Accountancy Business and the Public Interest
ISSN: 1745-7718

Volume: 40
Issue Number:01

DOES GENDER DEVELOPMENT HELP IN CREATING ECONOMIC MIRACLES

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Abstract

This paper aims to find out the relationship between the Gender Development Index (GDI) of a country and its Gross Domestic Product(GDP). The data from 1996 to 2022 was used to arrive at the conclusion. Fixed effect panel regression which is a Econometric model, Pedroni Residual Cointegration test, VAR model and Wald test were used to find out the results. It was found that long run causality exists between GDI and GDP per capita. One percent improvement in GDI leads to 32% increase in GDP of top ten GDI ranking countries and one percent increase in GDI leads to 5% increase in GDP of last 10 GDI ranking countries. This precisely means that the government of these countries should work on improving various factors which lead to improvement in GDI, such as women's education and health and simultaneously work on the levels of income generated by women in these countries.

Keywords: Gender Development Index, GDP per Capita, Econometrics, Pedroni Residual Cointegration, VAR Model, Wald test Long-Run Causality

INTRODUCTION

Gender equality is the basic human right and a mainspring of a just and prosperous society. It's about ensuring everyone, regardless of their gender, has similar opportunities and access to resources, rights, and participation in all walks of life. This includes education, healthcare, employment, political participation, and more. A mushrooming body of research convincingly demonstrates that gender equality is not merely a moral exigent but also an economic necessity. Nations that champion gender equality consistently enjoy higher economic growth, reduced poverty, and enhanced social well-being. Rather said than done, it's a well known fact that there exists no place where there is ultimate gender equality. Various government institutions and social welfare organizations are striving to develop women to reduce gender incongruence.

The interplay between gender development and economic growth has been meticulously examined for several years. Gender Development Index is a tool designed by United Nations Development Program (UNDP) to measure Gender Equality and a tool that measures the level of gender development in a country. The Gender Development Index (GDI) serves as a measure of determining gender equality, encompassing three critical dimensions: health, education, and economic opportunities. It uses three indicators for each of the three dimensions. For health, it considers female and male life expectancy at birth. For education, it looks at expected years of schooling for girls and boys, as well as mean years of schooling for adult women and men. And for economic opportunity, it takes into account female and male estimated earned income. The GDI It's scaled from 0 to 1. A score of 1 represents perfect gender equality, while 0 represents the most significant gender disparity. (UNDP). The GDI goes beyond simply comparing averages. It takes into account the inequalities between women and men within each of these dimensions. So, a country with a high average life expectancy might still have a low GDI if women's life expectancy is significantly lower than men's. (Stotsky,2006)
Several factors contribute to the likelihood of gender equality fostering economic growth. Firstly, when women are empowered and possess access to education and employment

opportunities, they make a more significant contribution to the economy. Secondly, gender equality can lead to a more efficient allocation of resources, as it mitigates gender-based discrimination and promotes innovation. Thirdly, gender equality can enhance social cohesion and reduce conflict, thereby establishing a more stable environment for economic growth.
The evidence supporting the correlation of gender equality with economic growth is robust and expanding. A World Bank study (2015) revealed that nations that have made progress in bridging the gender gap have experienced higher economic growth. The study estimated that if all countries were to eliminate the gender gap in labor force participation, GDP would increase by an average of 9% globally. According to a study published by IMF in 2020 companies with a higher ratio of women in leadership positions tend to be more profitable and achieve higher returns on investment.
Researchers have demonstrated that Despite the compelling evidence supporting the benefits of gender equality, progress has been sluggish in many countries. A number of factors contribute to gender inequality, including discriminatory laws and policies, societal norms that restrict women's opportunities, and restricted access to education and healthcare for women.

