Stagflationary Pressures in the Condition of Global Economic Shocks[1]

Стагфлаторни притисци у условима глобалних економских шокова

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Abstract: This paper analyses the key macroeconomic repercussions of the global pandemic and geopolitical crisis in terms of growing recessionary and inflationary pressures, and finally, the potential occurrence of stagflation. The subject of the econometric analysis is aimed at seeing how global energy price movements, unemployment rates, interest rates and money supply affect: (1) real gross domestic product; and 2) the movement of the inflation rate in the sample of 18 countries (EU-15, USA, Norway and Switzerland) in the period 2020q1-2023q1. Using Panel-corrected standard errors method (PCSE), two panel models are estimated in which the dependent variables are: (a) the real gross domestic product, showing potential recessionary pressures, and (b) the inflation rate, determining inflationary pressures. Results indicated that in the observed period, inflationary and recessionary pressures existed in the sample of 18 developed economies, as well as that these pressures can be characterized as the phenomenon of stagflation. The most profound impact on recessionary circumstances was caused by the rise in global energy prices in the second and third quarters of 2022, which can be considered as an exogenous shock and trigger of recessionary pressures, while inflationary pressures are dominantly determined by global oil price growth during the analysed period.
Keywords: stagflation, global economic shocks, Panel-corrected standard error method.
JEL: E31, E62, C23.

Сажетак: У овом раду анализирају се кључне макроекономске реперкусије глобалне пандемије и геополитичке кризе у смислу растућих рецесионих и инфлаторних притисака, и коначно, потенцијалне појаве стагфлације. Предмет економетријске анализе има за циљ да сагледа како кретања глобалне цене енергије, стопе незапослености, каматне стопе и новчане масе утичу на: (1) реални бруто домаћи производ; и 2) кретање стопе инфлације на узорку од 18 земаља (ЕУ-15, САД, Норвешка и Швајцарска) у периоду од

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првог квартала 2020. до првог квартала 2023. године. Користећи метод Панел-коригованих стандардних грешака (PCSE), оцењена су два модела панела у којима су зависне варијабле: (а) реални бруто домаћи производ, приказујући потенцијалне рецесионе притиске, и (б) стопа инфлације, осликавајући инфлаторне притиске. Резултати су показали да су у посматраном периоду постојали инфлаторни и рецесиони притисци на узорку од 18 развијених економија, као и да се ови притисци могу окарактерисати као феномен стагфлације. Најдубљи утицај на рецесионе околности имао је раст глобалних цена енергената у другом и трећем кварталу 2022. године, што се може сматрати егзогеним шоком и покретачем рецесионих притисака, док су инфлаторни притисци доминантно детерминисани растом глобалних цена нафте у анализираном периоду.
Кључне речи: стагфлација, глобални економски шокови, метод Панел-коригованих стандардних грешака.
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Introduction

For the creators of economic policies, it is of primary importance to observe and improve three fundamental macroeconomic indicators that manifest the success of an economy: stable growth of gross domestic product (GDP), low unemployment rate and low inflation. It has been assumed that it is almost impossible to ensure a strong pace of GDP growth without reducing unemployment or without inflationary pressure. Namely, conducting an anti-inflationary monetary policy implied lower GDP with a higher unemployment rate. However, the current circumstances, which are a reflection of the exogenous health shock -global pandemic crisis (2020) and the current geopolitical crisis due to Russian-Ukraine war (2022), resulted in far more complex situations for the global economy. Economic policymakers could be faced with the pressure of inflation and recession, and if these phenomena are simultaneously present, then stagflationary pressure could be recognized in an economy (Malenković, 2023).

Stagflation occurs at the moment when the economic environment experiences: 1) economic recession - decline in production, followed by increase in unemployment, and 2) high inflation, at the same time. In other words, three key macroeconomic indicators are going in the wrong direction, and the economy is simultaneously threatened by inflationary and recessionary adjustments. The focus of this research is assessment of the functioning of the global economy in crisis conditions from the moment the emergence of Covid-19, until the escalation of geopolitical crisis between Russia and Ukraine, with the intention of identifying crucial pressures. Namely, the aim of this paper is twofold: (1) to present an overview of stagflationary shocks in 1970s and stagflatory pressures after 2020, (2) to apply econometric analysis in order to detect stagflationary pressures in a sample of 18 developed countries (EU-15, USA, Norway, Switzerland), in the period 2020q1-2023q1. The hypotheses analyzed in the paper are:

(H1) Recessionary pressures as a consequence of global energy price growth are present in a sample of 18 developed countries in the period 2020q1-2023q1;

(H2) Inflationary pressures as a consequence of global energy price growth are present in a sample of 18 developed countries in the period 2020q1-2023q1;

(H3) Stagflationary pressures as a consequence of global energy price growth are present in a sample of 18 developed countries in the period 2020q1-2023q1.

The research shows that the presence of stagflation pressure, high inflation and a stagnant economy can fully coexist, and were present in the period 2020q1-2023q1 in the sample of 18 developed economies.

