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Impact of Energy Crisis on Manufactured Exports: A Case Study of Pakistan

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ABSTRACT

This study investigates the impact of the energy crisis on manufactured exports of Pakistan for the time period of 1990 to 2019 by employing the Ordinary Least Square method. Manufactured export is the regressand while energy crisis, energy price, real exchange rate, foreign demand, and industrial output are the regressors. The econometric analysis shows a significant negative relationship between manufactured exports and energy crisis, energy price, and exchange rate whereas a significant positive relationship has been found among manufactured exports and industrial output as well as foreign demand. The findings of this study call for such policy recommendations that can effectively tackle the issue of poor manufactured export performance in the light of the energy crisis. The government should take immediate initiatives to generate more energy to increase domestic production and to serve export purposes. Efficient energy policies should be formed, and innovative measures should be introduced for energy conservation.

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1. Introduction

Is the role of energy as a driver of various economic activities perhaps hyped up or does the crisis actually stand in the way of achieving desirable output? Not denying the fact, energy- be it oil, gas, or electricity, has emerged as one of the basic necessities of life along with food, shelter and clothing. Given the accelerated energy demand in every walk of life or sector of economy outstripping the Earth's ability to provide the required energy supplies, the world finds itself constantly grappling with what is known as 'energy crisis.' The very issue dramatically became the major concern after the Arab oil embargo of 1973 leaving the Third World to bear the maximum brunt of the crisis since then and concurrently bringing in its wake the balance of payment crisis. The ailing economy of Pakistan, not unlike many other developing countries has been confronting demand-supply gap in its energy sector. The increased reliance of power generation on imported furnace oil rather than hydropower and tripling global oil prices in 2007 only worsened the scenario (Aftab, 2014). Consequently, the industrial performance has suffered a striking blow as energy is the backbone of the industrial sector being the significant input of its produce. The net returns of the industrial sector are attributed to power generation (Ali & Zaigham, 2017). There is 34% of industrial share in total electricity consumption (Pakistan Economic Survey, 2019). Thermal energy comprising of coal, natural gas and Regasified Liquefied Natural Gas (RLNG) forms major i.e. 63% share of electricity generation in gigawatt hour (GWh) while the remaining 37% consists of hydroelectric (25.8%), nuclear (3%) and renewable sources (8.2%) (Ministry of Energy, Government of Pakistan, 2019). The main strain occurs as despite the depleting reserves of natural gas, the over-reliance on thermal for electricity generation manifests itself in the form of rising cost of production. This high cost negatively affects competitiveness of industrial goods (Yasmin & Qamar, 2013). The Global Competitiveness Index for industrial exports ranks

Pakistan at 110th out of 141 economies, even three positions lower than the last 107th position (Schwab, 2019).

Pakistan's export-to-GDP ratio has been consistently on decline as compared to other developing countries and it is found encountering balance of payment problem caused by trade deficit. The World Bank reports the fall in Pakistan's export share from 0.18% to 0.13% in world exports. The manufactured exports comprise 76% of Pakistan's total exports (State Bank of Pakistan, 2017). And the textile sector (contributing cotton and yarn exports) makes for 46% of the total manufacturing has been negatively affected by electricity shortfall (Afzal, 2012). Poor governance and inefficient taxation policies along with scarce raw material further reinforced exports' deterioration (Malik & Majeed, 2018). The ill performance of these manufacturing, industrial and consequently, export sector was largely to energy woes i.e. demand-supply gap and rising energy prices resulting into rising cost of production, declining export competitiveness and high cost of doing business (Mahmood & Ahmed, 2017). However, China-Pakistan Economic Corridor launched in 2015 has undertaken various power projects which aim at tackling energy issues thereby, brightening the prospects.

The significance of this study lies in that it adds to the literature concerning energy crisis in Pakistan. A substantial body of literature examines the nexus between energy crisis and economic growth, energy crisis and industrial output, and energy crisis and textile sector while there are only a few studies that explore the relationship energy crisis and trade or exports. And there is no existing literature which analyzes manufactured exports in the context of energy crisis in Pakistan. Therefore, this study serves to fill this gap by means of empirical analysis based on the evidence from Pakistan.

