



**The interrelationship between interest rate, inflation,
and Economic growth- A comparison between Germany
and France**

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Description

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Abstract

Economic growth can be affected by fiscal policy, monetary and other policies drawn by its governments and central banks. Several factors determine economic growth, and interest rate is one factor that influences borrowers' behaviours to invest. And mitigate financial crises such as inflation, the dot-com bubble, the Lehman brothers, and the Pandemic crisis. The interest rate and inflation cause and effect relationship seem complex; empirical studies have shown a negative, positive, and neutral influence on economic growth. The new normal of monetary policy, like negative interest rates, is believed to impact growth positively. The side effect of such measures could lead to a higher inflation rate affecting household income, RGDP and economic growth.

The thesis investigates the relationship and impact of interest rate, CPI and real gross domestic product in Germany and France featured long-term low inflation. Econometric analysis for Germany and France from 1991 to 2021 suggests that sustainable inflation is essential and significantly impacts economic growth. The findings of the thesis are demonstrated to conclude that the interest rate and the CPI rate positively correlated with the economic growth of Germany and France. In Germany, the Interest rate does not affect economic growth; inflation has a low effect (0.20%). In France, the Interest rate is very low, affecting (0.016) economic growth; inflation has a low effect.

Keywords/tags (subjects)

Interest rate (APR), Inflation (CPI), Real gross domestic products (RGDP), Aggregate demand (AD), Aggregate supply (AS),

Contents

1	Introduction	4
1.1	Motivation for research	7
1.2	Research Purpose.....	8
1.3	The Structure of the thesis.....	10
2	Literature Review	10
2.1	Economic Growth.....	11
2.2	Interest rate (APR).....	14
2.3	Inflation (CPI).....	18
2.4	Interactions between Inflation, Interest rate and RGDP	22
2.5	Inflation, Interest rate and Growth in 2021“ <i>A Quite Financial Crisis.</i> ”	24
2.6	Theoretical Framework	27
3	Methodology.....	32
3.1	Research Approach	32
3.2	Research Context	33
3.3	Data Collection	33
3.4	Data Analysis	40
3.5	Method of Analysis.....	41
	Correlation	41
3.6	Analysis models.....	42
3.7	Validity and Reliability.....	43
4	Result.....	43
4.1	Germany- Descriptive Analysis.....	43
4.2	Germany Pearson Correlation Analysis.....	45
4.3	Germany Linear Regression Model 1	46
4.4	Germany Linear Regression Model 2	47
4.5	France Descriptive Analysis	49
4.6	France Pearson Correlation Analysis.....	50
4.7	France Linear Regression Model 1	51
4.8	France Linear Regression Model 2	53
5	Discussion.....	55
5.1	Findings Germany's Descriptive Statistics.....	55
5.2	Findings Germany Pearson Correlation	55

5.3 Findings Germany Linear Regression Model No.1	57
5.4 Findings Germany Linear Regression Model No.2	57
5.5 Findings France Descriptive	58
5.6 Findings France Pearson Correlation	58
5.7 Findings France Linear Regression Model No.1	60
5.8 Findings France Linear Regression Model No.2	61
5.9 Findings Germany vs France Comparison Experience	61
5.10 Limitations.....	62
5.11 Conclusion	62
5.12 Recommendations	64
References.....	64
Appendices.....	76
Appendix 1. Germany ANOVA Model no.1	76
Appendix 2. Germany ANOVA Model no.2	76
Appendix 3. France ANOVA Model no.1	77
Appendix 4. France ANOVA Model no.2	77
Figures	
Figure 1. OECD GDP in the first quarter of 2020 (OECD,2020)	5
Figure 2. Euro Area annual inflation (Eurostat, 2022)	9
Figure 3 Components of GDP (Richter& Jun 28, 2019).....	13
Figure 4 Euro Bond Yields (Heise et al., 2019, p.7)	16
Figure 5 Short term interest rate (OECD, 2022)	17
Figure 6. Long term interest rate (OECD 2021)	18
Figure 7 Demand-Pull Inflation (Hall, 2021).....	21
Figure 8 Cost-Push Inflation (Hall, 2021)	21
Figure 9 World non-financial debt, public and private (Heise, 2019, p.67).....	25
Figure 10 Fed policy and the cycle (Heise, 2019, p.64).....	26
Tables	
Table 1 Descriptive Statistics Germany.....	44
Table 2 Pearson Correlation Germany.....	45
Table 3 Linear Regression Model 1 Germany	47
Table 4 Linear Regression Model 2 Germany	48
Table 5 Descriptive Statistics France.....	49

Table 6 Pearson Correlation France.....	51
Table 7 Linear Regression Model 1 France	52
Table 8 Linear Regression Model 2 France	54

1 Introduction

Financial Times, “A radical rethink of the financial system was essential after a devastating crisis,”. According to IMF, 147 financial crises were damaging to economic growth from 1970-2011. In the USA, 31 per cent of GDP loss and production compared to the Napoleonic wars and both world wars, a higher fiscal cost on the UK than the current crisis, in just three years from 2007 (Wolf, 2018). Heise stated that the ECB had faced three significant economic crises in the last two decades, severely damaging the financial sector because of massive financial bubbles that had grown up during the previous decades. Central banks restructuring and bailing out the countries, for instant, Greek and Italy, subsequently halt the insolvency. These mitigating measures inevitably create a financial bubble (Heise, 2019, p. 62; Heise, 2013).

Chief Economist of World Bank called the pandemic a “The quiet financial crisis”. She said that certain financial crises do not have the crisis or panic of the Lehman brother times but are still colossally expensive, such as bank restructuring, debt crisis, and slowing economic recovery. Covid -19 pandemic presented many moments of unwanted drama (Reinhart. 2021). The core point of this research thesis is based on the most recent economic crisis triggered by Sars-2 in 2019 November in China and spread worldwide. According to WHO (2020), countries worldwide have an exceeding 3.3 million death tolls. According to the IMF, a “crisis like no other”, the Covid pandemic would cost the global economy a \$12tn hit. Many countries introduced containment and mitigation measures in March in the guardian post. The epidemic led economies into a Great Lockdown, and border restrictions that mitigated the spread of illness and saved lives also created the most significant economic recession (Elliot, 2020). EU GDP dropped by – 3.8% in the first quarter of 2020, Germany by 2.6%, and France by 5.8% gross domestic product (OECD,2020).

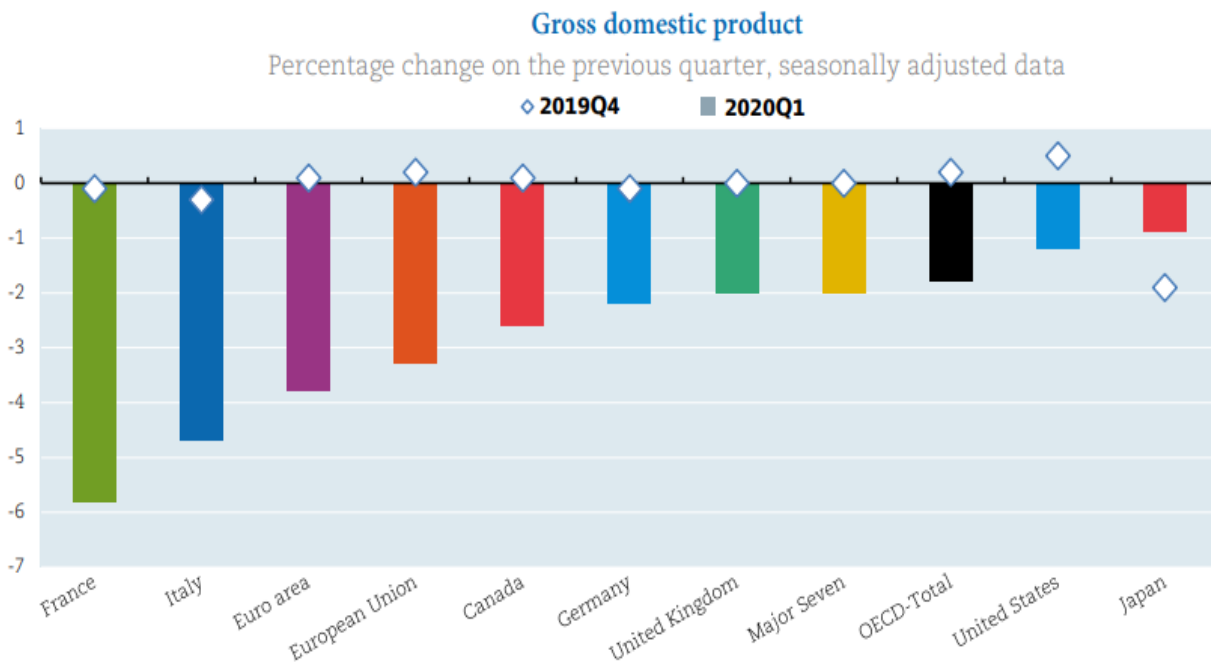


Figure 1. OECD GDP in the first quarter of 2020 (OECD,2020)

In the 1930s, the “Great Depression”. According to the author, nations' output had reduced due to the shutdown of operations, production, supply chain disruption, and increased unemployment. The Spanish flu pandemic started in March of 1918, as the first wave of infection began. Spain had reported the impact of the pandemic while others were suffering from the war. The second and third waves were the most devastating. Fifty million people died, 500 million were infected, and the fatality rate was about 2% (Terry,2020). The Federal Reserve of St Louis, in 2007, estimated that the impact of influenza or pandemic on the economy, manufacturing dropped by 18%, and there was a significant decline in supply and demand. The likelihood of influenza worldwide was already a worry for many countries worldwide. The World Bank assessed those 800 billion U.S. dollars would be a necessary cost of a global pandemic for the global economy and tens of millions of deaths. The initial cost to the economy may reach 166 billion U.S. dollars or nearly 1.5% of GDP. The Department of Health in the US gives a very different scenario. Long-lasting estimated costs are a lot higher. They calculate that up to 1.9 million people will die in the U.S, and the economic cost will be close to 200 billion U.S. dollars (Garett, 2008).

Covid – 19 pandemic. According to the European Banking Federation facts and figures, in the spring of 2020, mitigating the impact of the pandemic on economic growth requires powerful financial support for businesses and consumers. EBF stated that ECB monetary policy addressed

negative interest rates (APR) to increase demand for investment and credits across the yield curve. For example, quantitative easing (QE) provided more lending to the organizations and consumers. Thanks to the additional long term refinancing operations (LTROs), Monetary and Fiscal policies, banks can provide lending to the economy. Immense buying-up programmes like Pandemic Emergency Purchase Programme (PEPP) boosted by €600 billion on 4 June to a total of €1,350 billion, which reinforces economic growth and stimulates growth to post-pandemic levels (EBF, 2020).

History shows that policymakers strengthen the economic recovery from the financial crisis, such as a pandemic. During the Covid19, the Central banks worldwide have moved into a similar area, the negative interest rate and facilitated quantitative easing (QE). Subsequently, one of the things that happened is that QE pushed asset prices to go higher without increasing real output. Eventually, the overall CPI rate hit its record high (ECB,2022). OECD (2021) said that inflation (CPI) is a considerable risk to the real gross domestic product (RGDP), and the current price rises can be further than the forecast. Due to higher inflation, global growth is downrated from 5.7% to 4.5 in 2022. IMF (2021), policymakers are concerned that massive QE, accommodating policy support to respond to pandemic (Sars-2) and negative interest rates could cause recent inflation spikes. Supply shocks and significant uncertainties mainly associated with the evaluation of economic slack, rising housing prices, and a significant upswing in the commodity price show the headline inflation may climb significantly higher than the baseline.

Kollewe (2022) describes in the Guardian (Global economy), The most significant challenge the policymakers are facing around the world is the rising inflation rate. The article presents that Douglas Mc Williams, a think tank at CBER, downgraded the UK growth from 6.7 to 6.6. The Guardian (2022) BOE raised interest rates when the police makers noticed rising inflation to 5.1% a decade high. Further, the US Fed will have three rate hikes in 2022, reduce QE, and further asset buying. Rising interest rates and reversing QE will mainly halt the rising inflation and the soaring property market (CBER, 2022).

Heise (2018) stated that to achieve great moderation, growth, employment, and stable inflation. ECB has ignored the financial stability concerns, and they believed the price stability would assure economic growth. Though, "keeping price constancy is not sufficient to impress RGDP".

The research explores the link and influence of APR, overall CPI and RGDP in the EU, with long periods of low inflation. The scope of the thesis is economic growth, interest rate and overall CPI (from 1999 to 2021). I have collected secondary data from OECD and FRED for quantitative descriptive analysis. The thesis consists of interest rate, CPI, and RGDP. The core findings of the studies are that interest rates and inflation rates positively correlate with German and French economic growth. In Germany, interest rates and CPI have a low effect on RGDP, while in France, interest rates are low affecting RGDP; inflation has a very low influence. The thesis's structure and literature review chapter provide the relevant theoretical foundation. The methodology consists of the quantitative research approach and secondary data collected from OECD and FRED. In this respect, Descriptive statistics to understand the data. Pearson correlation and multiple linear regression analysis find the strength between the chosen macroeconomic factors. Econometric analysis was carried out for Germany and France, assuming that sustained inflation is essential and substantially influences economic growth.

1.1 Motivation for research

The thesis motivates me to explore the nature of the financial crisis—analysing them statistically and finding which independent variables influence economic growth highest than the other. The thesis covers key areas of arguments relevant to monetary policy, focusing on RGDP, interest rate and CPI. There are advantages of Monetary policy also challenges that occur through continuously expansionary monetary policies. I attempt to research academic literature and draw conclusions for a monetary policy using quantitative-based research analysis, which starts with its relation to RGDP and its impact on RGDP. Even though the debate is not new, its importance has increased immensely during the pandemic 2020. Central banks worldwide have moved into similar areas such as below zero LTIR and QE, as usual, do in all-natural disasters or financial crises. In recent years, it has become a new normal for ECB and FED reserves (ECB et al.,2022).

The national bureau of economic research mentioned that business investment decreases because of inflation and the effectiveness of productive factors. There is a lack of research to establish and analyse the correlation between RGDP and overall CPI (NBER, 1997).

According to El-Erian, Fed and the ECB have no option but to shoulder the majority responsibility for improving macroeconomic results and preventing drowning in their economies into a deep depression. There is always a challenge to convince the government policymakers to pass the required policy. Evaluation of findings may deliver practice-relevant information that banks and researchers can consider in future events, free from excessive bureaucracy (Heise et al., 2019, p90).

In personal motive, this topic needs more research regarding IBM and how the organizations can customize their strategies to the economic growth and interest rate. I expect to grow my academic and professional knowledge by further researching this field.

