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ENERGY PRICES AS SIGNIFICANT SUPPLY-SIDE SHOCKS: THE CASE OF THE FORMER SFRY AND VIŠEGRAD GROUP MEMBER COUNTRIES

Aleksandra Prascevic* and Milutin Jesic

University of Belgrade, Faculty of Economics, Belgrade, The Republic of Serbia

The influence of energy prices on macroeconomic stability is analyzed in this paper. Energy prices represent significant supply-side shocks, which have been leading cyclical fluctuation triggers through economic history. The analysis includes the countries that were the members of the former SFRY, as well as the countries the members of the Višegrad Group. The indicators under observation are presented for the EU27 for the purposes of comparison. In accordance with economic theory, the main conclusion of the paper is that supply-side shocks can be a significant source of cyclical fluctuations and an inflation trigger. Therefore, policymakers have a complex task to minimize the effects of these shocks. Nowadays, when energy prices are reaching historically high levels, the scientific contribution of supply-side shocks can be found in the deep analysis and well-grounded estimations of the role of those shocks in the preservation of macroeconomic stability and the economic policy measures necessary for the minimization of their negative effects.

Keywords: supply-side shocks, energy prices, business cycles, macroeconomic spillovers, former SFRY countries, Višegrad Group member countries

JEL Classification: E31, Q41, Q43

INTRODUCTION

Market economies are recording cyclical fluctuations in the form of the business cycles immanent in market-based economies and profit-oriented enterprises. Regardless of the fact that certain periods of long-term stability indicated that business cycles had become

shorter, with the smaller amplitudes of the declining economic activity, i.e. with shorter and weaker economic recessions, the topic of business cycles has never been more relevant in macroeconomics as it is today. Again, the current issues are the key sources of cyclical fluctuations and whether it is possible that the economic policy will mitigate or overcome them or not.

An interest in cyclical fluctuations, especially so in economic recessions, was renewed during the Great Recession of 2007-2009, with the start of the COVID-19

* Correspondence to: A. Prascevic, University of Belgrade, Faculty of Economics, Kamenicka 6, 11000 Belgrade, The Republic of Serbia;
e-mail: aleksandra.prascevic@ekof.bg.ac.rs

pandemic early in 2020 and it started gaining in importance. Today, it has gained a new momentum due to the obvious dramatic changes in energy prices, which can be considered the most important negative shocks that affect the aggregate supply side. While, in the recent past, there have mostly been financial shocks through the financial crises that have spread to the real sector of the economy, the new unknown disease COVID-19, which soon spread causing a pandemic, has left economists and policymakers with many dilemmas about the nature of the shock, more precisely said the shocks, caused by the pandemic itself, its impact and effects, and the responses of the economic policy as well. During the past two years, especially in 2020, the pandemic acted as a negative shock both on the side of aggregate demand and on the side of aggregate supply until the appearance of vaccines. The governments of the largest number of countries responded to it by implementing significant packages of fiscal assistance to the economy and the population, compensating for temporarily reduced aggregate demand. The fiscal expansion was accompanied by the monetary expansion. The impact of the pandemic on aggregate supply meant the interruptions of supply chains and value creation flows, the cessation of production and the like. What the pandemic had also produced was growing uncertainty about future economic developments, especially economic recovery. The decline in the economic activity was dramatic in 2020, whereas during 2021, the economy began to recover. However, it was impossible to predict with certainty how strong the recovery would be and whether the significant blows to aggregate demand generated by the continuation of the pandemic could be expected in the future. As a result, there was an imbalance between supply and demand in many markets, as demand recovered relatively quickly, supply being unable to keep pace with it. That resulted in an increase in the prices of certain products and inputs in production (e.g. metals), including energy prices.

Rising prices, i.e. rising inflation, appeared during 2021 as one of the relatively forgotten macroeconomic problems dating back in the 1980s. Although inflation has been in the background for decades, today's fear

of steady and rising inflation is justified and generally present both in economic research done by scientists, in economic policymakers' plans and in the plans made by businesspeople and the general public as well.

During 2021, especially during the second half of that year, the rising energy prices issue came to the fore, primarily caused by their insufficient supply on world markets, which was partly due to the unexpectedly rapid global economic recovery that had generated growth in demand for energy. Rising energy prices are the input for the growth of all other prices and the emergence of the so-called cost inflation. In addition to this category of inflation generated by rising production costs, the current rise in global inflation is a consequence of the obvious growth of aggregate demand due to significant government intervention in the form of large aid packages to the economy and the population. All said indicates the need for economic policymakers to have to pay more attention to curbing inflation in the forthcoming period, which will almost certainly have recessionary effects. Therefore, the question rightly arises as to whether the current rise in energy prices will be introduction to a new economic recession just as it has been the case several times in the past (of the last seven recessions in the US, as many as five have led to the growth of energy prices - primarily oil) or not.

The impact of rising energy prices in post-transition economies, as well as the question whether and to what extent recessionary effects can be expected or not and whether economic policy measures can help avoid inflation in this context to prevent a recession or not are a particularly interesting area of the analysis. Therefore, the research conducted in this paper is aimed at analyzing the influence of energy prices as the shocks that act from aggregate supply, with a special reference to the countries that were the members of the former SFRY and the Višegrad Group member states, and carrying out a comparative analysis with the EU27 as a whole. These countries have a lot in common, although simultaneously there are the differences visible in energy strategies.

Accordingly, the hypotheses that will be investigated in the paper read as follows:

- H1: Energy price shocks appear as the sources of economic recessions, i.e. they precede recessions, and these shocks are the cause of other macroeconomic instabilities.
- H2: The monetary authorities' response to the growth of energy prices is of great importance in generating a recession, because that response can encourage the emergence of a recession.
- H3: Causing a shock on both the aggregate supply side and the aggregate demand side, the COVID-19 pandemic disrupted both the balance of supply of and demand for energy, generating fluctuations in their prices.

These hypotheses can be confirmed by analyzing the major recessions of the past, as well as the current macroeconomic developments. The theoretical and methodological tools applied in the research process consist of general analytical methods, comparative analysis, and descriptive analysis.

The paper is formulated so that the Introduction is followed by the presentation of the theoretical basis of the effects of shocks as the source of cyclical fluctuations. The second part of the paper provides a brief overview of the dominant contemporary theories of cyclical fluctuations, focusing on supply shocks. The third part is dedicated to the theoretical analysis of the impact of energy shocks on the generation of unfavorable macroeconomic trends (inflation and recession). In the fourth part of the paper, the tendencies in the movement of energy prices are presented, the focus being on the electricity, oil and natural gas market. The fifth part discusses the impact on macroeconomic developments and the spillover effects of recent energy price growth shocks. The last part of the paper is devoted to the concluding remarks.

