Transformative Economic Challenges: The Impact of COVID-19 and the War in Ukraine on the European Union

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Abstract

This paper aims to explore the economic effects of the COVID-19 pandemic and the war in Ukraine on the twenty-seven European Union (EU) member states, known as the EU-27. A vector autoregression (VAR) of quarterly data for the period 2020–2022 was employed to study the impact of the coronavirus and the Russian invasion of Ukraine on growth, unemployment and inflation in the EU-27. The results from the empirical analysis indicated that the war in Ukraine lowered growth and raised inflation and unemployment, while the COVID-19 pandemic did not affect growth, increased unemployment and decreased inflation in the EU-27. It may be concluded that the war in Ukraine shifted the EU aggregate supply curve to the left, whereas the coronavirus pandemic resulted in inflation-unemployment trade-off in the EU.

Introduction

The occurrence of a black swan (an unexpected event with significant and wide-ranging consequences) complicates the work of policymakers in national economies and regional economic unions. When black swans are more than one and have different characteristics, the formulation and implementation of appropriate macroeconomic policies is extremely difficult and of key importance for utilizing the opportunities and neutralizing the threats created by the black swans.

The goal of this research was to investigate the economic influence of two black swans (the COVID-19 pandemic and the war in Ukraine) on the EU-27. The purpose of the study was achieved by the fulfilment of the following tasks:

- ✓ Systematize the theoretical fundamentals of black swans (section 1);
- ✓ Review the literature on the COVID-19 pandemic and the war in Ukraine and their economic impact on the EU;

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- ✓ Empirically estimate the effects of the two black swans on growth, unemployment and inflation in the EU;
- ✓ Formulate advisable macroeconomic policies for overcoming the negative consequences of the pandemic and the war (conclusion).

A vector autoregression (VAR) was applied to quarterly data over the period 2020–2022 to examine the influence of the coronavirus pandemic and the Russian invasion of Ukraine on growth, unemployment and inflation in the EU-27. The results from the empirical investigation showed that the war in Ukraine is a supply-side shock, whereas the COVID-19 pandemic is a demand-side shock to the EU economy.

Theoretical Foundations of Black Swans

The theory of black swans originally arose in the field of economics and in particular the financial markets, but subsequently, it became clear that it is fully applicable in all other fields. The theory, created and named by Nassim Nicholas Taleb, is based on the story of the arrival of the first explorers in Australia in the 17th century when all swans were believed to be white. The existence of swans with black feathers was considered impossible, and the discovery of such birds was an incredible event that changed people's perceptions (Taleb, 2007b). By using the term "black swan", Taleb questioned the use of economic analysis based on extrapolation of past events to make predictions, because sudden and, completely unexpected events could completely change the course of the future. He described black swan events as expectations, outside of the normal standards, because within their limits nothing indicates the reality of the occurrence of such events (Bourgon, 2009).

The black swan theory is used as a metaphor, mostly in the field of economics, to describe events that happen unexpectedly, such as ones that no one predicted because their occurrence was considered unlikely or even impossible, and which had a huge, in most cases negative impact and large-scale consequences over a long period or even forever (Taleb, 2007b). Taleb added that the failure to occurrence of an event that was considered certain also qualifies as a "black swan" because of its unexpected and highly impactful nature, which subsequently could have been predicted (Taleb, 2007a).

Taleb (2007b) identified three requirements for an event to be defined as a black swan:

- The event must be unexpected – nothing from the past provides evidence for it, it must be unlikely or even considered impossible;
- It must have a strong impact – the power and scope of impact must be very large, with the direction of impact most often being negative, but positive development is not excluded;
- The event must be retrospectively foreseeable – after the event has occurred, analysts must be able to find evidence that the event could have been foreseen and prevented. From this requirement also follows the characterization of events defined as black swans that they no longer recur, since the necessary measures have been taken to prevent the same scenarios. This is also a prerequisite for the impossibility of modelling them for future periods.

