



Impact of Green finance on energy efficiency: A Panel Data Analysis of Pakistan, Japan, China, United States, UK, and Germany

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Abstract

Developing a futuristic route that leads to self-sustainable energy use depends heavily on the landmark research on how financial services affect energy efficiency (EE) in developed and underdeveloped countries. Therefore, we are particularly interested in observing how trade liberalization and energy efficiency affect each country's environmental quality. In our research, we obtained annual time series data covering the years 1991 to 2021, and we ran various econometric models based on the penal data analysis and correlation using a single-country study first, then a multi-country study. With this approach, an in-depth investigation of the effects of green finance and energy efficiency is looked after. Although the average result of energy efficiency is modest nationally, it demonstrates a tendency for steady improvement throughout the research. From a national standpoint, there is a substantial imbalance in the development of energy efficiency, with Pakistan having the lowest levels and Japan, China, and the United States of America having the greatest. For all nations, green finance has significantly compelled an increase in energy efficiency; however, the green finance policies of Japan, China, and the United States have improved energy efficiency, while those of Pakistan have inhibited it. Green finance has significant relationships with energy efficiency.

Keywords: Green finance, Energy efficiency, GDP, Technological advancement, and FDI.

1. Introduction

There is always a limitation of every resource in this world; similarly, the available energy resources also have their limits. With time, the demand for these resources may increase, and provisions of resources may also become limited. So, taking some essential steps and providing awareness regarding the consumption of available energy resources is necessary. Thus, using energy resources efficiently without wasting them became necessary.

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Available resources regarding energy are always an essential function in the lifestyle of humankind. Using such available energy resources, humans can fulfill their needs and enjoy nature per their requirements by using all available resources in their domain. Green Finance shall support activities that play a role in energy-related issues and provide funding to use energy resources effectively and efficiently (Yang & Zeng, 2019).

According to my study development from the national perspective, Different countries' energy efficiency innovation is considerably imbalanced. In my research, I aim to find the impact of energy efficiency in Pakistan and other countries. It promotes the relationship between these top economies to evaluate Pakistan and their partner countries; the impact of green finance on energy efficiency, the average level of national energy efficiency is low (Wang et al. al., 2021). In the 1980s, The study of environmental finance and sustainable finance began globally. The Equator Principles were adopted as globally acceptable financial operating standards in 2003. This would not only jeopardize Pakistan's economic progress, but it may also have irreversible consequences for the people's lives and health. The persistent smog and the epidemic's quick onset are undeniably striking signs of man's fundamental imbalance with nature. Establishing altitudinous economic development through economic ecology in such conditions must be the primary way Pakistan may achieve man-nature harmony.

Pakistan requires significant improvement. Energy usage continues to be a factor in the economic boom because it is challenging to significantly reduce energy consumption by improving energy efficiency. Pakistan has emphasized green energy production and efficient usage. Low energy efficiency, on the other hand, Pakistan has existed for far too long, wasting vital natural resources while also dangerously harming the environment (Yang & Zeng 2019). Pakistan formally incorporated environmental civilization creation into the broader socialist movement in 2012. This not only provided the development of environmental protection and other components with the same strategic importance, but it also allowed the process to be incorporated into the economics, government, literature, and all other aspects and primary necessities (Wang et al., 2021).

Energy has straightforward resource and pricing advantages as a significant energy country. Although rural wind and solar power, In recent years, resources for natural gas and renewable energy, as well as other renewable energy and natural gas, have flourished, new energy development remains inadequate. Although green financing is becoming more prominent in emerging markets, contributing to boom-quality economic development, it is still uncertain.

The primary technique for achieving sustainable development is to decouple economic expansion from pollution emissions. Environmental protection is considered when making investment and financial instruments choices, leading funds to flow of green finance. On the other hand, the typical financial intermediaries are primarily concerned with the profitability of an investment project while neglecting the environmental consequences. Green finance advocates for a shift in investment from upswing pollution and energy consumption to energy conservation and ecological protection. In my study, the limited deduction of symmetry between the exchange rate and trade balance is claimed to have concealed the empirical evidence. Scholars in prior research examined the bilateral level between Pakistan and its vital economic partners. In recent years, Pakistan has supported and encouraged the construction of green finance and top economies to promote trade and long-term energy efficiency projects and enhance economic growth. Green financing and energy efficiency are vital in finance (Xie et al. & Chen, 2019).

