e-ISSN: 2564-7458

SELÇUK ÜNİVERSİTESİ
SOSYAL BİLİMLER MESLEK YÜKSEKOKULU DERGİSİ

Yıl: 2024 Cilt: 27 Sayı: 1

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Unemployment-Inflation Relationship in Germany

Almanya'da İşsizlik-Enflasyon İlişkisi

Abdullah Miraç BÜKEY [*]
Murat KALKAN [**]

ABSTRACT

The Federal Republic of Germany has been one of the historically remarkable countries socially and economically. In this context, one of the outstanding issues is undoubtedly the correlation between unemployment and inflation, which is at the intersection of economy and social policy. Therefore, in the study, the unemployment-inflation trade-off in Germany was examined with the help of macroeconomic data in the context of the Modified/Original Phillips Curve, which explores the unemployment-inflation relationship. The empirical study method is time series analysis, and the monthly data set covers the period from January 1992 to April 2023. According to the study's findings, no causality relationship could be detected between unemployment and inflation variables in Germany in the period, neither in the long run nor in the short run. Therefore, it shows that the German economy does not have to put up with the inflation problem in the fight against unemployment and the unemployment problem in the battle against inflation. In this respect, it would be beneficial to thoroughly examine the German labour market structure and monetary policy strategy in the literature.

KEYWORDS

Germany, Unemployment, Inflation, Phillips Curve, Social Policy

ÖZ

Almanya Federal Cumhuriyeti sosyal ve ekonomik bakımdan tarihi olarak dikkate değer ülkelerden birisi olmuştur. Bu kapsamda dikkat çeken konulardan birisi de, hiç şüphesiz ekonomi ile sosyal politikanın kesişme noktasındaki, işsizlik ve enflasyon ilişkisi olmaktadır. Dolayısıyla da çalışmada işsizlik-enflasyon ilişkisini irdeleyen Modifiye Edilmiş/Orijinal Phillips Eğrisi bağlamında Almanya'da işsizlik-enflasyon değiş tokuşu makro iktisadi veriler yardımıyla incelenmiştir. Ampirik çalışmanın yöntemi zaman serisi analizi olup aylık veri seti Ocak 1992-Nisan 2023 dönemini kapsamaktadır. Çalışmanın bulgularına göre söz konusu dönem bazında Almanya'da işsizlik ve enflasyon değişkenleri arasında ne uzun dönemde ne de kısa dönemde herhangi bir nedensellik ilişkisi tespit edilememiştir. Dolayısıyla Almanya ekonomisinin işsizlikle mücadelede enflasyon sorununa, enflasyonla mücadelede ise işsizlik sorununa katlanılmak zorunda olmadığını göstermektedir. Bu açıdan Alman emek piyasası yapısının ve para politikası stratejisinin literatürde derinliğine incelenmesinde fayda görülmektedir.

ANAHTAR KELİMELER

Almanya, İşsizlik, Enflasyon, Phillips Eğrisi, Sosyal Politika

Makale Geliş Tarihi / Submission Date 23.12.2023	*Makale Kabul Tarihi / Date of Acceptance* 06.03.2024
Atıf	Bükey, A. M. ve Kalkan, M. (2024). Unemployment-Inflation Relationship in Germany. *Selçuk Üniversitesi Sosyal Bilimler Meslek Yüksekokulu Dergisi*, 27 (1), 106-118.

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INTRODUCTION: THE HISTORICAL COURSE OF UNEMPLOYMENT AND INFLATION IN GERMANY

Unemployment and inflation and the relationship between them are among the main issues that economic and social policies have dealt with for many years. In other words, whether there is a causal connection between unemployment and inflation variables is an ongoing debate. At this point, it is known that the subject has been handled from different aspects in developed and developing countries and continues to be discussed. The purpose of the study in your hand is to examine the connection between unemployment and inflation in terms of the Federal Republic of Germany, which is among the leading countries in terms of economic size in the world, based on the years after the East-West Germany unification. The unification of the two German states in 1990 was not just an event with political consequences. Beyond that, it means the integration of two different 'conceptions of the world', which brings with it many social and economic issues (Delican, 2022). To put it more clearly, the merger of East Germany, which was built based on a planned economy approach, with West Germany, which has a market economy concept, was complicated for both regions and integration problems would inevitably arise. Despite this, however, with the unification, the Social Market Economy was implemented by switching to a market economy in the new states (i.e. in the former East German regions). This situation brought some burdens, especially for West Germany, which constitutes the backbone of the 'new country', as well as for the whole country, significantly the increase in inflation and the rise in unemployment (Lampert, 1995), and naturally made reforms inevitable.

To better comprehend those above, looking at some historical background is vital. From this point of view, it is understood that the Federal Republic of Germany is an exemplary country with the economic miracle it created ten years following the Second World War, and this has been realised as a result of the positive developments experienced within the context of the Social Market Economy concept, especially in the macroeconomic field. In this context, when we look at the labour market in the country, it is seen that unemployment remained at deficient levels (2-3%) in the 1960s, and 'full employment' was achieved. It is known that labour is demanded by some countries, especially Yugoslavia and Türkiye (Kalkan, 2022). However, after the oil shocks in Germany, it is seen that the whole employment situation in the labour market has changed negatively, and the unemployment problem has started to increase and become chronic in the country. When the unification of the two German states in 1990 is added, it is clear that unemployment is among the most critical problems in Germany (see Table 1). In this respect, the post-merger period constituted the starting point in the study.

