains the variation in GDP growth compared to the simple pooled regression.

Table 2: Regressions Split by Quartiles Based on GDP per capita

	GDP Growth	GDP Growth	GDP Growth	GDP Growth
Quartile	1	2	3	4
Gini Coefficient	-0.0629 (0.1861)	-0.1631 (0.1032)	-0.1611** (0.0731)	-0.1480*** (0.0423)
Log (GDP per capita)	0.0144 (0.0116)	0.0071 (0.0187)	0.0111 (0.0147)	-0.0232*** (0.0053)
Constant	0.0204 (0.1192)	0.0989 (0.1549)	0.0624 (0.1304)	0.3429*** (0.0593)
Adjusted R^2	-0.0032	0.0055	0.006	0.0346
Observations	494	493	493	493

Standard errors of the parameter estimates are presented in parentheses, with standard errors clustered by country to account for intra-country correlation.
** p < 0.1, ** p < 0.05, *** p < 0.01.*

Table 2 reports the relationship between income inequality and GDP growth across different levels of development by splitting the sample (of observations, not countries) into quartiles based on GDP per capita.

In the first quartile, representing the least developed countries (and earlier time periods), the coefficient on the Gini coefficient is -0.0629 with a standard error of 0.1861. This indicates a negative, although statistically insignificant, relationship between inequality and GDP growth. The adjusted R^2 is -0.0032, suggesting that the model does not effectively capture the variations in GDP growth in these countries.

Moving to the second quartile, the Gini coefficient becomes more negative at -0.1631, with a standard error of 0.1032. While still statistically insignificant, this larger coefficient starts to imply that as countries develop, the negative association between inequality and growth may become more pronounced. The adjusted R^2 slightly improves to 0.0055, though it remains low.

In the third quartile, where countries are more developed (and in time periods generally overlapping with global economic booms), the relationship between inequality and growth

becomes statistically significant at the 5% level. The Gini coefficient is -0.1611 with a standard error of 0.0731. The adjusted R^2 remains low at 0.0060, indicating that other factors are still likely at play affecting the relationship with GDP growth in these countries.

The most striking results are observed in the fourth quartile, comprising the most developed countries (mostly between 1990 and 2015). Here, the Gini coefficient is -0.1480 with a standard error of 0.0423, and the relationship is statistically significant at the 1% level. A 0.1 increase in inequality is associated with a 0.015 percentage point decrease in GDP growth. The adjusted R^2 is the highest at 0.0346, suggesting that inequality is able to explain a slightly larger portion of the variation in GDP growth in highly developed economies.

These results conclude that the negative relationship between inequality and growth becomes stronger and more statistically significant as countries develop. This could indicate that in more developed economies, inequality may have a more crucial link with economic outcomes.

Table 3: Fixed-Effects Model (Country-Specific and Time-Specific)

	GDP Growth	GDP Growth
Gini Coefficient	-0.0231 (0.1338)	-0.0277 (0.0421)
Log (GDP per capita)	-0.0187*** (0.0030)	0.0015 (0.0026)
Fixed Effects	Country	Time
Adjusted R^2 (Full Model)	0.0157	0.3486
Observations	1195	1293

*Standard errors of the parameter estimates are presented in parentheses, with standard errors clustered by country to account for intra-country correlation. The intercept is not reported due to it being absorbed by the country-specific or time-specific fixed effects. * p < 0.1, ** p < 0.05, *** p < 0.01.*

Table 3 presents the results of the two robustness checks which use fixed-effects models that account for unobserved heterogeneity by controlling for either country-specific or time-specific factors. These models help to isolate the impact of income inequality on GDP growth by accounting for persistent characteristics that could bias the results.

