Evaluation of inflation and unemployment and plotting the Philips curve of the Czech Republic

Tomáš Krulický[*], *Veronika* Šanderová, and *Dominik* Dolejš

Institute of Technology and Business in České Budějovice, School of Expertness and Valuation, Okružní 517/10, 37001 České Budějovice, Czech Republic

Abstract. The Phillips curve was supposed to mean an expansion of the doctrine based on the original regulatory ideas of J. M. Keynes. At the time of its inception (1950s), it gave governments theoretical hope, coming from the possibility of choosing a negative correlation between the price level (P) and the product (Y). Her early denial (at least in the short term) by Milton Friedman, on the other hand, has not changed anything about other applications that are still relevant until present time. In the fact, advantage of Phillips curve is her ability based on broad-spectrum use for any type of national economy. The aim of this work is to determine the shape of the Phillips curve for the Czech Republic in the period from 2000 to the present and to compare its shape with the shape of the original Phillips curve. The method of regression analysis is used here, comparison and prediction are performed using time series. In this paper, we find out what the short-term Phillips curve looks like for the Czech Republic, that it does not coincide with the original Phillips curve, and that in the future we can count on a growing correlation between inflation and unemployment.
Keywords: Inflation, Phillips curve, regression analysis, time series, unemployment, prognosis

1 Introduction

The results of a model estimate showed a significant and negative impact of inflation and unemployment on long-term economic growth, suggesting that inflation and unemployment have reduced economic growth in the long run [1].

Inflation is the weakening of the purchasing power of a currency against items that can be bought for that currency. This means that, for example, you will need more currency units each year for the same market basket. By comparing the year-on-year difference in the price of the market basket, we then obtain the percentage rate of year-on-year inflation.

Huber [2] found that his bounded bivariate model is better at prediction than many alternatives, including a version of his model with unlimited unobserved components. The model also provides reasonable estimates of trend inflation, NAIRU, inflation persistence, and the slope of the Phillips curve.

The paper will be processed by comparing data on unemployment and inflation. For this comparison, we decided to make it easier by using the Phillips curve, which describes the

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[*] Corresponding author: krulicky@mail.vstecb.cz

relationship between the unemployment rate and wage growth. Therefore, it should be a very useful source of information.

Powell [3] does not see as likely that the Phillips curve is dead or that it will happen soon. Many factors, including the better conduct of monetary policy over the last few decades, are more likely to have significantly reduced, but not completely eliminated, the effects of tight labor markets on inflation. However, no one fully understands the nature of these changes or the role they play in the current context. Common sense suggests that we should be careful when prognoses predict events rarely before they are observed in the economy.

It will be necessary to find a connection between the Philips curve and the inflation rate. The connections found need to be entered into charts and their accuracy evaluated. In particular, it will be necessary to work with information on the situation in which the Phillips curve remains in its original form.

It is interesting to follow, for example, the development of the Phillips curve in the USA. As average inflation expectations have been anchored in the US inflation target since 2000, the long-term Phillips curve may have skewed downwards. Since the Great Recession of 2008-2009, the US economy has recorded an average 0.22% point below the inflation target in 2008-2017Q4. Sayeed et al. [4] found that the long-term Phillips curve for the United States had flattened since 2008. The study also estimates that the US economy faced 1.6% higher average unemployment than if average inflation were equal to the target. These are significant unemployment costs resulting both from a broader long-term Phillips curve and from exceeding the inflation target.

Furthermore, it will also be important to find out whether the Phillips curve corresponds with the data from the Czech Statistical Office and if it is possible to apply it to the Czech economy, and thus able to aid us. However, it will most likely be necessary to derive data for a given region, in this case the Czech Republic, so that the data is sufficiently relevant for that use. The rate of disinflation and deflation is a topic that will also need to be included in the results. Their cause, the situation where there is a turnaround between them and the correlation with unemployment [5, 6].

Meaningful estimates of the non-accelerating inflation rate of unemployment (NAIRU) within the Phillips curve require an identified trade-off between inflation and unemployment. However, observations of inflation and unemployment are equilibrium points that cause the problem of simultaneity [7]. Kajuth [8] assessed conventional identification assumptions in the literature on the German NAIRU in the general bivariate system of inflation and unemployment equations. To identify the trade-off for Germany, he used a data-based identification method based on shifts in the relative volatility of shocks to unemployment and inflation. The results support models that estimate the current impact of unemployment on inflation and those that model inflation and unemployment together [8].