Table 1: Unemployment Indicators in Germany (1991-2022)

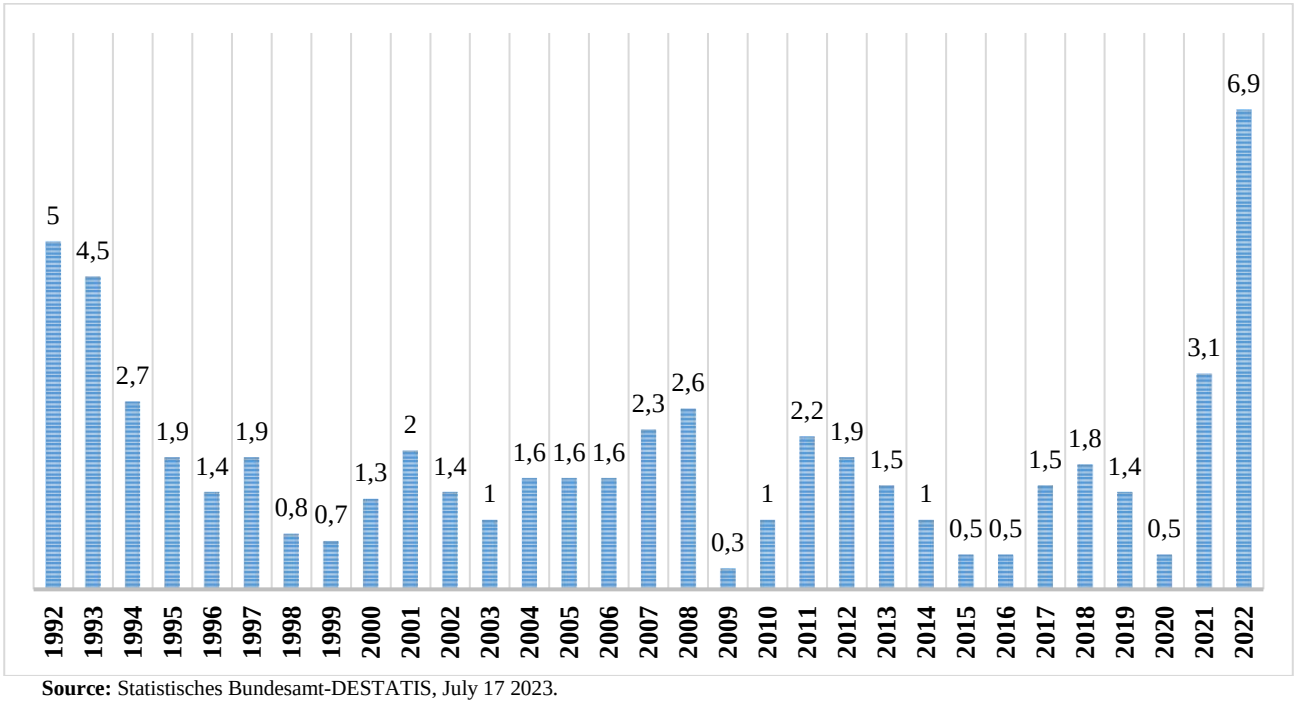
Year	Number of Unemployed (Person)			Unemployment Rate (%)		
	Total	West Germany	East Germany	Total	West Germany	East Germany
1991	2.602.203	1.596.457	1.005.745	7,3	6,2	10,2
1992	2.978.570	1.699.273	1.279.297	8,5	6,4	14,4
1993	3.419.141	2.149.465	1.269.676	9,8	8	15,4
1994	3.698.057	2.426.276	1.271.781	10,6	9	15,7
1995	3.611.921	2.427.083	1.184.838	10,4	9,1	14,8
1996	3.965.064	2.646.442	1.318.622	11,5	9,9	16,6
1997	4.384.456	2.870.021	1.514.435	12,7	10,8	19,1
1998	4.280.630	2.751.535	1.529.095	12,3	10,3	19,2
1999	4.100.499	2.604.720	1.495.779	11,7	9,6	18,7
2000	3.889.695	2.380.987	1.508.707	10,7	8,4	18,5
2001	3.852.564	2.320.500	1.532.064	10,3	8	18,8
2002	4.061.345	2.498.392	1.562.953	10,8	8,5	19,2
2003	4.376.795	2.753.181	1.623.614	11,6	9,3	20,1
2004	4.381.281	2.782.759	1.598.522	11,7	9,4	20,1
2005	4.860.909	3.246.755	1.614.154	13	11	20,6
2006	4.487.305	3.007.158	1.480.146	12	10,2	19,2
2007	3.760.586	2.475.528	1.285.058	10,1	8,3	16,7
2008	3.258.954	2.138.778	1.120.175	8,7	7,2	14,6
2009	3.414.992	2.314.215	1.100.777	9,1	7,8	14,5
2010	3.238.965	2.227.473	1.011.492	8,6	7,4	13,4