Over the years, various authors have looked at black swan events and interpreted the term. Aven (2013) identified two approaches as the most appropriate for the interpretation of the "black swan": first, as a rare incident with extraordinary consequences; second, as an exceptional incident, unexpected from the point of view of the current state of knowledge.

Aven & Krohn (2014) attempted to categorize "black swan" events for financial markets; however, this categorization is generally valid for national and international economies. There are three main categories:

a) Unknown unknowns - these are events that are completely unknown, improbable, unpredictable and unthinkable. Their consequences are very large and extreme and can be both positive and negative. An example of this type of event is the emergence of a new type of virus in society (COVID-19).
b) Unknown knowns – these are events that cannot be measured or estimated and it is not known when they are likely to occur, but when they do occur, the events or influencing factors can be clearly defined. It is rarely accepted that these types of events happen by chance and were not foreseen or there was no prior information about them. An example of this type of "black swan" is the 9/11 terrorist attack in the USA.
c) Known knowns - these are events that are known and can be measured and estimated, but are

ignored because the probability of their occurrence is considered to be negligible. However, when these types of events occur, they are very impactful. An example of such a black swan is Brexit.

Heinonen (2013) notes that the word „black" used in the term does not have a negative connotation, but only aims to emphasize the unexpectedness of the event. This statement supports the thesis that both black swan events and their resulting consequences can be both negative and positive. According to Heinonen, black swan events challenge the current state of knowledge and can quickly and unexpectedly change it. Events of this kind can occur in any sphere: in nature, economy, politics and culture. They can be the unintended result of one's accidental actions as well as intentional and deliberate actions. According to Robert Jervis (2009), an impulse for black swans can also be human beliefs. People's interpretations and understandings of the actions of others, and the inferences they draw from them, account for their behavior. Jervis argues that conclusions about the black swan concept must be made based on people's thoughts and judgments about others. Whether or not a black swan event will occur depends on how people respond to signs of the event that may occur.

According to Castles (2010), black swan events can be defined as those that are „sudden and unexpected national and international emergencies – the „black swans" of war, economic depression, hyperinflation and, more prospectively and topically, mass epidemics, terrorist incidents and environmental catastrophes" that have a significant impact on the nature of actions taken by policymakers and the development of national economies.

However, black swan events are most commonly used in risk assessment and analysis in financial markets, with Manhire (2018) highlighting that despite the different approaches used to estimate the probability of a black swan event occurring, accurately predicting the moment of occurrence of such an event is practically impossible. According to Zhao et al. (2011), precisely black swans are the reason for the strong volatility of share prices in the financial markets, and these black swans arise from factors in the economic situation in the country such as the level of inflation, return on capital, market sentiments, etc. Similar studies on national stock markets are conducted by Peša & Brajkovic (2016) for Croatia, Cristiano & Murhadi (2016) for Indonesia, Lin & I-Chun (2019) and Stavrova, Paskaleva & Stoikova (2020) for the Chinese stock market, etc.

Estrada (2009) proves that the actual impact that black swans have on long-term performance is very strong, referring to large swings daily that have a strong long-term impact and that were initially unexpected but later turned out to be easily predictable. According to Krupa & Jones (2013) „black swans" are often caused by the illusory sense of control and understanding of a particular situation on the part of people. The retrospective predictability of these events is also based on this.

Although by definition „black swans" are quite rare events, in today's increasingly complex and interconnected world, their frequency is increasing and they are becoming more widespread, and this affects their consequences, which are also becoming more - wide-ranging and longer-lasting (Wildman, 2015).