The aim of this article is to determine the shape of the Phillips curve for the Czech Republic in the period from 2000 to the present and to compare its shape with the shape of the original Phillips curve.

In order to fulfill the aim of the paper, the following research questions were set:

RQ1: What is the shape of the Phillips curve in the Czech Republic from 2000 to the present?

RQ2: How does the shape of the Phillips curve in the Czech Republic differ from the short-term Phillips curve?

RQ3: What development can be expected of the shape of the Phillips curve in the Czech Republic until 2025?

2 Literature research

Onifade et al. [9] used a bound co-integration test approach to test for the presence of relationship levels between variables. Their findings show that openness to trade and

domestic investment are significant for Nigeria's unemployment during the study period. Furthermore, the validity of the Phillips curve was confirmed. Zhu, Kavanagh and O'Sullivan [10] chose BoE to compare inflation projections with the actual impact of substituting values using the substitution method. They prove its functionality with their results. Barnichon and Masters [11] used a scientific description, a graphical method, synthesis and analysis, and a logical construction method to calculate lost GDP from youth unemployment in the EU in 2016. They found that youth unemployment was a serious microeconomic and macroeconomic problem. Peneva and Rudd [12] used a vector autoregressive model to investigate whether and to what extent the passage of labor costs to price inflation changed over time. Their findings call into question the explanation for recent inflationary behavior. Research by Busseti, Caivano and Delle Monache [13] has shown that the domestic output gap has a greater effect on the right part of the conditional inflation distribution graph than on the left part of the graph, suggesting a nonlinearity of the Phillips curve. The aim of Kadeřábková, Jasová and Holman [14] was to determine the nature and intensity of the slope of Phillips curves (PC) for workers at risk of unemployment in individual phases of the economic cycle between 2000 and 2016 in the Visegrad Group (V4). They used linear regressions to replace the household unemployment deflator. Also, from Barnichon's and Master's [11] research, we learn that the derivation of the Phillips multiplier is based on a simple instrumental variable regression of cumulative inflation and cumulative unemployment using monetary shocks as tools. Subsequently, I found that Álvarez and Correa-Lopéz [15] used a model with gradual regressions for their prognosis and evaluated their results using meta-regression. In addition, Damane and Sifat [16] used a combination of seemingly unrelated regression (SUR) and marginal regression techniques based on a multidimensional cumulative function to investigate the existence of a common Phillips curve between CMA members. Similarly, Furtula, Durkalic and Simionescu [17] examined the paradigm of the Phillips curve in macroeconomics and examined the relationship between inflation and the unemployment rate, which they analyzed on empirical data using Bayesian linear regression models. Berge [18], who examined the behavior of inflation expectations in the United States, is cited as the latest example of the regression model. His algorithm creates a regression model of expected inflation using a large panel of macroeconomic data as possible variables. However, for example, Daman's and Sifat's [16] model estimates were made using data on the annual time series of specific countries for inflation, unemployment and imports. Tule, Salisu and Chiemeke [19] also propose a Phillips curve based on supply for an oil-dependent (Nigerian) economy. They compare the predictive results of the Phillips curve based on oil data with traditional variants and time series models such as ARIMA and ARFIMA. Stuart [20] encountered the problem of lack of data, and therefore first solves how to proceed in this situation and then also predicts the Phillips curve for the next 50 years using time series and the method of combining forecasts. In a similar time frame, Ali et al. [21] use data from the time series, i.e. from 1961 to 2014, and apply descriptive statistical analysis, the autoregressive distributed delay model (ARDL) and the paired Granger causality test. Annual time series data was also used by Agboola and Bekun [22]. Specifically, from 1981-2014. The data was used to determine the stationarity properties of the considered variables. Tallman and Zaman [23] use a comparison of time series prediction models with the aggregated forecast and standard Phillips curve prediction models to refine their generation of aggregate inflation forecasts. Lopéz-Peréz [24] is the latest example of using time series; here it is used to examine unobservable individual heterogeneity among predictors, although true, in panel data, the Survey of Professional Forecasters dataset.

Correlation analysis, simple regression and time series regression seem to be the most suitable methods for obtaining answers to the research questions.