2011	2.976.488	2.026.545	949.943	7,9	6,7	12,6
2012	2.897.126	1.999.918	897.209	7,6	6,6	11,9
2013	2.950.338	2.080.342	869.995	7,7	6,7	11,6
2014	2.898.388	2.074.553	823.835	7,5	6,7	11
2015	2.794.664	2.020.503	774.162	7,1	6,4	10,3
2016	2.690.975	1.978.672	712.303	6,8	6,2	9,4
2017	2.532.837	1.894.294	638.543	6,3	5,8	8,4
2018	2.340.082	1.758.627	581.455	5,8	5,3	7,6
2019	2.266.720	1.723.059	543.661	5,5	5,1	7,1
2020	2.695.444	2.075.003	620.441	6,5	6,1	8,1
2021	2.613.489	2.006.132	607.357	6,3	5,9	7,9
2022	2.418.133	1.850.626	567.507	5,8	5,4	7,4

Source: Bundesagentur für Arbeit, 2023.

A series of social reforms (Hartz Reforms-Agenda 2010) were implemented in the country between 2002-2005 for unemployment, which started to be seen as an issue that needed to be resolved with the effect of East-West unification in Germany. These reforms have been necessary in two ways. First, as witnessed in Table 1, unemployment has decreased in Germany, except for cyclical situations such as the 2008 economic crisis and the COVID-19 pandemic. The second is that Germany, which is shown as a characteristic country in the social state approach (Kalkan, 2022), which means that social policies find a privileged place in the state organisation, the leading example of the conservative welfare state, the transformation in the social policy-social state approach, which has been and is continuing, has been triggered (Kalkan, 2020).

Figure 1. Annual Inflation Rates in Germany (1992-2022)



Source: Statistisches Bundesamt-DESTATIS, July 17 2023.

Looking at the course of inflation in Germany for the period after World War II, it is seen that the average inflation rate in Germany between 1950 and 2022 was approximately 2.4% per year. However, it is understood that inflation in Germany is affected by cyclical developments. When the inflation rates in Germany are examined, it is seen that the first years following World War II, as well as the 1st and 2nd Oil Crises, the unification of the two German states, the Covid-19 Pandemic and the Russia-Ukraine War in 2022, are important turning points. This causes inflation to be historically associated with recession in Germany; in other words, the increase in inflation rates heralds recession for Germany (Statistisches Bundesamt-DESTATIS, 10 July 2023). At this point, when we focus specifically on the data after the unification of the two German states, it is understood that inflation has not been a severe difficulty in Germany since the mid-1990s (Kitov, 2007). Still, as can be seen from Figure 1, it has been on an increasing trend in the last two years. Annual inflation in Germany reached 6.9% in 2022 (7.1% in 1973; 6.9% in 1974), almost the highest level of the last fifty years.

This indicates that energy prices have historically been the driving force of high inflation in Germany (Statistisches Bundesamt-DESTATIS, 10 July 2023).

After all these mentioned, the point that needs to be emphasised is the importance of this study. As can be seen from the literature review given below, the need for more current studies on the unemployment-inflation relationship in Germany is evident. Although it has been observed that unemployment has been under control and there has been no severe inflation problem in Germany for many years, these two problems may arise during crisis periods in Germany, as explained above and shown in Table 1 and Figure 1. In this regard, the Covid-19 pandemic is a current source of problems. In this respect, there is a clear need to evaluate the issue from the perspective of Germany, and in this study, unlike the literature, Germany is discussed separately.

In this direction, firstly, the course of annual unemployment and inflation indicators of East and West Germany in the post-1990 period is interpreted with the help of Table 1 and Figure 1. Then, after giving information about the theoretical background of the Phillips Curve, the empirical literature on the Phillips Curve will be examined. Afterwards, after providing information about the method and data set of the study, the unemployment-inflation relationship in Germany will be analysed with the help of a time series in the context of the Phillips Curve, using monthly data from January 1992 to April 2023.

1. THEORETICAL GROUND

The concept of the Phillips Curve historically dates back to the 1950s in the economics literature. In the study titled "The Relation Between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957" (Phillips, 1958) by Phillips, the connection between unemployment rates and nominal wage rates in the UK was examined through empirical findings. As the name of the study suggests, Phillips analysed whether the rate of change in unemployment statistically affects the change in nominal wages, taking the UK data from 1861-1957 as a reference. According to the analysis findings, the increase in the unemployment rate decreases the nominal wage change rate. In other words, a negative correlation was found among the two variables in the study (Phillips, 1958). The negative slope curve obtained by transferring the negative correlation between the unemployment rate and the percentage changes in the nominal wage to the coordinate plane is called the Original Phillips Curve in the literature (Motyovszki, 2013).

The unemployment rate-wage rate of change relationship in the original Phillips Curve (Bükey, 2023) has evolved into the change connection between the unemployment rate-general price level ratio in the modern version of the Phillips Curve. This change in the Phillips Curve is based on the perception that inflation is a cost-pull phenomenon in the period above. In the conjuncture where the unemployment rate is low, the general level of salaries tends to rise, and a negative and stable relationship emerges between unemployment and inflation since rising wages are a cost factor in production and have a triggering role in inflation (Samuelson & Solow, 1960).

