

Relationships between Inflation and Unemployment in the United States, Japan and Germany during the Economic Crisis Caused by the COVID-19 Pandemic

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Abstract

The aim of the article is to clarify the controversies surrounding the relationship between inflation and unemployment in the three most economically significant countries in the world (apart from China), namely the United States, Japan, and Germany, during the coronavirus pandemic (from January 2020 to February 2022). The pandemic has had various adverse effects worldwide, including a severe economic crisis lasting from the first quarter of 2020 to the end of the first quarter of 2021. The primary causes of this crisis include declines in aggregate supply due to lockdowns in many sectors of the economy, particularly the service sector. A decrease in aggregate supply should cause not only an increase in unemployment but also an increase in inflation. The article, therefore, hypothesises that the relationships between unemployment and inflation in the countries studied during the above period were unidirectional. To verify this hypothesis, two basic research methods were used: analysis of correlation coefficients between the variables mentioned above and the shape of Phillips curves. Ultimately, the hypothesis was rejected because inflation during this period showed a decreasing tendency (mainly due to a significant drop in commodity prices). The article extends research presented in the literature before 2020, offering additional value by examining the period of the pandemic which precipitated an economic crisis. Future analysis should be expanded to include more variables (including the output gap) in line with the New Keynesian Phillips Curve.



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Introduction

The complexity of mechanisms that govern the economy makes fundamental macro-economic categories, such as inflation and unemployment, interdependent. There are conflicting economic goals since the aggregate demand that stimulates policy, and that is aimed at reducing unemployment may cause increased inflation. In turn, if the aggregate demand-suppressing policy is carried out to curb inflation, it may result in increased unemployment. The article aims to explain controversies surrounding the relationships between the above-mentioned variables in the three economically most important countries in the world, excluding China, i.e. the United States, Japan and Germany, during the economic crisis caused by the COVID-19 pandemic (from January 2020 to March 2021¹).

The study consists of this introduction, two main parts and a summary. The first main part describes relationships between inflation and unemployment based on theories and research connected primarily with different types of the Phillips curve. The second part presents a statistical illustration of inflation and unemployment rates, as well as correlation coefficients between the variables and shapes of Phillips curves in the studied countries from the 1st quarter of 2020 to the 1st quarter of 2021. On this basis, we attempt to verify the hypothesis that Phillips curves were positively sloped (meaning that increased unemployment would be accompanied by increased inflation) in the period due to supply restrictions caused by lockdowns. The deliberations are recapitulated in a summary containing final conclusions.

Relationships between inflation and unemployment in the light of different versions of the Phillips curve

The first person to analyse the relationships between inflation and unemployment was Irving Fisher, the renowned economist, who observed a negative correlation between the two variables (as early as the 1920s). More specifically, he found a positive correlation between the rate of American dollar value changes and unemployment. According to Fisher, business owners view inflation positively as their revenues increase proportionally to the rising prices. Meanwhile, their expenditures grow more slowly

¹ Although the COVID-19 pandemic continued beyond this date, it is conventionally accepted that the economic crisis finished in the 1st quarter of 2021, which will be discussed further in the article as well.

because they are based on more long-term contracts. Consequently, profits rise during inflation, thus stimulating employment, which reduces unemployment (Fisher 1926, pp. 786–788).

In terms of economic theory, the Phillips curve is the most widely recognised concept to explain the relationships between inflation and unemployment. It takes its name from New Zealand economist A.W. Phillips, who explored relationships between nominal wage changes and unemployment rather than those between changing prices and unemployment. His analysis concerned Great Britain from 1861 to 1957. Assuming that the nominal wage growth rate may be regarded as a type of inflation (wage inflation), conclusions similar to those reached by Fisher can be drawn. The observed negative relationship between the analysed values may be explained as follows: When unemployment is low, employees can be expected to demand fast wage rises while employers will strive to accommodate those demands. What is more, every firm will try to offer above-average wages to attract the best-qualified labour force. On the other hand, when unemployment is high, employees will have a weaker bargaining position in the labour market, hence the wage increase rate will be low (Phillips 1958, p. 283). In Phillips's opinion, however, the relationship between wage increases and unemployment is non-linear because employees are very unwilling to accept wage reductions even in times of falling employment, which means that Phillips accepts Keynesian downward rigidity of wages. As a result, declining unemployment is accompanied by a relatively quick wage rise, while increasing unemployment is accompanied by only a slight reduction in the wage increase rate (Phillips 1969, pp. 277–278).

Lipsey played a prominent role in transforming the Phillips curve into a coherent theoretical construct. He offered a more in-depth understanding of the statistical relationship found by Phillips. He did it by positing the occurrence of: (1) A unidirectional relationship between surplus demand for the labour force and the nominal wage rise rate and (2) a multidirectional relationship between that surplus and the unemployment rate (Belka 1986, pp. 202–203; Snowdon, Vane, and Wynarczyk 1998, pp. 159–160). Later on, the modified Phillips curve, which illustrates relationships between the unemployment rate and the conventional inflation rate, indicating the general price increase rate, became more popular. Friedman and Phelps, among others, analysed associations between the variables.

Friedman's deliberations show that he partly accepted Fisher's view on the negative relationship between inflation and unemployment. Thus, applying expansionary fiscal and/or monetary policy may bring about desired effects in the form of reduced unemployment. However, this is primarily achievable in the short run, when the increased money supply and income have a more substantial impact on output and employment growth than on increased prices (following the Keynesian assumption of unused production capacity in the economy).