REVIEW OF RELATED LITERATURE

Unraveling the complex web of factors influencing economic growth, and isolating the precise causal role of gender inequality, remains an ongoing struggle despite extensive empirical efforts. The standard approach within the macroeconomic literature employs regression analysis to relate per capita income growth across countries to various measures of gender inequality, such as the Gender Development Index, labor force participation rates, and wage gaps, while controlling for standard growth determinants like population growth, investment levels, trade openness, and institutional quality. Reverse causality poses a particular challenge in examining the role of gender inequality for economic advancement, as the two are intricately linked: development itself can play a crucial role in minimizing gender inequality, and higher gender equality can, in turn, support development.

Furthermore, unobserved factors may simultaneously influence both economic growth and the gender gap. Instrumental variable analysis offers a potential avenue to address these challenges, but identifying a valid instrument that affects growth solely through its impact on gender inequality remains a significant obstacle. The intricate relationship between gender equality and economic growth has long captivated researchers, with numerous studies employing national-level data to explore this complex dynamic. However, a recent study by Ahmed, Amal, and Barata (2020) takes a novel approach, delving into the industry-level nuances of this association. Utilizing data from 142 countries spanning the period 1995-2016, their research offers valuable insights into how gender equality can differentially impact economic growth across diverse industry landscapes. Interestingly, a research by Ashraf and Weil (2002) found that gender inequality can have an adverse impact on economic growth by reducing female work force participation, reducing access to education for women, and increasing fertility rates. The model also suggests that policies that promote gender equality can have a positive impact on economic growth. Also, a report by the World Bank (2015) argues that empowering women is essential for achieving sustainable economic growth. The report reviews the evidence on the relationship between gender inequality and economic growth and discusses the different policy interventions that can be used to empower women. The report also provides a number of case studies of countries that have made progress in empowering women. A the study by Dollar and Gatti (1999) provides strong evidence that gender inequality is a serious constraint to economic growth. A very clear and precise relationship was discovered in a study by Knowles et al.

(2002) which found that a one-year increase in female labor force participation is linked with a 0.2 percent increase in GDP per capita.

Recently, in a research done by Steven Michael in 2022, it was found that the Gender Employment Gap Index if filled up, i.e, if women employment rates are increased, twenty percent GDP is likely to increase. Also, in a research published by Ferrant in 2010, which determined the relationship between gender inequalities and economic growth, using seemingly unrelated regressions, it found that 3.2% of growth deferred between South Asia and East Asia only for the differences in gender inequalities.

Another research conducted by Bertay et al. in 2020 found that gender inequality affects real economic outcomes. They tried discovering that by putting female labour to its productive use, gender inequality should disproportionately benefit industries with normally higher female share in their employment.

Harchand et.al in Febuary 2022, researched another dimension of Human development Index (HDI) called the gender inequalities index, (GII) which measures the inequalities in accomplishments between men and women.The findings suggested that the GII has an inverse relationship with the economic growth of the country, measured by Gross Domestic Product(GDP) per capita.

In a Human Development Research Paper by Amie Gaye, in 2010 the GII measure was used to curtail the Human Development Index, and the results revealed that GII significantly eroded human development achievements in all countries, but with vast variations.

Bhowmik in 2020 tried to investigate the relationship between Gender Development Index and human development Index and GDP of the 12 developed nations of the world. The results concluded that one percent increase in GDI per year leads to 0.114% increase in GDP and 0.0191% increase in HDI per year. A Research by Barsh & Yee, (2012); Cornell CAHRS, (2011) delves into the complex interrelation between gender equality and economic growth, taking a novel approach by focusing on a specific mechanism: the productive allocation of female labor.