The remainder of this paper is organized as follows. After this introduction, the first chapter presents a review of the literature, the second chapter discusses the stagflationary shocks during the 1970s and current stagflationary pressures. The third chapter elaborates the methods and data used, and finally the fourth chapter provides an empirical analysis of the influence of independent variables on the real GDP and the inflation rate (dependent variables), whose movements systematize the appearance of stagflation.

1. Literature review

The emergence of stagflationary pressures is a current and increasingly present topic that is being discussed at the global level. With reference to this, it directly reflects on the functioning of the state, the development of the economic environment, but also on the economic standard of individuals. This paper relies on the different views of economists who point to the harmfulness of the presence of stagflationary pressures, but also economists who pointed out that the appearance of stagflation is not the only possible scenario for the global economy, i.e. those economies did not reject the possibility of independent inflationary or recessionary pressures. Torry (2022) analyses the emergence of stagflation in the 1970s as one of the worst economic experiences of the last century, indicating that the economic environment needed more than a decade to revitalize its economic constructs. Author pointed out that the appearance of stagflation in the 1970s was something completely new, far more complex for the functioning of the entire macroeconomic system and required a completely different approach: a new solution with comprehensive analyses and different implementation of economic policies. Koegh (2022) explains the phenomenon of stagflationary pressures as a nightmare faced by economies, which has a sharp impact on key macroeconomic variables. Baltussen et al. (2023) indicate that high inflation has always caused great concern among investors, but in the last few decades it has almost never exceeded monetary targets. However, the emergence of the pandemic crisis, prolonged by geo-political turbulence, directly affected the increase in inflation and consumer prices, creating pressure and risk on investment premiums, which resulted in a change in investment strategy and a reduction in production. Pejčić, Beljić and Glavaški (2022) indicate in their research that a descriptive empirical analysis showed that similar dynamics of GDP growth and the inflation rate occurred in the USA, Germany and France in the period January 2020 - July 2022. More precisely, during the pandemic crisis, there were present recessionary pressures, as GDP growth declined until the first quarter of 2021 in the analysed economies, while inflation rates were stable, below 2%. On the other hand, with the recovery of the economy in the second quarter of 2021, inflationary pressures become stronger in each quarter until July 2022. Therefore, the conclusion is that inflationary and recessionary pressures existed in the USA, Germany and France in the period January 2020 - July 2022,

however, those pressures could not be identified as stagflation, because it did not happen simultaneously. Hawkins (2022) argues that the emergence of stagflationary pressures creates chronic problems at the global level, emphasizing the high degree of fear among economic policymakers when revitalizing economic life. Accordingly, only those countries that "today" make extremely difficult decisions regarding economic policy will be able to overcome the crisis situation.

Baqaee and Farhi (2022) emphasize the world's number one problem, when it comes to the macroeconomics is the rapidly growing inflation, describing its distorting effect on the purchasing power of the population. Namely, it is explicitly reflected in the reduction of demand on the goods market, which spills-over into the drop in demand on the labor market and consequently lowers the entire aggregate supply, introducing the economy into a deeper crisis. Consequently, problems of such proportions should be suppressed at the moment of creeping growth, and not at the moment when they assume galloping proportions. Chakraborty (2023) also points out that currently the biggest problem of the global economic system is the growing inflation, because people with fixed incomes, such as pensioners, then the population whose income is generated by social assistance, become increasingly poorer. Namely, as inflation rises, their purchasing power declines. Bobeica and Hartwig (2023) expand the scope of analysis of current macroeconomic problems generated by Covid-19 and geopolitical challenges. In their work, authors use vector autoregression (VAR) model and discuss the results focusing on Eurozone inflation. Indicating that the Eurozone in particular has struggled with low inflation to the extent that inflation expectations have become less rooted in the ECB's inflation target. Inflation continued to surprise during the pandemic, starting in 2020. Initially, while energy inflation fell rapidly, the response of Eurozone core inflation was modest relative to the decline in activity. From the middle 2020 of the year onwards, headline inflation declined further as core inflation increasingly reflected disinflationary tendencies and headline inflation went downwards. Starting in 2021, the situation completely reversed and inflation once again took centre stage in the economic debate. surprise. In this context of very atypical economic circumstances - economic closure and subsequent reopening - the key question is which tools can be used for inflation modelling to ensure the clearest possible picture of inflationary developments.

