IMPACT OF ENERGY PRICES ON PRICES
OF BASIC TOURISM SERVICES IN THE EURO AREA

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Abstract. The tourism sector in the euro area has faced several challenges over the last five years. After a period of accelerated development, tourism is facing a serious challenge caused by the COVID-19 crisis and a decline in the number of tourists and in tourism services provided. The period of recovery has been accompanied by significant inflationary processes and a shock increase in the prices of energy products, further provoked by the war on the territory of Ukraine. Furthermore, there has been a notable surge in the cost of services within the tourism industry. In light of these developments, it is imperative to investigate the interconnections between energy prices and those in the hotel and restaurant sector. The primary objective of this study is to ascertain the causal relationship between energy inflation and inflation in the hotel and restaurant sector across various periods of crises and external influences on the sector. This analysis seeks to elucidate the causal relationship between energy inflation and inflation in the hotel and restaurant sector. It is based on official statistics published by Eurostat for the euro area, utilising monthly data from the Harmonised Index of Consumer Prices, with a particular focus on the groups "Electricity, gas and other fuels" and "Restaurants and hotels". The results of the testing indicated that the highest correlation between the series of the annual inflation rate of energy products and the inflation rate of services provided by hotels and restaurants was observed when different lags were employed. Following the identification of the highest values of Pearson's coefficient between the inflation rate of energy products and the annual increase in the prices of services provided by hotels and restaurants, a dynamic analysis was conducted. The primary focus of the study is a regression analysis conducted with a predetermined monthly lag. The regression analysis revealed a causal relationship between the prices of hotels and restaurants and the dynamics of energy product prices, thereby enabling the prediction of the former based on the latter. The study reveals the existence of a specific functional relationship. The null hypothesis, which states that there is no causal link between energy product prices and the prices of services provided by hotels and restaurants, is also rejected. The statistical significance of the causal relationship between the two indices is demonstrated. A correlation analysis reveals a relationship between the monthly inflation rates for the categories "Electricity, gas and other fuels" and "Restaurants and hotels" on an annual basis. Furthermore, the two indices exhibit comparable dynamics with a lag of seven months. In particular, the price dynamics of energy products can be employed to forecast the price dynamics of the hotel and restaurant sector after a seven-month period. Moreover, the regression analysis indicates the existence of a statistically significant functional, linear relationship between inflation in energy products and inflation in basic tourism services. It seems plausible to suggest that the fluctuations in energy prices observed during the period 2019-2024 could serve as an indicator of potential shifts in the pricing of basic tourism services. In light of these findings, it is possible for euro area governments to implement targeted measures, while tourism managers can devise bespoke strategies.

Keyword: energy prices, tourism prices, causal relationship, statistically significant regression model.

JEL Classification: C13, E31, E37, Z32

1. Introduction

The tourism industry has been one of the hardest hit sectors economically over the last 5 years. The challenges faced by the tourism industry have long-term effects and are mainly caused by shocks that are difficult to predict. The COVID-19 pandemic had an extremely negative impact on the hotel and restaurant industry. The initial administrative and restrictive measures taken have led to a recovery in the number of tourists lost to Europe in 2024. The