The first column depicts the estimates from Equation (3) and includes country-specific fixed effects, which control for time-invariant characteristics unique to each country. The coefficient on the Gini coefficient is -0.0231 with a standard error of 0.1338. This negative association suggests that higher inequality is associated with lower GDP growth. Notably, this coefficient is less negative than the corresponding coefficient in Equation (2) (-0.1602), indicating that when controlling for country-specific factors, the negative relationship between inequality and growth becomes stronger. However, the result is not statistically significant. The coefficient on the log of GDP per capita is -0.0187 with a standard error of 0.0030, statistically significant at the 1% level. This indicates that higher levels of development are associated with slower GDP growth, consistent with the concept of diminishing returns to economic development. The adjusted R^2 value for this model is 0.0157.

The second column reports the results from the model that includes time-specific fixed effects, Equation (4). The Gini coefficient in this model has a slightly more negative coefficient of -0.0277 with a standard error of 0.0421, but it remains statistically insignificant. The log of GDP per capita is not statistically significant in this model, with a coefficient of 0.0015 and a standard error of 0.0026. The adjusted R^2 value is 0.3486, significantly higher than the country-fixed effects model, suggesting that time-specific factors play a more substantial role in explaining the variation in GDP growth.

While the Gini coefficient consistently shows a negative relationship with GDP growth, the lack of statistical significance suggests that the effect of inequality on growth is not robust across different model specifications.

4. Conclusion

The primary objective of this study was to investigate the relationship between income inequality, as measured by the Gini coefficient, and GDP per capita growth, across a diverse sample of countries and over an extended period of time. The analysis sought to determine whether higher levels of income inequality are associated with lower rates of economic growth, contributing to the broader debate on the economic consequences of inequality.

The findings from this study indicate a negative correlation between income inequality and GDP per capita growth. Specifically, the results suggest that an increase in the Gini coefficient is generally associated with a decrease in GDP per capita growth, with the strength of this relationship becoming more pronounced when controlling for the level of development. To further investigate this, the analysis split observations into quartiles based on GDP per capita. This revealed that the negative relationship between income inequality and GDP growth is most pronounced in countries and time periods where there are higher levels of economic development. Specifically, the third and fourth quartiles of observations exhibit statistically significant negative coefficients for the Gini coefficient, suggesting that the adverse effects of inequality on growth might be more substantial in contexts with higher levels of economic development. This is possible because, in advanced economies, inequality can more severely limit economic opportunities and efficiency, exacerbating the challenges to growth as these economies reach higher levels of development.

The inclusion of fixed effects, which control for unobserved heterogeneity across countries and time periods, show that while income inequality appears to negatively impact GDP growth, this effect is not statistically significant once we account for country-specific or time-specific factors. This means that the observed relationship may be influenced by other factors not captured in the models. A fruitful avenue for future research would be to empirically investigate which country-specific and time-specific factors these may be.

The findings in this paper have important implications for economic policy. The negative correlation between income inequality and GDP growth suggests that policies aimed at reducing inequality may not only address social justice concerns, but also contribute to higher and more sustainable economic growth. This is particularly relevant for more

developed economies, where the marginal returns to growth from higher inequality appear to be outweighed by its negative effects. However, the study's correlational nature implies that while a relationship between inequality and growth has been observed, the direction of causality cannot be definitively determined. This bidirectional ambiguity means that while reducing inequality could foster economic growth, it is also possible that it is slower growth that exacerbates inequality.

Despite its contributions, this study has a few limitations. Most notably, the use of a correlational design means that causal inferences cannot be drawn from the results. Additionally, the study's reliance on the Gini coefficient as a measure of inequality, while common in the literature, may not capture all dimensions of income inequality, such as wealth distribution or access to opportunities. Replicating the analysis in this paper using alternative measures of inequality could provide a more comprehensive understanding of the inequality-growth nexus.

In conclusion, while this study adds to the growing body of evidence suggesting that income inequality may hinder economic growth, particularly in developed countries, it also highlights the need for further research to explore the underlying mechanisms and causal pathways. Policymakers should consider the potential economic benefits of reducing income inequality, but they should also be cautious in interpreting these results, given the aforementioned limitations. Future research could build on these findings by exploring potential causal mechanisms in addition to the potential for policy interventions to mitigate the adverse effects of inequality on economic performance.

