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RESEARCH PAPER

Second-Round Effects of Energy Inflation in Manufacturing Sector: An Evidence for Pakistan

[1]Chanda Arshad, [2]Ashfaq Ahmad* and [3] Muhammad Ilyas

1. MS scholar, Department of Economics, GC Women University Sialkot, Punjab, Pakistan
2. Assistant Professor, Department of Economics, GC Women University Sialkot, Punjab, Pakistan
3. Professor, Department of Economics, GC Women University Sialkot, Punjab, Pakistan

***Corresponding Author:** ashfaqahmad146@gmail.com

ABSTRACT

Manufacturing is considered to be the backbone of social and economic development worldwide. The issue of energy inflation has become a major macroeconomic concern for many sectors, including manufacturing. This study examines Pakistan's manufacturing sector specifically to determine how second-round energy inflation affects its operations. Further, the study aims to determine the impact of macroeconomic indicators on manufacturing value-added (MVA) including inflation reverts. In this study, manufacturing value-added is used as a dependent indicator, while energy inflation (EI), core inflation (CI), political instability (PI), real interest rate (RIR), and financial development (FD) are independent indicators for the period 1991 to 2020. This study uses the gap model for capturing the variation or second round in inflation and the autoregressive distributive lagged model for individual long-run_ and short-run impacts on manufacturing value-added growth. Based on the gap model, results show the huge presence of second-round effects of energy inflation in Pakistan. ARDL results show that energy inflation, core inflation, financial development, and political instability all affect manufacturing value-added significantly excluding real interest rates. This research also helps the Pak government to promote energy efficiency and adoption of energy-saving technologies in the manufacturing sector. Companies can reduce their dependency on fuel and mitigate the impact of energy price fluctuations. This study helps to stabilize manufacturing costs and improve competitiveness, ultimately contributing to the growth of manufacturing value-added in Pakistan.

KEYWORDS ARDL, Energy Inflation, Financial Development, Manufacturing Sector, Political Instability, Second-Round Effects

Introduction

Pakistan's Variations in global commodity prices, such as oil or food prices, can also cause inflation. Inflation may be defined as an increase in prices and living costs in a country (C Oner - Finance & Development, 2010). When inflation is strong, product prices and services grow fast, while currency buying power falls. While industrialized nations have advanced technical infrastructure, high per capita income, and well-established financial markets, they may face inflation owing to a variety of circumstances. Price stability is widely accepted as the major target of monetary policy to sustain persistent inflation and avoid deflation (Die Wert et al., 2018).

The issue of inflation in the target country, as well as in Pakistan, is challenging and varied. The primary causes of inflation in Pakistan are the rise in food prices, the rise in gasoline prices, and the depreciation of the currency. Inflation in Pakistan during this time was primarily caused by increasing food and energy prices, particularly for vital commodities such as wheat, sugar, and vegetables. According to my information, Pakistan's inflation rate in September 2021 was pretty high. According to the State Bank of Pakistan, the average Consumer Price Index (CPI) inflation rate for the fiscal year 2020- July to 2021-June was 8.9%. This was much higher than the previous fiscal year's (7.1%) inflation rate (2019-2020). According to the Pakistan State Bank, Pakistan's inflation rate in December

2021 was 11.1%. It is crucial to remember, however, that inflation rates are impacted by a variety of factors, including global economic circumstances, government policies, and other macro indicators.

