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Eurozone Target Inflation along Nonlinear Philips & Beveridge Curves

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Master in Economics

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BUSINESS
SCHOOL

Department of Economics

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“To kindness, the quiet wisdom that teaches without words and dignifies the essence of being human “. Anonymous

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Resumo

Este estudo tem como objetivo identificar a inflação alvo na Zona Euro com base nas curvas não lineares de Phillips e Belverde. Desde 2021, a inflação atingiu níveis historicamente elevados, afetando significativamente o mercado de trabalho. Para representar a relação entre inflação e desemprego, serão utilizados dados históricos que combinam as estimativas das duas curvas. O Banco Central Europeu (BCE) procura manter uma economia saudável através da promoção do emprego e da estabilidade dos preços, ajustando as taxas de juro seja por aumentos ou reduções influenciando todos os mercados, incluindo as taxas de crédito à habitação. O objetivo do BCE é alcançar uma aterragem suave ao aumentar as taxas de juro para conter a inflação, através do endurecimento da política monetária. Este estudo visa contribuir para o aprofundamento da investigação sobre a inflação alvo e o conceito de aterragem suave na Zona Euro.

Abstract

This study aims to figure out the Eurozone target inflation along Philips and Beveridge Non-linear curve. As inflation has reached at its peak since 2021 which affected the Labor market, we will use historical data to represent the relationship between inflation and unemployment by combining the estimates of the two curves i.e., Philips and Beveridge curves. ECB maintains healthy economy through strong employment and stable prices by controlling the interest rates either by increasing or decreasing, which influences all markets and mortgage rates. The aim for Central Bank is soft landing when they raise interest rates to curb inflation by tightening the monetary policy. This study will further advance the research on target inflation and soft landing in eurozone.

Index

Acknowledgements	i
Resumo	iii
Abstract	v
Index	vii
List of Figures	ix
Chapter 1. Introduction	1
Chapter 2. Literature Review	5
Chapter 3. Methodology	13
Chapter 4. Empirical Study and Discussion	19
Chapter 5. Conclusion	25
Bibliographical References	29

List of Figures

Figure 4.1. Inflation, unemployment, and vacancies 20

Figure 4.2. Fitting a non-linear Beveridge curve 21

Figure 4.3. Fitting a non-linear Philips Curve 22

CHAPTER 1

Introduction

The Eurozone has experienced substantial economic shifts since the onset of the pandemic COVID-19 particularly in relation to labour market performance and inflation dynamics. Core inflation increased dramatically in 2022 and 2023 due to energy price volatility, supply chain disruptions and expansive fiscal and monetary measures by ECB. These events have revived interest in fundamental macroeconomic frameworks particularly Philips Curve and Beveridge Curve which serve as analytical tools for interpreting in the relationships between inflation, unemployment, and labour market efficiency.

The Phillips Curve once a cornerstone of Keynesian policy, suggests an inverse relationship between unemployment and inflation signifying that tight labour markets stimulate wage growth and, consequently, price pressures. However, recent empirical evidence from the Eurozone indicates a flattening of Philips curve implying that inflation may now be less responsive to changes in labour market slack than in previous decades. Similarly, the Beveridge Curve which maps the relationship between unemployment and job vacancies, exhibiting outward shifts in recent years indicating the inefficiency in matching labour supply and demand.

Analysing these curves in the current Eurozone perspective is crucial for assessing the efficacy of monetary policy responses and understanding the changing nature of economic adjustment mechanisms. As inflation continues to stabilize and unemployment remains at moderate level it is very important to reassess the empirical validity and policy impacts of these conceptual frameworks. This study examines recent trends in Eurozone inflation and labour market dynamics through the prism of the Phillips and Beveridge Curves, providing insights into their current behaviours.

Monetary policy is an economic policy that regulates the money supply in the economy. These policies are implemented through different tools i.e., Interest Rates, Reserve requirement and buying and selling of Government securities. In Eurozone the European Central bank (ECB) is responsible to maintain the inflation, Unemployment, and growth at optimum level by increasing or decreasing circulation of currency. Federal Reserve is responsible in USA to implement the Monetary policy.

In economic cycle there is always a fluctuation in prices, inflation occurs when there is huge increase in prices of goods and services and purchasing power decreases due to rise in prices. It can be demand pull and Cost push inflation. Their consequences can be destructive towards economy if not handled properly. In the case of the ECB, the objective of monetary policy to keep inflation at 2% to stable the prices, employment, and economic growth. When inflation is around at 2% then consumers and businesses are in good position to invest money also the reserves are in better condition.

ECB maintains healthy economy through strong employment and stable prices by controlling the interest rates either by increasing or decreasing, which influences all markets and mortgage rates. The aim for Central Bank is soft landing when they raise interest rates to curb inflation by tightening the monetary policy. Soft landing can also be affected adversely and unachievable due to externalities like Covid Pandemic or Ukraine war. In these situations, ECB soft landing plan hard to attain due to external shocks.

Our study concentrates on the descriptive analysis of the target inflation and the relationship between inflation and economic slack, the ratio of the unemployment rate to the job vacancy rate for the euro area since 2006. Despite the growing number of studies on the inflation at global level but a little research has been done on the non-linearity of Philips and Beveridge curves in Eurozone, so the objective of this study is to discuss the target inflation along a Philips and Beveridge Non-linear curve.

