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Unraveling the Nexus of Economic Factors: Analyzing the Impact of Trade, Energy Consumption, Electricity Generation, Exchange Rate, and Urban Population on Consumer Price Index in European countries

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ABSTRACT

The dynamics of consumer price index (CPI) and its influencing factors lie at the heart of economic stability and growth. In this comprehensive research paper, we investigate the multifaceted relationship between consumer price index (CPI) and a set of critical independent variables, including trade (T), primary energy consumption (PEC), electricity generation (EG), exchange rate (ER), and urban population (UP). This research examines a cross-sectional sample of 20 European countries using panel ordinary OLS regression and fixed- and random-effects models for the period of 2000–2020. The findings of this research suggest that there is a notable inverse relationship between Primary Energy Consumption and CPI. The coefficient associated with Primary Energy Consumption carries a negative sign and demonstrates statistical significance at the 5% level and urban population, exchange rate and Electricity generation show positive significant impact on Inflation, while trade does not have any significant impact on inflation.

Keywords

Inflation, Macro economic factors, European countries, inflation and economic growth, Panel data analysis

JEL Classification

P44, E31, B22

1. Introduction

All nations strive to ensure price stability and long-term economic prosperity. This requires careful coordination of fiscal policy, which aims to increase productivity, and monetary policy, which aims to maintain price stability. It can be challenging for policymakers to achieve both goals simultaneously. Some economists believe that mild inflation can stimulate growth. Mubarik and Riazuddin (2005) They argue that a small amount of inflation can encourage businesses to invest and expand, as they can expect prices to rise in the future. However, Sugihyanto (2021) believe that inflation can have a negative impact on growth. They argue that high inflation can lead to uncertainty and make it difficult for businesses to plan for the future. According to Orphanides

and Solow (1990),the relationship between inflation and economic growth is complex and there is no clear consensus among economists. Some studies have found that inflation can have a positive impact on growth, while others have found that it can have a negative impact. Two studies, those of Adaramola and Dada (2020) suggest that inflation had a negative impact on economic growth while Uddin (2021) suggest that inflation had a positive impact on economic growth. Inflation can also have negative consequences for economic growth, such as reducing the purchasing power of consumers and making it more difficult for businesses to plan for the future. Tobin (1965) proposed the Tobin effect, which states that inflation can have a positive impact on growth if money can be used as a substitute for capital. However, other economists, such as (Fischer, 1993; Barro, 1997; Bruno and Easterly, 1995) have argued that inflation can have a negative impact on growth, which is known as the anti-Tobin effect, most of the authors did not find any clear evidence to suggest that inflation has either a positive or negative impact on economic growth. More research is needed to better understand the relationship between these two variables. The relationship between inflation and economic growth is complex and there are many factors that can affect it. One of the channels through which inflation can affect growth is exports. According to Gokal and Hanif (2004) When inflation increases, it can make exports more costly and reduce the international competitiveness of countries. This can lead to a decline in exports, which can have a negative impact on economic growth. According to D'Acunto et al. (2023) Inflation can also affect borrowing and lending decisions. When inflation is high, borrowers may have to pay higher interest rates, which can make it more difficult for them to finance their investments. This can lead to a decline in investment, which can also have a negative impact on economic growth. One of the debates on the inflation-growth relationship is that inflation can distort income distribution, which can have a positive impact on economic growth. This is because inflation can lead to a delay in wage increases, which can increase the profit margins of firms. Increased profits can then be used to invest in new productive capacity, which can lead to economic growth (Datta and Mukhopadhyay, 2011). Additionally, inflation can increase savings, as upper-income groups tend to save more than lower-income groups. This increase in savings can lead to a decrease in interest rates, which can further encourage investment and economic growth. However, it is important to note that this is just one side of the debate. The consumer price index (CPI) is a closely watched statistic that is used to measure inflation. Changes in the CPI can have a significant impact on a variety of variables, such as the rate at which Social Security payments increase and the cost of living. In this study, we will examine the impact of the CPI on the change in urban population, trade, exchange rate, Primary energy consumption, and electricity generation. We aim to determine the relationship between these dependent and independent variables.

For past few years inflation is one of the problems which are faced by both develop and under develop economies. Inflation is a complex phenomenon that can have a significant impact on the economy. There is a growing body of research on the factors that can impact inflation, but there is still much that we do not know. This research paper will investigate the relationship between inflation and five independent variables: trade, electricity generation, exchange rate, primary energy consumption, and urban population. This study is conducted between the 20 European

countries to analyze the impact of macro economics factors on Inflation within these European economies.