Considering these observations, the objective of present paper is to evaluate the relationship between energy crisis and manufactured exports and to recognize the significant factors lying behind underperforming export industry of Pakistan. Hence, this study presents an insight to policy makers for the formulation of efficient strategies to overcome existing loopholes. The paper is assembled in such a way that after having introduced the research problem, background, objectives, and significance of the study in Section 1, Section 2 throws light on the reviewed literature. Then Section 3 discusses methodology employed for research followed by empirical analysis in Section 4. Finally, Section 5 gives concluding remarks along with policy recommendations.

2. Review of Literature

There is a vast literature which pinpoints energy as one of the significant factors of production bringing forth abundant studies exploring interdependence between energy consumption and economic growth while those digging into trade or exports are not only scarce but also ambiguous.

Shakeel, Iqbal, and Majeed (2014) have employed panel Cointegration approach to examine dynamic linkage between energy consumption, trade, and GDP for five South-Asian economies for the period 1980 to 2009 finding feedback link between energy consumption and exports in the short run along with the unidirectional causality flowing from exports to energy in the long run.

Halicioglu (2011) used Cointegration approach as well as Granger causality tests and found unilateral causality running from exports to energy consumption suggesting that energy conservation policies do not affect exports. Similarly, using Auto Regressive Distributed Lag (ARDL) bounds and Johansen Cointegration tests to explore the long run relation between economic growth, energy, and exports over period of 1970 to 2009, in Mauritius, electricity (used as a proxy for energy) has been found to be significantly influencing exports (Bakhtyar, Kacemi, & Nawaz, 2017; Nawaz, Hussain, & Hussain, 2021; Sultan, 2012).

Sami (2011), using annual data from 1960 to 2007 has come up with the long-run causality flowing from exports and real GDP to electricity consumption making use of bounds test and Vector Error Correction Method (VECM). Likewise, the evidence from Fiji from 1981 to 2011 shows the existence of long run Cointegration link between economic growth, electricity consumption, and exports with the causality running from the latter two to the former reflected from Granger causality test (Baloch et al., 2021; Makun, 2015).

In view of the perspective that energy crisis takes its toll on the country's industrial sector largely geared towards exports, considerable literature is found in the very regard. Korsakienė, Tvaronavičienė, and Smaliukienė (2014) have analyzed the industrial sector and exports of Lithuania for the time of 2000 to 2011, using correlation analysis and coming up with the conclusion that energy prices and exports of the observed industrial products are not related. However, the evidence from Nigeria for the span of 1990 to 2011 using VECM suggests that a positive relationship exists between electricity consumption, exports, and economic growth (Adenuga & Emeka, 2013; Chien, Kamran, et al., 2021).

Nnaji, Chukwu, and Nnaji (2013) have confirmed the existence of a significant relationship between energy consumption and exports i.e. Granger-causality flows from former to the latter. Also, the positive impact of shocks to energy consumption on exports has been suggested. Furthermore, the analysis of Iranian manufactured exports by Keramatfar (2012) for the period of 2000 to 2007, employing random effects model shows that there is significant negative relationship between energy prices and industrial exports while industrial exports are significantly positively related to exchange rate and value added.

Exploring the determinants of energy crisis in Pakistan, Qasim and Kotani (2014) found electricity prices to be positively and capacity utilization to be negatively related to energy consumption index for the period of 1971 to 2010 by employing Cointegration approach. On the other hand, factors like economic crisis along with industrial production, labor cost, real effective exchange rate and domestic demand have emerged as the determinants of manufacturing industry exports with domestic and foreign demand, and industrial production having significant positive impact while labor cost and exchange rate have been found to be statistically insignificant in the analysis using Generalized Method of Moments (GMM) and conducted on European Union members for the period of 2000 to 2011 (Basarac, Vuckovic, & Skrabic Peric, 2015; Chien, Sadiq, et al., 2021; Fazal, Gillani, Amjad, & Haider, 2020).

