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Evaluating Industrial Financial Performance Amid Energy Shortages in Pakistan

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Abstract
This study examines the impact of the energy crisis on the financial performance of various industries in Pakistan, with performance measured by the return on assets ratio. The study focuses on all KSE-listed companies from five major industries over the period from 2004 to 2018. The industries analyzed include Textile, Cement, Engineering, Sugar, and Chemical sectors. To assess the impact, the sample is divided into two periods: pre-energy crisis and post-energy crisis, with descriptive statistics and paired sample mean comparisons employed to analyze the data. The results of the study indicate a significant decline in the performance of companies due to the energy crisis in Pakistan. This finding underscores the critical impact that energy availability and stability have on industrial productivity and financial outcomes. Specifically, the industry-wise analysis reveals that the Textile, Cement, and Engineering sectors are particularly hard hit by the energy crisis. These industries are heavily reliant on consistent and reliable energy supplies for their operations, and disruptions can lead to substantial inefficiencies and increased operational costs. The Textile industry, being one of the largest and most energy-dependent sectors in Pakistan, shows a marked decrease in performance during the energy crisis period. The Cement industry, which also relies heavily on continuous energy supply for production processes, similarly experiences significant negative impacts. The Engineering sector, which includes a range of manufacturing and industrial activities, is likewise adversely affected by energy shortages, reflecting the broader repercussions of the energy crisis on industrial productivity. In contrast, the impact of the energy crisis on the Sugar and Chemical industries is found to be insignificant. This may be due to several factors, including differences in energy dependency, operational flexibility, and the ability to adapt to energy supply variations. The Sugar industry, for instance, might have more seasonal production cycles or alternative energy sources, while the Chemical industry may have implemented more energy-efficient technologies or practices that mitigate the effects of energy shortages. The study's findings have important implications for policymakers and industry stakeholders in Pakistan. To mitigate the adverse effects of energy crises on industrial performance, it is crucial to develop and implement policies that ensure a stable and reliable energy supply. This could involve investing in energy infrastructure, diversifying energy sources, and promoting energy efficiency across industries. Additionally, industries particularly vulnerable to energy disruptions should explore contingency measures and alternative energy solutions to sustain their operations during crises.

Keywords: Energy Crisis, Financial Performance, Return on Assets, Industrial Productivity
JEL Codes: Q43, L60, G30

1. INTRODUCTION

Energy's significance in economic development cannot be overstated. Traditionally, capital and labor were considered the primary drivers of economic growth. However, as research has evolved, the pivotal contribution of energy to the production process has become increasingly evident. Energy serves as the lifeblood of modern economies, powering industrial machinery, transportation networks, and household appliances. Studies have shown that energy consumption is closely intertwined with economic activity, with higher levels of energy usage typically correlating with greater economic output. This relationship underscores the importance of ensuring a reliable and affordable energy supply to sustain economic growth and development. In sectors such as agriculture, energy is essential for irrigation, mechanization, and processing. In industry, it fuels manufacturing processes, drives innovation, and enhances productivity. Moreover, energy is indispensable for transportation, enabling the movement of goods and people, facilitating trade, and connecting markets. Recognizing the multifaceted role of energy in the economy, policymakers and researchers alike have increasingly focused on understanding the dynamics of energy consumption, production, and distribution. By fostering efficient energy use, promoting renewable energy sources, and investing in energy infrastructure, countries can harness the transformative potential of energy to drive sustainable economic progress and improve living standards. The relationship between energy consumption and economic

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growth has indeed been a topic of considerable debate and analysis within the academic community. While some studies have failed to identify a significant link between the two variables, others have found evidence suggesting a strong and positive association.