COVID-19 and the War in Ukraine as Black Swans

The Impact of COVID-19 on the EU Economies

The pandemic of COVID-19 and the war in Ukraine are categorized as black swan events having an immense impact on the economies of the twenty-seven European Union (EU) member states. Almeida et al. (2021) revealed that discretionary fiscal policy measures significantly cushioned the adverse effects of the pandemic by reducing income loss, inequality, and poverty. Conversely, the International Labor Organization (ILO) highlighted another aspect of the crisis in 2020: a severe reduction in working hours, with Europe experiencing the sharpest decline. This contrast illustrates that, while fiscal policies were effective in some areas, labour market challenges persisted.

Similarly, the International Monetary Fund (IMF) underscored the pandemic's impact on global supply chains, leading to prolonged supply interruptions and fueling inflation in various countries (Congressional Research Service, 2021). In response, De la Porte & Heins (2022) documented how EU countries implemented income substitution, short-term work schemes, and other social policies to support disrupted work and family lives. Nonetheless, these measures also resulted in significant budget deficits, thereby highlighting a trade-off between immediate support and long-term fiscal stability.

Furthermore, G20 countries mirrored this approach by adopting government-funded short-time work and wage subsidy programs to sustain firms' liquidity and mitigate

job losses (ILO & OECD, 2020). In contrast, Yeyati & Filippini (2021) argued that the macroeconomic crisis caused by the pandemic was characterized more by prolonged fiscal deficits and missed growth opportunities than by liquidity concerns, indicating differing perspectives on the primary economic challenges. Moreover, EU Member States enacted various fiscal measures to counteract the immediate impacts of government restrictions, such as decreased demand, production, and employment (De Vet et al., 2021). Sulun (2020) observed that governments swiftly introduced temporary measures such as income assistance and subsidies to cushion the pandemic's shock and curb unemployment. This rapid response was crucial in mitigating the immediate economic fallout.

Conversely, the Economist Impact Research (2023) projected significant economic losses for countries with high COVID-19 infection rates and productivity levels, potentially hindering GDP growth and development. This projection was echoed by Pavolova et al. (2022), who identified notable disparities in GDP, unemployment rates, and trade among EU countries during the pandemic, thereby underscoring the uneven economic impact. Additionally, Nicola et al. (2020) presented divergent forecasts for economic recovery, with some experts predicting a swift rebound and others anticipating prolonged economic inactivity. Pekhnyk & Borzak (2022) argued that counteracting the pandemic's economic effects in the EU required stimulating demand, production, and overall economic activity to avoid long-term stagnation and negative multiplier effects, thereby emphasizing the need for proactive economic policies.

Table 1

Findings on COVID-19 Impact upon the EU Economies

Author/s	*Finding/s*
Almeida et al. (2020)	Discretionary fiscal policies mitigated income loss, inequality, and poverty during the pandemic.
ILO and OECD study (2020)	G20 countries adopted emergency measures to support firms and minimize job losses.
Sulun (2020)	Governments implemented temporary measures to alleviate the shock of the pandemic and mitigate unemployment.
Nicola et al. (2020)	Divergent predictions exist regarding the shape of economic recovery.
Petraskevicius et al. (2020)	Strong pre-crisis economic conditions influenced the economic performance during the pandemic.
Congressional Research Service (2021)	Global supply chain disruptions led to extended supply interruptions and inflationary pressures.
De la Porte & Heins (2021)	EU countries implemented income substitution and social policies, resulting in budget deficits.
UN Conference on Trade and Development (2021)	The surge in inflation may necessitate a shift towards reversing stimulus measures.
Pavolova et al. (2021)	Significant disparities were observed in GDP, unemployment rates, and trade among EU countries.
Yeyati and Filippini (2021)	The macroeconomic crisis was characterized by enduring fiscal losses and missed growth opportunities.
Pekhnyk & Borzak (2022)	Stimulating demand and overall economic activity is essential to prevent long-term stagnation.
Sazmaz et al. (2022)	Some European countries experienced a robust labour market recovery despite the pandemic.
Smit et al. (2023)	SMEs and start-ups should adopt digitalization and sustainable practices.
Zuleeg (2023)	Inflation and addressing the debt crisis are important considerations in the post-COVID world.
Szekely (2020-2022)	Europe lags in digitalizing its economy, particularly within the SME sector.