Green finance and green economy, which is social manufacturing economic science, coexist, are green and sustainable, and whether as a process or a consequence of green financing,

are critical to the economy's green and environmental processes (Zhang Guo, 2019). The goal of a green economy is to boost energy efficiency improvements. The growth of green financing in different parts of the world has been unequal, with varying effects on energy efficiency. As a result, green finance and energy efficiency concepts and theories were classified first and then summarized in three studies. The impact of green finance on the energy efficiency of every country is different, and relevant policies recommend and formulate how to support green finance in developing countries' green economies based on the economic development level and research on the country of the world of financial problems. The study gives a theoretical foundation and academic support for the government and related department decision-making. The following are the primary contributions of the study: (1) Trading emissions processes and included in the energy efficiency, (2) The effect of green finance on Pakistan's energy efficiency will be quantitatively measured to promote Pakistani energy efficiency from a financial development perspective, The evolution of energy-saving and emergence decrease strategies in various top partners' country. The country's energy efficiency is possibly more significant than one. To assess energy efficiency (Zhou, 2018).

Implementing fiscal policy is impacted by the scope of public spending in the green economy and the connection between the nature of public spending and economic development. My research is based on certain public expenditure elements that impact green economic activity more than others. A country can enhance its financial performance by altering the volume and content of its overall public investment (Iram, 2020). The global community developed the paradigm of green finance. There is no agreed-upon definition of green finance in academic circles, but some academics also refer to it as environmental finance and sustainable finance. Green money and sustainable finance, however, are two separate ideas, with sustainable finance being a broader definition (Wang, 2019).

2. Review of Literature

From the beginning of mankind's history, significant innovations have been made by human beings using the available resources, making effective changes, and improving their lifestyles with time. Humans indeed want to change their lifestyles so quickly; they want to go for any possible solution and use all available resources in their own time (Koloba, 2020).

The development of the economy and CE for the various oil-producing governments in the African region. It has been noted that NEN consumption has an unbalanced impact on both EG and CE emissions in all the targeted economies. When examining environmental degradation, the research has paid less attention to the constructive component (Awodumi & Adewuyi (2020).

In the race for development and innovation, we want to make life easier. To this end, we will utilize all the available resources without caring about the side effects of this revolution.

The study also aims to discuss one of the major concerns facing almost all developed and developing countries of the world: how they can productively and efficiently use their available energy resources by adopting new policies like green finance, which can be introduced in their economies to promote awareness regarding the savings of natural resources and do more productive work (Yang & Zeng, 2019).

This research, to the corpus of already published works, demonstrates how to use of energy from both renewable and nonrenewable sources, laws conserving the environment, and rising per capita GDP all affect greenhouse gas emissions in developing Asian countries. (Anh Tu 2021). Therefore, green finance includes any lending or investment that improves environmental sustainability and considers its influence on the environment. Sustainable banking and investment decisions are made using environmental screening and risk assessment to ensure that lending and

investment satisfy environmental sustainability requirements. This is a fundamental component of Green Finance (Chien, 2021). Most coastal regions in the United States have solar panel installations because they offer more economic prospects and are excellent locations for utility-scale solar plants. Utilizing a utility-scale solar panel installation is anticipated to reduce significant environmental damage (Hsu et al., 2021). Almost in recent decades, every developed and developing country would keenly focus on the issue that how they can protect their environment and save their resources. For this purpose, the major innovation or practice which is adopted by most of the developed countries is the promotion of green finance in all public listed companies and private companies and firms and enforce them to play their role in the adoption of such policies which help and environment friendly and help to secure energy resources. The definition of green finance according to the International Finance Corporation is that green finance is a product provided to investors to invest in green finance, which made a win-win relationship between environmental quality and economic development and the new financial product has sought more and more attention all around the world (Zhang et al., 2019)

The objective of green finance is to achieve the necessary development of financial activities, environmental care, and economic stability. This research is to justify the impact of green finance on economic structuring and environmental excellence. The study would conclude that green finance can positively improve this relationship, green finance plays a very vital role in the development of environmentally friendly policies and creates a win-win situation for the efficient and productive use of energy for the benefit of the global environment. (Xiao Guang Zhou, Ximmeng Tang & Rui Zhang, 2020).