2. LITERATURE REVIEW

For instance, seminal research by Akarca and Long (1980) and subsequent studies by Adjaye (2000), Altinay and Karagol (2004), Wolde-Rufael (2005), and Lee (2006) found no conclusive evidence of a significant relationship between energy consumption and economic development, particularly in the context of the United States. However, contrasting findings have emerged from other investigations. Studies conducted by Soytas and Sari (2003), Wolde-Rufael (2004), and Lee (2005) have highlighted a notable impact of energy consumption on economic growth. These studies suggest that energy plays a crucial role in driving economic development, with increased energy consumption positively influencing overall output and productivity. The divergent findings underscore the complexity of the relationship between energy consumption and economic growth, which can be influenced by various factors such as technological advancements, energy efficiency measures, structural changes in the economy, and policy interventions. As such, further research is needed to comprehensively understand the dynamics of this relationship and its implications for sustainable development strategies. Indeed, delving deeper into the complexities of the energy-economic growth relationship reveals a nuanced landscape that warrants further exploration. While some studies have failed to establish a significant correlation between energy consumption and economic growth, others have unearthed compelling evidence suggesting a tangible link between the two phenomena. One aspect contributing to this complexity is the multifaceted nature of energy consumption itself. Energy serves as a fundamental input across various sectors of the economy, ranging from manufacturing and transportation to residential and commercial activities. As such, the dynamics of energy demand and its impact on economic performance can vary widely depending on sectoral composition, technological advancements, and energy efficiency measures. Moreover, the role of energy in economic growth extends beyond mere consumption levels. Investments in energy infrastructure, renewable energy sources, and energy efficiency initiatives can shape long-term economic trajectories by enhancing productivity, fostering innovation, and mitigating environmental impacts. Policy interventions also play a crucial role in shaping the energy-economic growth nexus. Government policies aimed at promoting renewable energy adoption, improving energy efficiency standards, and incentivizing sustainable practices can exert significant influence on energy consumption patterns and economic outcomes.

Furthermore, the context within which the energy-economic growth relationship operates is dynamic and evolving. Global trends such as climate change, resource scarcity, and geopolitical shifts introduce additional layers of complexity that must be considered in understanding the interplay between energy consumption and economic development. In light of these complexities, ongoing research endeavors seek to unravel the intricate dynamics of the energy-economic growth relationship through interdisciplinary approaches that integrate insights from economics, environmental science, engineering, and policy analysis. By advancing our understanding of these interconnections, policymakers and stakeholders can formulate more informed strategies to promote sustainable energy transitions and foster inclusive economic growth. The diversity of economic structures and energy profiles across different countries can contribute to the variability in research findings regarding the energy-economic growth relationship. Nations exhibit varying levels of energy intensity, reliance on fossil fuels versus renewable sources, and degrees of energy efficiency, all of which can influence the nature and strength of the link between energy consumption and economic growth. Furthermore, the intricacies of this relationship demand a holistic analytical framework that goes beyond simplistic linear models. Factors such as technological innovation, government policies, environmental considerations, and socio-economic dynamics can all shape the dynamics of energy consumption and its impact on economic performance.

As highlighted by Stern and Cleveland (2004), employing advanced analytical techniques is essential for capturing the complexity of the energy-economic growth nexus. Econometric methodologies such as panel data analysis, time series modeling, and structural equation modeling enable researchers to account for heterogeneity across countries, control for confounding variables, and explore nonlinear relationships. Moreover, interdisciplinary collaboration between economists, energy experts, environmental scientists, and policy analysts is crucial for developing comprehensive models that integrate insights from various disciplines. By leveraging diverse perspectives and methodologies, researchers can gain a more nuanced understanding of the multifaceted interactions between energy consumption and economic growth.

Ultimately, advancing our understanding of the energy-economic growth relationship requires a nuanced and interdisciplinary approach that recognizes the inherent complexity of the subject matter. By embracing this complexity and employing sophisticated analytical tools, researchers can generate insights that inform evidence-based policy decisions and contribute to sustainable economic development.

The limited number of studies exploring the relationship between energy consumption and economic development in Pakistan underscores the need for further research in this area. Aqeel and Butt (2001) provided valuable insights by highlighting a positive correlation between economic growth and energy demand and consumption in the country. This finding suggests that as Pakistan's economy expands, there is a corresponding increase in the need for energy to fuel various