1.2 Research Purpose

The thesis main objective is to examine interest rates, inflation, economic growth, their relation, and their impact on RGDP. The main reason and problem determined in the study is that the ECB and central banks worldwide boost the economy at some point when sustainable inflation overall. Excessive QE and other measures stated previously may depress the output. Historically, ECB announced the end of QE in 2018 through large scale asset-buying with the combination of zero interest rate in 2019. EU economy had experienced ten years of economic growth. If the ECB area faces another crisis or recession, ECB has left without any firepower except a negative interest. The challenge is the inflationary pressure due to ECB balance sheet expansion and massive surplus to increase credit (Heise et al., 2019, p. 84).

According to Bloomberg (2021), These are the most considerable risk in 2022, and one of them is the threat of inflation U.S forecast 2% inflation by the end of the year, but it is close to 7%., a major miss and risk to the growth (Astol, Michela, Emmanuelle, & Curran et al., 2021). Nair said in a Reuters poll that Eurozone inflation would rise more. However, ECB rates would remain frozen. The inflation forecast has risen respectively, Q1 4.1% and Q2 3.7%, of 2022, all above the ECB inflation target of 2%. Any other variant or expansion of the war in the EU could push the inflation rate further up. Eurozone GDP projections have expected to be lower as supply-driven inflation reduces families' spending power, affecting EU-area economic development and consumption.

The European Union's statistics department, EU area inflation figure, CPI in the EU will reach 7.5%. Regarding the key components of the Eurozone, CPIEng has projected a sharp rise from 32.0% to 44.7% in 2022 and followed by CPI food, drink, and cigarettes, 4.2% to 5.0% rise (Eusepi et al., 2009). Economists say ECB should act and start early. Negative and zero interest rates are strictly crisis procedures, and they see no explanation for keeping rates very low. Bantleon Bank GDP growth in Germany downgraded to 4.0%, from 4.4%, and France's growth rate from 3.7% to 3.9%. These two most significant economies in the EU saw an uptrend in the inflation rate this year (Nair, 2022).

EU area annual inflation

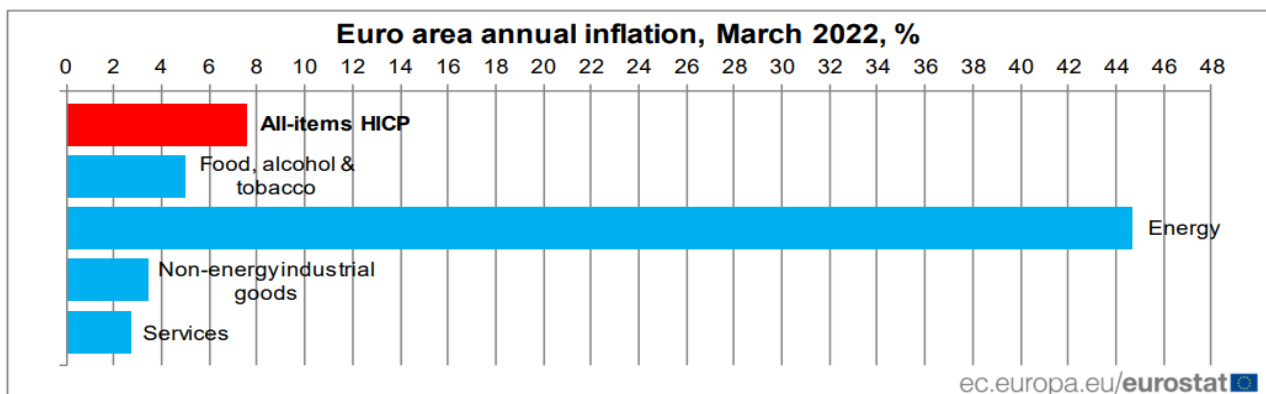


Figure 2. Euro Area annual inflation (Eurostat, 2022)

The thesis also sheds light on recommendations at the end of the thesis to decrease the damaging impact of the emerging crisis and explore the monetary policy in the literature to recover economic growth to its pre-crisis levels. Eventually, keeping inflation under control compensates for performance and higher per capita income (NBER et al., 1997). Despite all our knowledge of the problem, researchers point out that we do not know much about economic growth and inflation. The inflation rate is correlated and their influence, which can benefit understanding the valuable insight of uncertainty and add to the literature. The research for this work was mainly about the ambiguous environment and how current research focuses on understanding the unexpected phenomena through a holistic lens that can benefit from studying links and connections between global growth, interest rate and inflation rate.

This research paper investigates interest rate and inflation RGDP, which can add to prior studies. This paper takes the correlation coefficient and multiple linear regression method. Therefore, the

thesis aims to explore the relationship between CPI rate, LTIR, STIR and RGDP and their impact on, Germany and France.

Therefore, the research question for the thesis is:

What is the relationship between interest rate, CPI, RGDP and their impact on RGDP?

1.3 The Structure of the thesis

The thesis includes an abstract and an introduction containing the setup, topic, purpose, relevance, and research question. The topic of the thesis consists of three macroeconomic factors and two top GDP countries in the EU area. Chapter two literature review developed a coherent structure and clear justification for my research. Include definitions and depth explanations of the related literature and the theoretical framework. Chapter three contains the methodology, and the chapter explains the research strategy, data collecting, and analysing techniques. The research context has the practical context of the topic. Chapter four is the results of empirical research in Germany and France. Chapter five holds a discussion and a comparison experience. Conclusion retrieved from both countries' statistical results and possible logical recommendations.

2 Literature Review

The following literature review confirms that price policy is not the only purpose of ECB to attain great moderation in economic growth. QE and central banks' unconventional measures present challenges and do not impress the RGDP. For this purpose, the literature review consists of associated explanations, definitions, and a theoretical foundation for the thesis. It starts with an understanding and defining economic growth in-depth. The economists and think tanks consider the key factor in measuring the economic growth is RGDP. Define the APR further, what determines interest rates, in practice matters to the economy. Finally, defining inflation and its relation to growth and interest rate. Additionally, investigating theoretically and coupled with inflation, interest rate, growth, and their relation to the pandemic as the financial crisis.

2.1 Economic Growth

Macmillan 1920, Adam Smith Scottish economist, the father of modern economics). He discussed the topic of capital accumulation., population growth and productivity. Smith talked about free trade and opposed planned economies. In the *Wealth of Nations*, the primary source of economic growth is the nation's population employed in a productive workforce. Another reason is the accumulation of capital. He advocated achieving a high level of employment, and first, capital accumulation must expand. Alfred Marshall a century later. The size of the market and labour productivity count on national and international trade regulations. Random (1947). Any control will restrict the market size, decreasing the international specialization of labour and domestic productivity. Smith showed three phases that associate the division of labour with the boost in productivity. The first step to rising in the number of workforces; the next step is the improved efficiency of workers, and the last is the accumulation of capital.

In 1956 Robert Solow won a Nobel prize for his work-issued on economic growth. Later he served on an independent "commission on growth" by World Bank. The task was about weight, shift, and boosting economic growth. Mr Solow proved that anything adds to economic productivity without increasing more workforce and accumulation of capital. He described this wave of wealth as "technological progress" in 1956 and quantified in 1957 (*The Economist*, 2006).

IMF (2009) Working Paper. Describes the foreign investment has a meaningful influence on the total factor productivity, that fact on the national labour's level of education. As a result, a factor of accumulation has been the main growth driver in northwest Africa from 1970-to 2005. Economic growth: The European Union explored in-depth economic growth policy, and all economic bodies, including governments, have made a considerable attempt to encourage the growth trend. European Union primarily focuses on policy job creation, effective usage of financial resources, financing, innovation, and technology support. EU shows a key factor of economic growth is real GDP and the GDP per capita through the econometric data analysis (Cristescu & Tilvar, 2019).

The following section explains the measuring the economic growth. Adam Smith (1723-1790), the writer of the "bible of capitalism", described the economics of time, influenced by the notion that

the accumulation of gold and silver calculates a country's wealth. He proposed that the total production could measure the nation's wealth, in other words, by gross domestic product today (GDP) (Biography, 2019). Economists and prominent institutes like the IMF, World Bank, FED, OECD, and ECB use the real gross domestic product and GDP method as a standard metric to measure growth.

Gross Domestic Product (GDP)

The bank of Canada states that GDP is the standard method to measure how well the economy is doing. GDP is the sum of the value of all products produced in the country also includes the services. The concept of RGDP refers to minus the inflation from nominal GDP. The bank defines three time periods for measuring and comparing real GDP. To know the speed at which the economy is growing, economists use a standard method to measure real gross domestic product (RGDP). "RGDP is the sum of all products and services produced value in our economy". RGDP is the effect of inflation excluding the nominal GDP (Bank of Canada, 2021).

Bank of England, GDP is a way to analyse how big and how healthy the financial situation of a country is in a specific amount of time. It is applied to assess the size of various economies at various times. BOE states the method of calculating by adding up the GDP each quarter, the aggregate value of products and also includes services produced in the countries. The income of every person and expenditure on the land (BOE, 2022). IMF GDP is all around our cars, doctors, hairdressers, and people who produce goods and other services. If you add up the value of goods and services or add up the incomes of the selected country over a certain period, higher GDP means the country is doing good and vice versa. GDP defines the monetary value of products and also includes services produced over time; thus, some factors may not involve GDP, like the environment, a mother looking after the child at home, or a family member getting paid to look after another family member. GDP is the indicator used to measure the phase of an economy and indicate how much the economy produces a year. The statistical agencies of any country usually collect the information that helps calculate the country's GDP. Many countries pursue international standards confirmed by the IMF, ECB, OECD, the UN, AND the World Bank. Corporate Finance Institute (CFI) explains GDP in an article. It is a wide-scale financial measurement of a nation's total economic ac-

tivity, including total goods and services bought by consumers. Involves all private spending, government expenditure, investments and (total of export-total of imports equals net exports) (Callen,2020). There are two ways to observe GDP: nominal GDP and the second one is real GDP.

GDP Formula and Components of GDP

Expenditure Approach: $GDP = \text{Consumption} + \text{Government Expenditure} + \text{investment} + \text{Net Exports}$. $GDP = C + G + I + NX$

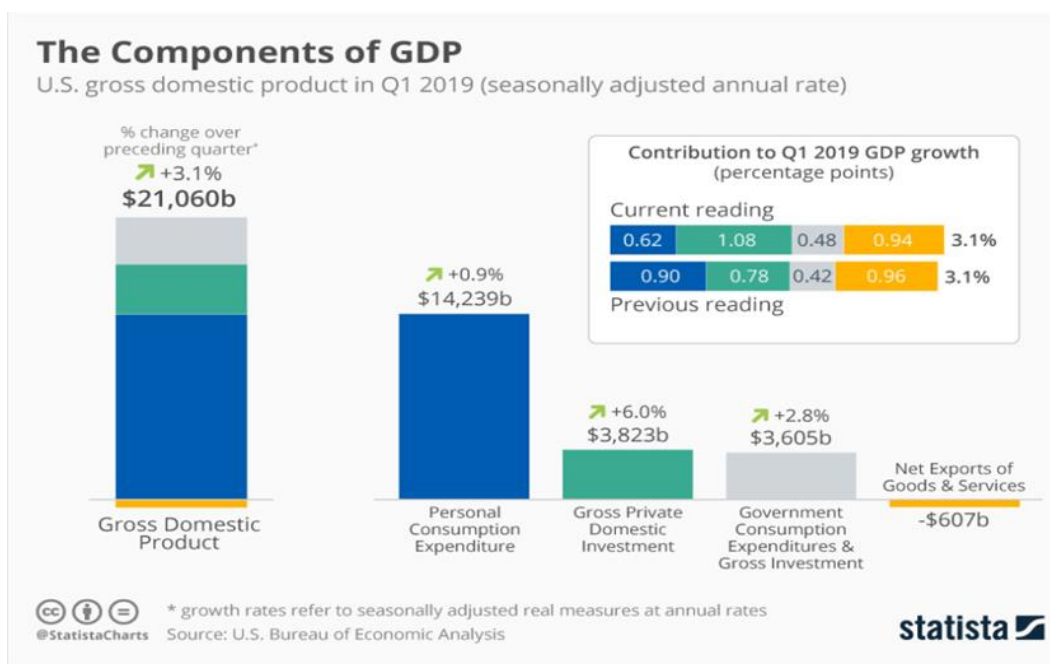


Figure 3 Components of GDP (Richter& Jun 28, 2019)

Real Gross Domestic Product (RGDP)

To find out if the economic output is rising. Are the countries in a better position now than ten years ago? GDP figures can assist us in answering all these problems. First, we must make some adjustments. That implies two possibilities for GDP growth. First, while the price level may increase the GDP statistics, in this situation, the economy is not creating additional products and services. Inflation is driving the rising GDP. An increase in the numbers may seem positive on paper, but it is an illusion, representing just nominal growth. Boyce's (2022) RGDP grows by producing more valuable things and services, which translates into more or better goods and services.

The productivity-based increase in the economic growth controls the inflation statistically, where the optimal rate of innovation can grow in the real gross domestic product (Dunave, 2013). Boyce (2022) To obtain an accurate economic picture, we utilize Real GDP in its research.

Because GDP quantifies the value of economic production, It does not give comprehensive and accurate information on how the economy is performing. For example, Venezuela faced tremendous inflation of over 1000% at the beginning of the 21st century, but it does not mean the economy has grown 1000% every year. Contrary argument, Boyce rejects the RGDP or Gross Domestic Product (GDP) to measure CPI. In other words, it ignores the role of pricing in economic growth and allows us to compare the quantity produced rather than the value (Boyce et al., 2022). The formula for

$$\text{RGDP } R = \frac{N}{D}$$

2.2 Interest rate (APR)

European Committee of the EP (1999) requested a briefing on the various topics, one of them being a determination of interest rate. First and foremost, it is essential to have a brief insight into the financial system that delivers the perspective of interest rates. To loan money from a lender and pay a reward for a period is also the price of money. Interest rate reward calculated in percentage and terms per annum (pa), including 7.5% pa. Along with understanding the financial system, the interest rate definition is different to a lawyer than an economist.

Economic definition: In economics, “interest is above all a price rewarded for credit or money”

The specialist journals academies describe STIR and LTIR.

Keynes believed the APR was used in the market for the loans and “Liquidity preferences” instead of investing their money in bonds and assets instead of cash. Conversely, if savers believe their assets' value falls, they keep their money. The theory of liquidity preferences is about the supply and demand of capital. Once the money supply rises, lenders prefer to buy assets, such as bonds, the price rises, and the rates fall. When investors prefer liquidity rather than bonds and securities, the demand for money rises, and the interest rate increases. Most economists agree on long-run equilibrium rates, the expected rate of return in simple terms to meet investor demand to concede sufficient consumption (Keynes, 1960, p. 165).

Professor James Tobin Neo-Keynesian Nobel prize winner in 1981 “Portfolio Selection Theory “choice made by the households and firms among physical or financial assets have different prices and rates of return. Not only but also all sorts of financial occurrences can impact these choices. Due to the fact modern economic thinking does not agree with the perception of a single long-run equilibrium (Investopedia, 2021).