Recognizing the varying gender compositions across countries, we exploit this heterogeneity within countries to isolate the causal impact of gender inequality on economic growth. By examining how different countries respond to changes in gender equality, we address the endogeneity concerns inherent in aggregate cross-country studies. Recognizing the varying gender compositions across countries, we exploit this heterogeneity within countries to isolate the causal impact of gender inequality on economic growth. By examining how different countries respond to changes in gender equality, we address the endogeneity concerns inherent in aggregate cross-country studies. We hypothesize that countries with a higher share of female employees will benefit disproportionately from increased gender equality. This benefit can occur through two key mechanisms: first Expanded Talent Pool- Higher gender equality leads to a larger pool of female talent available for recruitment, fostering industry growth (Cuberes & Teignier, 2016; Kochhar et al., 2017). As skilled women enter the workforce, industries with a higher female composition can readily access this talent pool, boosting their productivity and growth. Secondly, Unleashing Full Potential is the mechanism by which Gender equality also allows women to reach their full potential within the workplace, such as through career advancement opportunities (Islam & Amin, 2016). This enhanced productivity of female workers translates to improved industry performance and growth. These effects are expected to be most pronounced in industries with a traditionally high female workforce share. On the extensive margin, a larger proportion of newly-hired women will enter these industries, further expanding the talent pool. On the intensive margin, unlocking the full potential of existing female employees will significantly boost productivity and growth.

By focusing on a specific mechanism within a diverse economic landscape, this research provides valuable insights into the link between gender equality and economic growth. Future studies can build upon this framework by exploring the specific skills and contributions of female workforces in different industries, further elucidating the economic benefits of fostering gender equality across diverse sectors.

RESEARCH METHODOLOGY

This research has made an attempt to find out the relationship between the Gender Development Index and the Gross Domestic Product per capita of selected countries. The Gender Development Index of all countries is calculated, maintained and available on UNDP’s website. For this research, out of all the data available for 195 countries, the data of the top ten countries where the gender development index was highest were taken for analysis. These countries are Latvia, Estonia, Mongolia, Lithuania, Uruguay, Belarus, Ukraine, Barbados, Kazakhstan and Lesotho. Similarly data of the countries where GDI is lowest, was also considered for analysis. These countries are Bangladesh, Togo, India, South Asia, Guinea, Iraq, Central Africa Republic, Niger, Chad and Pakistan. The research analyzed data spanning 26 years, from 1996 to 2022

The main objectives of study are:

1. To measure the impact of Gender Development Index on Gross Domestic Product per capita of selected Countries.
2. To compare the Gross Domestic Product per capita between the top 10 countries where GDI is highest and those 10 countries where Gender Development Index is lowest..

E-views have been used for data analysis. It is software for econometrics and statistics that offers analytical tools. The long-run linkage between Gender Development Index and Gross Domestic Product per capita was explored.

The data was collected and a unit root test was applied using Augmented Dickey Fuller test, . This test is used for checking the stationarity of data. If the data is found stationary, only then, an appropriate analysis can be done.

After the unit root test, the test of cointegration was applied. Cointegration is applied to check whether two or more time series data are integrated in a way that they cannot deviate from equilibrium in the long run. For this purpose, the Kao Residual cointegration test was performed.

Since the data was not found to be cointegrated, panel vector autoregression model and Wald test were used to arrive at the results.

A VAR model plots the changes over time in a set of k variables, often known as endogenous variables. Every time interval has a number, such as $t = 1,..., T$. The variables are gathered into a k-length vector called yt. This vector can also be expressed as a $(k \times 1)$-matrix. As a linear function of its prior value, the vector is modeled. The components of the vector are denoted by the notation yi,t, which stands for the observation of the i th variable at time t.

$y_{i,t} = C_i + A_{11}yi\{t-1\} + A_{12}yi\{t-1\} + \varepsilon_{it}$

For a VAR (Vector Autoregression) model with two variables, Gender Development Index (GDI) and Gross Domestic Product (GDP), the linear equation is expressed as follows:

$GDI_t = C_1 + A_{11}GDI\_\{t-1\} + A_{12}GDI\_\{t-1\} + \varepsilon_{1t}$

$GDP_t = C_2 + A_{21}GDP\_\{t-1\} + A_{22}GDP\_\{t-1\} + \varepsilon_{2t}$

Where GDI_t and GDP_t are the GDI and GDP variables at time (t) respectively. C_1 and C_2 are the constant (intercept) terms for GDI and GDP equations. A_{11} and A_{22} are the autoregressive coefficients for the respective variables at lag 1.A_{12} and A_{21} are the coefficients representing the contemporaneous effects between GDI and GDP. ε_{1t} and ε_{2t} are the error terms for GDI and GDP equations.

