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FOR CRISIS MITIGATION**»

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Abstract

This paper analyses the development of monetary policy theory and how it affects the German monetary policy as a part of European Central Bank framework. It takes deeper look on the implementation of basic tools of monetary policy as interest rates, open market operations, long term refinancing operations and fine-tuning operations specific to the Bundesbank. In terms of crisis, it covers the actions of Bundesbank and ECB during Global crisis of 2008 and COVID-19 crisis to understand the framework and to see the development of new approaches. As for model it provides a linear regression for determining effects of monetary policy reflected in factors like GDP, interest rate and M3 aggregate on inflation. In addition, I discover the potential interest rates with the help of Taylor's rule. After that I implement a possible inflation rate with a linear regression equation to provide basis for comparison and evaluate the effectiveness of interest rate.

Keywords

Monetary policy, interest rate, ECB, crisis, money supply

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INTRODUCTION

This paper is bound to consider the development of monetary policy theory from the discovery of money up until the twentieth century. It covers the development of fiat currency, the creation and evolution of monetary institutions as central banks and how these developments gave rise to the monetary policy and basic ground rules for its performance. This outlook plays a vital part to understanding the key breakthroughs in monetary policy conveyance. The role of crisis, major political and historical events which would transform the perception and the role of monetary policy instruments and central banks. In addition, the consequences that these events led to in transformation of the economic order and conjecture. The paper also gives an outlook of relatively modern debates and schools of thought which are shaping the today's world as the Bullionist Debate, Keynesian and Monetarist debates. The significant part is how these frameworks would influence German monetary policy framework. Another important point is development of German school of thought as Ordo-liberalism and its impact on the general framework of ECB as the main monetary policy referee for the whole Euro-area.

The next sections are dedicated to exploring the Bundesbank operations like Main Refinancing Operations, Long-Term Refinancing Operations and Fine-tuning Operations as the main tools for conveying monetary policy. These instruments give a major understanding of German's Central Banks operations and its measures to providing liquidity along with the ECB's measures. Furthermore, the coverage of ECB's pillars of monetary policy as a deterministic system for the priorities and targets of the Euro-area as a whole. After a comprehensive look at the system as whole we dive into the analysis of monetary stance during two major crisis of 2008 and COVID-19 crisis. This paper takes a closer look at the minor monetary policies as changes in collateral requirements to the major ones as robust monetary activity to support the economies. It is important to note that this paper displays a general evaluation and trajectory of the world economy and German economy to provide further monetary policy advice. Here the economical guidance tool as Taylor's rule is discussed and how successful the ECB was in containing

the advised interest rate. For further analysis of monetary policy, a regression is used with factors like unemployment, GDP growth, M3 aggregate and interest rate to provide the explanation for the level of inflation. The general idea is to implement the interest rate from Taylor's rule and plug it in in the model to evaluate the potential inflation in theoretical scenario to understand whether the ECB was right in its deviation from a Taylor's rule framework.

Chapter 1 Literature review

1.1 Historical aspects of monetary policy development

Nowadays central banks are the main authority who are obliged to convey monetary policy and independently react to the circumstances that a country might find itself in. It is common sense to perceive central banks as the main source for implementing monetary policy, however this wasn't the case up until the twentieth century when the system of central banking was yet not implemented. In that case the actions were performed by the Treasury or in cases of some countries like Canada, New Zealand, Australia commercial banks were the ones who were entrusted with handling government's tax revenues. One of the first central banks dates back to the seventeenth century. Swedish Riksbank and the Bank of England can be deemed as the trailblazers conquering the frontiers of new financial institutions right in the middle of transformation from mercantilism to classical political economy which would later dictate the major changes in the political and economic state of the world.

Before getting into the central banks and their major role of influencing the money supply of the country it is important to trace the path which has brought humanity to this certain point of development and what transformations the school of thought has undergone. So the exploration should begin with the common usage of money as a medium for exchange. Which is believed to date back to the 8th century BC in ancient Lydia, however some economists, historians and anthropologists would argue for the Chinese origin. It is believed that the broad use of money is associated with the rise of commerce and trade. This revolutionary idea made storage of value way easier and in addition to this it was widely recognized and divisible. Precious metals are the most common predecessor of money as we know it today. It would serve as a unit of account and then as a medium of exchange. Governments would also take part in the exchange as

monarchs realized that it was a lot more convenient to pay their soldiers and servants with money rather than particular goods. That is the period when the government would try to completely take control of minting coins. Since ancient times the government generally had the monopoly of issuing the coins. It can be considered that the earliest predecessor of monetary policy is the government melting down coins and mixing them with cheaper metals to produce a greater amount therefore changing the weight of the coin or its quality. Another way of conveying prehistoric monetary policy was creating other denominations of coins. This method became widespread in the Roman Empire and reached its peak in the middle ages in Western Europe. This method has also been used in France as a way of getting an “inflation tax” since other ways of taxation were unavailable and were already drained by the Hundred Years War against England. Even though this method refers to fiscal policy rather than monetary policy it is still a crucial step in the development of monetary policy when using paper money. [24]

Paper money would make its way as a common medium of exchange in the commercial banks of Italy which would use it for the sake of economizing precious metals which were used for the production of coins. It claimed to be a greater way of circulating the claims. Early commercial bankers learned from that experience that it's essential to hold a sufficient reserve to fulfill the demands for redemption in business. Talking about governments they've caught up with this idea and started issuing paper money in the eighteenth century in Europe. An example for early use of paper money were Swedish notes issued to finance yet another military campaign. The widespread use of fiat money has been reached during the revolutionary wars in America. Congress issued notes which were convertible into the species. However, in the end these notes were worth nothing since the government didn't fulfill its promise since these notes happened to be untradable. At that time the rate at which these notes were issued would equal to 65% of inflation per year. The early predecessor of monetary policy can be considered the John Law's System. A politician whose part of the campaign was to convert national debt into stock. He then used this stock as the way to oppose the notes of Banque Royale. This note issue would finance the issue of further shares in 1719.

The origin of modern monetary policy was conducted still under the gold standard which dominated in the end of the nineteenth century and the beginning of twentieth century. This system would help countries to define their currency in accordance with the gold standard which means that every currency has its fixed weight of gold which allows holders to convert it to gold at any given moment. At that point of time one of the main responsibilities of central banks was to sustain the convertibility of notes. In addition to this, central banks would also manipulate discount rates to adjust to the outside shocks. If the deficit of balance payments occurs, usually gold flows abroad which decreases the gold reserves of a central bank. This would cause central banks to raise their discount rates. This would offset a deficit since higher rates encourage inflow of capital. In case of surplus, the amount of reserves would increase and discount rates would decrease.

Even though the gold standard has been restored after World War 1 governments put greater emphasis on central banks to fulfill domestic targets like the level of unemployment, stability of output and price stability. Less emphasis was put on external convertibility contrary to the previous period. During this time we have evidence of inappropriate monetary policy. One of the examples of it was the Great Depression. [26]

One of the first instruments of monetary policy were usage of the discount rate and rediscounting. In addition to this, the Bank of England gave rise to open market operations and popularized it during 1870's and 1880's in order to encourage borrowing. Other countries which didn't have the capacities for advanced money market operations would use credit rationing and gold policy. The latter has been used to harm regular flow gold. During this time the Federal Reserve would develop in the United States. Their primary tool was the discount rate which proved to be not enough since the chosen course of actions for handling post World War 1 inflation would cause a deep recession during 1920-1921. The development of Fed's toolbox continued with shifting to open market operations as a primary tool. During 1930's the Fed would also elaborate policies changing the reserve requirements which would eventually lead to doubling of reserve requirements. Besides freshly implemented operations new regulations would take place which covered a diverse array of directions such as capping interest rate ceilings, selective credit controls and margin requirements in stock purchase. These alterations

would not only prevail in the USA but they would be adapted all over the world. In comparison to today's state of market conditions instruments like credit ceilings were ineffective in the free market. That is why most of the central banks rely on open market operations as the primary resort.