2. LITERATURE REVIEW

It is a fact that many studies have been done for many years on the original Phillips Curve (Phillips, 1958), which deals with the nominal wage increase rate-unemployment relationship and its modified version of the unemployment-inflation relationship in the literature. It has been revealed that in some of these, the Phillips Curve is valid; in others, it is not (Akiş, 2022). When the works in this field are examined in the literature, it is seen that the research carried out independently for Germany is almost nonexistent, and it is seen that Germany is mainly examined in comparison with other countries. In this respect, in the literature review, the studies focusing on Germany and the studies carried out for different countries were examined, and these are summarised below by concentrating on the current ones.

Hsing (1989) examined the cogency of the Phillips Curve for six industrialised countries, including Germany, based on the 1964-1986 period. The regression analysis study concluded that the Phillips Curve was valid in these six countries between the years examined.

In the study of Kitov (2007), the potential links between inflation and unemployment in Germany were examined by regression analysis. A stable Phillips Curve was determined from the analysis based on the 1977-2006 period, but this relationship operates with a one-year lag. Accordingly, a one-unit upsurge in the inflation rate causes a 1.5 percentage point fall in the one-period lagged unemployment rate.

In the study published by Ormerod et al. in 2009, the unemployment-inflation relationship was examined for Germany, the US, and the UK using data between 1871 and 2009. As a result of the analyses made using the fuzzy clustering method, a consistent trade-off relationship between inflation and unemployment could not be determined in the short run.

In the study by Altay et al. (2011) investigating the connection between unemployment and inflation in G8 states, quarterly data between January 2000 and April 2009 and a panel data analysis method was used. In the study in which cointegration and causality test methods were used, it was determined that there was a connection between inflation and unemployment according to the cointegration test result. In contrast, according to the causality test result, the correlation was found to be from inflation to unemployment in the short run and, on the contrary direction, in the long run.

Nüß (2013) examined the empirical analysis of the inflation-unemployment relationship in Germany from 1970-2012. In this study, which uses cointegration, Dynamic Ordinary Least Squares Method (DOLS) and error correction model methods, it is determined that there is no negative correlation between inflation and unemployment in the short term, and it is emphasised that the Phillips Curve is an inappropriate tool for making political decisions in the short run.

Bayrak & Karaca (2013) inspected the cogency of the Phillips Curve in terms of the Turkish economy between 1970 and 2010 in their research. According to the study, which uses the least squares method with six-month data, it has been determined that the Phillips Curve analysis is not valid in the long term in the 40-year time interval in Türkiye. Still, there is a trade-off relationship between inflation and unemployment in the short term.

Bhattarai (2016) analysed the inflation-unemployment trade-off using panel data analysis for OECD countries as quarterly data covering 1990-2014. In the research, it has been determined that cointegration and Granger causality tests show that there are long-term relationships among unemployment-inflation variables in OECD economies. However, it has been stated that the Phillips Curve is not significant in some OECD countries, including Germany, and that solid labour unions pave the way for realising the inflation-unemployment relationship in this way. This study also emphasised that countries such as Germany, which made the labour market more flexible over time, significantly reduced unemployment rates.

Sancar Özkök and Atay Polat (2017) examined the causality relations between inflation and unemployment with panel data analysis, using quarterly data of G7 countries for the 1998-2016 period. According to the results of the causality test in the study, it is seen that there is a bidirectional causality relationship between both inflation and unemployment and unemployment to inflation. Therefore, according to the analysis made for the G7 countries, it has been revealed that the trade-off between inflation and unemployment is valid in the long run.

Shaari et al. (2018) examined the relationship between inflation and unemployment based on ten high-income countries from 1990-2014. As a result, panel causality analyses revealed a bidirectional causality between inflation and unemployment in the long and short term.

In their study, Korkmaz & Abdullazade (2020) focused on nine countries, including Germany and Türkiye, and examined the causality relationship between unemployment and inflation by applying a panel causality test to the data from 2009-2017. According to the Granger causality test, a one-way causality running from the inflation rate to the unemployment rate was determined in the study.

Alev et al. (2022) examined the relationship between inflation and unemployment in terms of Türkiye and G7 countries (Germany, USA, United Kingdom, Canada, France, Japan and Italy). In the study, which was analysed with the panel causality test based on the years 1991-2021, it was determined that there was a bidirectional causality relationship between inflation and unemployment throughout the panel, that is, causality from the inflation rate to the unemployment rate and from the unemployment rate to the inflation rate. This reveals that the Phillips Curve is also valid in developed countries.

Looking at the validity of the Phillips Curve in terms of G8 states, including Germany, İspir & Atılgan (2022) used the data between 1993 and 2020. It found a long-term relationship between unemployment and inflation with the cointegration test. The study, which examines the relationship between variables with panel causality analysis, discovered that the Phillips Curve is valid in G8 states and that there is a pivotal correlation between inflation and unemployment for Germany from these countries. This outcome is also by the study of Alev et al. (2022).