Also Panel regression equation between Gender Development Index (GDI) and Gross Domestic Product (GDP) using VAR (Vector Autoregression) model with two variables can be given by:

$GDP_t = C + A_{11}GDI\_\{t-1\} + A_{12}GDP\_\{t-1\} + \varepsilon_t$

Where GDP_t is the dependent variable (Gross Domestic Product) at time t. GDI_{t-1} is the lagged independent variable (Gender Development Index) representing its impact on GDP. A_{11} is the coefficient indicating the effect of GDI_{t-1} on GDPt. A_{12} is the autoregressive coefficient for GDP at lag 1.C is the constant (intercept) term.ε_t- is the error term.
Further t test independent samples using SPSS was used to compare the GDP per capita of top 10 GDI and last 10 GDI countries.The Independent Samples *t* Test compared the means of two independent groups in order to determine whether there is statistical evidence that the associated population means are significantly different.

Hypotheses

Panel Cointegration:

Ho : There is no cointegration across the time series and panels.

H1 : There is cointegration across the time series and panels

EMPIRICAL RESULT:

As discussed in the research methodology, GDI data from 195 countries were collected and arranged in descending order to identify the top 10 and the last 10 countries on the basis of GDI ranking. After the identification of the top 10 and bottom 10 countries GDI and GDP per capita data for these selected countries was collected from undp.org and the World Bank site respectively. To stabilize the variance of series GDI and GDP, logarithm transformation was considered. At the first difference, the values were found to be stationary for LGDI and LGDP.

Analysis of high GDI countries

Pedroni Residual Cointegration test (Table no. 1) was performed to check the cointegration among the variables. It was observed that 8 values out of 11 values of probability were more than 0.05(level of significance), hence the null hypothesis of panel cointegration failed to reject. Thus it can be concluded that the variables were not cointegrated, hence the VECM model was not applicable. Therefore the VAR model was used for checking long-term cointegration.

To check the impact of GDI on GDP per capita panel regression was carried out. The regression (table No 2) indicates that panel regression is significant as the p-value is 0.000. Clearly, it can be concluded from table no.2

LGDP = 3.468 + 32.458 * LGDI

It states that a one percent increase in the GDI per year led to a 32.458 % increase in the GDP per capita per year which is significant at a 5% level.

To check the applicability of the fixed effect model or random effect model, the Hausman test was performed on the variables. Table No. 3 indicates that both the probability values (0.000 and 0.0332)of LGDP(-1) and LGDI(-1) are less than 0.05(level of significance) thus it can be concluded that the fixed effect model (Table no 4) is suitable for the VAR model. Further Wald test was performed to check long-term equilibrium exists between the variables and clearly from Table 5, the value of chi-square statistic is 15390.51 and the p-value is 0.000 which clearly indicates that long term causality exist between GDI and GDP in top 10 GDI countries of the world.

Analysis of low GDI countries

Pedroni Residual Cointegration test (Table no. 6) was performed to check the cointegration among the variables. It was observed that 7 values out of 11 values of probability were more than 0.05(level of significance), hence the null hypothesis of panel cointegration failed to reject. Thus it can be concluded that the variables were not cointegrated, hence the VECM model was not applicable. Therefore the VAR model was used for checking long-term cointegration.

To check the impact of GDI on GDP per capita panel regression was carried out. The regression table indicates that panel regression is significant as p-value is 0.000. Clearly, it can be concluded from table no. 7

LGDP = 3.428 + 5.189* LGDI

It states that one percent increase in the GDI per year led to 5.189 % increase in the GDP per capita per year which is significant at 5% level.