We articulate the empirical foundation of our analysis through three theoretical models, each supported by graphical representations. Our first model represents the relationship among inflation, unemployment and vacancies based on the data from the period starting from 2006 and the second one displays the model of Beveridge Non-linear curve by showing the non-linear relationship between Job vacancy rate and Unemployment rate. The third model presents a graphical depiction of the fitted non-linear Phillips Curve, illustrating the relationship between the inflation rate and the unemployment to vacancy ratio.

This research is an in-depth analysis of the aforementioned scenarios to examine how they influence inflation and affect unemployment dynamics. In summary, this research utilizes data spanning from 2006 to 2024 and employs SPSS for model estimation and analysis. The structure of this thesis is organized as follows. Following the introductory chapter, the Literature Review delves into the theoretical foundations of the topic and critically evaluates existing empirical studies, highlighting both convergences and divergences in scholarly approaches and conclusions.

The subsequent chapter outlines the methodology employed for the empirical investigation, detailing the analytical framework and the construction of variables based on the selected dataset. Chapter Four presents the empirical analysis and discussion, where the models are applied, and the results are interpreted in depth. The final chapter refer to conclusion and summarizing the key findings and proposing directions for future research.

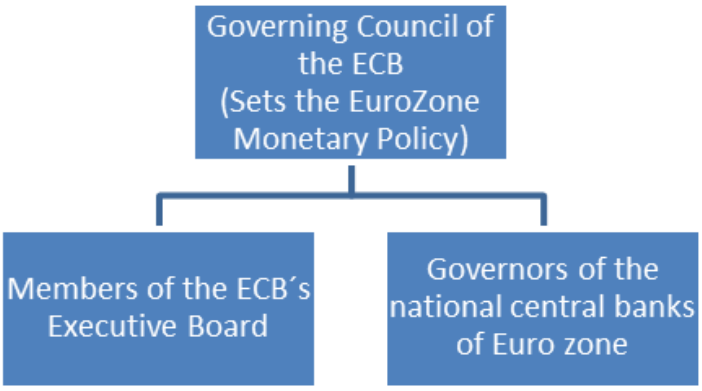
CHAPTER 2

Literature Review

Monetary policy is an economic policy that regulates the money supply in the economy by which a country's central bank strives to sustain low unemployment, stabilize economic development, and lessen fluctuations in inflation and foreign currency rates. These policies are implemented through different tools i.e., Interest Rates, Reserve requirement and buying and selling of Government securities.

In Eurozone, since 1999 the European Central bank (ECB) implements the Monetary policy and maintain the inflation, unemployment, and growth at optimum level by increasing or decreasing circulation of currency (Euro). It is the world´s largest economy after the United States of America (USA) whose monetary policy is governed by the Federal reserve.

The ECB´s Governing Council sets the monetary policy for whole Eurozone. It consists of six members of the executive board of ECB and governors of national central banks of European member states. They generally convene in every six weeks to take monetary policy decisions that benefits the Euro zone as a whole rather than their own countries of origin. In Eurozone, since 1999 the European Central bank (ECB) implements the Monetary policy and maintain the inflation, unemployment, and growth at optimum level by increasing or decreasing circulation of currency (Euro). It is the world´s largest economy after the United States of America (USA) whose monetary policy is governed by the Federal reserve.



The primary goal of ECB is to maintain price stability in the euro area. This means making sure prices do not increase a lot or have large fluctuations, i.e. ensuring that inflation is low and stable. In economic cycle there is always a fluctuation in prices, inflation occurs when there is huge increase in prices of goods and services and purchasing power decreases due to rise in prices. It can be demand pull and Cost push inflation. Their consequences can be destructive towards economy if not handled properly. In the case of the ECB, the objective of monetary policy to keep inflation at 2% to stable the prices, employment, and economic growth. When inflation is around at 2% then consumers and businesses are in good position to invest money also the reserves are in better condition.



A “soft landing” is a situation when monetary policy effectively reduces inflation without starting a recession by slightly elevating interest rates and "hard landing" on the other hand, is a policy-induced decrease in employment and production brought on by a sharp increase in interest rates. Soft landing is the process of an economy shifting from growth to slow growth to control inflation but avoid recession otherwise it would be hard landing.

The key difference between soft and hard landing is recession (Blinder, 2023). The 2021-2022 spike in inflation in advanced nations like US and Euro zone has sparked interest in understanding the factors influencing pricing and wage dynamics. Recent statistics indicate that both European Central Bank (ECB) and Federal Reserve (FED) have effectively stabilized inflation without sparking a significant recession, despite concerns and “soft landing” is unlikely because dropping inflation needs a significant output reduction.

There is a slack in economy when resources are not used at optimum level like lots of workers without employment or not any production in factories etc. The inflation happens when demand is high relative to supply. When there are lot of slacks in the economy there is little risk of inflation because there are

excessive resources available to fulfil the demand and supply is sufficient. For example, if workers demand suddenly increased the unemployed workers would get hired.