1.2 Theoretical pillars of monetary policy

Bullionist debate as a step to the development of monetary policy

The development of monetary policy regarding the theoretical aspect started to develop in the beginning of the nineteenth century. Bullionist debate or Bullionist Controversy is an essential part of the development of monetary policy. It is important to note that the concise debate has never happened but was rather a prolonged period of overlapping debates on the background of Britain fighting Napoleonic France during the end of eighteenth century and the beginning of the nineteenth century. These campaigns have caused inflation and for that reason the convertibility of bank notes were at risk. This suspension would cause the British monetary system to switch to the flexible exchange rate walking away from a commodity standard. This shift started the conversation about the price index since fiat currency relates to not only one but to a whole set of commodities.[24]

So the initial debates started during 1798-1801 when a quite big inflation spiked. So called bullionists saw symptoms like price increase of agricultural products, increase in the gold value and a significant dip in the exchange rates. The common verdict that they would give is that the Bank of England has significantly overissued notes which are supposed to buy the government debt. Problems like falling exchange rates and rising prices posed a significant challenge to the government's ability to cover its government debt since the notes were inconvertible to gold.

Anti-bullionists were the ones who are rather favorable of the government and blaming the outcome on the external factors. One of them was poor harvest. Falling exchange rates would tie to the necessity of greater food imports which, according to anti-bullionists, failed the exchange rate. In addition, excessive subsidies to the war allies would cause a great outflow of resources. The rising prices were thought to be not the

result of overissue but rather the fluctuations in price which are independent from the Bank of England.

Later these debates would reincarnate the Real Bills Doctrine but applied to the central bank rather than commercial banks as has been stated by Adam Smith. This idea is related to issuing notes of a two or a three months maturity which would give a borrower and a debtor real deadlines and a personalization of paying back the loan because of its short maturity period. This instrument was also debated about and according to Thorton he sees how this tool could be used as a result of previous monetary overexpansion.[32] However he argues that these drastic contractionary measures could turn into a banking system crisis.

This period is essential to the development of monetary policy since it touches on the topics of targets of monetary policy such as prices, unemployment and exchange rates. We can see the glimpses of understanding to the actual functions of monetary policy and connections to how a country and National Banks can influence different factors. We can definitely see that great shocks and inflation were consistently pedaling this debate. Eventually the convertibility of gold was restored for another century but the shocks were a significant driver for evoking new methods for conducting monetary policy in its most simple manner.[22]

The twentieth century is one of the most prolific ones considering the shift of monetary policy approaches. The main thing that is worthy of mentioning is a gradual transition from the gold standard which fundamentally marked the new age of monetary policy and economies in general. Up until the time where the gold standard was still in place goods or currencies were backed by the gold standard. This would put some constraint on central banks as its monetary policy was bound by the reserves of the gold which were an essential part of saving the value of a domestic currency. The importance of currency value comes from a gold parity which had to be maintained for the conduct of monetary policy.

As a result of debates in the nineteenth century we can extract two essential concepts as the gold standard and the doctrine of real bills. The second one is a result of the Banking School of theory whose doctrine would be based on lending from commercial

banks on the premise of liquidating short term bills. It is important to note that two pillars of monetary policy of the nineteenth century would usually clash since the expansion of the economy would anticipate ease while the balance would deteriorate and cause tightening. This incoherence would pop up on several occasions during the 1920's. This clash is believed to have caused economical disasters like recession in 1929 which would also scale to the Great Depression in the early 1930's. This theory suggested that a rapid boom on the stock market would cause high levels of inflation which would eventually cause deflation. This was one of the primary reasons for the Fed to cool the stock market. This move triggered the recession which was the reason for panics in the banking system. Fed's inability to mitigate the consequences of the recession caused the Great Depression which would also spread to other countries as a result of fixed exchange rates due to the gold standard. At that point of time monetary policy seemed like an ineffective way of mitigating the crisis. Eventually this led to a greater focus on fiscal policy over the next two decades. On the forefront of the monetary policy were two schools Keynesian and Monetarist.[41]

Monetarism vs Keynesianism, debate during 20th century

Monetarism would be developed in the late nineteenth century up until the middle of the twentieth century and its main concept was that a steady money supply in the economy is a primary method of economic growth. They argued that an increase in aggregate demand stimulates job creation which stimulates economic growth and decreases economic growth. Which essentially represents a Phillips curve. One of the main instruments in the monetarist toolbox was the adjustment of interest rates as it directly affects the money supply in the economy which they argued for. An increase in interest would decrease the money supply as the "price" of money would be higher which makes it more expensive to borrow therefore discourages borrowers and contracts the economy. On the contrary, decrease in interest rates is a powerful tool for effective

increase of money supply which would stimulate the growth of the economy at the expense of increased inflation. One of the prominent authors and advocates for monetarism is Milton Friedman who argued that the government should incorporate a steady growth of money supply that can boost the demand for goods and services.

Keynesianism was developed as a response to the ravages of the great depression. The main implication of this theory was for the government to take a greater charge in creating a greater demand by increasing government expenditures therefore increasing its role and influence. In addition, this theory advocated for increasing spendings during the times of crisis since the evident shrinkage in consumer demand made unemployment higher and the economy less robust.[23]

The essence of the debate between monetarists and Keynesians regarding monetary policy lies in the equation $MV=PQ$. The main would circle around the question of how money supply would affect velocity and quantity. Keynesians propose that V is either inversely correlated with the money supply or is an unpredictable variable. Meaning that spendings won't necessarily increase because market agents are able to increase their savings. While monetarists would argue that by increasing money supply they would be able to control aggregate demand since the velocity would not be affected.

The second matter of the debate lies in the premise of the quantity of national output where monetarists perceived long run aggregate supply to be inelastic which made them assume that increase in MV will be directly influencing price levels considering the equation above. According to this theory inflation is determined by the rate by which money increases. On the other hand, Keynesians argue the elastic aggregate supply except when approaching full employment. Therefore the quantity of goods is variable. So, a restrictive monetary policy is likely to reduce output and the price level to the degree that it influences aggregate demand, when there is opposition to price and wage reduction from monopolistic enterprises and unions. A prolonged recession may result if monetary policy is decreasing aggregate demand. The direct transmission mechanism is one way that monetarists differ from Keynesians. People have more money in their hands than they desire when the money supply is expanded. As a result, they increase overall effective demand by purchasing stocks, goods, and services with the surplus funds. The

notion of portfolio balance provides the theoretical support for this. According to this hypothesis, people store their wealth in a range of assets, including shares, bonds, bills, and physical assets like homes and cars. If the public's money supply increases, the balance of their portfolios is thrown off. The yields on bonds, securities, and tangible goods all fluctuate as a result. The extra cash will be spent buying liquid and close-to-cash assets, driving up the price of those assets on the market. As long as the balance in the people's portfolios is not restored, the rebalancing of the people's portfolios will continue. Keynesians have criticized the method because of doubts considering its performance in a short-term period.[34]

During the twentieth century these theories would push the development of monetary policy further. Keynesian theory had its influence during the 1950's as this approach would put greater emphasis on short term rates manipulation . After the implementation of this approach it would also last throughout 1960's. During this time monetarism adherents would be very persuasive to raise awareness about the necessity to stabilize the business cycle which according to monetarists the Fed was failing to do. In addition, they would criticize the Fed for blindly believing in the Phillips curve fixing unemployment at the expense of increasing inflation. This set of miscalculations would wind up in a recession during 1970's.

Ordo-liberalism

The socio-economic theory known as "ordo-liberalism" was developed in Germany in the early 20th century and had a big impact on the philosophy and framework of German monetary policy. It evolved as a response to the political and economic difficulties that Germany encountered during the interwar years and sought to construct a market economy with a solid foundation of institutions and regulations to guarantee both individual freedom and economic stability. Ordo-liberals place a high value on sound monetary order and monetary stability. They support the creation of a free-standing

central bank with a specific purpose for preserving price stability and reining in inflation.[28]

This reflects the viewpoint that long-term economic progress and the preservation of personal freedom depend on a stable monetary system. The foundation and ideology of German monetary policy have been significantly influenced by ordo-liberal concepts, notably since the founding of the Deutsche Bundesbank, the country's central bank. Price stability was made the main objective of German monetary policy as a result of ordo-liberalism's commitment to monetary stability and a sound monetary system.

Inflation management was given top priority by both the Bundesbank and the European Central Bank (ECB), ensuring that monetary policy decisions were made with the goal of maintaining low and stable inflation rates. German monetary policy reflects ordo-liberalism's prudence in regards to economic policy. The Bundesbank and other German central banks have a reputation for taking a conservative approach, putting stability first and opposing excessive money creation or unconventional monetary measures. With this strategy, long-term economic stability will be preserved and inflationary pressures will be avoided. Overall, by highlighting the significance of stability, monetary order, and a rules-based approach, ordo-liberalism has formed the structure and ideology of German monetary policy.