Role of interest rate matters in economic growth

OECD (2022) According to OECD's leading economic indicators, Investment is a significant source of a healthy economy. As I have explored above, the LTIR is one of the key types of Interest rate determining the encouraging investment factor. On the flip side, high-interest rates discourage investment, affect bond prices in financial markets, and slow down growth (Huddleston, 2022). According to Patterson and Lygernu (Directorate-General for Research) at European PA, fluctuations in LTR will impact the economy even though economic forces are highly complex and uncertain about the transmission mechanism which determines the LTR.

On the other hand, it affects investment to drop and this fall in AD and productivity. Vice versa drop in LTR will increase investment, demand and production. Despite also influenced by the structure of an economy and the mechanisms of demand.

Thomas Meyer (1995) demonstrated that a sharp bonds yield return pushes borrowing demand decreases. As a cause of falling GDP growth to 0.75% for the rise of 1% of interest rate and fail to keep up after few quarters. Nevertheless, a drop in long-term rates shows a positive effect on growth. Keynes shows that if Long-term rates are low, they have changed from 7.2 per cent and 7.8 per cent from 1994 to 1999, rising in the real economy (Otaki 2016).

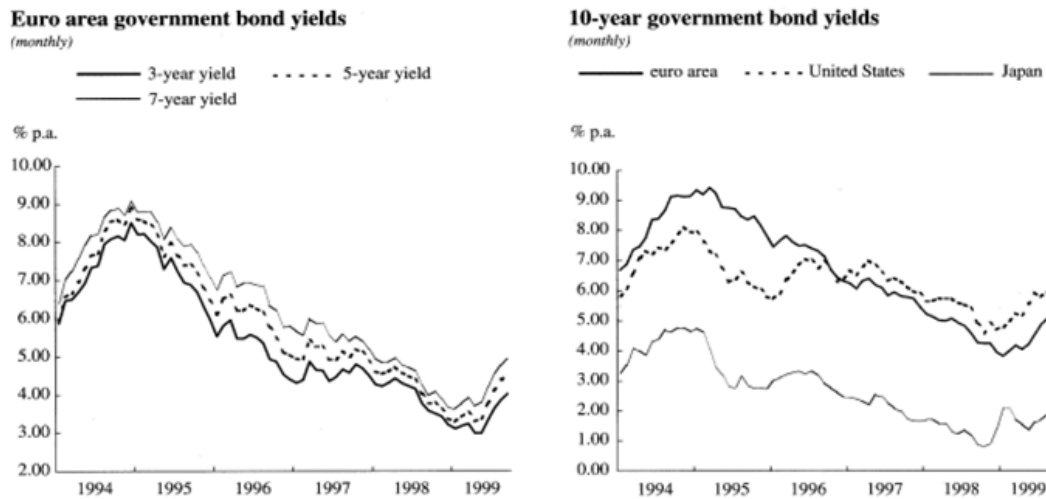


Figure 4 Euro Bond Yields (Heise et al., 2019, p.7)

A financial crisis started in the Euro area in the first quarter of 2020, resulting in a slip of Real GDP growth down to -11.68268, a decline greater than any past crisis since the great depression of 1930. Long term interest rate (LTIR) Feb 2020, 0.1% dropped, and the long-term interest rate failed to keep up after a few quarters, further drop seen to -0.1 in Jan 2021. Nevertheless, a drop in long-term rates shows a positive effect on growth. The figures show if Long-term rates are low, they have changed -from 11.68268% to 0.28971% per cent from the first quarter of 2020 to Q4 of 2021, a rise in the real economy. Also, Jan of 2020, 10 years bond yield at 0.1334 started to rise in April 2020 by 0.5539%, and real GDP rose in Q3 by 12.55337% 2020. LTIR in December bottoms -at 0.0915% in December and real GDP increased to 2.200%.

Interest Rate in practice

Any given interest rate has a given maturity period. Therefore, it split into “**STIR and LTIR**”. Short-term bills and treasury instruments have maturities of 1, 3, 6, and 12 months. The usual identical is known as “money market rates” and “treasury bill rate.” (OECD, 2022)

Euro Area STIR

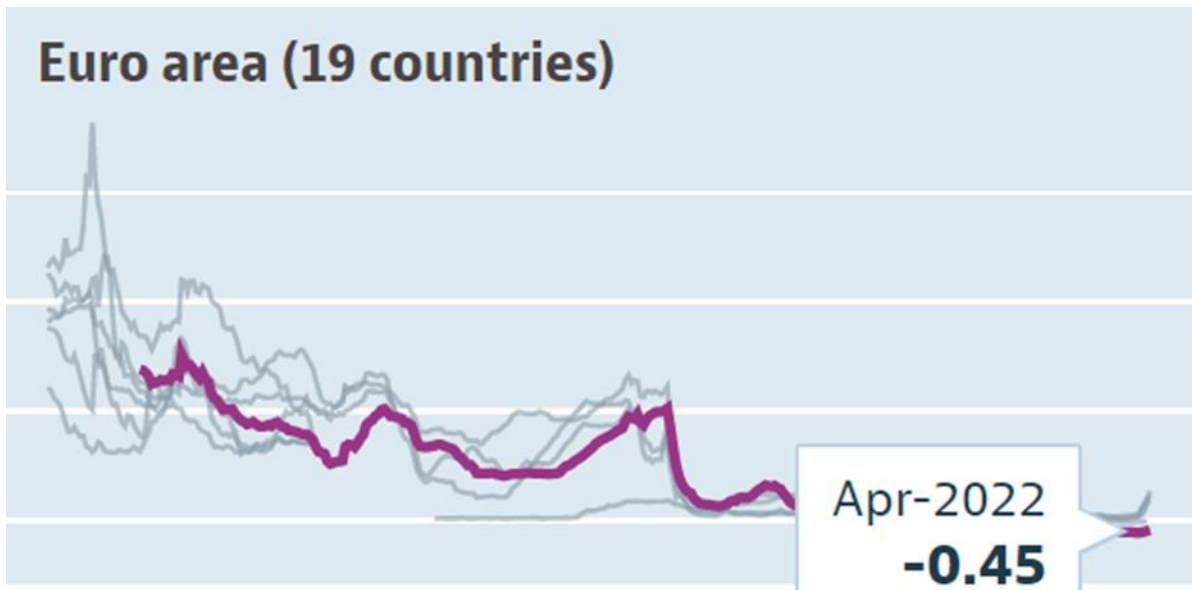


Figure 5. STIR (OECD, 2022)

Long-term Interest Rate (LTIR). Linked with the bonds whose maturity is longer than a year, such as five, ten, fifteen, etc. Ten-year bonds are benchmarks for defining the LTIR in the Eu. One should expect a higher return on bonds as compared to the bills. Since the longer the bonds' maturity, the higher the degree of uncertainty and risk involved. Therefore, higher the yield (return). And viewers in the bills short-term is, the maturity of bills relates to short term uncertainty and risk. During the present crisis, In July 2001, in the EU 19 countries, LTIR was 5.25%, and in January 2022, LTIR in the EU area was 0.53% (OECD, 2022).

Euro Area LTIR

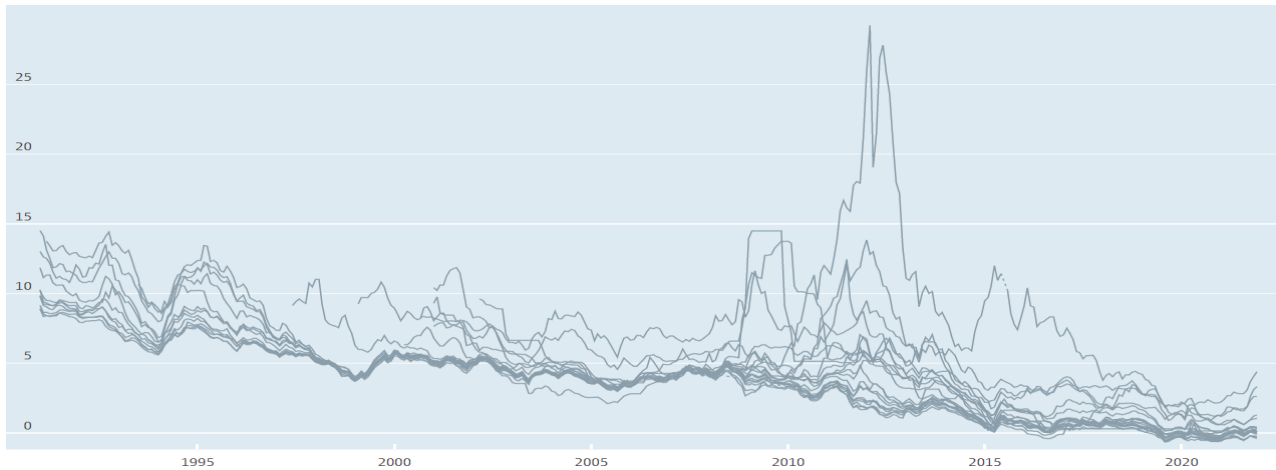


Figure 6. LTIR (OECD 2021)

2.3 Inflation (CPI)

According to World Bank, the explanation of inflation is a measurable value at which the average value level set of the same products and also includes the services in a country change at a definite time. It is simple when prices rise, and goods such as fuel or computers rise in price are, not inflation, and it only refers to the average price level of all products. Economists use national levels, the index of all prices in an economy, to measure inflation called the CPI (World Bank Group, 2022).

Delving into the explanation of CPI is critical to understanding how to evaluate it. The CPI determines price fluctuations in a set of products and includes the services frequently bought or used by families in a country from one period to another. Economists estimate CPI as an annual growth rate, and CPI is a measure which determines how the change in the price levels affects families. Each measure is created by taking the CPI weighted average of multiple elementary total indices. HICP indices were created by gathering a sample of prices for certain items and services from a group of stores or outlets. Other sources of products and services consumption in a certain region or by its residents and components of inflations are the following (Ha, Kose & Obsorge, 2021).

Consumer Price Index Energy (CPIEng): Change in the average price of electricity, gas, other fuels, and lubricants to operate personal transport equipment. (The Law Library, 2018)

Consumer Price Index Food (CPIF): Change in the average price households buy food for home. (Eusepi et al., 2011)

Consumer Price Index (CPIxFE): Overall CPI does not include food and energy price change. (Bade & Parkin, 2017)

Overall Consumer Price index (CPI): Change in the price of all items indexes is biased by average fluctuations in products and services (OECD, 2022).

Calculating the Inflation Rate CPI, Determines the value of a set of products for a certain year divided by the value of the same set of products in a base year.

$$\text{Inflation Rate: } \frac{\text{CPI year 2} - \text{CPI (previous year) 1}}{\text{CPI 1}} \times 100$$

Producer Price Index (PPI)

PPI determines the average price variation in local producers of products received in a region or country for their products. Deducting all taxes, trading margins, and transportation costs, the average change in prices received by producers of various commodities is also measured. PPI is an advanced economic indicator that measures pricing changes in semi-processed, intermediated and finished commodities, for example, consumer products and capital equipment. Including price fluctuations in consumer products and services from numerous price indices reported yearly (OECD, 2022).

Inflation and inflationary pressure are fundamental factors of macroeconomics and growth. Higher inflation was present in the USA in 1990 to consider the past inflation and current occurrence to make the comparison fair. When the price level increases and anyone loaning a certain

amount of money need to expect not to lose value when the loan has expired, it is essential to define the inflation (Oner, 2008).

Main types of inflation, The thesis mentioned three types of inflation.

- Demand-pull inflation
- Cost-push inflation.
- Stagflation

Demand-Pull Inflation

Aggregate demand (AD) moves further to the right in price inflation (Figure 7). Similarly, a shift occurs in GDP to the right, and P1 to P2 and P3 increase price levels. The change in the GDP to the right is due to enormous stress on producing more. Reasons there is more significant pressure on the existing factor of production are becoming scarcer. The resources prices go up like wages, price of labour, capital, and land. As a result, firms pass on those higher prices of products to the consumers. The increase in AD is due to various drivers, for example, lower interest rates and a reduction in borrowing, which makes consumers spend. The same scenario for businesses to invest in can weaken the exchange rate and boost net exports. Another reason is lower income taxes and corporation taxes, which retained profits and businesses' investments. Other factors like higher consumer confidence, business confidence, and government spending have a similar effect on AD (Hall, M 2021).

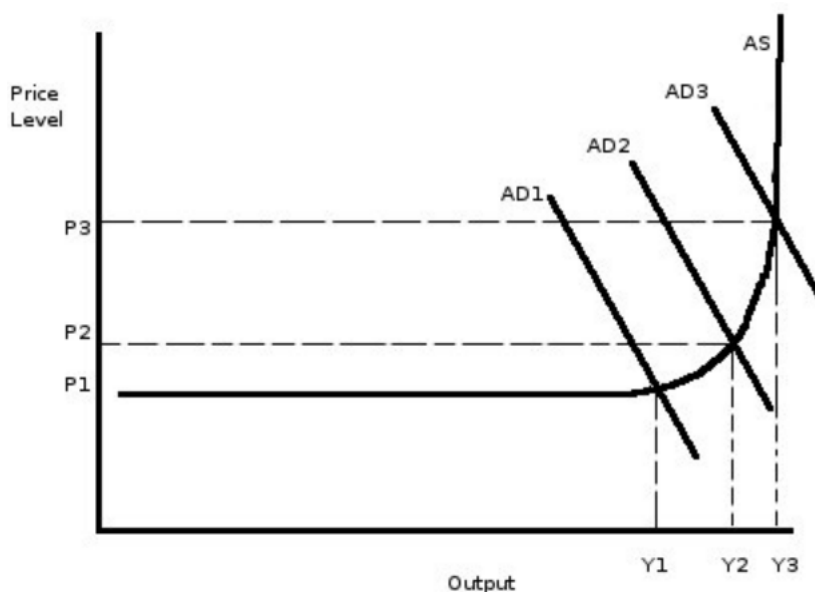


Figure 7 Demand-Pull Inflation (Hall, 2021)

Cost-Push Inflation

Wage push inflation or cost-push inflation where the Aggregate supply (AS) moves inwards. Figure 8 Shows the cost-push inflation shifts from P to P_1 when the cost of manufacturing increases for the majority of the producers in the economy. Producers' costs are passed to the market and finally added to the consumer. In other words, the higher manufacturing cost elevates the price levels. The AS moves to the left due to the raw material prices increase. Other factors include wages, business taxes, prices of imported raw materials, and weaker exchange rates. (Hall, 2021).

