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Energy Price and Greenflation in the European Union. Facts and Challenges

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Abstract: As the environmental and climate crises intensify, accelerating the green transition has become increasingly urgent. Only recently have scientists and economists begun to examine the relationship between green monetary policy and inflation. Therefore, it is important to investigate whether monetary policy can influence the green transition while supporting price stability. Although the concept of climatflation is gaining attention in empirical research, the effects of fossilflation and greenflation remain less understood and require further study. In particular, the sensitivity of green investments to changes in interest rates is a key issue that demands additional theoretical and empirical analysis. Systematic research in these areas is essential for shaping effective monetary policy and enabling policymakers and regulators to respond more efficiently to contemporary climate and environmental challenges. The aim of research on green monetary policy is to examine how central banks in the European Union (EU) can incorporate environmental sustainability, especially climate change into their decision-making frameworks. The research focuses on identifying how monetary policy instruments can be adjusted to support the transition to a low-carbon economy while preserving traditional objectives such as price stability and financial stability. A key objective is to better understand how climate-related risks affect inflation, financial stability, and economic growth, allowing central banks to adapt interest-rate policy to these emerging conditions. The study applied research methods based on literature analysis in banking and finance as well as econometric techniques, specifically the Vector Error Correction Model (VECM). Combining these approaches enabled a comprehensive analysis of green monetary policy and its potential impact on inflation and the development of a green economy.

Keywords: green economy; monetary policy; inflation; interest rate.

JEL classification: Q48; E52; O44.

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1. INTRODUCTION

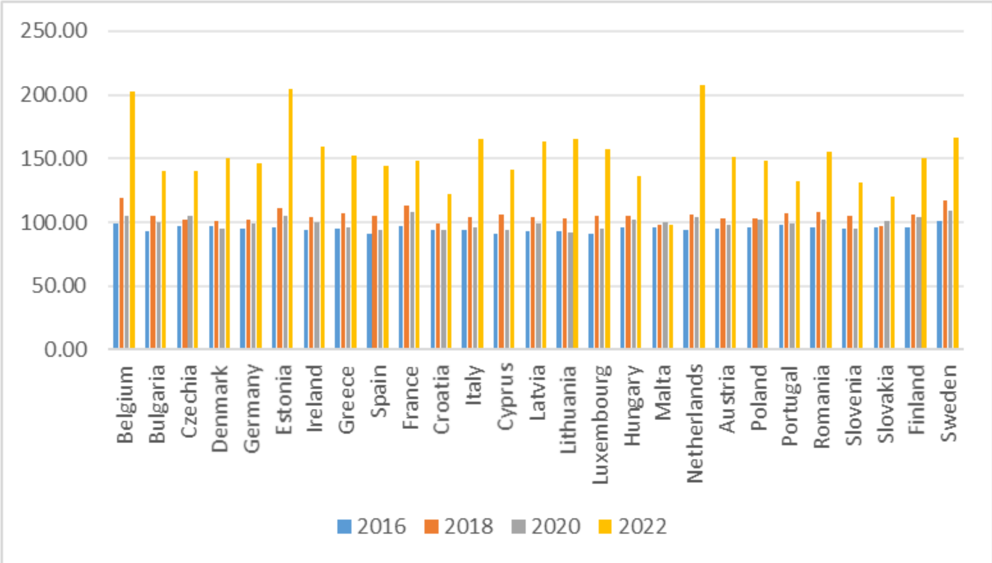
In the context of the global transition toward a low-carbon economy, new forms of inflation have emerged, shaped by both mitigation efforts and the intensifying impacts of climate change. Three interrelated but conceptually distinct inflationary phenomena are particularly relevant: greenflation, fossilflation, and climatflation. Each captures a unique mechanism through which climate-related dynamics influence price levels (see Table no. 1).

Table no. 1 – Typology of climate-related inflationary pressures

Term	Definition	Key Drivers	Examples
Greenflation	Inflation caused by increased demand and limited supply of green technologies and materials.	- High demand for critical minerals (lithium, copper, etc.) - Supply bottlenecks - Cost of environmental compliance	Rising cost of EVs due to lithium and cobalt price surges
Fossilflation	Inflation from fossil fuel price volatility and underinvestment during the energy transition.	- Reduced investment in fossil fuel infrastructure - Geopolitical shocks - Energy market imbalance	Oil and gas price spikes increase heating and transport costs
Climatflation	Inflation driven by the physical impacts of climate change disrupting economic activity.	- Extreme weather (droughts, floods, wildfires) - Agricultural and infrastructure disruption - Supply chain shocks	Drought reduces crop yields, increasing global food prices

Source: own study

The inflation rate in the EU member states has many interconnected causes, and its effects are widely felt by households, businesses and governments. In recent years, and especially after the Russian invasion of Ukraine, the prices of fossil fuels (especially gas, coal and oil) have increased dramatically. Russia was one of the main suppliers of gas to the EU, and the reduction of supplies (or complete interruption) led to shortages and increased competition for the raw material. Fluctuations in oil prices on the global market have also affected the costs of electricity production, especially in countries where oil is an important source of energy. The war in Ukraine and sanctions against Russia have affected the supply chains of energy raw materials. The EU had to look for alternative sources, which resulted in higher prices due to the need for rapid market reorganization and the construction of new infrastructure (e.g. LNG terminals). The transition to renewable energy sources (RES) under the Green Deal policy involves investments in new infrastructure, which initially increases costs. The introduction of the Emissions Trading System (ETS) also affects the increase in energy prices, as companies have to buy CO2 emission allowances, which increases the costs of energy production from fossil fuels. The lack of stability in energy production from renewable sources also increases the demand for traditional energy sources, such as gas or coal, which increases their prices. The largest increases in energy prices in the EU took place in 2022, in particular in the Netherlands, Estonia and Belgium (by over 100% compared to 2015), while the smallest growth dynamics were found in Malta and Croatia, where energy prices were similar to those in 2015 (see Figure no. 1).