European countries were chosen as the focus of our study for several reasons. Firstly, this region provides a diverse yet cohesive context for studying inflation dynamics, considering shared economic integration through entities like the European Union. Secondly, European countries typically offer robust and readily accessible economic data, including inflation indices like the Consumer Price Index (CPI), ensuring the reliability and accuracy of our study's findings. Thirdly, given the European Central Bank's (ECB) significant role in monetary policy formulation for Euro zone countries and the interconnectedness of European economies, studying inflation dynamics in this region holds substantial policy relevance. Lastly, by conducting comparative analyses across European countries with varying economic structures and policy regimes, our study contributes to a broader understanding of inflation determinants applicable beyond the European context.

While previous research has focused on traditional factors such as money supply, government spending, and economic growth to explain inflation, I propose examining the relationship between inflation and five independent variables: urban population, exchange rate, electricity generation, primary energy consumption, and trade. These variables have been overlooked in previous studies, but they can significantly influence inflation rates. For instance, urban population growth can increase demand for goods and services, putting upward pressure on prices. Exchange rate fluctuations can affect the cost of imports, influencing inflation. Electricity generation and primary energy consumption impact production costs, contributing to inflation. Trade can impact the availability of goods and services, again affecting prices. By exploring these relationships, my research aims to provide new insights into the causes of inflation, potentially informing policies to control inflation. The primary purpose of this research is to inquire into the connection between the CPI (Inflation) and the various variables include Urban Population(UP), Trade(T), official exchange rate-(ER) LCU per US$, period average, Primary Energy Consumption (PEC), and electricity generation) using panel data set of 20 European economies.

2. Literature Review

This section reviews the research that has been conducted by various authors on the relationship between inflation and economic growth. These studies have used a variety of econometric techniques to analyze the data and have found evidence of a connection between these two variables. Some studies have focused on the long-run relationship between inflation and growth, while others have examined the short-run relationship. Ayyoub et al. (2011) conducted a study on Pakistan economy and analyze the relationship between inflation, and economic growth and their study conclude that population had a negative impact on inflation and also conclude that there is a negative relationship exist between inflation and trade in Pakistan.

Sadiq et al. (2023) conducted a study and analyse the impact of primery energy consumption and urban population growth on inflation and they conclude that there is a postive relationship between inflation and primery energy consumption and also shows a positive relationship between

inflation and population growth as well.

The study conducted by Talha et al. (2021) found that Malaysian inflation rates are influenced significantly by primary energy consumption. In an alternate situation, when government bodies and residential or commercial entities excessively consume primary energy, it results in a heightened demand for energy resources surpassing the available supply. This imbalance between demand and supply causes energy prices to surge. Utilizing these higher-priced energy resources for production drives up production costs, consequently increasing the prices of end products Erdogan et al. (2020).When energy resources are excessively used, governments tend to allocate more budget. This increased circulation of money ultimately leads to a significant escalation in price levels, indicating a higher inflation rate.

Elheddad et al. (2020) studied how inflation changes and pointed out that using different types of primary energy affects how much things cost. They found that both renewable and non-renewable energy can make inflation up and down, but non-renewable energy consumption is more likely to cause inflation to rise. Using renewable energy in businesses is cheaper because it can be reused or naturally replaced without much cost.

Yang and Shafiq (2020) conducted a study on south Asian economy and analyze the impact of macroeconomic variables on economic growth and they conclude that there is a negative relationship between trade and inflation in south Asian economy.

(Ha et al., 2020) looks at how changes in exchange rates affect the prices we pay for things. They did this by looking at different reasons why currencies change value. What they found was that when changes were caused by how a country manages its money (like through policies about money supply), it had a bigger impact on prices compared to other reasons for currency changes. But when the changes were because of things happening globally, the impact on prices varied a lot from one country to another. In countries where they have flexible exchange rates and a good record of controlling inflation, the effect of these changes on prices tended to be smaller. They suggest that to understand how exchange rates affect prices, we should consider what causes the changes in currency value and how each country deals with them.

Mukhtarov et al. (2019) conducted a study and analyze the impact of exchange rates, and oil prices on inflation in Azerbaijan and conclude that exchange rate had a significant positive impact on inflation in Azerbaijan.