Hunt (2022) believes that "inflationary psychology" is a phenomenon that currently underlies macroeconomic problems, and therefore the expected rise in prices tomorrow accelerates consumption today, automatically reflecting on harmful aggregate demand and price accumulation. Therefore, the reaction of the economic authorities, which is "required" in order to curb inflation through higher interest rates and reduction of state spending, only pushes the economy into recession. Diego (2021) points out that the decline in economic activities is the key problem, considering that the shape of the recession cannot be accurately predicted. However, it is certain that the recovery will not be quick and that the economies will have to make a lot of efforts to return the level of economic activity to level before the emergence of Covid-19. Ozili and Arun (2023) indicate that the current global macroeconomic situation indicates the emergence of recessionary pressures, but also that the current recession produced by the coronavirus has created a new type of recession that differs from previous ones. They point out that the financial crisis of 2008 was created by loose

monetary policy, creating a bubble, followed by weak regulatory structures and high leverage in the banking sector. The reason for today's crisis is far more complex, caused by a break in the energy supply chain that is the generator of today's production growth. Eti et al. (2023) indicate that the possible continuation of the tightening of relations between Russia and Ukraine would lead to an increase in the price level of oil derivatives, which would result in an increase in global inflation, moreover, a gradual entry into the phase of recession, i.e. the possible occurrence of stagflation. Huang and Liu (2005) explain that the presence of inflation is a huge problem that can arise for two reasons. The first reason is an increase in demand resulting in an increase in the price level, while the second reason is related to disruptions in the supply chain. Furthermore, he points out that the limited supply of oil derivatives, electricity or agricultural inputs can be recognized as a generator of stagflation, pointing out the fact that people today buy less at higher prices. Bluedorn et al. (2022) point out that a possible increase in the level of interest rates by central banks in response to an increase in the price level would have a devastating effect on household budgets. He also cites two crucial reasons that preceded the current state of the global economy, firstly, the sharp drop in industrial production caused by the emergence of Covid-19, and secondly, the effects of military interventions on the territory of Ukraine, which directly complicated the global economic situation. The expected contribution of our paper is to fill the gap in the literature concerning the simultaneous analysis of inflationary and recessionary pressures in 18 developed countries (EU-15, USA, Norway, Switzerland), in the period 2020q1-2023q, using modern robust econometric techniques.

2. Stagflatory shocks of the 1970s and current stagflationary pressures

The key question in this paper is: what is the precondition for the emergence of stagflation? Stagflation occurs most often when there is a so-called shock on the supply side. If the supply structure of a production factor that is key to existence further growth, development of the economy is disrupted in different segments, such as the supply of labor on the labor market, electricity or oil supply.

The last time such a situation, which economists call a "nightmare", happened in the United States of America (USA) in the 70s of the last century. Namely, it was a period in which the prices of energy products (petroleum derivatives) rose incredibly and directly affected the rapidly growing inflation rate and the sharp decline of the entire production. If the supply of oil on the market decreases, as it did, it would automatically lead to an increase in the price level (inflation), while, on the other hand, producers would reduce the aggregate supply. Furthermore, a reduction in supply would lead to a decline in national production, with a rapid rise in the unemployment rate. Rising energy prices fuelled a spiral in wage and cost prices, which directly resulted in widespread price increases across the spectrum of economic activity. Frequent recessions have raised unemployment without cooling inflation. The Federal Reserve was focused on stimulating growth and powerless to „tame" rising prices. Faced with external economic shocks, economic policymakers allowed inflationary expectations to settle, discouraging investment (Zarić, 2022). Unemployment exceeded the

standards set in the previous two decades, and growth was completely uneven. The US economy was in recession from December 1969 to November 1970 and again from November 1973 to March 1975. When US economy was not in recession, the economy grew with real GDP growth above 5% in 1972-73 and mostly above 5% in 1976-78. However, in the 1970s, lower living standards and declining confidence in economic policy were commonplace. Grzegorz et. al (1987). In a short period of time, the American economy simultaneously experienced an increase in the consumer price index above 10% (such an increase in the US has not been recorded since World War II), while unemployment rose from 4.6% in 1973 to 9% in 1975, and the GDP fell. OPEC countries continued to increase the price of oil and in the following period, so this was automatically reflected in the fact that inflation grew from year to year, and the economy sank into recession. Beginning with a recession, the 1970s were a decade of pessimism and ended painfully with the Vietnam War. Memories of the Great Depression made economic policymakers reluctant to use restrictive monetary and fiscal policies to curb inflationary pressures, as it was believed that an increase in unemployment would be completely unacceptable, meaning that the American population would experience additional deflationary adjustment (Mansur, 1988).

Figure 1, (panel a) shows the movement of the inflation rate, while (panel b) shows the movement of the GDP growth rate in the United States of America in the time interval 1969-1982. The conclusion is that the American economy faced simultaneous inflationary and recessionary pressure twice, the first time in the period 1974-1975, while the second time was in 1980, which indicated the presence of stagflation.