According to (Clark et al., 2018) there would be around 178 economies signed the agreement in Paris to collaboratively highlight the issue related to global climate change and its related issues. In the record of statistics of the International Energy Agency, it is available that in 2014 there would be around dollar 53 trillion dollars will be required to maintain the 2degree Celsius temperature benchmark by 2035. Meanwhile, according to the available data in 2018, the trading volume of the world stock market is about 68.212 trillion dollars. So, it is encouraging that financial capital is used to minimize this high funding gap.

The adoption and excellence of green finance can upgrade environmental performance and improve the quality of the usage of economic resources courage their specification (Poberezhna, 2018) According to this study, researchers promote the green economy and express their views. Economy and to address the block chain to facilitate the global water shortage that poses a threat to the environment Scholars also examined and degraded these major issues, and scholars examined the need to utilize and mobilize the financial resources according to the Paris Agreement and achieve the carbon-reducing target and offered that green bonds that are most key tools (Gianfrate & Peri 2019)

This study investigated how to eradicate conflicts like terrorism activists and war elements that disturb the trading activities between Pakistan and the world's top economies. With the help of diplomats and related departments, it was possible to provide peace and encourage trading factors between nations. If peace is achieved in the country, exports and imports will be promoted, and industries and factories will improve their performance in their fields.

For the transition of economies, researchers identified the correlation among export, import, and economic growth. According to empirical findings, economic growth and export have a unidirectional causal relationship. Empirical studies suggest that in certain nations, the improvement export hypothesis is correct, and growth is influenced more by a rise in import demand.

Green finance and energy efficiency have stimulated the interest of a few scholars. Green finance is not a significant tool in many nations, according to a group of scholars, due to several core issues. (Fu & Ng, 2021).

In contradiction to research showing green finance to have neutral or negative effects, a set of studies has shown that green finance has a positive impact on several macroeconomic variables (Naeem et al., 2021). It is crucial to recognize that the outcomes of implementing green funding vary per country and depend on several conditions.

The expansion of financial institutions, the establishment of economies, trade openness, human capital, FDI, energy consumption, and technological innovation on environmental quality. This research article is related to previous research. First, the relationship between green finance energy efficiency and green innovation was examined in a contemporary/similar fashion. The second aspect of the relationship between variables is examined from top green finance assistance globally. To find the important insight, the difference between green energy resource development utilizing the. A final aspect of approximation progress under the that is dependable analysis framework in energy economics.

This chapter provides an understanding of this study by using the previous research and studies critical literature reviews and scholars' and researchers' recommendations regarding this area of research for future researchers who want to conduct the study in this innovative and emerging field of green finance and its role in the betterment and awareness regarding its use for energy efficiency. Three categories were used in earlier research to categorize this association. In recent years, academics and decision-makers have shown a strong interest in the connection between globalization, economic growth, and environmental quality (Iram, Anser, Awan, Ali, Abbas, Chaudhry, 2020).

3. Research Methodology

My study presents the data collection mechanism from which the data has been collected. Data collected by the Panel Data Analysis of Pakistan, Japan, China, the United States, the UK, and Germany from 1991 to 2021. Green finance and energy efficiency in the following regions (Japan, Germany, China, the UK, United States) with data from the World Bank. Data Selection and processing in my research uses the relevant indicators from 1991 to 2021 to estimate Pakistan, China, the United States, Japan, the UK, and Germany's green finance and energy efficiency levels. The data come from World Development Indicators and data stream annual financial operation reports of various countries in the world; based on the availability of data, 6 countries in the world were selected for analysis. In the present study, we have considered Energy efficiency as a dependent variable in our model. Independent Variable We have considered Green Finance in our model. Green finance can be divided into four types: green loans, green bonds, green and carbon financing, FDI EP, and technological advancement (TE).