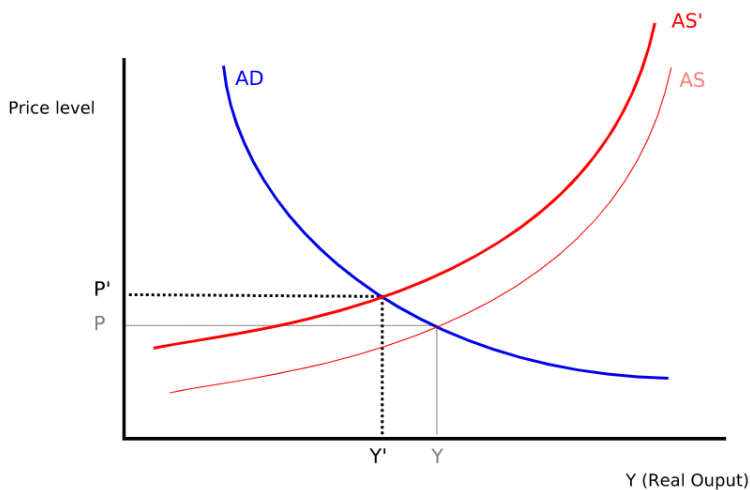


Figure 8 Cost-Push Inflation (Hall, 2021)

Stagflation

Stagflation, sometimes known as recession-inflation, occurs when the overall price levels rise, economic growth halts, and unemployment rises further. It binds economic policymakers since measures to reduce inflation may exacerbate unemployment. In initial condition macroeconomic models, a shrinking output has trailed an increase in price levels. Consequently, a stagflation economy faces evidence of an unexpected supply shock, and demand shocks, involving monetary and fiscal policy shocks, should cause inflation and production to move in the same direction (Loyo, 2000).

According to Sargent and Wallace (1981), monetary tightening may cause inflation to rise while having no supply-side effect. The same is true of the recommended fiscal approach to price determination Leeper (1991). According to fiscal equilibrium determination, monetary contraction causes inflation to rise rather than fall. When prices are sticky, the tight money dilemma accompanies a fast drop in activity level. As a result, economic contraction creates stagflation despite the absence of any cost-push route of monetary policy transmission (Loyo et al., 1999; Sims, 1994)

In late 2021 and early 2022, the pandemic's Delta and Omicron waves significantly impacted output in the EU and other parts of the world. Russia's invasion campaign of Ukraine has raised oil and food costs, disrupted supply networks, and harmed consumer confidence. Continuous unexpected financial crises are hammering the EU economy. Furthermore, just when the EU was ready for a significant comeback from the pandemic, Putin's war halted the embryonic economic recovery. The EU faces stagflation risk and may descend into stagflation (Wearden, 2022).

Fox (2022), Central banks in Europe used to be boring institutions led by dull men in double-breasted jackets, but in the last 15 years, they've gained a reputation for interventionism. But, with Europe facing the economic double whammy of price increases and flat wages, known as stagflation, the ECB has run out of monetary rabbits to pull out of the hat. Fuel costs have skyrocketed, and that is only the beginning. Several countries' wheat shortages have been due to the interruption of Ukrainian and Russian supplies, notably in North Africa. Who knows how much bread and spaghetti will cost in six months?

2.4 Interactions between Inflation, Interest rate and RGDP

Understanding CPI, interest rate and growth is essential for financial stability and analysing the correlation between them, which meets the main objective of the thesis. Special consideration, there are approaches to retreat cost-push inflation. Suppliers and producers consider raise aggregate supply. Governments should consider tax relief, and ECB can increase the interest rate to neutralise QE's aftereffects and unconventional monetary measures. The interest rate increase is similar to combating wage push inflation. The government and central bank would use contractionary monetary and fiscal measures to retreat price inflation and temper AD. ECB had taken revolt steps

during the pandemic financial crisis, have accumulated many Govt debts and facilitated unlimited quantitative ease and borrowing opportunities for banks. ECB assured low-interest rates promise. Such policies were unthinkable and changed the banks' traditional ways of managing the crisis, triggering various taboos like financing Govt deficits, which could also trigger a rise in inflation. The ECB has been targeting sustainable CPI sine the long run. As a result, ECB entered the unknown ground, a *new normal* for the bank.

After the financial crisis of 2008, the central bank's objectives for many years were to keep in unchange territory. But in 2017, inflation started to shift up, so central banks began to reduce their stimulus packages and move towards conventional policies. However, ECB kept their policies on hold and interest rates at zero. Significant asset-buying programs have expanded their balance sheets during the quantitative easing. Such unconventional dogma and *new norms* impact economic growth and inflation, raising controversy. As in empirical evidence, Barro (1995) clarified that high inflation inhibits investment, hurting economic growth. He noted that a rise in annual CPI of 10% per year decreases RGDP per capita by 0.2% to 0.3%. Barro data from one hundred countries and covers 30 years from 1960 to 1990. Sidrauski (1967) claimed no link between inflation and real growth. In 2022, a debate: instead of emphasising inflation targets, negative interest rates, and quantitative easing as the correct concepts of monetary policy to boost economic growth. Or economists need to look at other more sustainable mechanisms to feed into economic growth and inflation (Heise et al., 2018, p.1).

National Bureau of Economic Research published at OECD level (1997) Does Inflation Harm Economic Growth? Increased inflation reduces business investment and efficiency, with which productivity decreases. The paper stated the base of 1973 to 1984 when inflation reached an average rate of 13 per cent. According to Fisher's (1993) research, the link between growth and CPI is negative. Another investigation pointed out that developing countries have positive and developed countries negatively associated with growth. (Paul, Kearny & Chowdhury,1997)

Economists and monetary policymakers have understood that sustainable economic growth is achievable when the inflation “monster is tamed”. A single per cent point fall in inflation positively impacts per capita income of 0.5 per cent to two per cent. The author argues that there is little op-

portunity in their interpretation that inflation is not neutral and does not support a boost in economic growth, hence in the long term and medium. The researcher added the other factors, such as investment rates, population growth, rate of education, and impact of supply shocks that occurred during the analysed period. The author discovers negative, neutral and positive associations between inflation and growth. Inflation also decreases business investment efficiency and productive factors. According to NBER, if measures can lower the inflation by a minimum, lowering it by one percentage point, policymakers can increase growth by 0.5- 1%. As a result, “sustainable keep inflation helps performance and output in the long run. (NBER et al.,1997). Mallik and Chowdhury (2001) The researchers determined that mild inflation is beneficial to accelerating economic growth. They gathered data from India, Srilanka, Bangladesh and Pakistan. Mamo (2012) The significance of anticipating overall CPI for growth might affect economic growth favourably or adversely. The literature review explores a negative, positive, and neutral association between CPI, interest rate and RGDP,

2.5 Inflation, Interest rate and Growth in 2021“A Quite Financial Crisis.”

World Bank (2021) Worldwide Covid-19 pandemic has led to rising inflation rates, lockdowns, supply chain disruption and decreased record-breaking productivity. Growing poverty levels but added to all trends, a quiet crisis emerges, and it might endanger economic recovery such as bank runs. Asset prices collapse when households and firms are over-leveraged.” Financial Crisis”. Even though panics, low consumer confidence, and business confidence link with the term.

Covid-19, new variants and war in Ukraine cause supply chain disruption and higher commodity prices, affecting low-wage families and small businesses. ECB has only some measures to protect them from higher inflation and insolvency. Since the first quarter of 2020, the interest rate has been negative, asset-buying programs, the central bank's expansion of balance sheets, and quantitative easing have side effects. The Central banks are unprepared to manage and hit their balance sheet. Significantly, the non-regulated financial sector is more vulnerable to risk.

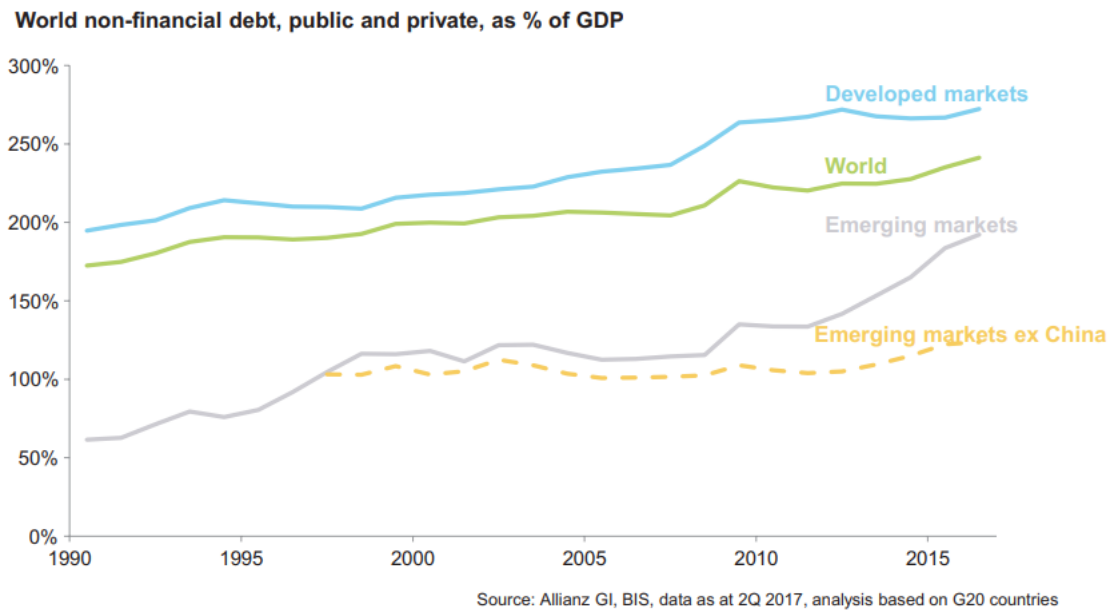


Figure 9 World non-financial debt, public and private (Heise, 2019, p.67)

Subsequently, it takes significant time and costs to restore such harm to the balance sheet. Policy-makers and central banks must revise their overborrowing and lending methods, which harms economic growth or slow recovery may last for years to come. May lead to a risk of serial financial bubbles, as shown in the Figure below, In the 1990s, the tech scene was at a boom, but US federal reserve did cause concern to slow down. Fed dropped the interest rate to 4.7% in the last quarter of 1998, but financial crises were evident. Then they hiked the interest rate to 6.5% end of 2000. Fed s hike did shift the bond yield and did not halt the financial crisis. Fed did not see it as a major problem because we expected the tech boom to improve productivity. In retrospect, it had no potential impact on output and stayed unchanged. As a result, the economic cycle was still in strong play with a financial risk bubble.

Further, in 2001 terrorists at the world trade centre kicked the can down the road and the financial bubble busted and reinforced. The Fed funds rate decreased in 2004 by around 1 %. Following Fed hiked rates from 2005 to 2007 by about 5%. The speculative expectation of future growth kept growing until signs of a bubble busting emerged second half of 2007 and the bankruptcy of Lehmann Brothers in September 2008. Fed slashed the interest rate to nearly zero in 2009 (Heise et al.,2019).

The St. Louis Fed Pres. Talks about rate hikes and the economy, the hot CPI reports and the last four reports of CPI interpretation that inflation is broadening and accelerating globally. He suggested in US 100 bases point by July. He also recommends removing quantitative accommodation. He also stated that 7.5% is a lot of inflation. Also, they have not seen these numbers in the last 40 years.

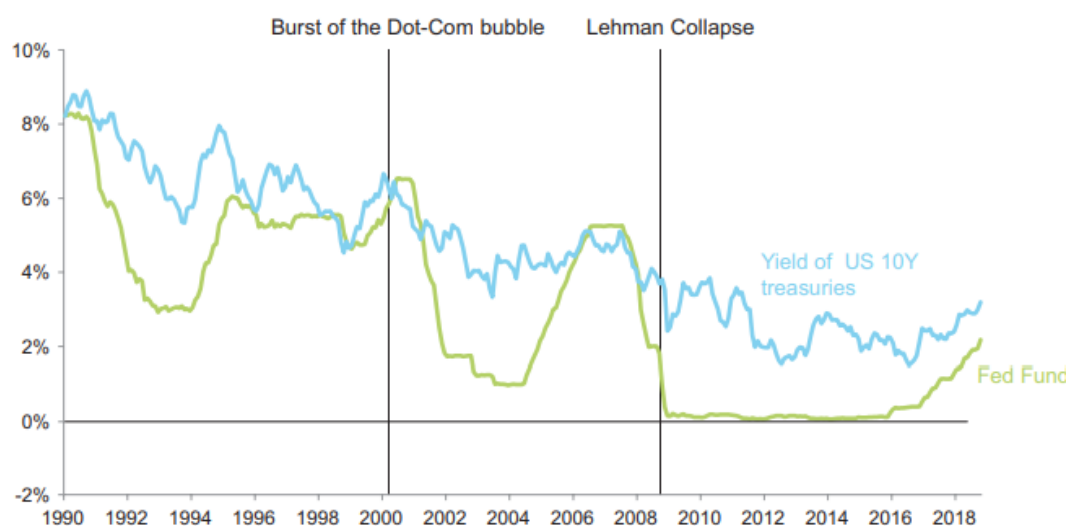


Figure 10 Fed policy and the cycle (Heise, 2019, p.64)

The central bank's credibility is at stake in US and ECB. The conclusion is that banks need to act in an organized fashion, not disrupt the economies. And to remove accommodation gradually as initial rate hikes start.

Global Financial Report (2017), Risk builds up when economic conditions are smooth. In other words, exogenous and internal environments are calm. The IMF recommends that The findings underscore the importance of increasing awareness regarding shocks or risk hazards that may convert into financial crises. IMF stated in their report that the hike in LTIR should become the top agenda of the Central banks and macro-financial concerns. The IMF reminds us that a steady hike in Long-term rates is healthy and echoes solid US recovery. It also assists in mitigating the unconventional central banks and government support such as expected asset prices and elevated financial vulnerabilities. Sudden rate hikes can lead to significant spillover worldwide and a sudden violent twist in economic recovery (IMFBlog, 2021).

Finally, banks need to act organised, not disrupt the economies. The gradual removal of quantitative ease as initial rate hikes will not twist economic growth. Policymakers need to see more data and CPI reports before taking any step toward the word rate hike. Though economists expected high inflation at the beginning of 2001, inflation would naturally moderate in a reasonable period. Still, war has pushed the can down the road like the 2001 terrorist attack on the USA world trade centre. No matter how we observe the numbers, the war has put the economy in an incredibly challenging era and will make it appear that the central banks are not defending the sustainable desired inflation target. Inflation is terrible for lower, moderate households, and real wages and consumer confidence will decline. Consumers and businesses need reassuring that financial institute must defend their desired inflation targets. Dealing with the financial fragility and crisis is when it is at the beginning stages. The first step towards retreating from financial fatigue is recognising and finding the correlation between the significant factors causing it and their relationship with the systematic approach. Given the massive economic and human consequences of the epidemic and the Ukrainian conflict, preventing that scenario must be a major concern for politicians, economists, and everyone else.

The ECB has run out of monetary rabbits to pluck from its hat. Due to Ukrainian and Russian supply disruptions, Fuel prices have risen dramatically, and wheat shortages in North Africa. Eurozone confronts stagflation as the price level rises sharply. Who knows what the cost of food will be in the next year?

2.6 Theoretical Framework

This research paper investigates interest rate, Inflation and RGDP, which can add to prior studies. Therefore, the thesis explores the interrelationship of the LTIR, the CPI rate, and the RGDP and their impact on the top two GDP countries in the euro area, Germany and France.