On the contrary when there is very little slack, and economy operates and utilize its all resources there are more chances of inflation. When most of the people are on jobs, they may demand higher wages which leads to higher prices of goods eventually needs more money to fulfil the demand of goods. Slacks can provide information regarding present and prospective economic pressures (Crust et al., 2023)). ECB uses interest rates to control demand and inflation but failed to prevent a burst of high inflation in 2021-22 (Reis, 2022). According to Ricardo Reis' research, central banks failed to avert excessive inflation in 2021-22 due to a number of causes, including a misdiagnosis of initial shocks, an over-reliance on historical credibility, and a disregard for inflation expectations data that revealed a de-anchoring tendency. These concerns resulted in policies that were overly expansionary for too long.

Therefore, strength of economic slack indicates about present and ongoing current and future rising prices and escalating costs. It is one of crucial factor that helps ECB to determine when to rise or reduce the interest rates while making monetary policy. But it is very critical to take decision on right time as an economic recovery may suffer if interest rates are raised too soon, while inflation may increase if they are raised too late.

In 1940, William Beveridge a British economist developed a concept of Beveridge curve or Unemployment Vacancy (UV) curve that shows the relationship between Job vacancies and the level of unemployment. The curve suggests the inverse relationship between vacancies and unemployment as vacancies rise the level of unemployment falls and vice versa. It is the tool with which we can analyse the health of labour market as if the unemployment is either due to demand side (lack of job vacancies) or supply side (lack of skilled labour) issue. The higher in vacancy rate and a lower unemployment rate represents a booming and growing economy and a “tight” labour market. During a period of recession, unemployment will rise, and vacancies will fall as economic activity decreases. While during the period of economic growth, unemployment will go down, and vacancies will rise.

The chances of achieving a soft-landing based on the trade-off between lower job vacancies and higher unemployment, and this empirical relationship known as the Beveridge curve. The shape of the curve reflects the underlying process of matching job seekers and job openings. This job-matching process can change over time, so it’s important to assess the relationship in real time to understand its potential implications for the current labour market and monetary policy. (Hobijn, Bart et al., 2012).

(Barlevy et al., 2023) analysed the Beveridge curve shifts from 1959 to 2023 in United States and challenged this traditional view that outward shifts in curve reflects the decline of matching effectiveness. They argued that shift has various causes demographic changes, behavioural changes and structural inadequacies.

Philips Curve A.W. Phillips, New Zealand economist in 1958 analysed wages and unemployment data from 1861 to 1957 for the UK and discovered the inverse relationship between inflation and unemployment (Philips, 1958). The basic idea is that when in economy there are more vacancies or job openings and less unemployment consequently firms will have to offer higher wages, which leads to inflation and vice versa. Despite criticism Philips curve still a fundamental tool of implementing monetary policy as it is used by Federal reserve in US and European Central Bank (ECB) in euro zone for inflation forecast and making economic decisions on interest rates. Philips curve´s slope has utmost importance in implementation of monetary policy either non-standard or standard to the extent of economic slack in the economies that impact the rise of prices and wages.

Fed´s Vice Chairman Donald L. Kohn. Quoted in speech at 53rd Annual Economic Conference, Chatham, Massachusetts “A model in the Phillips curve tradition remains at the core of how most academic researchers and policymakers including this one think about fluctuations in inflation; indeed, alternative frameworks seem to lack solid economic foundations and empirical support”.

The recent literature on Inflation drift in Euro area emphasize on the geographical variations and non-linear macroeconomic dependencies (Faber & Züllig, 2025) by expanding on previous studies on the Philips curve stability (Blanchard, 2016).Their research demonstrates the shape and slope of the Philips curve in European region from 2001 to 2024 and found a significant non-linear or kink behaviour of the Philips curve which remains flat during the period of labour market slack but becomes significantly steeper when unemployment falls below the crucial threshold. In Euro area this kinked behaviour is more pronounced than United States implying that policy factors such as wage-setting mechanism and labour market stringencies play a pivotal role in influencing inflation responsiveness.

Brexit did not directly impact the Euro Area but had direct effect in UK due to devaluation of sterling. Brexit amplified the inflation by shortage of labour supply by cessation of free entry of EU citizens and reduced the purchasing power by imposing tariffs on trade and other barriers (Posen & Keller, 2022) argued that Brexit has had a detrimental impact on the UK economy by increasing prices, reducing foreign direct investment (FDI), and creating new trade barriers. During COVID-19 period the

government across the world imposed extraordinary restrictions in economy but after pandemic Eurozone labour market displayed exceptional resiliency.

Since past few years inflation is on higher side and reached at its highest level in Eurozone, USA and in other countries due to global pandemic and Russia's invasion of Ukraine. Consumer price goods increased due to broken supply as well as import of oil, wheat etc also affected due to tension between Ukraine & Russia. As long-term high inflation was not predicted, and it surge to many forecast errors which considered before pandemic & war. It left persistent inflationary effects which leads to hike in prices and wages. However, by the end of 2021, employment had returned to pre-crisis levels or even exceeded in many developed countries, while deficits persisted in most developing economies.