Figure 1: Two stagflationary shocks in USA (period 1969-1983)

Source: Pejčić, Beljić and Glavaški (2022).
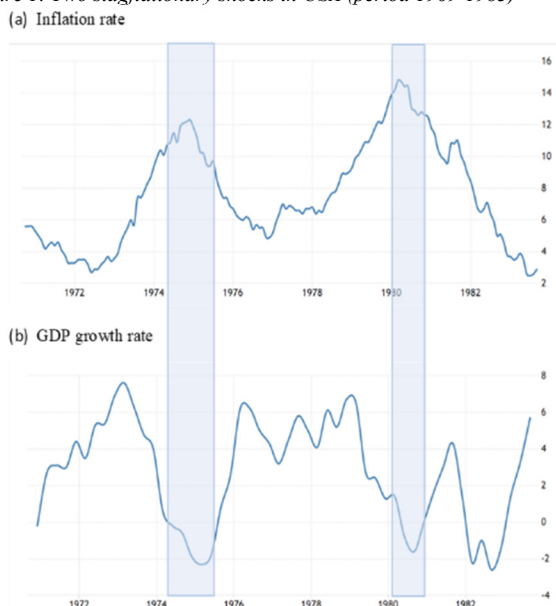
Most analysts and economists, including the IMF, do not expect a repeat of the bad old days of the 1970s decade of economic crisis. But just as the oil crisis reverberated throughout the global economy in the 1970s, so the double whammy of pandemic and Russia-Ukraine war has put unprecedented pressure on the supply of goods and services around the world today. What is certainly an essential question both for the creators of economic policies at the global and national level, as well as for political exponents, is how to reduce the unwanted economic repercussions of Covid-19 and geopolitical-military operations on the territory of Ukraine (Vidal, 2016). Border closures to prevent the capillary spread of the virus lead to a drop in production and demand in the short term. As in the case of an increase in the price of oil, the reduction in potential production may be temporary if production were to return to the projected level. However, if the lockdown decision is extended, it could lead to a much slower return of current production levels to projected levels (Rebić, & Antić, 2022).

Figure 2: Inflationary and recessionary pressures in 18 developed economies (2020q1-2023q1)
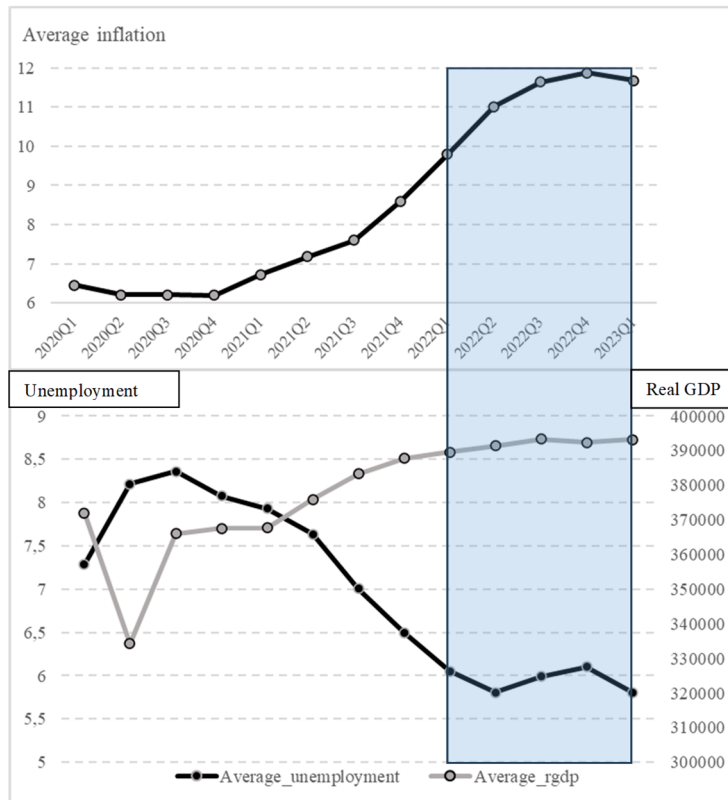
Source: authors.

The potential possibility of a return to stagflation is causing fear among economic policymakers because there are little monetary / fiscal policy tools for the solution of stagflation (Cvetković, Simonović, & Đorđević, 2022). As it is indicated in the introduction part, stagflation means that three key macroeconomic indicators are going in the wrong direction (inflation, real GDP and unemployment rate). Figure 2 shows pressures represented through average movements of inflation rate, real GDP and unemployment rate in the sample of 18 developed economies (EU-15, Norway, USA and Switzerland) in the period 2020q1-2023q1. Inflationary pressures are detected and intensified after the first quarter of 2021 (Figure 2, panel (a)), meaning increase of average inflation rate. On the other hand, recessionary pressures occurred in the same period measured through unemployment rate, while decrease of real GDP is not detected in the analysed period (Figure 2, panel (b)). Therefore, Figure 2 indicates potential stagflationary pressure which will be checked using panel model econometric framework (Zarić, 2022).