Nevertheless, this effectiveness is mainly due to the fact that enterprises and their employees have been “misled” into treating changes in nominal values as if they were real. That may be the case when they make their economic decisions according to the adaptive expectations hypothesis. Thus, after a period of stable prices, workers may interpret nominal wage rises as real, which increases the cost-effectiveness of work and the supply of the labour force. Therefore, unemployment would fall below its natural rate (Friedman 1977).

Phelps also drew attention to a possible substitution between unemployment and inflation. His analyses showed that inflation depends on, among other things, the degree of production capacity use. Only when the economy manufactures at full capacity will the real inflation rate equal the expected inflation rate. If the national income produced exceeds the potential income, the current inflation rate will exceed the expected inflation rate. On the other hand, unused production capacity will lead to the opposite situation, i.e., the real inflation rate will be lower than the expected one (Phelps 1967, pp. 261–263). Considering that unemployment is also dependent on the extent of production capacity used (it is higher than natural if there is unused production capacity), Phelps’ analyses showed that the relationship between the studied variables would also be reversed (i.e. higher unemployment will correspond to lower inflation).

In the 1970s, Lucas, as well as Sargent and Wallace, drew attention to a possible reverse relationship between unemployment and inflation, but solely under specific conditions. Lucas posited that positive deviations of current real wages from their “normal” increase rate and deviations of prices from their perceived “normal” trend have a positive effect on labour supply and output (Lucas Jr. and Rapping 1969, p. 747). This is because the latter factor contributes to increasing “information noise”, which, in turn, makes it more difficult for economic subjects to differentiate general from relative price increases (Lucas Jr. 1973, p. 327). Both employers and employees acquire information about the prices of goods they produce or increases in wages offered to them faster than information about general price rises. Employers may misinterpret inflation as an increase in the relative price of a good offered for sale. Consequently, business owners may increase supply, leading to a rise in aggregate output beyond its potential volume. This scenario becomes plausible, especially when employees in the discussed model of misperceptions also increase labour supply, initially considering wage rises to be real. However, such a situation may occur only until economic subjects remain “misled”, thinking that rises in prices of offered goods and wages exceed inflation (Lucas Jr. 1973, p. 333).

In turn, Sargent and Wallace’s concept shows that a price rise may be accompanied by real national income growth and unemployment reduction. However, this will happen only in the event of an unexpected monetary “surprise” in the form of a higher-than-expected money supply increase rate. Although a growth in money supply will be “embedded”

in economic entities' predictions, assuming their rational expectations, decision-makers may increase the money supply by a greater percent than in previous periods (Sargent and Wallace 1975, p. 243). That additional, unexpected expansion will then contribute not only to a price rise but also to increased output and employment (Snowdon, Vane, and Wynarczyk 1998, p. 212).

In more contemporary analyses, possible negative relationships between inflation and unemployment are typically explained by the "grease" effect, i.e., inflation rises have positive effects on the labour market in low inflation conditions. It may be connected with the optimistic moods of business owners. The principal factor that makes the grease effect work is the downward rigidity of nominal wages, which allows real prices to decrease only when inflation co-occurs with the money illusion of employees (Groshen and Schweizer 1997, pp. 1–4). A real wage fall that contributes to decreased production costs may then result in increased output and employment.

Prices are procyclical in all the above-mentioned models. As unemployment is a countercyclical variable, relationships between unemployment and inflation are multidirectional. While they move along the Phillips curve, decision-makers may choose a combination of unemployment and inflation, which will involve the lowest costs of those phenomena from the social and economic point of view (Niskanen 2002, p. 193). However, the choice of an optimum combination is always painful, i.e., lower unemployment at the cost of higher inflation or lower inflation at the expense of higher unemployment (Belka 1986, pp. 204–205). Thus, it largely depends on the priorities set by decision-makers.

The possible substitution between the two values resulting from the modified Phillips curve has been proven by economic reality. Therefore, in the 1960s and early 1970s, the negatively sloped Phillips curve gained immense popularity, becoming the basis of many countries' economic policies. In the 1970s, however, a then-surprising phenomenon of stagflation occurred (Niskanen 2002, p. 194). Consequently, the notion that the negatively sloped Phillips curve may accurately explain the described processes only in the short run, and even that this is dependent on economic entities' incorrect predictions about inflation, started to play an increasingly important role (as asserted by Friedman, Lucas, Sargent and Wallace). Subsequently, the long-run vertical Phillips curve appeared in the economic discourse, indicating a lack of relationship between unemployment and inflation. Phillips himself claimed that the trade-off between the wage increase rate and the unemployment rate would not apply to periods characterised by quickly rising prices of imported goods (Phillips 1969, pp. 296–297).

A little later, Samuelson and Solow (1960, p. 190) drew attention to the occurrence of cost-push inflation while also noting that unemployment may be structural. That type of unemployment is not dependent on economic fluctuations; hence, no substitution would occur between unemployment and inflation either.

In turn, as already mentioned, according to Friedman, unemployment and inflation substitution are possible. However, it may principally appear in the short run when economic entities operate in accordance with the adaptive expectations hypothesis. However, increased money supply and, consequently, increased total demand result in price rises after some time. At a certain point, the rises start to be considered in calculations by employees who will ultimately realise that their real wages have not increased despite nominal wage rises. As a result, some employees will give up their jobs, reducing the labour supply. Thus, unemployment will return to its natural rate (Friedman 1968, pp. 8–12). A similar course of events can also be observed in models by Lucas, as well as Sargent and Wallace. The occurrence of both “information noise” and “money surprise” is doubtful (or at least rare) in the economic reality.