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number of international tourist arrivals in Europe will fall from 742.4 million in 2019 to 239.7 million in 2020. The recovery is slow, with 700.4 million international tourists in Europe in 2023, and is expected to exceed pre-crisis levels in 2024 (Statista, 2024). The fall in tourist numbers and the negative impact on hotels and restaurants during and immediately after COVID-19 were caused not only by the direct administrative measures on the sector, but also by the closure of borders and restrictions on the free movement of people and goods. The aforementioned factors have a direct negative impact on the entire euro area economy, with the tourism industry, and in particular the hotel and restaurant sub-sectors, being among the most directly affected. The overall recovery of the euro area tourism sector after the pandemic caused by the COVID-19 is taking place in an environment of accelerating inflation, which is creating further pressures on the tourism sector. In this period, the US Federal Reserve has been more prompt in implementing anti-inflationary measures, whereas the European Central Bank has been comparatively cautious in its approach to combating inflation (Borisova, 2021). The recovery of the euro area economy following the advent of the COVID-19 pandemic has been accompanied by a notable surge in energy prices. Concurrently, there has been an increase in the cost of tourism services. To illustrate, Eurostat data indicates that in certain months, the cost of energy products (including electricity, gas and other fuels) has increased by 58.2% compared to the previous year. This negative trend is most pronounced following the commencement of hostilities in Ukraine, when the inflation rate for energy products reached its highest point. Eurostat data indicates that, in certain months, the price growth in the hotel and restaurant sector approached 9%. Furthermore, the ongoing conflict in Ukraine is introducing new challenges for the tourism industry. As reported by the European Travel Commission (2024), the ongoing conflict in Ukraine represents a significant concern for 10% of potential tourists. Other concerns relate to high inflation, which is reported by 22% of respondents, and the personal financial situation is a problem for another 17%. It can therefore be surmised that the pricing of services within the tourism sector, in addition to the personal financial circumstances of tourists, are pivotal factors influencing the growth of the sector. It is for this reason that an examination of the relationship between energy product prices and prices in the hotel and restaurant sector is required. This analysis should be conducted over the past five years, a period during which the tourism sector has encountered considerable challenges. These interrelationships are of particular interest in the euro area, given that the European Central Bank is one of the leading institutions with the objective of maintaining low inflation rates. Furthermore, the principal tourist attractions in the entire continent of Europe are situated within the eurozone. Additionally, inflation in energy products can be used as a basis for forecasting price dynamics in the tourism sector, which is of the utmost importance for managers, governments, and the Eurozone economy in general.

The principal objective of this study is to analyse and identify any correlations and causal relationships between the inflation of energy products and that of the hotel and restaurant sector.

The argument put forth is that over the past five years, there has been a notable correlation between the monthly fluctuations in energy inflation and those in the cost of tourism services, particularly in the hospitality sector. There is a notable causal relationship between the alteration in energy product prices and the subsequent increase in the cost of services provided by hotels and restaurants, with a lag of seven months. Based on the changes in energy prices and the existence of a causal relationship, the dynamics of the prices of services provided by restaurants and hotels can be predicted. As a result of the forecast, specific measures can be developed to support the tourism sector, and managers can accordingly implement and develop specific development strategies.

2. Literature Review

There are some studies that focus on the relationship between energy prices and hotel and restaurant prices, but the subject is not widely covered in the economic literature and, more importantly, in the academic literature on the tourism sector. A study covering the period between the first quarter of 2001 and the first quarter of 2017 has been carried out for the United States (Usman et al., 2021). It looks for relationships between energy prices and restaurant and hotel prices, and a relationship between the exchange rate and restaurant and hotel prices. The cointegration test and the Autoregressive Distribution Lag (ARDL) method are used. The findings indicate that an increase in the exchange rate is associated with a decline in restaurant and hotel prices, whereas an uptick in energy prices is linked to an uptick in hotel and restaurant prices. Furthermore, the study identified causal relationships and presented the results in terms of policy implications. Another study that examined restaurant and hotel prices in the United States over the period 2001:M12 to 2019:M01 also investigated the links with monetary and exchange rate uncertainty, and partially revealed the relationship with energy price shocks (Alola et al., 2023). In particular, a nonlinear autoregressive distributed lag (NARDL) model is employed. The results demonstrate that an increase in energy prices has a positive effect on the prices of restaurant and hotel services. Furthermore, a unidirectional