The creation of institutions, the goals of the central bank, and the policy choices made to uphold price stability and guarantee long-term economic stability in Germany have all been affected by these concepts.

ECB as the pillar of central banking

The next stage to the development of the monetary system was a long ignored principal which nowadays is considered a basis for conducting different policies. The correlation between independence and price stability was discovered which eventually led to a gradual transition of central banking becoming more independent. Reasoning behind this pivotal moment is the fact that policies usually were oriented on a short term

which would inevitably spike the inflation and lead the economy into recession. The decision for transition has been made to avoid short-term political manipulation as it prevented effective and long term growth.

It is interesting to consider the ECB's monetary policy in light of the progress made so far in central bank theory and practice. The change of government, with the potential for significant structural disruption, was marked by the switch from the country's long-established currency to the new currency, the euro. As a result, the ECB could not easily adopt the policies of other central banks. Instead, she had to reflect on her past lessons and economic research findings and adapt them to the specific situation she faced: ECB strategies and policies were influenced by central bank findings or Based on an evaluation of theoretical progress.

However, the ECB's strategy and monetary policy also contain certain unique elements. In this case, the "two pillars" of the approach are the key elements. The final direction of monetary policy actions aimed at achieving the ultimate goal of maintaining price stability is provided by a comprehensive and continuous cross-check of economic and monetary analyses. The most important factor that distinguishes the ECB's strategy from most other central bank strategies in this context is the role that money plays. It's important to remember that financial analysis always involves a lot more than just comparing M3 growth to a reference value. [25]

Credit as well as other monetary aggregations were often examined. With time, monetary analysis significantly deepened and diversified, particularly by incorporating a significant role for credit. Examining credit and money together makes it easier to gauge how likely monetary trends are to cause inflation. Examining credit and money together makes it easier to gauge how likely monetary trends are to cause inflation. Despite the fact that the recent financial turbulence presented severe obstacles for central banks, the value of a monetary analysis "that complements model-based information with institutional knowledge" has once again underlined the suitability of the ECB's decision for the strategy

Inflation targeting was widely seen as the "cutting edge" approach to monetary policy when the ECB started its activities. Nevertheless, the idea of inflation targeting has

since been significantly revised. There is growing evidence that asset prices are correlated with changes in money and credit. A monetary policy strategy that closely monitors monetary and credit developments as potential drivers of consumer price inflation over the medium to long term has important side effects. While helpful in limiting the occurrence of unsustainable developments in asset valuations, inflation targeting has serious limitations in integrating asset price developments. This is another example that highlights the comprehensive nature of the ECB's monetary policy approach.

The dual pillar model also aids the ECB in maintaining a stable posture on monetary policy. A central bank is continually inundated with economic news and runs the risk of falling under the spell of the most recent indicators, the market's anticipated response to those indicators, and the central bank's response. so forth. A medium to long-term orientation has been supplied by the strategy with a clear focus on monetary changes, which has also avoided the traps of fine-tuning.[27]

Chapter 2 Methods and materials

2.1 Market operations of the Deutsche Bundesbank

The Bundesbank, the central bank of Germany, is one of the most unique central banks in the way it operates financial liquidity in markets. Unlike central banks across the world that intervene in the market very few times a year, the Bundesbank regularly intervenes by conducting weekly repurchase tenders, with major operations when necessary during the year. One of the advantages that the bank enjoys from regular market interventions is that the bank can effectively communicate its assessment of the economic situation, therefore, creating more transparency between the bank and the German People.

Given the idea that a central bank closely controls liquidity in the market to enact its monetary policies, the Bundesbank has three important liquidity operations which allow the central bank to control liquidity and interest rates in the money market as and when required by the policies set by the centralized Eurosystem. The bank has the facility to instrumentalise the following operations accordingly:

1. Main refinancing operations
2. Longer-term financing operations
3. Fine-tuning operations

Each of these operations varies in the time duration and regularity, as such this section of the policy paper will discuss these operations available to the Bundesbank in detail.

Main Refinancing Operations

Main refinancing operation is one of the most regularly used and the most important tools of the Bundesbank. In its essence, the operation is a liquidity provision

instrument of the Bundesbank. The bank operates this instrument with a weekly frequency and provides liquidity to banks with a maturity of one week,. The Bundesbank designs the operation in accordance with the monetary policy of the Eurosystem and releases a yearly calendar marking the days in which liquidity will be provided to the markets. Participating financial institutions can place their bids at the end of the trading day and will be notified of the allotment on the following day. [11]

Given that the maturity of the liquidity is for one week, the liquidity provision allows the participating financial institutions to rotate capital several times in a week thereby enabling more transmission of the liquidity.

Historically, the Bundesbank has used main refinancing operations strategically wherein during the 2007 financial crisis the Bundesbank updated its minimum bidding rate to 3.75% per annum by cutting the rate by almost 0.5% to encourage financial institutions to mobilize the bank's liquidity facilities. The move taken by the Bundesbank was also in accordance with 6 other central banks in the Eurosystem as part of a joint effort to control the fallout from the financial crisis. The Bundesbank is currently increasing the number of allotments with 688 Million Euros allotted earlier this year in June to nearly 4.588 Billion Euros being allotted in the last week of October. The increase is in accordance with an expansionary monetary policy which is injecting more liquidity into the financial markets. [17]

Longer-term Refinancing Operations

Longer-term Refinancing operations are another fundamentally important operation of the Bundesbank wherein it is also a liquidity-providing system, however with a longer maturity period of 91 days. The Bundesbank operates this liquidity provision each month, opening the tenders for participating financial institutions. Like the Main refinancing operation system, the longer-term system also works in accordance with the Monetary policy set by the Eurosystem, with a decentralized operation solely conducted by the Bundesbank. [10]

The bank has the precedence and the option to conduct special tenders that are not part of the regular tenders set by the bank in yearly calendars. Special tenders are announced according to the bank's assessment of the financial markets, hence not only does the bank provide liquidity through special tender but also communicates its assessment.

Due to the long maturity period, the longer-term operations allow liquidity to rotate in several cycles and can be extremely efficient during a crisis. We can not evidence of the same in the 2007 financial crisis where financial institutions largely preferred the longer-term operations over the main refinancing operations due to the longer maturity period. [39]

Currently, the Bundesbank has increased the allotments from 10 million Euros in January of 2022 to 408 million euros in October 2022. Likewise, the bank has maintained a 0% per annum interest rate on this operation to encourage financial institutions to use longer-term operations. It becomes evident that the current operation setting is also in synchrony with an expansionary monetary policy as it enables more liquidity to be transmitted into the economy. [16]

The key aspect of the longer-term refinancing operation is the precedence the Bundesbank holds to create special tenders as and when necessary to respond to changing economic conditions. As such, the longer-term operations provide more flexibility in the timing and the quantity of the tenders, and are reflective of the Bank's assessment of the economic condition. Currently, the bank has created and allotted more tenders as it deems it to be a requirement in the response to the current economic turmoil.

Fine-tuning Operations

Fine-tuning operations are the most disruptive liquidity operation of the Bundesbank due to the nature in which the operation is employed. Fine-tuning operations are used during sudden and unexpected liquidity changes that require immediate liquidity relief. Unlike Main refinancing operations and Longer-term refinancing operations, fine-

tuning operations are not decided in advance, and as such their maturity periods are not standardized. [10] Moreover, a key difference between Fine-tuning operations and the other two operations of the bank is that while MROs and TFO can only be used for injecting liquidity, Fine-tuning operations can be employed for absorbing and injecting liquidity into the markets. Moreover, Fine-tuning operations can be released in merely 90 minutes from when the Bundesbank announces the tender, whereas the other operations take a one-trading day for settlements.[9]

In a joint response to the financial crisis of 2007, the Eurosystem including the German Bundesbank had injected nearly Ninety-Five Billion Euros through Fine-tuning operations. The mobilization of the Fine-tuning operation during the 2007 crisis displayed how the operation is the Bundesbank's first measure against emergency crisis situations.[35] While the 2007 crisis mandated an immediate injection of liquidity, the Eurosystem including the Bundesbank did not operate fine-tuning operations as the first response in the first year of the COVID-19 pandemic. [21]

However, similar emergency liquidity operations have taken place across the world. For example, the United States created specific ad hoc emergency liquidity provisions to enact their economic response to the impact of the pandemic. That being said, ad hoc liquidity provision is not out of the ordinary for the Bundesbank, and the operation can be modified according to monetary policy.