A study conducted by Latif and Javid (2016) for the span of 1972 to 2013 and employing GMM estimates, realizes the income of trading partners as well as real effective exchange rate as the significant (positively influencing) determinants of Pakistan's textile exports. In the very perspective, the distinction of this study lies in terms of both the variables used for analysis (specification of the model) and the time period under consideration along with the fact that there exists no literature in Pakistan which examines the impact of energy crisis on manufactured exports which doubtlessly lies at the core of the issue at hand (Nawaz, Ahmad, Hussain, & Bhatti, 2020; Shafiq, ur Raheem, & Ahmed, 2020).

Raza, Shahbaz, and Nguyen (2015), using time series data from 1973 to 2011 have verified feedback hypothesis while investigating the relationship between energy consumption and trade openness by employing ARDL approach. Not only the existence of long-run link between both the variables has been found but also bidirectional causality between GDP and energy consumption, between exports and energy consumption and between imports and energy consumption has been shown.

Babatunde (2017) analyzed the relation between electricity consumption and industrial production for the span of 1980 to 2015 brings to fore the significant positive relationship between energy consumption and Nigerian manufactured exports making use of the dynamic OLS technique; at the same time, determining significant positive relationship between manufactured exports and foreign demand.

Ahmed and Awan (2020), considering time span of 1972 to 2017 and analyzing the impact of energy crisis on trade openness along with other macroeconomic variables like investment, money supply, carbon dioxide emission, inflation, industrial output, and services sector output concludes the presence of long run Cointegration between the variables upon applying ARDL bounds testing approach.

The significance of this study lies in that it adds to the literature concerning energy crisis in Pakistan. A substantial body of literature examines the nexus between energy crisis and economic growth, energy crisis and industrial output, and energy crisis and textile sector while there are only a few studies that explore the relationship energy crisis and trade or exports. And there is no existing literature which analyzes manufactured exports in the context of energy crisis in Pakistan. Therefore, this study serves to fill this gap by means of empirical analysis based on the evidence from Pakistan.

3. Research Methodology and Data Collection

This section is devoted to theoretical framework and specification of the research model based on the evidence provided from the review of literature. It also brings forward the methods of analysis used in the study.

3.1 Theoretical Framework (Variable relationship)

Manufactured export is the dependent variable keeping in view the importance of manufacturing in Pakistan's export performance and vulnerability of the industrial sector to energy crisis. It is derived from the share of manufactures in total merchandise exports and choice of the variable is based upon its direct relation with energy use. Based on the assumption that export performance is directly influenced by excess demand of energy (Babatunde, 2017) and consequently, energy crisis (shortage) tends to affect manufactured exports, therefore, the difference between energy demand and energy supply i.e. shortfall in kilotonnes of oil equivalent (ktoe) has been used as the proxy. Real effective exchange rate which is the weighted real exchange rate between a country and its trading partners directly influences export prices interfering with their competitiveness (Basarac et al., 2015). Also, as exports are constrained by the economy's productive capacity (Babatunde, 2017; Basarac et al., 2015), for which industrial output has been employed as the proxy. Moreover, foreign demand for exports reflected by the nation's trading partners has been found to be exerting positive effect on the exports (Babatunde, 2017), and is proxied by world GDP. And the price of energy has been found to influence exports by means of affecting industrial productivity and cost of production (Keramatfar, 2012). Therefore, total average sale price of electricity in rupees per kilo Watt hour (Rs. /kWh) has been used as the proxy for energy price.

3.2 Model Specification

Based on theoretical grounds, the functional form of the model is specified as,

Manufactured Exports= f(energy crisis, energy price, productive capacity, foreign demand, exchange rate)

Expressing the model in the estimable form,

$$MX_t = \beta_1 + \beta_2 \text{ ENCR}_t + \beta_3 \text{ ENPR}_t + \beta_4 \text{ IND}_t + \beta_5 \text{ FORD}_t + \beta_6 \text{ REER}_t + \mu_t$$

μ_t is the error term which accounts for introducing those extraneous factors that cause variations in the manufactured exports and are not included in the model. β_1 is the intercept of the model and rest of the βs are the partial regression coefficients where subscript 't' represents time series data. Based on the priori, it is expected that $\beta_2<0$, $\beta_3<0$, $\beta_4>0$, $\beta_5>0$, and $\beta_6>0$.The study uses annual time series data of the variables covering the sampling period from 1990 to 2019.