SHOCKS AS SOURCES OF CYCLICAL FLUCTUATIONS

The sources of cyclical economic fluctuations are paid great attention to in economics, so that there are

almost no questions in macroeconomics that have been asked and considered in different ways than those related to the sources and nature of the shocks that affect economies and the role of the state and its economic policies in causing or overcoming shocks as well. In general, the shocks affecting an economy can be categorized into those acting on the aggregate demand side and those acting on the aggregate supply side. It is also possible to distinguish monetary shocks from the real shocks that hit an economy, thus causing cyclical fluctuations. The impact of these shocks on the economy can of course be stimulating or limiting, in which case we can talk about either the positive or negative shocks that affect aggregate demand or supply. These issues are the subject matter of the extensive literature dealing with business cycles both from a theoretical perspective and from an empirical perspective, and from the perspective of the economic policy, too.

Monetary shocks and the importance of the monetary policy

The monetary shocks that act on the aggregate demand side in the form of money supply growth and lowering interest rates, which has a stimulating effect on the economic activity through aggregate demand growth, investment and consumption growth, are amongst the best-known and the most common sources of cyclical fluctuations. The economic expansion caused in this way is considered as artificial in some theories (in K. Wicksell's theory or the Austrian school) and is inevitably accompanied by the monetary contraction that causes unpleasant economic recessions. This view of the source of cyclical fluctuations was the basis of the modern theories offered by monetarists and the representatives of new classical macroeconomics who focused on the monetary sources of the cycle, placing them in a dynamic economic environment and providing evidence for their insistence that the monetary policy was not used to stimulate the economic activity or mitigate cyclical fluctuations, simultaneously advocating rules in its creation. The different concepts of expectations were an important element of the cyclical fluctuations monetary theories.

The monetaristic explanation of cyclical fluctuations arose in the state of high unemployment, with burdensome and persistent inflation, which was increasingly becoming the primary economic problem. According to monetarists, changes in the money supply appear as the sources, not consequences, of recessions, which implies the potency of the monetary policy, not its inefficiency. Money supply should grow at a fixed rate in line with the output growth in order to maintain long-term price stability. However, the eighth decade of the twentieth century would follow, during which the leading market economies would be faced with the significant supply shocks generating an economic recession, which the monetary authorities would respond to with an inadequate monetary policy that would further deepen the rising and persistent inflation issue. The decade that began with Nixon's expansive economic policies with the slogan "prosperity without war" in response to the weak recovery of the American economy after a short recession in 1969 ended with the far-reaching changes that occurred in the period from 1978 to 1980, which marked the final rise and transition to neoliberal politics.

Starting from the monetarist assumptions that the economic system is stable, the shocks that affect it are exogenous and in the form of changes in money supply which increase the fluctuations of the economic activity, whereas in the long run, it is only high inflation rates that are generated. According to M. Friedman, two factors are key to the transmission of business cycles:

- the existence of price rigidity, and
- delays in adjustment.

That is why monetarists strongly oppose any use of the monetary policy for countercyclical purposes, because the economy should be left to itself to overcome shocks. Monetarists explain this attitude towards state intervention by the incompetence of economic policymakers, long delays, as well as the stability of demand for money.

After monetarists, the macroeconomic scene was entered and dominated by the representatives of new classical macroeconomics (NCM), who

further explained cyclical fluctuations, insisting on the classical foundations of the Walrasian general equilibrium. They noticed that the existence of business cycles could be the key unsolved problem of their theory. For that reason, they developed several models so as to explain serially correlated economic fluctuations, the mechanisms of the action of the sources of these fluctuations on trends in the economy. In the first phase of NCM development, the explanation of business cycles was based on a monetary surprise, the so-called "monetary shock", which generated the short-term deviations of the economic variables from their long-term trend even in the conditions of rational expectations and continuous market clearing. Thus, because of being unannounced, the monetary surprise could lead to real effects on the economic activity (Lucas, 1972). Starting from that fact, the mitigation of cyclical fluctuations meant changes in the way how the monetary policy was created and conducted, which led to results in mitigating and shortening economic recessions in the last decades of the 20th century following real macroeconomic trends.

In the next phase of NCM development that started in the 1980s, monetary shocks were abandoned as a source of cyclical fluctuations and real shocks acting on the aggregate supply side had already been introduced. This phase, the so-called "schools of real business cycles" dominated until the Global Recession of 2007-09 and covered the period of the longest economic prosperity. However, although the focus was on aggregate supply and real shocks as primarily technological shocks changing the production function and relative prices influencing economic entities' decisions, the introduction of the Global Recession yet turned out to be partially initialized by the monetary policy and the mistakes having been made in connection with it. Therefore, in order to explain the beginning of the recession, the moves of the monetary authorities that may lead to a recession still need to be carefully analyzed, regardless of the fact that they may be preceded by supply shocks. The monetary policy often inadequately responds to these shocks, generating a cyclical decline in the economic activity.

Further in this paper, this problem is analyzed by focusing on the supply shock caused by energy prices during the pandemic functioning of the global economy.

Supply shocks as the sources of cyclical fluctuations

It has already been pointed out that supply shocks appeared as the sources of cyclical fluctuations in the past. They affected aggregate supply, either positively, primarily through the positive technological shocks affecting the production function and generating economic expansion, or negatively, primarily through the energy (oil) shocks that generated rising product prices and declining aggregate supply, thus causing economic recessions.

The very idea of the importance of the real factors for explaining business cycles is not new and can be seen in the pre-Keynesian economy. In this context, it is necessary to emphasize the importance of D. Robertson's (1915) work pointing to the importance of technological changes for the economic fluctuations that occur as a result of excessive investment in certain periods causing later economic recessions, as well as J. A. Schumpeter's theory (1939) presented in his book entitled *Business Cycles*. According to J. A. Schumpeter's analysis, short-term instability and long-term, dynamic development depend on technological changes and their spread through the economy.

The most important modern cycle theory that focuses on real shocks on the aggregate supply side was that formulated by the New Classics in their second phase of development since the 1980s. This phase of the equilibrium business cycles theory development began with the papers F. E. Kydland and E. C. Prescott (1982); J. B. Long and C. I. Plosser (1983). The empirical data on the movement of the social product, employment, industrial production and many other important aggregates of the US economy directly pointed to the conclusion that real shocks were more important than monetary shocks in order to explain

the movement of the aggregate product (Nelson & Plosser, 1982).

It was the paper by C. Nelson and C. I. Plosser (1982) that ended the dominance of the settings that defined business cycles as short-term fluctuations, because they couldn't exclusively be viewed as temporary events, without noticeable long-term consequences. The movements of the macroeconomic variables except for the unemployment rate proved to partially represent permanent changes. Economic developments indicated that business cycles represented fluctuations in the trend itself, whereas fluctuations around the trend were very small. Based on that fact, the real business cycles theory concluded that the real factors affected both economic growth and the fluctuations that made up business cycles. That inevitably led to a change in the perception of the role and importance of the economic policy for generating and overcoming cyclical fluctuations. According to the real business cycles school, economic expansion is a consequence of positive technological shocks, whereas economic downturns are a consequence of the absence of significant technological progress in the form of positive technological shocks.