Neo-Keynesian models of the Phillips curve also point to somewhat weak relationships between inflation, economic fluctuations and unemployment, highlighting the fact that prices do not often change, hence their limited relationship with phases of the economic cycle. For example, the near-rational model by Akerlof, Dickens, and Perry posited that low inflation is commonly ignored by enterprises, which do not consider that in setting the prices of produced goods. Their behaviour is similar with respect to wages since costs of frequent price and wage changes at low inflation could exceed the corresponding revenues. Therefore, wages and prices in enterprises fall in real terms (Akerlof, Dickens, and Perry 2000, pp. 20–23, 42–44).

Due to rigidities assumed in neo-Keynesian models, the models typically accept that firms determine the prices of goods they produce for relatively sustained periods. Along with deferred price-change decisions, the models often posit that price changes do not occur in response to any kind of changes in demand or costs, but only upon crossing a certain threshold (Roberts 1995, p. 976). Thus, relationships between prices and unemployment are also slightly rigid.

Although the negatively sloped and vertical Phillips curves had their rightful place in the history of economics, the Phillips curve may also be positively sloped in economic reality. This arises from the very definition of stagflation, as the term denotes a simultaneous rise in both unemployment and inflation (Niskanen 2002, p. 194). Hence, relationships between unemployment and inflation would be unidirectional, and the Phillips curve would be positively sloped. That may be the case when cost-push rather than demand-pull inflation occurs, as pointed out by Samuelson and Solow as far back as 1960. In such a case, an increase in costs may contribute not only to a rise in prices but also to a fall in employment in enterprises (Samuelson and Solow 1960, pp. 180–182). A rise in costs may also lead to a fall in aggregate supply. That, in turn, contributes to an even faster rise in prices, *ceteris paribus*.

On the other hand, a growth in aggregate supply, *ceteris paribus*, would cause an increase in output and employment and a decrease in unemployment and inflation.

In that context, the state may influence not only the demand side but also the supply side of the economy in the long run. Growth in aggregate supply may be affected by increasing production capacity as a result of increasing the volume of economic resources and technological progress. That can be achieved in the long run thanks to spending more on education and research and development (R&D), as well as by introducing more stable tax laws that offer tax reliefs for new business owners and a pro-family policy that increases the future volume of the labour force. Low unemployment could then be accompanied by low inflation. This situation would be possible if enterprises curbed wage rises while simultaneously increasing productivity. Thus, they would be able to boost employment without raising prices (Levy 2001, p. 282).

On the other hand, bad macroeconomic policy, manifested in the long run by, among others, a failure to promote R&D or unstable and complicated laws with high taxes, could decrease aggregate supply. Consequently, both unemployment and inflation would probably rise, even if the central bank increased money supply.

In more contemporary analyses, representatives of the real business cycle school referred to the concept of cost-push inflation and changes in prices due to changes in aggregate supply. In their opinion, the price level is mainly connected with the supply side of the economy. Therefore, it principally depends on production capacity and supply shocks rather than on aggregate demand. According to that approach, prices are anticyclical, and inflation results from a negative supply shock. The negative shock may be caused by different factors, which may include adverse weather conditions, wars, political coups and social unrest, significant rises in raw material prices, and natural catastrophes (Snowdon, Vane, and Wynarczyk 1998, pp. 256–277). Until 2020, the last category had seemed to primarily include earthquakes, droughts and floods. However, the COVID–19 pandemic may undoubtedly be considered a kind of natural catastrophe. It caused a negative supply shock since lockdowns led to the closure of many enterprises (mainly in the service sector) for some time. That might suggest that prices should be anticyclical during an economic crisis caused by a pandemic.

Apart from isolated theories, the price level is typically determined by both demand and supply factors in economic reality. Either may prevail in various periods. Moreover, in certain cases, categorising inflation as demand-pull or cost-push may solely depend on what period is chosen as a base for analysis. The inflation process entails a series of dynamic interactions in which consecutive impulses result in subsequent impulses leading to new ones and so forth (Żukowski 1997, pp. 216–217).

During an economic crisis, when both supply and demand fall, the net effect on inflation is uncertain. It depends on which of the falls is more significant: If demand decreases more than supply (inflation or even the price level will fall) or vice versa (inflation will rise). If automatic stabilisers act during a crisis, aggregate demand usually declines more slowly than aggregate supply. Thus, prices should ultimately rise, although to a lesser extent than in an economic boom. However, if aggregate supply is considered

likely to fall significantly, as it did during the COVID–19 pandemic, due to freezing a large part of the economy unconnected with the lack of demand, inflation, or at least the price level, should continue to rise, as inflation is anticyclical. This effect was intensified by increases in aggregate demand in periods between pandemic waves when the unfreezing of economies took place. On the other hand, unemployment is traditionally considered an anticyclical variable, hence it should be expected to rise during an economic crisis. Taking the above analysis into account, in the next section, we verify the hypothesis that Phillips curves were positively sloped due to supply restrictions caused by lockdowns.

Relationships between inflation and unemployment during the economic crisis caused by the COVID–19 pandemic

The COVID–19 pandemic caused a series of adverse consequences in the world, including a grave economic crisis. The analysis of relationships between unemployment and inflation during the crisis concerns three of the four largest economies in the world in terms of their produced nominal GDP, i.e. the United States, Japan and Germany (see Table 1). They are among the group of developed countries, also in terms of GDP per capita. Despite being one of the most economically important countries in the world, China was excluded from the study since it had a different economic system than the other countries for most of the period. Moreover, it had lower GDP per capita.