3 Data and methods

The data will be obtained from the MLSA website of the Ministry of Labor and Social Affairs of the Czech Republic [25]. It will be entered into the table in MS Excel so that in column A there will be time data, in column B the relevant data on unemployment and in column C the relevant data on inflation. This paper will further be based on this table. The values of unemployment and inflation are entered into Chart 1, which shows their development in the period from 01.01.2000 to 28.02.2021.
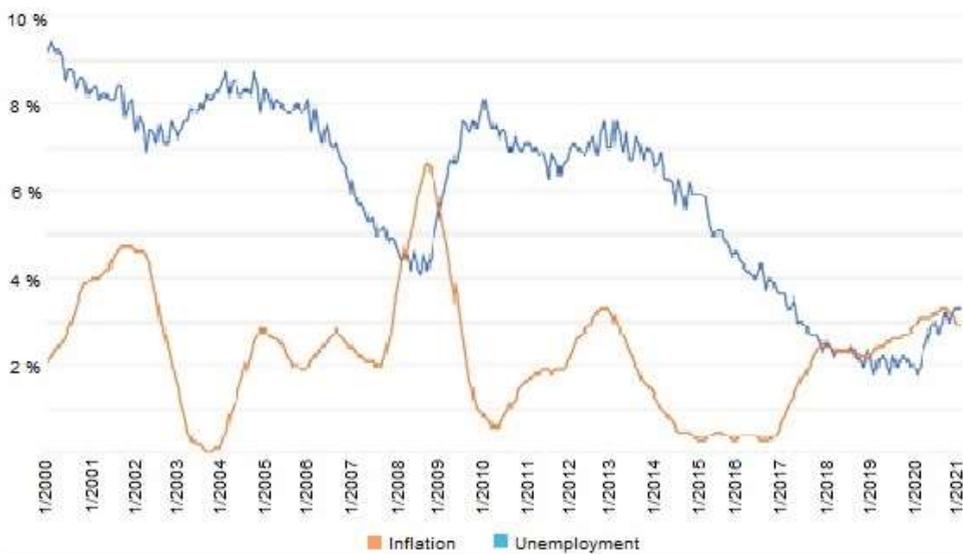

Fig. 1. Unemployment and inflation 2000-2021
Source: MLSA [25].

Next, a scatter plot will be created using regression analysis, and the most accurate trend line will be determined, according to the value of the reliability coefficient (R^2). Specifically, the linear trend line with the value $R^2 = 0.69$ work best here. And this line is a Phillips curve for the Czech Republic. This is then compared with a short-term Phillips curve. This will provide answers to the first two research questions. We decided to answer the third research question using time series. Thus, in the program Statistica in version 13.0 from the company TIBCO, through advanced methods, time series, unemployment is selected as a variable and time series alignment is processed. We insert the resulting table into MS Excel again. We will do the same with the variable inflation. We assign the result to the correct date, in our own columns for prediction. We then insert all values from 2000 to 2025 into a line chart, which will be extended by prediction up to 2025.

Next, we create a chart depicting the development of the Phillips curve in the future up to 2025. The values on which the graph is based are rounded to two decimal places. The graph will be made by the same method as the Phillips curve based on already known values, namely regression analysis and trend line.

4 Results

Using regression analysis, we found that the shape of the Phillips curve for the Czech Republic looks like this in the given time period (Figure 2).
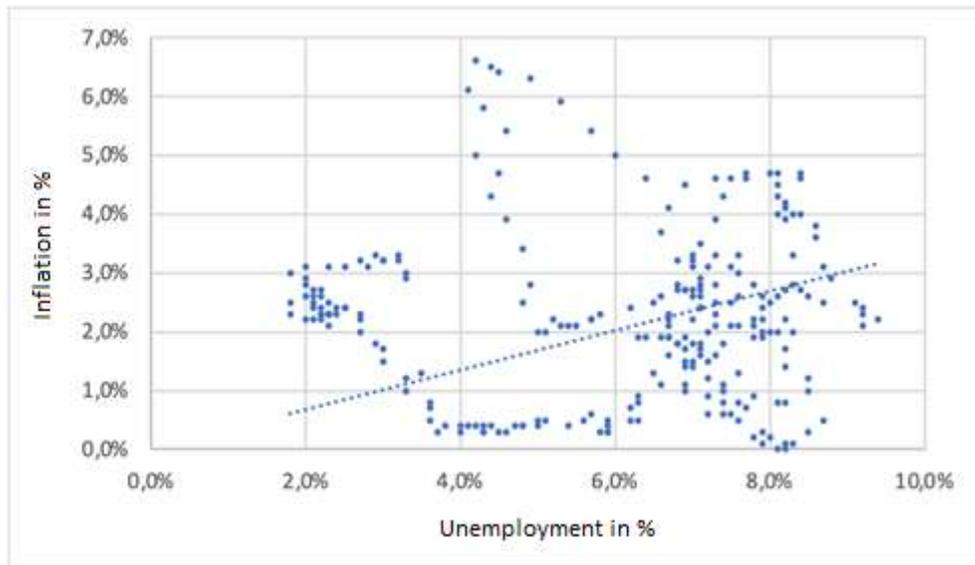
Fig. 2. Philips curve of the Czech Republic
Source: Own processing.