In addition to the technological changes that focus real business cycles theories as the sources of cyclical fluctuations, it is possible to determine other factors, i.e. the shocks that affect aggregate supply. Thus, the economic trends during the 1970s were primarily the result of the shocks on the aggregate supply side, namely the rise in food and energy derivatives - oil. The recession of the period 1973-75 had permanent negative effects on the movement of the gross domestic product of developed countries; so, during the 1980s and the 1990s, the gross domestic product remained below the level of the trend that would have been reached if the growth rate had continued the growth trend of the period preceding the year 1973, i.e. the no-recession period. This means that the recession of this period had permanent effects on the slowdown in the economic activity in the decades that followed.

Shocks on the aggregate supply side represent much more difficult and much more complex challenges

for economic policymakers than aggregate demand shocks. Namely, if the growth of the world oil price increases the costs of production thus the prices of products as well causing inflation, then the monetary authorities are faced with a choice between a policy to fight the inflation that will have recessionary effects and an expansive policy to fight recession itself.

Even more complex problems arose in a situation when, in addition to supply shocks in the form of rising energy and food prices, there were other shocks in the form of the supply or production chain disruptions that occurred during the first waves of the 2020 COVID-19 pandemic. It should be added that there was a negative shock of aggregate demand during those first waves due to the locking measures (the quarantine and the closure of countries). Governments around the world responded to that shock by taking expansionary fiscal and monetary policy measures to help the population and the economy, which recovered aggregate demand. Such increased aggregate demand faced with insufficiently recovered aggregate supply led to a global rise in inflation and facing a choice between further boosting the economy and the population in a situation where the pandemic was continuing, on the one hand, and easing the inflationary pressures that could lead to inflationary expectations increased uncertainty and risks, thereby limiting post-pandemic economic recovery and growth, on the other.

These shocks refer to the most important events during the last two years of the pandemic, during which economies were the subject matter of sudden and unanticipated shocks both on the supply side and on the demand side. They brought back into focus the once important issues that were considered to have already been overcome, such as a rising inflation and the way the monetary policy was conducted. Only a few years ago, the use of "helicopter money" would have been completely unacceptable as a way of conducting the monetary policy. Today, however, we are being faced with its inflationary consequences, as well as the consequences of the strong shocks of aggregate supply in the form of rising energy prices. These issues are focused on further in this paper

on the example of the countries of the group of the Višegrad Group and former SFRY member countries.

ENERGY PRICES AS SIGNIFICANT SUPPLY-SIDE SHOCKS

As has already been pointed out in the paper, the significant growth of energy prices and drastic falls in the supply of energy, primarily oil¹, on world markets caused cyclical declines in the economic activity in the past. In economic terms, oil is at the heart of industrialized economies. Gasoline is the most important product from crude oil. The other important products are heating oil, diesel fuel, kerosene and others. In economic terms, oil is of great importance for the global economy because it affects the functioning of the entire economy as one of the main energy sources, which has been the case since the invention of the internal combustion engine that caused the technological revolution also marking the oil industry development.

The theoretical foundations of the influence

For the USA postwar economy, it is clearly noticeable that jumps in oil prices preceded economic recessions, which was the case with as many as five postwar American recessions. This became especially evident during the 1970s, which were marked by recessions in the United States, and by oil shocks as well (Prašević, 2013, 41). The extensive literature focused on that influence (Hamilton, 1985; Bjørnland, 2000; Barsky & Kilian, 2004; Nordhaus, 2007; Engemann, Kliesen & Owyang, 2011; Kilian & Vigfusson, 2017). Those changes were primarily the supply shocks whose performance in the standard AS-AD model is represented by a shift to the left of the SAS curve (short-term aggregate supply) corresponding to a higher general price level (i.e. the inflation rate) due to the rising production costs due to the rising energy prices included in the prices of all the other products (Figure 1).

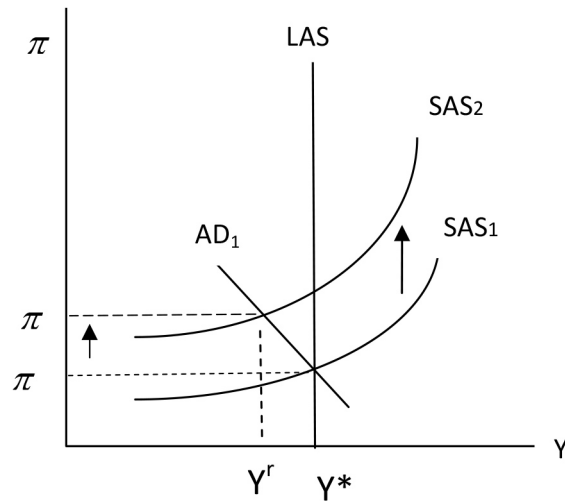


Figure 1 The negative supply shock due to the rising energy prices (oil)

Source: Authors

The oil price growth, as well as the growth of the price of the other energy sources, primarily gas, negatively affects the economy in several ways, affecting:

- an increase in transport costs,
- an increase in heating costs,
- an increase in production costs,
- an increase in risk and uncertainty leading to further price increases,
- increasing risk and uncertainty affecting investment and spending decisions,
- changes in the allocation of labor and capital between energy-intensive sectors and those that are not.

In addition to the effects on spending and investment decisions, these effects have a negative impact on aggregate supply, of which the impact on the reallocation of labor and capital between individual economic sectors has long-term effects on economic growth.

Short-term changes in oil prices show that demand for oil is more determined by changes in income than by changes in oil prices. That is the reason why demand for oil has steadily been following the income growth

in the past decades, regardless of the significant fluctuations in the oil price. Income elasticity is close to unity, especially in fast-growing economies, while it is somewhat lower in developed economies. On the other hand, the price elasticity of demand is very low with the trend of further decreasing compared to the period of the 1970s (Hamilton, 2009). The recent global recession has, however, shown that this can change and that the oil price can affect demand for it if the conditions of the recession affect a significant reduction in disposable income, so that a significant segment of the population cannot afford earlier quantities.

Oil shocks and economic recessions in the past

Oil shocks negatively affect the economic activity, causing an economic recession. This was exactly the case with the 1973-75 recession, which was generated by a fourfold increase in oil prices due to a decision made by the Arab exporting countries (AOPEC) in the autumn of 1973, causing stepping into a long period of an economic slowdown and decline, which lasted until the mid-1990s, with short interruptions. During

this period, there was a drastic decline in investment growth rates and productivity growth rates, which slowed wage growth with the emergence of significant unemployment. The economy tried to respond to the decline in profits that had been recorded since 1965 and at the significantly higher rates of decline than in the G-7 economies by reducing direct and indirect labor costs and redistributing income to the detriment of labor, in favor of capital (Praščević, 2008, 14).

Unlike the previous ones, the recession of the 1973-75 period was not accompanied by deflation, but by inflation, which is the reason why the Keynesian recommendations for economic contraction overcoming could not have been applied². Significant financial crises were recorded during this period, some of which can be compared to those of the 1930s. In the early 1980s, there were again sharp recessions. This time, they were attributed to fighting inflation by central banks in most countries, and to a new oil shock following the Iran revolution and later the Iraq-Iran war in October 1980 as well. After the period of recovery in the early 1990s, like most European economies, the US economy contracted

again, this time after the event that had disrupted global oil supplies due to the Gulf War (August 1990). During the first half of the 1990s, economic growth was slower than in the 1980s, which was already significantly slower than that in the 1970s, especially so compared to the 1960s. For the cyclical economic fluctuations that occurred during the 1970s, 1980s and 1990s (Table 1), it is characteristic that the contractions of the economic activity occurred simultaneously in European countries and Japan, as well as in the USA, due to the integration and globalization of the international economy. Therefore, there has been a significant diffusion of cyclical fluctuations worldwide, which can be seen together with the recessions of the 21st century.