Table 1. The economically most important countries in the world in terms of nominal GDP in 2021 (in USD trillions)

Position	Country	GDP (in bn USD)
1	United States	22.998
2	China	17.458
3	Japan	4.937
4	Germany	4.226
5	Great Britain	3.188
6	India	3.042
7	France	2.936
8	Italy	2.101
9	Canada	1.991
10	South Korea	1.799

Note: The countries analysed in the article are in bold.

Source: International Monetary Fund (2022).

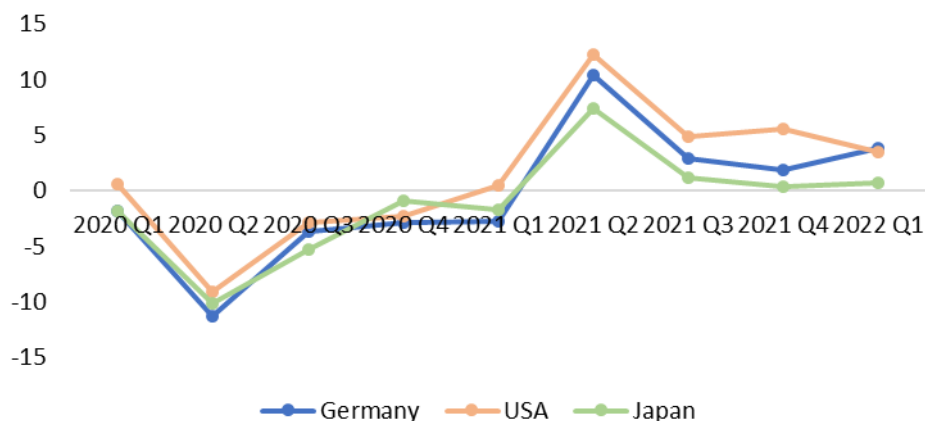


Figure 1. The real GDP growth rate (in per cent) in the United States, Japan and Germany from the 1st quarter of 2020 to the 1st quarter of 2022 (compared to the corresponding quarter of the preceding year)

Source: own work based on Organization for Economic Co-operation and Development (2022).

The data presented in Figure 1 indicates significant business cycle synchronisation in all three analysed countries. The economic crisis caused by the COVID–19 pandemic lasted from the 1st quarter of 2020 to the 1st quarter of 2021. However, a powerful rebound occurred as early as the 2nd quarter of 2021, which was partly due to real factors connected with the temporary easing of restrictions and partly to a low base effect.

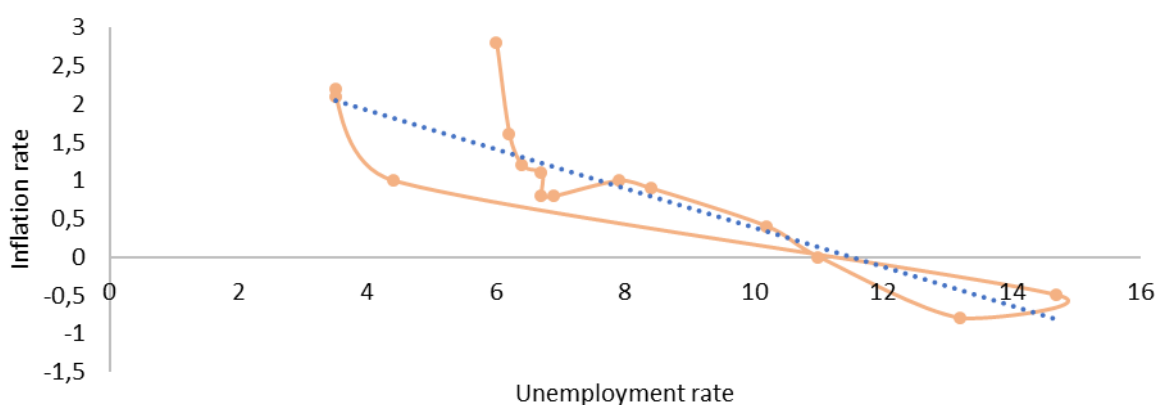
In order to present relationships between unemployment and inflation during the economic crisis (the 1st quarter of 2020 – the 1st quarter of 2021), linear correlation coefficients were computed between the variables. The calculations were also made considering lags of one variable relative to the other of 1, 2 and 3 months, respectively. The results are presented in Table 2, which shows that the coefficients were negative in the vast majority of cases for all three countries (except for three-month inflation lags in the United States and Germany, and three-month unemployment lags in the United States). Except for Japan, the coefficient values markedly decreased with increasing lags as a rule. Nevertheless, if lags are not considered, the coefficients may be considered to be surprisingly high: about -0.53 in Germany, about -0.64 in Japan (where an even higher value – about -0.78 – may be observed with three-month inflation lags) and about -0.87 in the United States. Therefore, the hypothesis about positive relationships between unemployment and inflation during the economic crisis caused by the pandemic should be categorically rejected for all three countries, in particular, the US and, to a slightly lesser extent, Japan and Germany.

Table 2. Unemployment rate (u) – inflation rate (i) correlation coefficients in the most economically important countries of the world from January 2020 to March 2021

Relationship	Japan	USA	Germany
$u_t - i_t$	-0.640	-0.866	-0.533
$u_t - i_{t+1}$	-0.693	-0.563	-0.382
$u_t - i_{t+2}$	-0.764	-0.028	-0.193
$u_t - i_{t+3}$	-0.778	0.271	0.016
$u_{t+1} - i_t$	-0.538	-0.729	-0.684
$u_{t+2} - i_t$	-0.332	-0.146	-0.796
$u_{t+3} - i_t$	-0.013	0.456	-0.768

Source: own calculations based on FRED Economic Data (2021); Eurostat (2024a; 2024b).