The section that follows describes how to calculate economic growth. Adam Smith (1723-1790), author of the "Bible of Capitalism." He articulated the economics of time, motivated by the idea that the accumulation of gold and silver calculates a country's wealth. He proposed that the nation's wealth could not be quantified through metrics but rather by overall output and trade, as defined by gross domestic product today (GDP). Many academics and notable institutions, like the

IMF, World Bank, Federal Reserve, OECD, and ECB, utilize GDP as a standard yardstick to gauge economic growth (Biography 2019).

As previously stated, NGDP represents the sum of the price of all products and services. This implies two possibilities for GDP growth. First, price levels can rise under this situation, and GDP statistics can climb, but the economy is not creating additional products and services. With inflation and higher price levels, increase in GDP. A rise in the numbers may be positive on paper, but it is an illusion, representing just nominal growth (Boyce et al., 2022). Another way GDP grows is by producing more valuable products and services, translating into more or better goods and services. The second rise in GDP that I want to examine in the thesis is the interrelationship between LTIR and CPI and the increase in RGDP. Productivity-based increases in economic growth statistically control inflation. The optimal pace of innovation can increase real GDP (Dunave et al., 2013).

To acquire a realistic economic picture, we use Real GDP in our study. Because the value of economic output is measured by nominal GDP, it does not give comprehensive and accurate information on how the economy is performing. Although Venezuela had over one thousand per cent inflation at the start of the twenty-first century, this does not imply that the economy has increased by 1000 per cent per year. Boyce, the RGDP equals Gross Domestic Product (GDP) less Inflation. In other words, it ignores the role of pricing in economic growth and allows us to compare the quantity produced rather than the value" (Boyce et al., 2022).

The European Monetary Affairs Committee of the EP (1999) requested a briefing on many matters, one of which being interest rate setting. The thesis explores a brief understanding of the financial system regarding interest rates in the literature review. Interest rates, when a borrower loans money from a lender and pays a reward for a set length of time, the money price is the interest rate. Banks determine the price in percentages and terms per annum of (pa), with per cent pa or, in some cases, on the base year. Keynes (1960) believed investors charge benefits in the market for the loans and "Liquidity preferences" instead of investing their money in bonds and assets instead of cash.

Inflation and inflationary pressure are significant issues to consider in macroeconomics and growth. Higher inflation was prevalent in the United States in 1990. Therefore, the comparison

must take both previous and current inflation into account. When the price level rises and everyone lending a given amount of money must assume that the loan will not lose value when it expires, it is necessary to define inflation.

The international monetary fund defines inflation as “After delving into the notion of inflation, it appears critical to understand how to calculate the inflation rate. Households' value of products and services regularly bought, as measured by the CPI (Oner, 2008). Categories of CPI are as follows.

CPIF, Food purchased for consumption at home and CPIEng, Electricity, gas, other fuels, and lubricants to operate personal transport equipment. CPIxFE, CPI excluding food and energy. Overall CPI All items' indexes are the average change of a set of consumer products and include services costs. PPI is the rate of change in the price of items sold and left by the manufacturer (Eusepi et al., 2009). Economists use many indices to calculate PPI (OECD, 2022). When there is a high PPI, consumers will be more likely to pay more, and they buy less but will spend more on retail. (Koba, 2013). STIR, In the market, treasury instruments have expiries of 1, 3, 6 and 12 months, , categorised as short-term bills.LTIR, In the market, treasury instruments linked to the bonds have expiries of longer than a year, such as five, ten, or fifteen.

In a wage pull inflation appears when AD moves further right. Reasons for the increased demand on current production factors are becoming scarcer wages, labour costs, capital costs, and land prices all rise. As a result, producers pass on elevated prices to their consumers. When the total price level rises in the manufacturing sector, the economy's AS falls (Hall,2021). The thesis also sheds light and explores the recommendations to mitigate the negative impact of crises and investigates in the literature the monetary strategy to restore economic growth to pre-crisis levels while keeping the inflation rate steady. Eventually, controlling inflation compensates for inferior performance and increases per capita income (NBER et al., 1997).

As a result, the influence of macroeconomic conditions on inflation has been one of the most worrying subjects in economic study. It has occurred. Mehdi and other economists and researchers, such as Ahking and Miller (1985), Hamburg, M.J., and Zwick, have researched and noted (1981).

The budget deficit, inflation, and money supply are all causative and linked with other impoverished nations worldwide. The thesis provides a functional representation of these three connection variables, the specified stepwise research strategy—the relationship among LTIR, STIR, CPI and RGDP and their impact. In the research context, RGDP, CPI food, CPI (excluding food and energy), CPI energy, overall CPI, PPI, STIR, and LTIR, and their impact on overall CPI in Inflation. The author presents a functional form of these hypotheses based on the relationships below (Bade & Parkin, 2017).

Hypotheses

Based on the above-mentioned empirical evidence, the following hypotheses.

H1 = There is a relationship between RGDP and LTIR.

H1a = There is a relationship between RGDP and STIR.

H1b = There is a relationship between RGDP and CPITOT.

H1c = There is a relationship between RGDP and CPI_{FE}.

H1d = There is a relationship between RGDP and CPI_F.

H1e = There is a relationship between RGDP and CPI_{Eng}.

H1f = There is a relationship between RGDP and PPI.

H2 = There is an impact of CPITOT on RGDP.

H2a = There is an impact act of CPI_F on RGDP.

H2b = There is an impact CPI_{Eng} on RGDP.

H2c= There is an impact of PPI on RGDP.

H2d= There is an impact of CPIxFE on RGDP.

H2f= There is an impact of STIR on RGDP.

H3= There is a relationship between LTIR and CPITOT.

H3a=There is a relationship between LTIR and CPIxFE.

H3b= There is a relationship between LTIR and CPIF.

H3c= There is a relationship between LTIR and CPIEng.

H3d=There is a relationship between LTIR and PPI.

H4= There is a relationship between STIR and CPITOT.

H4a= There is a relationship between STIR and CPIF.

H4b= There is a relationship between STIR and CPIxFE.

H4c= There is a relationship between STIR and CPIEng.

H4d= There is a relationship between STIR and PPI.

H5= There is an impact of LTIR on CPITOT.

H5a= There is an impact STIR on CPITOT.

H5b= There is an impact of CPIEng on CPITOT.

H5c= There is an impact of CPIF on CPITOT.

H5d= There is an impact of CPIxFE on CPITOT.

H5e= There is an impact of PPI on CPITOT

3 Methodology

Quantitative systematic investigation of the benchmark collects numerical data and conducts statistical, computational, and mathematical methods. I have chosen the analytic deductive approach and descriptive and inferential statistical analysis techniques. The secondary data collecting and data analysis quantitative research process involved. Data sources are well-known, such as FRED and OECD.

3.1 Research Approach

The research has 366 observations and seven variables of Germany and France. The quantitative approach is appropriate for the numerical assessment of the RGDP rate, LTIR, and CPI. The analysis interrelationship requires a stepwise system and strategy for the research problem.

The secondary data had collected from OECD and FRED. Hence the RGDP, LTIR and CPI are large populations in numbers since the thesis prospect is a European area. I am confident that these figures are exact and reliable due to the data sources' authenticity. The deductive approach method is a logical flow from a theory or hypothesis to systematic empirical observation and reasoning (VanderStoep, Scott & Johnson, 2009, p.168). The approach is used in four steps in the thesis, exploring the theories related to and formulating the hypothesis based on the current approach. The third step collects data, and the fourth step analysis the results of both countries separately. The two models and their equations identify the impact of independent variables individually on dependent variables. When it comes to setting the research strategy context for the investigation in a quantitative approach, descriptive, correlation, and multiple regression could be the correct answer. The qualitative approach is challenging to analyse numerical data relationships and influence dependent variables. Qualitative experimental research is the participants' study environment,

and the attitudes and actions learned during the investigation occur in real-life situations. The quantitative analysis method for my research is free from these challenges (VanderStoep et al., 2009, p.36). The quantitative approach is suitable to meet the purpose of the thesis for the following reasons. Due to the nature of the topic, the population size is large, and reliability, accuracy, and quick access to data collection and analysis are important. To avoid the personalized comments or biasing of results and ensure achieved results are fair and exact. (Streekkerk, 2019, p.7)

3.2 Research Context

The research context consists of economic growth, interest rate, and price levels. On the practical side of research, the monetary policy has one of the essential financial mechanisms, interest rate. Interest rates in practice and research context may include long-term and short-term interest rates regarding inflation, overall CPI, CPI excluding food, CPI food, CPI energy and producer price index. The paper aims to research the relationship between the phenomenon, but it is similarly essential to analyse the related practical context related to the topic.

3.3 Data Collection

In certain studies, researchers wish to emphasise generalizability, how much, how well, or how similarly the findings from the present group apply to the total population (Kelley & Maxwell 2003). Germany and France have data transparency and political stability as the first top-two European economies. OECD and Fred are well-known, trustworthy, and reliable for secondary data collecting. Quantitative analysis has become increasingly simple to perform using the internet, and most study topics have information accessible online, which helps increase the validity of the results and findings. This exploratory study focused on secondary data that is freely accessible. The major macroeconomics factors are RGDP, interest rate, and CPI from 1991 to 2021. The choice of Germany and France linked to the EU monetary union has experienced a sustainable 2% inflation rate targeted by ECB (VanderStoep et al., 2009, p.92).

Description of Variables

Kumar (1999) Constantly, we all do value assessments that we must examine in our professional environment in our daily lives; all our judgements are based on our preferences. In economics, we

can recognize some indicators and factors that determine and influence each other and analyse whether these judgments or their relationship require a sound basis. Let's describe this in a professional context through a Macroeconomics lens.

- Inflation and interest rate influence growth.
- Inflation and interest rate does not influence growth
- Inflation harms economic growth.

All above are the judgements that need a rational, sound basis which requires a measuring mechanism. A Variable is an observation, concept, or judgement able of measurement, in simple words, taking different values. Measurable and quantifiable concepts refer to a variable. Variables are evaluated on several scales, including nominal, ordinal, interval, and ratio. Variables have crucial in research because they significantly impact the analytic process, identify research questions and hypotheses, and implement statistical tests. Quantitative studies emphasise exploring association in the data and measurement; variables perform a significant part (Kumar, 1999).

In addition, According to Fletcher (2007), A variable holds on to various values and changes. Also, they hold numerical values.

In this empirical study, the author considers its operationalisation, which is a process where he identifies indicators, such as RGDP. The researcher made sure all indicators like inflation, interest rate and RGDP have a logical link with the economic growth and financial crisis (Pandemic). All selected variables have a value base which is the dollar.

Independent variables (IV)

A change variable: "The variable bringing about change in the situation, circumstances or phenomenon." Outcome variable: what is the effect of a variable change. Connecting/linking variable: In some instances, which is required in some instances to achieve the link between cause-and-effect. The literature review provides a brief description to understand better the research issue and sign predictions. It is important to recognize that we can use the variables as independent or dependent—an Independent variable. Kumar (1999) states that an independent variable is responsible for

making the change (s) in DV. According to Johnso and Christensen (2014), “An Independent variable believed to affect DV. The thesis has a dependent variable, RGDP and Inflation is independent, CPIFF, CPIEng, CPIxFE, PPI, STIR and LTIR

Define inflation and how calculated, then understand the data, correlation, and multiple regression —only the ways. Much, Correlation with RGDP, a country with low-interest rates then inflationary pressures is harmful to growth (Pascal, 2021).

Characteristics that determine inflation:

Consumer Price Indices (CPI)

CPI is an independent variable in the thesis analysis. It is how inflation is measured, and it affects the change in the costs of a set of products and services purchased by families regularly. (OECD, 2022).

CPI: Determines the price of the same set of products for a specific year divided by the value of the same set of products in a base year.

$$\text{Inflation Rate: } \frac{\text{CPI year 2} - \text{CPI (previous year) 1}}{\text{CPI 1}} \times 100$$

Although CPI and GDP determine the change in prices of products and services used by consumers, the GDP, which uses the PCE price index to calculate the fluctuation in consumer costs, includes a wider variety of collected products and services.

CPI is, in other words, a way to see the change in inflation. Therefore, a higher CPI follows the same consequences as inflation.

CPI Food (CPIF): The change in the price of food purchased from families regularly (Eusepi et al., 2009).

CPI Energy (CPIEng): Change the average price of electricity, gas, other fuels, and lubricants to operate personal transport equipment (The Law Library el at., 2018).

CPI (CPIxFE): Overall CPI does not include food and energy price change. (Bade el at., 2017)

Overall (CPITOT): Change in the average price of all items indexes are average change of a set of consumer products and services costs. (OECD, 2022)

Producer Price Indices (PPI)

PPI is the rate of change in the price of items sold and left by the manufacturer. Economists use many indices to calculate PPI (OECD, 2022). When there is a high PPI, consumers will be more likely to pay more, and they buy less but will spend more on retail. (Koba, 2013).

Connecting and Independent Variable (IV)

And the interest rate is a linking variable or connecting variable with CPI and RGDP, which are connecting variables between independent (Inflation) and dependent variables (Growth)—as mentioned above, repeated here again. (Kumar et al., 1999, p.85; Adrian et al., 2021).

Interest rate (APR)

APR is the proportion of the loan amount that the lender charges the borrower, expressed as an annual percentage rate (APR). According to (Saracoglu & Lanyi 1983), there is a positive link between interest rate levels and real GDP. The GDP will increase in response to a rise in interest rates. Research that looked at the influence of APR, CPI, and GDP on Jordan's economic growth between 2000 and 2010 found that real interest rates positively impacted GDP and national income (Azmi, F 2013).

LTIR and short and STIR are two main categories.

The interest rate calculating formula is as follows the following,

$$\text{Interest Rate} = \frac{\text{Simple Interest} \times 100}{\text{Principal} \times \text{Time}}$$

LTIR and Bonds Yield Index (BYI)

The return that an investor realizes on a bond is the bond yield, calculated by the last updated value of the company share and multiplied by outstanding shares.

The simplest definition of yield is (yield = price or coupon price).

With the interest rate increase, yields tend to be higher when you purchase new bonds. Yield curves tend to correlate negatively with GDP, and investors use yield curves to predict economic growth. An inverted yield curve shows a recession (Famiglietti & Garriga, 2021). Short-term bills and treasury instruments have maturities of 1, 3, 6, and 12 months. Usual identical names are “money market rates” and “treasury bill rate.” (OECD, 2022)

Dependent Variables (DV)

Kumar (1999) states that a DV is “the outcome or change(s) brought about by the introduction of an independent variable”. According to Johnson & Larry (2014 p92), A variable is presumed to be affected by one or more IVs. I have chosen in this thesis the economic growth prime dependent variable. The correlation coefficient determines the link between variables, and a correlation is a statistical determination of the magnitude and the direction of variables. A correlation coefficient has a magnitude and a direction, and the outcome might be positive, negative, or neutral. I have analysed multiple linear regression with two models. The first model determines the influence of independent variables on DV RGDP, and the results of model 2 where DV overall CPI validate the conclusions with SPSS software.