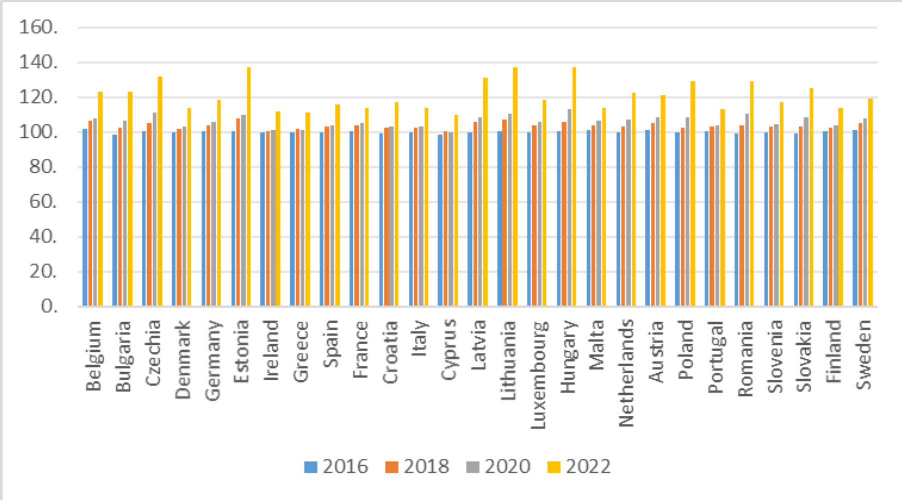
Source: author's own work based on data from Eurostat (2024)

Figure no. 1 – The dynamics of energy price in the EU countries (2015 year=100)

The increase in fuel prices affects the costs of transport and distribution of energy. Transporting gas, oil and even coal is becoming more expensive, which additionally increases energy costs. Due to the drive for decarbonisation and withdrawal from investments in fossil fuels, there is a lack of new investments in traditional energy sources, which limits their availability and increases costs. The increase in energy prices translates into higher electricity, gas and heating bills. Households, especially those with lower incomes, experience greater financial difficulties, which leads to so-called energy poverty. Companies, particularly those in energy-intensive sectors must pay more for energy, resulting in greater production costs and a decline in worldwide competitiveness. Because energy is a basic expense in many areas of the economy, rising energy prices create an overall increase in the pricing of goods and services (greenflation). This puts further strain on households and businesses.

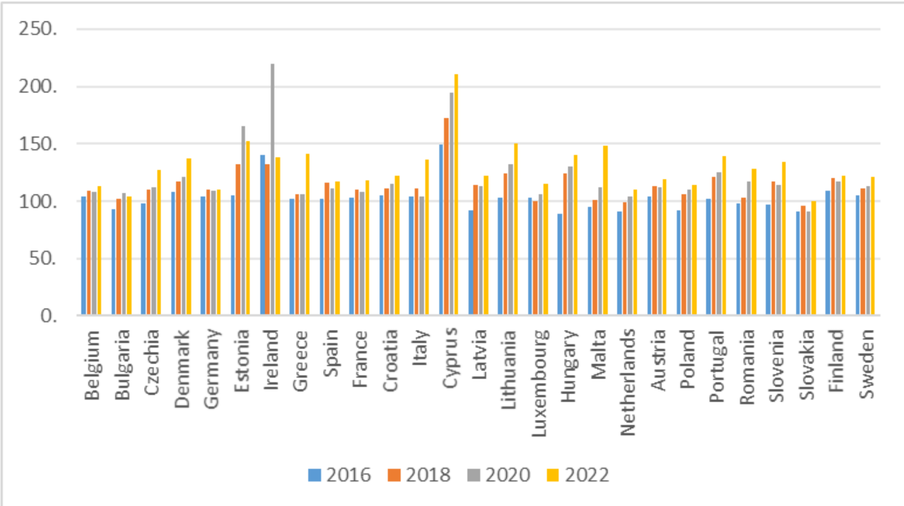
In the case of EU countries, the highest price dynamics of consumer goods and services was recorded in Lithuania, Estonia and Hungary (an increase of around 37% compared to 2015), while the lowest price dynamics was recorded in Cyprus, Italy and Ireland, where the price dynamics was around 10% compared to 2015 (see Figure no. 2).

Rising energy costs generally lead to a decline in consumption and investment. Businesses usually reduce production and investment, and consumers reduce their spending on goods and services. The lowest investment dynamics were recorded in countries where energy prices rose relatively quickly, leading to a significant acceleration in inflation. This includes countries such as Slovakia and Bulgaria, where investment volumes in 2022 were similar to those in 2015. On the other hand, the highest investment growth dynamics was revealed in Cyprus (an increase of over 100% compared to the volume in 2015) (see Figure no. 3).



Source: own study based on data from Eurostat (2024)

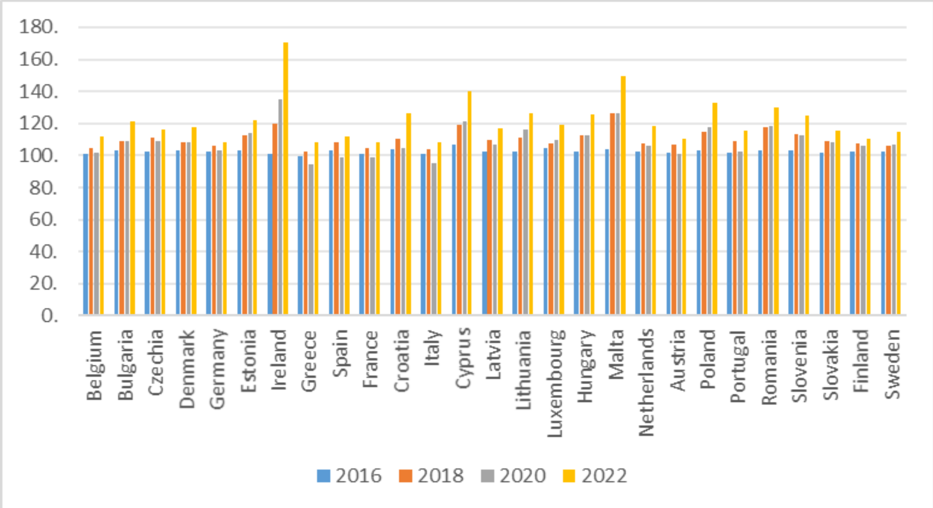
Figure no. 2 – Inflation rate in the EU countries (2015 year=100)



Source: author's own work based on data from Eurostat (2024)

Figure no. 3 – The dynamics of investments in the EU countries (2015 year=100)

The increase in energy prices, acceleration of inflation and the resulting decrease in investment and consumption dynamics led to a significant economic slowdown in the countries studied. The lowest GDP growth dynamics in 2022 were recorded in Greece, France and Italy (GDP growth of approx. 10% compared to 2015), while the highest GDP growth dynamics were recorded in Ireland (an increase of over 70% compared to 2015) (see Figure no. 4).