The graphical illustrations presented in Figures 2–4, which depict the relationships between unemployment and inflation in all three countries, confirm the negative slope of the Phillips curves.

**Figure 2.** Relationships between inflation and unemployment rates (in per cent) in the United States from January 2020 to March 2021 (linear trend)

Source: as for Table 2.

Furthermore, it can be observed that the unemployment rates showed an upward trend in all three countries during the economic crisis caused by the pandemic (see Figure 5). There was then a fall after the 2nd quarter of 2021. In Germany and Japan, however, there was only a slight rise during the economic crisis (until the 1st quarter of 2021) and a slight fall during the economic recovery (since the 2nd quarter of 2021). Thus, unemployment was a typical anticyclical variable in those countries in the studied period, although the changes were only minor. At the end of the crisis, unemployment was roughly 4% and 3% in Germany and Japan, respectively. At the end of the 1st quarter of 2022, it was lower by about 0.5 pp in both countries. The situation was slightly different in the United States, where unemployment was extremely sensitive to the occurrence

of the COVID-19 pandemic, reaching almost 15% as early as April 2020. As mandatory restrictions were subsequently relaxed and households and firms adapted to the pandemic, many sectors of the economy recovered rapidly, and unemployment fell (Federal Reserve System 2021). Still, the rate below 5% was reached as late as September 2021.

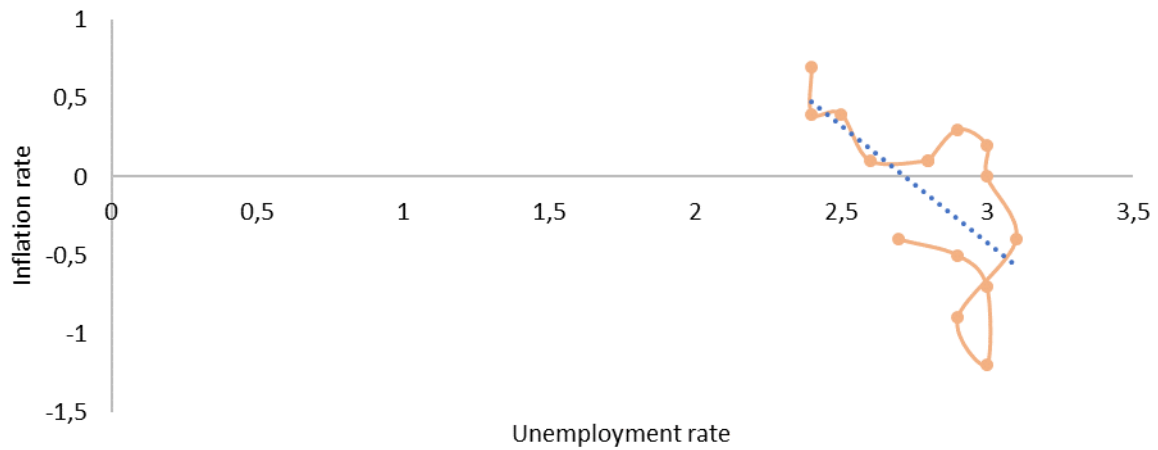


Figure 3. Relationships between inflation and unemployment rates (in per cent) in Japan from January 2020 to March 2021 (linear trend)

Source: as for Table 2.

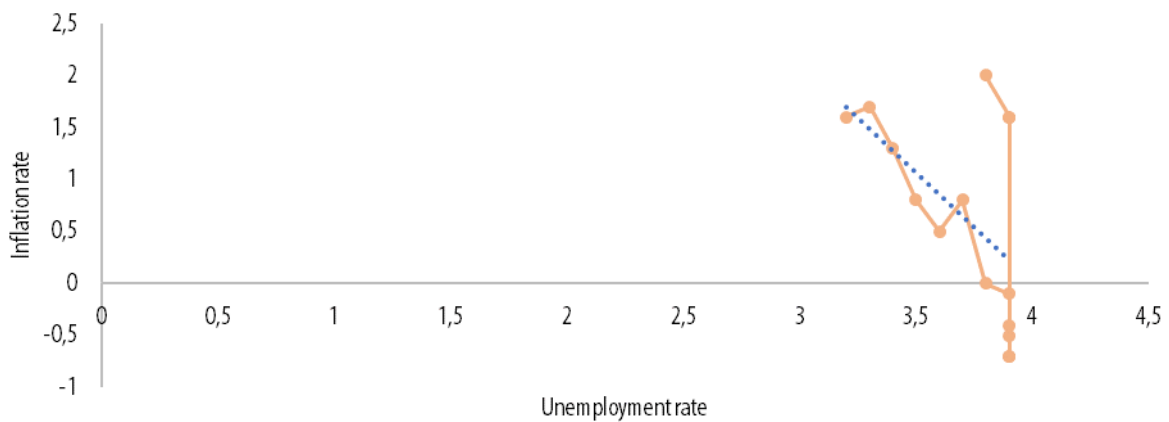


Figure 4. Relationships between inflation and unemployment rates (in per cent) in Germany from January 2020 to March 2021 (linear trend)

Source: as for Table 2.