Table1: Variables' Description and Data Source

Variable	Description	Data Source
MX	Manufactured exports as percent of GDP	WDI
ENCR	Log of Energy demand minus supply (shortfall in ktoe)	IEA
ENPR	Log of total average sale price of electricity (Rs. /kWh)	PSS
IND	Industrial Output as percent of GDP	WDI
FORD	World GDP growth rate	WDI
REER	Real effective exchange rate index	WDI

IEA: International Energy Agency, PSS: Power System Statistics, 44th edition, WDI: World Development Indicators

3.3 Econometric Analysis

E Views software has been employed to analyze the data. The methodology includes descriptive analysis, correlation analysis, and Ordinary Least Square (OLS) estimation after examining stationarity of the variables. Also, diagnostic tests have been employed to test various assumptions of OLS.

3.3.1 Descriptive Analysis
It has been employed to understand the basic properties of the data which are reflected by summary statistics of each variable and include mean, median, maximum, minimum, standard deviation, skewness, kurtosis etc.

3.3.2 Correlation Analysis
The bivariate correlation among the variables has been analyzed by means of the correlation matrix which presents the nature and degree of relationship between the variables.

3.3.3 Stationarity Test
Kwiatkowski-Phillips-Schimdt-Shin (KPSS) unit root test has been used to assess the stationarity of the time series data and Augmented-Dickey-Fuller (ADF) test has been employed to test if the unit root is present in the residuals of the estimated equation in order to avoid spurious results.

3.3.4 Estimation Technique
After determining stationarity of the time series, the regression equation has been estimated by Ordinary Least Squares (OLS) method which determines beta coefficients and the direction of relationship between regressand and the regressors.

3.3.5 Sensitivity Analysis
Multicollinearity among the variables has been diagnosed by examining Variance Inflating Factors (VIF) and Tolerance (TOL) statistics. Normality of the data has been analyzed through Jarque-Bera test. Breusch-Godfrey Serial Correlation LM Test has been employed to test for the presence of auto/ serial correlation. And Breusch-Pagan-Godfrey test has been used to test Heteroscedasticity.

4. Empirical Analysis and Findings
This section presents the results of the techniques of analysis employed in the study along with the interpretation of the findings.

4.1 Descriptive Analysis
The following table gives the basic descriptive statistics of the variables:

Table 2: Result of Descriptive Analysis

Statistics	MX	ENCR	ENPR	IND	FORD	REER
Mean	1.1789	6842.6	6.005	20.21	2.821	109.03
Median	1.2209	4922.5	4.5950	20.00	2.938	107.26
Maximum	1.4968	27629	12.970	22.93	4.408	126.58
Minimum	0.7081	743	1.2500	17.54	-1.673	96.49
Standard deviation	0.2249	7408.02	4.0397	1.764	1.202	9.649
Skewness	-0.7540	1.9285	0.6637	-0.036	-1.586	0.263
Kurtosis	2.6303	5.3793	1.9981	1.631	7.646	1.563
Jarque-Bera	3.014	25.6721	3.4570	2.347	39.55	2.926
Probability	0.2216	0.000	0.1775	0.309	0.000	0.231