Source: Own processing

Economic performance varied among EU countries, with those possessing stronger pre-crisis economic conditions experiencing less deceleration (Petraskevicius et al., 2022). Meanwhile, Sazmaz et al. (2021) noted that, while the pandemic negatively impacted unemployment rates, some European

countries experienced a robust labour market recovery, thereby highlighting the importance of pre-existing economic strengths. However, at the UN Conference on Trade and Development (2021), it was noted that rising inflation led to a shift toward reversing the COVID-19 stimulus measures. This more restrictive fiscal and monetary stance might suppress economic activity and weaken global demand, thereby posing additional challenges for developing nations, indicating a complex balancing act for policymakers.

Looking ahead, Smit et al. (2023) proposed that future crises could be mitigated by encouraging SMEs and start-ups to adopt more productive digital business models and sustainable practices. Similarly, Szekely (2020) emphasized that Europe lags behind its main competitors in digitalizing its economy, particularly within the SME sector, suggesting an area for potential improvement. Finally, Zuleeg (2020) suggested that the post-COVID world might experience changes in its relationship with inflation, acknowledging the persistent threat of deflation and the need for a certain level of inflation to manage a debt crisis. This perspective underlines the ongoing challenges and adjustments required in economic policy post-pandemic.

In conclusion, while discretionary fiscal policies alleviated some pandemic impacts, supply chain disruptions exacerbated inflation. EU countries implemented various supportive measures but faced budget deficits, thereby illustrating the complexity of balancing immediate relief with long-term fiscal health. The path to economic recovery remains uncertain, necessitating efforts to stimulate demand and bolster SMEs. Rising inflation may prompt stricter fiscal policies, and addressing the debt crisis will be crucial in the post-COVID era.

The Impact of the War in Ukraine on the EU Economies

Examining the effect of the war in Ukraine on European stock markets, Ahmed et al. (2022) discovered a negative reaction across these markets. However, considerable variation was observed across industries, countries, and company sizes in the magnitude of stock price changes, indicating a nuanced impact that depended heavily on specific market conditions. Similarly, Chen (2022) found that the conflict negatively impacted GDP per capita by constraining both local and international trading benefits. This impact can be attributed to three main components: the loss of life, damage to physical and human capital, and a direct decline in per capita GDP. This highlights the multifaceted economic repercussions of the war.

Further emphasizing the broad scope of the conflict's impact, Celi et al. (2022) highlighted cascading effects on sectors including energy, raw materials, technology, security and defence, food and agriculture, and migration. This was compounded by sociopolitical transformations, existing political and economic instability, poverty, and growing international migration caused by mass unemployment, as noted by Tsvetanova (2022).

In the Netherlands, the war-induced uncertainty regarding energy supply led to significant price increases for oil and gas, exacerbating pre-existing constraints in the supply and transportation of raw materials and goods still recovering from pandemic restrictions. Consequently, product prices soared, resulting in high inflation (Berben et al., 2022). The war in Ukraine disrupted the global post-pandemic economic rebound, manifesting in two key areas: disturbances in international trade and supply chains, and shifts in commodity prices resulting in inflation (Congressional Research Service, 2022). Eurochambers (2022) further indicated that high inflation levels were exacerbated by short-term increases in natural gas, oil, and food prices, posing a threat to economic recovery as inflation remained high in the long term. Guenette et al. (2022) supported this, arguing that inflation would likely stay elevated in the near term as demand and supply shocks influenced wage and price-setting processes.