Historically, the oil price has become particularly volatile since the 1970s. The fact that it was for the first time during the Suez Crisis in 1956 that the Arab countries limited oil supplies which preceded the recession in USA that began a few months later (in August 1957) should be noted. This could be seen as the test of what would happen a decade after the Organization of the Petroleum Exporting Countries

Table 1 Oil shocks and the recession in USA

Oil shock	Causes	Recession
The first oil shock (1973-74)	The Yom Kippur War and the suspension of supplies to Western economies, as well as the quadrupling of oil prices (1973-75)	November 1973-March 1975
The second oil shock (1978-80)	The Iranian Revolution (the autumn of 1978) and the doubling of oil prices, the Iraq-Iran conflict (started in September 1980)	Two recessions in the period from 1980-1982 (January 1980-July 1981; July 1981-November 1982)
The third oil shock (1990)	The Iraqi Invasion of Kuwait (August 1990)	July 1990-March 1991
“Half-shock” (2001)	The attack on the Twin Towers in New York (September 11, 2001) and intervention in Iraq	March 2001-November 2001
The fourth oil shock (2007-2008)	The causes are different compared to the previous shocks - a significant increase in global demand with stagnant supply	December 2007-June 2009

Source: Authors

(OPEC) had been founded in 1960 to manipulate the price and quantity of the oil they supplied to the world for political reasons³.

Given the fact that the fluctuations in oil prices, as well as the restrictions on its supply, had been significant, the International Energy Agency (IEA) was established in 1974. It takes the central place in global dialogue when energy is concerned, especially with the aim to regulate the oil market and the market of other energy sources, too. The world oil market structure is determined by the relationship between supply and demand, with a significant influence of political and economic, as well as technological, factors.

Empirical research shows that the growth of oil prices in a similar recessionary way affected the economies of the other developed economies (the G7 countries), not only the US. It is estimated for developed countries that 10% of external disruptions in oil supply have an impact of an about 2% reduction in real income growth from one to two years after the shock (Killian, 2005). Although rising oil prices affect other prices as well, the impact on inflation is not as clear as the impact on real income and real growth. In some economies, it causes stagflation, whereas in others it does not. Therefore, it can be concluded that the general increase in the oil prices did not have a strong inflationary effect. However, it is important to point out the fact that a deeper analysis has to take into account any economic policy measures taken in response to a particular oil shock, which may have consequences for both the recession and inflation.

In addition to the political factors that influenced the disturbances on energy markets, especially so in oil markets, the growth of these prices was strongly influenced by the growth of the world demand due to the economic growth of certain economies (the BRICS countries and other Asian economies). Thus, the oil price is affected by the level of the global economic activity and its growth due to economic expansion, or a decline due to recessionary pressures. Also, the growth of the living standard of populous countries affects the growth of consumption of and demand for energy, especially oil. It is these influences that

have determined the movements on the oil market since 1999, characterized by rising oil prices during the first two decades of the 21st century, yet with temporary and occasional declines, primarily due to the slowdown in the global economy. Between 1999 and 2006, real oil prices tripled without visible effects on the leading economies' economic growth. The fourth oil shock followed in the period 2007-08, which coincided with the Global Recession.

The causes and dynamics of the fourth shock differed significantly from the previous shocks. Instead of reducing supply, which was the case with the previous shocks, supply stagnated now, yet facing drastic growth in oil demand, which resulted in rising prices. By mid-2007, oil prices had tripled compared to 2001, followed by a drastic rise that lasted until July 2008, after which the prices fell equally dramatically. This growth in demand was a consequence of the accelerated global economic development in the previous years, especially the economic growth recorded by China. High economic growth rates in China also meant a significant increase in oil consumption in that country (Yuxian, Xiaoling & Songke, 2014). From the country that had been a net exporter of oil until 1992, it had become the third largest importer of oil by 2007, which had a decisive influence on the world market trends, which was due to the growth of oil consumption by an average of 7% per year in China during the previous two decades. Due to supply stagnation, it was necessary to reduce the consumption of other large oil consumers such as the United States, Europe and Japan, which happened in the period 2006-08 (Wong, 2016). Having reached an extremely high level of oil prices, they significantly fell in the second half of 2008, so that they were lower than they had been in 2005 in December 2008, which was certainly a consequence of the economic recession which economies around the world entered in 2008 and 2009. In addition to economic contraction, however, such dramatic fluctuations in oil prices were also a consequence of the speculative activities of buying oil as commodity futures.

TENDENCIES IN ENERGY PRICE MOVEMENTS

In the past, energy prices have caused cyclical fluctuations in the economic activity on the world markets as has been pointed out above in the paper. This was especially the case with changes in oil prices. Due to strong correlation in price movements, however, electricity and gas prices also significantly contributed to these fluctuations. For that reason, a global analysis of the impact of the COVID-19 pandemic on energy prices is presented in the next part of the paper, followed by an overview of electricity, oil and gas prices for the former SFRY, Višegrad Group member states and the EU27 as a whole for the purpose of comparison.

The impact of the COVID-19 pandemic on energy prices

The last big challenge to the functioning of the energy market was imposed by the COVID-19 pandemic, which began in early 2020 and which has hit the global economy in several waves ever since, both on the side of aggregate demand and on the side of aggregate supply. In the first months of the COVID-19 pandemic already, it was clear that there would be an economic recession. The impact of the pandemic caused a drop in aggregate supply due to a reduction in the economic activity because of locking countries and applying quarantine measures. Production and logistics chains were interrupted. The delivery of semi-finished products or components was suspended because products were difficult to move across borders. At the same time, aggregate demand decreased because there was a decrease in all its components - personal consumption, investment, government expenditures (except those intended for healthcare) and net exports. The shocks that had hit the economy were unique in modern economic history. The largest number of countries' economic policies responded to that in a similar fashion: easing the position of households and the economy and maintaining financial stability. Due to that fact, huge packages of fiscal assistance were being applied along with the monetary expansion carried out

through applying unconventional measures because the monetary policy became inefficient due to the low interest rate in the previous decade. Given those measures, aggregate demand quickly recovered, which was contributed to by the dynamics of the pandemic, as well as the relatively rapid discovery of the vaccines whose application led to the relatively rapid overcoming of the most severe forms of the disease, thus to the weakening of the epidemiological measures that had threatened aggregate demand and supply (Prašćević, 2020; Prašćević, 2021).

Figure 2 shows that, after the negative shocks of aggregate supply (shift to the left of the SAS curve) and aggregate demand (the shifting of the AD line to the left) due to the pandemic in its early stages, the economy shifted into recession. After that, the recovery of aggregate demand (moving the AD line to the right to AD₃) was accompanied by a rise in prices (inflation rates) with income recovery. The rise in the prices that unexpectedly followed the pandemic was a consequence of the increase in aggregate demand due to the expansive fiscal and monetary policy, as well as the rise in energy prices, which put additional pressure on the prices due to rising production costs.

