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Content

Inflation forecast with oil price forecast

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Abstract

The aim of the work was to map the development of the inflation rate in the Czech Republic and oil prices on world markets in the period from January 2020 to March 2024, and in connection with this development, to create a forecast of the development of the inflation rate in the Czech Republic and oil prices on world markets in the following period, i.e. from April to December 2024. Another aim was to compare both quantities, or rather their development, and to determine whether the inflation rate in the Czech Republic is influenced by the price of oil on world markets. The chosen method for determining the forecasts of the development of both quantities was linear regression. Quantitative content analysis was used to obtain data. The values of the inflation rate and oil prices were subsequently also expressed graphically for better clarity. From May 2022 to August 2022, the inflation rate ranged from 16% to 18%. The price of Brent oil in the same period ranged between CZK 2,374 and CZK 2,613.70. In both cases, it was a sharp increase compared to 2020. Although the curves of both quantities showed a similar trend, a detailed comparison subsequently showed that the price of oil on world markets does not have a direct connection with the inflation rate in the Czech Republic, although it certainly influences it to some extent in certain periods. Both the inflation rate in the Czech Republic and the price of Brent oil on world markets will have a slightly increasing trend until the end of 2024, but will not return to their highs from the summer of 2022. The most significant limitation of this work was the factor of the Russian-Ukrainian conflict, which caused large fluctuations in values, which could have distorted the actual relationship between the two quantities.

Keywords: Inflation, oil price, linear regression, inflation rate development, forecast

Introduction

According to Alsuhaili, the higher inflation rate and Panigrahi (2023) have a greater negative impact on the country's financial development, while GDP growth reduces this impact. Many external factors influence the level of inflation. The study by Nguyen et al. (2020) shows that exchange rate and oil shocks have also been significant factors recently. The growth of the money supply and output is also not negligible. These findings have profound implications for the formulation of monetary policy and price stability.

The increase in inflation has a significant impact on the economy and purchasing power of households, with the lowest income and socially weaker groups of the population and seniors being most affected, whose nominal wages and pensions (if not valorized) are devalued. Inflation also affects the economic performance of companies - if inflation decreases, then the profit of companies will constantly increase, on the contrary, if the inflation rate increases, the total profit will continuously decrease (Padiyar, 2023).

Higher inflation rates also reduce the value of deposits and loans, and higher inflation expectations lead firms to increase prices, demand for loans, and reduce employment and capital (Coibion et al., 2020). In this situation, the national central bank has a significant position, as its measures can influence inflation, both positively and negatively. Although it is an independent institution that determines the country's monetary policy, it is subject to some influence and in many cases also under political pressure, especially from left-wing governments that are trying to implement a looser monetary policy.

The Covid-19 pandemic has increased inflation and unemployment worldwide, prompting national central banks to implement measures to mitigate their impacts (Long, et al., 2022). Another negative impact on inflation developments not only in the Czech Republic was the Russian invasion of Ukraine, which began in February 2022. A study conducted on the basis of data from the Czech Statistical Office showed the extent to which the European financial system is sensitive to external shocks that occur during significant inflationary changes (Vochozka et al., 2023).

Since the inflation rate is one of the most important macroeconomic indicators and its level is an important aspect for price formation, wage and interest rate setting, as well as for pension valorization, it is necessary to predict its development in the upcoming period, usually in the following calendar year.

The aim of this work is to forecast the development of inflation in the Czech Republic in 2024 in connection with the development of oil prices on world markets.

In connection with the objective, the following research questions are set:

VO1: How will the expected inflation rate in the Czech Republic develop in 2024?

VO2: What is the expected development of oil prices on world markets in 2024?

Methods and Data

Data

In order to answer the first research question, quantitative content analysis of data will be used, namely from data available on the website of the Czech Statistical Office. Here, the Inflation, consumer prices tab will be searched, and then the Inflation – types, definitions, tables section will be searched. In this section, only data from Part 2 will be used (https://www.czso.cz/ csu / czso / mira_inflace). Here, the inflation rate is expressed as the increase in the consumer price index to the same month of the previous year and expresses the percentage change in the price level in the reported month of the given year compared to the same month of the previous year. It is therefore the achieved price level that excludes seasonal effects by always comparing the same months. From the table in this section, data for individual months in the period 1/ 2020 – 3 /2024 will be used, which will be entered into a table in MS Excel and subsequently visualized in the form of a graph.