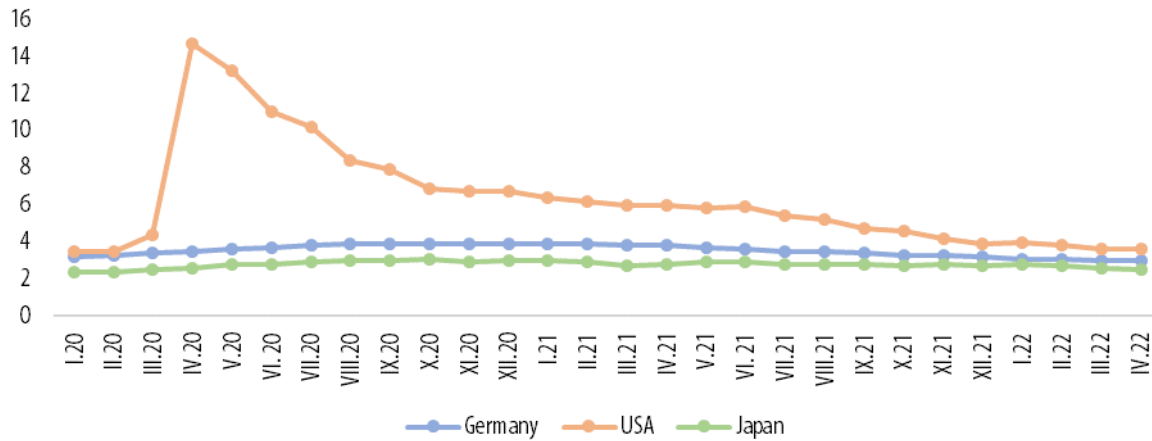


Figure 5. Unemployment rate (in per cent) in the United States, Japan and Germany from January 2020 to April 2022

Source: own work based on Eurostat (2024b).

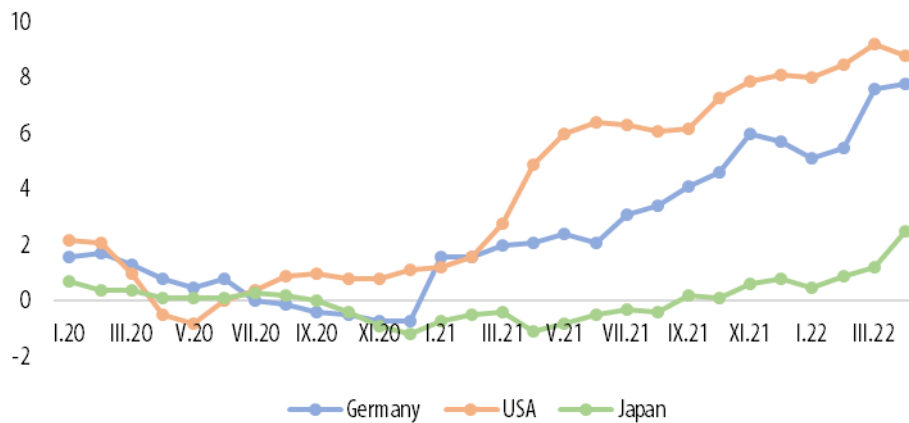


Figure 6. Inflation rate in the United States, Japan and Germany from January 2020 to April 2022

Source: own work based on FRED Economic Data (2021); Eurostat (2024c).

The data in Figure 6 show clear deflationary processes in 2020 (in the United States until May and in Germany and Japan until December). The fall in global inflation in the first months of the pandemic was due to a negative demand gap connected with a decline in aggregate demand and a general weakening of economic activity. This, in turn, was connected with a limited supply of goods and services in some branches of the economy (due to the lockdown) and the loss of income among owners who operated in those branches. Moreover, inflation also fell at that time as a result of a significant decrease in food, raw material and oil prices (roughly until September 2020). Thus, an upward trend in unemployment co-occurred with a downward trend in inflation for most of the economic crisis caused by the pandemic. The latter, to a large extent, resulted from extraordinary circumstances connected with a considerable fall in raw material prices (Bank of Japan 2020; European Central Bank 2020; Federal Reserve System 2020; 2021).

The most direct effect of the pandemic was a significant fall in aggregate supply (due to the closure of many economic branches), which necessarily led to increasing inflation in 2021 (see Figure 6). Other factors that pushed up inflation at that time may include an increase in aggregate demand in restriction easing periods (satisfying deferred demand) and an increase in operation costs on the part of enterprises. The latter was mainly associated with a significantly intensified “rebound” of energy and raw material prices (Bank of Japan 2022; European Central Bank 2022; Federal Reserve System 2022). For instance, the average price of oil worldwide in November 2021 was 80% higher than the year before, while coal was more than two and a half times more expensive and natural gas more than five times as expensive (National Bank of Poland 2021). Further increases took place in the first months of 2022. Again, they mostly concerned natural gas, which became more than twice as expensive between January and March. This was due to the Russian aggression against Ukraine, which led to a limited supply in most European countries. Agricultural raw materials also increased in price due to the limited supply from Ukraine (National Bank of Poland 2022).

Table 3. Unemployment rate (u) – inflation rate (i) correlation coefficients in the most economically important countries of the world from January 2020 to April 2022

Relationship	Japan	USA	Germany
$u_t - i_t$	-0.575	-0.689	-0.815
$u_t - i_{t+1}$	-0.493	-0.638	-0.773
$u_t - i_{t+2}$	-0.464	-0.541	-0.676
$u_t - i_{t+3}$	-0.404	-0.483	-0.550
$u_{t+1} - i_t$	-0.617	-0.711	-0.902
$u_{t+2} - i_t$	-0.443	-0.672	-0.951
$u_{t+3} - i_t$	-0.218	-0.618	-0.956

Source: as for Table 2.

It stems from the above analysis that a reversal of the situation was observed in the world economy in 2021 as the end of the crisis made the labour market situation improve and unemployment fall. In turn, inflation showed a strong upward trend. Thus, relationships between the variables remained multidirectional (negative). Therefore, extending the study period by subsequent months, in which the COVID-19 pandemic was still present but the economic crisis was already over, would not change the above conclusions, resulting in the rejection of the hypothesis. What is more, Table 3 shows that correlations between the variables would be even stronger in some variants. This refers mainly to Germany, where, with 2- and 3-month unemployment lags, negative coefficients exceeded -0.95 .