3. Methodology and data

With the aim of a detailed analysis of stagflationary pressures using PCSE (Panel-corrected standard error) econometric techniques, with the inclusion of 18 countries in the analysis, during the crisis period, the paper used panel data. The subject of the econometric analysis will be aimed at looking at how global energy price movements, viewed through the prism of energy and oil prices, and other control variables: unemployment rates and money supply, affect the movement of the inflation rate and real GDP in a sample of 18 countries (EU-15, USA, Norway and Switzerland) in the period 2020q1-2023q1 (quarterly presentation of data). What is characteristic of micro panels is a short time series (T), homogeneity is assumed, while individual time effects include all heterogeneity, which can be estimated and presented within a fixed and stochastic specification. When we talk about the specification with the heterogeneous free term and the homogeneous regression parameters, it is important to point out that the free term varies by units, while the regression parameters are constant. The specification of the model implies heterogeneity in the free term, but according to the principle that only variations according to comparative data are included in the analysis, while the regressors along with the coefficients remain unchanged. If we are talking about variables that vary only by units of observation, but not over time, then it is a model with fixed individual effects. The specification of the observed model with fixed individual effects, using a dummy variable is as follows:

$$y_{it} = b_0 + b_1 X_{it} + b_2 X_{it} C_i + \mu_i + \lambda_t + u_{it} \tag{1}$$

where y_{it} is dependent variable of country i in year t. X_{it} contains regressors which vary over i and t, while C_t is dummy variable for the time t. This general specification contains individual (unobservable country-specific) effects μ_i, along with time effects λ_t, and stochastic disturbance term u_{it}. In order to test differentiated effects of specific period of time (oil prices), group effects are encompassed by the interaction term, $X_{it} C_i$.

The procedure used in order to select the optimal panel model specification, as well as its estimation method, involves several steps in the research. After the analysis of descriptive statistics and potential transformation of variables, two models have to be

estimated: (1) RE model (random effects - stochastic individual effects), and (2) FE model (fixed effect - fixed individual effects). It is also important to highlight the Hausman specification test, which is based on the difference between the estimates of the regression parameters of the model with fixed and stochastic effects. The Hausman test is widely used even in methods with heterogeneous regression parameters. Assuming that the Hausman test shows us that the long-term coefficients are homogeneous (in the case of accepting the null hypothesis), then it is necessary to evaluate a given model using the method of combined group means, because it is unjustified to introduce heterogeneity for both short-term and long-term coefficients, i.e. otherwise, the method of group means should be applied.

Furthermore, in the event that the RE (random effects - stochastic individual effects) or FE (fixed effect - fixed individual effects) model does not provide appropriate parameter estimates that have an adequate level of statistical significance and are in line with economic logic, as well as in the presence of autocorrelation and/ or heteroskedasticity, then during the econometric analysis, the robustness of the estimates will be checked. Namely, the application of PCSE methods enables the calculation of panel-corrected standard error estimates for linear cross-sectional time series models where the parameters are estimated using OLS or Prais-Winsten regression. When calculating the standard error and estimating the variance and covariance, the PCSE method assumes that there is heteroskedasticity in the model and at the same time correlation of the panel data. It is important to point out that unfulfilled assumptions refer to heteroskedasticity or the presence of autocorrelation within panels, where the autocorrelation parameter can be constant across panels or different for each panel. Although PCSE allows for other disturbance covariance structures, the term PCSE, as used in the literature, refers specifically to models that are both heteroskedastic and simultaneously linked across panels, with or without autocorrelations.

Described procedure is used and repeated two times in order to estimate two models, one, where dependent variable y_{it} is real GDP growth (*rgdp*), and the second one, where dependent variable is inflation rate (*inflation*). Following the main results in the empirical studies, a set of determinants, X_{it}, are employed: *unemployment, global energy price, M1, real interest rate*. One of the most significant independent variables, *global energy price*, which rose sharply from the first quarter of 2021, to reach its maximum in the third quarter of 2022, had a strong impact on the dependent variables. The increase in the price of energy caused a direct negative impact in both panels on the dependent variables (decrease in real GDP and increase in the inflation rate). The analysis of the available data used in the econometric analysis was taken from the Federal Reserve Economic Data database (FRED).

The aim of this paper is to use econometric analysis to detect stagflationary pressures in a sample of 18 developed countries (EU 15, USA, Norway, Switzerland), in the period from the first quarter of 2020 to the first quarter of 2023 (2020q1-2023q1). Therefore, the baseline model, derived from theoretical framework, to test Hypothesis 1, could be specified as:

$$rgdp_{it} = b_0 + b_1 unemployment_{it} + b_2 inflation_{it} + b_3 real\ interest\ rate_{it} + b_4 M_1 +$$
$$b_2 oilprice_{it} q_2 q_3 2022_i + \mu_i + \lambda_t + u_{it}$$
$$(2)$$

while model to test Hypothesis 2, is specified as:

$$inflation_{it} = b_0 + b_1 unemployment_{it} + b_2 real\ interest\ rate_{it} + b_3 M_1 +$$
$$b_4 globalenergyprice_{it} + \mu_i + \lambda_t + u_{it} \qquad (3)$$