The global supply chain was significantly impacted by the war, leading to disruptions in energy and trade supplies. This disruption was reflected in a sudden rise in energy costs, goods, and food prices, which contributed to heightened inflation in multiple countries (Kalogiannidis et al., 2022). Korosteleva et al. (2022) predicted that the war would accelerate the EU's greening transition, central to its twin objective of sustainable development encompassing digital and green transformations towards a 'zero carbon, zero waste' economy. Moreover, Skaliotou (2022) suggested that the pace of digitalization of the EU economy could be expedited to mitigate risks from supply chain disruptions, steering the economy towards technological and green transitions and reducing reliance on oil. Garicano (2022) concurred, noting that the energy crisis from the war provided an opportunity to accelerate the green transition and reduce fossil fuel dependency.

Contrastingly, the OECD (2022) projected that global growth in most OECD countries in 2023 would revert to pre-pandemic rates, anticipating full employment and inflation converging to policy objectives. However, Prohorovs (2022) found that the Russian war in Ukraine

and subsequent trade restrictions significantly drove up inflation and aggravated existing economic problems. Lastly, deliberations at the United Nations Conference on Trade and Development in March 2022 centred on the vulnerability of developing nations and least-developed countries to the conflict's effects on trade expenses, commodity rates, and financial markets. Given the precarious state of the global economy and the developing world due to the COVID-19 pandemic, concerns were raised about potential social unrest, food scarcity, and economic downturns triggered by inflation.

Table 2

Findings on Ukraine War Impact upon the EU Economies

Author/s	*Finding/s*
Ahmed et al. (2022)	European stock markets displayed a tendency to react negatively to the war in Ukraine. Considerable variation in stock price changes observed across industries, countries, and company sizes.
Chen (2022)	The war had a negative impact on GDP per capita by limiting local and international trading benefits. Three main components to consider: loss of life and damage to physical and human capital, as well as a direct decline in per capita GDP.
Celi et al. (2022)	The war had cascading impacts on various sectors including energy, raw materials and technology, security and defence, food and agriculture, and migration.
Berben et al. (2022)	In the Netherlands, the war caused uncertainty in energy supply, leading to steep price increases for oil and gas. Constraints in the supply and transportation of other raw materials and goods were intensified, contributing to high inflation.
CRC (2022)	The war disrupted international trade and supply chains, as well as resulted in shifts in commodity prices and inflation, posing challenges to the post-pandemic economic recovery.
Eurochambers (2022)	Short-term increases in natural gas, oil, and food prices intensified high inflation levels, threatening economic recovery in many countries in the long term.
Guenette et al. (2022)	Inflation is expected to remain elevated in the near term due to demand and supply shocks affecting wage and price-setting processes.
Kalogiannidis (2022)	The war disrupted the global supply chain, leading to disruptions in energy and trade supply, resulting in a sudden rise in energy costs, goods and food prices, and heightened inflation in multiple countries.
Korosteleva et al. (2022)	The war between Russia and Ukraine is predicted to accelerate the greening transition of the EU, aligning with its sustainable development goals for a 'zero carbon, zero waste' economy.
Skaliotou (2022)	The pace of digitalization in the EU economy could be expedited to mitigate supply chain disruptions and reduce reliance on oil.
Garicano (2022)	The energy crisis resulting from the war in Ukraine provided an opportunity to accelerate the green transition and reduce reliance on fossil fuels.
OECD (2022)	Global growth is expected to return to pre-pandemic rates in 2023, with full employment anticipated. Inflation is projected to converge on policy objectives.
Prohorovs (2022)	The war and subsequent trade restrictions significantly increased inflation and aggravated existing economic problems.
UNCTD (2022)	Concerns were raised about social unrest, food scarcity, and inflation-induced economic downturns due to the fragile global economy and the impact of the COVID-19 pandemic.

Source: Own processing

In conclusion, the war in Ukraine had wide-ranging effects on European stock markets, GDP, and various economic sectors. While some regions faced severe disruptions and inflation, others saw potential opportunities for accelerated digital and green transitions. The conflict's impact on global supply chains and inflation underscores the complex and interconnected nature of modern economies, highlighting the need for coordinated policy responses to navigate these challenges effectively.