Adaramola and Dada (2020) examine how inflation may affect the Nigerian economy's potential for expansion. The results of the study show that there is a strong negative relation exist between inflation and exchange rate and they also have a strong negative influence on economic growth.

Al-Mutairi et al. (2020) evaluated the link between CPI and imports as well as the gross domestic product, the rate of exchange, and money supply in Kuwait. They discovered that there is a negative relationship between inflation and GDP and the exchange rate. This means that as inflation increases, GDP and the exchange rate decrease.

ERDOĞAN et al. (2020) Examine the factors influencing inflation in the 28 European Union

countries and candidate nations. The empirical findings suggested that the reasons for the rise in inflation were the money supply ratios and the monetary exchange rate. The domestic money supply, currency rate, and neighborhood relations between nations are all exerting growing pressure on inflation rates positive spatial effects. Zhiyong (2008) found that inflation and economic growth are positively related when there is a lag of three quarters.

There is a growing body of research on the factors that can impact inflation. However, most of this research has focused on a limited number of variables, such as the money supply, interest rates, and government spending. There is less research on the relationship between inflation and other factors, such as trade, electricity generation, exchange rate, primary energy consumption, and urban population in European countries. The research gap in this study is that it will investigate the relationship between inflation and five independent variables that have not been studied extensively in previous research. This research will help to fill the gap in the literature and provide new insights into the factors that can impact inflation.

3. Data and Methodology

The Our study is based on cross-section of 20 different European Countries and list of European countries are attached in appendix section Table A. We are utilizing yearly data from 2000 to 2020 in this analysis. The World Development Indicators (WDI) and the British Petroleum will be used to collect data. The WDI provides data on CPI, urban population, trade, and official exchange rate and British Petroleum provides data on primary energy consumption and electricity generation.

Model of study

$$Y_{it} = \alpha + \beta_1 UP_{it} + \beta_2 T_{it} + \beta_3 ER_{it} + \beta_4 PEC_{it} + \beta_5 EG_{it} + \varepsilon_{it} \quad (1)$$

Here,

Y= Inflation/ CPI

α = denotes the unknown intercept of every single entity

UP = Urban population

T = Trade

ER = Official exchange rate

PEC = Primary energy consumption

EG = Electricity Generation

Ɛ = refers to the error term

i = cross-section dimension, t = time series dimension

The values in this study are in constant form and are based on % of GDP. This means that the values represent the relative sizes of the variables, rather than their absolute sizes. We have taken the natural logarithms of the values to make the units of all variables the same. This makes the

variables more comparable with other studies and makes it easier to interpret the results. Table 1 shows the variable names, their log form versions, and the proxies for the variables used in this study.

Table 1 Variables description

Variable name	Log form	Proxy of variable	Data source
Consumer price index (2010 = 100)	LNCPI	CPI (2010 = 100)	WDI from 2000 to 2020
Urban Population	LNUP	Total	WDI from 2000 to 2020
Trade (% of GDP	LNT	(% of GDP)	WDI from 2000 to 2020
Official exchange rate	LNER	(LCU per US$, period average)	WDI from 2000 to 2020
Primary Energy Consumption	LNPEC	Exajoules	British petroleum from 2000 to 2020
Electricity Generation	LNEG	Terawatt-hours	British petroleum from 2000 to 2020

Log transformed model are present in below:

$$\boldsymbol{Ln(CPI)_{it}} = \boldsymbol{\alpha_0} + \boldsymbol{\beta_1 Ln(UP)_{it}} + \boldsymbol{\beta_2 Ln(T)_{it}} + \boldsymbol{\beta_3 Ln(ER)_{it}} + \boldsymbol{\beta_4 Ln(PEC)_{it}} + \boldsymbol{\beta_5 Ln(EG)_{it}} + \varepsilon_{it} \quad \textbf{(2)}$$

3.2 Methods and Statistical techniques

We obtain all the data from the websites of WDI and British Petroleum, reformat it using Excel, then import it into Stata where we look for correlation, VIF, and descriptive tables and estimate the findings of FE, RE, and Panel. To determine the impact of various variables and countries, the data is analyzed using both random and fixed effect models. The distinction among fixed and random effects (FE and RE) tackles the unseen behavior of individual cross-sections and time. Because of historical changes in the observations, the fixed impact intercepts can differ across different cross-sections. The Hausman test is employed to ascertain the superior accuracy between the two models. This test compares the significance levels of estimation techniques, specifically the FE and RE models in this instance.