Description of variables

			Dependent Variable		Relation to growth	
Variable name	Label	Description/source	German	France		

Real Gross Do- mestic Product	RGDP	(RGDP) a (GDP) that accounts for inflation or deflation. $R = \frac{N}{D}$		
Source: Fred				
Independent variable				
Overall Consumer Price Index	CPI TOT	All items index the average change in the costs of a set of consumer products, including services.	Low Pos- itive	Low Positive
Source: OECD				
Consumer Price Index (minus food and energy)	CPI x FE	Minus from CPI food and en- ergy.	Negative	Low Positive
Source: OECD				
Consumer Price Index Food	CPI F	Food purchased for consump- tion at home.	Low pos- itive	Nega- tive
Source: OECD				

Consumer Price Index Energy	CPIEng	Electricity, gas, other fuels, and lubricants to operate personal transport equipment.	Neutral	Negative
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Source: OECD

Producer Price Index	PPI	PPI is an economic measurement of the average price change from the producers' standpoint.	Positive	Positive
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Source: OECD

Short Term Interest Rate		Short-term bills. Treasury instruments have maturities of 1, 3, 6 and 12 months.	Low positive	Low positive
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Source: OECD

Long Term Interest Rate		The long term is associated with the bonds whose maturity is longer than a year, such as five, ten and fifteen.	Low positive	Low positive
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Source: OECD

Analysis Model

Model no, 1

$$RGDP = \alpha + \beta_1 CPI + \beta_2 CPITOT + \beta_3 PPI + \beta_4 LTIR + \beta_5 STIR + \beta_6 CPIF + \beta_7 CPIEng$$

Model no, 2 CPITOT

$$CPITOT = \alpha + \beta_1 CPI + \beta_2 PPI + \beta_3 LTIR + \beta_4 STIR + \beta_5 CPIF + \beta_7 CPIEng$$

β = Beta true parameter α = a constant; Equals the value of Y, when the value of X=0 . Beta the coefficient of X, the slope of regression line; Y changes for each unit there is a change in X. X is the value of the independent variables, Y is presented or explaining value. (PennState, n.d)

3.4 Data Analysis

Htoon (2021) Log transformation reinstates variable DV or IV with a “log (x)” type of data transformation. The mean, or arithmetic average of a data collection, is the most used metric of central tendency. Means are useful in descriptive research since they provide the average participant's score on a measure.

Descriptive statistics analysis is about central tendency and spread. The researcher commonly uses variance and standard deviation (VanderStoep et al., 2009, p.38).

Most investigations in field research include looking at correlations. The correlation coefficient measures the relationship that determines the link between variables and is a statistical determination of the relationship of the variables. A correlation coefficient has a magnitude and a direction, and the arrow may point in either a positive, negative, or neutral direction. A positive correlation represents that both variables are moving in the same direction; a negative when changing in the opposite direction (VanderStoep et al., 2009, p.92-93). The regression approach evaluates the strength of the link between DV and IV(s). However, the multiple regression techniques suit the paper's data analysis, where the investigation includes more variables. I have suggested multiple linear regression, which has two models. The first model 1 finds the impact of independent variables on real GDP, and the findings from model 2 confirm the conclusions and lead the research to

recommendations. The descriptive techniques used in this paper are Pearson correlation and multi regression in the data analysis technique, SPSS software, and EXCEL, which are the most popular for analysing social science.

3.5 Method of Analysis

The thesis consists of three types of analysis to analyse research topics. First, descriptive statistics are used to analyse the acquired data. Second, the Pearson correlation analysis confirms the existence and kind of relation between APR, CPI, and RGDP. Third, linear regression analysis looks at multiply correlations between independent factors that affect dependent variables (VanderStoep et al., 2009).

Descriptive Statistics

Four points in descriptive statistics one may consider in descriptive analysis. The first looks at how frequently something happens. The central tendency is the next step, which examines the distribution from several angles. The dispersion of data spread over the stated intervals is the third factor to consider. Finally, the position describes where the data is relative to each other data points—measured through standardised results (Spriestersbach, Röhrig, Prel, & Gerhold, 2009).

Measures of central tendency are Frequency, Count, and per cent. Then Mean is the average value of the data, Median is the middle value of data, and mode is the most occurring value in the data. Single-mode, there is one variable that occurs the most. Bi-modal, two variables the most in the data. Multi-modal, multiple variables occur the most, ranging between the highest and lowest values. Standard Deviation is how much a certain data point deviates from the mean. Percentile and Quartile ranks, Shows data interrelation (Sonnad, 2002). Following are the Examples of the formulas.

Standard deviation: $\sqrt{\frac{\sum(x-\bar{x})^2}{(n-1)}}$ Sample mean: $\bar{x} = \frac{\sum x}{n}$ Population Mean: $\mu = \frac{\sum x}{N}$

Correlation

Correlation is looking at the relationship between two or more numeric variables. The equation explains the similarities and distinctions of these tools (Pascal et al., 2021). The trend and strength of the relationships between two numeric variables, X and Y, are always between -1.0 and 1.0 (KnowledgeBase, 2019). For example, suppose the correlation coefficient is 0.89. In that case, it shows a strong positive relationship between the DV and IV values, and the systematic risk of factor X is higher, and then factor Y will also have a high risk. As stated above, the correlation between two variables always lies between -1.0 and 1.0. The author has tested bivariate correlations using Pearson's two-tailed test (Al-Samman & Eyad, 2012).

$$\text{Equation, } r_{xy} = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum(x_i - \bar{x})^2 \sum(y_i - \bar{y})^2}}$$

The simple linear regression technique finds the strength and quality of the relationship between data, one DV and one IV have to test the assumptions. Linear regression is a technique for developing the relationship between DV and IV. The equation is also known as the slope formula. Y is DV (On Y-axis), and X is an IV. β is a slope of the line or the trend, and a is an intercept.

The Formula is as follows. $Y = a + \beta X$

Multiple linear regression is when independent, predictor explanatory or regressor more than two variables is an extension of simple regression. In regression, the ANOVA table indicates the significance of the model (Aiken & West, 1991). The author has established the subsequent (OSL) model to analyse the influence of inflation on RGDP; the research aims to evaluate the CPI on RGDP and interconnected variable interest rates related to growth and inflation. The purpose is to know other variables that may affect the dependent variable (Mooi, 2014; Minitab, 2019).

$$\text{Formula } Y = a + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_p X_p + e$$

3.6 Analysis models

The first model examines the dependent variable economic growth RGDP in conjunction with the independent factors such as LTIR, STIR, CPITOT, CPIF, CPIEng, CPIxFE and PPI. The second model

includes the dependent variable CPITOT, independent variables interest rate, the LTIR, STIR, and inflation subcategories such as CPIxFE (excluding food and energy), CPIF, CPIEng, and PPI.

Model no, 1 RGDP Dependent variable

$$RGDP = \alpha + \beta_1 CPI + \beta_2 CPITOT + \beta_3 PPI + \beta_4 LTIR + \beta_5 STIR + \beta_6 CPIF + \beta_7 CPIEng$$

Model no, 2 CPITOT Dependent variable

$$CPITOT = \alpha + \beta_1 CPI + \beta_2 PPI + \beta_3 LTIR + \beta_4 STIR + \beta_5 CPIF + \beta_7 CPIEng$$

3.7 Validity and Reliability

In the systematic investigation process, you are using numerical data in quantitative research to assess the results of hypothetical generalization. And to expand the researchers' work to improve the value of the study. Reliability and validity measurement helps to accomplish this. In Reliability, internal constancy using correlation/relationship between separate sets, by using Cronbachs. A single value from 0-1 and vice versa negative correlation is below 1 in minus value, (r) correlation coefficients. Validity is when a concept is correctly measured or a valid method and evaluated (Alfaro et al., 2004). There are two comprehensive measurements, one internal (to deliver the reasons for the result) and another external (usually by experimental laboratory design) of validity (AskanAcademic. 2019).

4 Result

Results consist of descriptive statistics, Pearson correlation and multiple regression analysis of Germany and France.

4.1 Germany- Descriptive Analysis

Germany demonstrates in Table 1 that the mean of RGDP data is 4.66 on 366 observations. The mean of RGDP is higher than the CPIxFE, overall CPI, PPI and CPIxFE. And higher than the LTIR and

STIR. The standard deviation data of RGDP had 0.017, and the CPIEng data had a standard deviation of 5.93 highest of all variables. The overall CPIEng data has a higher standard deviation and tells me that overall CPIEng is more spread out than the rest.

Mean data of LTIR had found 3.51 whereas short-term interest rate STIR data had 2.63 data, and LTIR rate data tells me that LTIR and STIR data is more dispersed than STIR data. The range and variance of CPIEng 30.23/35.26, CPIF 11.31, and STIR data were 10.43/7.09. Descriptive statistical analysis tells me that CPIEng, CPIF, and STIR data had found to be more spread than the rest of the data. Finally, the standard deviation of STIR and CPIF data was much closer to the mean than the rest.

Table 1 Descriptive Statistics Germany

Descriptive Analysis							
Variables	N	Mean	Std. Deviation	Variance	Range	Minimum	Maximum
RGDP	366	4.6042	0.01705	0.000	0.14	4.50	4.64
CPIxFE	366	1.7061	1.24246	1.544	6.24	0.21	6.45
CPITOT	366	1.7599	1.19701	1.433	6.74	-0.50	6.24
PPI	366	4.5160	0.09989	0.010	0.37	4.35	4.72
LTIR	366	3.5192	2.50261	6.263	9.28	-0.65	8.63
STIR	366	2.6394	2.66430	7.099	10.43	-0.55	9.88
CPIF	366	1.5754	1.99534	3.981	11.31	-3.09	8.22

CPIEng	366	2.9983	5.93869	35.268	30.23	-12.04	18.18
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RGDP, real gross domestic product. CPIXFE, The change in the price of food purchased from families regularly. CPIEng, Change in the average price of Electricity, gas, other fuels, and lubricants to operate personal transport equipment. CPIxFE, Overall CPI does not include food and energy price change. Overall CPITOT: Change in the average price of all items' indexes are a weighted average change of a set of consumer products and services costs. PPI is the rate of change in the price of items sold and left by the manufacturer. LTIR, long term interest rate. STIR, short term interest rate.

To get further profound analysis the predictive techniques (Pearson correlation) for the dependent and independent variables were run and executed in SPSS.

4.2 Germany Pearson Correlation Analysis

Let's look at the statistical correlation analysis to get a more descriptive and meaningful analysis—the correlation model of the independent and dependent equation. Table 2 correlation of coefficients of various explanatory variables. Fundamental macroeconomics drivers: RGDP weights score as the DV, and independent variables are APR and overall CPI. For example, RGDP data positively correlated with LTIR and STIR data. Overall CPITOT, CPIXFE and CPIEng positively correlate with RGDP. More LTIR is moderate-higher with the overall consumer price index CPITOT and CPIXFE. Variable STIR positively correlates with overall CPITOT, CPIXFE, and CPIEng. PPI negatively correlate with RGDP, LTIR and STIR.

Table 2 Pearson Correlation Germany

Pearson Correlation								
	RGDP	CPIXFE	CPITOT	PPI	LTIR	STIR	CPIX	CPIEng
RGDP	1	.166**	.390**	-.218**	.351**	.418**	.356**	.420**
CPIXFE	.166**	1	.853**	-.458**	.535**	.708**	0.082	0.044
CPITOT	.390**	.853**	1	-.378**	.549**	.731**	.393**	.496**
PPI	-.218**	-.458**	-.378**	1	-.933**	-.825**	.278**	-.136**

LTIR	.351**	.535**	.549**	-.933**	1	.913**	-0.078	.290**
STIR	.418**	.708**	.731**	-.825**	.913**	1	0.077	.323**
CPIF	.356**	0.082	.393**	.278**	-0.078	0.077	1	.236**
CPIEng	.420**	0.044	.496**	-.136**	.290**	.323**	.236**	1

** . Correlation is significant at the 0.01 level. Sig at** p<0.01. * p<0.05

4.3 Germany Linear Regression Model 1

Linear multiple regression method on SPSS used with Model 1 dependent variable is RGDP and predictors: (constant) are seven variables. Model 2 dependent variable is the overall consumer price index (CPITOT), and predictors (constant) are six variables.

$$RGDP = \alpha + \beta_1 CPI_{FE} + \beta_2 CPITOT + \beta_3 PPI + \beta_4 LTIR + \beta_5 STIR + \beta_6 CPIF + \beta_7 CPIEng$$

The following is descriptive of the significant coefficient retrieved from Model 1 and stated in Table 3. R is a multiple correlation coefficient at 0.60 representing the quality of prediction and R² is 0.36, the explained variance (1 – 0.36= 0.64) (100 – 64 = 36), 36 % of explained variables by the independent variables in this model. You can see that the IVs explain 36% of the response variables.

Output overall model shows a statistical quality outcome. The ANOVA table (Appendix 1) shows that the IVs explain the DV at a high sig level. $F(7/358) = 28.741$. $p < .001$.

The unstandardized beta of PPI is 0.044 and positively correlated with a sig level of 9.5% means a change in PPI, then RGDP changes by 4.4%. The unstandardized beta of STIR has a very low positive correlation, almost showing no change, though the data is significant.

Finally, the regression model indicates that the predictors explained 36% of the variance, and the significant collective effect had found significant collective confidence at <0.001. The intercept (constant) of the model shows the impact on RGDP of the seven predictors is 4.39.

Table 3 Linear Regression Model 1 Germany

Linear Regression				
Variable	Beta	SE	t	Sig.
(Intercept)	4.395***	0.121	36.452	<0.001
CPIxFE	-0.005	0.005	-1.03	0.304
CPITOT	0.002	0.006	0.359	0.720
PPI	0.044*	0.026	1.673	0.095
LTIR	0.001	0.001	0.672	0.502
STIR	0.004***	0.001	4.011	0.000
CPIF	0.002*	0.001	1.609	0.108
CPIEng	0.000	0.001	0.642	0.522
R Square	0.36			
F Value	28.74			0.001

Dependent variable RGDP.

4.4 Germany Linear Regression Model 2

Model 2 dependent variable is the total consumer price index (CPITOT), and predictors (constant) are six variables.

$$\text{CPITOT} = \alpha + \beta_1 \text{CPIxFE} + \beta_2 \text{PPI} + \beta_3 \text{LTIR} + \beta_4 \text{STIR} + \beta_5 \text{CPIF} + \beta_7 \text{CPIEng}$$

The following is descriptive of the significant coefficient retrieved from Model 2. The model shows the standard error of 0.1198, $R = 0.99\%$ and adjusted ($R^2 = 99\%$). R is a multiple correlation coefficient coming at 0.995, representing the quality of prediction, and R^2 is 0.990, the explained variance of 99% of explained variables by the IV in this model. You can see the IVs explain 99% of the response variables. The ANOVA table (Appendix 2) shows that IV explains DV at the sig level.