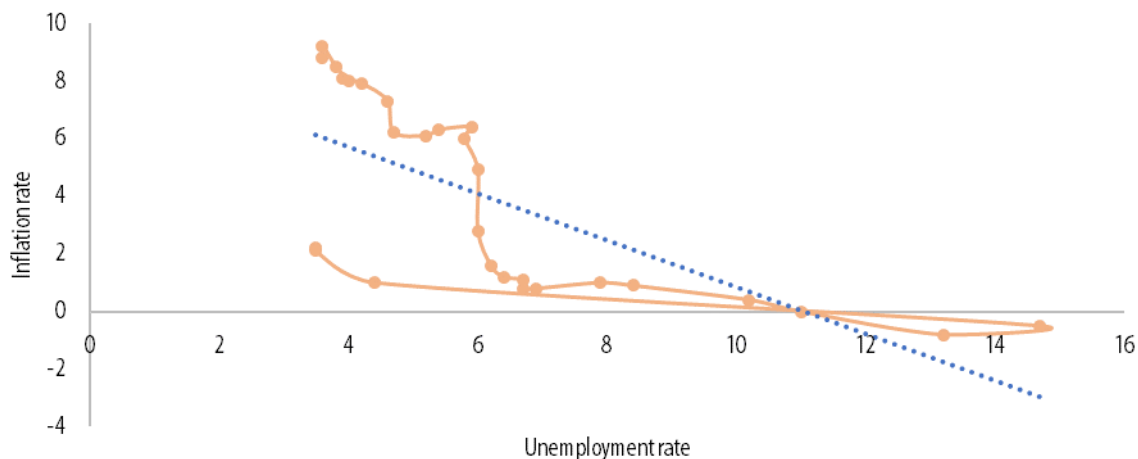


Figure 7. Relationships between inflation and unemployment rates (in per cent) in the United States from January 2020 to April 2022 (linear trend)

Source: as for Table 2.

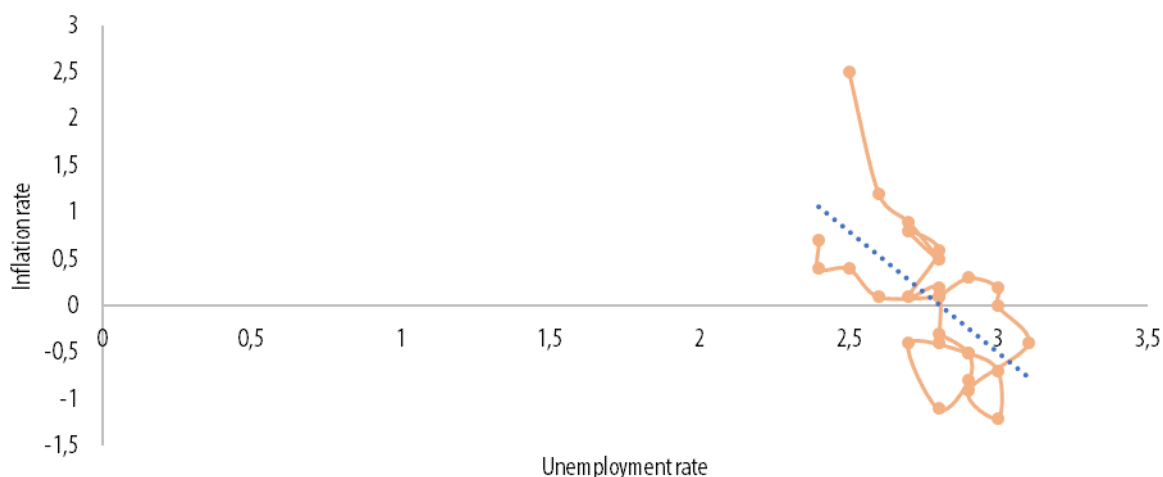


Figure 8. Relationships between inflation and unemployment rates (in per cent) in Japan from January 2020 to April 2022 (linear trend)

Source: as for Table 2.

In the period extended beyond the economic crisis, trend slopes of the curves constructed on the pattern of the Phillips curve were also clearly negative (see Figures 7–9). Nonetheless, unemployment and inflation substitution (as an attempt at choosing the lesser evil) would currently be impossible by applying traditional macroeconomic policy instruments that impact aggregate demand, as was proposed until the first half of the 1970s, when the Phillips curves were also negatively sloped. This is because inflation is nowadays largely driven by cost-push factors. Thus, combatting inflation through contractionary fiscal and/or monetary policies could trigger inflation even more².

² Algebraic analyses of contemporary Phillips curves are based on additional exogenous variables that may affect inflation. The most commonly studied factors include expected inflation, inertia reflecting