Source: author's own work based on data from Eurostat (2024)

Figure no. 4 – The dynamics of GDP in the EU countries (2015 year=100)

The increase in energy prices has forced EU governments to take the necessary measures to protect citizens and the economy from the worst effects of the energy crisis. Various support programs have been introduced, such as energy subsidies, price freezes or tax cuts, which, however, constitute an additional burden on state budgets. The increase in energy prices in the EU is therefore a complex phenomenon that results from both external and internal factors (political, economic and technological). The effects of this phenomenon are felt on many levels and require integrated actions to minimize its negative impact on society and the European economy.

2. LITERATURE REVIEW

2.1. Supportive studies on green monetary policies

A substantial body of literature supports the view that central banks should play an active role in mitigating climate change and accelerating the green transition. These studies emphasize the interlinkages between monetary policy, economic stability, and environmental sustainability.

Khan *et al.* (2019) explore how central banks can mitigate climate change and reduce its macroeconomic effects. Given the strong correlation between economic activity and carbon emissions, monetary policy impacts both inflation and emissions. Chen *et al.* (2021) propose modifying the Taylor rule by adding an "emission gap" target alongside inflation and output gaps. This approach allows monetary authorities to respond to deviations in carbon emissions from their target paths, effectively aligning monetary tools with environmental goals. However, Vollme (2024) notes that such integration might strain central banks' mandates by requiring them to balance multiple conflicting objectives.

The green transition requires large-scale capital reallocation. According to Bouckaert *et al.* (2021), the global economy needs an annual investment of approximately 2% of global GDP from 2010 to 2050 to achieve decarbonization. Weber *et al.* (2022) and Campiglio (2016) argue that central banks can help overcome investment barriers such as limited credit availability and poor risk-return profiles by facilitating access to green financing.

Roy (2024) further supports the strategic use of green credit to strengthen energy security and reduce reliance on fossil fuels. Empirical findings indicate a positive relationship between green credit flows and inflation control in advanced economies. However, the same effects may not materialize in developing countries due to structural constraints and weaker monetary frameworks.

Several studies highlight the disproportionate sensitivity of green investments to interest rates. Steffen and Waidelich (2022) show that rising rates impact green investments more severely than high-carbon alternatives because of their capital intensity and reliance on financial leverage. This raises concerns about monetary tightening undermining climate objectives.

Supporting this view, Voldsgaard *et al.* (2022) estimate that increasing the cost of capital from 5% to 10% raises the cost of electricity from offshore wind by 47%, rooftop solar by 60%, and large-scale solar by over 50%. In contrast, the same increase has only an 8% cost impact on natural gas energy. Ferguson and Storm (2023) confirm that renewable energy is far more sensitive to interest rate changes than fossil fuels, creating an uneven playing field during periods of monetary tightening.

Beyond interest rates, central banks are also exploring other tools. Ferrari and Nispi Landi (2020) propose implementing green quantitative easing, where central banks purchase green bonds to influence long-term yields and promote sustainable investments. DiLeo (2023) suggests that quantitative tightening might inadvertently harm the green transition by raising capital costs, especially if asset purchase programs previously favored high-emission sectors.

Several central banks have already launched green refinancing schemes. For instance, Bangladesh Bank offers concessional lending for green projects (Dikau and Ryan-Collins, 2017). Similarly, the European Central Bank (Schnabel, 2023) is considering greening its long-term refinancing operations. These tools, when aligned with collateral policy reforms – as suggested by Dafermos *et al.* (2018) – can address climate-related financial risks and promote green lending.

Innovative strategies have also been proposed, including adjusting capital reserve requirements. For example, the Central Bank of Lebanon reduced reserve requirements for green loans (Barmes and Livingstone, 2021), while the Chinese central bank offers favorable interest rates on reserves for green-lending banks. Campiglio (2016) recommends incorporating carbon certificates as part of reserve requirements and adjusting risk weights to favor low-carbon assets.

2.2. Critical perspectives on green monetary policies

Despite the potential benefits of green monetary policy, several scholars caution against its widespread adoption, pointing to institutional, macroeconomic, and structural limitations.

One major concern is the risk of mandate overreach. Critics argue that central banks are designed to focus on price and financial stability, not environmental goals. Expanding their mandate could compromise their independence and credibility. Vollme (2024) warns that tasking central banks with climate goals may result in "policy overload," where monetary institutions are expected to deliver results traditionally achieved through fiscal or regulatory channels.

Another criticism lies in the inflationary implications of green policy tools, especially in the short term. Roy (2024) and Aguila and Wullweber (2024) note that while green investments may reduce inflation in the long run, they often trigger short-run price increases due to supply constraints in critical raw materials, commonly referred to as greenflation.

Furthermore, these inflationary effects are uneven across countries. Developing economies often face greater difficulties in implementing green monetary policies due to underdeveloped financial systems, limited credit availability, and institutional constraints. Monetary policy in these contexts may inadvertently raise inflation, as noted by Roy (2024), rather than stabilize it, thereby undermining policy effectiveness.

Another key criticism is the regressive nature of interest rate hikes. As interest rates rise, renewable projects become more expensive relative to fossil fuel investments, as shown by Ferguson and Storm (2023). High borrowing costs reduce access to financing for capital-intensive green technologies, widening the competitiveness gap between clean and dirty energy sources.