Table 2 shows that the average value of manufactured exports is 1.18% during 1990 to 2019 in Pakistan while the maximum and minimum values have been 1.47% and 0.71% respectively. The deviation from mean is 0.22 and the data mirrors mesokurtic distribution as shown by2.6 value of kurtosis. The null hypothesis of Jarque-Bera statistic cannot be rejected and we conclude that the data of manufactured exports is normally distributed. The mean value of energy crisis is 6842.6 ktoe for thirty observations i.e. from 1990 to 2019. The maximum value of shortfall has been 27629 ktoe in 2018 while the minimum value has been 743 ktoe in 1991. The deviation from mean for energy crisis is 7408.02. The null hypothesis of Jarque-Bera is rejected for energy crisis as reflected by probability value of 0.000 and the data is not normally distributed. The mean value for energy price is Rs. 6 per kWh; the maximum value is Rs. 12.97/ kWh and the minimum value is Rs. 1.25/ kWh while deviation from mean is 4 which are close to mean and null hypothesis of Jarque-Bera cannot be rejected, so the data for energy price is normally distributed. The average value of industrial output is 20.21%, foreign demand growth rate is 2.82%, and that of exchange rate index is 109. The maximum value of industrial output is 22.93%, the minimum value is 17.4%, and deviation from mean is 1.764. The standard deviation is 1.202 and 9.649 for foreign demand and exchange rate, respectively. The null hypothesis of normality cannot be rejected for both industrial output and exchange rate suggesting that they follow normal distribution while it is rejected for foreign demand growth rate implying that the data for foreign demand growth is not normally distributed.

4.2 Correlation Analysis

Table 3 given below shows the degree of correlation among the variables represented by Pearson's correlation coefficient ranging from -1 to 1, along with the significance of the relationship reflected by their probability values. The coefficient of 0 represents no correlation, 1 means perfect correlation and 0.5 reflects moderate correlation. The correlation coefficients of -0.8 and -0.87 suggest that there is highly significant strong negative relationship between manufactured exports and energy crisis as well as energy prices, respectively. Similarly, highly significant and strong positive linear relationship exists between manufactured exports and industrial output as reflected by the correlation coefficient of 0.7 between the two. However, correlation between manufactured exports and foreign demand as well as exchange rate has been found to be insignificant. Moreover, observing pair-wise correlation among the regressors, statistically significant moderate positive relationship has been found between energy crisis and energy price as shown by correlation coefficient of 0.5; while significant and moderate negative correlation has been found between energy crisis and industrial output, energy price and industrial output as well as exchange rate as depicted by coefficients of -0.5, -0.5, and -0.49 respectively. Highly significant moderate positive correlation exists between industrial output and exchange rate as reflected by Pearson's correlation coefficient of 0.5.The correlation between foreign demand and all other variables is insignificant. Also, the linear association between exchange rate and energy crisis is found to be insignificant.

Table 3: Result of Correlation Analysis

Variables	MX	ENCR	ENPR	IND	FORD	REER
MX	1					
ENCR	-.846** .000	1				
ENPR	-.872** .000	.561** .000	1			
IND	.708** .000	-.501** .005	-.593** .001	1		
FORD	.053 .781	.052 .786	.077 .684	-.131 .491	1	
REER	.207 .273	-.105 .581	-.493** .006	.510** .004	-.017 .928	1

* p < .05, ** p < .01

4.3 Stationarity Test

The KPSS unit root test for examining stationarity (with intercept) of the variables gives following results:

Table 4: Result of KPSS Unit Root Test

Variable	LM statistic	CV at 1%	CV at 5%	CV at 10%	Decision
MX	0.626404	0.739000	0.463000	0.347000	I(0)
ENCR	0.540087	0.739000	0.463000	0.347000	I(0)
ENPR	0.692718	0.739000	0.463000	0.347000	I(0)
IND	0.422745	0.739000	0.463000	0.347000	I(0)
FORD	0.120133	0.739000	0.463000	0.347000	I(0)
REER	0.339155	0.739000	0.463000	0.347000	I(0)

CV: critical value

Table 4 shows that the null hypothesis of stationarity cannot be rejected for any of the variables as Lagrange-Multiplier (LM) statistic for each variable does not exceed critical value (1%, 5% or 10%). Thus, it can be concluded that the time series of manufactured exports, energy crisis, energy price, industrial output, foreign demand, and exchange rate are stationary at level and that we can proceed with OLS estimation. This result can be further reinforced by checking the presence of unit root in the residuals which is examined by ADF unit root test as shown below. Table 5 shows that the null hypothesis of a unit root can be rejected for the residuals as the p-value of 0.004 is less than 0.05. It can be concluded that the residuals are stationary and the OLS estimation will not give spurious results.