The indirect impacts of inflation on the economy that arise as an outcome of price rises in one sector of the economy impacting prices in other sectors are referred to as the pass-through effects of inflation. The ability of cost-setting companies to raise prices and wage-setting labor to increase wages in reaction to comparable price disruptions in other commodities and services drives the Second-Round Effect (SRE) of food and energy inflation (Baumeister et al., 2010). Energy inflation and core inflation are two separate measurements of headline inflation that might have differing effects on each other. In general, energy inflation is more likely to return to core inflation. There is some volatility from fuel prices to overall inflation, but it is tiny, transitory, and decreasing over time. Because of lowering wage rigidities, increasing financial policy reliability, and a drop in the percentage of depletion and creation of oil before the mid-1980s, the impacts of oil price fluctuation and activity on inflation were significantly higher before the mid-1980s than later (Blanchard & Gal, 2007). Similarly, a study estimated that the concept of pass-through was five times as large before 1980, where a 10% rise in oil prices equals a 0.3% increase in inflation (Moreno et al., 2007). The proportion of energy inflation and core inflation in headline inflation varies according to historical periods and economic conditions.

Over the last few decades, the industrial sector in developed countries has seen major transformations. Manufacturing contributes significantly to Pakistan's economy, accounting for around 13% of GDP and employing approximately 15% of the workforce. Textiles, food processing, chemicals, pharmaceuticals, cement, and autos are among the industries represented. Textiles are the most significant manufacturing sub-sector, accounting for over 60% of Pakistan's exports. Pakistan is the fourth-largest cotton producer in the world and has a well-established textile industry that includes spinning, weaving, dyeing, printing, and finishing.

Manufacturers rely on energy to perform their activities, from powering machinery to heating and cooling buildings. One of the most critical topics highlighted was energy inflation, which played a key role in growth and progress. The growing demand for energy, transportation, housing, and energy generation compounds the situation (Hart, 2018). This increase in transportation costs can, in turn, lead to the pricing of other products and services rising. Reduced input costs result in larger outputs and sales, whereas higher input costs result in lower output capacity, increased selling, and lower total sales (Gans et al., 2011; Sickles and Zelenyuk, 2019). Furthermore, automation and digitalization have increased manufacturing productivity and efficiency, making advanced countries more competitive in the global market.

Literature Review

This section briefly reviews the scientific literature related to inflation's second-round effects, and scheduling problems in manufacturing systems are discussed. Since 1970, the manufacturing sector has played a significant role in economic development. No country has ever reached and maintained a high standard of living without major advancements in its manufacturing sector. A summary of the literature is provided in three categories: inflation affect targeting, integrated second-round effects scheduling, and manufacturing sector production.

Umaru and Zubairu, (2012) and Bakare et al., (2015) examined the effect of inflation on economic growth and development in Nigeria. The study found a positive impact on inflation and economic growth. Gokal and Hanif (2004) noted that different economic theories hold opposing views regarding output growth's response to inflation. The aggregate supply-demand framework shows a positive relationship between inflation and output growth.

On the other hand, numerous researchers have studied food inflation, such as Munene and Misati (2015). They emphasized the second-round and pass-through impacts of food prices on inflation. According to findings, the second-round impacts of food prices on inflation are apparent, although the Philips curve indicated or suggested a domestic food price pass-through of 0.49% to total inflation and 0.38 to non-food, non-fuel inflation.

Muhammad Haseeb (2022) discussed food inflation persistence and the second-round effect. He revealed that food inflation is more persistent in Pakistan than non-food, headline, and core inflation. Shahzad et al., (2022) calculated the pass-through of food inflation and inflation persistence on headline inflation. Based on empirical analysis, food inflation is more consistent than the core, headline, taxes, GDP, and energy imports.

Furthermore, numerous studies have presented empirical evidence on the energy challenges. Sidra et al. (2021) investigated energy inflation causes instant. They found that energy imports and taxes are positively correlated with energy inflation, while the other variables are negatively correlated with M2 and have a negative relationship with oil prices, GDP, taxes, and energy imports.

However, various researchers declared a significant and insignificant relationship between private domestic investment, large-scale manufacturing, public investment, export, value-added manufacturing, employed labor force, energy shortages, exports of goods and services, inflation, GDP deflator, market size, etc. While Kabini, (2019) revealed the significant impact of fuel price volatility on the manufacturing sector because South Africa is a country that imports a large number of petroleum products. Just like Pakistan, many determinants influence the manufacturing sector such as the cost of productivity, the price level of goods, foreign direct investments, private domestic investment, trade openness, consumer behavior in the market, wages, labor, inflation, interest rate, exchange rate, etc.