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References

[1] Ahluwalia, M. S. (1976). Inequality, poverty and development. Journal of development economics, 3(4), 307-342.
[2] Alesina, A., & Rodrik, D. (1994). Distributive politics and economic growth. The quarterly journal of economics, 109(2), 465-490.
[3] Atkinson, A. B., & Brandolini, A. (2001). Promise and pitfalls in the use of "secondary" data-sets: Income inequality in OECD countries as a case study. Journal of economic literature, 39(3), 771-799.
[4] Banerjee, A. V., & Newman, A. F. (1993). Occupational choice and the process of development. Journal of political economy, 101(2), 274-298.
[5] Barro, R. J. (1997). Macroeconomics. MIT Press.
[6] Barro, R. J. (2000). Inequality and Growth in a Panel of Countries. Journal of economic growth, 5, 5-32.
[7] Benhabib, J., & Rustichini, A. (1996). Social conflict and growth. Journal of Economic growth, 1, 125-142.
[8] Benos, N., & Karagiannis, S. (2018). Inequality and growth in the united states: Why physical and human capital matter. Economic inquiry, 56(1), 572-619.
[9] Berg, A., Ostry, J. D., & Zettelmeyer, J. (2012). What makes growth sustained?. Journal of Development Economics, 98(2), 149-166.
[10] Berg, A. G., & Ostry, J. D. (2011). Inequality and unsustainable growth: two sides of the same coin?. IMF Economic Review, 65, 792-815.
[11] Bhorat, H., Van der Westhuizen, C., & Jacobs, T. (2009). Income and non-income inequality in post-apartheid South Africa: What are the drivers and possible policy interventions?. Development Policy Research Unit DPRU Working Paper, (09/138).
[12] Blair, G., Cooper, J., Coppock, A., Humphreys, M., Sonnet, L. (2024) .estimatr: Fast Estimators for Design-Based Inference. R package version 1.0.2, https://declaredesign.org/r/estimatr/.
[13] Blanchflower, D. G., & Oswald, A. J. (1998). Entrepreneurship and the youth labour market problem: a report for the OECD. Report to OECD, Paris. November.
[14] Breunig, R., & Majeed, O. (2020). Inequality, poverty and economic growth. International Economics, 161, 83-99.
[15] Cingano, F. (2014). Trends in Income Inequality and Its Impact on Economic Growth.
[16] Coco, G., & Pignataro, G. (2010). Inequality of opportunity in the credit market (No. 2010/5). University of Catania, Department of Economics and Quantitative Methods.
[17] Coco, G. (2000). On the use of collateral. Journal of Economic Surveys, 14(2), 191-214.
[18] Cornia, G. A., Addison, T., & Kiiski, S. (2003). Income distribution changes and their impact in the post-World War II period. United Nations University, World Institute for Development Economics Research.
[19] Dabla-Norris, M. E., Kochhar, M. K., Suphaphiphat, M. N., Ricka, M. F., & Tsounta, M. E. (2015). Causes and consequences of income inequality: A global perspective. International Monetary Fund.
[20] Deininger, K., & Squire, L. (1996). A new data set measuring income inequality. The World Bank Economic Review, 10(3), 565-591.
[21] Forbes, K. J. (2000). A reassessment of the relationship between inequality and growth. American economic review, 90(4), 869-887.
[22] Frank, M. W. (2009). Inequality and growth in the United States: Evidence from a new state-level panel of income inequality measures. Economic Inquiry, 47(1), 55-68.
[23] Galbraith, J. K., & Kum, H. (2005). Estimating the inequality of household incomes: a statistical approach to the creation of a dense and consistent global data set. Review of Income and Wealth, 51(1), 115-143.
[24] Gallup, J. L. (2012). Is there a Kuznets curve. Portland State University, 1, 1-28.
[25] Galor, O., & Moav, O. (2004). From physical to human capital accumulation: Inequality and the process of development. The review of economic studies, 71(4), 1001-1026.
[26] Galor, O., & Moav, O. (2004). From physical to human capital accumulation: Inequality and the process of development. The review of economic studies, 71(4), 1001-1026.