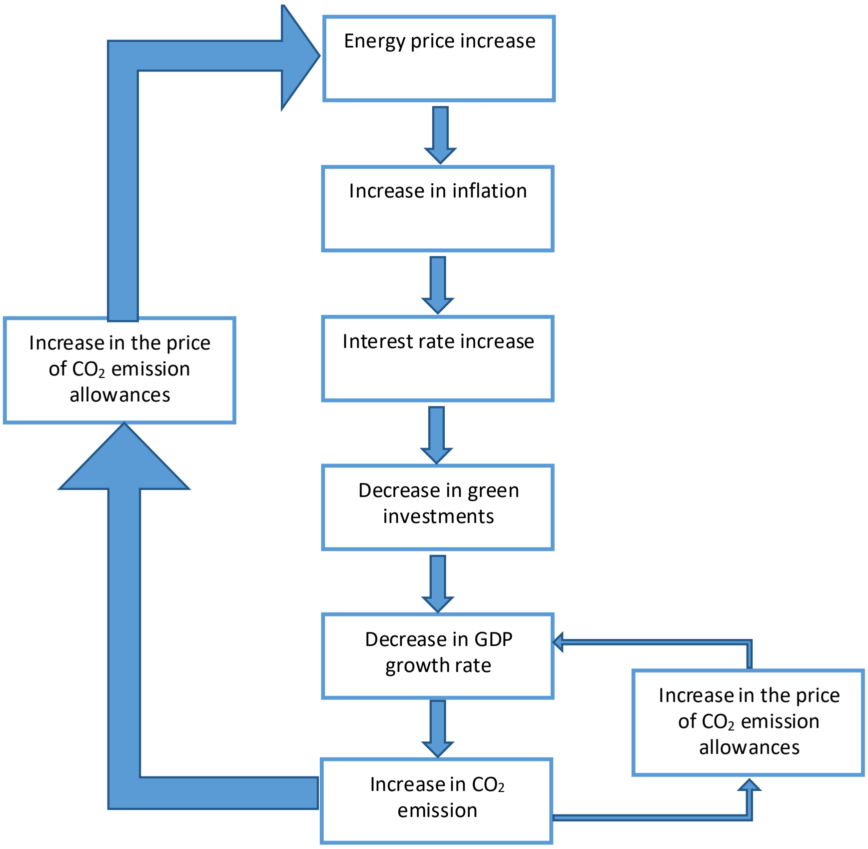
Moreover, monetary tightening affects households and governments, limiting their ability to fund or adopt green solutions. Batsaikhan and Jourdan (2021) emphasizes that higher borrowing costs discourage individuals from switching to sustainable home heating and cooling systems, while governments may find it more difficult to fund green infrastructure initiatives.

Lastly, critics are skeptical about the effectiveness of greening traditional monetary instruments. Some argue that central banks' collateral frameworks and interest rate policies are not designed to differentiate climate risks effectively. Without robust risk metrics and regulatory support, these efforts may distort market signals, misallocate credit, or foster green asset bubbles (Khan *et al.*, 2019).

These empirical studies support the view that monetary policy has a measurable impact on the pace and quality of the green transition, but they also underscore the complexity of balancing inflation control with environmental goals. The emerging consensus suggests that green monetary tools can be effective, but their design must account for macroeconomic trade-offs, financial stability concerns, and regional differences.

3. METHODOLOGY

This part of the article attempts to empirically examine whether monetary policy can affect pro-ecological expenditure and, as a result, the level of carbon dioxide emissions in the economy. Therefore, the potential impact of interest rates on carbon dioxide emissions was examined by creating appropriate conditions for financing green investments, while ensuring a stable price level in the European Union economy. According to the adopted model assumption, the increase in energy prices leads to an increase in inflation, which results in an increase in interest rates in the country as a result of the appropriate reaction of the central bank to rising prices. Subsequently, rising interest rates cause a decrease in investment expenditure (including expenditure financing green investments), which results in a decrease in GDP dynamics. The decrease in real incomes means that enterprises, households and governments of individual countries are less interested in financing pro-ecological projects, which ultimately leads to an increase in carbon dioxide emissions in the economy (see Figure no. 5).



Source: author's own work

Figure no. 5 – The mechanism of price impulse transmission in the green economy

To investigate the relationship between monetary policy and the effects of pro-environmental investments, the following panel data model was used. The econometric model was proposed by (Roy, 2024).

$$E_{it} = \alpha_i + \beta_{1i}GDP_{it} + \beta_{2i}Green_{it} + \beta_{3i}IR_{it} + \beta_{4i}CPI_{it} + \varepsilon_{it} \quad (1)$$

where:

E_{it} – carbon dioxide emission level in countries i = 1, 2, ..., N in the period t = 1, 2... T;

GDP_{it} - gross domestic product in countries i = 1 , 2, ..., N in period t = 1, 2... N;

$Green_{it}$ - value of expenditures on pro-ecological purposes in countries i = 1, 2, ..., N in the period t = 1, 2... N;

IR_{it} - long-term interest rate (yield rate on 10-year Treasury bonds) in countries i = 1, 2, ..., N in period t = 1, 2... N;

CPI_{it} - , consumer price index measuring the inflation rate in countries i = 1, 2, ..., N in the period t = 1, 2... N;

B_{1i}, ..., β_{4i} - estimated parameters defining the influence of a given explanatory variable on the explained variable;
and $_{it}$ - the free term of the equation;
$\mathcal{E}_{it}$ - random error.

4. DATA AND EMPIRICAL RESULTS

It should be noted here that due to the fact that twenty EU member states belong to the euro zone, where a single monetary policy is conducted by the European Central Bank, while in the seven remaining EU countries independent monetary policies are conducted by national central banks, instead of central bank interest rates, the study uses long-term interest rates (10-year Treasury bond yields), which in fact affect the cost of long-term investments in all EU member states. An additional advantage of using 10-year Treasury bond yields is that their level depends on the level of central bank interest rates and the risk associated with the capital recipient. Therefore, the risk factor is also included in the levels of these interest rates.