This study does not confine itself to a particular industry; rather, it investigates the relationship of dependent variable Inflation (Consumer Price Index) with different independent variables (Urban Population, Trade, Exchange rate, Primary Energy Consumption, Electricity Generation) taken on a cross-section of 20 different European Countries all over a period of 2000 to 2020, Proposing the use of longitudinal data (panel data), if we consider a single nation, the focus would

be on time-series information, providing results for only one economy. On the other hand, cross-sectional data can be analyzed across multiple nations, but limited to a single year (one-year data), thus reflecting the outcomes of that specific year exclusively. Consequently, it is advantageous to explore panel data in order to obtain multidimensional insights encompassing various sectors.

To obtain extensive results, this research employs panel data that takes into account both time- and country-specific effects. Because of the various variables, this research is also interested in learning about the country-specific effect. (CPI, Up, Trade, official exchange rate, PEC, Electricity Generation); therefore, the statistics from the RE model also implies the FE model. The size of the effect on various countries may vary, as confirmed by the FE model.

4. Results and Discussions

The findings and their explanation are carried out in this section.

4.1 Descriptive Analysis

The table 2 below shows the description of the variables. The mean CPI rate is 4.5856, with a standard deviation of 0.2326. The distribution of the CPI is negatively skewed, with a kurtosis of 15.1562. This suggests that the distribution is more peaked than a normal distribution and has a longer tail on the left side. The Jarque-Bera test indicates that the distribution of the inflation rate is not normally distributed. The mean energy generation rate is 4.7335, with a standard deviation of 0.9913. The distribution of the energy generation rate is slightly positively skewed, with a kurtosis of 2.5258. This suggests that the distribution is more peaked than a normal distribution but does not have a long tail on either side. The Jarque-Bera test indicates that the distribution of the energy generation rate is not normally distributed. The mean exchange rate is 0.3738, with a standard deviation of 0.4472. The distribution of the exchange rate is negatively skewed, with a kurtosis of 4.2381. This suggests that the distribution is more peaked than a normal distribution and has a longer tail on the left side. The Jarque-Bera test indicates that the distribution of the exchange rate is not normally distributed. The mean primary energy consumption is 0.9147, with a standard deviation of 0.9836. The distribution of the primary energy consumption is slightly negatively skewed, with a kurtosis of 2.0927. This suggests that the distribution is more peaked than a normal distribution but does not have a long tail on either side. The Jarque-Bera test indicates that the distribution of the primary energy consumption is not normally distributed. The mean trade is 4.4092, with a standard deviation of 0.3632. The distribution of the trade is slightly positively skewed, with a kurtosis of 2.8694. This suggests that the distribution is more peaked than a normal distribution but does not have a long tail on either side. The Jarque-Bera test indicates that the distribution of the trade is not normally distributed. The mean LNUP is 4.9730, with a standard deviation of 2.9403. The distribution of the LNUP is positively skewed, with a kurtosis of 17.9654. This suggests that the distribution is more peaked than a normal distribution and has a longer tail on the right side. The Jarque-Bera test indicates that the distribution of the LNUP is not normally distributed.

Table 2 Descriptive analysis test results

Descriptive stats	LNCPI	LNEG	LNER	LNPEC	LNT	LNUP
Mean	4.5856	4.7335	0.3738	0.9147	4.4092	4.9730
Median	4.6052	4.7841	0.3844	0.8619	4.3887	4.3461
Maximum	5.6677	6.4815	1.4181	2.6783	5.5308	17.9773
Minimum	3.0250	2.3754	-1.2760	-1.1646	3.7461	3.9783
Std. Dev.	0.2326	0.9913	0.4472	0.9836	0.3632	2.9403
Skewness	-0.6427	-0.1857	-0.7851	-0.0546	0.6125	4.1118
Kurtosis	15.1562	2.5258	4.2381	2.0927	2.8694	17.9654
Jarque-Bera	2614.9300	6.3499	69.9678	14.6158	26.5584	5102.82
Probability	0.0000	0.0418	0.0000	0.0007	0.0000	0.0000
Sum	1925.9320	1988.0590	156.9901	384.1739	1851.8480	2088.6570
Sum Sq. Dev.	22.6687	411.7344	83.7778	405.3662	55.2660	3622.3790
Observations	420.0000	420.0000	420.0000	420.0000	420.0000	420.0000

After discussing the descriptive statistic now we are going toward correlation table 3 that are appear in below.