[27] Galor, O., & Zeira, J. (1993). Income distribution and macroeconomics. The review of economic studies, 60(1), 35-52.
[28] Gaure, S. (2024). lfe: Linear Group Fixed Effects. R package version 3.0-0, 2024, https://CRAN.R-project.org/package=lfe.
[29] Hagemann, H. (2009). Solow's 1956 contribution in the context of the Harrod-Domar model. History of Political Economy, 41(Suppl_1), 67-87.
[30] Kaldor, N. (1957). A model of economic growth. The economic journal, 67(268), 591-624.
[31] Kuznets, S. (1955). International differences in capital formation and financing. In Capital formation and economic growth (pp. 19-111). Princeton University Press.
[32] Kuznets curve. Wikimedia Commons. (2007, May 2). https://commons.wikimedia.org/wiki/File:Kuznets_curve.png
[33] Li, H., & Zou, H. F. (1998). Income inequality is not harmful for growth: theory and evidence. Review of development economics, 2(3), 318-334.
[34] Majeed, M. T. (2010). Inequality, trade openness and economic growth in Asia.
[35] Majeed, M. T. (2016). Economic growth, inequality and trade in developing countries. International Journal of Development Issues, 15(3), 240-253.
[36] Malinen, T. (2011). Income inequality in the process of economic development: an empirical approach. Research Reports Kansantaloustieteen tutkimuksia, (125).
[37] McKnight, A. (2019, July). Understanding the relationship between poverty, inequality ... https://sticerd.lse.ac.uk/dps/case/cp/casepaper216.pdf
[38] Mdingi, K., & Ho, S. Y. (2021). Literature review on income inequality and economic growth. MethodsX, 8, 101402.
[39] Mendes, M. (2013). Inequality and Growth: an overview of the theory. Núcleo de Estudos e Pesquisas da Consultoria Legislativa.
[40] Niyimbanira, F. (2017). Analysis of the impact of economic growth on income inequality and poverty in South Africa: The case of Mpumalanga Province. International Journal of Economics and Financial Issues, 7(4), 254-261.
[41] OECD. (2008). Growing unequal?: Income distribution and poverty in OECD countries. OECD, Organisation for Economic Co-operation and Development.
[42] Ostry, M. J. D., Berg, M. A., & Tsangarides, M. C. G. (2014). Redistribution, inequality, and growth. International Monetary Fund.
[43] Partridge, M. D. (1997). Is inequality harmful for growth? Comment. The American Economic Review, 87(5), 1019-1032.
[44] Partridge, M. D. (2005). Does income distribution affect US state economic growth?. Journal of Regional Science, 45(2), 363-394.
[45] Paukert, F. (1973). Income distribution at different levels of development: A survey of evidence. Int'l Lab. Rev., 108, 97.
[46] Persson, T., & Tabellini, G. (1991). Is inequality harmful for growth? Theory and evidence.
[47] Persson, T., & Tabellini, G. (1994). Does centralization increase the size of government?. European Economic Review, 38(3-4), 765-773.
[48] Piketty, T. (1997). The dynamics of the wealth distribution and the interest rate with credit rationing. The Review of Economic Studies, 64(2), 173-189.
[49] Raghuram, S. (2009). Pro-Poor Development in Crisis: Combating economic recession and market fundamentalism. Development, 52(3), 349-355.
[50] R Core Team (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/.
[51] RStudio Team (2019). RStudio: Integrated Development for R. RStudio, Inc., Boston, MA. http://www.rstudio.com/.
[52] Scholl, N., & Klasen, S. (2019). Re-estimating the relationship between inequality and growth. Oxford Economic Papers, 71(4), 824-847.
[53] Shahbaz, M. (2010). Income inequality-economic growth and non-linearity: A case of Pakistan. International Journal of Social Economics, 37(8), 613-636.
[54] Smith, A. (1776). An inquiry into the nature and causes of the wealth of nations: Volume One. London: printed for W. Strahan; and T. Cadell, 1776.
[55] Solow, R. M. (1956). A contribution to the theory of economic growth. The quarterly journal of economics, 70(1), 65-94.
[56] Stiglitz, J. E. (2016). Inequality and economic growth. The Political Quarterly, 86(S1), 134-155.
[57] Topuz, S. G. (2022). The relationship between income inequality and economic growth: are transmission channels effective?. Social Indicators Research, 162(3), 1177-1231.