Similarly, Rahman and Bakar (2018) explored an overview of determinants similar to foreign direct stock in Pakistan's manufacturing sector. This study examined the link between FDI and the manufacturing sector theoretically and empirically. The results showed that FDI's contribution to the manufacturing sector is significant.

Furthermore, Rahman and Bakar (2019) presented a complete evaluation of Pakistan's manufacturing industry and its growth. They defined Pakistan as facing core issues like low employment, high inflation, less focus on economic growth, and falling foreign investment. He found that the slow-growing economy of Pakistan faces instability and exchange rate volatility because of high levels of inflation and fiscal deficits.

Rahman et al. (2022) analyzed the effects of private domestic investment and manufacturer export on development output in Pakistan's large-scale manufacturing. He found a significant connection between private domestic investment, exports, and the value of large-scale manufacturing. On the other hand, Ali (2015) described the other factors that affect the large-scale manufacturing sector. He evaluated the public investment, political stability, value-added, and capital costs in the manufacturing sector. He concluded that the given variables have significant effects on Pakistan's manufacturing sector.

Moreover, Grainger and Zhang (2019) stated a shortage of electricity and production in the manufacturing sector in Pakistan. He tested how manufacturing production is affected by value-added, product value, cost of raw material, cost of total employment, cost of electricity, and values of fixed assets. He indicated the result of a strong negative connection between the shortage of electricity and manufacturing value-added and a positive correlation between the labor shares of output.

Material and Methods

Ongoing research aims to define the second-round effect of energy inflation and the individual impact of other economic indicators on manufacturing value-added. Two models are followed for this research. Firstly, this study used the gap model to identify whether the second-round effects exist, and secondly, the econometric model to quantify individual impact on manufacturing value-added.

Gap model for testing Second-round effects

This research employed the gap model to define the second-round effects of energy inflation in Pakistan. The gap model is used to analyze the second-round effects in these studies (Clark, 2001; Cogley, 2002; Rich & Steindel, 2005; Lafleche & Armour, 2006; Ceccetti & Moessner, 2008; Janak & Sangita, 2011; Ruch & Bester, 2012). This study refers to the studies of Ceccetti & Moessener, 2008 in response to the questions below:

Does the headline inflation return to the core inflation?

The following regression calculated on headline inflation using annual data provides empirical insight into the problem.

$$\pi_t^{headline} - \pi_{t-i}^{headline} = \alpha + \beta(\pi_{t-i}^{core} - \pi_{t-i}^{headline}) + \varepsilon_t \quad (1)$$

Is the core inflation reverting to the headline inflation?

Empirically, this issue is investigated by examining the regression generated using yearly data from 1991 to 2020.

$$\pi_t^{core} - \pi_{t-i}^{core} = \delta + \gamma(\pi_{t-i}^{headline} - \pi_{t-12}^{core}) + \varepsilon_t \quad (2)$$

Does the energy inflation return to the headline inflation?

The following empirical analysis uses yearly data from 1991-2020 to examine the given issue.

$$\pi_t^{energy} - \pi_{t-i}^{energy} = \alpha + \beta(\pi_{t-i}^{headline} - \pi_{t-i}^{energy}) + \varepsilon_t \quad (3)$$

Econometric model: To achieve the aims of this research, establish a mathematical functional model specification as follows:

$$MVA = f(EI, CI, RIR, PI, FD) \quad (4)$$

where MVA refers to the manufacturing value added in current US$ that transforms into a log form, EI refers to the proxy of nominal imported oil prices in dollars, CI refers to the core inflation in prices of non-energy and non-food items, RIR refers to the real interest rate in percentage, PI refers to the political instability, and FD refers to the financial development. To avoid data sharpness, it is necessary to modify the data of the variables featured in the study's model.