Empirical Analysis of the Economic Effects of COVID-19 and the War in Ukraine on the European Union

Impact on Growth: Methodology and Data

The influence of COVID-19 and the war in Ukraine on economic growth in the EU-27 was estimated via a vector autoregression (VAR), which included the following variables:

$GDPGR_{ij}$ – real output growth rate in country i in quarter j (in percent); $TTCGR_{ij}$ – total COVID cases growth rate in country i in quarter j (in percent); WAR_j – binary dummy variable for the war in Ukraine (1 means war and 0 means peace in quarter j).

Quarterly Eurostat data on real economic growth and total COVID-19 cases growth rate in the 27 EU member states for the period 2020-2022 were used in the VAR.

Impact on Growth: Results

The unit root test indicated that GDPGR and TTCGR were integrated of order zero (see Tables 3 and 4), which allowed the application of an unrestricted VAR.

The test for the optimum number of lags in the VAR (see Table 5) showed that this number was one according to the Schwarz information criterion, therefore the VAR was estimated with one lag.

The equation for the target variable in the VAR GDPGR was

$$GDPGR_{ij} = \alpha_0 + \alpha_1 * GDPGR_{i,j-1} + \alpha_2 * TCCGR_{i,j-1} + \alpha_3 WAR_{j-1} + \sigma_{ij} \quad (1)$$

where α_0 was a constant, α_1, α_2 and α_3 were regression coefficients and σ_{ij} was an error term.

Table 3
Unit Root Test on the Level Values of GDPGR

Method	*Statistic*	*Probability*	*Cross-sections*	*Observations*
Null: Unit root (assumes common unit root process)				
Levin, Lin and Chu t-statistic	-54.5865	0.0000	27	249
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-statistic	-36.2159	0.0000	27	249
ADF-Fisher Chi-square	477.341	0.0000	27	249
PP-Fisher Chi-square	316.126	0.0000	27	270

Source: Own processing with EViews

Table 4
Unit Root Test on the Level Values of TTCGR

Method	*Statistic*	*Probability*	*Cross-sections*	*Observations*
Null: Unit root (assumes common unit root process)				
Levin, Lin and Chu t-statistic	-13.4592	0.0000	27	237
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-statistic	-6.02584	0.0000	27	237
ADF-Fisher Chi-square	131.274	0.0000	27	237
PP-Fisher Chi-square	180.797	0.0000	27	243

Source: Own processing with EViews

Table 5
Optimum Number of Lags in the VAR

Lag number	*Schwarz information criterion*
0	19.80594
1	18.81235*
2	18.81579

Note: * Indicates lag order selected by the criterion
Source: Own processing with EViews

Real economic growth in the EU-27 was negatively influenced by the war (a fall of 2.01 percent with a lag of one quarter) but unaffected by the coronavirus (see Table 6). These estimates could be considered accurate and reliable for Equation (1) adequately reflected the relationship between the dependent and the independent variables (its determination coefficient and probability of F-statistic were respectively 0.53 and 0.00).

Table 6
Results from the Estimation of Equation (1)

Variable	*Coefficient*	*Standard Error*	*t-Statistic*	*Probability*
C	*2.838288*	*0.188731*	*15.03883*	*0.0000*
GDPGR(-1)	*-0.423915*	*0.028254*	*-15.00348*	*0.0000*
TCCGR(-1)	*3.97E-05*	*0.000381*	*0.104417*	*0.9169*
WAR(-1)	*-2.011157*	*0.344036*	*-5.845770*	*0.0000*

Source: Own processing with EViews

Impact on Unemployment: Methodology and Data

The influence of COVID-19 and the war in Ukraine on unemployment in the EU-27 was estimated via a vector autoregression (VAR), which included the following variables: $UNEMPL_{ij}$ – the unemployment rate in country i in quarter j (in percent); $TTCGR_{ij}$– total COVID cases growth rate in country i in quarter j (in percent); WAR_j – binary dummy variable for the war in Ukraine (1 means war and 0 means peace in quarter j).