$F(6/359) = 60$, $p = 0.000$ (the regression model is a good quality for the statistics).

The unstandardized beta of CPIxFE had positively correlated with CPITOT at 0.79, which signifies that a change in CPIxFE then CPITOT changes by 0.79. The unstandardized beta of CPIF is 0.14 and positively correlated with a sig level of 0.008, which signifies a change in CPIF responses on CPITOT by 14%. The unstandardized beta of CPIEng had 0.08 and had positively correlated with a sig level of < 0.001 , which means that a change in CPIEng then CPITOT changes by 0.008.

Finally, the intercept (constant) of the model shows the impact on the overall consumer price index CPITOT of the six predictors is 0.79. The regression model indicates that the predictors explained 99% of the variance, and a significant collective effect had found at 0.000 confidence levels. (the data explains the model's good quality).

Table 4 Linear Regression Model 2 Germany

Linear Regression				
Variable	Beta	SE	T	Sig.
(Intercept)	0.796	1.048	0.759	0.448
CPIxFE	0.798***	0.008	95.3	0.000
PPI	-0.196	0.227	-0.86	0.388

LTIR	0.028***	0.010	2.65	0.008
STIR	-0.033***	0.008	-3.89	0.000
CPIF	0.147***	0.004	35.6	0.000
CPIEng	0.082***	0.001	64.1	0.000
<hr/>				
R Square	0.79			
F Value	60			0.000

Dependent variable CPITOT Sig at*** $p < 0.01$. ** $p < 0.05$ * $p < 0.10$

4.5 France Descriptive Analysis

France's descriptive statistic demonstrates that the mean of RGDP data is 4.60 on 366 observations. The mean of RGDP is higher than the CPIxFE, overall CPI, PPI and CPIxFE. And higher than the LTIR and STIR.

The STIR data had a standard deviation of 2.94, the highest of all variables. The STIR data had a higher standard deviation, and STIR and CPIF had more spread out than the rest. Mean data of LTIR had found 3.84 whereas STIR data had 2.82 data, and LTIR data tells me that LTIR and STIR data are more dispersed than STIR data. The range and variance of LTIR were 9.5/6.09, and STIR data had found to be 12.65/8.68. Descriptive statistical analysis tells me that LTIR and STIR data were more spread out than the rest of the data.

Finally, the standard deviation of STIR and CPIF data was much closer to the mean than the rest.

Table 5 Descriptive Statistics France

Descriptive statistics

Variables	N	Mean	Std. Devia- tion	Range	Variance	Minimum	Maximum
RDGP	366	4.6023	0.02727	0.26	0.001	4.37	4.63
CPIxFE	366	1.3556	0.76960	3.5	0.592	-0.02	3.49
CPITOT	366	1.4653	0.83170	4.49	0.692	-0.73	3.76
PPI	366	4.5187	0.10110	.33	0.010	4.35	4.68
LTIR	366	3.8440	2.46957	9.5	6.099	-0.34	9.16
STIR	366	2.8250	2.94640	12.65	8.681	-0.55	12.10
CPIF	366	1.5188	1.63391	8.97	2.670	-1.87	7.10
CPIEng	366	1.3556	0.76960	3.5	0.592	-0.02	3.49

4.6 France Pearson Correlation Analysis

Let us look at the statistical correlation analysis to get a more descriptive and meaningful analysis.

The correlation model of independent and dependent data variables equation:

$$\mathbf{RGDP} = \alpha + \beta_1 \text{CPIxFE} + \beta_2 \text{CPITOT} + \beta_3 \text{PPI} + \beta_4 \text{LTIR} + \beta_5 \text{STIR} + \text{CPIF} + \beta_7 \text{CPIEng}$$

Table 6 shows that the RGDP had a low positive correlation with the LTIR, and STIR indicates a very low positive correlation. CPIxFE data, whereas LTIR and STIR had a high positive correlation compared to other variables. More overall CPITOT variables data had found to be moderate positive associated. Overall CPITOT whereas CPIEng high positive associated. CPIxFE data whereas CPIEng perfect positive correlated. Overall, CPI had found to be with CPIEng high positive associated.

PPI data had found that RGDP, CPIxFE, and CPITOT were negatively correlated. PPI data had found, whereas STIR and CPIxFE were low and negatively correlated. PPI data had found, whereas LTIR and STIR had a high negative correlation.

Table 6 Pearson Correlation France

Pearson Correlation								
	RDGP	CPIxFE	CPITOT	PPI	LTIR	STIR	CPIF	CPIEng
RDGP	1	0.088	.304**	-0.096	.285**	.245**	.109*	0.088
CPIxFE	0.088	1	.715**	-.495**	.709**	.749**	0.038	1.000**
CPITOT	.304**	.715**	1	-.261**	.550**	.564**	.436**	.715**
PPI	-0.096	-.495**	-.261**	1	-.841**	-.777**	0.058	-.495**
LTIR	.285**	.709**	.550**	-.841**	1	.923**	0.079	.709**
STIR	.245**	.749**	.564**	-.777**	.923**	1	0.097	.749**
CPIF	.109*	0.038	.436**	0.058	0.079	0.097	1	0.038
CPIEng	0.088	1.000**	.715**	-.495**	.709**	.749**	0.038	1

Sig. at** p<0.01. * p<0.05

4.7 France Linear Regression Model 1

Linear multiple regression method on SPSS used with Model one dependent variable is RGDP and predictors: (constant) are seven variables. Model 2 dependent variable is the total consumer price index (CPITOT), and predictors (constant) are six variables.

$$\mathbf{RGDP} = \alpha + \beta_1 \text{CPIxFE} + \beta_2 \text{CPITOT} + \beta_3 \text{PPI} + \beta_4 \text{LTIR} + \beta_5 \text{STIR} + \beta_6 \text{CPIF} + \beta_7 \text{CPIEng}$$

The following is descriptive of the significant coefficient retrieved from Model no.1 and stated.

Table 7 R is a multiple correlation coefficient coming at 0.52, representing the quality of prediction and R2 is 0.27, the explained variance of 52.5 % explained by the IV in this model. You can see the IVs are 27.5% of the response variables.

The ANOVA table (Appendix 3) shows that the IV explains DV at a high sig level $F(6/359) = 22.739$. $p < .001$.

The unstandardized beta of PPI is 0.126 and had positively correlated with a sig level of 12.6%, which means that a change in PPI then RGDP changes by 12.6%. The unstandardized beta of STIR has a very low positively correlated and almost shows no change.

Finally, the model's intercept (constant) shows that the impact on the RGDP of the seven predictors is 4.013. PPI positively affects the RGDP, CPITOT, and LTIR. The regression model indicates that the predictors explained 27% of the variance and < 0.001 collective significant confidence levels.

Table 7 Linear Regression Model 1 France

Variable	Linear Regression			
	Beta	SE	t	Sig.
(Intercept)	4.013***	0.116	34.5	0.001
CPIxFE	0.003	0.002	0.088	0.093
CPITOT	0.016***	0.003	5.70	0.000
PPI	0.126***	0.025	4.98	0.000
LTIR	0.008***	0.002	5.26	0.000

STIR	0.001	0.001	1.24	0.213
CPIF	-0.003***	0.001	-3.11	0.002
CPIEng	-0.024***	0.003	-7.61	0.000
<hr/>				
R-Value	0.275***			
<hr/>				
F Value	22.7			

RGDP dependant Sig at*** p<0.01. ** p<0.05 *p<0.10

4.8 France Linear Regression Model 2

Model 2 dependent variable is the total consumer price index (CPITOT), and predictors (constant) are six variables.

$$\text{CPITOT} = \alpha + \beta_1 \text{CPIxFE} + \beta_2 \text{PPI} + \beta_3 \text{LTIR} + \beta_4 \text{STIR} + \beta_5 \text{CPIF} + \beta_7 \text{CPIEng}$$

The following is descriptive of the significant coefficient retrieved from Model 2, whereas the model shows the standard error of 0.45 (R = 70%) and adjusted (R² = 0.990). ANOVA (Appendix 4) R is a multiple correlation coefficient coming at 0.84, representing the quality of prediction and R² is 0.70, the explained variance of 84.1% explained by the IV in this model. You can see the IVs explain 70.7% of the response variables.

Output, the ANOVA table (Appendix 4) shows that the DV statistically responds to the IV, F (5/360) = 174.151 p < 0.001. The unstandardized beta of PPI is 2.62 and had positively correlated with CPITOT at < 0.000, which signifies that a change in PPI then CPITOT changes by 2.62. The unstandardized beta of CPIxFE is 0.77 and had positively correlated with CPITOT at < 0.000, which signifies that a change in CPIxFE then CPITOT changes by 77%.

Finally, CPIxFE data had 0.79, CPIEng 0.66 and PPI had 2.66, meaning the highest impact on the model compared to other variables. The model had found a 70% impact on the dependent variable and < 0.001 collective significant confidence levels. (the data explains the model's high quality).

Table 8 Linear Regression Model 2 France

Linear Regression				
Variable	Beta	SE	t	Sig.
(Intercept)	-12.0***	2.156	-5.58	<0.001
CPIxFE	0.773***	0.040	0.715	<0.000
PPI	2.620***	0.467	5.61	<0.000
LTIR	0.141***	0.030	4.71	<0.000
STIR	-0.020	0.023	-0.90	0.368
CPIF	0.187***	0.015	12.41	<0.000
CPIEng	0.666***	0.049	13.6	<0.000
R Squared	0.707			
F Value	174			

CPI TOT Dependent Sig at*** $p < 0.01$. ** $p < 0.05$ * $p < 0.10$

5 Discussion

The thesis findings suggest that the relationship between the APR, overall CPI and RGDP may be significant in some variables and their impact on the RGDP of Germany and France.

The research question has two parts first part is about the relationship between DV and IVs. The second part is about the impact of IVs on DV. The thesis has evaluated research questions with three types of analysis. First, Descriptive statistics analysis to understand the collected data. Second, The Pearson correlation analysis verifies the conceivable relation and nature of the relationship between interest rate, overall CPI, and RGDP. Third, linear regression analysis investigates the impact of independent variables on dependent variables. The regression analysis has two models—the first model analyses DV RGDP, and independent variables are overall CPI, CPIF, CPIEng, CPIxFE, PPI, LTIR and STIR. The second model contains the dependent variable overall CPI and IVs, the LTIR, STIR and CPI categories like CPIxFE, CPIF, CPIEng, and PPI.

5.1 Findings Germany's Descriptive Statistics

In descriptive statistics analysis from Table 1, the results explained and evaluated all variables' volatility. A considerable difference had found between the minimum and maximum values in the CPIEng, CPIF, and STIR. Further, these variables standard deviation is higher than the mean. As well, CPI energy, CPI food, and STIR have the highest range, variance which shows that the data is more dispersed.

5.2 Findings Germany Pearson Correlation

The paragraph explains and evaluates RGDP's relation to independent variables. LTIR, CPIF, overall CPI, and CPIxFE are low and positive correlated with the RGDP, which these results explain a positive relationship in hypotheses such as (H1), (H1a), Additionally hypotheses such as positive relationship with (H1b), (H1c), (H1d), and (H1e) with the significant level of 99%.

All the above may cause price inflation, which increases economic growth and, crucially, higher prices. Because there is stress on present factors to manufacture more due to AD increase, these

explanations align with the study of Alban William called Phillips's curve and empirical evidence (Barth & Bennett. 1975)

This paragraph explains and evaluates the findings related to interest rates and all CPI variables. First, the overall consumer price index (CPITOT) and CPIxFE positively correlate significantly higher with LTIR than other variables, (H3), (H3a). Second, CPIEng is very low and positively correlated. Still, the high significant p-value for LTIR and STIR (H3c), (H4c). Additionally, results explain that CPIxFE has a high positive correlation with STIR (H4b). Overall CPI and CPIxFE noticed a highly positively correlated relationship at the highest significant level (H5d).

Monetary policy expansion can cause AD through excess money supply in the economy. It makes it cheaper for buyers to borrow and spend at a very low-interest rate or negative interest rate. Other factors are weak exchange rates, boosted exports, and lower-income tax increased disposable income for consumers. However, low-interest-rate helps businesses borrow more and invest, resulting in business confidence rise and economic growth, representing demand-pull inflation. Thus, these results may coincide with Agarwal's empirical study that a considerable amount of cash is trailing only some products. (Agarwal, 2022).

A negative correlation had found in hypotheses (H1f), (H3b) and (H4d) concerning PPI. Negative correlation between RGDP and PPI, with a high p-value (H1f). LTIR and STIR with PPI are highly negatively correlated, but the data is highly significant (H3d), (H4d). The data suggest that the LTIR) and CPIF had a negative relationship at insignificant levels (H3b).

Explanation: The producer price index represents the industry, commodity, and commodity-based final goods. Comparing the correlation of CPI data and PPI to RGDP indicates a divergence. There are several reasons. The PPI's consumption concept includes all marketable production sold to households through domestic manufacturers. The CPI covers products and services offered by businesses or the government for which users pay apparent user charges. PPI eliminates the most significant skewed element, owners' equivalent rent. More example, PPI includes imports, and CPI excludes them. PPI does not include taxes since they do not represent producer revenue. CPI includes consumer sales and other taxes, and household spending. Finally, PPI is a degree of inflation from a producer standpoint.

A negative correlation in these results explains the increase in PPI and decreased impact on RGDP or vice versa. When there is a cost of production increase in most the firms due to a rise in raw material or inputs, but not more goods and services produced, it represents a risk of wage push inflation. The findings align with the paper, explains George (2008), who studied this issue in depth. RGDP, LTIR, and STIR to PPI do not shift in the same direction (Henricks 2021). PPI is a lagging indicator to the Overall CPI rather than the leading indicator., The following paragraph discusses regression to explain the results in depth.

5.3 Findings Germany Linear Regression Model No.1

The following paragraph discusses Regression analysis results. Model no 1 explained that 36% change in the DV (RGDP) is due to IV (s).

The results explain beta of PPI, CPIF, and STIR have a significant influence on the RGDP, (H2a), (H2c), and (H2f). The findings are related to the second part of the research question. CPIEng (H2d), LTIR (H2e), and CPIxFE (H2d) suggest the lowest influence and level of confidence above 10%. And the overall CPI had no impact on RGDP(H2).

PPI examples include raw materials (commodities, cotton, gas, etc.) from the producer standpoint. The final level of PPI is about finished goods being in their final stage before being sold to the consumer. PPI's 1991 to 2021 influence is more significant than all other inflation categories in the present scenario. The impact of PPI on growth is pointing out towards higher cost of production, risk of cost-push inflation resulting in lower growth and increases the price levels to the producer finally passed over to the consumer, which impacts overall CPI.