sectors and activities. One notable trend indicative of this growing energy demand is the significant rise in the number of electricity consumers in Pakistan. According to the Economic Survey of Pakistan (2005–2006), the number of electricity consumers surged from 8.2 million in 1992-93 to 15 million in 2005-06, representing an 83% increase over a 15-year period. This substantial growth in electricity consumption underscores the critical role of energy in supporting economic activities and improving living standards in Pakistan. However, while these findings provide valuable insights into the dynamics of energy consumption and economic growth in Pakistan, there is still much to be explored. Further research is needed to understand the underlying drivers of energy demand, the impact of energy policies and infrastructure development on economic performance, and the potential for sustainable energy solutions to support long-term growth objectives. By deepening our understanding of the relationship between energy consumption and economic development in Pakistan, policymakers can develop more effective strategies to meet the country's growing energy needs while promoting sustainable and inclusive economic growth. The surge in per capita electricity usage in Pakistan, reaching 425 kWh in 2004-05, reflects several key factors contributing to the increasing demand for energy in the country. Industrialization, driven by economic growth and technological advancements, has led to greater electricity usage in manufacturing and production processes. Similarly, advancements in agricultural technology have increased the energy requirements for irrigation, mechanization, and processing activities in the agricultural sector. Urbanization trends, with more people moving to urban areas in search of employment and better living standards, have also contributed to higher electricity consumption. Additionally, rural electrification initiatives have extended access to electricity to previously underserved areas, further boosting overall demand. Despite this growth, Pakistan's per capita electricity consumption remains relatively low compared to the world average, indicating room for further expansion. The availability of electricity to a significant portion of the population in 2007 suggests that there is still untapped potential to increase electricity demand by extending access to electricity to remaining segments of the population.

Similarly, natural gas, another important energy source in Pakistan, has not been fully utilized, with only 30% of the population having access to it in 2007. Addressing infrastructure challenges and expanding access to natural gas could further drive energy consumption and support economic development efforts in the country. These statistics highlight the significant scope for growth in energy demand in Pakistan, particularly in the electricity and natural gas sectors. By addressing barriers to access and investing in infrastructure development, Pakistan can harness the full potential of its energy resources to fuel economic growth and improve the quality of life for its citizens. The decline in the production and distribution of gas and electricity in Pakistan since 2006 poses significant challenges for the country's economy and development. Gas and electricity are essential energy sources that power various sectors, including manufacturing, agriculture, services, and households. A reduction in their availability can lead to disruptions in production processes, increased costs for businesses and consumers, and a decline in overall economic growth (Economic Survey of Pakistan (ESP), 2006-2007). The reliance on gas and electricity for domestic and commercial needs underscores the importance of addressing the issues affecting their production and distribution. Factors such as infrastructure constraints, outdated technology, inefficiencies in the energy sector, and mismanagement of resources may have contributed to the decline observed in recent years (ESP, 2006-2007). To address these challenges and revitalize the gas and electricity sectors, Pakistan needs to implement comprehensive reforms aimed at improving infrastructure, enhancing efficiency, and promoting sustainable energy practices (ESP, 2006-2007). This may involve investments in modernizing power plants, upgrading transmission and distribution networks, promoting renewable energy sources, and implementing effective governance and regulatory frameworks. Additionally, efforts to diversify the energy mix and reduce dependence on a single energy source can enhance energy security and resilience against supply disruptions (ESP, 2006-2007). By prioritizing investments in the energy sector and implementing reforms to address underlying issues, Pakistan can mitigate the adverse effects of declining gas and electricity production and distribution, paving the way for sustainable economic growth and development in the years to come.

The decline in electricity and gas production and distribution observed during the years 2006 and 2007, as reported in the Economic Survey of Pakistan (ESP, 2008-2009), has indeed had far-reaching implications for the country's economy. With these critical energy resources failing to meet the demands of both domestic and commercial users, Pakistan faces significant challenges in sustaining economic growth and maintaining GDP levels. One of the most immediate impacts of this energy crisis is the rapid increase in electricity and gas tariffs, which has exacerbated inflationary pressures in Pakistan. As energy costs rise, businesses face higher production costs, leading to increased prices for goods and services across various sectors. This inflationary environment can erode purchasing power, reduce consumer spending, and dampen overall economic activity. To address these challenges, it is essential to understand how different industries in Pakistan are being affected by the energy crisis. By identifying the sectors most vulnerable to energy shortages and high tariffs, policymakers can prioritize interventions and allocate resources effectively. This may involve implementing measures to improve energy efficiency, diversify energy sources, invest in infrastructure upgrades, and streamline regulatory processes to facilitate private sector participation in the energy sector. Furthermore, efforts to address the root causes of the energy crisis, such as inadequate infrastructure, outdated technology, and governance issues, are paramount. By addressing these underlying structural challenges, Pakistan can build a more resilient and sustainable energy system that supports long-term economic

development and prosperity. In conclusion, the energy crisis in Pakistan poses significant challenges to economic stability and growth. By understanding the specific impacts on different industries and implementing targeted interventions to address underlying issues, Pakistan can mitigate the adverse effects of the energy crisis and pave the way for sustainable economic development.