Table 1: Variables and description

Variable	Variable description	Sources
EE	Energy efficiency	WDI & Data stream
GF	Green finance	WDI & Data stream
Tech.A	Technological advancement	WDI & Data stream
FDI	Foreign Direct investment	WDI & Data stream
EP	Energy price	WDI & Data stream

3.1. Econometric Model

This article used the panel data analysis to measure energy efficiency in emerging countries, including (Japan, Germany, China, the UK, United States) and we collected the data from the World Bank Indicator. The other relevant techniques that I ignored (After running data analysis, the issues of heteroscedasticity, autocorrelation, and multi-collinearity, which are dependent on data, are addressed (Green Finance may have a beneficial or positive impact on Pakistan and top economies of the world, depending on the outcomes of data analysis).

The following model is estimated:

$$EE_{it} = B_0 + B_1GF_{it} + B_2FDI_{it} + B_3Tech.A_{it} + B_4EP_{it} + e_{it} \quad (1)$$

Where EE stands for energy efficiency, GF for green finance and tech, A for technical advancement, FDI for foreign direct investment, and EP for energy price. The e is a model error, i is a cross-section, and t is a time series.

4. Empirical Findings

4.1. Descriptive statistics

It displayed that the EE mean value was 8.36%, while the EP average value was 8.8%, and the FDI mean value was 1.93%. In addition, the findings also indicated that the GF mean value was 81.13%, while the TE average value was 2440%, and the STD mean value was 6.14% (Table 2).

Table 2: Descriptive statistics

	EE	EP	FDI	GF	TE
Mean	8.363	8.872	1.923	81.137	2440.0
Median	7.309	6.984	1.189	71.876	2042.8
Maximum	20.47	30.41	11.92	191.410	7532.3
Minimum	0.544	3.581	-1.307	14.682	69.32
Std. Dev.	6.142	5.765	2.183	51.624	2119.4
Skewness	0.438	1.929	1.817	0.433	0.339

4.2. Pre-regression diagnostics test.

In this table, the Heteroscedasticity Test: White shows that the R square is 68.95873% and the probability is 0.000%, so the R square is the best fit in the study.

Table 3: Heteroscedasticity Test

F-statistic	4.860	Prob. F(20,165)	0.000
Obs*R-squared	68.95	Prob. Chi-Square(20)	0.000
Scaled explained SS	34.33	Prob. Chi-Square(20)	0.023

Table 4: Breusch-Godfrey Auto Correlation LM Test

F-statistic	767.026	Prob. F(1,179)	0.000
Obs*R-squared	150.806	Prob. Chi-Square(1)	0.000

Table 5: Breusch-Godfrey Auto Correlation LM Test

F-statistic	127.83	Durbin-Watson stat	1.717
Prob(F-statistic)	0.000		

This table shows the results of the Breusch-Godfrey Auto Correlation LM Test used in the study. P-value equal to 0.0000 its statistically and significantly positive relationship. The observation R square is the best fit the data, And Durbin – the Watson state is 1.7177 is also the best fit the data.

Table 6: Multicollinearity - Variance Inflation Factors

Variable	Variance	VIF
GF	0.000	1.213
EP	0.004	1.503
FDI	0.024	1.125
EE	6.02E	1.534
TE	2.83E	1.214

Table 7: Correlation Matrix

	EP	TE	FDI	EE	GF
EP	1.000				
TE	-.221**	1.000			
FDI	-0.076	-0.127	1.000		
EE	-.448**	0.059	0.044	1.000	
GF	0.486**	0.361**	0.203**	0.221**	1.000

***/**/*. significant at the 1%, 5%, and 10%

As discussed in Table 5, correlation was performed to confirm the strong or weak relationship among variables. From Table 5, the strength of variables GF, EP, TE, FDI, and EE is positively correlated except for TE, FDI, and EE.

4.3. The impact of green finance on energy efficiency.

A study analyzing penal data from 1991 to 2021 on how green financing affected energy efficiency. A table displays the outcomes.