4.2 Pearson's Correlation Matrix:

The correlation matrix illustrates the interrelationships between variables. The following table 3 presents the estimated results of the correlation analysis between CPI and Up, Trade, exchange rate, PEC, Electricity Generation. As the table below indicates, there is a weak positive correlation between the inflation rate and energy generation with the value of 0.053. This means that as the inflation rate increases, the energy generation tends to increase as well. However, the correlation is weak. There is a weak negative correlation between the inflation rate and the exchange rate with the value of -0.0746. This means that as the inflation rate increases, the exchange rate tends to decrease. There is a weak positive correlation between the inflation rate and the primary energy consumption with the value of 0.053. This means that as the inflation rate increases, the primary energy consumption tends to increase as well. There is a weak positive correlation between the inflation rate and the trade with the value of 0.1213. This means that as the inflation rate increases, the trade tends to increase as well. There is a weak negative correlation between the inflation rate and trade. This means that as the inflation rate increases, the trade tends to decrease while other independent variables show significance positive and negative correlation with each other.

Table 3 Correlation results

Correlation	LNCPI	LNEG	LNER	LNPEC	LNT	LNUP
LNCPI	1.0000					
LNEG	0.0531	1.0000				
LNER	-0.0746	0.2727	1.0000			
LNPEC	0.0053	0.9713	0.2943	1.0000		

LNT	0.1231	-0.4849	-0.7001	-0.4195	1.0000	
LNUP	-0.0235	0.1557	0.2689	0.1547	-0.2998	1.0000

4.3 Co linearity Statistics Tolerance VIF:

After discussing Pearson's Correlation Matrix now we move forward toward table 4 that are appearing in below. The table below shows the variance inflation factors (VIFs) for the independent variables in this study. VIF is a measure of Multicollinearity, which is a condition where independent variables are too highly correlated. A VIF of less than 10 is generally considered to be acceptable, and the VIFs in this table are all less than 10. This suggests that there is no significant Multicollinearity between the independent variables in this study. As we see in below table electricity generation, exchange rate, trade and urban population shows VIF value of 1.0804, 1.3074 and 1.024 which is <10 so there is no Multicollinearity exist among natural log of electricity generation, exchange rate, trade and urban population while VIF value of the Electricity Generation and Primary Energy Consumption has Multicollinearity with a value of VIF greater than 10 and if we see VIF relation between natural log of exchange rate and primary energy consumption, trade, urban population shows VIF value of 1.0948, 1.9615 and 1.0779 which is <10 so there is no Multicollinearity exist among natural log of exchange rate, primary energy consumption, trade and urban population. Rest of the independent variables shows no Multicollinearity among them.

Table 4 VIF results

VIF	LNCPI	LNEG	LNER	LNPEC	LNT	LNUP
LNCPI	-					
LNEG	1.0028	-				
LNER	1.0056	1.0804	-			
LNPEC	1.0000	17.6483	1.0948	-		
LNT	1.0154	1.3074	1.9615	1.2135	-	
LNUP	1.0006	1.0249	1.0779	1.0245	1.0988	-

The test below in Table 5 investigates the existence of random effects. During the LM test, the initial assumption is that there are no variances among entities. The outcomes presented in the table for the Breusch-Pagan Lagrange Multiplier test validate the presence of panel effects, thereby substantiating the need for a Fixed or Random effects model. Conversely, Table 6 displays the findings of the Hausman Test, which examines the correlation between fixed and random effects, assuming that individual effects exhibit no correlation with the other regressors in the model. A random effect model generates biased estimators when correlated (Ho is rejected), thus allowing a choice for the fixed effect model. Decision: Since p-value is not greater than 0.1 Fixed Effect is preferred. After analyzing Hausman test in table 6 now moves towards Table 7 which shows the results of Wooldridge test for autocorrelation. Statistics indicate that the Ho is rejected (p-value less than 0.05), and it can be concluded that residuals are serially correlated. As a result, OLS coefficients are unlikely to be prejudiced, erratic, or ineffective.