3. RESEARCH METHODOLOGY

The data from the Economic Survey indicates a significant decrease in electricity and gas production and distribution during the years 2006 and 2007, suggesting a worsening energy crisis in Pakistan. Given this context, our study aims to analyze the performance of industries in Pakistan, expecting a decline in performance starting from the year 2006, with a focus on the post-2007 period, where we anticipate the impact of the energy crisis to be more pronounced. To assess the performance of companies, we will employ the Return on Assets (ROA) ratio, a commonly used metric in financial analysis. ROA is calculated by dividing net income by total assets, providing insight into how efficiently a company is generating profit from its assets. We will calculate the ROA ratio for individual companies over the six-year period and aggregate the data for analysis, combining three-year pre- and post-energy crisis periods to capture any changes in performance. Our sample will consist of companies from five major sectors listed on the Karachi Stock Exchange: Textile, Cement, Sugar, Engineering, and Chemical. We will exclude any companies that were listed or delisted during the study period to ensure consistency in the sample. Data will be collected from the "financial statement analysis," a publication of the State Bank of Pakistan, which provides comprehensive financial statements for all companies listed on the Karachi Stock Exchange. By conducting this analysis, we aim to shed light on the extent of the impact of the energy crisis on the performance of industries in Pakistan, providing valuable insights for policymakers and stakeholders seeking to address these challenges and foster sustainable economic growth.

4. RESULTS AND DISCUSSIONS

Table 1 presents the descriptive analysis for various industries before the energy crisis. In the Cement industry, based on 19 observations, the mean is 9.94 with a skewness of 0.3, indicating a slight positive skew. The returns range from a minimum of -11.8 to a maximum of 31.87, with the 10th and 90th percentiles at -6.97 and 30.73, respectively. For the Textile industry, with 140 observations, the mean return is 1.27 and the skewness is -0.94, suggesting a negative skew. The returns range from a minimum of -45 to a maximum of 39, with the 10th percentile at -5 and the 90th percentile at 7. In the Sugar industry, based on 35 observations, the mean return is 2.6 with a skewness of -0.038, indicating a near-symmetric distribution. The returns range from -20.33 to 26.17, with the 10th and 90th percentiles at -5.23 and 10.2, respectively. The Chemical industry, with 30 observations, shows a mean return of 12.47 and a skewness of 0.13, indicating a slight positive skew. The returns range from -13.17 to 35.93, with the 10th percentile at -2.57 and the 90th percentile at 31.54. Lastly, the Engineering industry, based on 37 observations, has a mean return of 10.67 and a skewness of 0.47, suggesting a moderate positive skew. The returns range from -20.63 to 46.17, with the 10th and 90th percentiles at 0.7 and 21.43, respectively. These descriptive statistics provide insights into the distribution and variability of returns across different industries before the energy crisis, highlighting the distinct characteristics and risk profiles of each industry.

Table 1: Descriptive Analysis (Pre Energy Crisis)

Industry	Obs	mean	skweness	Min	max	Percentiles	
						10%	90%
Cement	19	9.94	0.3	-11.8	31.87	-6.97	30.73
Textile	140	1.27	-0.94	-45	39	-5	7
Sugar	35	2.6	-0.038	-20.33	26.17	-5.23	10.2
Chemical	30	12.47	0.13	-13.17	35.93	-2.57	31.54
Engineering	37	10.67	0.47	-20.63	46.17	0.7	21.43