Buyrukoğlu & Altunakar (2022) examined the relationship between unemployment and inflation in Türkiye using the Engle-Granger cointegration test based on the monthly data available from May 2009 to November 2021. As a result of the analysis, it has been seen that there is a cointegration relationship between the variables, in line with the existence of a causal relationship between inflation and unemployment. The Phillips Curve is valid for the examined period in Türkiye, and a 1% increase in inflation provides a 2.6% decrease in unemployment.

Bozkaya (2023) wanted to measure whether the Phillips Curve validates in BRICS countries. Konya (2006), the second-generation causality test, was used in the study examining the relevant countries using 1997-2018

annual data. The study determined a unidirectional causality between unemployment and inflation, running from inflation to the unemployment rate.

As shown above, the Phillips Curve produces different results in terms of country and time in the studies in the literature. In other words, while the exchange relationship between inflation and unemployment is bidirectional and unidirectional in some countries, no causality relationship emerges in others. When the subject is approached from the perspective of studies focusing on Germany, it is seen that different results are obtained. For example, in the analyses made by Kitov (2007) based on the period between 1977 and 2006, it was revealed that the Phillips Curve operates with a 1-year delay, while Nüß (2013), who analysed the period between 1970 and 2012, found that there is no negative relationship in the short term.

3. METHOD

The correlation between unemployment and inflation rate variables discussed in the study will be examined in the context of the Phillips Curve.

In this direction, first of all, to avoid spurious regression, the variables will be subjected to unit root tests to test their stationarity. Within the scope of stationarity analysis, Phillips Perron (Phillips & Perron, 1988) and Lee and Strazicich (Lee ve Strazicich, 2003) unit root tests were preferred among various unit root tests. The existence of stationarity between the variables and whether there is a long-term relationship among the variables after determining the degrees of stationarity will be chosen using the Johansen cointegration test (Johansen & Juselius, 1990). In the case of a long-term relationship, the long-term coefficients will be estimated. Suppose a long-term relationship cannot be determined. In that case, the causality correlation among the variables, whether there is a reciprocal bidirectional correlation or a one-way relationship from any variable to the other or there is no relationship, will be analysed with the help of the Toda-Yamamoto causality test (Toda & Yamamoto, 1995).

In this context, two types of equations emerge for the empirical part of the study, based on the theoretical background of the Phillips Curve and the possibility of the causality relationship existing in both directions according to the mentioned method. These are:

$$Unemployment\ Rate = \beta_0 + \beta_1\ Inflation\ Rate \quad (1)$$

$$Inflation\ Rate = \beta_0 + \beta_1\ Unemployment\ Rate \quad (2)$$

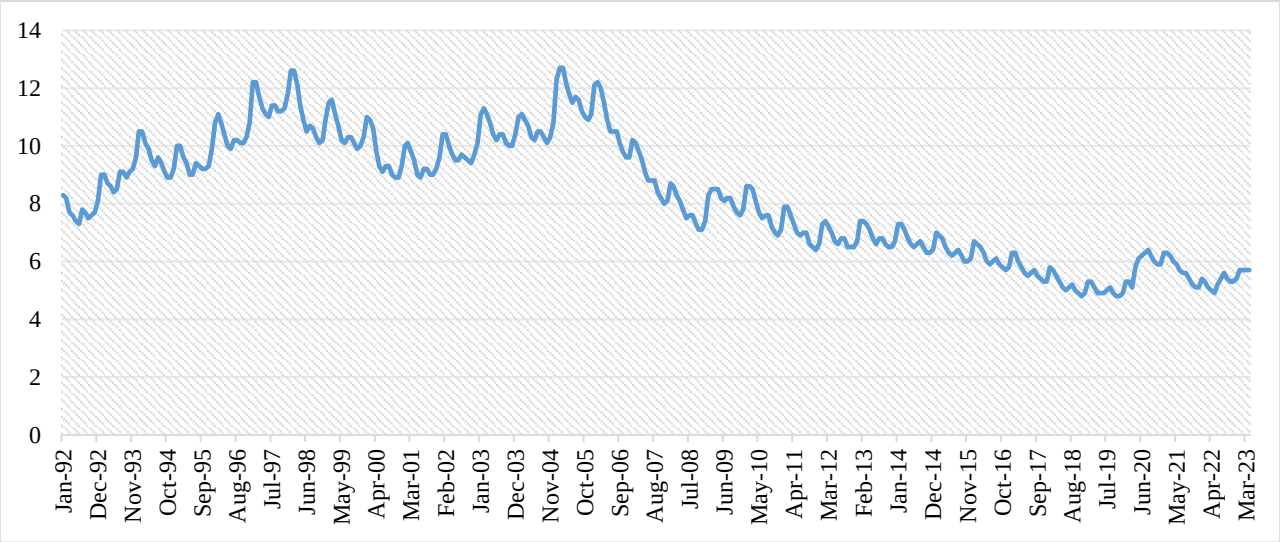
4. VARIABLES

The variables that will be included in the econometric model of the study are the unemployment and inflation rates of the Federal Republic of Germany. The data used in the model are the monthly data for 1992: January 2023 to April. The inflation variable was obtained from the German Federal Statistical Institute (Statistisches Bundesamt-DESTATIS, 02 May 2023). Unemployment data –seasonally adjusted– were received from the German Federal Employment Agency (Bundesagentur für Arbeit, 2023).