The presented dynamics of the pandemic trends had a significant impact on the energy market, namely electricity, oil and gas. The first phases of the pandemic during which there was a decline in aggregate demand and aggregate supply resulted in a decline in demand for energy as global production declined. During that period, oil companies reduced their activity with operating losses in the first half of 2020 and reduced investments. The pandemic thus became an additional challenge for the oil sector and the entire energy sector as well, which was under pressure for long because there were climate and energy policy measures aimed at reducing oil consumption, especially in more developed countries. As a result, there was a dizzying drop in the oil price in early March 2020 (\$ 24 per one barrel of Brent oil). However, that was only partly a consequence of the pandemic and partly a consequence of the "oil war" between Saudi Arabia and Russia, which refused to reduce production. That led to Saudi Arabia bringing down the oil price, "punishing" Russia in that way.

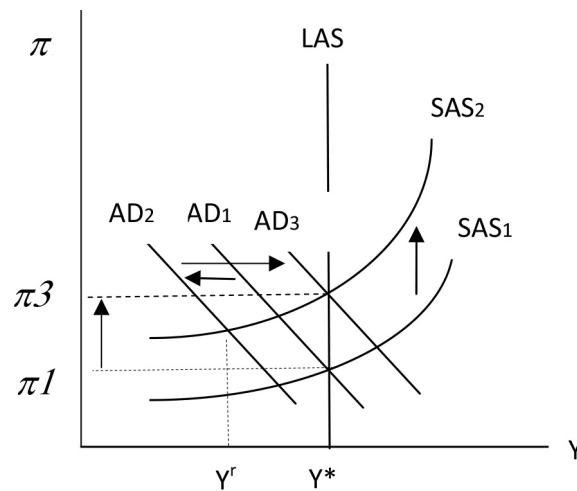


Figure 2 The impact of the COVID-19 pandemic on macroeconomic dynamics

Source: Authors

The oil price continued to fall and was at a record low in April 2020.

Even with the first signs of economic recovery, however, demand for energy increased. It faced insufficient energy (oil and gas) supply in the second half of 2021, thought, which was not only a consequence of the COVID-19 pandemic shock, but also a consequence of the geopolitical tensions and the application of the green economy standards and pollution reduction, too, by switching to the renewable energy sources whose use was limited by the technical and technological conditions of exploitation (e.g. wind energy, etc.). In general, the green economy reduced energy supply while demand remained unchanged, which led to an increase in energy prices. Therefore, the world was faced with rising energy prices and their shortage in the second half of 2021. The oil price recovered during 2021, with occasional declines mainly with the emergence of the new strains of coronavirus that led to increased uncertainty about the future economic activity.

The price of gas as another important energy source was also influenced by pandemic movements in a similar way as oil. In this case, however, geopolitical tensions also had a great impact, culminating at the beginning of 2022. The gas prices in Europe

in December 2021 and early in 2022 exceeded all the records (more than \$ 2,000 for 1,000 cubic meters of gas). Those changes in the gas price were accompanied by a drastic increase in electricity prices. All that had negative consequences on production, as well as prices (already rising inflation). The tensions between Russia and the EU and the United States are certainly contributing to this, due to the Ukrainian crisis (delaying the release of the Nord Stream, which would provide an alternative route for gas supply and bypass Ukraine). This puts the European economies importers of gas from Russia in a particularly difficult position. In the next part of the paper, the foregoing trends are presented in more detail.

The electrical energy market

The analysis of the price trends on the electricity market is complex as this market is specific on several grounds. First of all, electricity as a commodity has certain technical characteristics that condition the functioning of the market itself. In addition, certain activities in the electricity sector are regulated in many countries.

When speaking about the regulatory aspects of certain activities in the electricity system, economic theory

advocates that regulated activities remain those in which the economic preconditions of a natural monopoly are applied. In addition to the economies of scale, it is essential that there is cost-subadditivity. In R. Serbia, for example, transmission and distribution prices are regulated for all system users, as well as the prices of certain ancillary services. In addition to the above-mentioned, the electricity prices for guaranteed supply and the prices of the lease of power reserves for the system services of secondary and tertiary regulation can be regulated (Agencija za energetiku).

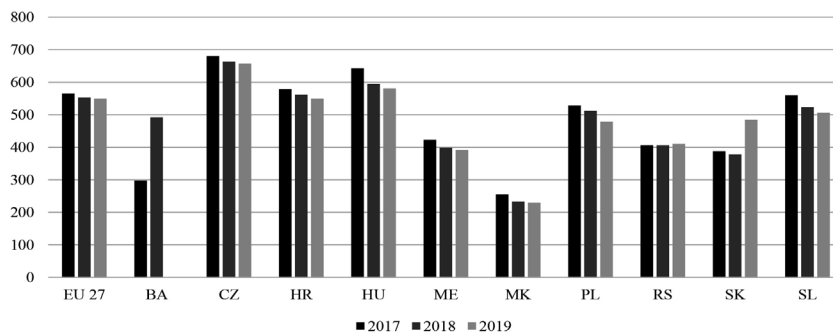
Therefore, the electricity price for final consumers is partly a derivative of meeting the supply of and demand for electricity on the market itself, often much more, and other determinants such as regulatory restrictions, the government policy, international factors, and so forth. Electricity prices are considered as one of the instruments of the income policy and the redistributive policy by which countries, especially those developing, strive to achieve certain economic, social and broader social goals (Jakšić and Ješić, 2021). The electricity price is a significant factor in demand for electricity although, generally speaking, this demand is quite price-inelastic. The rigidity of the supply of and demand for electricity is one of the key features of the electricity industry (Filipović and Tanić, 2010, 10). Electricity consumption, however, varies a lot not only in one single day but also seasonally during a year, which requires that the

installed capacities should follow that demand so that it could be satisfied even at the peak load.

For a partial understanding of the electricity demand determinants, it is useful to note the differences between the countries under observation in their *per capita* household energy consumption. It significantly oscillates between the observation units. In some countries, such as the Czech Republic or Hungary, energy consumption *per capita* is sometimes more than twice as high as consumption in e.g. North Macedonia (Figure 3).

Table 2 provides a comparative overview of the electricity prices for households in the first half of 2021 for the consumers consuming between 2500 and 5000 kWh per year (medium consumers, according to the Eurostat methodology). In addition to that, the overview of the basic price components: the network costs, the fees and charges, VAT and the sustainability fees are given.

According to Table 2, the electricity prices measured in EUR significantly differ between the observed countries. The households in North Macedonia, Serbia, and Bosnia and Herzegovina pay the lowest price, whereas the highest price is paid in the Czech Republic and Slovenia. The prices measured by the purchasing power parity reveal that the lowest electricity price is paid by the households in Hungary and Serbia, whereas the highest price is paid by the households in the Czech Republic and Poland.



Note: The data for Bosnia and Herzegovina for 2019 are not available.