The reliability coefficient for this curve corresponds to $R2 = 0.6359$, $y = 3355x$.
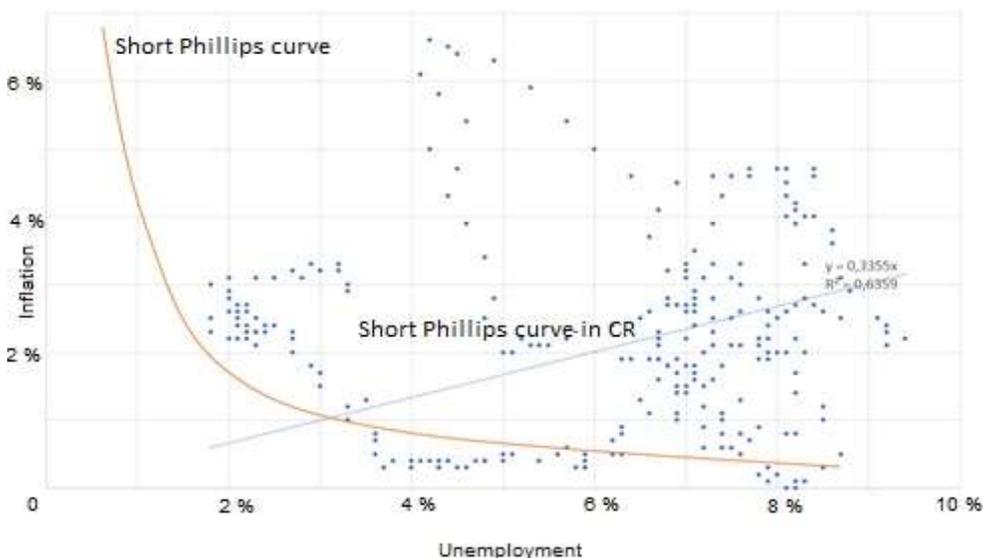To compare the two curves, we use the already created graph and enter the Phillips curve
(Figure 3).

Fig. 3. Phillips curve of the Czech Republic and standard Phillips curve
Source: Own processing.

Therefore, I found out that these two curves do not match, the Phillips curve for the Czech
Republic has a completely different shape and slope than the traditional Phillips curve.

The aforementioned time series are used to predict the Phillips curve. We plotted the
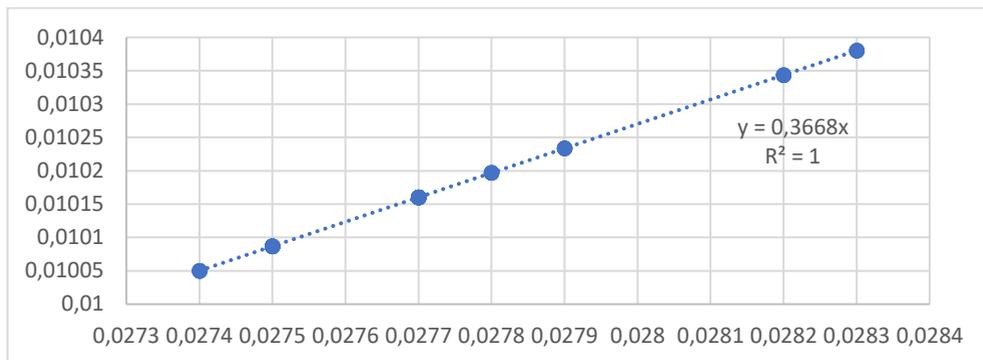results in Figure 4.

Fig. 4. Phillips curve prediction
Source: Own processing.