$$\ln MVG_t = \beta_0 + \beta_1 EI_t + \beta_2 CI_t + \beta_3 RIR_t + \beta_4 PI_t + \beta_5 FD_t + \varepsilon_t \quad (5)$$

where subscript t shows the time period: t = 1, 2, 3,……T, ε represents the error term, β_0 is intercepted, and β_1, β_2, β_3, β_4, β_5 are the coefficients of independent indicators. There is a brief explanation of the methodology and step-by-step procedures for the ARDL and ECM models. For both long-term and short-term associations, the unrestricted error correction model is provided as follows:

$$\Delta \ln MVA2t = \alpha_0 + \sum_{i=1}^{p} \beta_{1i} \Delta \ln MVA_{2t-r} + \sum_{i=0}^{p} \beta_{2i} \Delta EI_{t-r} + \sum_{i=0}^{p} \beta_{3i} \Delta CI_{t-r} + \sum_{i=0}^{p} \beta_{4i} \Delta RIR_{t-r} + \sum_{i=0}^{p} \beta_{5i} \Delta PI_{t-r} + \sum_{i=0}^{p} \beta_{6i} \Delta FD_{t-r} + \beta_7 \ln MVA_{2t-1} + \beta_8 EI_{t-1} + \beta_9 CI_{t-1} + \beta_{10} RIR_{t-1} + \beta_{11} PI_{t-1} + B_{12} FD_{t-1} + \varepsilon_t \quad (6)$$

The second phase of the study involves investigating long-run and short-run correlations after validating cointegration between the variables.

$$\mathbf{lnMVA_{2t} = \alpha_1 + \sum_{i=1}^{p} \beta_{1i} lnMVA_{2t-i} + \sum_{i=0}^{p} \beta_{2i}\, EI_{t-i} + \sum_{i=0}^{p} \beta_{3i}\, CI_{t-i} + \sum_{i=0}^{p} \beta_{4i}\, RIR_{t-i} + \sum_{i=0}^{p} \beta_{5i}\, PI_{t-i} + \sum_{i=0}^{p} \beta_{6i}\, FD_{t-i} + \varepsilon_t} \quad \textbf{(7)}$$

$$\mathbf{\Delta lnMVA_{2t} = \alpha_2 + \sum_{i=1}^{p} \beta_{1i} \Delta lnMVA_{2t-i} + \sum_{i=0}^{p} \beta_{2i}\, \Delta EI_{t-i} + \sum_{i=0}^{p} \beta_{3i}\, \Delta CI_{t-i} + \sum_{i=0}^{p} \beta_{4i}\, \Delta RIR_{t-i} + \sum_{i=0}^{p} \beta_{5i}\, \Delta PI_{t-i} + \sum_{i=0}^{p} \beta_{6i}\, \Delta FD_{t-i} + \phi ETC_{t-1} + \varepsilon_t} \quad \textbf{(8)}$$

In this situation, the ECTt-1 coefficient indicates the error correction term, which is computed as follows:

$$\mathbf{ECT_{t-1} = lnMVA_{2t-1} - \alpha_1 - \beta_{2i}EI_{t-1} - \beta_{3i}CI_{t-1} - \beta_{4i}RIR_{t-1} - \beta_{5i}PI_{t-1} - B_{6i}FD_{t-1}} \quad \textbf{(9)}$$