Table 5 Breusch and Pagan Lagrangian multiplier test for Inquiring panel effect

Breusch and Pagan Lagrangian multiplier test for Inquiring panel effect
Ho: *No Panel Effect*
chibar^2(01) = 0.00
Prob > chibar^2 = 1.0000

Table 6 Hausman Test Choice between FE and RE

Hausman Test Choice between FE or RE
Ho: Estimates of Random effect are efficient
chi2(5) = 710.25
Prob > chi2 = 0.0000

Table 7 Wooldridge test for autocorrelation in panel data

Wooldridge test for autocorrelation in panel data
H0: No first-order autocorrelation
F(1, 19) = 2927.284
Prob > F = 0.0000

Hetroskedasticity test results are present in Table 8; Hetroskedasticity can lead to incorrect predictions of coefficient standard errors and thus t-values. Although OLS estimates are not biased in this case, the standard errors are incorrect. Since the null hypothesis is rejected (p-value = 0.000, which is below the significance level of 0.05), it is improbable that the estimated standard errors for coefficients, and consequently their t-values, are precise.

Table 8 Wald test

Modified Wald test for group wise heteroscedasticity in fixed effect regression model
H0: sigma(i)^2 = sigma^2 for all i
chi2 (20) = 35027.80
Prob>chi2 = 0.0000

After discussing diagnostic now we move forward towards Table 9 displays the projected outcomes of the regression analysis between CPI and UP, Trade, exchange rate, Primary energy consumption and electricity generation. Pooled OLS estimation shows that Trade and Electricity Generation are significant at 5% level in explaining variation in Consumer Price Index. Means that if 1 percent increase in Trade and Electricity generation leads to increase in CPI by 0.29% and 0.35% respectively in case of trade our study are contradict with the studies of (Yang and Shafiq, 2020; Elheddad et al., 2020; Ayyoub et al. 2011). Moreover PEC has negative and significant impact on CPI which shows that if 1% increase in primary energy consumption will leads to decreases the CPI by 0.31%. our finding are contradict with the study of (Sadiq et al., 2023). Model

2, Given the endorsement of the FE model's appropriateness as demonstrated by Housman's findings, the FE model yields more dependable results compared to RE. In Model 2, Primary Energy Consumption exhibits a notable inverse effect on CPI, with a significant coefficient displaying a negative sign and reaching a 5% level of significance means that if 1% increases in primary energy consumption will leads to decreases the CPI by 1.21%. And if 1 percent increases in urban population, exchange rate and Electricity generation leads to increase in CPI by 3.54%, 0.96% and 0.22% respectively findings similar to the study of (Bednář et al., 2022; Starr et al., 1984; Sadiq et al., 2023 Mukhtarov et al. 2019) while Trade (the impact of imports and exports in combine) shows no association with CPI. In general, positive and significant relations exist between all variables except one. These results support our findings, indicating that Urban Population, exchange rate, and Electricity Generation has a positive association with Inflation whereas, Primary Energy Consumption has a negative association with inflation. Reason of positive relation between urban population and inflation in European countries are following; as urban populations grow, there is a corresponding increase in demand for goods and services. This can lead to higher prices, as businesses pass on the increased cost of production to consumers. In urban areas, people tend to spend money more quickly than in rural areas. This is because there are more opportunities to spend money in urban areas, such as on transportation, entertainment, and dining out. The faster velocity of money can lead to higher inflation, as businesses raise prices in order to keep up with the demand for goods and services another reason is that urban areas tend to have higher labor costs than rural areas. This is because there is a greater demand for labor in urban areas, which drives up wages. Higher labor costs can lead to higher prices, as businesses pass on the increased cost of labor to consumers. Reason of positive relation between exchange rate and inflation in European countries are, if the value of a country's currency decreases, it will take more of that currency to buy the same amount of goods and services from other countries. This can lead to higher prices for imported goods, which can then contribute to inflation. A weaker currency can make it cheaper for foreign investors to buy domestic assets. If the value of a country's currency decreases, foreign investors will be able to buy more domestic assets for the same amount of their own currency. This can lead to an increase in demand for domestic assets, which can then push up prices. Reason of positive relation between electricity generation and inflation in 20 European countries are following increased demand for electricity: As the economy grows, so does the demand for electricity. This is because more businesses and households are using electricity to power their operations and homes. This increased demand can lead to higher electricity prices, which can then lead to higher inflation. Increased costs of production: The production of electricity requires the use of various inputs, such as fuel, labor, and capital. If the prices of these inputs increase, then the cost of producing electricity will also increase. This can lead to higher electricity prices, which can then lead to higher inflation. Government policies: Governments can also play a role in impacting inflation through their policies on electricity generation. For example, if the government subsidizes the production of electricity, then this can lead to lower electricity prices, which can then lead to lower inflation. Conversely, if the government taxes the production of electricity, then this can lead to higher electricity prices, which