5. FINDINGS

This study section presents time path graphs of the data used in the model, followed by descriptive statistical results before the analysis. Then, firstly, the stationarity analysis of the variables will be done using unit root tests. Then, whether there is a long-term relationship between the variables will be tested, and according to the test results, the dimensions of the long- or short-term relationship between the variables will be examined.

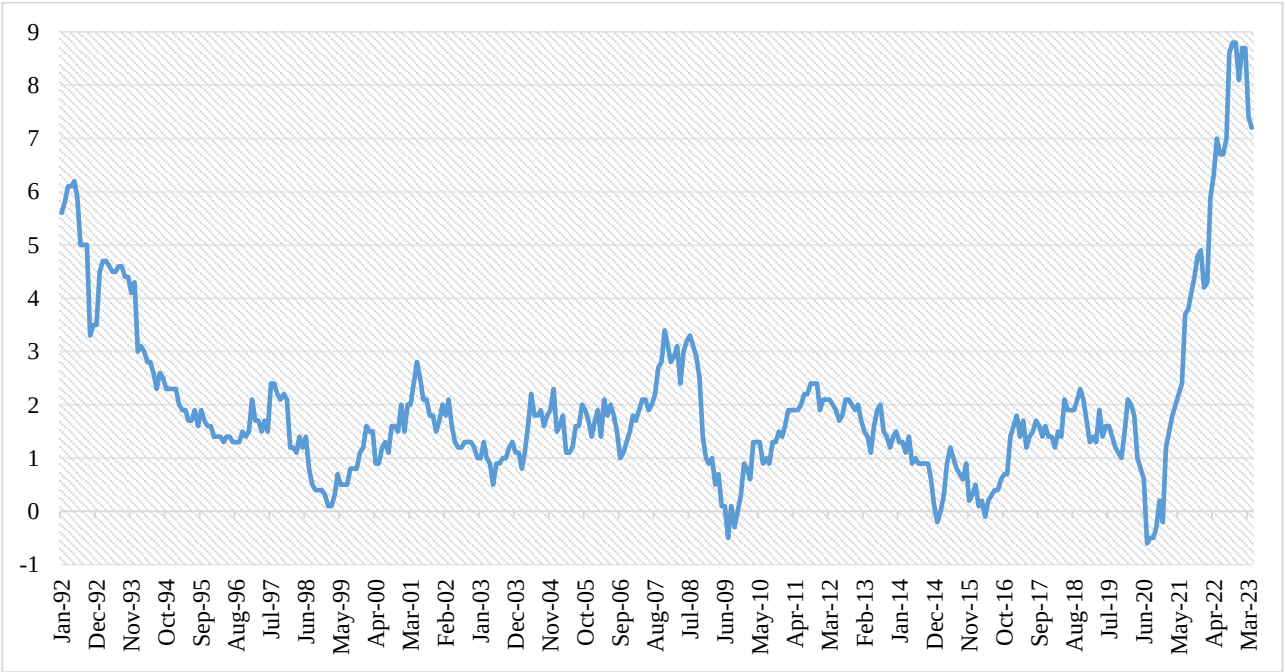
Figure 2. Monthly Unemployment Rates in Germany (1992: January-2023: April)



Source: Statistisches Bundesamt-DESTATIS, July 10 2023.

When examining the unemployment rate series in Germany from January 1992 to April 2023, it is noteworthy that the highest rate occurred in February-March 2005. Unemployment trended upward from October 2004, peaked, and then declined. The unemployment rate from January to August 2009 remained above 8 points due to the 2008 Global Financial Crisis. It is worth noting that the unemployment rate started to rise again in April 2020 due to the impact of the COVID-19 pandemic. However, it began to decline in May 2021 after a year-long period.

Figure 3. Monthly Inflation Rates in Germany (1992: January-2023: April)



Source: Statistisches Bundesamt-DESTATIS, July 10 2023.

When Figure 3 is examined, it can be stated that the inflationary process reflects the transition process from the German Mark to the Euro (1999-2002) and its ongoing effect. It is seen that a deflationary process was experienced during the 2008 Global Financial Crisis and the COVID-19 pandemic. It is noteworthy that after Covid-19, inflation rates increased significantly above the reference period.

Table 2: Descriptive Statistics

	Unemployment	*Inflation*
Mean	8.260428	1.964973
Median	8.300000	1.600000
Maximum	12.70000	8.800000
Minimum	4.800000	-0.6000
Std. Dev.	2.120204	1.603875
Sum	3089.400	734.9000
Sum Sq. Dev.	1676.734	959.5111
Observations	374	374

When Table 2 is examined, it is noteworthy that in the period 1992: January - 2023: April in Germany, the maximum value of the unemployment rate was 12.7 points, and the inflation rate was a maximum of 8.8 points. This situation reflects Germany's success in the fight against both unemployment and inflation. The low standard deviations for both variables indicate that stability has been achieved in the fight against unemployment and inflation.