Conceptual framework

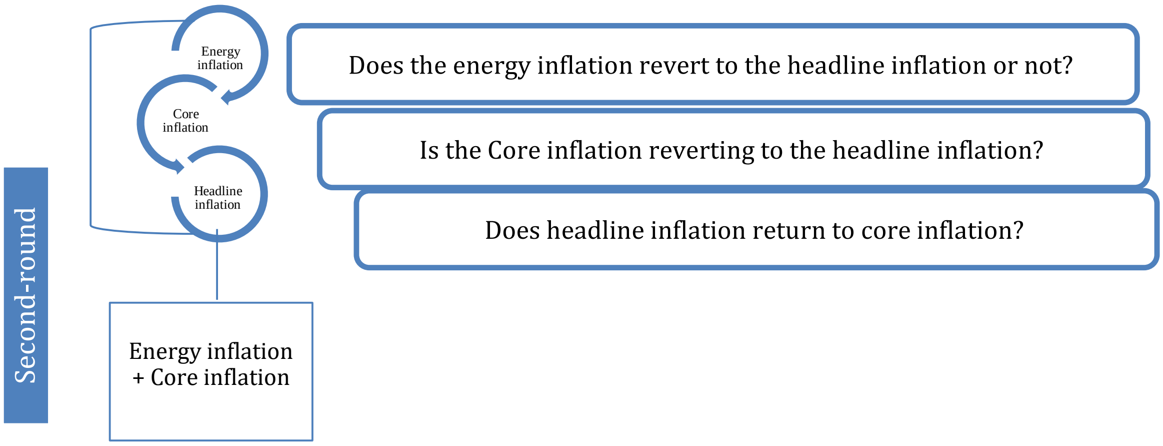

Figure-1: The Individually long run and short run impact of selected indicators on manufacturing value-added

Results and Discussion

Result for second-round effects

Pakistani energy inflation was tested based on the Gap model to determine whether second-round effects exist. Positive significant results of coefficients indicate that the second-round effects are present. Based on the coefficient value of -0.04, the headline inflation fully reverts to the core inflation. The study's results demonstrate that there are no second-round effects occurring. This study was conducted using the methodology described in Equation 2 by Gelos and Ustyugova (2012). As a result of this study, it has been determined that the coefficient is -0.75, which means that core inflation has fully reverted to headline inflation and there is no second-round effect in Pakistan. In the below table 1 shows the coefficient value is 0.89 which is positive and significant, it means that energy price changes affect the overall inflation, confirming that the shock is present and the SRE of energy inflation is large in the case of Pakistan from1991 to 2020. Our result implies that every 1% rise in energy inflation leads to a 0.89 increase in headline inflation.

Table 1
Results of Regression Analysis of SRE

dependent variable:	$\pi_t^{headline} - \pi_{t-i}^{headline}$	$\pi_t^{core} - \pi_{t-i}^{core}$	$\pi_t^{energy} - \pi_{t-i}^{energy}$
$\pi_{t-i}^{core} - \pi_{t-i}^{headline}$	-0.04(-0.27)		
$\pi_{t-i}^{headline} - \pi_{t-12}^{core}$		-0.75(-3.80)	
$\pi_{t-i}^{core} - \pi_{t-i}^{headline}$			0.89*(4.90)

Descriptive statistics

This study uses descriptive statistics to check the characteristics of data whether it is normal or not. A summary of descriptive statistics is presented in Table 2 which shows that the study's model is normally distributed.

Table 2
Results of Descriptive Analysis

	Mean	Median	Maximum	Minimum	Std.Dev.
Y	23.52185	23.52485	24.44463	22.68348	0.639735
EI	45.85869	37.96093	102.5803	12.06666	29.13678
CI	7.924462	7.952721	21.70604	-4.205343	6.183358
RIR	0.563811	-0.014507	7.125313	-5.079301	3.086954
PI	3.533333	7.000000	8.000000	-6.000000	5.600082
FD	23.99063	24.24965	24.80474	23.04031	0.552541

Unit-root test

Table 3 presents the results of the stationary test. The study applied the augmented Dickey-Fuller and Phillips Perron stationary tests. This model integrates all variables in mixed order. Here, the autoregressive distribution lag (ARDL) methodology is utilized.