Table 5: Result of ADF Unit Root Test for Residuals

t-statistic	Probability
-3.992405	0.0047

4.4 Model Estimation

The OLS technique employed for model estimation yields following results:

Table 6: Result of OLS Estimation

Dependent Variable: MX				
Regressors	**Coefficient**	**Std. Error**	**t-statistic**	**Probability**
ENCR	-0.0625	0.0264	-2.3597	0.0268*
ENPR	-0.1852	0.0379	-4.8797	0.0001***
IND	0.0435	0.0103	4.2003	0.0003***
FORD	0.0284	0.0106	2.6600	0.0137*
REER	-0.0067	0.0018	-3.6606	0.0012**
Constant	1.7656	0.2794	6.3182	0.0000***
R-squared	**Adj. R-squared**	**F-statistic**	**Prob (F-statistic)**	
0.9233	0.9073	57.814	0.000	

*p < .05, ** p < .01, *** p < .001

Table 6 presents the estimated regression model, and it can be observed that manufactured exports are significantly negatively related with energy crisis, energy price and exchange rate, while they are positively related with industrial output and foreign demand. The value of β_2 i.e. -0.0625 shows that one percent increase in energy crisis or shortfall in kilotonnes of oil equivalent (ktoe) causes manufactured exports to decline by 6.25 percent on average, holding all other factors constant. The p-value of 0.026 shows that the relationship is significant at 5 percent level. The finding conforms with the previous studies which have shown negative association between energy crisis and trade revealing that energy crisis tends to reduce exports (Ahmed & Awan, 2020).

The coefficient of energy price is highly significant and the value of β_3 i.e. -0.1852 suggests that if energy price rises by one percent, the share of manufactured exports in GDP, on average falls by 18.5 percent, ceteris paribus. This finding complies with the study conducted by Keramatfar, 2012 which shows negative relationship between energy prices and manufactured exports as energy price comprises the major portion of cost of production (energy being the input). This implies that any shock to energy price is detrimental to production process and harms manufactured exports by means of affecting industrial produce (Keramatfar, 2012).

Moreover, statistically significant positive relationship has been found between manufactured exports and industrial output and the coefficient shows that one percent increase in industrial output would lead to four percent increase in manufactured exports, on average; holding all other factors constant. This finding is consistent with the findings of other empirical studies as productive capacity of the economy has been found to be exerting positive effect on manufactured exports (Basarac et al., 2015). Increase in industrial sector output means its productivity has increased which leads to more exports (Ahmed & Awan, 2020).

The coefficient of foreign demand is statistically significant and the value of β_5 implies that one percent increase in foreign demand, on average causes manufactured exports to rise by 2.8 percent, ceteris paribus. The finding is in accordance with previous literature in that foreign demand has already been found to be a stimulator of growth of manufactured exports (Basarac et al., 2015). This foreign demand represents income of the trading partners which has positive and significant impact on manufactured exports (Babatunde, 2017).

A closer examination of the model reveals that the real exchange rate is negatively and significantly related to manufacture exports. One percent rise in exchange rate leads to 0.6 percent decline in manufactured exports. The sign difference from prior expectation could be the result of constant fluctuations or instability of exchange rate in Pakistan. The coefficient of determination shows that 92.3 percent of the variation in manufactured exports is explained by energy crisis, energy price, industrial output, foreign demand, and exchange rate while the rest 7.7 percent variation which is not explained by the model must be due to the error term or the factors that are not included in the model. However, overall fitness of the model is represented by adjusted R-squared of 90.7%. High F-value of 57.8 and the corresponding p-value of 0.000 indicate that the model is good fit.

4.5 Sensitivity Analysis

The collinearity among the regressors is diagnosed by their VIF and TOL statistics as given below.