The penal data analysis of the above table indicates that the variables are statistically significant, so p-values equal to 0.000. On the other hand, the number of observations is 31, and the R square is 0.9239 which is the best fit, the proportion of variation in the dependent variable (Y) explained by the independent variable (X). Standard deviation we use the regression model to estimate the dependent variable.

Table 8(a): Regression Analysis China

Source	SS	Df	MS	No of obs	31
				F(5, 25)	60.74
Model	132.680	5	26.536	Prob > F	0.001
Residual	10.921	25	0.436	R-squared	0.923
				Adj R-squared	0.908
Total	143.602	30	4.786	Root MSE	0.660

The significant level of green finance, when seen globally, is merely 0.01. This demonstrates that the economic implications of green collect the required have not yet fully

developed, as high energy-consuming industries have not been significantly compelled to raise their energy efficiency. It has been shown that the benefits of green funding on EF in various nations vary greatly. The use of green financing was observed via the green finance coefficients.

Table 8(b): Regression Analysis China

EE	Coef.	Std. Err	t-value	P> t	[95% Con f. Interval]	P-Value
EP	0.148	0.119	1.24	0.225	-0.097	0.395
TE	0.000	0.000	0.36	0.719	-0.000	0.001
FDI	0.589	1.474	0.4	0.693	-2.448	3.626
GF	0.036	0.009	3.76	0.001	.0563	0.164
cons	-9.295	22.24	-0.42	0.68	-55.11	36.52

This table shows the results of penal data analysis of all variables used in the study. GF is an independent variable in this study, and energy efficiency is a Dependent variable, so the Energy price and FDI coefficient value and their probability value have a significantly negative relationship with energy efficiency. The coefficient values of all remaining variables have a positive correlation with EE. R square is the best fit in this table.

Table 9(a): Regression Analysis Japan

Source	SS	df	MS	Num of obs	31
				F(5, 25)	12.03
Model	101.99	5	20.39	Prob > F	0
Residual	42.403	25	1.696	R-squared	0.706
				Adj R-squared	0.647
Total	144.40	30	4.813	Root MSE	1.302

The regression output of the above table shows that the variables are statistically significant because their p-values equal to 0.000. On the other hand, the number of observations is 31, and the R square is 0.7063, which is the best fit, the dependent variable (Y) explained by the independent variable (X) indicates the proportion of variance. Standard deviation was using the regression model to estimate the dependent variable.

Table 9(b): Regression Analysis Japan

EE	Coef.	Std. Err	t-value	P> t	[95% Conf. Interval]	P Value
EP	-0.827	0.402	-2.06	0.05	-1.655	0.000
TE	0.001	0.000	2.65	0.014	0.000	0.003
FDI	-0.172	0.134	-1.28	0.212	-0.450	0.105
GF	0.014	0.013	1.07	0.295	0.041	0.013
cons	6.354	3.706	1.71	0.099	-1.278	13.98

This table shows the results of penal data analysis of all variables used in the study. GF is an independent variable in this study, and energy efficiency is a Dependent variable, so the EP, TE, GF, and FDI coefficient values and their probability values are significantly positively related to energy efficiency. R square is the best fit in this table.

Table 10(a): Regression Analysis Pakistan

Source	SS	df	MS	Num of obs	=	31
				F(5, 25)	=	55.99
Model	0.323	5	0.064	Prob > F	=	0
Residual	0.028	25	0.001	R-squared	=	0.918
				Adj R-squared	=	0.901
Total	0.352	30	0.011	Root MSE	=	0.033

The regression output of the above table shows that the variables are statistically significant because their p-values equal to 0.000. On the other hand, the number of observations is 31 and the R square is 0.918, which is the best fit, the proportion of variance in the dependent variable (Y) explained by the independent variable (X). Standard deviation we use the regression model to estimate the dependent variable.

Table 10(b): Regression Analysis Pakistan

EE	Coef.	Std. Err	t-value	P> t	[95% Con f. Interval]	P-Value
EP	0.006	0.002	2.21	0.037	0.000	0.012
TE	0.021	0.029	0.07	0.942	0.053	0.036
FDI	0.039	0.013	2.94	0.007	0.011	0.066
GF	0.005	0.003	1.27	0.215	-0.003	0.013
Cons	0.264	0.121	2.17	0.039	0.013	0.515

This table shows the results of penal data analysis of all variables used in the study. GF is an independent variable in this study, and energy efficiency is a Dependent variable, so the EP, TE, GF, and FDI coefficient value and their probability value significantly positively relate to energy efficiency. R square is the best fit in this table.