Table 3
Results of Stationarity Tests (ADF & PP)

Var	ADF (with constant) lag criteria AIC				PP (with constant) lag criteria AIC			
	At level		At 1st difference		At level		At 1st difference	
	t-test	Pro.Val	t-test	Pro.Val	t-test	Pro.Val	t-test	Pro.Val
lnMVA	-0.6575	0.8421	-3.3059	0.0242*	-0.6950	0.8327	-3.3384	0.0225*
EI	-1.5024	0.5182	-4.6414	0.0010*	-1.5539	0.4927	-4.5821	0.0011*
CI	-3.0575	0.0413*			-2.9412	0.0429*		
RIR	-4.6368	0.0009*			-4.6562	0.0009*		
PI	-1.4148	0.5612	-4.6554	0.0009*	-1.5673	0.4860	-4.6554	0.0009*
FD	-1.3640	0.5852	-3.4958	0.0157*	-1.4699	0.5342	-3.4749	0.0165*

Lag selection criteria

After estimating the unit root test the next step is to optimize the lag length criteria. When estimating a VAR model, utilize a high enough number of lags dependent on the amount of data. By choosing the wrong lag length or frequency, false correlations, omitted variables biases, or endogenous results may be generated. As a general rule, the criteria with the lowest value, which is the AIC at 19.57038 significant, should be chosen since the model is more accurate the lower the number. The model's best criterion is AIC, and the lag duration is 1.

Table 4
Results of Optimal Lag Length Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-356.0423	NA	6857.416	25.86017	26.14564	25.94744
1	-231.9853	186.0855*	13.57286*	19.57038*	21.56869*	20.18128*
2	-203.4418	30.58238	34.37826	20.10298	23.81413	21.23752

Note: * show the significance level of lag selection for model

F-Bound test for co-integration

No relationship exists because the f-statistics is smaller than the lower critical value I(0) so we accept the null hypothesis and vice versa. The critical value of the estimated f-statistic (7.408145) is greater than the upper critical I(1) 5.23 at 5% so, this study will accept the alternative hypothesis and reject the null hypothesis.

Table 5
Results of the F-Bound Test

f-bound test			
Significance level	1%	5%	10%
Lower bounds	3.93	3.12	2.75
Upper bound	5.23	4.25	3.79
F-Statistics 7.4081			
Null-hypothesis: No level of relationship			

Note: The significance level is shown by the symbols ***, **, and * at 1%, 5%, and 10%, respectively.

ARDL long-run analysis

The ARDL long-run outcomes are shown in the below table 6. It provides the results of the long run using the auto-regressive distributive lag (1, 0, 0, 0, 0, 1) method. In this study, all the variables have a significant impact on manufacturing value-added in the case of Pakistan except the real interest rate. Furthermore, this research will provide justifications about the real interest rate having an insignificant impact on manufacturing value-added in the contexts of different researchers.

In the long run, energy inflation has a considerable and favorable influence on industrial value-added. It demonstrates that manufacturing cost tends to grow along with rising energy prices owing to inflation, which may have an impact on manufacturing value-added. The long-run results of this study reveal that a 1% increase in energy inflation corresponds to a 0.005935% rise in manufacturing value-added in Pakistan. Similarly, core inflation has a long-run positive substantial influence on industrial value-added. A 1% increase in core inflation results in a 0.023684% increase in manufacturing value-added. Core inflation and manufacturing value-added are complex relationships that can vary based on a variety of factors and economic conditions.

The real interest rate has a negatively insignificant impact on manufacturing value-added in the long run. In the case of Pakistan, this study shows a 1% rise in the real interest rate leads to a -0.000394% decline in manufacturing growth. Zvi Hercowitz (1986) revealed the negative effect of real interest rates on output. Okerekeoti and Egbunike (2018) analyzed the insignificant connection between the real interest rate and manufacturing value-added. He found that the real interest rate had an insignificant impact on manufacturing value-added.