asymmetric causality is identified, emerging from a positive (negative) shock to a positive (negative) shock in energy prices. It can thus be concluded that the restaurant and hotel industries in the United States can achieve stable and low prices through the implementation of general anti-inflation measures for energy products. Empirical evidence indicates a statistically significant negative relationship between gasoline prices and the demand for certain lodging products over a 13-year period for branded hotels in the United States (Walsh et al., 2004). The findings indicate that an increase in gasoline prices is associated with a decline in the demand for lodging. This is the case for all travel segments with the exception of higher-end hotels and in urban areas. Another study demonstrates a correlation between annual fluctuations in energy prices and the utility costs incurred by hotels (Woodworth et al., 2014). In particular, the prices of energy products are included in the Consumer Price Index (CPI) for the period between 2000 and 2009. A high degree of correlation was identified over the specified period. The energy products included in the study are electricity, natural gas, heat, and water. The significance of electricity costs and their role in the hospitality industry are investigated with the objective of encouraging the utilisation of renewable energy sources to power hotels (Meschede et al., 2017). The results of the study show that electricity consumption in hotels is the largest contributor to their total energy costs. Therefore, it is concluded that, in certain cases, it is optimal to use 63% of electricity from renewable sources, distributed in a ratio of 2:1 between photovoltaic and wind energy. The particular importance of the cost of electricity also necessitates the use of batteries, which are also used to balance the differences between day and night consumption. Statistical price dependencies in the tourism sector have been studied for EU Member States. In particular, the impact of carbon prices on tourism demand is examined (Boto-García et al., 2024). Using monthly panel data for the period 2005-2019, a V-shaped pattern is found. The linkages between the energy security and tourism sectors are examined for the United States for the period 1997-2020 (Balcilar et al., 2024). A kernel-based machine learning and regularised least squares (KRLS) approach was used. The results of the study indicate that tourism development increases the energy security risks of the US. This study utilises the energy insecurity index developed by Dang et al. (2023) to examine the impact of energy insecurity on tourism revenues in 11 European countries. To this end, fully modified ordinary least squares (FMOLS) framework was employed, and the resulting relationships were incorporated into a panel vector error correction model (VECM). The findings indicate that a 1% increase in energy insecurity is associated with a 0.08% decline in tourism receipts in

Europe (Kocourková et al., 2024). A study conducted for Thailand revealed a statistically significant relationship between oil prices and the domestic price levels of a range of goods and services (Jatuporn C., 2024). The analysis employs both linear and non-linear ARDL specifications, utilising a monthly time series data set spanning the period from January 2005 to June 2023.

3. Methodology

The comprehensive examination of the causal relationship between energy inflation and inflation in the hospitality sector is grounded in official statistics published by Eurostat and is particularly pertinent to the euro area. In particular, the study employs monthly data from the Harmonised Index of Consumer Prices (HICP), utilising the annual rate of change. For the prices of energy products, data on 'Electricity, gas and other fuels' are used, which is a separate heading in the statistical classification of individual consumption by purpose (COICOP). For prices of services provided by hotels and restaurants, the line "Restaurants and hotels" of the same classification is used. The overall statistical information used is for the Harmonised Index of Consumer Prices (HICP) as defined in Regulation (EU) 2016/792 of the European Parliament and of the Council of 11 May 2016. The period considered is from January 2019 to March 2024 inclusive. This particular period covers the period before the COVID-19 pandemic, as well as the period of the pandemic itself, when tourism was very much affected. The analysed period also includes the period of recovery of the tourism sector after the pandemic, as well as periods of rising energy prices, which resulted in higher prices for services provided by hotels and restaurants. The period under review also includes the negative impact on prices caused by the war that broke out in Ukraine. In order to identify the strongest correlation between the annual inflation rate of energy products and the inflation rate of services provided by hotels and restaurants, the time series is interchanged on a monthly basis. The time series is shifted in order to identify the highest values of the linear correlation, with the objective of determining the optimal lag period for forecasting the price of hotel and restaurant services based on the price dynamics of energy products. In this instance, the Pearson linear correlation coefficient is employed. Following the identification of the highest value of Pearson's coefficient between the series of data on the inflation of energy products and the annual price increase of services provided by hotels and restaurants, a dynamic analysis was conducted. Subsequently, a regression analysis is conducted on the basis of the lag identified for the time series. The objective of the regression analysis is to identify a causal relationship

that can be used to predict the prices of hotels and restaurants based on the price dynamics of energy products. This can be achieved once a particular functional relationship has been established. The study also aims to refute the null hypothesis, which posits that there is no causal relationship between energy product prices and hotel and restaurant prices. Furthermore, the statistical significance of the causal relationship between the two distinct indices and the significance of the coefficients in the linear equation are also examined.