Table 11(a): Regression Analysis Germany

Source	SS	df	MS	Num of Obs	31
				F(5, 25)	66.91
Model	142.71	5	28.542	Prob > F	0
Residual	10.664	25	0.4265	R-squared	0.930
				Adj R-squared	0.916
Total	153.37	30	5.1126	Root MSE	0.653

The penal data analysis output of the above table shows that the variables are statistically significant because p-values equal to 0.000. On the other hand, the number of observations is 31, and the R square is 0.9305, which is the best fit, indicating the proportion of variance in the dependent variable (Y) explained by the independent variable (X). Standard deviation we used the regression model to estimate the dependent variable.

Table 11(b): Regression Analysis Germany

EE	Coef.	Std. Err	t	P> t	[95% Con f. Interval]	P-Value
EP	0.190	0.113	1.68	0.105	-0.042	0.423
TE	-0.010	0.002	-5.23	0	-0.015	-0.006
FDI	0.105	0.063	1.65	0.111	-0.025	0.237
GF	0.081	0.023	3.47	0.002	0.032	0.129
Cons	5.894	0.942	6.25	0	3.953	7.836

This table shows the results of penal data analysis of all variables used in the study. GF is an independent variable in this study, and energy efficiency is a Dependent variable, so the EP, GF, and FDI coefficient values and their probability value have a significantly positive relationship with energy efficiency. While TE has a negative relationship with EE. R square is the best fit in this table. R square is the best fit in this table R square is the best fit in this table R square is the best fit in this Regression.

Table 12(a): Regression Analysis United Kingdom

Source	SS	df	MS	Number of obs	31
				F(5, 25)	216.6
Model	72.719	5	14.543	Prob > F	0
Residual	1.6783	25	0.067	R-squared	0.977
				Adj R-squared	0.972
Total	74.397	30	2.479	Root MSE	0.259

The regression output of the above table shows that the variables are significant because their p-values equal to 0.000. On the other hand, the number of observations is 31, and the R square is 0.7063, which is the best-fit variance in the dependent variable (Y) explained by the independent variable (X). Standard deviation we use the regression model to estimate the dependent variable.

Table 12(b): Regression Analysis United Kingdom

EE	Coef.	Std. Err	T-value	P> t	[95% Con f.Interval]	P-Value
EP	0.079	0.049	1.59	0.123	-0.023	0.182
TE	0.000	0.000	3.08	0.005	0.000	0.000
FDI	0.010	0.016	0.67	0.508	-0.022	0.044
GF	0.008	0.002	4.03	0	0.004	0.013
Cons	15.468	0.803	19.25	0	13.80	17.110

This table shows the results of penal data analysis of all variables used in the study. GF is an independent variable in this study, and energy efficiency is a Dependent variable, so the EP, TE, GF, and FDI coefficient value and their probability value significantly positively relate to energy efficiency. R square is the best fit in this table.

Table 13(a): Regression Analysis United States

Source	SS	df	MS	Number of obs	31
				F(5, 25)	77.45
Model	126.31	5	25.262	Prob > F	0
Residual	8.1545	25	0.3261	R-squared	0.939
				Adj R-squared	0.927
Total	134.46	30	4.4821	Root MSE	0.571

The regression output of the above table shows that the variables are statistically significant because their probability values are equal to 0.000. On the other hand, the number of observations is 31, and the R square is 0.7063, which is the best fit, variance in the dependent variable, independent variable, and Standard deviation. We use the penal data analysis to estimate the dependent variable.