As a basis for answering the second research question, a content-based quantitative analysis of data from the Kurzy.cz website will also be used as a basis for answering the second research question, where the commodity Oil, more precisely Brent Oil, will be specified in the Commodities section. Here, in the Brent Oil history section, the table lists oil prices for individual calendar years, and data for the period 1/2020 – 3/2024 will be used for the analysis. It will therefore be necessary to click on the given year in order to obtain data for individual months (https://www.kurzy.cz/komodity/ropa-brent-graf-vyvoje-ceny/historie-czk-1barel). It will also be necessary to specify the currency, in this case CZK, for 1 barrel. The Average data will be used from the data offered. The values will be recorded in a table in MS Excel. Subsequently, this data will also be converted into a graph.

Methods

To evaluate research questions 1 and 2, a regression method will be used, which will allow us to examine the relationship between two variables, one of which is the independent variable x and the other the dependent variable Y, assuming that both variables are continuous.

The conditions of the regression model are as follows:

$$Y_1 = \beta_0 + \beta_{1.xi} + e_i \qquad (1)$$

Where:

1. $E(e_i) = 0$ for each i=1, 2, …., n
   the mean value of the random component is zero
2. $D(e_i) = \sigma^2$ for each i=1, 2, …., n
   the variance of the random component is constant
3. $Cov(e_i e_j) = 0$ for each $i \neq j$, where i, j = 1, 2, … n
   the covariance of the random component is zero
4. Normality: The random components ei have a normal distribution for i = 1, 2, …, n.

5. The regression parameters β_1 can take on arbitrary values
6. The regression model is linear in parameters

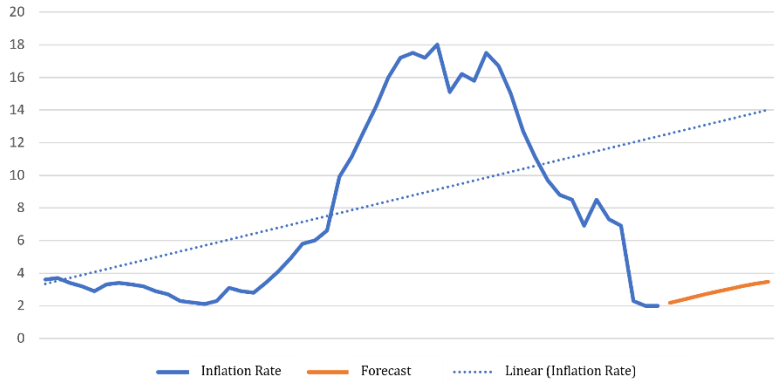
The existence of a linear relationship between two quantities is determined by answering the question whether the slope β_1 is equal to zero. If the answer is positive, it means that the slope of the adjustment line differs from zero only by chance, so the relationship between the monitored variables is not linear. Otherwise, it will be a linear relationship. The conditions of the linear regression model will need to be verified within the framework of the regression analysis, which will confirm or refute the connection between the price of oil and the inflation rate. At the same time, based on the calculation performed, it will be possible to predict the development of both variables in the next period of 2024.

Data from the content analysis of the development of the oil price and the inflation rate in the period 1/2020 - 3/2024 will be used as input data for the calculation.

Results

Both the price of oil and the inflation rate were monitored for one calendar month, from January 2020 to April 2024. The source data with the price of oil and the inflation rate were included in the Annexes chapter.