To check the applicability of fixed effect model or random effect model, the Hausman test was performed on the variables. Table 8 indicates that both the probability values (0.000) of LGDP(-1) and LGDI(-1) are less than 0.05(level of significance) thus it can be concluded that the fixed effect model (Table no 9) is suitable for the VAR model. Further Wald test was performed to check long-term cointegration exists between the variables and clearly from Table 10 , the value of chi-square statistic is 52577.41 and p-value is 0.000 which clearly indicates that long-term causality exists between GDI and GDP in the bottom 10 GDI countries of the world.

Hence it can be reasonably concluded that GDI is significantly affecting GDP per capita of countries.

Comparison of GDPs of top 10 and bottom 10 GDI Countries

Furthermore to check the significant difference between Average GDP of top 10 GDI and last 10 GDI countries independent t test was applied using SPSS. Sig value 0.000 (table. 12) indicates that there is a significant difference between the average GDP of top 10 GDI and last 10 GDI countries. Clearly from table Av. log GDP of top 10 GDI countries is 3.678 whereas Av. log GDP of top 10 GDI countries is 2.851, which shows that the countries having higher GDI reflects higher GDP. It also supports the findings of VAR model and panel regression analysis of top 10 and bottom 10 countries. Hence it can be concluded that GDI is positively affecting GDP.

CONCLUSION AND SUGGESTIONS:

Enhanced economic growth offers numerous opportunities to foster long-term gender equality. Extensive global evidence supports this claim. However, achieving the desired outcomes necessitates more than mere economic advancement. It requires an institutional framework that ensures equal rights and opportunities for both genders, alongside policy interventions targeting ongoing disparities.

Results obtained from the analysis showed that countries having high GDI progressed more as compared to countries in which GDI was insignificant.(Barata ,2020), (Ashraf and Weil 2002), (World Bank 2015), (Dollar and Gatti 1999). Results of the independent t test also showed a significant difference between the av. GDP of top 10 GDI and last 10 GDI countries. The countries having higher GDI reflects higher GDP, which also concludes how reducing the gender gap can unlock economic potential. We examine how greater opportunities and resources for women can lead to more efficient use of talent and skills, especially in the countries where GDI was highest and lowest. While our analysis focuses on this specific example, the underlying principle applies across all countries

Our findings provide compelling evidence that investing in gender equality is crucial for maximizing economic growth. Bridging the gender gap demands a concerted effort from governments, businesses, and civil society Policies aimed at leveling the playing field for women, such as strengthening legal protections, improving access to healthcare and education, equal pay laws, maternity leave policies, and affordable childcare. and fostering financial and technological inclusion (Jain-Chandra et al., 2018; Stotsky, 2016), are not only essential for human rights and fairness, but also represent powerful tools for enabling all members of society to contribute and benefit from economic prosperity. Businesses can foster gender equality by creating inclusive workplaces that provide equal opportunities for both women and men. Civil society can contribute by advocating for gender equality and raising awareness of the issue.

Achieving gender equality is undoubtedly a complex challenge, but it is one worth pursuing. The evidence unequivocally demonstrates that gender equality is not merely a moral responsibility but also an economic requisite.By closing the gender gap, we can create the way for a more just and prosperous world for all.

Table no 1: Showing Cointegration between the variables (Analysis of Top 10 GDI Countries)

Pedroni Residual Cointegration Test
Series: LGDI LGDP
Date: 05/10/23 Time: 11:53
Sample: 1996 2021
Included observations: 260
Cross-sections included: 10
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	0.680818	0.2480	0.709251	0.2391
Panel rho-Statistic	-0.624060	0.2663	-0.284362	0.3881
Panel PP-Statistic	-1.588382	0.0561	-0.851476	0.1973
Panel ADF-Statistic	-2.178243	0.0147	-1.644508	0.0500

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	0.897679	0.8153
Group PP-Statistic	-0.306052	0.3798
Group ADF-Statistic	-1.693411	0.0452

Cross section specific results

Phillips-Peron results (non-parametric)