The three primary operations of the Bundesbank are key tools of operation to enact the monetary policy set in the Eurosystem. The varying factors between the three operations is the rigidity in the timings and frequency as in:

1. Main refinancing operation: Fixed annual schedule, weekly frequency
2. Longer-term refinancing operation: Fixed annual schedule with ad hoc, monthly frequency
3. Fine-tuning operations: No fixed schedule, ad hoc only

These differences between the operations allow the bank to inject liquidity efficiently at the time of a crisis and enable them to create a wider range of responses. To conclude, these are the liquidity operations of the Bundesbank that lie in accordance with the later discussed monetary policy.

2.2 Monetary policy analysis during crisis

2008 crisis

Initially the ECB was created to secure price stability and a sustainable growth paired with financial stability. Further into its operations ECB became main referee for deciphering steps for mitigating and recovering from crisis using the variations of instruments. It is also regarded as a last resort lender for debt markets of countries included in the eurozone. The European Central Bank is a facilitator for operations of 20 National Central Banks in the Eurosystem. It also has authority to consult other Central Banks in the field of its competence.

Considering monetary policy, it has several crucial and deeply engrained principals which define the whole ECB's operations framework and give guidance to further adjustments. The first pillar of the monetary policy is holding inflation at the moderate level of 2 percent. This pushes the idea of determining a suitable interest rate to achieving this goal and price stability. However, it is worth noting that this target also refers to early increase of a Eurostat calculated metric called Harmonized Index of Consumer prices. Essentially this target represents aspirations for remaining a flow of steady investments without disrupting investor's expectations. The second pillar is regarding a set of instruments required for conducting monetary policy and hitting the target of an interest rate. The ECB and NCB eligible to enter margin transactions with credit institutions and other market participants based on appropriate collateral to buy, sell, lend, or borrow any type of marketable instrument in any currency, as well as precious metals. Directly or in the framework of a repurchase agreement.[29]

Considering the crisis handling I will observe the period since 2007 which will provide a much clearer view of ECB's actions during periods of crisis and recovery. So,

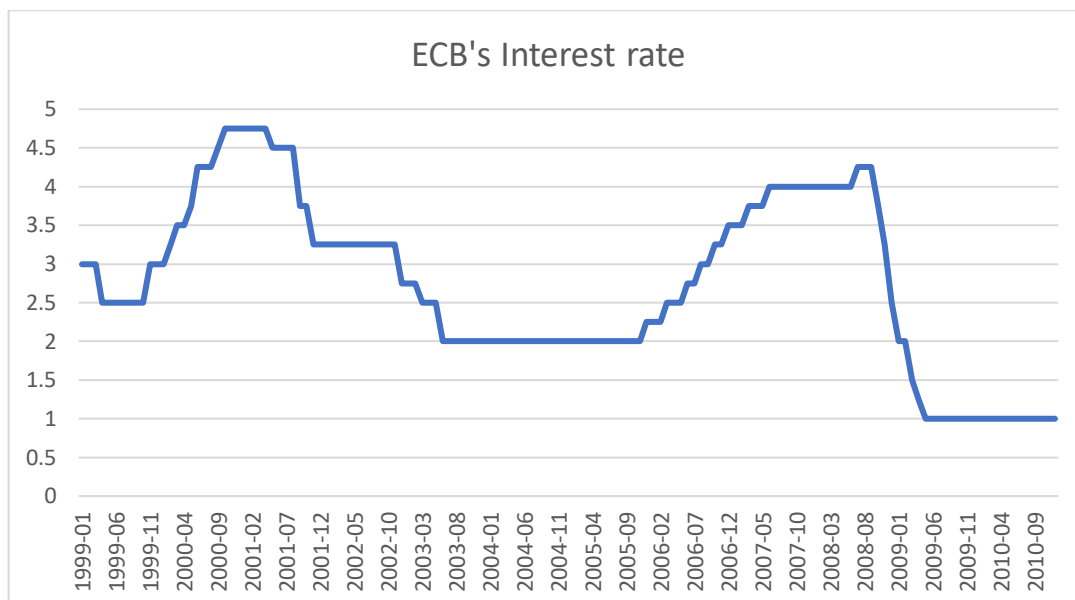
the characterization starts from the 2007 as the beginning of a global crisis. During the beginning of the global crisis in the US, the European financial system at times experienced stabilization. However, the second part of 2007 brought a lot of uncertainty to the agents of the European markets. Even though the ravages of a crisis haven't gotten to the European continent the impact has already been significant and was determined by liquidity hoarding which at that time already affected.

The 2008 turmoil could be characterized as a sudden need for credit risk repricing as the leverage which has been used before started to lose its value. This happened in the US subprime mortgage market coupled with excessive risk-taking behavior. This series of actions caused a rapid liquidity evaporation from different markets including German as some of those assets would serve as a collateral.[26] In addition to this, rating agencies would be the ones who were greatly responsible for such crisis. They were undermining the potential risk of the assets and omitted a systematic negligence of firms which would give out a huge number of loans without a proper background check or a proper collateral. The aspects would create an unpleasant atmosphere of distrust since rating agencies failed to properly assess asset riskiness. The challenge of exposure valuation arose in 2008 as a lot of economies came unprepared to tackle the market disruption without knowing the level of their exposure. Set of these events would cause capital hoarding which eventually wasn't beneficial to the solving of the upcoming challenges.[4]

A signifying trigger which has exposed the weaknesses of financial system was a fall of Lehman Brothers, the US investment bank. A rapid tightening on the money market has followed with banks raising cautiousness. It significantly affected overnight loans as during that time EONIA turnovers would hit lows of 30 billion while daily average during August would be around 55 billion. Banknotes in circulation peaked at 765 billion in December 2008. In 2008, average of over 9% growth was reached, which was still pretty solid and roughly constant from the previous year. Several factors contributed to the impact on banks. One is that they actually invested directly in subprime market assets, but that was a relatively small part of the story. It provided a collateral frame for the body. These vehicles have grown very rapidly over the last few years. Additionally, companies can no longer rely on the market to absorb the liabilities they assume, whether it be

leveraged his loans or mortgages. Banks withdrew due to extreme fears of liquidity and capital impacts from the potential for large-scale involuntary re-intermediation. So seeing the situation much clearly, the realization came that this putting huge liquidity constraints on the economy and meticulously deteriorates big market players in the financial field which slowed down growth and brought down the level of market operations which had to be faced.[9]

Talking about interest rates as the first line of defense for handling effects of crisis in the beginning of 2008 ECB's stance on monetary policy as they were pursuing. The stability of price levels and at that point it posed the major concern for the governing council. This is the reason why in the beginning of crisis we could see a minor increase in interest rate from 4% to 4,25%. This led to a consequential increase for marginal lending and for the deposits. However, this stance disproved its relevance since other major effects as lack of liquidity, the deterioration of a market and the fall of commodity prices made Governing Council reconsider. This led to a continual drop in interest rates as the perspectives of moderate inflation enabled to provide policy easing. In addition, the later part of 2008 signified a temporary shift from a general monetary policy framework to tackle intensifying market clutter with expanding the range of potential collateral to expand resources for liquidity. In addition, main refinancing operations were decided to be processed at a fixed rate. During late 2008 and the beginning of 2009 the interest rates faced a sudden drop as the liquidity requirements have risen. Interest rates quickly dropped to the 1% mark and remained there for almost two years facing further consequences of crisis.