Table 7: Multicollinearity Test

Variable	ENCR	ENPR	IND	FORD	REER
VIF	3.38	4.78	2.06	1.02	1.93
TOL	0.30	0.21	0.49	0.98	0.52

Table 7 presents VIF and TOL for explanatory variables. As the values of VIF are less than 10 and the values of TOL are greater than 0 for all the variables, we can conclude that the regressors i.e. energy crisis, energy price, industrial output, foreign demand, and exchange rate are not collinear. This result can be further ensured by looking at the correlation matrix presented in correlation analysis which shows that none of the regressors have pair-wise correlation more than 0.8. And Multicollinearity does not pose a serious threat in this case. The following table summarizes the results of the tests used for assessing normality, Heteroscedasticity, and auto or serial correlation.

Table 8: Result of Normality, Heteroscedasticity and Autocorrelation Test

Test	Type	Statistic	Probability
Normality	**Jarque-Bera**	0.936692	0.626037
Heteroscedasticity	**Breusch-Pagan**	0.818276	0.5486
Serial correlation	**Breusch-Godfrey LM**	1.101791	0.3499

Table 8 depicts the relevant statistic and the corresponding probability for each diagnostic test that has been employed to test if any of the OLS assumptions is violated. The normality of the residuals has been diagnosed by means of Jarque-Bera test, the null hypothesis for which states that the data is normally distributed. The p-value of 0.626 implies that null hypothesis of normality cannot be rejected, and we may conclude that the data follows normal distribution. Breush-Pagan-Godfrey (BPG) test has been employed to examine Heteroscedasticity in the error term. The result shows that we fail to reject the null hypothesis of homoscedasticity as reflected by the p-value of 0.548. Hence, variance of the residuals is constant as they are excused from the problem of Heteroscedasticity. Similarly, the test conducted for examining auto or serial correlation among the residuals called Breusch-Godfrey LM test gives the p-value of 0.349 which is greater than 0.05. It suggests that there is not enough evidence to reject the null hypothesis of no serial correlation. We conclude, therefore, that there is no problem of serial correlation. It can be clearly observed that the assumptions of OLS are not violated as the data is not only normally distributed but also there is no problem of Multicollinearity, Heteroscedasticity, or serial correlation. Hence, the estimates provided by the OLS may as well be regarded as reliable.

5. Conclusion and Policy Recommendations

This study attempts to investigate the impact of energy crisis on manufactured exports along with examining other drivers of manufactured exports in Pakistan by using time series data from 1990 to 2019 by employing OLS technique. The findings of negative relationship between energy crisis as well as energy price and manufactured exports clearly bring forward the underlying factors behind the deteriorating export sector of Pakistan. Facing severe energy crisis and confronting rising energy prices, the manufacturing sector has suffered a hard blow as energy not only serves as an input for the production process but also bears importance as far as trade balance is concerned. Moreover, increased energy consumption is coupled with higher productivity of the industrial sector which is constrained by shortfall in energy demand and supply (megawatts or kilotonnes of oil equivalent), thereby contributing to falling exports of goods. Moreover, the productive capacity of the economy as well as demand for exports coming from abroad have been found to be significantly positively related to manufactured exports while exchange rate has been found to be significantly negatively related to manufactured exports.

The afore-mentioned findings call for such policy recommendations that can effectively tackle the issue of poor manufactured export performance in the light of energy crisis which has been the major concern for policymakers for quite some time now. The government should take immediate initiatives to generate more energy to increase domestic production and to serve export purpose. Efficient energy policies should be formed, and innovative measures should be introduced for energy conservation. The steps should be taken to shift the reliance from high-cost thermal to low-cost hydroelectric sources. Moreover, there is a need for industrial policies and that the government should direct its focus on promoting industrial sector to not only enhance its productive capacity but also to uplift its manufactures. Also, steps should be taken to keep exchange rate stable over time. And manufactured exports should be made more competitive to attract foreign demand which calls for effective strategies for price adjustment and input cost management.

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