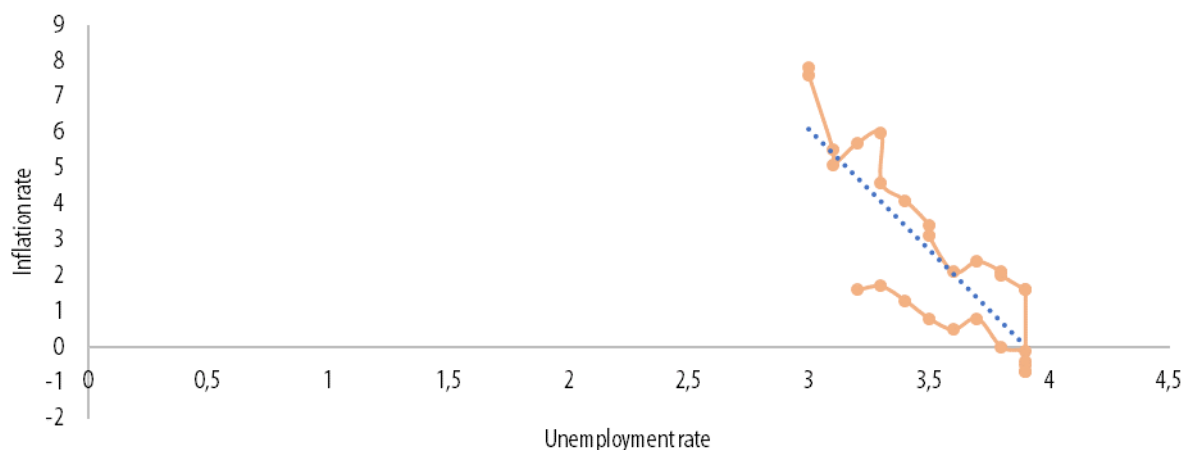


Figure 9. Relationships between inflation and unemployment rates (in per cent) in Germany from January 2020 to April 2022 (linear trend)

Source: as for Table 2.

Conclusion

The article extends research in the literature before 2020, offering additional value by examining the period of the COVID–19 pandemic, which precipitated an economic crisis. Our analysis allows us to draw several important conclusions:

1. Phillips curves, renowned in economic theory, were traditionally depicted as either negatively sloped (running down) or vertical. The former are known as short-run and the latter as long-run Phillips curves. However, the emergence of stagflation in the economic reality suggested the possibility of positively sloped (running up) curves. That may happen when an economic crisis is caused by decreased aggregate supply, which occurred as a result of consecutive lockdowns due to the COVID–19 restrictions. Therefore, we proposed a hypothesis that both unemployment and inflation should rise, and thus, relationships between the variables should be positive (unidirectional) in the United States, Japan and Germany during the economic crisis that lasted from the 1st quarter of 2020 to the end of the 1st quarter of 2021.
2. The analysis indicated that the hypothesis ought to be unequivocally rejected for all three analysed countries. Although the anticyclical unemployment rate variable showed an upward trend during the analysed period, the inflation rate trend was downward, mainly because of the significant fall in raw material prices. Thus, negatively

prior period inflation, the marginal cost measure (Nason and Smith 2008, pp. 363–365), output, expected output growth (Mankiw and Reis 2002, pp. 1299–1301), the output gap (Baranowski 2011, p. 320) and inflation caused by supply shocks (Eller and Gordon 2002, pp. 13–16). Analysis of those variables, however, goes beyond the scope of this article.

sloped Phillips curves were not entirely due to demand factors, which was highlighted in the original versions of the Phillips curve created in the 20th century.

3. Even extending the study period to include the time when real GDP started to recover despite the stringent COVID–19 pandemic restrictions still in force (from April 2021 to April 2022) would not result in the need to change the conclusions as the Phillips curves were still clearly running down (negatively sloped) in the studied countries from January 2020 to April 2022, despite unemployment showing a downward trend since the 2nd quarter of 2021. At the same time, however, strong reflationary processes were observed globally, mainly due to costs associated with a very strong upward rebound of raw material prices. Combatting cost-push inflation is particularly difficult, and thus, it is impossible to apply unemployment and inflation substitution in an attempt to choose the lesser evil, which was highlighted in the Phillips curve analyses in the 1970s.

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Zależności między inflacją a bezrobociem w Stanach Zjednoczonych, Japonii i Niemczech w czasie kryzysu gospodarczego wywołanego pandemią COVID-19

Celem artykułu jest wyjaśnienie kontrowersji dotyczących zależności między inflacją a bezrobociem w trzech najważniejszych pod względem ekonomicznym (oprócz Chin) państwach świata, tj. Stanach Zjednoczonych, Japonii i Niemczech, w czasie pandemii koronawirusa (od stycznia 2020 do lutego 2022 r.). Pandemia ta wywołała szereg niekorzystnych następstw na świecie, w tym poważny kryzys gospodarczy trwający od I kwartału 2020 do końca I kwartału 2021 r. Do podstawowych jego przyczyn należy zaliczyć spadki agregatywnej podaży spowodowane lockdownami w wielu gałęziach gospodarki, związanych przede wszystkim z sektorem usług. Spadek agregatywnej podaży powinien powodować nie tylko wzrost bezrobocia, ale także wzrost inflacji. W artykule postawiono w związku z tym hipotezę, że zależności między bezrobociem a inflacją w badanych krajach w ww. okresie były jednokierunkowe. W celu jej weryfikacji zastosowano dwie podstawowe metody badawcze: analizę współczynników korelacji między ww. zmiennymi oraz kształtu tzw. krzywych Phillipsa. Ostatecznie powyższą hipotezę odrzucono z uwagi na to, że inflacja w tym czasie wykazywała tendencję malejącą (przede wszystkim ze względu na znaczący spadek cen surowców). Artykuł jest uzupełnieniem badań prezentowanych w literaturze przedmiotu przed 2020 r., a jego wartością dodaną jest badanie okresu pandemii, która spowodowała kryzys gospodarczy. W przyszłości analizę należałoby poszerzyć o większą liczbę zmiennych (w tym o lukę produkcyjną), zgodnie z New Keynesian Phillips Curve.

Słowa kluczowe: bezrobocie, inflacja, krzywa Phillipsa, kryzys gospodarczy, pandemia