4. Results and Discussion

4.1 Correlation Relationships

In order to ascertain the highest value of linear correlation between inflation in energy products and price growth of services provided by hotels and restaurants, the Pearson coefficient is tested by shifting the time series by one month. In particular, the time series encompasses the two monthly indices between January 2019 and March 2024. The time series are adjusted until the highest coefficient value is identified. Once the optimal lag has been identified based on the high correlation, it is then applied consistently in the dynamic and regression analysis.

The results demonstrate a robust correlation between the monthly HICP (year-on-year) for "Electricity, gas and other fuels" and the monthly HICP (year-on-year) for "Restaurants and hotels". A Pearson coefficient test on the shifted data series indicates an increase to a shift of seven months. After that, the coefficient starts to decrease. The highest value of the linear Pearson coefficient of 0.8626 is reached with a lag of 7 months.

Table 1
Coefficient of linear correlation (Pearson)

Monthly HICP "Restaurants and hotels" (y/y)	Monthly HICP "Electricity, gas and other fuels" (y/y)	Linear correlation coefficient
month – t	month – t	0.4944
month – t	month – t-1	0.5648
month – t	month – t-2	0.6343
month – t	month – t-3	0.6970
month – t	month – t-4	0.7530
month – t	month – t-5	0.8057
month – t	month – t-6	0.8477
month – t	month – t-7	0.8626
month – t	month – t-8	0.8616
month – t	month – t-9	0.8432
month – t	month – t-10	0.8105

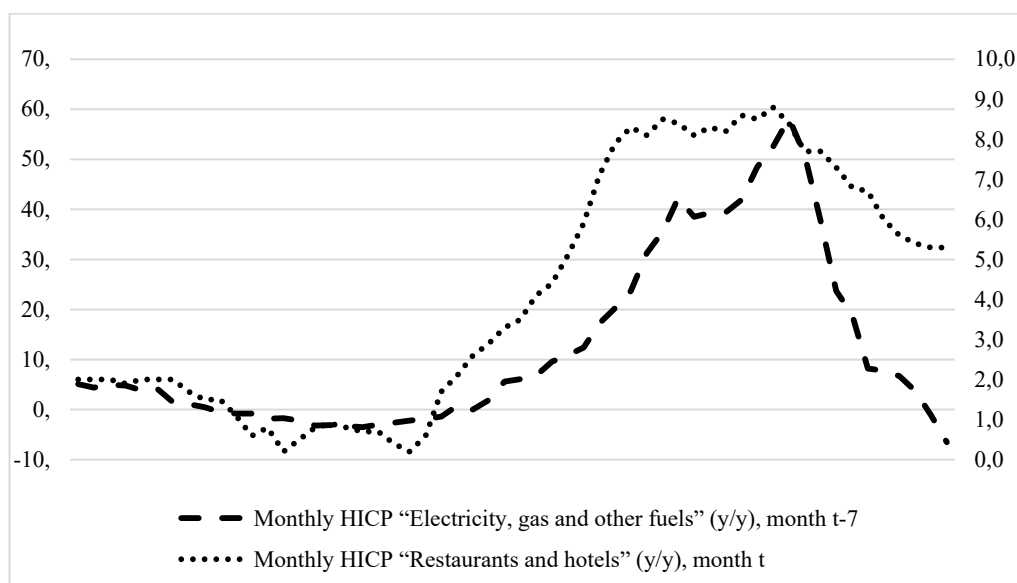*(Source: Eurostat, author's own calculation)*

Figure 1. Monthly HICP "Electricity, gas and other fuels" (y/y), month t-7 and Monthly HICP "Restaurants and hotels" (y/y), month t

Source: (Eurostat, own calculation)

Therefore, for the purposes of this study, in accordance with the methodology, a lag of 7 months will be used. With this lag, the dynamic analysis and the regression analysis are carried out.