The early belief was challenged that the primary cause of inflation is tight labour markets rather than ascribing most of the price hike from 2021 onwards to sector-specific supply shocks and higher prices of commodities (Bernanke & Blanchard, 2023). They analysed the USA inflation drivers in pandemic era of COVID-19 using a dynamic model that attributes inflation expectations, price hikes and wage determination. Their study conclude that supply shocks are primary driver of causing inflation instead of wage growth and Federal reserve should carefully nuanced economic policy responses that distinguish among structural and transitory inflation factors.

According to FED "Inflation is the increase in the prices of goods and services over time. Inflation cannot be measured by an increase in the cost of one product or service, or even several products or services. Rather, inflation is a general increase in the overall price level of the goods and services in the economy". ECB explained inflation as "Inflation occurs when there is a broad increase in the prices of goods and services, not just of individual items; it means, you can buy less for €1 today than you could yesterday. In other words, inflation reduces the value of the currency over time".

When Inflation occurs, it reduces the purchasing power, and we can buy fewer goods with the same amount of money and services too. Everything becomes costly and there is a general jump in price across the economy. Inflation is considered as an indisputably unfavourable phenomena that has no potential positive economic consequences. Cost Push inflation is the reduction in overall goods and services supply usually occurs due to rise in the production costs like increase in labour or raw material costs. While the increase in aggregate demand of goods and services leads to the Demand-Pull inflation like in the case of economy expansion.

Euro Area Inflation is determined by the “Harmonised Index of Consumer Prices”, usually denoted as “HICP”. The term “harmonised” denotes the fact that all the countries in the European Union follow the same methodology. This ensures that the data for one country can be compared with the data for another. Each country´s national statistical institute calculates its HICP and sends its figures to the “Statistical Office of the European Communities” known as Eurostat. The Eurostat calculate the HICP for the whole Euro area and also ensure the national statistics are compliant in accordance with the legal obligatory requirements.

Inflation rate is a %age change in current period price index compared to the last period which is usually calculated on annual basis. For example, the price index of 182 for February of this year and 177 for February of previous year then the annual inflation rate would be (182/177-1) = 2.8% (Eurostat)

"Inflation is like sin; every government denounces it and every government practices it". Paul Valker

"The first panacea for a mismanaged nation is inflation of the currency; the second is war. Both bring a temporary prosperity; both bring a permanent ruin. But both are the refuge of political and economic opportunists." Ernest Hemingway

CHAPTER 3

Methodology

This section outlines the study's methodology and data. The literature on the link between the Beveridge and Philips Curves is still limited. According to research conducted in many academic databases and publications, the relationship between the two disciplines is rarely discussed and has few practical applications. Even though there was a lot of study but there weren't much research articles that integrated the two ideas. As a result, using an empirical method is crucial when attempting to bridge these two domains.

Research Method Description

We will review ECB policy against inflation and unemployment for both pre-crisis and post crisis to evaluate the current scenario. Usually, we use Linear Model of Beveridge and Philips curve for analysis but in this study, we will use Non-linear models of both curves to show the elevated inflation. The focus of European Central Bank is to reduce inflation while staying away from significant increase in unemployment.

This study will also present the empirical formulation of our analysis in form of graphical figures and deep dive how it triggers inflation and impact unemployment. Our research will discuss the European Central Bank aim of Monetary policy, Inflation and their mandate and understanding of Hard and Soft landings. But our main discussion is reducing inflation along a Philips and Beveridge Non-linear curve to analyse the relationship between inflation and a particular measure of labour market slack.

Data Sample and Data Source

The data was gathered through ECB, FED & Eurostat. Different articles also studied with the help of existing literature and Google scholar used as primary source for gathering information. The dataset covers the EU 27 countries including Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Lativia, Lithuania, Luxemburg, Malta, Netherlands, Portugal, Poland, Romania, Slovenia, Slovakia, Spain and Sweden.

Our study consists of four data sets namely and briefly explained as:

1) Harmonized Index of Consumer Prices (HICP)

This is a statistical measure that the ECB uses in Euro zone to track changes in the prices of a stable basket of consumer goods and services in order to measure inflation.

2) Unemployment Rate

It is a crucial macroeconomic indicator and widely used by economists' policy makers and represents the percentage of jobless labour force that actively seeking to be deployed. ECB also defined the unemployment rate as "the number of unemployed, according to the ILO's definition, as a percentage of the labour force, as published by Eurostat".

3) Job vacancy Rate (JVR)

A job vacancy represents as a latest unoccupied, or about to become vacant positions. The job vacancy rate (JVR) measures the ratio of total vacant posts to the sum of total of occupied and vacant posts that are vacant expressed as a percentage as follows:

JVR = Total number of job vacancies * 100 / (Total occupied posts +Total job vacancies).

4) Unemployment to Vacancy Ratio

It is the ratio that measures the number of jobless or unemployed individuals for every position that is vacant. It is the critical variable of Beveridge curve and indicates the health of economy and helps in monetary decisions like on interest rates and job creation plans. Ratio equals to 1 is considered balanced labour market where individual vacancy is available for each unemployed person. The ratio less than 1 indicates tight labour market where more job vacancies are available than unemployed individuals and it represents high labour demand and expected scarcity of labour. While the ratio greater than 1 signifies the labour market slack where more unemployed people are available than job vacancies and it leads to labour supply surplus and shortage of existing job openings.