Table 13(a): Regression Analysis United States

EE	Coef.	Std. Err	t	P> t	[95% Con f. Interval]	P-Value
EP	-0.687	0.212	-3.24	0.003	-1.125	-0.249
TE	0.001	0.000	1.84	0.077	-0.000	0.002
FDI	0.349	0.163	2.13	0.043	0.011	0.686
GF	0.138	0.033	4.07	0	0.068	0.208
Cons	25.63	2.431	10.54	0	20.62	30.64

This table shows the results of penal data analysis of all variables used in the study. GF is an independent variable in this study, and energy efficiency is a Dependent variable, so the EP, TE, GF, and FDI coefficient value and their probability value significantly positively relate to energy efficiency. R square is the best fit in this table.

5. Discussion and conclusion

This article has been conducted to determine the influence of green finance and energy efficiency A penal data analysis of China. Pakistan, Germany, Japan, the United States of America, and the United Kingdom, the results of the article show that there is a significant positive correlation between green finance and energy efficiency.to reach this decision, we used multiple regression analysis and bi-variate correlation analysis using Stata and EViews. This is cross cross-sectional study in which we have taken annual data from the data stream and with the help of World Bank indicators. The study model comprises four independent variables, i.e., green finance, foreign direct investment, technological advancement, and Energy price. All these variables show a significant influence on energy efficiency.

A study has been conducted on five major economies of the world and Pakistan. We collected thirty years of data through data streams and World Bank data indicators and analyzed it through Stata and EViews. The result was positive regarding green finance and energy efficiency.

We are particularly interested to see the effects of energy efficiency and green finance the trade liberalization on the quality of the environment of the countries in top economies of the world and Pakistan. In my study, I used annual time series data from 1991 to 2021, and we performed different econometric models based on the penal data analysis and correlation using a single-country study and then an all-country study. This method aims to compare the effects of energy efficiency and green finance for an In-depth analysis.

According to the study's findings, all explanatory variables are correlated with one another. To find revealed a statistically significant link among all variables.

This study has limitations that must be acknowledged. First, we have only concentrated on the two forms of green finance (green bonds and green loans) without taking into account the potential for the use of additional instruments that might produce results that are perhaps more successful.

Finally, but not least, future academics will desperately need to conduct a thorough analysis of multiple rating systems to unify rating disparities and focus on factors that are important to investors both socially and financially. Indeed, this is a topic on which we will concentrate our future research. A similar analysis might be repeated with additional developing and developed

nations included. Different proxies of green finance and energy efficiency may be applied. Actual green finance and energy efficiency between China, Pakistan, Germany, the United States of America, United Kingdom.

Based on the findings of the result in my empirical research, policy suggestions for enhancing national energy efficiency were developed; the deployment of green energy and green financing can only aid nations in the long-term reduction of CO₂ emissions,

References.

- Adebayo, T. S., Awosusi, A. A., Rjoub, H., Agyekum, E. B., & Kirikkaleli, D. (2022). The influence of renewable energy usage on consumption-based carbon emissions in MINT economies. *Heliyon*, 8(2), e08941.
- Adom, P. K., & Adams, S. (2020). Technical fossil fuel energy efficiency (TFEE) and debt-finance government expenditure nexus in Africa. *Journal of Cleaner Production*, 271, 122670.
- Andries, P., & Faems, D. (2013). Patenting activities and firm performance: does firm size matter?. *Journal of Product Innovation Management*, 30(6), 1089-1098.
- Awodumi, O. B., & Adewuyi, A. O. (2020). The role of non-renewable energy consumption in economic growth and carbon emission: evidence from oil producing economies in Africa. *Energy Strategy Reviews*, 27, 100434.
- Fu, J., & Ng, A. W. (2021). Scaling up renewable energy assets: Issuing green bond via structured public-private collaboration for managing risk in an emerging economy. *Energies*, 14(11), 3076
- Gu, B., Chen, F., & Zhang, K. (2021). The policy effect of green finance in promoting industrial transformation and upgrading efficiency in China: analysis from the perspective of government regulation and public environmental demands.
- Hafner, S., Jones, A., Anger-Kraavi, A., & Pohl, J. (2020). Closing the green finance gap—A systems perspective. *Environmental Innovation and Societal Transitions*, 34, 26-60.
- Hands, D. W. (2010). Economics, psychology and the history of consumer choice theory. *Cambridge Journal of Economics*, 34(4)
- Hira, T. K. (2012) Promoting sustainable financial behaviour: Implications for education and research.
- Hsu, C. C., Quang-Thanh, N., Chien, F., Li, L., & Mohsin, M. (2021). Evaluating green innovation and performance of financial development: mediating concerns of environmental regulation.
- Huang Q, Zheng H, Li J, Meng J, Liu Y, Wang Z, Zhang N, Li Y, Guan D (2021) Heterogeneity of consumption-based carbon emissions and driving forces in Indian states
- Huang, H., & Zhang, J. (2021). Research on the environmental effect of green finance policy based on the analysis of pilot zones for green finance reform and innovations. *Sustainability*, 13(7), 3754.
- Iram, R., Anser, M.K., Awan, R.U., Ali, A., Abbas, Q., Chaudhry, I.S., (2020) Prioritization of renewable solar energy to prevent energy insecurity: an integrated role. *Singapore Econ. Rev.*
- Jeffrey, F., & Romer, D. (1999). Does trade cause growth? Tamazian, A., Chousa, J. P., & Vadlamannati, K. C. (2009). Does higher economic and financial development lead to environmental degradation?
- Khan, M. K., Teng, J., & Khan, M. O) 2019. Impact of globalization, economic factors and energy consumption on CO₂ emissions in Pakistan.
- Koloba, H. A. (2020). Purchase intention toward TE's environmentally friendly products among