can then lead to higher inflation. Reason of negative relation primary energy consumption and inflation are following. The European Union has a number of policies in place to reduce its dependence on imported primary energy. These policies include renewable energy targets, energy efficiency standards, and carbon pricing. These policies help to keep the price of primary energy in the European Union relatively stable, which can help to reduce inflation. Moreover R^2 is a measure of the proportion of changes in the dependent variable (CPI) caused by changes in independent variables (UP, T, ER, PEC and EG). In the model, the value of R^2 is 11.27% which shows that only 11.27% of the fluctuations in the outcome variable caused by the influencing factors.

Table 9 Regression results

Dependent Variable: LNCPI						
Independent Variables	**Model – 1 Pooled OLS**		**Model – 2 Fixed Effect (FE)**		**Model – 3 Random Effect (RE)**	
	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value
LNUP	0.0021	0.860	3.5402	0.000	0.0021	0.594
LNT	0.2923	0.047	0.0271	0.755	0.2923	0.000
LNER	0.1145	0.348	0.2258	0.000	0.1145	0.002
LNPEC	-0.3187	0.000	-1.2176	0.000	-0.3187	0.000
LNEG	0.3565	0.001	0.9764	0.000	0.3565	0.000
Prob > F	= 0.0001					
R-squared	= 0.1127					

5. Conclusion and policy implication

The primary purpose of this research is to inquire into the connection between the CPI (Inflation) and the various variables include Urban Population, Trade, Exchange rate, Primary Energy Consumption, and Electricity Generation. This research examines a cross-sectional sample of 20 European countries using panel ordinary OLS regression and fixed- and random-effects models for the period of 2000–2020. The reliability of the FE model's results surpasses that of the REs' results, as indicated by the acceptance of the FE model's suitability based on Hausman results. In Model 2, the coefficient of Primary Energy Consumption demonstrates a notable inverse impact on CPI. It bears a negative sign and reaches statistical significance at the 5% level of significance means that if 1% increases in primary energy consumption will leads to decreases the CPI by 1.21%. Moreover if 1 percent increases in urban population, exchange rate and Electricity generation leads to increase in CPI by 3.54%, 0.96% and 0.22% respectively while Trade (the impact of imports and exports in combine) shows no association with CPI.

European countries can implement a range of policy measures to address inflation and promote sustainable economic growth in light of the research findings that urban population, exchange rate, and electricity generation had a positive impact on inflation while primary energy consumption had a negative impact.

For urban population, policies should be implemented to encourage urban development and growth, including affordable housing, infrastructure development, and economic incentives for businesses to locate in urban areas. Additionally, policies should be implemented to manage the demand for goods and services in urban areas, such as those that encourage public transportation, promote energy efficiency, and reduce waste.

Regarding exchange rate, maintaining a stable exchange rate is crucial, which can be achieved through central bank interventions or international agreements. Currency wars should be avoided as they can lead to higher inflation and economic instability. Furthermore, promoting international trade through trade agreements, investment incentives, and support for small and medium-sized enterprises (SMEs) can prove beneficial.

In terms of electricity generation, investments in renewable energy sources can help reduce electricity costs and make them less susceptible to fossil fuel price fluctuations. Promoting energy efficiency through policies that encourage the use of energy-efficient appliances and technologies, along with public education campaigns, can be effective. Additionally, investments in grid infrastructure can ensure the electricity grid can meet the demands of a growing economy. For primary energy consumption, reducing reliance on fossil fuels is essential, and this can be achieved through policies that promote renewable energy sources, improve energy efficiency, and discourage fossil fuel use. Investments in carbon capture and storage (CCS) technology can capture carbon dioxide emissions from power plants and other industrial sources and store them underground, preventing them from entering the atmosphere and contributing to climate change. Lastly, implementing carbon pricing can incentivize businesses and consumers to reduce their emissions. By implementing these policy measures, European countries can effectively address inflation and foster sustainable economic growth.

The study's limitation is that it exclusively considers European economies. Future studies could look at comparing European economies to Asian economies, which contain both developing and developed countries. Inflation can be affected differently in different countries, depending on their unique economic conditions and policies. Researchers should study how these factors affect inflation in different countries to develop policies that are tailored to each country's specific needs.