4. Empirical analysis of stagflation in developed economies

Table 1 shows a summary analysis that provides descriptive statistics (mean value, standard deviation, minimum and maximum) of dependent and independent variables. The number of observations covered by the panel is 234, where the variable variable *rgdp* represents real gross domestic product, with a mean value of 378053.3, where there are large differences in the case of minimum versus maximum values of real GDP. The lowest level of *rgdp* was recorded in the 2nd quarter 2021 in Spain, while the highest level of GDP was achieved by the United States of America. The variable *inflation* refers to the inflation rate, whose mean value is far above the target, 8,551 in the observed sample. The stated inflation rate occurred in Great Britain in the third quarter of 2022. The *M1* money supply is shown by the variable of the same name, showing the monetary expansion during the pandemic crisis. The variable *realinterestrate* refers to the real interest rate, with a mean value of 0.447 and reaching a maximum value of 4.51 to combat inflation. In the United States, the real interest rate in the first quarter of 2023 was 4.51. The unemployment rate is indicated by *unemployment* with a mean value of 6.982, but also reaching a maximum during the analysed period of 19.44. Such a high unemployment rate was dominantly present in the second quarter of 2020 in Greece. Finally, the variable *dummy globalenergyprice* is defined as a dummy variable for the price of energy, but in the period of global shock from the point of view of the price of energy - the second and third quarters of 2022. It is defined as the interaction between energy prices and a specific time interval (II and III quarters of 2022) with the aim of covering the shock due to the increase in *global energy prices*.

Table 1: Summary analysis for independent and dependent variables

Variables	Obs	Mean	Std. Dev.	Min	Max
Rgdp	234	378053.3	318652.2	12205.8	1160831
Inflation	234	8.551047	27.46308	-2.0510	144.2952
M1	234	1.11e+13	2.06e+12	4.07e+12	2.06e+13
Real interest rate	234	0.447124	0.7876848	-0.35627	4.51455
Unemployment	234	6.98287	3.551175	2.66667	19.4333
Globalenergyprice	234	192.3762	87.48073	68.76653	350.1239
Dummy golbalenergyprice	234	0.3076923	0.4625278	0	1

Source: Author's calculation.

4.1. Analysis of recessionary pressures using the panel model

In order to detect recessionary pressures, the next step in the analysis of the panel model is to check whether there are significant individual effects in the model and whether they are of a fixed or stochastic character.

Table 2: Fixed vs random individual effects model for recessionary pressures

Fixed effect	Model			Random	effect	Model
Dep. variable: Rgdp	Coef.	Std. error.	P>(t)	Coef.	Std. error.	P>(t)
M1	2.97e-09	1.072-09	0.006	2.99e-09	1.06e-09	0.005
Inflation	787,694	384,614	0.042	795,727	380.6095	0.037
Unemployment	74.17224	1023.26	0.942	22.6127	1020.785	0.982
Dummy golbalenergyprice	10043.75	3057.369	0.001	9957.003	3051.332	0.001
Real interest rate	8292.447	2043.176	0.00	8225.45	2035.807	0.00
Cons	331018.6	14429.25	0.00	331186	78768.65	0.00
R2	0.1337			0.1337		
Wald chi ^{2}	23.79		0.000			
Breuch-Pagan test				119.56		0.000
Httest3	1277.82		0.000			
Autocorrelation	12.217		0.028			
Hausman test	0.59		0.946	0.59		0.946
Number of observations	234			234		

Source: Author's calculation.

Based on Table 2, we come to the conclusion that variables *M1, inflation rate, global energy price* and *real interest rate* are statistically significant, while other independent variables included in the model are not statistically significant in Fixed specification of the model. The F-test of fixed individual effects checks whether there are fixed individual effects in the model. The null hypothesis is that all individual effects in the model except for one equal individual effect are equal to 0. If the null hypothesis is not rejected, we choose the OLS estimation method. In our case, the *p*-value of the F test is less than 0.05 and we conclude that there are fixed individual effects in the model. The next step is to test random individual effects with the Breusch Pagan LM test, namely in Random effects specification. It is necessary to clarify the hypothesis in terms of acceptance or rejection. We come to the conclusion that the variables *M1*, the *inflation rate*, *global energy price* and the *real interest rate* are statistically significant, while the other independent variables included in the model are not statistically significant. The Breusch Pagan LM test determines whether there are stochastic individual effects in the model. Null hypothesis: the variance of the individual effects is equal to 0. If the null hypothesis is not rejected, we choose the OLS estimation method. In our case, the *p*-value of the Breusch Pagan LM test is less than 0.05, which is why we conclude that there are stochastic individual effects in the model. If the existence of fixed individual effects (FE model) and stochastic individual effects (RE model) is determined, the choice between these two models is made using the Hausman test. Null hypothesis: regression parameter estimates obtained using RE methods are consistent and efficient, while

regression parameter estimates obtained using FE methods are consistent. Alternative hypothesis: regression parameter estimates obtained using FE methods are consistent, while regression parameter estimates obtained using RE methods are inconsistent. In our case, the *p*-value of the Hausman test is greater than 0.05 and we conclude that the stochastic specification (RE model) is better, because the RE model gives more efficient estimates compared to the FE model. However, if heteroskedasticity and autocorrelation are present in the model, it is necessary to switch to robust estimates. The null hypothesis assumes homoscedastic errors *p*-value greater than 0.05, while if the *p*-value is less than 0.05 it indicates that the errors are heteroskedastic. Based on the obtained results, we conclude that the null hypothesis is rejected and that there is the presence of heteroscedasticity and autocorrelation. In order to check the robustness of the estimates, the PCSE method can be applied.