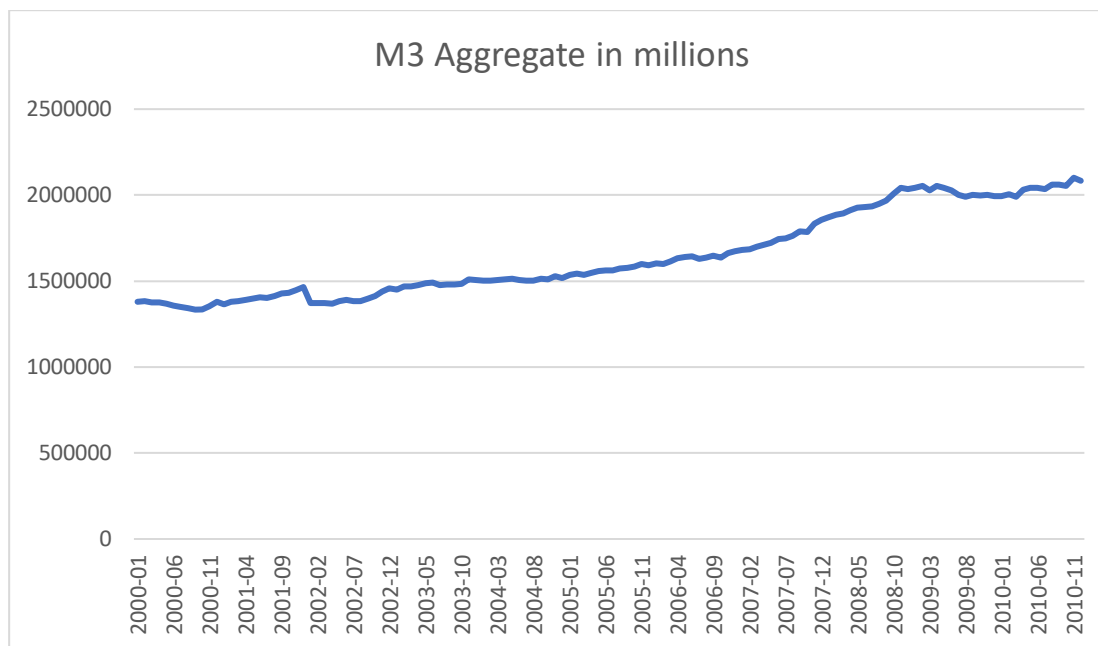
Graph 2.1 Made by author based on data from [13]

The credit institutions of the euro area are also required to maintain minimum reserves on their current accounts at the Eurosystem, which are currently set at 1% of deposits and debt securities with maturities up to two years, in order to stabilize money market interest rates and maintain a "structural" liquidity shortage in the banks, strengthening the ECB's ability to control rates with open market operations. However, until 2012, these standards were set at 2%.

Since October 2008, MROs and LTROs have been made available on a whole allocation and fixed rate basis, in order to ensure that any liquidity demand is met at an appropriate price until enough collateral has become available. In May 2009, the limit maturity of LTROs was increased from 6 to 12 months. The ECB also launched its first covered bond purchase program through this scheme, purchasing approximately 60 billion euro of securities with a view to reviving the market that serves as an important source of funding for European banks and is now being depleted in both liquidity and issuance. During the crisis, the ECB provided banks in the euro area with a great deal of liquidity. For example, in December 2008, the ECB provided financial support to banks with about 348 billion euro (\$416 billions of funding under a LTRO that lasted for 12 months. In June 2009, the ECB provided banks with over EUR 442 billion in funding as part of a six-month long-term refinancing operation. These measures have enabled banks

to improve their ability to deal with liquidity problems and ensure that they are able to meet the funding needs of individuals and companies.

Another important step taken by the ECB during the crisis has been its intervention on the government bond market to increase prices for eurozone bonds issued in 2009.[5] To this end, the securities markets program. SMP was used and it entailed purchases of government bonds in secondary markets. The SMP will start in May 2010 and last for up to September 2012.[6]



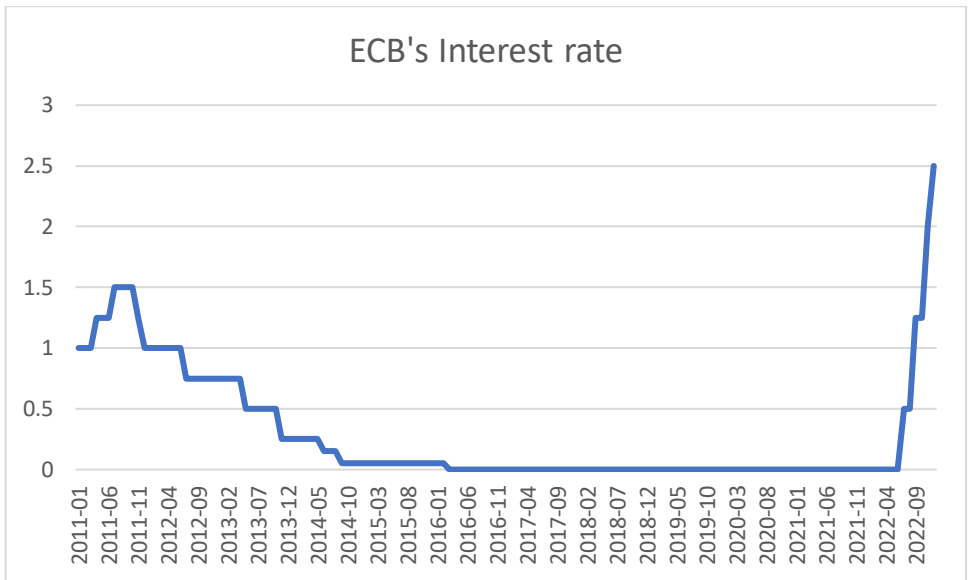
Graph 2.2 Made by author based on data from [42]

The ECB has set out several measures to reduce tensions on the money markets. To this end, the main refinancing operations have been switched for a period into fixed auction rates with complete eligibility and thereafter to long term refinancing operations as well.

The greatest threat to financial stability would come from an extended period of stagnation in the major economies. Because of weak growth and a sharp rise in joblessness, the process for reforming the finance sector that has begun may prove to have fallen through due to rising loan losses across both industry and real estate markets. This cyclical pattern is not only common, but also an indication of recessions linked to the financial crisis.