Cross ID	AR(1)	Variance	HAC	Bandwidth	Obs
Latvia	0.745	1.85E-06	1.85E-06	0.00	25
Estonia	0.861	1.82E-06	2.18E-06	1.00	25
Mongolia	0.790	8.42E-06	1.18E-05	2.00	25
Lithuania	0.715	2.18E-06	2.33E-06	1.00	25
Uruguay	0.469	1.83E-06	1.83E-06	0.00	25
Belarus	0.877	1.15E-06	1.15E-06	0.00	25
Ukraine	0.773	1.88E-06	2.67E-06	2.00	25
Barbados	0.824	4.04E-06	4.58E-06	1.00	25
Kazakhstan	0.683	4.83E-06	5.81E-06	1.00	22
Lesotho	0.666	7.38E-06	7.83E-06	1.00	25

Augmented Dickey-Fuller results (parametric)

Cross ID	AR(1)	Variance	Lag	Max lag	Obs
Latvia	0.667	1.82E-06	1	--	24
Estonia	0.830	1.79E-06	1	--	24
Mongolia	0.759	8.36E-06	1	--	24
Lithuania	0.638	1.94E-06	1	--	24
Uruguay	0.179	1.38E-06	1	--	24
Belarus	0.842	1.05E-06	1	--	24
Ukraine	0.708	1.57E-06	1	--	24
Barbados	0.789	4.10E-06	1	--	24
Kazakhstan	0.579	4.52E-06	1	--	21
Lesotho	0.592	7.26E-06	1	--	24

Source: Author's Calculations

Table No: 2 Showing Panel Regression Between The Variables. (Analysis Of Top 10 GDI Countries)

Dependent Variable: LGDP
Method: Panel Least Squares
Date: 05/24/23 Time: 16:50
Sample: 1996 2021
Periods included: 26
Cross-sections included: 10
Total panel (unbalanced) observations: 257

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.467990	0.041415	83.73788	0.0000
LGDI	32.45816	4.542859	7.144875	0.0000

R-squared	0.166801	Mean dependent var	3.685024
Adjusted R-squared	0.163533	S.D. dependent var	0.493440
S.E. of regression	0.451294	Akaike info criterion	1.254354
Sum squared resid	51.93479	Schwarz criterion	1.281973
Log likelihood	-159.1845	Hannan-Quinn criter.	1.265461
F-statistic	51.04924	Durbin-Watson stat	0.036600
Prob(F-statistic)	0.000000		

Source: Author's Calculations

Table No 3: Hausman Test To Check Random Effect Among Vasriables (Analysis Of Top 10 GDI Countries)

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	9.416511	2	0.0090

** WARNING: estimated cross-section random effects variance is zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
LGDP(-1)	0.940592	0.975460	0.000131	0.0023
LGDI(-1)	2.045181	1.924470	0.437675	0.8552

Cross-section random effects test equation:
Dependent Variable: LGDP
Method: Panel Least Squares
Date: 05/10/23 Time: 14:42
Sample (adjusted): 1997 2021
Periods included: 25
Cross-sections included: 10
Total panel (unbalanced) observations: 247

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.233900	0.051504	4.541394	0.0000
LGDP(-1)	0.940592	0.014357	65.51677	0.0000
LGDI(-1)	2.045181	0.954626	2.142391	0.0332

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.984975	Mean dependent var	3.702084
Adjusted R-squared	0.984271	S.D. dependent var	0.489190
S.E. of regression	0.061351	Akaike info criterion	-2.697036
Sum squared resid	0.884537	Schwarz criterion	-2.526539
Log likelihood	345.0839	Hannan-Quinn criter.	-2.628393
F-statistic	1400.474	Durbin-Watson stat	1.403118
Prob(F-statistic)	0.000000		

Source: Author's Calculations

Table no 4: Calculation of fixed effect model (Analysis of Top 10 GDI Countries)