A significant relationship exists between manufacturing value-added and real political instability (Table 6). Pakistan's manufacturing value-added is adversely affected by political instability. The ARDL long-run data reveal that a 1% rise in political instability produces a -0.002355% diminish in manufacturing value-added. The finding of the present study is that financial development and manufacturing value-added have a highly significant connection. Increasing value-added in manufacturing is positively affected by financial development. Based on the results, Pakistan's manufacturing value-added increased by 0.30172% with a 1% increase in financial development.

Table 6
Results of ARDL Long-run Analysis

ARDL Long-run relation				
Variables	**Coefficient**	**Std. Error**	**T-Statistics**	**Prob. Val.**

EI	0.005935**	0.000314	2.427771	0.0234
CI	0.023684**	0.010172	2.328287	0.0290
RIR	-0.000394	0.001405	-0.280666	0.7815
PI	-0.002355**	0.001037	-2.272122	0.0327
FD	0.363251***	0.034114	10.64815	0.0000
C	19.18281***	0.785191	24.43076	0.0000
Trend	0.030172***	0.001880	16.05333	0.0000

Note: ** and *** show 5% and 1% significance level respectively

Short-run Analysis

The D(FD) calculates the relationship between manufacturing value-added and financial development. It evaluates how the variation in financial development from one period to the next affects short-term variations in manufacturing value-added. ECT is highly significant (0.0000) and negative (-0.396203), which indicates that the disequilibrium in the long-term model is being corrected at a 39% rate. The value of Durban Waston Statistics demonstrates that there is no autocorrelation in the regression model whose value is 2.1182. The Durban-Waston must be ≥ 2. The value of the R^2 is 0.87 and the adjusted R^2 is 0.85 showing whether the model of the study is fit or not. If the value is closer to 1 it means that the model is best. This study's model is close to 1, showing that it is the best fit for the study. AIC, SIC, and HQIC are the lag selection criteria.

Table 7
Results of Short-run Analysis

Variables	Coefficient	Std. Dev	T-Statistics	Prob.Val
C	4.512261***	0.605439	7.452877	0.0000
Trend	0.012464***	0.001738	0.001738	0.0000
D(FD)	0.658730***	0.063533	10.36827	0.0000
ECT	-0.396203***	0.053154	-7.453931	0.0000
R-square	0.870099	**Schwarz Criterion**	-3.365946	
Adjusted R-square	0.854511	**Hannan-Quinn-Criterion**	3.495474	
Durban Waston Statistics	2.118262	**Akaike info Criterion**	-3.554538	

Note: Displays the significance levels at *** 1%, ** 5%, and * 10%.

Table 8
Diagnostic test Results

Tests	R^2	f-statistics	Prob.Val
Heteroskedasticity	12.24675	1.827520	0.1308
Breusch-Godfrey LM	4.031142	1.453021	0.2600
Ramsey RESET		0.022863	0.8815
Normality (Histogram)			0.5251

The given results show that there are no heteroskedasticity problems, normality, serial correlation, and no omitted variables in the model. It indicates that the model is correct and well-fitted. In Table 8, the results of the diagnostic tests are shown.

CUSUM and CUSUMSQ are used to examine the changes in regression coefficients and instant changes in regression coefficients. Ultimately, CUSUN and CUSUMSQ reveal that the study's model is accurate and stable.

