The Impact of the Current Energy Crisis on Small Enterprises and How to Adverse its Effects

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Abstract. The ongoing energy crisis has introduced significant challenges to businesses across various sectors, prompting a critical examination of its repercussions and the exploration of strategies to mitigate its effects. This essay delves into the profound influence of the current energy crisis on businesses, highlighting its multifaceted consequences, including increased operational costs, supply chain disruptions, and reduced consumer spending. By constructing ARIMA model, in order to provide a comprehensive understanding of how businesses are affected by energy crisis-induced volatility. Furthermore, this essay offers insights into viable mitigation measures that businesses can adopt to navigate these challenges. Drawing from empirical evidence and industry best practices, proposing strategies encompassing energy-efficient practices, diversification of energy sources, and resilience-building tactics. This research contributes to a nuanced comprehension of the energy crisis's impact on businesses and equips stakeholders. Many actionable insights include diversifying supply chains and stimulating supply routes, increasing collaborations with the more usage of digital planning to minimize the giving adverse effects, fostering long-term sustainability and resilience.

Keywords: Energy crisis; Businesses; SZSCV Stock Data; ARIMA Model.

1. Introduction

Companies are currently grappling with an unforeseen challenge: swiftly adjusting their operations in response to the Ukraine conflict's repercussions. The present energy crisis has emerged as a critical concern for businesses on a global scale, particularly for small enterprises. Small and medium-sized enterprises (SMEs) are confronted with a multitude of difficulties that could potentially harm their business activities, financial performance, and long-term viability. These challenges stem from the limited availability and escalating costs of energy resources within brackets [1]. As of May 2022, these adverse effects on businesses encompass restrictions on accessing funding, diminished purchasing power, a surge in inflation rates [2], and the looming spectre of hindering sustainable growth, ultimately resulting in trade constraints. The majority of SMEs are witnessing a decline in profitability as they grapple with abrupt cost-cutting measures brought about by sudden changes [3].

In the realm of modern financial analysis, the application of advanced statistical tools has become increasingly crucial in unravelling the intricate dynamics of economic phenomena. This study embarks on a journey through the realms of data-driven inquiry, employing Stata as the analytical conduit, to construct an Autoregressive Integrated Moving Average (ARIMA) model. The focus of this investigation lies in comprehending the profound ramifications of the ongoing energy crisis on businesses, using stock price data spanning from 2016 to the present. As energy-related challenges continue to shape the global landscape, understanding their impact on the corporate world assumes paramount significance. By examining stock price patterns, this research aims to discern the nuanced shifts that have transpired before and after the energy crisis. The comparative analysis of stock data of SMEs seeks to illuminate how businesses have responded to the fluctuating energy dynamics, shedding light on the intricate interplay between energy market fluctuations and corporate performance.

In examining the effects of the War on various businesses, many academic studies have predominantly employed single-factor analysis using the available data [4]. This essay aims to delve into the root causes of the crisis and assess its ramifications on diverse nations and sectors.
Additionally, it will examine potential factors that could influence businesses, and propose policy recommendations to alleviate these effects, along with offering future forecasts. This study draws on an extensive dataset of stock prices, juxtaposing periods of relative stability with those marked by energy crisis-induced volatility. The empirical findings, generated through ARIMA modelling and data analysis, aspire to unravel the multifaceted consequences of the energy crisis on businesses. By charting a course through the ebbs and flows of stock price fluctuations, this investigation contributes valuable insights into the adaptive strategies businesses employ in response to the energy crisis, ultimately fostering a more resilient and informed corporate landscape.

2. Research Design

2.1. Data Source

The data utilized in this research originates from the historical data available at investing to collect opening and closing stock prices of the SME ChiNext Value Index from 2016 until now, which is specifically focused on innovative and growth-oriented small and medium-sized enterprises, is particularly relevant to this study's objective of assessing the impact of the energy crisis on businesses. This index is reflective of a dynamic segment of the market, potentially showcasing the effects of energy crisis-induced fluctuations on businesses that are more susceptible to external shocks [5]. All data is then sorted by annual and daily and then modelled.

2.2. Weak Stationarity Test

In order to test whether the data collected is stationary, the stationarity test is applied in the first step. Logarithmic sequence (RAW), First-order differenced logarithmic sequence and second-order differenced logarithmic sequence are separately examined. It is noticeable that the p-value of RAW is higher than 0.05 and not statistically significant, however, the p-values in Table 1 for both first and second-order difference are 0.0000, which are statistically significant and shows the data are stationary.