The result is practically an extension of the original Phillips curve. Thus, the Phillips curve for the Czech Republic will continue to move away from the short-term Phillips curve. Its slope and position in the chart will move further from the prediction of the short-term Phillips curve. Furthermore, the reliability coefficient for this curve is higher than for the curve based on historical data. We also used the line chart in Figure 5, which was created by combining already known data and predictions up to 2025. According to the examined prediction, it is assumed that inflation and unemployment will stabilize in the next five years.
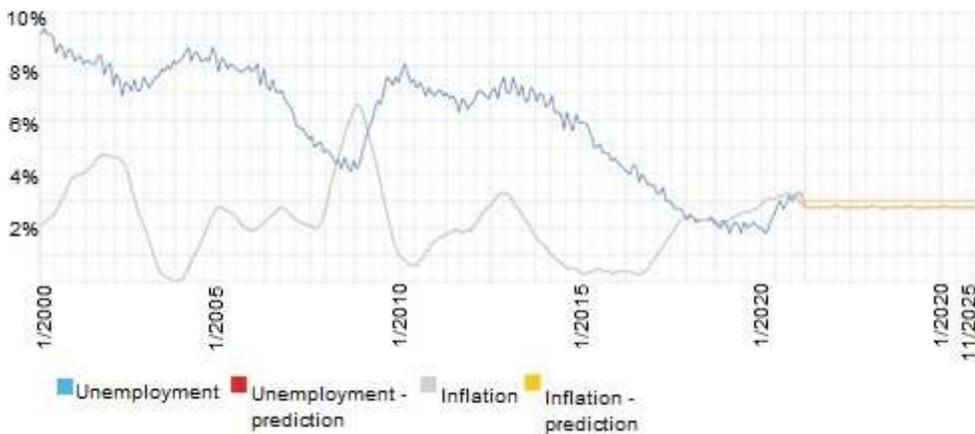

Fig. 5. Prediction of unemployment and inflation in the Czech Republic
Source: Own processing.

5 Discussion

Based on the results, we are able to answer the research questions which we set out.

So, what is the shape of the Phillips curve from 2000 to the present? The short-term Phillips curve appears to have a decreasing tendency reminiscent of an exponential decline. However, such a tendency did not appear in the Phillips curve for the Czech Republic. The Phillips curve for the Czech Republic has an upward trend, and moreover, the typical shape of the curve has not been shown here. For the Czech Republic, it came out almost practically flat. This may be due to the fact that no methods were used for our work that would show a more accurate result, however, the difference in the original and in my curve is so drastic that even with a more accurate method we would come to the same conclusion that the curves do

not match. The credibility of the method of regression analysis is also evidenced by its use in the work of Barnichon and Masters [11], or Álvarez and Correa-Lopéz [15].

How does the shape of the Phillips curve in the Czech Republic differ from the short-term Phillips curve? As we have already mentioned, they really are very different. There may even be doubts about the validity of the original Phillips curve, but this has already been confirmed by several studies. For example, Onifade, Asongu and Bekun [9] add in their research that the Phillips curve was valid for their use. It should therefore be about the differences in our and foreign economies that make such a drastic difference.

What development of the Phillips curve can be expected in the Czech Republic up to 2025? Based on the results, the answer is that a further rise of the Phillips curve can be expected in the future. This will continue to move away from the original curve. This conclusion can be drawn from Figure 4, but also from Figure 5 where it can be seen how both quantities approach each other more and more over time and therefore their correlation increases and therefore it is logical that the curve will have an upward trend. The validity of the results obtained by this method proves the use and accuracy of the results in the works of Lopéz-Peréz [24], or Agboola and Bekun [22].

5 Conclusion

The aim of the paper was to determine the shape of the Phillips curve for the Czech Republic in the period from 2000 to the present and to compare its shape with the shape of the original Phillips curve.

The shape of the Phillips curve was determined by verified methods. We came to the surprising conclusion that the original short-term Phillips curve is unusable in the case of the Czech Republic because the curve based on domestic data is different and has an increasing tendency, and from the prediction it can be concluded that it will have this tendency in the future. That is, the relationship between unemployment and inflation will strengthen. Furthermore, the effectiveness of the methods was confirmed to some extent, but a more efficient method could be chosen for the prediction. While regression analysis was evaluated as a sufficiently accurate method.

It would therefore be appropriate to ask how economic development differs in the Czech Republic and in other countries of the world. In the same way, other questions arise, which unfortunately cannot be answered from the given results. How is it possible that the investigated curves are so different? Is it possible for national economies to have such different unemployment and inflation rates? It is therefore appropriate to propose follow-up research examining the relationship between unemployment and inflation in other countries of the European Union, or to include in the research even more distant countries for greater relevance of the results. We can also recommend the use of a more accurate method for predicting inflation, if such a prediction needs to be made. This is how research limits can be defined.

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