Quarterly Eurostat data on the unemployment rate and total COVID cases growth rate in the 27 EU member states for the period 2020-2022 were used in the VAR.

Impact on Unemployment: Results

The unit root test indicated that UNEMPL and TTCGR were integrated of order zero (see Tables 5 and 7), which allowed the application of an unrestricted VAR.

Table 7
Unit Root Test on the Level Values of UNEMPL

Method	*Statistic*	*Probability*	*Cross-sections*	*Observations*
Null: Unit root (assumes common unit root process)				
Levin, Lin and Chu t-statistic	-17.6296	0.0000	27	230
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-statistic	-3.34891	0.0004	27	230
ADF-Fisher Chi-square	124.568	0.0000	27	230
PP-Fisher Chi-square	214.661	0.0000	27	243

Source: Own processing with EViews

The test for the optimum number of lags in the VAR (see Table 8) showed that this number was two according to the Schwarz information criterion, therefore the VAR was estimated with two lags.

The equation for the target variable in the VAR UNEMPL was

$$UNEMPL_{ij} = \beta_0 + \beta_1*UNEMPL_{i,j-1} + \beta_2*UNEMPL_{i,j-2} + \beta_3*TCCGR_{i,j-1} + \beta_4*TCCGR_{i,j-2} + \beta_5*WAR_{j-1} + \beta_6*WAR_{j-2} + \sigma_{ij} \quad (2)$$

where β_0 was a constant, β_1 to β_6 were regression coefficients and σ_{ij} was an error term.

Unemployment in the EU-27 was adversely affected by the war (a rise of 0.19 percent with lags of one and two quarters) and the coronavirus (an increase of 0.000215 percent per 1 percent rise in TCCGR with a lag of one quarter) as indicated in Table 7. These estimates could be considered accurate and reliable since Equation (2) adequately reflected the relationship between the dependent and the independent variables (its determination coefficient and probability of F-statistic were respectively 0.98 and 0.00).

Table 8
Optimum Number of Lags in the VAR

Lag number	*Schwarz information criterion*
0	20.95975
1	16.33204
2	16.32758*

Note:* Indicates lag order selected by the criterion
Source: Own processing with EViews

Table 9
Results from the Estimation of Equation (2)

Variable	Coefficient	Standard Error	t-Statistic	Probability
C	-0.090958	0.072597	-1.252907	0.2116
UNEMPL(-1)	0.813532	0.044960	18.09452	0.0000
UNEMPL(-2)	0.145842	0.043729	3.335149	0.0010
TCCGR(-1)	0.000215	7.42E-05	2.895536	0.0042
TCCGR(-2)	2.89E-05	6.87E-05	0.419907	0.6750
WAR(-1)	0.189389	0.082234	2.303063	0.0223
WAR(-2)	0.189161	0.105454	1.793770	0.0743

Source: Own processing with EViews

Impact on Inflation: Methodology and Data

The influence of COVID-19 and the war in Ukraine on inflation in the EU-27 was estimated via a vector autoregression (VAR), which included the following variables: $INFL_{ij}$ – inflation rate in country i in quarter j (in percent); $TTCGR_{ij}$ – total COVID cases growth rate in country i in quarter j (in percent); WAR_j – binary dummy variable for the war in Ukraine (1 means war and 0 means peace in Ukraine in quarter j).

Quarterly Eurostat data on the inflation rate and total COVID cases growth rate in the 27 EU member states for the period 2020-2022 were used in the VAR.

Impact on Inflation: Results

The unit root test indicated that INFL and TTCGR were integrated of order zero (see Tables 10 and 4), which allowed the application of an unrestricted VAR. The test for the optimum number of lags in the VAR (see Table 11) showed that this number was one according to the Schwarz information criterion, therefore the VAR was estimated with one lag.