In order to examine the potential impact of interest rate policy on the effects of ecological transformation, relevant statistical data for the European Union member states (27 countries) from the Eurostat statistical database were used. The data had an annual frequency and covered the period 2015-2022 (see Table no. 2).

Table no. 2 – Descriptive statistics of the data used in the panel study

Statistic	CPI	E	GDP	IR	GREEN
Mean	2.456744	7008.370000	512952.300000	1.344698	602.701200
Median	1.400000	42277.340000	210192.000000	0.830000	9.310000
Maximum	19.400000	670815.30	3953850.00	9.67	9476.29
Minimum	-1.500000	1316.118000	10221.400000	-0.510000	0.000000
Std. Dev.	3.624506	128910.8	803360.0	1.588521	1738.39
Skewness	2.364262	2.616682	2.447822	2.082040	3.525314
Kurtosis	9.049727	10.422820	8.525810	9.011546	14.352770
Jarque-Bera	528.1665	738.9396	488.2462	479.0760	1599.9280
Probability	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	528.2000	19502300.0000	110000000.0000	289.1100	129580.8000
Sum Sq. Dev.	2811.328	3.56E+12	1.38E+14	540.0076	6.47E+08
Observations	215	215	215	215	215

Source: author's own work using Eviews software

The descriptive statistics presented in Table no. 1 show that among the variables used in the basic analysis, the average value of the parameter E (the amount of carbon dioxide emissions) was over 90708 thousand tons, while the standard deviation of E was over 128910 thousand tons, which means that there are huge differences in the effects of the green transformation policy conducted between the European Union countries. In turn, the average level of the long-term interest rate in the EU countries was 1.34%, and its standard deviation was almost 1.59%, which indicates that there is a significant disproportion in monetary policy activities in the EU countries. On the other hand, the average value of pro-ecological expenditure in the EU was almost EUR 603 billion, and the standard deviation was EUR 1738 billion, so also in this respect there were significant differences between the EU member states.

The calculated correlation coefficient between the variables studied indicated a strong and positive linear relationship between the amount of carbon dioxide emissions and the amount of GDP (0.91), which indicated that larger economies were accompanied by greater emissions of carbon dioxide pollutants. A relatively high positive correlation was also observed in the case of the linear relationship between the value of pro-ecological expenditures and the amount of carbon dioxide emissions (0.80), which could result from time lags between the period of making green investments and the effects of these investments. On the other hand, the correlation coefficients between the level of the interest rate and pro-ecological expenditures and between the level of the interest rate and the amount of carbon dioxide emissions were negative but relatively low, which could also indicate the occurrence of time lags between the variables studied (see Table no. 3).

Table no. 3 – Correlation coefficients between the studied variables

	CPI	E	GDP	IR	GREEN
CPI	1.00	-0.04	-0.02	0.26	-0.01
E	-0.04	1.00	0.91	-0.03	0.80
GDP	-0.02	0.91	1.00	-0.15	0.90
IR	0.26	-0.03	-0.15	1.00	-0.19
GREEN	-0.01	0.80	0.90	-0.19	1.00

Source: author's own work using Eviews software

Before the econometric analysis, a test for the presence of a unit root was performed. The general process generating panel data can be written in the following form:

$$y_{it} = \alpha_i + \delta_{it} + \varphi_i y_{it-1} + \theta_t + \varepsilon_{it} \quad (2)$$

This method differentiates between two individual effects (α), individual linear trends (δ), heterogeneous autoregressive parameters (φ), and heterogeneous time effects (θ). In certain cases, some of these parameters may not be heterogeneous. When testing stationarity, it's crucial to examine the parameter φ. There are various methods for determining the presence of unit roots in panel data. There are two categories of tests: first-generation and second-generation. They address the question of cross-sectional data reliance differently. First-generation tests assume no interdependence, whereas second-generation tests allow for cross-sectional dependence (Staszczyk, 2017). The Levin, Lin, and Chu y tests, Peseran and Shin tests, and Fisher's test were employed to determine the stationarity of the variables under consideration (see Table no. 4).

Table no. 4 – Test for the occurrence of a unit root in panel data

Panel unit root test: Summary			
Series:	E		
Date:	10/04/24	Time:	19:31
Sample:	2015–2022		
Exogenous variables:	Individual effects		
User-specified lags:	1		
Newey-West automatic bandwidth selection and Bartlett kernel			
Balanced observations for each test			
Null: Unit root (assumes common unit root process)			

Method	Statistic	Prob.**	Cross-sections	Obs
Levin, Lin & Chu t*	-3.25491	0.0006	27	162
Null: Unit root (assumes individual unit root process)				
Method	Statistic	Prob.**	Cross-sections	Obs
Im, Pesaran and Shin W-stat	1.77451	0.962	27	162
ADF - Fisher Chi-square	32.7819	0.99	27	162
PP - Fisher Chi-square	48.2003	0.6966	27	189

Note:** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Source: author's own work using Eviews software

Since the value of the p parameter is lower than the assumed significance level of 0.05, it can be stated that the variables studied do not have a common unit root, i.e. treated as homogeneous, they are stationary. The tests also indicate that some individual variables have an individual unit root, so they may not be stationary. Johansen (1988), analyzing the issues of cointegration, concluded that it is possible to study the long-term equilibrium between variables using the vector autoregression model (VAR), if this model is supplemented with the so-called error correction component, presenting the long-term relationship between non-stationary variables. This means transforming the VAR model into a vector error correction model (VECM) (Marona and Bieniek, 2013).

Therefore, due to the presence of a unit root in the case of several individual variables, the vector error correction model was used instead of the VAR model. Therefore, the next stage of the analysis was to determine the structural parameters of the model (1). To determine the optimal number of lags for the variables included in the VECM, two commonly used information criteria were applied: the Akaike Information Criterion (AIC) and the Schwarz Bayesian Information Criterion (SBIC), also referred to as the Bayesian Information Criterion (BIC). These criteria are based on a trade-off between model fit and model complexity. AIC aims to minimize the information loss by balancing goodness-of-fit (log-likelihood) with the number of estimated parameters. It is more permissive and tends to select models with more lags. SBIC/BIC, on the other hand, applies a stronger penalty for the inclusion of additional parameters, thus favoring more parsimonious models. Formally, the criteria are defined as:

$$AIC = -2ln(L) + 2k \tag{3}$$

$$SBIC = -2ln(L) + k\, ln(n) \tag{4}$$

where:

L is the likelihood of the model;

k is the number of estimated parameters;

n is the number of observations.