The high correlation between inflation in energy products and inflation in the restaurants and hotels sector, as indicated by the Pearson coefficient, is corroborated by the dynamic analysis when a seven-month lag is employed. The dynamic analysis indicates that the two price indices exhibit a comparable trend when the time series for inflation in energy products (electricity, gas and other fuels) is shifted by seven months. Following the application of a seven-month time lag, the two price indices exhibited relatively constant values prior to the onset of the pandemic. Subsequent to the zenith of the pandemic and the imposition of stringent administrative constraints on the operations of the tourism sector, the prices of both energy products and services in the restaurant and hospitality sector experienced a decline. The recovery of the tourism sector following the impact of the pandemic has been accompanied by a simultaneous increase in the prices of both energy products and tourism services. This has resulted in inflation in energy products leading hotel and restaurant prices by seven months. A comparable phenomenon has been documented since the onset of the armed conflict in Ukraine, with energy prices reaching their highest levels. The stabilisation of energy markets and the subsequent decline in energy product prices have now been followed by a decrease in prices in the restaurant and hotel sector. Therefore, although energy products do not constitute a significant cost factor in the hotel and restaurant sector, it appears that the dynamics of energy inflation can be used to predict similar price dynamics in hotels and restaurants. In light of the aforementioned evidence and the high value of the correlation coefficient between the two indices (0.8626), it is imperative to investigate the potential causal relationship between them. The causal relationship may be investigated through the use of regression analysis. The regression analysis will, in turn, provide an answer as to whether there is a statistically significant causal relationship between inflation in energy products and price increases in services provided by the restaurant and hotel sector. Furthermore, the regression analysis should also reject the null hypothesis, which posits that there is no causal link between the harmonised consumer price index for energy products and the same index for hotels and restaurants.

4.2 Regression Analysis

The regression function was employed to fit the regression model, and the principal findings were elucidated. The results of the study, which employed a monthly HICP for "Electricity, gas and other fuels" on an annual basis as a factor (variable X) and a monthly HICP for "Restaurants and hotels" as the dependent variable, are presented in Table 2.

– Looking at the results of the regression analysis, it appears that the Pearson correlation coefficient (Multiple R) is 0.8626, indicating a strong correlation between the inflation of energy products as a factor (variable X) and the annual increase in the price of hotels and restaurants as a dependent variable.

– The results demonstrate that 74.4% of the variance in the monthly HICP for the "Restaurants and hotels" sector on an annual basis is explained by the variance in the monthly HICP for the "Electricity, gas and other fuels" sector. This conclusion is a necessary consequence of the model, which shows that R^2 (R-Square) is 0.7441.

– Adjusted R2 (R-Square) is 0.7394.

– The standard error is 1.5575. This result from the regression model indicates that the observed values deviate, on average, by 1.56 units from the regression line for the 56 observations made.

– The value of Significance F is 1.29581E-17, which demonstrates that the functional relationship between HICP for "Electricity, gas and other fuels" and HICP for "Restaurants and hotels" is statistically significant at the 0.05 confidence level. The low value of Significance F also validates the statistical significance of the regression model.

– Based on the results obtained from the model fitting the coefficients in the regression equation, the relationship between inflation in energy products and inflation in services provided by the hotels and restaurants sector can be represented by the following formula:

$Y_t = 2.3461 + 0.1477 * X_{t-7}$, in which:

Y is monthly HICP for "Restaurants and hotels" on an annual basis (annual rate of change).

X is monthly HICP for "Electricity, gas and other fuels".

t is the month with published monthly HICP for "Restaurants and hotels".

– In accordance with the model, the Intercept is (2.3461), and the corresponding P-value is 1.04613E-12. This indicates that the free coefficient in the formula is statistically significant.

– The coefficient associated with the factor X (representing the monthly HICP for the category "Electricity, gas, and other fuels") is 0.1477. The coefficient is statistically significant at the 0.05 level of significance (P-value = 1.29581E-17 < 0.05).