<table>
<thead>
<tr>
<th>Table 1. Weak stationarity test.</th>
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<tr>
<td></td>
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<tr>
<td>Daily</td>
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<tr>
<td>Raw</td>
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<tr>
<td>1st order difference</td>
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<tr>
<td>2nd order difference</td>
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<tr>
<td>Weekly</td>
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<tr>
<td>Raw</td>
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<tr>
<td>1st order difference</td>
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<td>2nd order difference</td>
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2.3. ARIMA model

The ARIMA model is typically denoted as ARIMA (p, d, q), p is the order of the AutoRegressive component (AR); d is the degree of differencing required to make the data stationary; q is the order of the Moving Average component (MA). The purpose of ARIMA is prediction, and the purpose of incorporating other variables into ARIMA is prediction and an additional explanation of the influence of those variables on the dependent variable y.

\[
(1 - \phi_1 B - \phi_2 B^2 - \cdots - \phi_p B^p)(1 - L)^d X_{t-1} = \phi_0 + (1 - \theta_1 B - \cdots - \theta_q B^q)a_t \tag{1}
\]

\[
(1 - \phi_1 B - \phi_2 B^2 - \cdots - \phi_p B^p) \quad \text{Represents the AR component of the ARIMA model. It relates the current value } X_t \text{ to its past values, each multiplied by a coefficient } \phi_p. \text{ This part captures the influence of past values on the current value. Differencing involves subtracting the previous}
\]
value $X_{t-1}$ from the current value $d$ times. This operation removes trends and seasonality, making the time series stationary.

The MA component models the relationship between the current value and past error terms $e_t$, each multiplied by a coefficient $\theta_q$. This section encompasses the impact of prior forecast inaccuracies on the present value. The equation offers a method for modeling and predicting time series data by incorporating historical values and the repercussions of previous forecasting errors.

3. Results and Analysis

3.1. Order of ARIMA model

PACF and ACF can be useful in deriving the lag orders for AR ($p$) and MA ($q$) components in the ARIMA model. The lag order of $p$ and $q$ is difficult to detect when $d$ equals 1 and thus second-order difference is applied. The daily PACF lag order is fixed at 10 as MLE is not convergence afterwards, which stands for $p$ equal to 10. As for the weekly lag order, the AR ($p$) is 5 as PACF plot shows. The order of ACF for both daily and weekly data is 1, which indicates $q$ is equal to 1 in both cases.

![Figure 1. ARMA (p, q) identification.](Photo credit: Original)

3.2. Estimation results

The probability of residual test for both daily and weekly ARIMA models is above 0.05 and it is assumed not to reject the null hypothesis, which is no autocorrelation presented in the residuals and the residuals are white noise.
Table 2. Residual test.

<table>
<thead>
<tr>
<th>Model</th>
<th>Portmanteau (Q) statistic</th>
<th>Prob &gt; chi2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily-ARIMA (10,2,1)</td>
<td>54.6026</td>
<td>0.0617</td>
</tr>
<tr>
<td>Weekly-ARIMA (5,2,1)</td>
<td>31.4045</td>
<td>0.8325</td>
</tr>
</tbody>
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Set 2022/02/24 as the energy crisis started, the blue line in Figure 2 shows the actual value in 2022 while the orange line shows the estimated fitted value without the energy war should look like.

Figure 2. Actual value and fitted value, daily.

Photo credit: Original

Average treatment effect (ATE) is the average difference between the fitted value and the actual value, as it provides a single summary measure of this effect and facilitates comparisons across different studies and contexts. Compared with the weekly analysis, there is a dramatic jump in daily value whereas the weekly value shows a slight increase after decreasing. To be more specific, the average daily decrease change is 3.62% while that of the weekly change is 6.56%, an overreaction tends to occur within four weeks since the energy crisis started.

Figure 3. Actual value and fitted value, weekly.

Photo credit: Original.
4. Policy Implications with Future Forecast

Enhancing the resilience of Europe's energy supply represents a long-term strategic objective for governments, and it constitutes the most direct means of mitigating the spillover effects stemming from the conflict in Ukraine. Nevertheless, this endeavor may entail a protracted timeframe for accomplishment. In the short term, the European economic downturn is more likely to be exacerbated due to factors such as China's economic slowdown, heightened investor apprehension, and tightening monetary policies in the United States [6]. Shifting away from reliance on Russia as an energy source in favor of transitioning to liquefied natural gas (LNG) and renewable energy sources will be a formidable medium-term goal [7]. Over the long run, energy efficiency measures will significantly improve, resulting in a greener energy supply within the European Union, facilitated by the adoption of renewable technologies. Both households and businesses are anticipated to invest more in energy efficiency initiatives, potentially reducing living expenses and production costs [8].