Figure 3 The final energy consumption in households *per capita* (in kg of oil equivalent)

Source: Eurostat

Table 2 The electricity prices for households (per kWh)

	Final price 2021 (January-June)		Price components in 2020			
	EUR	PPS	Network costs	Charges and fees	VAT	Sustainability fees
EU 27	0.2192	0.2194	0.0600	0.0900	0.0300	0.0300
BA	0.0875	0.1723	0.0367	0.0152	0.0129	0.0024
CZ	0.1802	0.2460	0.0464	0.0500	0.0300	0.0188
HR	0.1291	0.2029	0.0448	0.0292	0.0152	0.0139
HU	0.1003	0.1619	0.0442	0.0214	0.0214	0.0000
ME	0.0980	0.1997	0.0426	0.0176	0.0183	0.0037
MK	0.0841	0.1839	0.0192	0.0123	0.0123	0.0000
PL	0.1548	0.2634	0.0489	0.0571	0.0289	0.0066
RS	0.0791	0.1510	0.0306	0.0177	0.0131	0.0000
SK	0.1668	0.2115	0.0440	0.0618	0.0287	0.0182
SL	0.1662	0.1994	0.0468	0.0434	0.0276	0.0126

Notes: The prices are in EUR and the PPS (the purchasing power parity). The prices are shown with all the taxes and fees. The price components are the average values for all the consumption ranges.

Source: Eurostat

When taxes are in question, some countries have not introduced sustainability tariffs. In addition to that, some fees are not shown in the table because they were introduced by a small number of the observed countries. Slovakia, for example, has nuclear energy fees.

A similar analysis was conducted for the enterprise sector also in the first half of 2021, and it was carried out for the consumers consuming between 500 MWh and 2000 MWh of electricity per year (Table 3). In addition, the overview of the basic price components: the network costs, the fees and charges, VAT and the sustainability fees is presented below.

Based on Table 3, a conclusion can be drawn that the companies operating in the countries under observation have different total expenditures for one unit of the electricity consumed, sometimes more than double (e.g. in North Macedonia, it is 0.1346 EUR, and in Slovakia 0.2999 EUR), which each can affect the profitability of the company. In addition, it should be noted that the companies pay a lower total electricity price in all the countries under observation, except Slovakia, in comparison with the EU27 average.

Besides, based on the data about the electricity market trends, it can be seen that the prices measured by the purchasing power parity are often not small compared to the observed countries with developed countries regardless of the fact that electricity prices differ from one country to another. This is especially true for the prices for the economy, which can be a significant generator of fluctuations in the economic activity.

The oil market

The world market Brent oil price has recently significantly been raised (Figure 4). This shock leaves significant consequences for macroeconomic stability as oil is the main input in a large number of industries.

This trend on the global market partially spills over into the final price for consumers (Figure 5), which depends on many factors, just like the electricity market. When regulation on the oil and oil derivatives market is concerned, the situation differs from one country to another. In Serbia, improved competition in the oil, oil derivatives, biofuels and compressed natural gas sectors (Službeni glasnik Republike Srbije,

Table 3 The electricity prices for companies (per kWh)

	Final price 2021 (January-June)		Price components in 2020			
	EUR	PPS	Network costs	Charges and fees	VAT	Sustainability fees
EU 27	0.1573	0.1620	0.0272	0.0628	0.0224	0.0226
BA	0.0874	0.1722	0.0318	0.0323	0.0207	0.0105
CZ	0.1069	0.1458	0.0254	0.0156	0.0133	0.0023
HR	0.1158	0.1820	0.0319	0.0266	0.0136	0.0130
HU	0.1143	0.1846	0.0240	0.0335	0.0211	0.0090
ME	0.1043	0.2125	0.0234	0.0209	0.0146	0.0058
MK	0.0888	0.1942	0.0182	0.0138	0.0138	0.0000
PL	0.1343	0.2284	0.0267	0.0518	0.0244	0.0063
RS	0.0954	0.1823	0.0179	0.0208	0.0153	0.0000
SK	0.1530	0.1940	0.0413	0.0609	0.0265	0.0182
SL	0.1123	0.1347	0.0178	0.0313	0.0194	0.0095

Notes: The prices are expressed in EUR and the PPS (the purchasing power parity). The prices are shown inclusive of all the taxes and fees. The price components are the average values for all the consumption ranges.

Source: Eurostat

2014). The regulated prices in this sector are only determined for the natural monopoly activities of oil transport through oil pipelines, i.e. the transport of oil derivatives through product pipelines.

Given the fact that, according to the Eurostat data in the consumer price index of the observed countries, the fuel prices participate with a share usually ranging from 2% to 3%, it is clear that any change in

fuel prices significantly affects inflation. In addition, as a shock from the supply side, these changes can cause fluctuations in the economic activity.

The natural gas market

In addition to the electricity and fuel prices, gas prices can have a significant impact on macroeconomic stability. In EU's developed countries, a large



Figure 4 The Brent oil price (in \$/barrel)

Source: Federal Reserve Economic Data

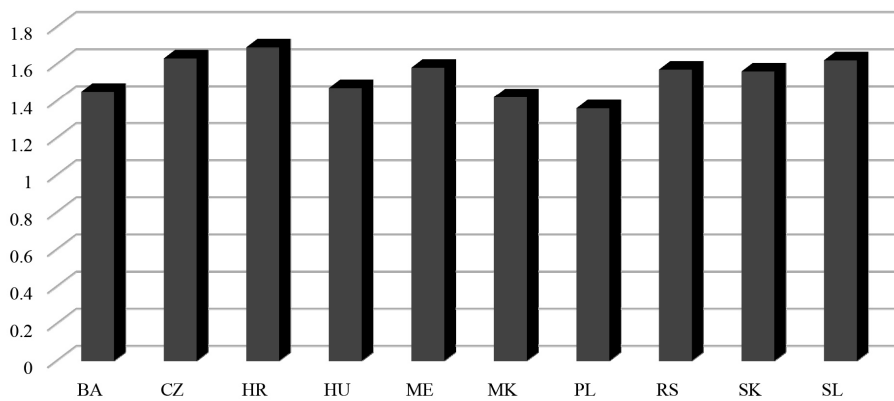


Figure 5 The fuel prices for the final consumers (in \$/liter) in February 2022

Source: Trading Economics

segment of industry uses gas as the main input. Natural gas prices have recorded record levels on the world stock exchanges in recent months (Figure 6). In Serbia, the prices of access to the natural gas transportation system, the price of access to the natural gas distribution system, the price of access to the natural gas storage, and the price of natural gas for public supply (households and small customers) are regulated.

As natural gas is one of the main inputs in many industries, it is certain that the latest developments on this market will leave significant macroeconomic consequences.

When the natural gas price as per the observed countries is in question, Table 4 allows us to conclude that most of them have more favorable prices compared to the EU27 average for households, and that this applies to the price without taxes and levies. On the other hand, the companies in the largest number of the observed countries pay a lower gas price than the EU27 average, but when the taxes and levies are excluded, the price is higher in most countries than the EU27 average. This shows that the state policy in the observed countries tries to depreciate a slightly higher gas price with lower taxes and levies than the EU27 average.