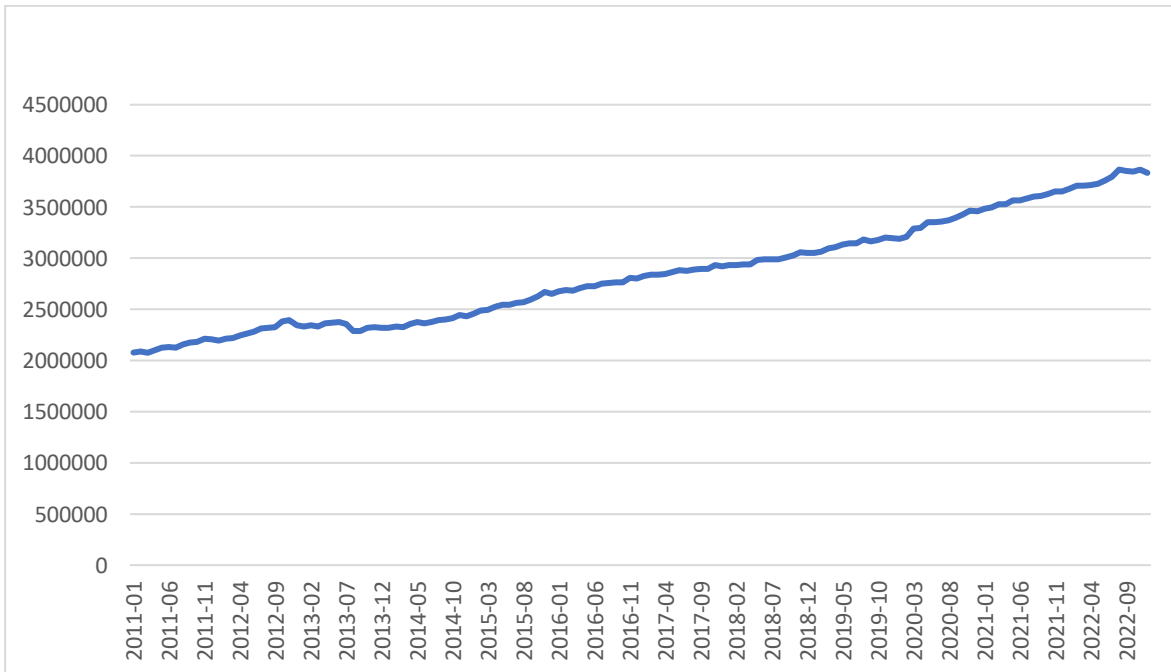
2020 crisis

The crisis of Covid-19 was a completely unexpected shock which targeted the whole world and caused general restructuring of economies. One of the main factors for the occurrence of these changes was a social distancing principle which has been adopted by a huge array of countries. This principal led to closure of mostly all organization which required physical presence. This regards schools, restaurants, manufacturing, etc.[2] The active phase of this crisis would last for almost 2 years starting from March 2020. It caused a lot of small businesses to shut down, people would lose their jobs and a lot of people would start working from their homes. The biggest problem considering businesses was the failure of major supply chains which would drastically plunge global manufacturing output. In addition to this the level of GDP for the whole world significantly dropped by almost 7% in 2020.[3] OECD countries have felt the shock as a result of a rough supply and demand shock. This crisis is of completely different nature from the 2008 crisis as it had evident social impact rather than only on the financial system. Government were desperately giving out money to people who lost their jobs due to covid and supporting small businesses which suffered due to the lack of demand caused by major lockdowns. These factors have led central banks to implement unconventional monetary policy. Before Covid-19 crisis a lot of advanced economies were facing disinflation which made low inflation possible. A lot of these economies had their interest rates close to zero and some would even implement negative interest rates and therefore implement tools of unconventional monetary policy. These changes were caused by the so-called natural interest rates.[2] This theory implies that the nominal interest rate minus expected inflation has to follow the natural interest rate which is the rate consistent with the level of the economy's output and a stable inflation which has to keep inflation at an appropriate level



Graph 2.3 Made by author based on data from [13]

This is a part of the reason why ECB’s interest rates remained so low for such a long time. So the eruption of Covid-19 crisis has paved the way for the development of new monetary policy. The main challenges facing this crisis were market stabilization, steady credit supply, keeping inflation intact.



Graph 2.4 Made by author based on data from [42]

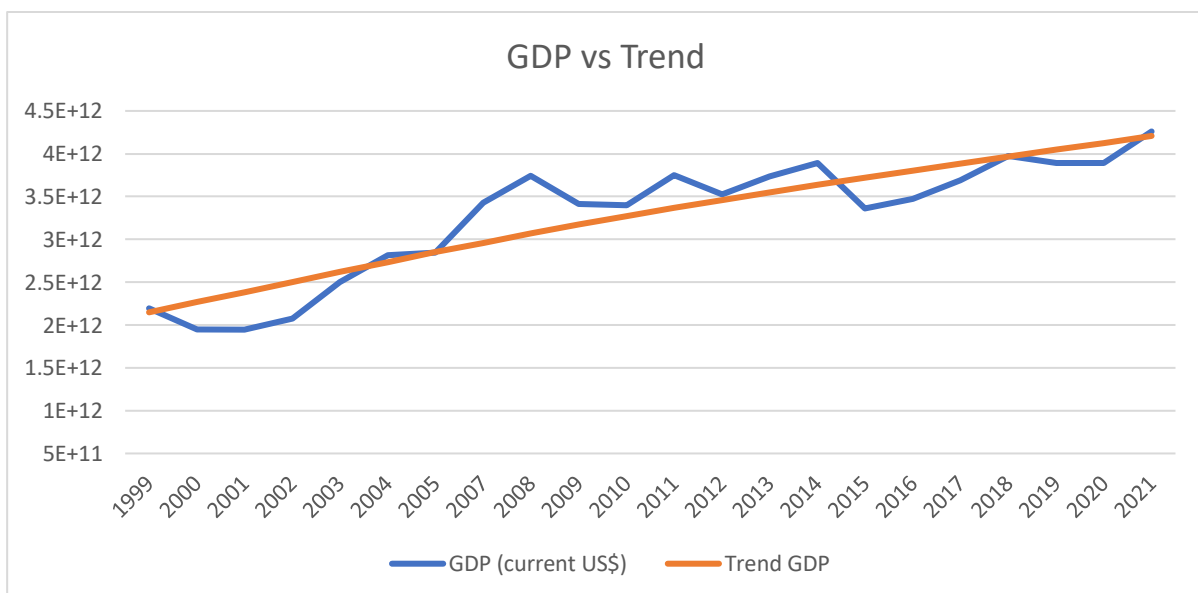
As the risks of Covid crisis were evident the ECB took a powerful stance on monetary policy by focusing on unconventional tools APP(Asset Purchase Program) and PEPP(Pandemic Emergency Purchase Program) while using conventional tools as LTRO, TLTRO and others with an objective to provide the liquidity for the banks to keep lending

and to evoke monetary policy transmission effects. This way, the ECB wanted to promote lending to the groups of people who were most negatively impacted by the expansion of COVID-19, especially small and medium-sized businesses and independent contractors who depend more on bank credit since they had a harder time obtaining market-based financing. The majority of this liquidity appears to be being used by banks to provide loans to the actual economy. This was shown in the euro area Bank Lending Survey (BLS) of April 2020, where 74% of the banks surveyed said they anticipated using the TLTRO III's liquidity to extend loans to individuals and businesses over the following six months. The ECB unveiled the PEPP during the special Governing Council meeting on March 18. Under this temporary programme, the same classes of assets from the public and private sectors will be bought as under the APP. The PEPP differs significantly from the APP in that acquisitions will be made in a flexible way and variations in their distribution over time, throughout jurisdictions, and across asset classes will be permitted. The PEPP was created with a dual use in mind, as I have explained in past contributions. To start, asset purchases were, along with the ECB's other monetary policy tools, the most crucial method for providing the extra monetary accommodation needed to assist the recovery of the economy and maintain price stability over the medium term. Second, the PEPP's flexibility across time, asset classes, and jurisdictions was vital to the ECB's ability to effectively and efficiently stabilize financial markets. According to the pandemic-related forward guidance for PEPP, net PEPP purchases would continue until the Governing Council determined that the coronavirus crisis period had passed. The reinvestment horizon for this type of purchases will be revised in the end 2024.[16] The ECB announced PEPP which included commercial and public sector securities and an initial "envelope" of €750 billion. On June 4 and December 10, 2020, respectively, this amount was increased to €1,350 billion and subsequently €1,850 billion. Additionally, the ECB decided to launch a new series of fixed-rate full-allotment, non targeted PELTROs at its monetary policy meeting on April 30, 2020, in order to maintain stable money market conditions during the pandemic period by acting as a reliable source of liquidity. The PEPP will bring the portfolio of the Eurosystem's securities purchase programmes to around €4.4 trillion in June 2021, along with the further acquisitions made under the

APP.[1] The PEPP announcement significantly lowered financial stress levels in the euro area. Following the launch of the PEPP, sovereign debt yields sharply decreased. The ACC frameworks' usage of appropriate credit evaluation systems now encompass a wider range of methods. Due to the governmental guarantee programmes put in place in response to the epidemic, loans to businesses and the self-employed that benefited from them became eligible for collateral. Third, the Governing Council agreed that as long as their rating did not drop below a specific level (BB), all investment grade (BBB- or better) marketable assets that were acceptable as collateral on 7 April would continue to be so. The latter action sought to lessen the impact that any rating downgrades brought on by this crisis may have on collateral volumes.[3]