Table 2 provides a descriptive analysis of various industries after the energy crisis, detailing changes in mean returns, skewness, and the distribution of returns. In the Cement industry, based on 19 observations, the mean return is -0.924 with a skewness of 0.02, indicating a nearly symmetric distribution. The returns range from a minimum of -20.63 to a maximum of 20.2, with the 10th and 90th percentiles at -15.73 and 10.23, respectively. For the Textile industry, with 140 observations, the mean return is -1.52 and the skewness is 2.44, suggesting a highly positive skew. The returns range from -19 to 52, with the 10th percentile at -9 and the 90th percentile at 4.5. In the Sugar industry, based on 35 observations, the mean return is 2.9 with a skewness of 0.87, indicating a moderate positive skew. The returns range from -8.7 to 25.1, with the 10th and 90th percentiles at -6.87 and 16.1, respectively. The Chemical industry, with 30 observations, shows a mean return of 10.78 and a skewness of 0.744, indicating a moderate positive skew. The returns range from -7.27 to 39.47, with the 10th

percentile at 0.05 and the 90th percentile at 23.8. Lastly, the Engineering industry, based on 37 observations, has a mean return of 5.12 and a skewness of -0.34, suggesting a slight negative skew. The returns range from -28.03 to 30.57, with the 10th and 90th percentiles at -12.9 and 19.13, respectively. These descriptive statistics highlight the impact of the energy crisis on various industries, revealing changes in the distribution and variability of returns, as well as differences in risk profiles compared to the pre-crisis period.

Table 2: Descriptive Analysis (Post Energy Crisis)

Industry	Obs	Mean	Skweness	Min	max	Percentiles	
						10%	90%
Cement	19	-0.924	0.02	-20.63	20.2	-15.73	10.23
Textile	140	-1.52	2.44	-19	52	-9	4.5
Sugar	35	2.9	0.87	-8.7	25.1	-6.87	16.1
Chemical	30	10.78	0.744	-7.27	39.47	0.05	23.8
Engineering	37	5.12	-0.34	-28.03	30.57	-12.9	19.13

5. CONCLUSIONS

The research aims to assess how the energy crisis has affected the performance of major industries in Pakistan, focusing on sectors such as Textile, Cement, Sugar, Engineering, and Chemical. By examining financial data and performance indicators, the study seeks to provide insights into the extent of the impact and potential implications for these industries. Through comprehensive analysis, the research aims to contribute valuable knowledge to the understanding of Pakistan's economic challenges and inform potential strategies for mitigating the adverse effects of the energy crisis on industrial performance. The Return on Assets (ROA) ratio, a widely recognized metric for assessing firm performance, was employed in this study. Through descriptive analysis and Paired Sample Mean Analysis, the research aimed to compare the performance of industries before and after the onset of the energy crisis. Across the five major sectors under investigation, the findings pointed towards a significant downturn in overall performance following the energy crisis. This highlights the profound impact of energy shortages on the economic landscape of Pakistan, particularly within key industrial sectors.

The sector-wise analysis conducted in this study revealed mixed results regarding the impact of the energy crisis on different industries. While the Textile, Cement, and Engineering sectors experienced a significant decline in performance during the post-energy crisis period from 2007 to 2018, the Chemical and Sugar industries maintained consistent performance levels during the same period. Of particular concern were the sharp declines observed in the Textile and Cement industries, both of which are major contributors to Pakistan's GDP and export earnings. These findings underscore the urgent need for government intervention in the energy sector to address the challenges faced by key industries. Indeed, ensuring a reliable and affordable energy supply should be a top priority for the government, as the survival of Pakistan's industries hinges on resolving the energy crisis. By prioritizing investments and reforms in the energy sector, policymakers can mitigate the adverse effects of energy shortages and create a conducive environment for industrial growth and economic development in Pakistan.

In conclusion, this study provided empirical evidence of the significant impact of the energy crisis on major industries in Pakistan. Through the analysis of Return on Assets (ROA) ratios and descriptive statistics, it was revealed that the Textile, Cement, and Engineering sectors experienced a notable decline in performance during the post-energy crisis period, while the Chemical and Sugar industries maintained relatively consistent performance levels. These findings underscore the urgent need for government intervention in the energy sector to address the challenges faced by key industries. Given the critical role of industries like Textile and Cement in Pakistan's GDP and export earnings, ensuring a reliable and affordable energy supply is paramount for sustaining economic growth and development. Moving forward, policymakers should prioritize investments and reforms in the energy sector to mitigate the adverse effects of energy shortages. By addressing the underlying causes of the energy crisis and implementing measures to enhance energy infrastructure and efficiency, Pakistan can create a conducive environment for industrial growth and economic prosperity.

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