Figure 1: Development of the inflation rate (in %)

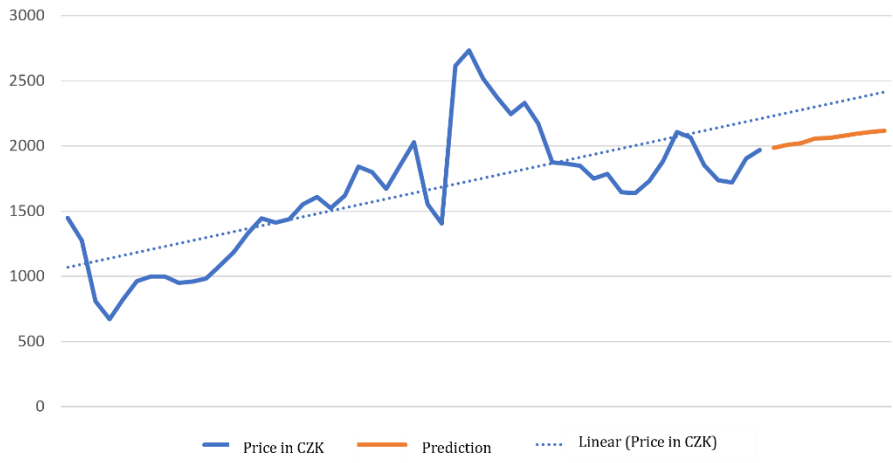


Source: Author.

Figure 1 shows the development of the inflation rate in the period from January 2020 to March 2023. Inflation was monitored in percentages, using the values from the second part of the table, where the inflation rate is expressed as the increase in the consumer price index compared to the same month of the previous year and expresses the percentage change in the price level in the reported month of the given year compared to the same month of the previous year. The low inflation rate is evident throughout 2020, when it averaged around 2.24%. In April 2021, its value increased slightly to 3.1%, but immediately decreased again. In July 2021, it rose to 3.4%, and from this month onwards, only an increase followed, which gradually accelerated, with inflation reaching a record rate of 18% in September 2022. In April 2023, a significant decrease to 12.7% was recorded, which then continued until February 2024, when the inflation rate stopped at

2%. The prediction for the period April - December 2024 shows an increasing trend, which, however, will no longer reach the extreme values of 2022 and will stick to the average monthly value of 2.87%.

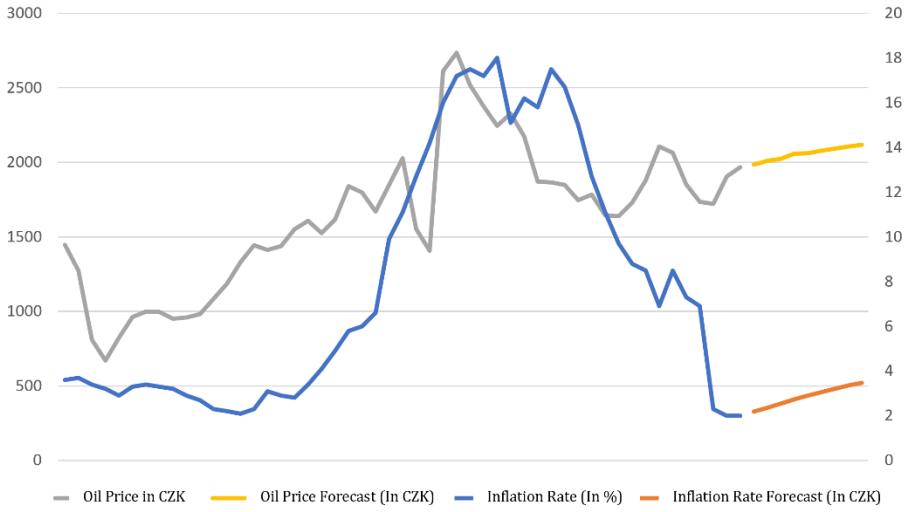
Figure 2: Brent oil price development (in CZK per barrel)



Source: Author.