Table 3: PCSE method – recessionary pressures

Panel-corrected standard error (PCSE)			
Dependent variable *Rgdp*	Coef.	Std. Error.	P>(t)
M1	3.42e-08	6.39e-09	0.000
Inflation	443.4615	83.86798	0.000
Unemployment	-25110.48	2327.709	0.000
Dummy globalenergyprice	-51511.85	1432.44	0.000
Realinterestrate	-21617.67	11044.37	0.050
Cons	195917.5	70601.73	0.006
R2	0.1337		
Wald chi2	358.11		
Number of observations		234	

Source: Author's calculation.

Based on Table 3, we conclude that all independent variables included in the model are statistically significant, and we consider the specified specification to be optimal. Given the estimation using PCSE methods, problems of heteroskedasticity and autocorrelation in panel data are eliminated, and robust estimates are considered relevant. The estimated model indicates that if *M1* increases by one unit, the assumption is that there will be an increase in the dependent variable by 3.43. This result is in line with macroeconomic theory, because the growth of money supply generates the growth of demand, which further stimulates the growth of real GDP. If the *inflation* rate increases by one unit, the assumption is that there will be an increase in the dependent variable by 443.46, whereby the theoretical interpretation is similar to the case of *M1* growth. If the *unemployment* rate increases by one unit, the assumption is that there will be a decrease in the dependent variable by 25110.48, which is justified, based on the assumption that the crisis circumstances affected the growth of the unemployment

rate, and consequently the decline of the real GDP. If the real interest rate increases by one unit, the assumption is that the dependent variable will decrease by 21617.67, confirming recessionary pressures as a consequence of the contractionary monetary policy. If the dummy variable (*dummy globalenergyprice*) increases by one unit, the assumption is that the dependent variable will decrease by 51511.85. When analyzing the impact of the variable *dummy globalenergyprice* on the dependent variable, it was detected not only that the increase in the price of energy affects the reduction of the real GDP, but it was also determined that the negative impact of the increase in energy prices on the real GDP is most pronounced in the second and third quarters of 2022, which is identified as the key shock and determinant of recessionary pressures. Based on the conducted analysis, we conclude that the hypothesis (*H1*) can be accepted, i.e. that recessionary pressures are present in the sample of 18 developed countries in the period 2020q1-2023q1, and that they are determined by the variable energy price growth, as well as by the variables *M1*, *inflation*, *unemployment rate*, *real interest rate*. We emphasize that the most profound impact on recessionary circumstances was caused by the increase in energy prices in the second and third quarters of 2022, which can be considered an exogenous shock and trigger of recessionary pressures.

4.2. Analysis of inflationary pressures using the panel model

In order to detect inflationary pressures, again, first step is to estimate the panel model, and to check whether there are significant individual effects in the model and whether they are of a fixed or stochastic character.

Table 4: Fixed vs random individual effects model for inflationary pressures

Fixed	**effect**	**Model**			**Random**	**effect**	**model**
Dep. variable: *Inflation*		Coef.	Std. Error.	P>(t)	Coef.	Std. Error.	P>(t)
M1		-1.29e-13	2. 17e-13	0.552	-1.32e-13	2.16e-13	0.541
Unemployment		0.1098026	0.179833	0.542	0.0904	0.179038	0.613
Globalenergyprice		0. 0246315	0.003656	0.000	0.02447	0.0 0364	0.000
Cons		4.47766	2.617883	0.089	4.6772	7.151441	0.513
R2		0.0853		0.000			
Breuch-Pagan test							0.000
Httest3		6757.24		0.000			
Autocorrelation		157,980		0.000			
Hausman test		1.38		0.946	1.38		0.946
Number of observations		234			234		
Wald chi ^{2}		27.70		0.000			

Source: Author's calculation.

Based on table 4, Based on Table 4, we come to the conclusion that only the energy price variable is statistically significant, while the other independent variables included in the model are not statistically significant. The F-test of fixed individual effects checks whether there are fixed individual effects in the model. The null hypothesis is that all individual effects in the model except for one equal individual effect are equal to 0. If the null hypothesis is not rejected, the OLS estimation method would fail. In our case, the *p*-value of the F test is less

than 0.05 and we conclude that there are fixed individual effects in the model. The next step is to test random individual effects with the Breusch Pagan LM test. It is necessary to clarify the hypothesis in terms of acceptance or rejection. The Breusch Pagan LM test determines whether there are stochastic individual effects in the model, with null hypothesis that the variance of the individual effects is equal to 0. If the null hypothesis is not rejected, we choose the OLS estimation method. In our case, the *p*-value of the Breusch Pagan LM test is less than 0.05, which is why we conclude that there are stochastic individual effects in the model.