Appendix A - *R* Code

```
#=======================================
#  Preliminaries: Settings,  packages, and options
#=======================================

### Clear the working space
rm(list=ls())

### Set working directory
getwd() # Check your working directory
setwd("/Users/lakshya/Downloads/GrowthPaper")

list.of.packages = c("estimatr", "dplyr", "writexl", "lfe",
"haven")  # Add packages required for analysis
new.packages = list.of.packages[!(list.of.packages %in%
installed.packages()[,"Package"])]
if(length(new.packages)) install.packages(new.packages)

library(estimatr) # To run regressions
library(dplyr)    # To manipulate data (mutate, group_by)
library(writexl)  # To load excel files
library(haven)    # To load .dta files
library(lfe)    ### For felm()

#=======================================
```

```
#   Cross-Country Analysis
#=======================================


### Load dataset
  df <-
readxl::read_xlsx("Regression.xlsx",col_names=TRUE)

 length(unique(df$Country)) # count distinct number of
countries
 dim(df)   # dim() to get dimensions of the dataframe (rows,
columns)
 nrow(df) # or nrow() to count the number of rows


### Simple OLS Regression - Clusters
 lm_model1 <- lm_robust(GDP_Growth ~ Gini, data=df,
                        clusters = df$Country,
                        se_type = "stata")
 summary(lm_model1)

### OLS Regression - Clusters
  lm_model2 <- lm_robust(GDP_Growth ~ Gini +
log(GDP_Per_Capita), data=df,
                         clusters = df$Country,
                         se_type = "stata")
  summary(lm_model2)


df1 <- df[df$quart_GDP_Per_Capita == 1,]
df1 <- df1[!is.na(df1$quart_GDP_Per_Capita),]

lm_model3 <- lm_robust(GDP_Growth ~ Gini +
log(GDP_Per_Capita), data=df1,
                       clusters = df1$Country,
                       se_type = "stata")
summary(lm_model3)


df4 <- df[df$quart_GDP_Per_Capita == 4,]
df4 <- df4[!is.na(df4$quart_GDP_Per_Capita),]

lm_model4 <- lm_robust(GDP_Growth ~ Gini +
log(GDP_Per_Capita), data=df4,
                       clusters = df4$Country,
                       se_type = "stata")
summary(lm_model4)


df2 <- df[df$quart_GDP_Per_Capita == 2,]
df2 <- df2[!is.na(df2$quart_GDP_Per_Capita),]

lm_model5 <- lm_robust(GDP_Growth ~ Gini +
log(GDP_Per_Capita), data=df2,
                       clusters = df2$Country,
                       se_type = "stata")
summary(lm_model5)


df3 <- df[df$quart_GDP_Per_Capita == 3,]
df3 <- df3[!is.na(df3$quart_GDP_Per_Capita),]

lm_model6 <- lm_robust(GDP_Growth ~ Gini +
log(GDP_Per_Capita), data=df3,
                       clusters = df3$Country,
                       se_type = "stata")
summary(lm_model6)


### Fixed Effects Regression - Clusters
felm_model1 <-felm(GDP_Growth ~ Gini +
log(GDP_Per_Capita)| Country | 0 | Country,
                   data = df, exactDOF=TRUE)
summary(felm_model1)


### Fixed Effects Regression - Clusters
felm_model2 <-felm(GDP_Growth ~ Gini +
log(GDP_Per_Capita)| time | 0 | Country,
                   data = df, exactDOF=TRUE)
summary(felm_model2)


### ****************************************###
### ****************************************###
```