The aggregated and summary results of the regression model demonstrate that there is a statistically significant causal relationship between inflation in energy products and inflation in services provided by the hotel and restaurant sector, with a lag of seven months. The causal relationship can be represented

Table 2

Regression function is the result of the data analysis package

SUMMARY	OUTPUT							
Regression	Statistics							
Multiple R	0.8626							
R Square	0.7441							
Adjusted R Square	0.7394							
Standard Error	1.5575							
Observations	56							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	1	380.911	380.911	157.031	1.29581E-17			
Residual	54	130.988	2.426					
Total	55	511.898						
	Coefficients	Standard Error	tStat	P-value	Lower 95%	Upper 95%	Lower 95%	Upper 95%
Intercept	2.3461	0.2540	9.238	1.04613E-12	1.837	2.855	1.837	2.855
X Variable 1	0.1477	0.0118	12.531	1.29581E-17	0.124	0.171	0.124	0.171

Source: (Eurostat, own calculation)

by a linear equation using the monthly HICP for "Electricity, gas, and other fuels (y/y), which affects the monthly HICP for "Restaurants and hotels" after a period of seven months. The comprehensive regression model also demonstrates that 74.4% of the observed variance in inflation rates for services provided by the hotel and restaurant sector can be attributed to the observed variance in inflation rates for energy products. Furthermore, the coefficients in the linear equation are also statistically significant. In light of the model's findings, it may be beneficial to devise strategies to encourage the utilisation of renewable energy sources for the tourism industry's own requirements, coupled with the integration of energy storage and energy-saving technologies. The current study could be extended in order to develop a more detailed model for price forecasting in the hotel and restaurant sector. A two-factor regression model may be tested by including additional independent factors in the development of the statistical model. One potential avenue for developing a predictive causality model to determine price dynamics in the tourism sector is to examine the price dynamics of both energy and food products.

5. Conclusions

The study includes an overview of a 5-year period covering the period before the COVID-19 pandemic, the pandemic itself, and the eurozone's economic recovery. The five-year period also encompasses the months of accelerated inflation, which was accompanied by a sudden surge in energy prices, as well as the period of armed conflict on Ukrainian territory, which further contributed to inflationary

growth. Furthermore, the subsequent period, during which prices of energy products exhibited a degree of stability following the commencement of hostilities on Ukrainian territory, is also subjected to analysis. The period under examination is that beginning in 2019 and concluding in March 2024. This period is characterised by the occurrence of various crises affecting the tourism sector in the euro area, particularly notable among which are significant deviations in the prices of energy products, which also exert an impact on the prices of tourism services, in particular in the hotels and restaurants sector. To illustrate, the price growth in the hotels and restaurants sector in the euro area over the five-year period under examination is approaching 20%. The numerous challenges encountered by the tourism sector over the past five years underscore the necessity for the development of indicators and models that can serve as an early warning system regarding the dynamics of tourism service prices. This would enable the formulation of targeted development strategies or the implementation of measures at the government level. Over the five-year period under review, there is a strong positive correlation between energy inflation and service price growth in the restaurant and hotel sector, with the correlation reaching its peak at a lag of seven months. The results of the dynamic and correlation analyses indicate a correlation between the monthly HICP for "Electricity, gas and other fuels" at an annual base and the monthly HICP for "Restaurants and hotels" at an annual base. Furthermore, the inflationary trends observed in the prices of energy products exhibit a comparable dynamic to that observed in the prices of the hotels and restaurants

sector, with a lag of seven months. In particular, based on the dynamics of energy prices, prices in the and "Restaurants and hotels" sector can be forecasted in 7 months. A comprehensive regression analysis reveals a statistically significant linear correlation between the monthly HICP for "Electricity, gas and other fuels" at the annual base and the monthly HICP for "Restaurants and hotels" at the annual base, with a seven-month lag. Furthermore, the regression analysis demonstrates that 74.4% of the observed variance in inflation within the hotel and restaurant sector can be attributed to the preceding seven-month period, during which inflation in energy products was also observed. The regression analysis also yielded a statistically significant linear functional relationship between the monthly HICP for "Electricity, gas and other fuels" at the annual base and the monthly HICP for "Restaurants and hotels" at the annual base. It can be seen that over the five-year period studied, which was accompanied by a number of challenges for the tourism sector, the dynamics of energy product prices can be used as an early warning of price changes in basic services within the tourism sector. This provides a foundation for the implementation of targeted measures by euro area governments and the formulation of tailored strategies by tourism managers.

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