In the current study, a range of lag lengths was tested, and both the AIC and SBIC were computed for each specification. The criteria values were then compared across lag lengths. Although AIC and SBIC sometimes yield different suggestions, in this case, both pointed to a lag order of 2 as providing the best balance between explanatory power and model simplicity. This result implies that incorporating two lags (two years) captures the most relevant dynamic interdependencies among the variables, namely carbon emissions, green investment, interest rates, inflation, and GDP without introducing overfitting or unnecessary complexity.

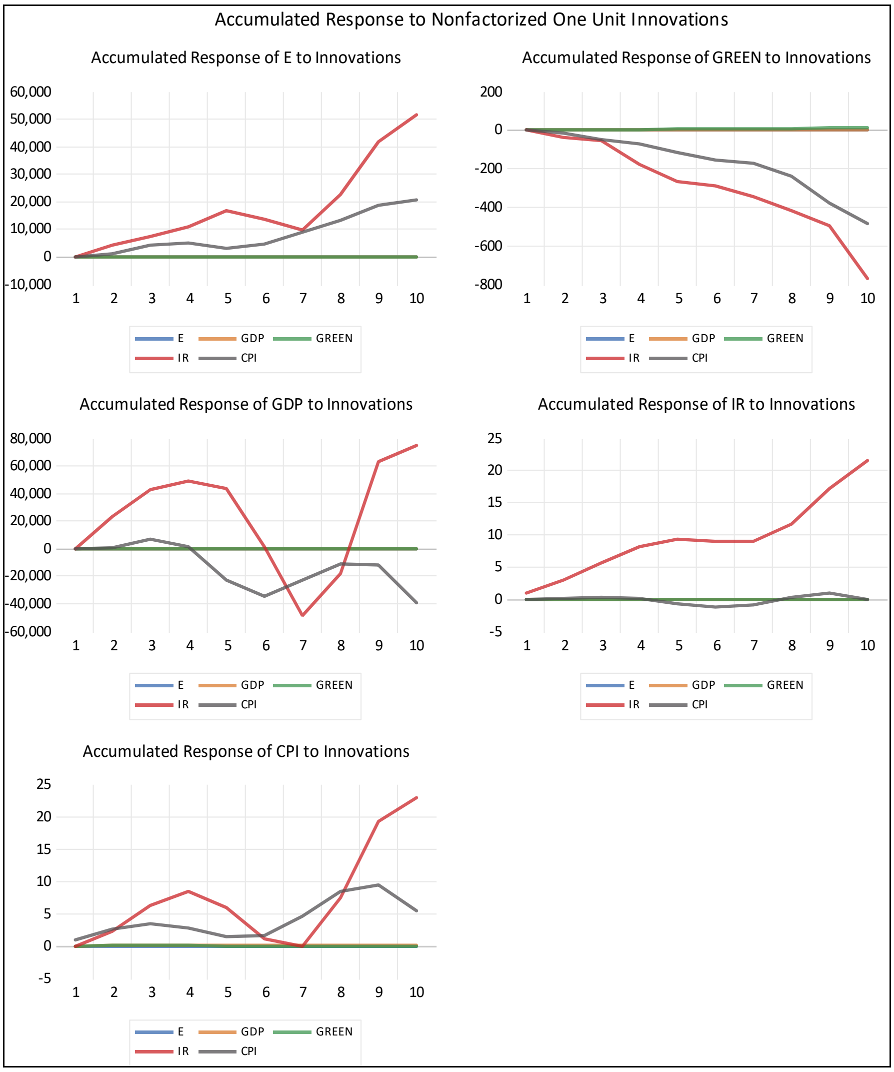
Selecting a two-period lag structure allows the model to account for the delayed effects of monetary policy and economic conditions on environmental and investment outcomes. This is particularly important in green transition dynamics, where policy impacts (such as interest rate changes) typically manifest over multiple years due to the long-term nature of infrastructure and capital investment cycles. Consequently, the VECM was specified with a two-period lag structure, as recommended by both information criteria, ensuring robust and interpretable results for the subsequent analysis. Finally, the results of the analysis are presented below (se Table no. 5).