- Sahoo, P., & Bhunia) A. (2014, July). BCIM Corridor is a game changer for South Asian trade. In East Asia Forum.
- Sbia R, Shahbaz M, Hamdi H). A contribution of foreign direct investment, clean energy, trade openness, carbon emissions and economic growth to energy demand in UAE.
- Tanimura, T., Jaramillo, E., Weil, D., Raviglione, M., & Lönnroth, K. (2014). Financial buTEen for tuberculosis patients in low-and middle-income countries: a systematic review.
- Wang, G., Wu, P., Wu, X., Zhang, H., Guo, Q., & Cai, Y.2020). Mapping global research on sustainability of megaproject management: A scientometric review.
- Wang, R., & Tan, J. (2021). Exploring the coupling and forecasting of financial development, technological innovation, and economic growth. *Technological Forecasting and Social Change*, 163, 120466. Wang, R., & Tan, J. (2021).
- Wang, Z., & Wang, X. (2022). Research on the impact of green finance on energy efficiency in different regions of China based on the DEA-Tobit model.
- Wei, M., Patadia, S., & Kammen, D. M. (2010). Putting renewables and energy efficiency to work: How many jobs can the clean energy industry generate in the US?
- Xiao, H., Ma, Z., Zhang, P., & Liu, M. (2019). Study of the impact of energy consumption structure on carbon emission intensity in China from the perspective of spatial effects.
- Yang, J., & Luo, P. (2020). Review on international comparison of carbon financial market. *Green Finance*,
- Yang, Y., Wang, G.S., 2017). Measurement of the development level of green finance taking Shanghai as an example. *Hainan Finance*.
- Zhang, D., Mohsin, M., Rasheed, A. K., Chang, Y., & Taghizadeh-Hesary, F. 2021. Public spending and green economic growth in BRI region: mediating role of green finance.
- Zhang, D., Zhang, Z., & Managi, S. (2019). A bibliometric analysis on green finance: Current status, development, and future directions. *Finance Research Letters*, 29, 425-430.
- Zhang, J., Guo, X.X., 2019). Research on the construction of the whole industry chain of the new energy automobile industry in southern Jiangsu green finance. *Market*
- Zhang, J., Guo, X.X., 2019). Research on the construction of the whole industry chain of the new energy automobile industry in southern Jiangsu green finance.
- Zhou, H.C., 2018. Green development needs green finance support. *Chn. Bus)*
- Zhou, J. (2022). Analysis and Countermeasures of Green Finance Development under Carbon Peaking and Carbon Neutrality Goals. *Open Journal of Social Sciences*, 10(2), 147-154
- Zhou, X., Tang, X., & Zhang, R. (2020). Impact of green finance on economic development and environmental quality: a study based on provincial panel data from China. *Environmental Science and Pollution Research*, 27(16), 19915-19932.