All the data sets used in the study are attached and extracted through the ECB

DATE	TIME PERIOD	Unemployment Rate	Job Vacancy Rate	HICP	Unemployment to vacancy Ratio
31/03/2006	2006Mar	8.7	1.1	2.2	7.9
30/06/2006	2006Jun	8.5	1.2	2.5	7.0
30/09/2006	2006Sep	8.3	1.3	1.8	6.4
31/12/2006	2006Dec	8.0	1.1	1.9	7.3
31/03/2007	2007Mar	7.8	1.3	1.9	6.0
30/06/2007	2007Jun	7.6	1.2	1.9	6.3
30/09/2007	2007Sep	7.5	1.1	2.1	6.8
31/12/2007	2007Dec	7.4	1.4	3.1	5.3
31/03/2008	2008Mar	7.3	1.5	3.6	4.9
30/06/2008	2008Jun	7.6	1.1	3.9	6.9
30/09/2008	2008Sep	7.7	1.1	3.6	7.0
31/12/2008	2008Dec	8.3	1.2	1.6	6.9
31/03/2009	2009Mar	9.3	1.1	0.6	8.4
30/06/2009	2009Jun	9.6	1	-0.1	9.6
30/09/2009	2009Sep	9.9	1	-0.3	9.9
31/12/2009	2009Dec	10.0	1.2	0.9	8.3
31/03/2010	2010Mar	10.1	1.2	1.6	8.4
30/06/2010	2010Jun	10.1	1.2	1.5	8.4
30/09/2010	2010Sep	10.1	1.2	1.9	8.4
31/12/2010	2010Dec	10.0	1.4	2.2	7.2
31/03/2011	2011Mar	10.0	1.6	2.7	6.2
30/06/2011	2011Jun	10.0	1.5	2.7	6.7
30/09/2011	2011Sep	10.3	1.5	3	6.9
31/12/2011	2011Dec	10.7	1.5	2.8	7.1
31/03/2012	2012Mar	11.1	1.6	2.7	6.9
30/06/2012	2012Jun	11.4	1.5	2.4	7.6
30/09/2012	2012Sep	11.6	1.4	2.6	8.3

31/12/2012	2012Dec	11.9	1.4	2.2	8.5
31/03/2013	2013Mar	12.2	1.4	1.7	8.7
30/06/2013	2013Jun	12.1	1.3	1.6	9.3
30/09/2013	2013Sep	12.1	1.3	1.1	9.3
31/12/2013	2013Dec	11.9	1.4	0.8	8.5
31/03/2014	2014Mar	11.9	1.5	0.5	7.9
30/06/2014	2014Jun	11.6	1.4	0.5	8.3
30/09/2014	2014Sep	11.6	1.4	0.3	8.3
31/12/2014	2014Dec	11.4	1.5	-0.2	7.6
31/03/2015	2015Mar	11.3	1.6	-0.1	7.0
30/06/2015	2015Jun	11.0	1.5	0.5	7.4
30/09/2015	2015Sep	10.7	1.5	0.2	7.1
31/12/2015	2015Dec	10.5	1.6	0.3	6.6
31/03/2016	2016Mar	10.3	1.7	0	6.1
30/06/2016	2016Jun	10.1	1.7	0	6.0
30/09/2016	2016Sep	9.9	1.6	0.4	6.2
31/12/2016	2016Dec	9.7	1.7	1.1	5.7
31/03/2017	2017Mar	9.4	2	1.5	4.7
30/06/2017	2017Jun	9.1	2	1.3	4.6
30/09/2017	2017Sep	8.9	2	1.6	4.5
31/12/2017	2017Dec	8.7	2	1.3	4.3
31/03/2018	2018Mar	8.5	2.2	1.4	3.9
30/06/2018	2018Jun	8.2	2.1	2	3.9
30/09/2018	2018Sep	8.0	2.1	2.1	3.8
31/12/2018	2018Dec	7.9	2.3	1.5	3.4
31/03/2019	2019Mar	7.7	2.4	1.4	3.2
30/06/2019	2019Jun	7.6	2.3	1.3	3.3
30/09/2019	2019Sep	7.5	2.3	0.8	3.2
31/12/2019	2019Dec	7.5	2.3	1.3	3.3
31/03/2020	2020Mar	7.2	2.1	0.7	3.4
30/06/2020	2020Jun	8.1	1.7	0.3	4.8
30/09/2020	2020Sep	8.6	1.8	-0.3	4.8
31/12/2020	2020Dec	8.2	1.9	-0.3	4.3
31/03/2021	2021Mar	8.2	2.2	1.3	3.7
30/06/2021	2021Jun	7.9	2.4	1.9	3.3
30/09/2021	2021Sep	7.4	2.7	3.4	2.7
31/12/2021	2021Dec	7.0	2.9	5	2.4
31/03/2022	2022Mar	6.8	3.2	7.4	2.1
30/06/2022	2022Jun	6.8	3.3	8.6	2.0
30/09/2022	2022Sep	6.7	3.2	9.9	2.1
31/12/2022	2022Dec	6.7	3.2	9.2	2.1
31/03/2023	2023Mar	6.6	3.2	6.9	2.0
30/06/2023	2023Jun	6.5	3.1	5.5	2.1
30/09/2023	2023Sep	6.6	3	4.3	2.2
31/12/2023	2023Dec	6.5	2.9	2.9	2.2
31/03/2024	2024Mar	6.5	2.9	2.4	2.2