Finally, it is necessary to compare the FE and RE models and explain the hypotheses in terms of acceptance or rejection. The *p*-value of the Hausman test is greater than 0.05 and we conclude that the RE model gives more efficient estimates compared to the FE model. However, due to the presence of heteroskedasticity and autocorrelation in the model, it is necessary to switch to robust estimates. The null hypothesis assumes homoscedastic errors: *p*-value greater than 0.05, while if the *p*-value is less than 0.05 it indicates that the errors are heteroskedastic. Based on the obtained results, we conclude that the null hypothesis is rejected and that there is the presence of heteroscedasticity and autocorrelation. In order to check the robustness of the estimates, the PCSE method is applied.

Table 5: PCSE method – inflationary pressures

Panel-corrected standard errors (PCSE)			
Dependent variable *Inflation*	Coef.	Std. Error.	P>(t)
M1	-1.29e-12	2.65e-13	0.000
Unemployment	-2.207421	0.16328	0.000
Globalenergyprice	0.013205	0.0 0418	0.000
Cons	35.68235	3.44475	0.000
R2	0.0853		
Wald chi2	211.49	0.000	
Number of observations		234	

Source: Author's calculation.

Based on the Table 5, we conclude that all independent variables included in the model are statistically significant. If *M1* increases by one unit, the assumption is that the dependent variable will decrease by 1.29, which is not in accordance with economic logic. The assumption is that monetary expansion and an increase in the money supply lead to an increase in the level of inflation. If the unemployment rate variable *increases* by one unit, it is estimated that the dependent variable will decrease by 2.207, confirming the economic logic and the existence of a relationship typical of the Phillips curve. If the growth of *global energy prices* increases by one unit, the assumption is that there will be an increase of the dependent variable by 0.013, pointing to the conclusion that the growth of energy prices is one of the key generators of inflation. Based on the conducted analysis, we conclude that the hypothesis (*H2*) can be accepted, i.e. that inflationary pressures are present in a sample of 18 developed countries in the period 2020q1-2023q1, and that they are determined by the variable *global energy price* growth, as well as by the variables *M1* and the unemployment rate. Taking into account the acceptance of hypotheses *(H1)* and *(H2)*, we indirectly conclude that stagflationary pressures as a consequence of energy price growth are present in a sample

of 18 developed countries *(H3)*, considering the detected recessionary and inflationary pressures in the period 2020q1-2023q1.

Conclusion

Based on the described and empirically documented problem of stagflation, taking into account the experiences of the 1970s, it can be concluded that the global economy is currently in an unenviable situation. During the analyzed time period 2020x1-2023x1, we identified an unstable global economy, complicated by the Covid-19 epidemic and geopolitical conflict. Global inflation has risen sharply since the mid-2020s, fueled by disruptions in supply chains and rising food and energy prices, particularly since the Russian Federation's invasion of Ukraine. Based on past developments, inflation peaked in mid-2022 and then began to decline (Marjanović, Mihailović, & Dimitrijević, 2021). Global growth is moving in the opposite direction: it has fallen sharply since the start of 2020 and is expected to remain below the 2010s average for the rest of the decade. The unemployment rate is increasing in the analyzed period, which indicates recessionary pressures.

The econometric analysis used in the work, based on robust estimates, showed that the independent variable global energy price had a dominant role, which inversely reflected on the dependent variable real GDP (increase in energy prices - decrease in real GDP) and proportionally another dependent variable, inflation rate (increase in the price of energy - increase in the inflation rate). Namely, on the basis of the conducted analysis, we conclude that the hypothesis (H1) can be accepted, i.e. that recessionary pressures are present in a sample of 18 developed countries in the period 2020q1-2023q1, and that they are determined by the variable global growth in energy prices, as well as by the variables M1, inflation , unemployment rate, real interest rate. We emphasize that the most profound impact on recessionary circumstances was the increase in energy prices in the second and third quarters of 2022, which can be considered an exogenous shock and trigger of recessionary pressures. Additionally, the hypothesis (H2) is accepted, i.e. that inflationary pressures are present in a sample of 18 developed countries in the period 2020q1-2023q1, and these effects are determined by the variable of global energy price growth, as well as the variables of M1 and the unemployment rate. Finally, taking into account the acceptance of hypotheses (H1) and (H2), we indirectly conclude that stagflationary pressures as a consequence of the global increase in energy prices are present in the sample of 18 developed countries. A close examination of stagflation shows that it is directly related to slow economic growth, higher unemployment and inflation. Rising inflation has dire social consequences. An increase in the price level of basic essential products causes an automatic decrease in purchasing power and a decline in living standards. Combined with depressed economic activity and rising unemployment, significant social hardship has been created for many workers in the economies under review (Rebić & Antić, 2022). The mentioned result can be considered a warning for economic policy makers because history is likely to repeat itself, and stagflation is one of the most undesirable episodes in the economy.

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