Dependent Variable: LGDP
Method: Panel Least Squares
Date: 05/10/23 Time: 15:04
Sample (adjusted): 1997 2021
Periods included: 25
Cross-sections included: 10
Total panel (unbalanced) observations: 247

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.233900	0.051504	4.541394	0.0000
LGDP(-1)	0.940592	0.014357	65.51677	0.0000
LGDI(-1)	2.045181	0.954626	2.142391	0.0332

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.984975	Mean dependent var	3.702084
Adjusted R-squared	0.984271	S.D. dependent var	0.489190
S.E. of regression	0.061351	Akaike info criterion	-2.697036
Sum squared resid	0.884537	Schwarz criterion	-2.526539
Log likelihood	345.0839	Hannan-Quinn criter.	-2.628393
F-statistic	1400.474	Durbin-Watson stat	1.403118
Prob(F-statistic)	0.000000		

asd

Source: Author's Calculations

Table no 5: Wald Test showing short run Causality between variables (Analysis of Top 10 GDI Countries)

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	7695.256	(2, 244)	0.0000
Chi-square	15390.51	2	0.0000

Null Hypothesis: C(2)=C(3)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(2)	0.975460	0.008665
C(3)	1.924470	0.688211

Restrictions are linear in coefficients.

Source: Author's Calculations

Table 6: Showing Cointegration Between The Variables (Analysis Of Lowest 10 GDI Countries)

Pedroni Residual Cointegration Test
Series: LGDI LGDP
Date: 05/10/23 Time: 11:57
Sample: 1996 2021
Included observations: 260
Cross-sections included: 10
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	0.618725	0.2680	-0.330690	0.6296
Panel rho-Statistic	-2.132629	0.0165	-0.432656	0.3326
Panel PP-Statistic	-3.516206	0.0002	-1.583398	0.0567
Panel ADF-Statistic	-1.915699	0.0277	-0.530442	0.2979

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	-0.243170	0.4039
Group PP-Statistic	-2.412964	0.0079
Group ADF-Statistic	-1.301528	0.0965

Cross section specific results

Phillips-Peron results (non-parametric)

Cross ID	AR(1)	Variance	HAC	Bandwidth	Obs
Bangladesh	0.771	1.51E-05	3.31E-05	3.00	25
Togo	0.495	1.91E-05	1.91E-05	0.00	25
India	0.683	8.15E-06	1.03E-05	1.00	25
South Asia	0.645	7.60E-06	9.56E-06	1.00	25
Guinea	0.696	4.59E-05	5.90E-05	1.00	25
Iraq	0.688	5.85E-05	5.85E-05	0.00	25
Central Africa...	0.901	2.01E-05	2.01E-05	0.00	25
Niger	0.330	0.000144	0.000135	1.00	25
Chad	0.992	1.30E-05	2.05E-05	2.00	21
Pakistan	0.331	9.07E-05	8.96E-05	2.00	25

Augmented Dickey-Fuller results (parametric)

Cross ID	AR(1)	Variance	Lag	Max lag	Obs
Bangladesh	0.863	1.25E-05	1	--	24
Togo	0.518	1.99E-05	1	--	24
India	0.636	7.39E-06	1	--	24
South Asia	0.643	7.02E-06	1	--	24
Guinea	0.673	4.05E-05	1	--	24
Iraq	0.578	4.97E-05	1	--	24
Central Africa...	0.890	1.95E-05	1	--	24
Niger	0.463	0.000144	1	--	24
Chad	0.961	1.28E-05	1	--	20
Pakistan	0.099	8.67E-05	1	--	24

Source: Author's Calculations

Table no: 7 showing Panel Regression between the variables. (Analysis of Lowest 10 GDI Countries)

Dependent Variable: LGDP
Method: Panel Least Squares
Date: 05/24/23 Time: 16:56
Sample: 1996 2021
Periods included: 26
Cross-sections included: 10
Total panel (unbalanced) observations: 256

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.427873	0.068094	50.34007	0.0000
LGDI	5.189575	0.599415	8.657730	0.0000