30/06/2024	2024Jun	6.4	2.6	2.5	2.5
30/09/2024	2024Sep	6.3	2.5	1.7	2.5
31/12/2024	2024Dec	6.3	2.5	2.4	2.5

CHAPTER 4

Empirical Study and Discussion

European Central Bank aims to lower the rising inflation that is now occurring without significantly raising the unemployment rate. The probability of attaining this objective is referred to as Soft Landing depends on two crucial pragmatic interrelated relationships in Eurostat: the Beveridge curve and the Phillips curve. The Beveridge curve depicts the relationship between Job vacancies and unemployment both of which influence the extent slack in Labour market. The relationship between inflation and labour market slack is the Phillips curve.

We combine the Beveridge and Phillips curves in a unique manner that offers insight into the relationship between inflation and specifically measure the labour market slack, the ratio of the unemployment rate to the job vacancy rate. To simplify calculations in Economic models the Beveridge and Phillips curves often appear as linear relationships. On contrary, we use nonlinear versions of both curves, which captures the Eurozone data more accurately, especially during this time characterized by high job vacancy and inflation rates, while simultaneously experiencing notably low unemployment rates.

Inflation, Unemployment, and Vacancies

Figure 4.1 depicts the data series that comprise the fitted Beveridge and Philips curves. The sample period in our analysis ranges from 1995 to 2024. We opt for this sample time frame because it signifies a period where expectations for long-term inflation from ECB's Survey of Professional Forecasters (SPF) remained well anchored close to the ECB long term inflation target of 2%. This is crucial because economic theory also emphasizes on that the inflation not solely depends on the extent of labour market slack but also on the rate of inflation rate that people predict to exist in the future periods. To construct our fitted Phillips curve, we consider that the long-term predicted inflation rate can be represented by a constant value of 2%.

We estimate core inflation using 12 months change in harmonized index of consumer prices (HICP) excluding volatile components like energy and food to better reflect underlying inflation trends, this measure represents the future core HICP inflation according to European Central Bank. Core inflation

surged in March 2023 at 5.7%, up from 1% in August 2021. Subsequently then inflation has significantly decreased, reaching 2.7% in December 2024.

Research indicates that considering both the unemployment and job vacancy rates is helpful in forecasting future inflation (Barnichon & Shapiro, 2022). Our measure of labour market slack is the ratio of the rate of unemployment to the job vacancy. The labour market slack goes in the identical path as the unemployment rate over the economic cycle but encompasses further information about demand of employers for workers, as indicated by the job vacancy rate. Like the unemployment rate itself, the unemployment-to-vacancy ratio increases during recessions and decreases during expansions. Particularly, current rates of the unemployment-to-vacancy ratio are significantly lower than observed in 2013 and 2014. This trend explains why inflation rates are higher today than in 2013 and 2014, as discussed more below.

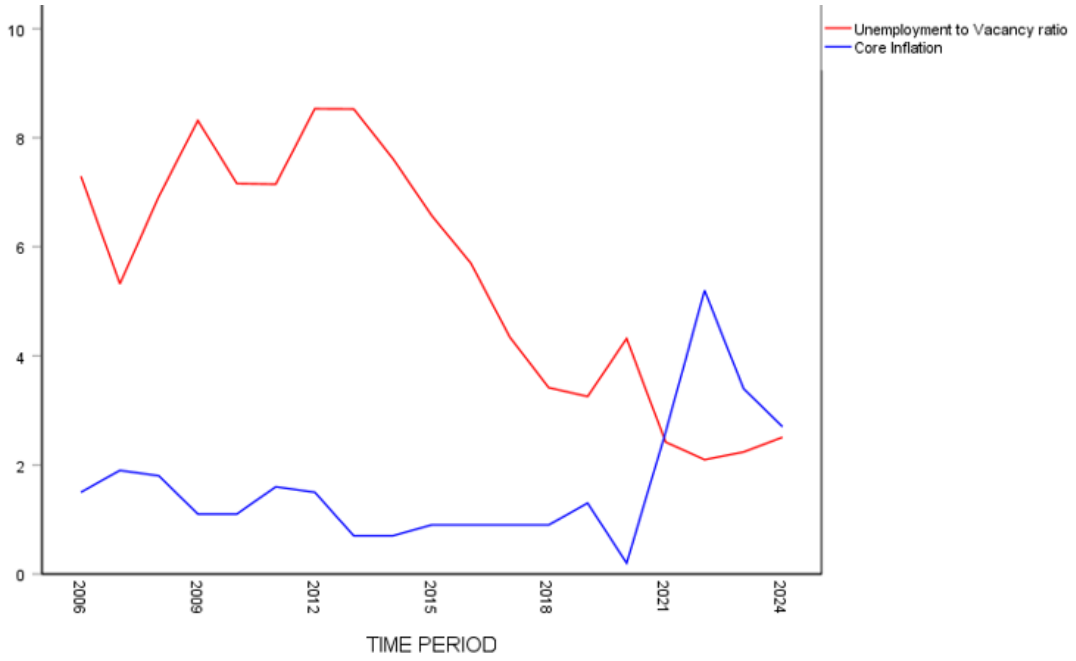


Figure 4.1: Inflation, unemployment, and vacancies.