To mitigate the adverse consequences of supply chain disruptions and sustain a manageable inflation level, diversifying supply chains and supply routes assumes paramount importance [9]. The European Union government could promote this concept and establish additional platforms to foster collaboration and identify more robust supply chain sources [10]. The specific mitigation strategies may vary across different industries. For instance, fostering closer collaboration with diverse suppliers is advisable for industries dealing with industrial products, services, and consumer goods. Similarly, the automotive sector may find it beneficial to increase inventories of parts and supplies [11]. In contrast, the tourism and travel industry can enhance its digital planning efforts to bolster publicity and promotional activities, thereby generating revenue [12]. However, it is worth noting that certain businesses in the financial and technology sectors appear to be less inclined to take action, as indicated by a survey [13]. Among Small and Medium-sized Enterprises (SMEs), constituting 58% of the surveyed businesses, there is an expectation that the supply chain will recover by 2023. These businesses continue to prioritize strategies such as organic growth, digitalization, and market expansion. According to the Bank of Latvia's 2022 forecast, inflation in Latvia is projected to reach 9.5% in 2022 and subsequently decrease by more than 6% by 2023 [14].

5. Discussion

Policymakers should interpret this study as an important exploration of the impact of the Russo-Ukrainian conflict on the global economy [15]. By employing ARIMA modelling on stock data from the Small and Medium Enterprises (SZSCV) sector, the study unveils potential cascading effects of the conflict on the economy. The findings underscore the vulnerability of small and medium enterprises to international conflicts, signalling the economic spill over effects that wars and geopolitical tensions might trigger [16]. Policymakers can derive insights into the degree of economic threat posed by the Russo-Ukrainian conflict and subsequently formulate policies to stabilize the economy and safeguard the interests of small and medium enterprises [17]. Furthermore, the ARIMA modeling approach offered in this study provides a valuable tool for predicting future economic fluctuations arising from conflicts, which holds promising implications for strategizing responsive measures.

As for investors, this study's findings offer actionable insights. Understanding the relationship between geopolitical events and the SZSCV sector's stock performance can guide investment decisions during times of heightened geopolitical tensions. Investors may opt to diversify portfolios to include assets less affected by such conflicts, potentially mitigating risk [18]. Furthermore, this study underscores the importance of staying informed about geopolitical developments, enabling investors to anticipate and navigate market fluctuations related to international conflicts.
6. Conclusion

The conflict in Ukraine has inflicted severe damage on the world economy, affecting not only the energy sector but also leading to significant inflation and disruptions in supply chains. Various nations and industries have suffered varying degrees of financial hardship as a result. To counter these challenges, both governments and small and medium-sized enterprises (SMEs) should formulate strategies for growth and recovery. Over the long term, it is anticipated that profitability, energy prices, and employment rates will eventually revert to their usual levels.

In conclusion, this study provides a nuanced perspective on the economic repercussions of the Russo-Ukrainian conflict, highlighting the SZSCV sector's vulnerability and offering a forecasting tool for economic downturns during geopolitical crises. The research has broad implications for policymakers seeking to fortify economic resilience and for investors aiming to navigate uncertain global conditions with more informed decisions.

In future research, it may be prudent to take into account the factors or potential variables that could influence single-factor analysis. Additionally, a more comprehensive dataset could enhance the precision of the quantitative economic model in assessing the outcomes of the conflict.

The findings of this study shed light on the potential impact of the Russo-Ukrainian conflict on the global economy, utilizing ARIMA modelling on stock data from the SME sectors and comparing the average treatment effect which is the differences between the actual and fitted value. Previous research has addressed the geopolitical implications of conflicts on financial markets, while this study uniquely focuses on the SME sector's stock data, offering a granular perspective on economic effects that complements broader analyses. After providing evidence of how the market responds to the energy crisis, some possible solutions for governments and firms are explained as well. This can be beneficial for entrepreneurs who have start-ups in recent years, as they are able to take action adverse the negative impacts of crisis.

References


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