Table 3: Phillips-Perron Unit Root Test Results (In Level Values)

Variables		*Constant/Trend*
Unemployment rate		-2.654683 [47]
Critical values	**%1** **%5** **%10**	-3.982720 -3.421853 -3.133739
Inflation rate		-1.477255 [5]
Critical values	**%1** **%5** **%10**	-3.982988 -3.421983 -3.133816

Note: Square brackets indicate the automatically selected bandwidth.

According to the Phillips Perron Unit Root Test results in Table 3, the test statistics in constant/trend forms are less than the critical values in absolute value. The primary hypothesis that unemployment and inflation rate series contain unit roots in their level values cannot be rejected. In other words, both series contain unit roots in their level values and are not stationary.

Table 4: Lee Strazicich LM Unit Root Test with Two Structural Breaks (In Level Values)

Variables		*Model A*	*Model C*
Unemployment rate		-1.759069 (2005M04) (2005M08) [8]	-4.138901 (2000M10) (2006M10) [8]
Critical values	**%1** **%5** **%10**	-4.186120 -3.622196 -3.314144	-5.623636 -5.185696 -4.877720
Inflation rate		-3.093666 (2019M01) (2019M10) [4]	-4.783395 (1996M12) (2020M01) [2]

Critical values	**%1**	-4.187400	-5.694440
	%5	-3.622620	-5.145640
	%10	-3.313680	-4.824200

Note: Parentheses indicate structural break dates, and square brackets indicate lag lengths. Since monthly data was used in the analysis, the maximum lag length was chosen as "8" (Göksu & Balkı, 2023).

According to the two-break LM unit root test results in Table 4, the test statistic for the unemployment rate variable according to Model A is smaller than the critical values at all significance levels. According to this result, the primary hypothesis that the unemployment rate variable contains unit roots and structural breaks could not be rejected. The structural break dates were determined internally by the test as May 2005 and August 2005. This points to when the positive results of the Hartz Reforms (for the reforms, see Kalkan, 2022), the last legal regulation which came into force in January 2005, started to be obtained.

According to another result in Table 4, according to Model C, the test statistic for the unemployment rate variable is smaller than the critical values at all significance levels. According to this result, the primary hypothesis that the unemployment rate variable contains unit roots and structural breaks could not be rejected. The structural break dates were determined internally by the test as October 2000 and October 2006. The year 2000 may mark the beginning of the transition from the Mark currency to the Euro currency.

According to another result in Table 4, it is seen that the test statistic for the inflation rate variable according to Model A is smaller than the critical values at 5% and 1% significance levels. According to this result, the primary hypothesis that the inflation rate variable contains unit roots and structural breaks could not be rejected. The test internally determined the structural break dates as January 2019 and October 2019.

According to the final result in Table 4, the test statistic for the unemployment rate variable according to Model C is smaller than the critical values at all significance levels. According to this result, the primary hypothesis that the unemployment rate variable contains unit roots and structural breaks could not be rejected. The structural break dates were determined internally by the test as December 1996 and January 2020. The unification of the East-West German states was effective in inflation and other socio-economic indicators (e.g. unemployment) after the 1990s, and especially in this context, the increase in labour costs emerged as an essential factor. In addition, it should be noted that energy price increases, historically identified as one of the leading causes of inflation in Germany, impacted inflation towards the 2000s. It should also be stated that the COVID-19 pandemic 2020 caused an inflationary shock (Grömling, 2022).

Table 5: Phillips-Perron Unit Root Test Results (At First Difference Values)

Variables		***Constant/Trend***
Unemployment rate		-11.60790]57]
Critical values	**%1**	-3.982786
	%5	-3.421885
	%10	-3.133758
Inflation rate		-19.87684 [4]
Critical values	**%1**	-3.983192
	%5	-3.422082
	%10	-3.133875

Note: Square brackets indicate the automatically selected bandwidth.

According to the Phillips Perron Unit Root Test results in Table 5, test statistics are higher than the critical values regarding constant/trend forms. Therefore, the primary hypothesis that both the unemployment rate and the inflation rate series contain a unit root in the first difference values is rejected. Thus, both series do not contain unit roots at the first difference values and become stationary.

Table 6: Determination of the Appropriate Lag Length

Lag length	***LogL***	***LR***	***FPE***	***AIC***	***SC***	***HQ***
0	-1404.170	NA	10.58569	8.035257	8.057303	8.044032
1	-181.1053	2303.488	0.014180	1.419822	1.485958	1.446146
2	-204.4080	75.03405	0.011672	1.225189	1.335415	1.269063
3	-178.8694	50.05568	0.010320	1.102111	1.256428	1.163535

4	-171.1976	14.94901	0.010106	1.081129	1.279537	1.160103
5	-162.7145	16.43309	0.009851	1.055511	1.298010	1.152034
6	-152.9125	18.87585	0.009530	1.022357	1.308946	1.136430
7	-148.5697	8.313243	0.009512	1.020398	1.351078	1.152021
8	-97.46686	97.24145*	0.007267*	0.751239*	1.126010*	0.900411*

According to Table 6, which includes different lag criteria, eight lag lengths were deemed appropriate.