Figure No. 2 shows the development of the price of Brent crude oil in the period from January 2020 to March 2023. The price was monitored in Czech crowns and in the unit of measure barrel, and the Average values were considered. The data was taken from the website kurzy.cz (kurzy.cz, 2024). The graph shows the lowest price in April 2020, when it was 669.86 CZK per barrel. Then the price gradually increased. In April 2022, there was a rapid decline, but immediately the price began to rise again, and in June 2022 it reached its maximum with a value of 2734.7 CZK per barrel. Subsequently, there was a gradual decline again, but the price did not return to its initial values. Based on the linear regression method, the development of the price of this commodity in the subsequent periods of 2024 was predicted - i.e. from April to December. According to this forecast, the price of oil will tend to continue to rise slightly in the following period, exceeding CZK 2,000 per barrel in May and remaining at an average value of CZK 2,059.23 per barrel until the end of the year.

Figure 3: Comparison of inflation and oil price developments



Source: Author.

Both data on the development of the inflation rate and the development of Brent oil prices were included in graph number 3 in order to compare whether there is a relationship between the two variables, i.e. whether the development of oil on world markets has an impact on the development of inflation in the Czech Republic. In April 2020, both variables showed a decrease, while in May 2020 the price of oil increased slightly, while the inflation rate, on the contrary, decreased. Until the end of 2020, identical and opposite trends continued. Already in February 2021, the price of oil increased significantly to CZK 1,330 per barrel compared to CZK 1,185 in January, while the inflation rate, on the contrary, decreased by 0.1%. Until December 2021, the inflation rate increased slowly, while the price of oil rose more steeply. In January and February 2022, both variables had the same upward trend. In April 2022, the price of oil fell sharply, while the inflation rate continued to rise steeply. From November 2022 to June 2023, the price of oil fell, but the inflation rate alternately rose and fell. Then, until March 2024, both variables had completely opposite development trends. From a comparison of the curves of both variables, it can be concluded that the price of oil on world markets does not have a direct connection with the inflation rate in the Czech Republic, although it certainly influences it to some extent in some periods.

Discussion

Based on the results obtained, it is possible to answer the following research questions*:*

VO1: How will the expected inflation rate in the Czech Republic develop in 2024?

In the case of this research question, quantitative content analysis of data was used, based on data available on the website of the Czech Statistical Office. The first month monitored was January 2020, when the inflation rate in the Czech Republic was 3.6%. Until July 2021, there was an alternating slight increase and decrease in the inflation rate in the range of up to 3.4%. However, in August 2021, there was an increase to 4.1% and until the end of

2021, the inflation rate was only increasing, reaching its maximum in September 2022, at 18%, which was an increase of 400% compared to January 2020. After that, there was an initially fluctuating decline to the current value of 2% in March 2024. Using the regression method, an estimate of the development of the inflation rate until the end of 2024 was determined, with its values continuing to range between 2 and 3.5%.

The study by Nguyen et al. (2020) examined the impact of exchange rate and oil shocks on inflation rates. For this reason, another research question examined the development of oil prices on global markets to assess the actual impact on inflation rates.

VO2: What is the expected development of oil prices on world markets in 2024?

To answer this research question, it was necessary to obtain data using quantitative content analysis. The source was the website www.kurzy.cz. At the beginning of the monitored period, i.e. in January 2020, the price of one barrel of Brent crude oil was CZK 1447.5, then there was a gradual decrease to the price of CZK 823.29 per barrel. However, in June 2020, there was a sharp increase in the price, and this growth had an upward trend with small fluctuations in the following months. The price reached its maximum in May 2022, when it was CZK 2734.7 per barrel, which was an increase of almost 89% compared to January 2020. From July 2022, the price gradually decreased until June 2023, when it reached the level of CZK 1638.8 per barrel. Until September 2023, the price rose again, but from October 2023 there was a gradual decline to CZK 1,968.9 per barrel in March 2024. The regression analysis shows that the price per barrel of Brent crude oil will have a slightly increasing trend in the following months of 2024, but will no longer reach the maximum of May 2022.

Conclusion

The aim of the work was to map the development of the inflation rate in the Czech Republic and the price of oil on world markets in the period from January 2020 to March 2024, and in connection with this development, to create a forecast of the development of the inflation rate in the Czech Republic and the price of oil on world markets in the following period, i.e. from April to December 2024. Another aim was to compare both quantities, or rather their development, and to determine whether the inflation rate in the Czech Republic is influenced by the price of oil on world markets. The aim of the work was met.