Table no. 5 – VECM model estimation results

Error Correction:	D(E)	D(GDP)	D(GREEN)	D(IR)	D(CPI)
COINTEQ1	-0.0020	0.0640	0.0002	0.0000	0.0000
	0.0020	0.0097	0.0001	0.0000	0.0000
	[-0.97753]	[6.57273]	[2.68058]	[-2.52057]	[-2.12392]
D(E(-1))	0.0332	1.1885	-0.0011	0.0000	0.0000
	0.0973	0.4746	0.0029	0.0000	0.0000
	[0.34071]	[2.50418]	[-0.39067]	[-0.59070]	[-0.23755]
D(E(-2))	-0.3698	-1.5131	-0.0015	0.0000	-0.0001
	0.0990	0.4829	0.0030	0.0000	0.0000
	[-3.73497]	[-3.13348]	[-0.51200]	[-2.79832]	[-2.38621]
D(GDP(-1))	-0.2160	-0.7724	0.0021	0.0000	0.0000
	0.0265	0.1292	0.0008	0.0000	0.0000
	[-8.15730]	[-5.97996]	[2.66252]	[1.77357]	[0.72128]
D(GDP(-2))	-0.1260	-0.5874	-0.0028	0.0000	0.0000
	0.0365	0.1779	0.0011	0.0000	0.0000
	[-3.45588]	[-3.30258]	[-2.59104]	[0.03169]	[0.35137]
D(GREEN(-1))	0.8009	-24.3543	-0.0055	0.0003	0.0007
	0.2477	0.1208	0.0742	0.0003	0.0009
	[0.32332]	[-2.01587]	[-0.07440]	[1.03276]	[0.79480]
D(GREEN(-2))	12.9610	-5.8487	0.1205	0.0000	-0.0003
	0.2614	0.1275	0.0783	0.0003	0.0010
	[4.95786]	[-0.45871]	[1.53809]	[0.06402]	[-0.27363]
D(IR(-1))	4307.6549	23756.0889	-37.6591	0.8975	2.1499
	0.1412	0.6889	0.4232	0.1514	0.5233
	[3.04998]	[3.44863]	[-0.88983]	[5.92722]	[4.10863]
D(IR(-2))	-2595.0389	-13504.6688	51.8913	-0.4992	-1.3697
	0.1463	0.7137	0.4385	0.1569	0.5421
	[-1.77352]	[-1.89232]	[1.18351]	[-3.18194]	[-2.52666]
D(CPI(-1))	824.3765	5425,1204	-4.9847	0.1482	0.4073
	0.5138	0.2506	0.1540	0.0551	0.1904
	[1.60447]	[2.16487]	[-0.32376]	[2.69122]	[2.13957]
D(CPI(-2))	930.3182	4674.6714	10.8868	-0.3551	-1.4975
	0.6403	0.3123	0.1919	0.0686	0.2372
	[1.45298]	[1.49691]	[0.56743]	[-5.17344]	[-6.31289]
C	38.9195	36324.9814	49.0916	0.0460	1.4087
	0, 118 7	0, 5801	0, 3564	0.1275	0.4407
	[0.03272]	[6.26096]	[1.37724]	[0.36038]	[3.19645]
R-squared	0.6811	0.6259	0.5191	0.5981	0.5387
Adj. R-squared	0.6518	0.5916	0.4750	0.5612	0.4964

Source: author's own work using Eviews software

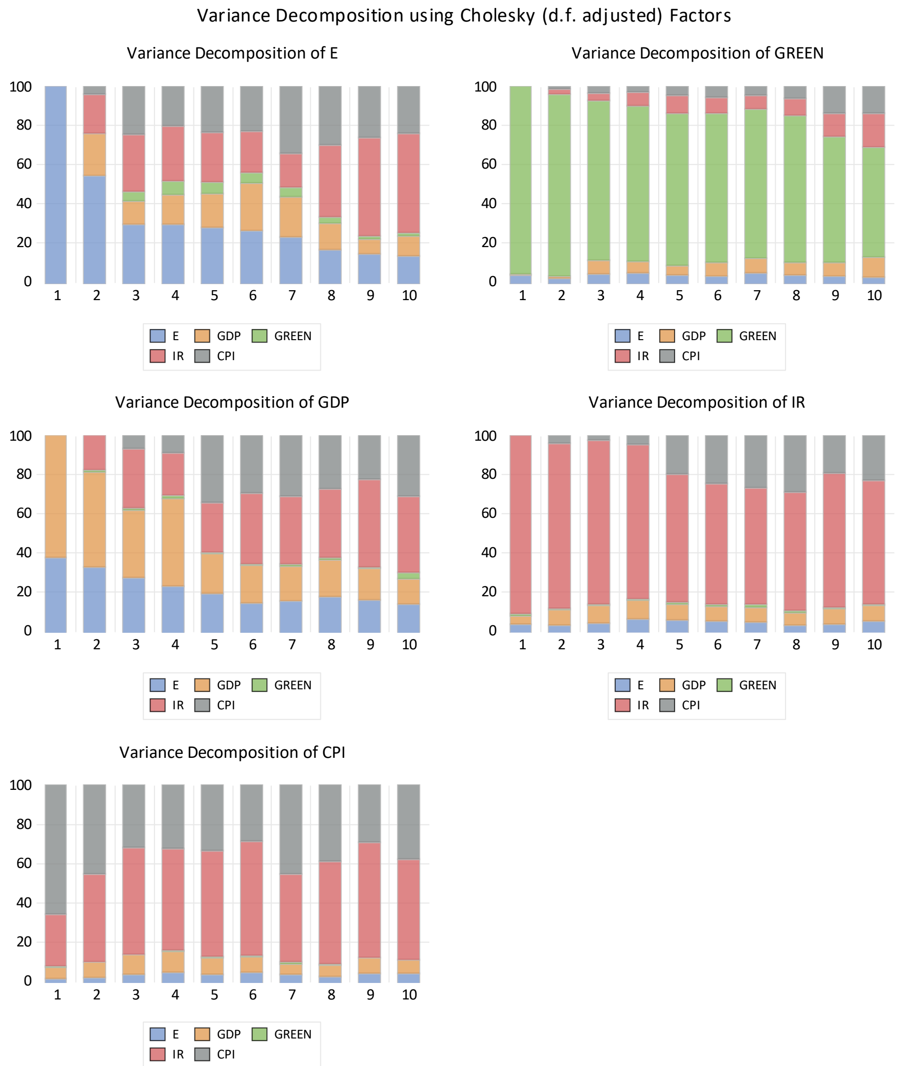
According to the data presented in Table no. 5, in the period under review there was a negative impact of the long-term interest rate lagged by two years on carbon dioxide emissions in the EU countries. This meant that the increase in the interest rate, through the increase in costs and consequently the decrease in the volume of green investments, contributed to the increase in carbon dioxide emissions in the EU economy. The negative impact of lagged inflation on the effects of the green transformation was also revealed, as the rising prices of goods and services could significantly limit the investment possibilities of households, enterprises and the government in the green economy.



Source: author's own work using Eviews software

Figure no. 6 – Impulse response function

The impulse response function, on the other hand, illustrates the time lines that show how variables react to unexpected events or shocks in a dynamic system. In general, the impulse response captures the reaction of any dynamic system when confronted with an external shock. An impulse in the form of an increase in the long-term interest rate caused a gradual increase in carbon dioxide emissions during the next 7 years following the shock, and then a sharp increase in CO_2 emissions in the following years. On the other hand, a shock increase in the long-term interest rate by one unit led to a sharp decline in expenditure on financing green investments within 10 years from the moment of the change in the interest rate (see Figure no. 6).