Table 7: Johansen Cointegration Test Results

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	***Eigenvalue***	***Trace Statistic***	***0.05 Critical Value***	***Probability***
r=0	0.028133	10.90025	20.26184	0.5517
r≤0	0.002873	0.998296	9.164546	0.9517
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	***Eigenvalue***	***Trace Statistic***	***0.05 Critical Value***	***Probability***
r=0	0.028133	9.901951	15.89210	0.3434
r≤0	0.002873	0.998296	9.164546	0.9517

According to the Johansen Cointegration Test results obtained within the scope of the linear deterministic model numbered 2 in Table 7, the primary hypothesis of "there is no cointegration between the series" cannot be rejected at the 95% confidence level for both the trace statistics and the maximum eigenvalue statistics. Accordingly, it can be said that there is no long-term relationship among the series, that is, between the unemployment rate and the inflation rate variables. In this direction, the empirical analysis will be continued with the help of the Toda-Yamamoto Causality test.

In the Toda-Yamamoto causality test, the lag length (p) must first be determined (Akgül & Bükey, 2020). A VAR model is established in the first stage to choose the delay length, and the delay length is determined through the VAR model. In the second stage, the highest degree of integration of the series (dmax) is added to this lag length. Thus, the equation of the Toda-Yamamoto causality test is obtained through a VAR model with a (p + dmax) lag (Dogan, 2017):

$$Y_t = \alpha_0 + \sum_{i=1}^{p+dmax} + \sum_{i=0}^{m} \alpha_{2i} + u_t \quad (3)$$

$$Y_t = \beta_0 + \sum_{i=1}^{p+dmax} \beta_{1i} + \sum_{i=0}^{m} \beta_{2i} Y_{t-i} + v_t \quad (4)$$

In equations 3 and 4, the primary hypothesis, "There is no causality relationship from Y to X", is tested against the alternative hypothesis “, There is a causality relationship from Y to X" (Doğan, 2017).

Table 8: Toda-Yamamoto Causality Test Results

Chi-Square Test Statistic	**$K+d_{max}$**	**Probability**	**Direction of Causality**
11.74888	9	0.1628	Inflation Rate>>Unemployment Rate
3.966581	9	0.8601	Unemployment Rate>>Inflation Rate

According to the outcomes of the Toda-Yamamoto Causality Test, no statistically significant causality correlation was found among unemployment and inflation rate variables. This result shows no long-term relationship between unemployment and inflation in the Johansen Cointegration Test analysis and that this relationship does not exist in the short term either. The analysis findings will be interpreted and evaluated in the conclusion section.

CONCLUSION AND EVALUATION

In this study, the limitation of examining the relationship between variables only from a linear perspective, the validity of the Phillips Curve, which explores the correlation between inflation and unemployment in Germany between January 1992 and April 2023, was analysed using the time series analysis method. In this direction, first of all, the stationarity status of the variables was examined by Phillips Perron and Lee Strazicich with two structural breaks unit root tests. It was seen that both variables contained unit roots in their level values but became stationary at their first difference. After the variables were found to be stationary at the first difference values, the Johansen Cointegration Test examined whether there was a long-run relationship among them. According to the Johansen Cointegration Test results, no long-term relationship between unemployment and inflation variables in Germany could be found. In the absence of a long-term relationship between inflation and unemployment, it was determined that the relationship between the two variables did not exist in the short run, according to the outcomes of the Toda-Yamamoto Causality analysis test applied.

The analysis findings of the study seem to be compatible with the results of the studies shown in the literature summary and focusing on Germany (Ex, Nüß, 2013; Bhattarai, 2016). This is an important consideration. According to most of the studies in the literature, it has been determined that the Phillips Curve is valid both in country specifics and in studies conducted with the panel data analysis method based on the multi-country group. Still, this trade-off relationship does not exist in the studies above conducted in Germany.

These findings, both in other studies in the literature and this study that the Phillips Curve does not work in the German economy, indicate that inflation does not have to be tolerated in the fight against unemployment in the German labour market and that an upsurge in inflation does not escort an upsurge in employment. In addition, the absence of causality in both directions shows that the German economy does not have to put up with unemployment to suppress inflation. However, the lack of this causality relationship indicates the possibility that the total demand structure of the German economy could be more robust or the consumption tendency could be more significant. Therefore, the fact that no factor triggering demand inflation emerges in parallel with the increase in employment is worth examining in depth in the literature. So, it is essential to determine in the literature which dynamics are effective in combating unemployment in the German labour market and ensuring price stability in monetary policy.

The disconnection of the causal relationship between inflation and unemployment will make it easier for the German monetary policy authorities to implement a contractionary monetary policy to restore price stability when inflationary pressure is high. On the contrary, it will allow the implementation of expansionary economic policies to increase employment in recessionary periods when unemployment rises without fear of inflationary pressure. In this respect, the German economy, compared to the economies of other countries where the Phillips Curve is valid, provides excellent flexibility to economic policy practitioners, making their work easier.

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