R-squared	0.227861	Mean dependent var	2.859562
Adjusted R-squared	0.224821	S.D. dependent var	0.329099
S.E. of regression	0.289752	Akaike info criterion	0.368201
Sum squared resid	21.32493	Schwarz criterion	0.395898
Log likelihood	-45.12976	Hannan-Quinn criter.	0.379341
F-statistic	74.95629	Durbin-Watson stat	0.047127
Prob(F-statistic)	0.000000		

Source: Author's Calculations

Table no 8: Hausman Test to check Random Effect among vasriables (Analysis of Lowest 10 GDI Countries)

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	39.775350	2	0.0000

** WARNING: estimated cross-section random effects variance is zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
LGDP(-1)	0.822917	0.991759	0.000776	0.0000
LGDI(-1)	1.310459	0.023216	0.062101	0.0000

Cross-section random effects test equation:
Dependent Variable: LGDP
Method: Panel Least Squares
Date: 05/10/23 Time: 15:00
Sample (adjusted): 1997 2021
Periods included: 25
Cross-sections included: 10
Total panel (unbalanced) observations: 246

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.673229	0.114073	5.901764	0.0000
LGDP(-1)	0.822917	0.030292	27.16625	0.0000
LGDI(-1)	1.310459	0.280607	4.670081	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.974363	Mean dependent var	2.872388
Adjusted R-squared	0.973158	S.D. dependent var	0.328129
S.E. of regression	0.053759	Akaike info criterion	-2.961064
Sum squared resid	0.676265	Schwarz criterion	-2.790072
Log likelihood	376.2108	Hannan-Quinn criter.	-2.892213
F-statistic	808.5028	Durbin-Watson stat	1.648915
Prob(F-statistic)	0.000000		

Source: Author's Calculations

Table 9: Calculation of fixed effect model (Analysis of Lowest 10 GDI Countries)

Dependent Variable: LGDP
Method: Panel Least Squares
Date: 05/10/23 Time: 15:01
Sample (adjusted): 1997 2021
Periods included: 25
Cross-sections included: 10
Total panel (unbalanced) observations: 246

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.673229	0.114073	5.901764	0.0000
LGDP(-1)	0.822917	0.030292	27.16625	0.0000
LGDI(-1)	1.310459	0.280607	4.670081	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.974363	Mean dependent var	2.872388
Adjusted R-squared	0.973158	S.D. dependent var	0.328129
S.E. of regression	0.053759	Akaike info criterion	-2.961064
Sum squared resid	0.676265	Schwarz criterion	-2.790072
Log likelihood	376.2108	Hannan-Quinn criter.	-2.892213
F-statistic	808.5028	Durbin-Watson stat	1.648915
Prob(F-statistic)	0.000000		

Source: Author's Calculations

Table no 10: Wald Test showing short run Causality between variables (Analysis of Lowest 10 GDI Countries)

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	26288.70	(2, 234)	0.0000
Chi-square	52577.41	2	0.0000

Null Hypothesis: C(1)=C(2)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(1)	0.673229	0.114073
C(2)	0.822917	0.030292

Restrictions are linear in coefficients.

Source: Author's Calculations

Table no 11: Comparative Group statistics of Top 10 and Lowest 10 countries

Group Statistics					
	Category	N	Mean	Std. Deviation	Std. Error Mean
LGDPT	Top	260	3.678879250382322	.493875965539866	.030628887152863
	Low	260	2.851353376136535	.333128248379834	.020659736935980

Source: Author's Calculations

Table no 12: Calculations showing Independent Sample T Test between top 10 and Lowest 10 Countries

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig.(2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
LG DPT	Equal variances assumed	56.952	.000	22.399	518	.000	.827525874245787	.036945276538236	.754944876195263	.900106872296311
	Equal variances not assumed			22.399	454.258	.000	.827525874245787	.036945276538236	.754921017210007	.900130731281567

Source: Author's Calculations

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