Source: author's own work using Eviews software

Figure no. 7 – Variance decomposition

The last stage of the analysis is the decomposition of the variance of the residual component of variables (the amount of carbon dioxide emissions and expenditures on pro-ecological investments), in order to estimate the impact of changes in the long-term interest rate on changes in individual variables. Based on the data presented in Figure no. 6, it can be seen that changes in the long-term interest rate explained a significant part of the changes in carbon dioxide emissions. About 50 % of the changes in carbon dioxide emissions were explained by changes in the interest rate during the 10th year from the change in the size of the issue. However, in a much lower m the extent to which changes in the long-term interest rate were explained by changes in expenditure on financing green investments. Namely, almost 20% of changes in expenditure on financing pro-ecological investments could be explained by changes in the long-term interest rate 10 years after the change in these expenditures (see Figure no. 7).

Therefore, based on the research conducted, it can be concluded that monetary policy can indeed contribute to the energy transformation and meeting environmental challenges without threatening price stability, through cheaper financing of green projects at lower interest rates. Since external financing costs are the main factor determining the costs of investment in green projects, lower interest rates can contribute to falling energy prices. In the case of renewable energy sources, which are to replace fossil fuels, lowering their financing costs, and thus their prices, will reduce the inflationary effect resulting from the continued dependence of economies on non-renewable resources. Moreover, higher investment usually encourages innovation, stimulating efficiency growth, which can reduce costs and, consequently, prices. Moreover, green investments can contribute to mitigating climate change and adapting the economy to its effects, thereby reducing inflationary environmental and climate shocks and increasing resilience to risks related to changes in climate conditions.

5. CONCLUSION

Climate change is decreasing central banks' ability to conduct effective monetary policy by raising energy prices and increasing investment risk. Price shocks can be either transitory or lasting. Climate change hazards are split into two categories: physical risk and transformation risk. Physical climate change risk refers to the likelihood of an increase in the frequency and severity of negative supply shocks (e.g., capital stock erosion, supply chain disruptions) and demand shocks (e.g., deterioration of household and corporate balance sheets, resulting in reduced consumption and investment). While monetary policy can usually handle demand shocks, supply shocks are more difficult to eliminate because they force central banks to choose between stabilizing inflation and stabilizing production variations. The increased frequency and severity of negative supply shocks makes it more difficult for central banks to accurately anticipate potential output, the output gap, and, as a result, inflation. Changes in established weather patterns, in particular, may increase inflation volatility, for example, by affecting food and energy prices.

Transition risk emerges as a result of changes in economic policy to meet the new demands of a low-emission economy (also known as the green economy). The shift to a low-emission economy necessitates the implementation of several climate laws, significant technological advancement, investment in green technology, and significant socioeconomic changes. While this transition opens up chances for innovation, investment, and potential green growth, it also introduces hazards connected with economic upheaval. Changes in climate policy, technology, or market attitude can cause inefficient resource allocation in the economy, necessitating the revaluation of some financial assets. Climate-related changes in predicted earnings and costs, in particular, can have a detrimental impact on banks' and other financial institutions' ability to repay debt and provide collateral to borrowers, as well as enhance the credit risk they face. The rate at which such asset revaluations occur is unknown, but their consequences can be considerable for financial institution safety and soundness, as well as the economy's financial stability.

Greenflation and green monetary policy are two sides of the same coin in the global shift to a sustainable economy. Greenflation describes the inflationary pressures caused by green policies and shifting market dynamics, whereas green monetary policy refers to central banks' efforts to control these transitions and promote environmental sustainability. The challenge is to balance inflationary pressures, maintain economic stability, and direct the economy towards long-term environmental goals. Policymakers must connect green policies with appropriate risk management to ensure that the most vulnerable groups are not disproportionately affected by these changes.

However, several limitations of research results must be acknowledged. First, the analysis omits other potentially influential macroeconomic variables, such as exchange rates, government fiscal spending, technological innovation, and environmental regulation, which may also shape the dynamics of green investment and emissions. Second, while the study includes all 27 EU countries, it does not explicitly account for structural differences among them, such as disparities in energy mix, financial system development, or institutional capacity, which could influence the effectiveness of monetary transmission mechanisms. Third, the use of the Vector Error Correction Model (VECM), while appropriate for capturing long-run equilibrium relationships, imposes certain restrictions on the data structure and may not fully capture non-linearities, asymmetric effects, or policy regime shifts that are characteristic of real-world green transitions.

Future research could address these limitations by incorporating additional control variables, employing non-linear or threshold models, and exploring cross-country heterogeneity through interaction terms or multi-level modeling. A more granular understanding of country-specific contexts and the interplay between monetary and fiscal tools would further enrich the policy implications of green monetary frameworks in the EU and beyond.

6. COMMENTS

The influence of climate policy on inflation is difficult to assess since it is dependent on the employment of inflation-control measures and the amount to which fiscal policy supports central bank efforts. As the scope of climate policy in the European Union expands to cover previously excluded industries, the pressure on inflation will make it more difficult for EU national central banks, as well as the European Central Bank in the case of eurozone states, to deal with climate-related shocks. According to the International Monetary Fund, two criteria are required to alleviate fears that the current high-inflation environment will damage the ability to manage inflation while not further damaging the economy.

To avoid major economic implications, the shift must be carefully planned and executed. However, if the shift is too sluggish, the institutions in charge of these processes will need to intervene in an abrupt and disorderly manner. However, if it is too rapid, it may have major ramifications for the economy's ability to respond to new conditions, as well as central banks' ability to manage the monetary policy trade-off. The continuance of climate policy in the European Union is expected to contribute to a 13.5% annual increase in energy prices in a disorderly scenario, whereas a carefully managed transition would increase energy prices by 3.5% per year (Drudi *et al.*, 2021). Second, the credibility of the monetary policy is critical to keeping inflation expectations stable in the medium term. This may make it more difficult to accomplish more ambitious plans for decreasing carbon dioxide emissions and implementing climate policy, since an overly quick energy transition could dramatically increase green inflation in EU countries.

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