THE IMPACT OF THE LAST SUPPLY SHOCKS IN THE ENERGY SECTOR ON THE MACROECONOMIC STABILITY

Energy prices have significantly risen in the last two quarters. If a part of the market is regulated, such a shock as a rule is first felt by the participants on the unregulated market, but it is just a matter of time when exactly it will overflow onto the regulated market. Such a supply shock often leads to restrictions in quantities, not only to rising prices.

The latest supply shocks in the energy sector have different roots that can trigger turbulence on these markets. They stand out economically and geopolitically. Rising energy prices, for example, were not the only cause of the rising inflation in this area, but also a consequence of the rising taxes and fees in some countries (ECB, 2021). As has already been pointed out in the previous part of the paper, economic theory suggests that, in the short run, rising energy prices will lead to rising domestic prices and a falling GDP. Rising energy prices have a negative impact on consumption, investment and employment. The impact of rising energy prices on the GDP components primarily depends on the two factors:

- the strength of the effects on consumption, and
- the strength of the effects on inflation.

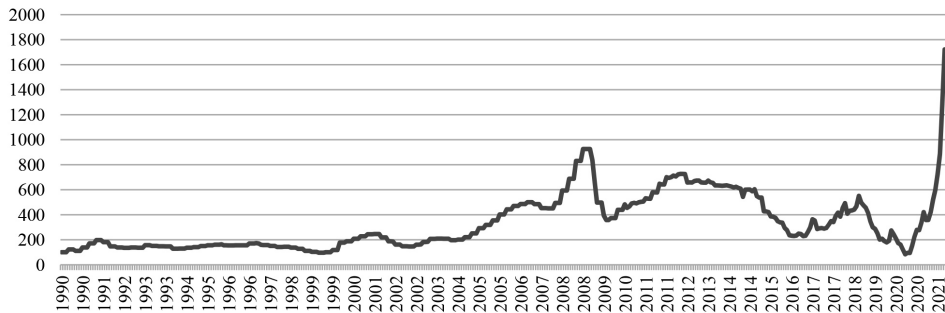


Figure 6 The global price of natural gas (the index 1990M1 = 100)

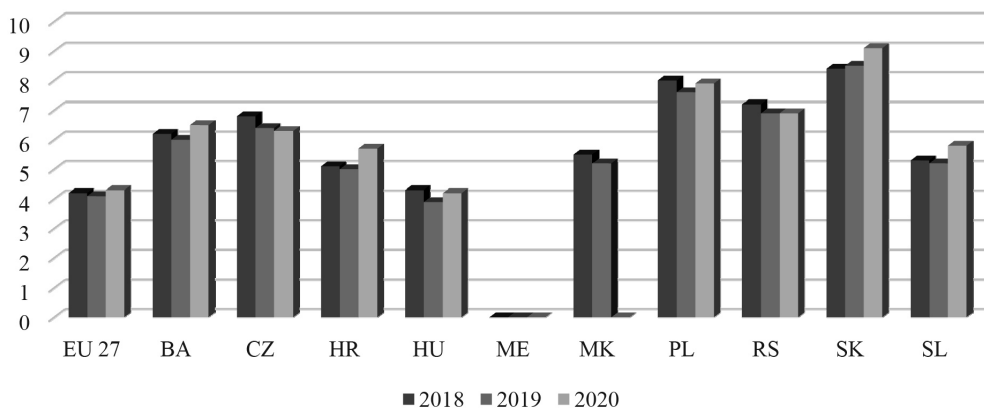
Source: Federal Reserve Economic Data

Consumption is affected by the effect of rising prices on disposable income. The negative effect is also present in the investment field. When speaking about employment, if prices rise over a long period of time, it can affect change in the production structure and can have an impact on unemployment (Lescaroux & Mignon, 2008).

In the context of the effects on the consumption generated by the growth of energy prices, the share of the expenditures for electricity and other energy sources in the total consumption should be analyzed. If the expenditures of the households among the

observed countries are compared, significant differences can be noticed according to Figure 7. In some countries, such as Slovakia, Poland and Serbia, the households have on average significantly higher electricity expenditures. energy and energy from others. These shares are often twice the EU27 average. It follows that they are more sensitive to changes in energy prices, because the effects of price changes on macroeconomic aggregates will be greater in absolute terms.

The impact of the changes in the energy prices on inflation is more obvious. It happens in two phases



Note: The data for Montenegro and North Macedonia (for 2020) are not available.

Figure 7 The final expenditures made by the households for electrical energy, gas and other fuels (as a percentage of the total amount)

Source: Eurostat

(Figure 8) and direct effects are dominant. The direct effects are visible through the impact on the consumer and producer prices, while the indirect effect, the so-called second-round effect, is the agents' reaction primarily in the form of wages and profits adjustment. The second-round effect depends a lot on nominal and real rigidities. If rigidities are higher, the effect on the price changes is smaller, and vice versa. While there is little the monetary policy can do about the first-round effects, on the one hand, it can do much more in terms of strengthening credibility and influencing expectations and consequently macroeconomic stability in the event of such supply shocks, on the other. Besides, the monetary policy can influence additional channels, such as the economic activity and financial markets. By their very nature, shocks in energy prices have significant effects on the macroeconomic stability of a country through spillover effects, irrespective of how immanent the monetary regime is. However, inflation-targeting central banks appear to be struggling to overcome supply shocks. Bearing in mind the fact that the largest number of the central banks that apply this monetary regime de facto apply the so-called flexible inflation targeting, the unfavorable circumstance of

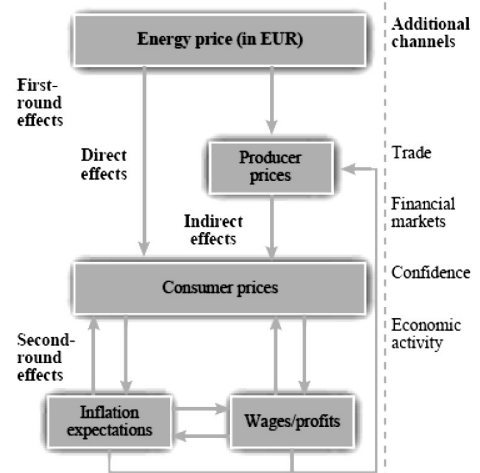


Figure 8 The transmission channels of the impact of energy prices on inflation

Source: ECB, 2010

the supply shocks of this type is that prices and the GDP are moving in opposite directions, so a central bank must make a certain trade-off, simultaneously minimizing the loss function. In other words, supply shocks are more demanding to neutralize or

Table 4 The natural gas prices for households and companies (per kWh)

	Households		Companies	
	Excluding taxes and levies	All taxes and levies included	Excluding taxes and levies	All taxes and levies included
EU 27	0.0411	0.0638	0.0238	0.0365
BA	0.0274	0.0321	0.0354	0.0414
CZ	0.0463	0.0562	0.0238	0.0304
HR	0.0300	0.0374	0.0275	0.0367
HU	0.0241	0.0307	0.0208	0.0284
ME	/	/	/	/
MK	0.0414	0.0488	0.0236	0.0279
PL	0.0301	0.0376	0.0271	0.0346
RS	0.0305	0.0337	0.0285	0.0313
SK	0.0342	0.0411	0.0261	0.0329
SL	0.0382	0.0547	0.0254	0.0378

Notes: The data for Montenegro are not available. The prices are in EUR. The prices are for the households consuming between 20 GJ and 200 GJ. The prices are for the companies consuming between 10000 GJ and 100000 GJ.