Chapter 3 Results

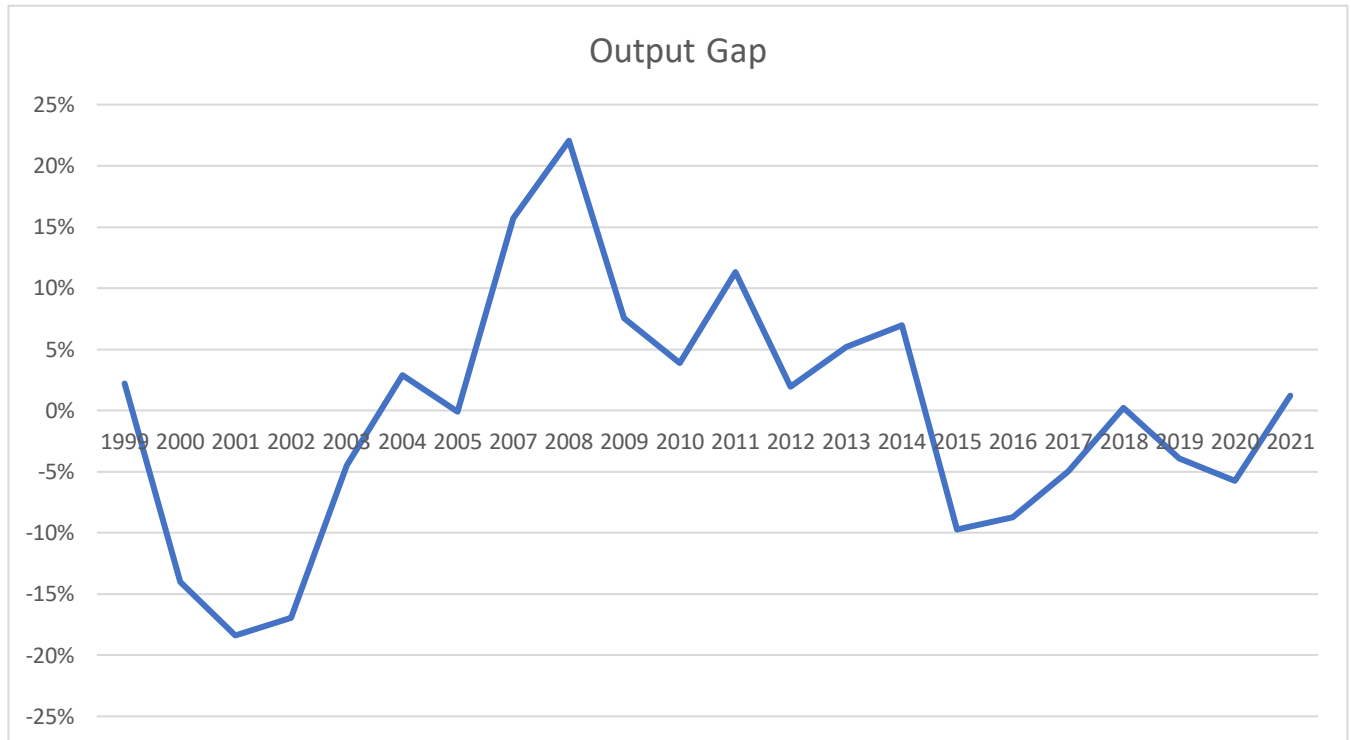
For evaluation of the effectiveness of monetary policy I have chosen to focus on the interest rate as one of the tools for affecting inflation. As discussed above keeping inflation close to 2 percent is the major goal for whole. ECB framework as it provides a stable environment for investment activities and maintains the price stability necessary. So as the first part of the analysis I simulate alternative interest rate according to the Taylor's rule framework to give another perspective to possible interest rates. The reason I chose this instrument is because it is already a theoretical pillar for monetary analysis of central banks around the world as it provides guidance for the country during relatively stable times. It is important to note that this theory is just another perspective rather than a rule which has to be religiously obeyed. I have used a basic formula for Taylor's rule which already includes the inflation target of 2%. It includes inflation rate and output gap and looks like this $r = p + 0.5y + 0.5(p - 2) + 2$. As a first part of using Taylor's rule I use a Hodrick-Prescott filter to create a trend for GDP to find the output gap.



Graph 3.1 Made by author based on data from [42,13]

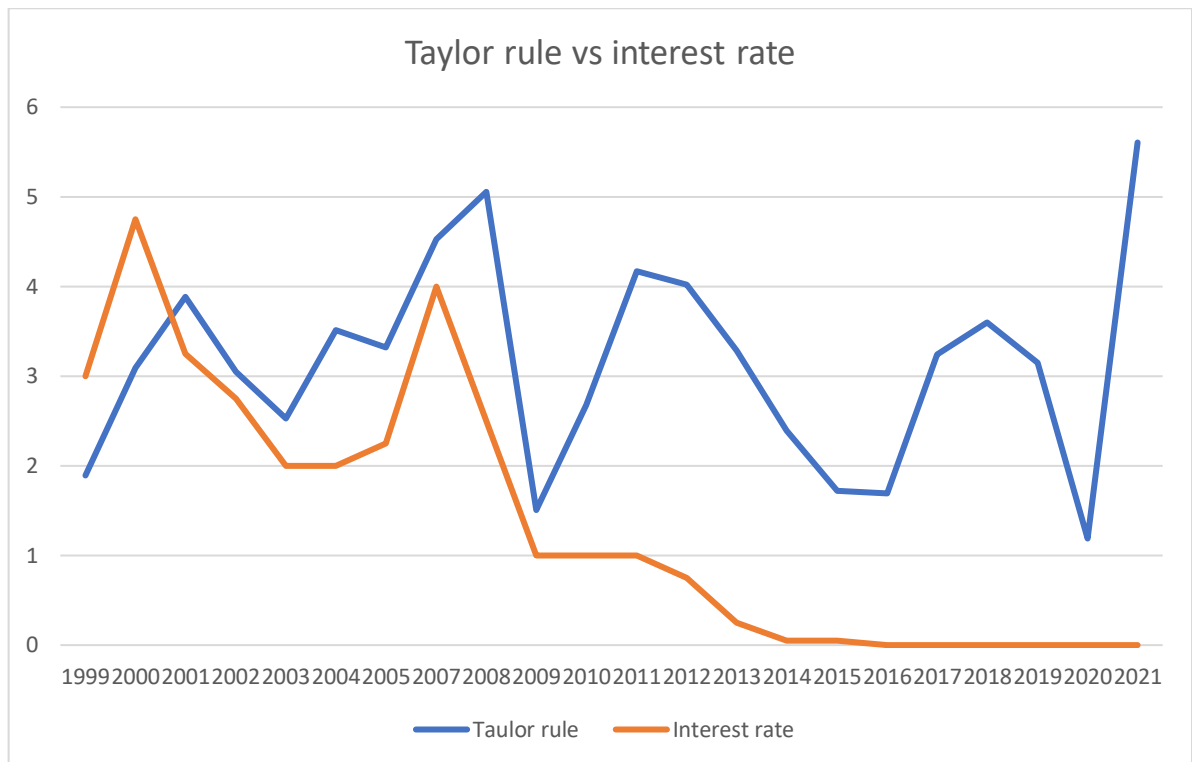
We can see that the ascending trend which says about the steady growth of German economy. Looking at the output gap we can say that major dispositions were happening leading up to the crisis of 2008 and during the next 2 years of Global crisis. Even though the indexes might seem scattered Germany shows steady growth and recovery.

Having all the necessary information for the Taylor's Rule projection we can see that the



Graph 3.2 Made by author based on data from [13,42]

interest rates are completely different from the 2008. Leading up to the Global crisis real interest rates somewhat reflected interest rates proposed by the Taylor's rule. They are not completely the same, however the trend of simulation is definitely evident. While after the Global crisis the Taylor's rule interest rates and real interest rates. The ECB's framework was fighting deflationary pressures discussed above which have led to plunging interest rates down and keeping them low up until 2022. The interest rates proposed by the Taylor's rule are more of a tightening nature which would be associated with fighting the expansionary policies during crisis.



Graph 3.3 Made by author based on data from [13,42]

For further analysis I create a linear regression model for determining inflation. For external factors I use M3 aggregate as a factor which reflects market operations. The second factor is interest rate which is an undisputed determinant for inflation. The third factor is GDP level which is a part $MV=PQ$ model and an implied factor for impacting inflation. This model explains 90% of inflation which is a pretty significant character. The result is the regression equation in which I can plug in interest rates from the Taylor's rule to see whether the ECB was more effective in implementing their interest rates and walking away from Taylor's rule guidance.

Equation: UNTITLED Workfile: E-VIEWS DATASET::Untitled\									
View	Proc	Object	Print	Name	Freeze	Estimate	Forecast	Stats	Resids
Dependent Variable: CPI									
Method: Least Squares									
Date: 05/23/23 Time: 18:33									
Sample (adjusted): 1 91									
Included observations: 91 after adjustments									
Variable	Coefficient	Std. Error	t-Statistic	Prob.					
C	-83.01845	6.416206	-12.93887	0.0000					
GDP_ADJUSTED	0.000278	9.75E-06	28.54626	0.0000					
M3_PERCENT	-62.29793	36.54972	-1.704471	0.0919					
DIFFERENCE_INTEREST_RATE	-1.980960	1.667325	-1.188106	0.2380					
R-squared	0.907620	Mean dependent var	101.1174						
Adjusted R-squared	0.904435	S.D. dependent var	15.81525						
S.E. of regression	4.889070	Akaike info criterion	6.054842						
Sum squared resid	2079.562	Schwarz criterion	6.165210						
Log likelihood	-271.4953	Hannan-Quinn criter.	6.099369						
F-statistic	284.9214	Durbin-Watson stat	0.611660						
Prob(F-statistic)	0.000000								

Regarding the model we can say that all of the factors are pretty significant. Even though that some factors are exceeding the necessary value of 0,05 we cannot deny the effects of these factors on the level of inflation.