The Red Line represents Unemployment to vacancy ratio and Blue Line does Core inflation

Fitting a non-linear Beveridge curve

As stated in Bok et al. (2022), at lower rates of employment our fitted non-linear Beveridge curve is very steep and pronounced. This finding suggests that vacancies can decline from their current high levels without leading a significant increase in unemployment. Likewise, our fitted nonlinear Phillips curve to Eurozone data is very steep when the unemployment-to-vacancy ratio is extremely low, as currently we have. This finding indicates that a statistically insignificant rise in labour market slack can descend inflation from high level at present. Given that people's anticipation of inflation stays well rooted. By combining, the fitted Beveridge and Philips curves indicates a possible, but not certain, approach to the economy's soft landing.

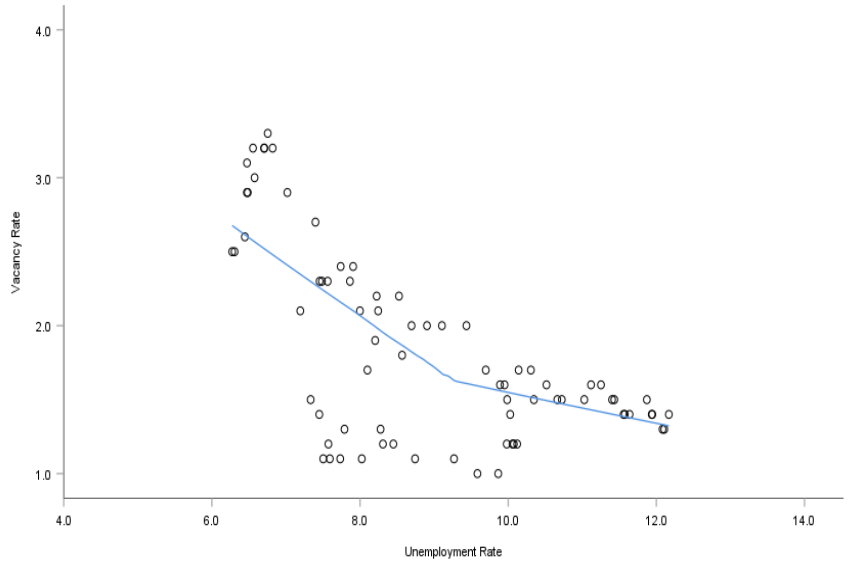


Figure 4.2: Fitting a Non-Linear Beveridge Curve

The blue line illustrates the fitted Beveridge curve using data from January2006 to December2024. In Bok et al. (2022), by shortening the sample period, the fitted curve can accurately reflect the behaviours of a typical labour market, excluding transient pandemic interruptions. The latest vacancy and unemployment data fall on the upper-left section of the pre-pandemic estimated Beveridge curve. If the fitted curve remains steady, it suggests that the vacancy rate can decrease without significantly increasing the unemployment rate. In fact, in March 2022, in May 2023, the vacancy level has already decreased from 3.2% to 2.2% with any slight alteration in unemployment rate

Fitting a non-linear Phillips curve

Originally Philips in 1958 introduced the Philips curve concept, who found a nonlinear relationship between unemployment and nominal wage growth from1861–1957 in the United Kingdom. Wage growth surged as the unemployment rate decreased, and the curve steepened significantly as the rate of unemployment dropped below 3%.

Take note of that the ratio of the unemployment rate to the job vacancy rate is how we calculate labour market slack. Beveridge curve also indicates these two variables. We demonstrate that, like the primary Philips curve, inflation rises as the ratio of unemployment to vacancy falls. The curve becomes significantly steeper as the ratio falls below one. When the unemployment to vacancy ratio falls, it signifies that fewer individuals are looking for work than there are available positions. This makes it more challenging for firms to recruit and hire suitable employees.

According to this perspective, as firms raise prices in response to high demand of their products, advertisements for employment become ineffective in attracting people to satisfy output and demand. When the labour market is extremely tight, as shown by unemployment to vacancy ratio less than 1.0, this scenario creates a steeper slope of Philips curve. In the same circumstances, the form of the Philips curve directly correlates with the form of the Beveridge curve. Considering that the basic mechanism that matches individuals with employment opportunities in the labour influence in both curves.

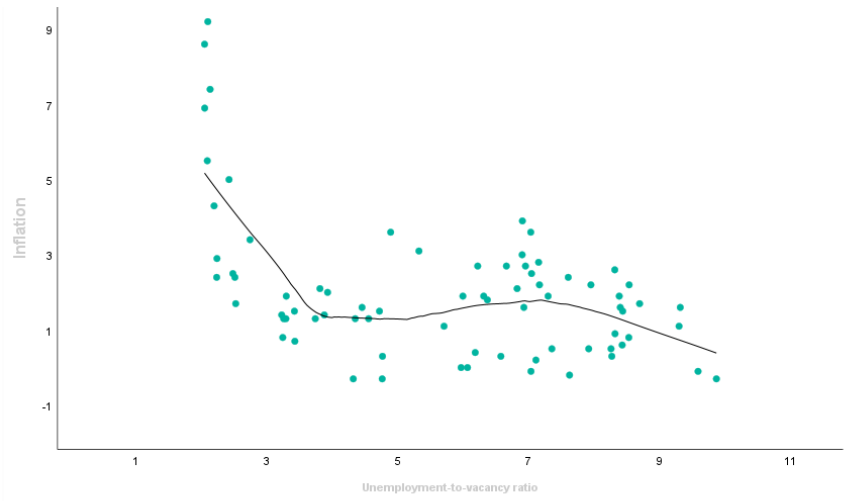


Figure 4.3: Fitting a Non-linear Philips Curve

The above figure 4.3 compares unemployment on the horizontal axis to inflation on the vertical axis.