References

Adaramola, A. O. and O. Dada (2020). "Impact of inflation on economic growth: evidence from Nigeria." Investment Management and Financial Innovations 17(2): 1-13.

Al-Mutairi, A., et al. (2020). "Determinants of inflation in Kuwait." Journal of Developing Areas 54(3).

Ayyoub, M., Chaudhry, I. S., & Farooq, F. (2011). Does Inflation Affect Economic Growth? The case of Pakistan. Pakistan Journal of Social Sciences (PJSS), 31(1).

Barro, R. J. (1997). Macroeconomics, MIT Press.

Bednář, O., et al. (2022). "Energy prices impact on inflationary Spiral." Energies 15(9): 3443.

Bruno, M. and W. Easterly (1995). Inflation Crises and Long-Run Growth. World Bank Policy &Research, Working Paper.

D'Acunto, F., Malmendier, U., & Weber, M. (2023). What do the data tell us about inflation expectations? Handbook of economic expectations (pp. 133-161): Elsevier.

Datta, K. and C. K. Mukhopadhyay (2011). Relationship between inflation and economic growth in Malaysia-An econometric review. International Conference on Economics and Finance Research.

Elheddad, M., Djellouli, N., Tiwari, A. K., & Hammoudeh, S. (2020). The relationship between energy consumption and fiscal decentralization and the importance of urbanization: Evidence from Chinese provinces. Journal of environmental management, 264, 110474.

ERDOĞAN, S., et al. (2020). "Dynamics and determinants of inflation during the COVID-19 pandemic period in European countries: A spatial panel data analysis." Duzce Medical Journal 22(Special Issue): 61-67.

Fischer, S. (1993). "The role of macroeconomic factors in growth." Journal of monetary economics 32(3): 485-512.

Gokal, V. and S. Hanif (2004). "Relationship between inflation and economic growth (Vol. 4)." Suva: Economics Department, Reserve Bank of Fiji.

Ha, J., Stocker, M. M., & Yilmazkuday, H. (2020). Inflation and exchange rate pass-through. Journal of International Money and Finance, 105, 102187.

Mubarik, Y. A. and R. Riazuddin (2005). Inflation and growth: An estimate of the threshold level of inflation in Pakistan, State Bank of Pakistan Karachi.

Mukhtarov, S., Mammadov, J., & Ahmadov, F. (2019). The impact of oil prices on inflation: The case of Azerbaijan.

Orphanides, A. and R. M. Solow (1990). "Money, inflation and growth." Handbook of monetary economics 1: 223-261.

Sadiq, M., Ou, J. P., Duong, K. D., Van, L., & Xuan Bui, T. (2023). The influence of economic factors on the sustainable energy consumption: evidence from China. Economic Research-Ekonomska Istraživanja, 36(1), 1751-1773.

Starr, H., et al. (1984). "The relationship between defense spending and inflation." Journal of Conflict Resolution 28(1): 103-122.

Sugihyanto, T. (2021). "Pengaruh PENGARUH INFLASI, SUKU BUNGA, ROA DAN MARKET SHARE TERHADAP PROFITABILITAS PADA BANK UMUM

SYARIAH:(Studi Kasus pada Bank Umum Syariah yang terdaftar di Bursa Efek Indonesia)." Sustainabilty Accounting and Finance Journal (SAFJ) 1(1): 12-17.

Talha, M., et al. (2021). "Impact of oil prices, energy consumption and economic growth on the inflation rate in Malaysia." Cuadernos de Economía 44(124): 26-32.

Tobin, J. (1965). "Money and economic growth." Econometrica: Journal of the Econometric Society: 671-684.

Uddin, I. (2021). Impact of inflation on economic growth in Pakistan. Economic Consultant, 34(2).

Yang, X., & Shafiq, M. N. (2020). The impact of foreign direct investment, capital formation, inflation, money supply and trade openness on economic growth of Asian countries. iRASD Journal of Economics, 2(1), 25-34.

Zhiyong, W. (2008). Chinese Economic growth and inflation, Chinese society science Institute Press.

Appendix

Table A	
Sr No	**European countries**
1.	Austria
2.	Belgium
3.	Croatia
4.	Denmark
5.	Finland
6.	France
7.	Germany
8.	Greece
9.	Ireland
10.	Italy
11.	Netherlands
12.	Norway
13.	Poland
14.	Portugal
15.	Spain
16.	Sweden
17.	Switzerland
18.	Turkey
19.	Ukraine
20.	United Kingdom