5.4 Findings Germany Linear Regression Model No.2

The German outcomes indicate that a 70% change in the DV overall CPI had due to independent variables. The results indicate CPIEng, CPIxFE, CPIF, and LTIR influenced overall CPI (H2a), (H2c), (H2f). Additional STIR had no impact on overall CPI, the p-value of 38% (H5a).

Explanation: Model 2 CPIxFE and CPIF had the highest unstandardized beta, p-value <.001 highest confidence level. CPIEng had the second-highest unstandardized beta in the model. CPIEng unstandardized beta 0.66, p-value <.001 highest confidence level. Similarly, CPIF unstandardized beta 14.70 % p-value <.001 confidence level. LTIR unstandardized beta 0.028, p-value 8% confidence level. CPI energy and CPI food are leading indicators to measure inflation; both impact consumers directly, finally contributing to overall inflation. Marketwatch (2021), due to an increase in energy price, particular in WTI, crude oil hits 82 \$ on the 27th of October 2021 barrel high form breaking the last high of October 15th, 2018, of 74\$. WITS (2019) Germany imports 15.22 billion dollars; food imports are higher in Europe. Lu (2022) Germany's dependency on foreign energy is 63.70% of the total.

So, these results suggest that an increase in Germany's RGDP also increases CPI, excluding food and energy and overall CPI. The rising long-term interest rate does benefit the economic growth in Germany. Finally, Model no 1 and Model no 2 conclude the regression analysis findings, the PPI, LTIR and overall CPI impact RGDP growth. But PPI has the highest impact on RGDP, increasing the risk of cost-push inflation in the German economy.

5.5 Findings France Descriptive

The results in descriptive statistics analysis from Table 5 explain and evaluate all variables' central tendency and volatility. There is a considerable difference between the minimum and maximum values in LTIR and STIR. The further standard deviation of STIR and CPIF data is higher than the mean. STIR, CPIF and LTIR have the highest range and variance, suggesting that the data is more dispersed. There is evidence of a static correlation between CPITOT, LTIR and STIR variables to be low positive correlated but higher than the other independent variables related to RGDP.

5.6 Findings France Pearson Correlation

The following Paragraph explains and evaluates RGDP's relation to independent variables. LTIR, overall CPI, and CPIF positively correlated with the RGDP, which explains a positive relationship in hypotheses such as (H1), (H1d), (H1b), CPIxFE (H1c), STIR (H1a), and CPIEng (H1e) with the significant level of 99%. There is evidence that overall CPI, and CPIF, boost economic growth and raise price levels. Because there is stress on current factors to manufacture more as AD rises, these

ideas are consistent with Alban William's analysis known as Phillips' curve in the empirical study. These explanations align with the study (Barth, J. & Bennett. 1975). As we know, RGDP is a measure adjusted for inflation, indicating that the French economy is producing more or more highly valued goods and services, which means real productivity and real output growth in the economy.

LTIR increase when growth and inflation have risen already. A healthier economy positively influences demand which resulting higher inflation. My findings line with Nell (2000). His empirical findings imply that low-single-digit inflation may be beneficial to GDP. This paragraph explains the findings related to interest rates and all inflation variables. Overall CPITOT and CPIxFE high positively correlated to LTIR significantly (H5b). Short term interest rate STIR, with CPITOT and CPIxFE positively correlated at the highest significant level, (H4b), (H4). CPIEng data and CPIxFE had a perfect positive correlation. Data tells us inflation is when including energy inflation index in the analyses had suggested a significantly higher positive impact on overall CPI.

PPI data negatively correlated with RGDP, LTIR, CPIxFE, CPITOT, and CPIEng (H1f), (H2c), (H3d), (H4e). PPI data had found, whereas STIR and CPIxFE were low and negatively correlated. PPI data had found that LTIR and STIR had a high negative correlation.

The data reveal a negative correlation between the LTIR and the CPIF at negligible levels (H3b). The producer price index represents the industry, commodity, and commodity-based final and intermediate demand. There is a divergence when comparing the connection of CPI and PPI data to RGDP data. The PPI's consumption definition includes all marketable production sold to households through domestic manufacturers. The CPI includes items and services provided by businesses or the government and for which users pay apparent user fees. PPI does not include major skewed factors. Owners' equivalent rent and Imports does include in CPI. Because taxes do not represent producer revenue, on the other hand, consumers pay sales tax and other taxes and incorporate them into the CPI as part of their overall expenditure. Finally, the Producer Price Index (PPI) measures inflation from the producers' perspective. Increases in PPI negatively influence RGDP and vice versa, indicating the possibility of Cost-push inflation. The findings had explained in the study and investigated by George (2008). Due to an increase in manufacturing costs, the AS curve changes. The relationship between PPI and growth, LTIR, and STIR does not proceed in the same direction. Rather than a trailing indicator, the PPI is a lagging indicator for the overall CPI

(Henricks,2021). The following paragraph discusses regression analysis to examine and explain the results in depth the influence of independent factors on dependent variables.

5.7 Findings France Linear Regression Model No.1

The section discusses the Regression analysis model no. 1 of the first explanations was that a 27% change in the dependent variable (RGDP) was due to independent variables. The results explain beta of PPI, CPITOT, and LTIR influenced real gross domestic product (RGDP), (H2c), (H2), (H2e). And the overall CPI has a 3% impact on RGDP. CPIEng at the p-value has no effect but a higher confidence level (H2b). CPIF indicated no influence but a confidence level below 10% (H2a).

Explanation, the result of model no.1 suggests that the overall CPI impacts the RGDP growth of France. Similarly, the Producer Price Index has a high positive impact on RGDP growth. To go into depth in our findings, I have analysed model no.2 to determine which one of the chosen independent variables increases overall CPI.

Since the model suggests that the PPI have a high impact on growth, a reasonable explanation can be that PPI examples include raw materials and commodities: cotton, gas, and crude oil. The final level of PPI is about finished goods in their final stage before being sold to the consumer. PPI's 1991 to 2021 influence is higher than all other inflation categories in the present scenario. An increase in PPI is an example of price inflation in the economy. On the other hand, commodity price and final demand of commodity or finished goods in demand. The impact of PPI on growth is pointing out towards higher cost of production that represents a risk of wage push inflation resulting in lower growth and increases the price levels to the producer finally shifted to the consumer or in other words, impact overall CPI. Cost-push inflation can change the AS curve inwards. If the price of input goods for production keeps rising, stagflation risk becomes increasingly high.

LTIR impacts growth, and the thesis investigation align with (Berthold & Grundler 2012). Their findings suggest that a complex interaction of factors drives stagflation and that the oil price increases have faded in the 2000s. The researchers discovered the evidence that this influence has increased again near the sample's back edge. Nonetheless, rising oil and gas prices mostly cause stagflation, and it can raise the overall inflation rate.

5.8 Findings France Linear Regression Model No.2

The following paragraph discusses Regression analysis model No. 2.

The results indicate that a 99% change in the predicted overall CPI was due to IV. The results explain that PPI, CPIEng, CPIxFE, CPIF and LTIR influenced overall CPI (H5), (H5c), (H5b), (H2f), (H5d). Additional STIR had no impact on overall CPI, but confidence levels were above 10%, which is unacceptable in this model.

Discussion: model 2 PPI had the highest unstandardized beta of 2.60. CPIEng is second highest in the model have noticed CPIEng unstandardized beta 0.66, p-value <.001 highest confidence level. Similarly, CPIF unstandardized beta 0.18 and LTIR unstandardized beta 0.14 both, p-value <.001 highest confidence level. It means the consumer price index of energy in France affects the overall consumer price index compared to other CPI, such as the consumer price index of food. If the energy prices increase in France, it will affect their economic growth. But also cost of production increases, which will raise cost-push inflation risks in the economy. Similar Investigation by (Li & Lee, 2022)

5.9 Findings Germany vs France Comparison Experience

Germany and France's correlation and regression tests indicate that RGDP significantly relates to overall CPI, LTIR and STIR. The PPI has indicated a negative relation to growth and a significant impact on the RGDP of both economies. The PPI signifies the rising cost of production and wholesale prices in both countries. Germany and France import energy for their domestic use (Lu,2022). Germany's dependency on foreign energy is 63.70% of the total, and France's dependency on foreign energy is 44.50 % of total energy. Thus, the average dependency rate in the European area is 57.50%. Germany is above the average, and France is below the average.

I have seen the findings of the thesis. In regression model no. 1 of Germany, the impact of the independent variable on RGDP is 36% which is higher than in France. In regression model no. 1 of France, the impact of the independent variable on the real gross domestic product is 27.5% in France. And in the second model of regression indicates that the influence of predictor factors on the overall CPI was 99% in Germany and 70.70 per cent in France (WITS,2019). Germany's food imports are 15.22 billion dollars, and France imports 3.5 billion food imports. Models' comparison suggests that a country is more dependent on foreign energy and food imports. In that case, its

real gross product and overall consumer price index are more vulnerable to exogenous shocks that negatively impact domestic economics.

5.10 Limitations

Consumer confidence, Business confidence, and Composite Leading Indicator impact growth, though they are important to investigate in relation to economic growth. But these variables do not meet the assumptions of parametric statistics. Suppose I include those variables in the investigation. In that case, it will invalidate or contaminate the results. Although it is accepted, there is still some controversy. Future studies can be done exclusively on these variables.

The results investigated are only for two top economies in the Euro area. Data limitations and validity hurdles exist in countries that do not gather regularly, and politicians manipulate data for political reasons. To have precise results and conclusions, other circumstances such as the pandemic and the Ukrainian are the temporary links between economic activity though they have profound consequences. All of those mentioned above may result from demand-pull inflation risk. Our data from 1991 – to 2021 does not cover the Ukrainian war financial crisis.

5.11 Conclusion

The study's findings are evidence to conclude that the APR and the overall CPI rate positively correlated with the economic growth of Germany and France. In Germany, the APR does not affect economic growth; inflation has a very low effect (0.20%). In France, the Interest rate is very low, affecting (0.016) economic growth; inflation has a low effect.

Additionally, the PPI impacts the RGDP growth of Germany and France from 1991-to 2021. There is a positive correlation between APR, overall CPI, and RDGP, except for PPI, which negatively correlates with interest rate and growth. The findings conclude that PPI in Germany and France impacts RGDP growth, and CPITOT has a very low impact. Model no.2's findings conclude that Germany's CPIxFE and CPIF impact the overall inflation rate. Model no.2's findings conclude that France's PPI, CPIEng and CPIF impacted the overall inflation rate. Researchers tried to find the in-

terrelationship between APR, GDP, overall CPI, and RGDP. Mundell's (1963) nominal Apr and expected CPI rate do not have a correspondence association. The thesis does not look at this phenomenon from a bird's eye view. For that purpose, I investigated the effect of APR, categories (STIR, LTIR) and overall CPI (CPI food, CPI excluding food and energy, CPI energy, overall CPI, PPI)

Both economies are far from self-sufficient in energy, yet countries are dependent on imported energy (Lu et al., 2022). Germany's energy dependency is 63.7%, and France's energy dependency is 44.5%. Since the global recovery from the last financial crisis (Covid-19) seems to have confronted further setbacks due to the war in Ukraine, the Global economic growth outlook is increasingly uncertain and challenging. All those challenges and external settings add to the internal uncertainties associated with the European geopolitical anxiety. However, Germany and France's economies have achieved strong growth. Both economies are still facing the challenge of exceeding CPI. Due to soaring prices in energy and a sharp rise in PPI, AD and AS have weight and mismatch, which increases the risk of wage-push inflation. The PPI represents domestic producers and wholesalers to industry or producer—price changes before it arrives at the customers. Higher cost of commodity prices and raw materials increase the cost of production. To conclude the findings, there is clear and convincing evidence of PPI's impact on RGDP and overall CPI. However, the study has shown a positive correlation between LTIR and STIR with RDGP.

Surprisingly, the most important part of this research investigation is pointing out an emerging quiet financial crisis—my investigation aligned with (Roubini,2021). Historical evidence reveals that in 1950, PPI underestimated inflation for almost 20 years. Then in the 1970s, it caught up quickly. After the 1970s, two oil supply shocks followed the Yom Kippur war (1973) and the Iranian revelation (1979). This occurrence matches the present scenario. (Clark, 2022) in January 2022, PPI in Europe increased by 23.08 % from last year and by more than 17% from 2015. All the above stated have one common issue, Stagflation (Roubini et al., 2021).

Further research is consequently necessary to ascertain the impact of CPI on RGDP within a larger group of data as a comparison experience before a precise conclusion.

5.12 Recommendations

Based on the thesis, hiking the interest rate may halt the inflationary pressure and balance the soaring CPI that has struck record highs. Central banks are losing their credibility due to flip flops in monetary policies, such as the new monetary policy norm to maintain negative interest rates. Consequently, Policymakers need to look for alternative oil supply, and the European central bank should concentrate on factors keeping the inflation rate stable. The shortage of oil and gas supplies raises the risk of price inflation and increases the risk of wage push inflation due to the higher production price. Amadeo (2021), the oil price is inevitable at \$150, and oil suppliers can make it impossible to meet the supply gap. Paraskova (2022) Demand-pull inflation is one of the causes of Hyperinflation. Flip flop Monetary policies may create a perpetual inflationary vicious circle. For researcher may concentrate on the monetary policy fit for the future.

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Appendices

Appendix 1. Germany ANOVA Model no.1

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.600 ^a	.360	.347	.01378

a. Predictors: (Constant), CPIENG, CPI, CPIF, PPI, STIR, LTIR, CPITOT

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.038	7	.005	28.741	<.001 ^b
	Residual	.068	358	.000		
	Total	.106	365			

a. Dependent Variable: RGDP

b. Predictors: (Constant), CPIENG, CPI, CPIF, PPI, STIR, LTIR, CPITOT

Appendix 2. Germany ANOVA Model no.2

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.995 ^a	.990	.990	.11989

a. Predictors: (Constant), CPIENG, CPI, CPIF, PPI, STIR, LTIR

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	517.824	6	86.304	6004.147	.000 ^b
	Residual	5.160	359	.014		
	Total	522.985	365			

a. Dependent Variable: CPITOT

b. Predictors: (Constant), CPIENG, CPI, CPIF, PPI, STIR, LTIR

Appendix 3. France ANOVA Model no.1

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.525 ^a	.275	.263	.02341

a. Predictors: (Constant), CPIENG, CPIF, PPI, CPITOT, STIR, LTIR

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.075	6	.012	22.739	<.001 ^b
	Residual	.197	359	.001		
	Total	.271	365			

a. Dependent Variable: RDGP

b. Predictors: (Constant), CPIENG, CPIF, PPI, CPITOT, STIR, LTIR

Appendix 4. France ANOVA Model no.2

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.841 ^a	.707	.703	.45293

a. Predictors: (Constant), CPIEng, CPIF, PPI, STIR, LTIR

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	178.628	5	35.726	174.151	<.001 ^b
	Residual	73.851	360	.205		
	Total	252.479	365			

a. Dependent Variable: CPITOT

b. Predictors: (Constant), CPIEng, CPIF, PPI, STIR, LTIR