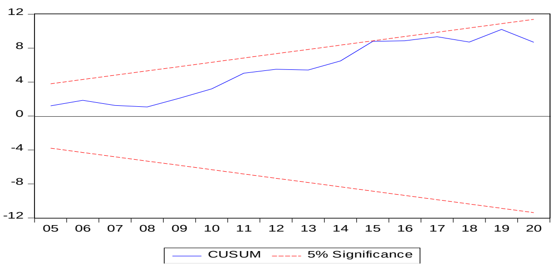

Figure -2: CUSUM stability test

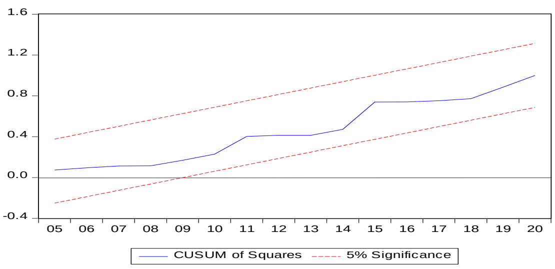

Figure-3: CUSUM-square long-run

Summary of the Study's Outcomes

There are several general and particular aims of the study, basically to analyze the second-round consequences of energy inflation in the manufacturing sector's value-added in the scenario of Pakistan. Specifically the first aim is to evaluate the second-round effects of energy inflation. Secondly, to identify the separate impact of economic factors on the manufacturing value-added.

Based on the specific first objective, this research analyzed the second-round impact of energy inflation by using the Gap model, which checks reverts of headline, core, and energy inflation. The gap model outcomes indicate that weather the second-round effects exist. Based on the gap model, the result shows the huge presence of second-round effects from energy inflation to headline inflation, but core inflation and headline inflation have no presence of second-round effects. The current study shows the significant relation between energy inflation and headline inflation, justifying that the shock of energy prices is huge in Pakistan. The result suggests that a 1% rise in energy prices indicates a 0.89% increase in headline inflation during the period from 1991 to 2020.

A second objective is to estimate Pakistan's manufacturing value-added over the long and short terms. The objective of the study discover the positive and negative direction toward manufacturing value-added in the long run and the short run. First of all, the energy inflation has positively and significantly impacted Pakistan's manufacturing value-added. A rise in energy prices raises the manufacturing value-added. The long-run analysis shows that a 1% increase in energy inflation results in a 0.0005% increase in Pakistan's industrial value-added.

Similarly, the manufacturing value-added and the core inflation have a significant and positive relationship. An increase in core inflation suggests that the overall prices are growing resulting in a rise in production costs for manufacturers, including expenses for raw materials, labor, and other inputs. Then manufacturers are moving towards advanced technologies. The result shows that a 1% hike in core inflation gives a 0.023% increase in manufacturing value-added. Other variables such as real interest rate negatively and insignificantly related to the manufacturing value-added in the long run. The study indicates a -0.0003% decline in manufacturing value-added due to a 1% rise in real interest rate. The next step shows the connection between political instability and manufacturing value-added is significant but negative. The autoregressive distributive lags demonstrate a -0.002% decrease in manufacturing value-added due to a 1% rise in political instability. Financial development has a positive influence on manufacturing value-added. An increase in financial development of 1% results in an increase in manufacturing value-added of 0.0301%.

Conclusion

Globally, manufacturing is considered to be the backbone of social and economic growth. Energy inflation has become a major macroeconomic issue for many emerging nations, affecting a variety of industries, including manufacturing. Pakistan's manufacturing sector is studied in this study specifically to determine the effects of second-round energy inflation on their operations. The manufacturing value-added is used as a dependent indicator and energy inflation (EI), core inflation (CI), political instability (PI), real interest rate (RIR), and financial development (FD) as independent variables. This study uses the yearly data from 1991 to 2020 for time series analysis. This study has used the gap model for capturing the variation or second round in inflation and has also utilized the autoregressive distributive lagged model for long-run and short-run impacts on manufacturing value-added.

Policy Implications

This research also helps the Pak government to promote energy efficiency and adoption of energy-saving technologies in the manufacturing sector. Companies can reduce their dependency on fuel and mitigate the impact of energy price fluctuations. This study can help to stabilize manufacturing costs and improve competitiveness, ultimately contributing to the growth of manufacturing value-added in Pakistan. The central bank should reduce the real interest rate. By lowering the cost of borrowing, manufacturers can access cheaper capital for investment which can stimulate production, boost manufacturing value-added, and promote economic growth. The government should increase the investment to encourage technological advancements and innovation in the energy sector to increase efficiency and reduce costs. The government of Pakistan should promote political stability. By fostering peaceful and stable political environments, the government can create a favorable climate for manufacturing industries to thrive.

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