We presume that the fitted Philips curve shares the same properties as the Beveridge curve in figure 4.2 in terms of the inherent identical process among workers and jobs. The upper left side of figure 4.3 presents the most recent data beginning in January 2021, when inflation surged by more than 3 percentage points prior to peaking in September 2022 at 9.9%.

These higher inflation rates correspond to the lowest unemployment-to-vacancy ratio and follow the steepest area of the Phillips curve. Surprisingly these low ratios are lower than those recorded in 2012 and 2013, when the labour market was less tight. In contrast, those previous unemployment-to-vacancy ratios were approximately dropped to a record low of 2.04 in June 2022 due to recent highs in job openings, showing substantially decrease slack in the labour market.

How does this viewpoint match the expectations of ECB policy makers?

In 2025 and 2026, inflation is predicted to reduce and average 2.0% and 1.6%, respectively, before rising back to 2.0% in 2027. While the average projection for unemployment is 6.3% in 2025 after then, the current economic resurgence, though slight, may cause a further drop in the rate from the first quarter of 2026, reaching 6.0% in 2027. By substituting the inflation rate of 2% projection into our estimated non-linear Phillips curve we obtain an implicit unemployment-to-vacancy ratio close to 3.15. In comparison to the value of this ratio in June 2024 was significantly lesser at 2.48.

Given that by fitting Phillips curve, to bring inflation close to 2% the unemployment-to-vacancy ratio would have to increase from 2.48 to 3.15. Let´s consider that in figure 2 labour market develops along the fitted Beveridge curve to get align with ECB forecast the unemployment rate would decline from 6.4% in June 2024 to 6% in 2027. Simultaneously, the vacancy rate is also expected to fall from 2.6% to 2.2%.

CHAPTER 5

Conclusion

This study presents an analysis of the relationship among inflation, Philips and Beveridge Curve. We presented three analyses, and the first one showed the relationship among inflation, unemployment and vacancies while the second scenario displayed the model of Beveridge Non-linear curve by showing the non-linear relationship between Job vacancy rate % and Unemployment rate%. The third analysis represented the fitting non-linear Philips curve and displayed the relationship between inflation% and unemployment to vacancy ratio.

When unemployment-to-vacancy ratio declines it means that there are high number of job vacancies and a smaller number of people are looking for jobs. It makes very difficult for employers to fill the vacancies. We will discuss how the shape of both Phillips curve Beveridge curve is directly linked because both curves are based on the fundamental assumptions by which jobs and job seekers are matched in the labour market.

As long as the Phillips curve remains stable with inflation expectations, it encourages the idea that even a small increase in labour market slack can bring inflation down from raised levels. The required increase in slack can be achieved by either an increase in unemployment or a decrease in vacancies, with the decrease in vacancies being more favourable to reaching a soft landing.

Since 2021 the Eurozone has undergone pronounced fluctuations in core inflation predominantly caused by post pandemic economic recuperation, energy market volatility, and supply chain disruptions. It reached at peak in March 2023 and this surged reflected enduring cost pressures and robust sustained demand. However, by the end of 2024 and until September 2025 core inflation had moderated aligning with the European Central bank.

Concurrently labour market is still very resilient and indicating softening in market. This is reinforced by a decrease in vacancy rates and increasing unemployment to vacancy ratio that’s implying a shift toward a more stable labour market.

A relatively low unemployment to vacancy ratio indicates a very stringent labour market which makes very difficult for employers to find and employ new workers. Which eventually put upward pressure on prices and wages. In this study we estimated a nonlinear Beveridge and Phillips curves and these inherent characteristics contribute to inflation dynamics in recent years.

Normally the relationship between inflation and labour market slack is not that stable but when there are tight job market conditions and less unemployment than its normal threshold the Philips curve shows the steeper curve. Similarly, the Beveridge curve outward shift is reflecting labour market is not functioning at optimal efficiency in matching of jobs with job seekers as higher job vacancy rate persists with the significant higher rate of unemployment.

These dynamics accentuate a transitional phase in the Eurozone's economy where inflation is decreasing while labour market frictions still persist. Our estimates suggest that reflecting current conditions labour market, the European central bank´s anticipated target of soft landing of the Eurozone economy is achievable if inflation rate is up to 2% which is accompanied by decline in labour market stiffness generally from a substantial decrease in job vacancies with only a slight rise in unemployment.

"Economics is not just about predicting the future it's about shaping it with courage, clarity, and compassion." Muhammad Yunus

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