Source: Eurostat

reduce the negative effects of the economic policy instruments than demand shocks.

How great an effect the inflation of energy prices will have on the overall inflation also depends on how inflation is measured, i.e. on the importance of individual components in the price index itself that is being monitored. For the EU countries, Eurostat publishes weights in the Harmonized Index of Consumer Prices (HICP), but for some other countries, data on this weight can be found in their respective price index - most often the Consumer Price Index (CPI). Based on the data for the observed countries, Table 5 shows that again this weight is higher for almost all the countries than for example the Eurozone as a whole, which speaks of the greater "vulnerability" of the observed countries to these shocks. This is the case when a weight is only observed for electrical energy and when the scope is extended to gas and other fuels as well.

To sum up, the effects of the recent shocks on energy markets will have significant consequences for the macroeconomic stability. Economic history teaches us that these types of shocks should not be viewed as transitory, and that economic policymakers will have to find a way to mitigate the negative effects of these shocks on the key macroeconomic aggregates. Their neutralization is difficult and almost impossible, so economic policymakers will be faced with a choice among the priorities in the range of economic goals.

CONCLUSION

Shocks on the aggregate supply side represent a special challenge for economic policymakers in neutralization and are much more difficult and much more complex than aggregate demand shocks. A rise in energy prices is one of the most significant supply shocks. Significant increases in energy prices and drastic declines in energy supply, primarily in oil supply, on the world markets have caused cyclical declines in the economic activity in the past. Today, when electricity and gas are important inputs in industrial activities, in addition to oil, the movement

Table 5 The HICP weights and the corresponding price indices

	Electrical energy, gas and other fuels	Electrical energy
Eurozone	5.891	2.875
BA	/	/
CZ	8.939	4.52
HR	8.919	5.176
HU	5.101	1.814
ME	/	/
MK	6.613	4.001
PL	8.349	2.864
RS	8.745	4.645
SK	11.24	4.108
SL	6.416	3.251

Note: The data for Bosnia and Herzegovina and Montenegro are not available.

Source: Eurostat

of the prices of all these energy sources (often correlated) is in the focus of economic policymakers' interest. The impact of rising energy prices on the GDP components primarily depends on the two factors: the influence of the effects on consumption and the influence of the effects on inflation. The key scientific contribution of the supply-side shock analysis can be found in the in-depth analysis and sound assessment of the role of these shocks in preserving macroeconomic stability, as well as economic policy measures necessary to minimize their negative effects. The research confirmed the research hypotheses and proved that energy price shocks can be sources of economic recessions and other macroeconomic instabilities, too. In addition, the importance of the monetary authorities' response to rising energy prices in generating a recession has been demonstrated as well. Finally, the COVID-19 pandemic has proven to disrupt the balance of the supply of and demand for energy, generating fluctuations in their prices.

Rising inflation appeared during 2021 as one of relatively forgotten macroeconomic problems. During that year, especially so during the second half of that year, the rising energy prices issue came to the fore and was primarily caused by their insufficient supply

on the world markets partly due to the unexpectedly rapid global economic recovery that generated growth in demand for energy. The last big challenge to the functioning of the energy market was imposed by the COVID-19 pandemic and geopolitical tensions as well.

The complexity of the analysis of these supply shocks is reinforced by the fact that certain activities in the energy sector in the process from production to the final consumption are regulated, whereas some are left to the free market. It depends on the country and the type of energy source, too. Together with their economic characteristics, the most often regulated activities have met the conditions for the existence of a natural monopoly.

On the electricity market, the electricity price for final consumers is partly a derivative of meeting the supply of and demand for electricity on the market itself, frequently much more than the other determinants such as regulatory restrictions, the state policy, international factors, and so on. Among the set of the observed countries, there are differences in energy consumption in households per capita. In the Czech Republic and Hungary, energy consumption *per capita* is sometimes more than twice as high as consumption in, for example, North Macedonia. Electricity prices also significantly vary from one country to another. Households in North Macedonia, Serbia and Bosnia and Herzegovina pay the lowest price, while in the Czech Republic and Slovenia the highest price is paid.

On the oil and oil derivatives market, price spikes have also recently been recorded. Economic history has shown that this shock has very big consequences for macroeconomic stability. In the consumer price index of the observed countries, the fuel prices participate with a significant share, which imposes the conclusion that any change in fuel prices significantly affects inflation, for the reason of which fact these shocks have to be under special monitoring of the central bank.

In addition to electricity and fuel prices, gas prices can have a significant impact on supply macroeconomic stability. In EU developed countries, a large segment of industry uses gas as the main input, since this fuel

has the status of an ecological fuel, and the effects of its use on the natural environment are significantly of a smaller size than those of other fuels. The largest number of the observed countries have more favorable gas prices compared to the EU27 average for households, which is the case with companies when the final price is observed.

The effects of the recent shocks on energy markets will certainly have significant consequences for macroeconomic stability. Their nature, the macroeconomic environment in which they take place, the accumulated macroeconomic problems that have been “under the radar” lately with the help of unconventional policies will be a challenging problem to solve. The problem caused by these shocks is that their complete neutralization is almost impossible, so economic policymakers will be given a choice among the priorities in a wide range of economic goals. In the macroeconomic policy field, the central bank plays the key role, which may partly mitigate the intensity of these shocks with certain monetary policy instruments. The key limitations of the research study relate to uncertainty in the movement of energy prices, which is a consequence of global trends, as well as the differences in the regulatory aspect of the energy market in the observed countries. Possible directions of future research refer to a broader analysis of the possibilities available to economic policymakers in the conditions of supply shocks.

ENDNOTES

- 1 In the total world energy consumption, the share of oil is about 37%.
- 2 Inflation in the United States, as well as all European countries, except Germany, recorded the double-digit rates that remained present even after the 1975 recovery.
- 3 The OPEC countries have 2/3 of the total oil reserves, producing about 40% of the total oil production, covering 1/2 of the world oil exports.

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Aleksandra Prascevic is a full professor at the Faculty of Economics and Business of the University of Belgrade, where she teaches the following subjects: The Fundamentals of Macroeconomics, Macroeconomic Analysis, The History of Economics and Macroeconomics (the LSE module) in the undergraduate academic studies. Her areas of scientific interest are macroeconomic theory and analysis, political macroeconomics, especially politically generated cyclical macroeconomic fluctuations.

Milutin Jesic is an assistant professor at the Faculty of Economics and Business of the University of Belgrade, where he teaches the following subjects: The Fundamentals of Macroeconomics, The Theory and Analysis of Economic Policy and Macroeconomics (the LSE module) in the undergraduate academic studies. The areas of his scientific interest include macroeconomic theory and politics, applied macroeconomics, political macroeconomics.