Picture 3.1 Linear regression model

Made by author based on data from [13,42]

In this case I have used difference of interest rates from the previous period expressed in nominal value, M3 growth from the previous period expressed in percent and adjusted GDP. This had been done to avoid the multicollinearity.

The screenshot shows the EViews software interface with a correlation matrix displayed. The window title is 'Group: UNTITLED Workfile: E-VIEWS DATASET::Untitled\'. The menu bar includes View, Proc, Object, Print, Name, Freeze, Sample, Sheet, Stats, and Spec. The correlation matrix is titled 'Correlation' and shows the following values:

	CPI	GDP_ADJU...	M3_PERCENT	DIFFERENC...
CPI	1.000000	0.950674	0.147884	0.114710
GDP_A...	0.950674	1.000000	0.205355	0.149220
M3_PE...	0.147884	0.205355	1.000000	-0.176616
DIFFE...	0.114710	0.149220	-0.176616	1.000000

Picture 3.2 Correlation matrix

Made by author based on data from [13,42]

Talking about autocorrelation it could not be omitted because of the specificity of this dataset. The matter of fact that every factor is the reflection of monetary policy stance and is predetermined by the previous values. So, in this case autocorrelation is not that important.

F-statistic	21.41051	Prob. F(4,83)	0.0000
Obs*R-squared	46.21283	Prob. Chi-Square(4)	0.0000

Picture 3.3 Autocorrelation test

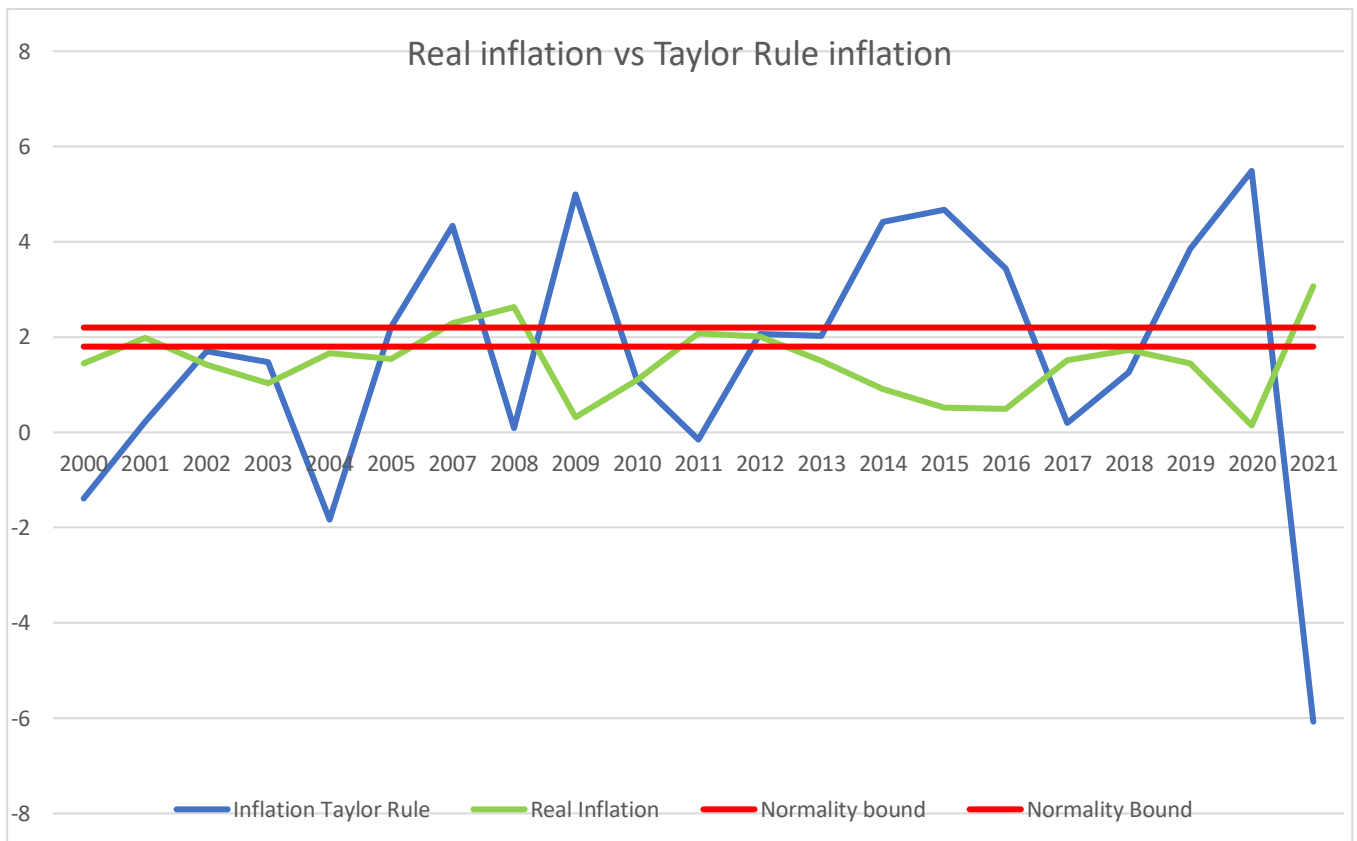
Made by author based on data from [13,42]

After taking the test for the absence of heteroscedasticity we can see that in the case of this model it is 85% has homoscedasticity which is a good evaluation for this model.

F-statistic	0.522456	Prob. F(9,81)	0.8543
Obs*R-squared	4.992776	Prob. Chi-Square(9)	0.8349
Scaled explained SS	7.493340	Prob. Chi-Square(9)	0.5859

Picture 3.4 White’s homoscedasticity test

Made by author based on data from [13,42]



Graph 3.4 Made by author based on data from [13,42]

Looking at the graph it is evident that the ECB was more successful in moving away from the guidance of Taylor rule. There are 2 aspects worth noting. First of all, the results for the Taylor’s rule are majorly scattered and fluctuate dramatically while real inflation is fluctuating less and looks more predictable. Secondly, we can definitely see that real interest rate helps to hit the target inflation multiple times across 22 years which is a good index of efficiency unlike Taylor’s rule framework.

CONCLUSIONS

After analyzing the country of Germany and how it conveys its monetary policy it is obvious to say that this country is implementing the principals of ordo-liberalism in its approach to monetary policy. It is evident how the development monetary policy theory is reflected in the actions of both Bundesbank and European Central Bank which gives the idea that they are eager to develop and rigorously weigh their decisions which is one of the pillars for ECB's monetary policy. This country has evidently demonstrated its dedication to a sustainable growth and stability of a financial system which is reflected in its target for keeping inflation under control while remaining a steady level for growth. Looking at the global crisis of 2008 and a COVID-19 they were resolute at making quick adjustments to their monetary policy frameworks along with defining main targets for containing economy at the most stable state possible. In addition, they portrayed a wide array of stimuli for the monetary policy by using their tools and implementing new regulations. Especially when it comes to COVID-19 crisis Germany along with other countries developed a set of unconventional monetary tools as quantitative easing and advanced forward guidance for further stabilization of financial system. However, we could see that the output gap for Germany's GDP fluctuated a lot even though most of the time it was above the projected GDP. It is worth noting that Germany has had success in keeping interest rates consistent with the Taylor's rule framework up until 2008 crisis. We could see that looking at the interest rates the economy of Germany and a world economy in general could not recover from this crisis since the interest rates remained on such low level. It is also worth noting that apart from 2 major crisis Euro-area faced other economical tensions in between as Brexit and a Greek buyout which have impacted the monetary policy and could not allow for any tightening. It is obvious that today's tensions and tightening are majorly a result of previous expansionary trajectory. After the analysis of interest rates, we can say that real interest rates provided by the ECB were rather successful the ones provided by Taylor's rule guidance. It is evident that throughout 22 years Germany has been able to hit its monetary target inflation multiple times by walking away from a Taylor's rule guidance.

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