From May 2022 to August 2022, both the inflation rate and the price of oil were at their maximum values, with inflation ranging from 16% to 18%, which was an increase of approximately 400% compared to the beginning of the monitored period in January 2020. The price of Brent oil in the same period ranged between CZK 2,374 and CZK 2,613.70, which was an increase of an average of 89% compared to January 2020. Both quantities were undoubtedly significantly influenced by the Russian aggression in Ukraine in the given period, which began in February 2022 and from May to August 2022 had the strongest impact on global economic development, including inflation and the price of oil.

It was found that both the inflation rate curve and the oil price curve had a similar, but not entirely identical, course in the monitored period. A detailed comparison subsequently revealed that the price of oil on world markets has no direct connection with the inflation rate in the Czech Republic, although it certainly influences it to some extent in some periods.

Regarding the development of the inflation rate in the Czech Republic and the price of Brent oil on world markets in April - December 2024, the result of the linear regression was the finding that both quantities will have a similarly slightly increasing trend in this period. The price of Brent oil will not return to its 2020 lows or attack the summer 2022 highs, but will fluctuate around CZK 2,000 per barrel until the end of 2024. In contrast, the inflation rate in the Czech Republic already returned to its 2020 value in January 2024 and will maintain the current trend of between 2% and 3.5% until the end of 2024.

The most significant limitation of this work was the factor of the Russian-Ukrainian conflict, which caused large fluctuations in values, which could have distorted the true relationship between the two quantities.

For this reason, follow-up research and monitoring of the further development trend of both quantities in the coming years is recommended, especially in connection with global socio-political developments.

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Appendix

Appendix No 1

Figure 4: Brent crude oil price on world markets and inflation rate in the Czech Republic in the period January 2020 – March 2024, including the forecast of both quantities for the period April – December 2024

Month	Inflation rate (in %)	Inflation forecast (in %)	Oil price (in CZK)	Oil price forecast (in CZK)
January 20	3.6		1447.5	
February 20	3.7		1275.1	
March 20	3.4		809.08	
April 20	3.2		669.86	
May 20	2.9		823.29	
June 20	3.3		961.02	
July 20	3.4		999.3	
August 20	3.3		997.52	
September 20	3.2		950.02	
October 20	2.9		959.42	
November 20	2.7		981.13	
December 20	2.3		1083.9	
January 21	2.2		1185	
February 21	2.1		1330	
March 21	2.3		1445	
April 21	3.1		1411.2	

May 21	2.9		1436.7	
June 21	2.8		1551.7	
July 21	3.4		1606.9	
August 21	4.1		1524.5	
September 21	4.9		1617	
October 21	5.8		1840.6	
November 21	6		1797.3	
December 21	6.6		1670.8	
January 22	9.9		1848.6	
February 22	11.1		2028.2	
March 22	12.7		1552.9	
April 22	14.2		1406.4	
May 22	16		2613.7	
June 22	17.2		2734.7	
July 22	17.5		2516.7	
August 22	17.2		2374	
September 22	18		2243.9	
October 22	15.1		2328.4	
November 22	16.2		2173.4	
December 22	15.8		1872.6	
January 23	17.5		1865.2	
February 23	16.7		1847.8	
March 23	15		1747.8	
April 23	12.7		1783.8	
May 23	11.1		1645	
June 23	9.7		1638.8	
July 23	8.8		1729.2	
August 23	8.5		1880.5	
September 23	6.9		2106.7	
October 23	8.5		2063.8	
November 23	7.3		1852.6	
December 23	6.9		1735.7	
January 24	2.3		1719.9	
February 24	2		1904.3	
March 24	2		1968.9	
April 24		**2.180877828**		**1985,19881**
May 24		**2.363034814**		**2009.61153**
June 24		**2.546091837**		**2022.8121**
July 24		**2.725314807**		**2058.30684**
August 24		**2.897375116**		**2061.8525**
September 24		**3.055874191**		**2077.31704**
October 24		**3.208722003**		**2092.93104**
November 24		**3.349344609**		**2106.92104**

Source: Author.