The equation for the target variable in the VAR INFL was

$$INFL_{ij} = \gamma_0 + \gamma_1 * INFL_{i,j-1} + \gamma_2 * TCCGR_{i,j-1} + \gamma_3 * WAR_{j-1} + \sigma_{ij} \quad (3)$$

where γ_0 was a constant, γ_1 to γ_4 were regression coefficients and σ was an error term.

Table 10
Unit Root Test on the Level Values of INFL

Method	Statistic	Probability	Cross-sections	Observations
Null: Unit root (assumes common unit root process)				
Levin, Lin and Chu t-statistic	-18.5638	0.0000	27	224
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-statistic	-3.71506	0.0001	27	224
ADF-Fisher Chi-square	140.784	0.0000	27	224
PP-Fisher Chi-square	144.150	0.0000	27	243

Source: Own processing with EViews

Table 11
Optimum Number of Lags in the VAR

Lag number	Schwarz information criterion
0	19.72273
1	18.96380*
2	18.99626

Note: * Indicates lag order selected by the criterion
Source: Own processing with EViews

Inflation in the EU-27 was decreased by the COVID-19 pandemic (by 0.000708 percent for a 1% rise in TCCGR with a lag of one quarter) but raised by the war in Ukraine (by 1.30 percent with a lag of one quarter), as indicated in Table 10. These estimates could be considered accurate and reliable since Equation (3) adequately

reflected the relationship between the dependent and the independent variables (its determination coefficient and probability of F-statistic were respectively 0.32 and 0.00).

Table 12
Results from the Estimation of Equation (3)

Variable	*Coefficient*	*Standard Error*	*t-Statistic*	*Probability*
C	1.333756	0.177198	7.526940	0.0000
INFL(-1)	0.179888	0.090293	1.992273	0.0476
TCCGR(-1)	-0.000708	0.000322	-2.200831	0.0288
WAR(-1)	1.298224	0.390267	3.326507	0.0010

Source: Own processing with EViews

Conclusion

This research has important implications for macroeconomic policy in the EU-27. Its results provided evidence that the war in Ukraine hit the EU-27 as an adverse shock in aggregate supply, while the COVID-19 pandemic affected the EU-27 as a negative shock in aggregate demand. The simultaneous manifestation of supply and demand disturbances requires both long-term supply-side measures (investments in new energy sources and energy supply diversification) and short-run demand-side policies (fine-tuning or aggregate demand management).

This study contributes to the literature by exploring the simultaneous and combined economic effects of two black swans (a pandemic and a war) on the EU-27, by drawing inferences about the type of prevailing economic disturbance (demand or supply shock) and by recommending macroeconomic policies, which match the type of dominating economic disorder.

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Transformacijski izzivi gospodarstva: Vpliv COVID-19 in vojne v Ukrajini na Evropsko unijo

Izvleček

Namen članka je raziskati gospodarske učinke pandemije covid-19 in vojne v Ukrajini na sedemindvajset držav članic Evropske unije (EU-27). Za preučevanje vpliva koronavirusa in ruske invazije na Ukrajino na rast, brezposelnost in inflacijo v EU-27 je bila uporabljena metoda vektorske avtoregresije (VAR) na četrtletnih podatkih za obdobje 2020–2022. Rezultati empirične analize so pokazali, da je vojna v Ukrajini zmanjšala gospodarsko rast ter povečala inflacijo in brezposelnost, medtem ko pandemija covid-19 ni vplivala na rast, povečala je brezposelnost in znižala inflacijo v EU-27. Zaključimo lahko, da je vojna v Ukrajini premaknila agregatno krivuljo ponudbe EU v levo, medtem ko je pandemija koronavirusa povzročila kompromis med inflacijo in brezposelnostjo v EU.

Ključne besede: Evropska unija, covid-19, vojna v Ukrajini, gospodarski učinki