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Department of Economics and Finance

Course of International Economics

How Recent Economic Shocks and Monetary Policy influenced the Euro/Dollar Exchange Rate

Prof. Cecilia Jona-Lasinio

SUPERVISOR

Federico Decataldo - ID No. 236921

CANDIDATE

Academic Year 2022/2023

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In this elaborate we will look closely at the effects of the unforeseen economic shocks since 2020 on the EUR/USD exchange rate. Through the theory of international finance, we will see how interest rates administration and the monetary policy to contrast inflationary trends in 2022 and 2023 will ultimately change the currency pair.

The study starts with an in-depth analysis on the nature of inflation and understanding dynamics of price spikes caused by the COVID-19 pandemic and the Russo-Ukrainian war.

Building on this groundwork, the thesis proceeds to highlight the economic theories that will give a first answer to the research question, including the Fisher Effect, Purchasing Power Parity, and market models. These theoretical assumptions are examined and applied in the context of the observed inflationary trends to seek for an empirical correlation.

As we advance to the last part of the elaborate, a comparative analysis on the monetary policy of the European Central Bank and the Federal Reserve and the corresponding economic response will show possible projections of the exchange rate at issue.

Chapter 1

The year 2023 has emerged as a pivotal moment for the global economy that is navigating through many challenging events over the past years. As we delve into the difficulties of this economic landscape, a central theme emerges: the increase of inflation. The European and American Central Banks' monetary policies aimed to contrast the constant rose of inflation that did burst above target. The initial chapter of this thesis explores the essentials needed to comprehend inflation – its causes, characteristics, and forms.

The first part will be assigned to the core principles and theories behind inflation. This approach ensures that the following analysis of price dynamics will not only inform but also

unfold. Thus, this chapter serves as the key to our elaborate exploration, setting the stage to understand how exogenous shocks of the last years will affect the central banks' monetary policy and the Euro/Dollar exchange rate.

1.1 Inflation: Literature Introduction

Inflation has long been a contested topic of study and debate among economists. The Quantity Theory of Money (QTM) is a fundamental economic theory that links the money supply in an economy to the level of prices and the rate of inflation. An increase in the amount of currency or liquid assets in circulation directly and proportionally increase inflation. Thus, inflation can potentially be controlled as it is related to only one variable, the money supply, but the effects will not show in the shorter terms. However, such assumption is arguable and have been challenged over time. Central to this discourse are the Keynesian and Monetarist schools of thought, each offering distinct opinions regarding the causes, consequences, and controls of inflation but concurred on the inequitable nature of it.

1.1.1 Keynesian Theory

A first and new extension of the economic theory came from John Maynard Keynes that did accept QTM over the long run but believes that changes in money supply do not affect prices in the short or medium run. From the Keynesian point of view inflation is rather caused by demand pressures and that money demand "liquidity preference" depends on the interest rate as well as nominal income. An excess of demand, overtaking aggregate supply, causes inflation. This may be due either to a shock that increases demand or to a shock that reduces supply. It is possible now to define the Triangle Model employed by the Keynesian

theory as a model that identifies three main sources of inflation: cost-push inflation, demand-pull inflation, and built-in inflation:

The cost-push theory attributes inflation to an increase in production costs, whether raw materials or wages, or more generally a drop in aggregate supply due to events that drastically impact economy as natural disasters, pandemics, or wars. Businesses will be facing higher prices for the same inputs and so they will raise outputs prices. Eventually workers will demand higher wages in order to preserve the same purchasing power further feeding inflation. One example of this type of inflation could arguably be the oil crisis of the 1970s led by increases in the price of petroleum imposed by OAPEC.

The demand-pull theory implies an increase of demand that greatly exceed aggregate supply in contraposition of the first one explained. One of the causes could be a boost in employment, or aggressive fiscal policies that leads to an increase in aggregate demand. In response to that, businesses in the economy in non-full-employment condition might hire more workers to increase output. In this way, more individuals are hired, general disposable income or spending increases. Eventually demand could outpaces production and supply bringing a condition that some economists describe as too much money chasing too few goods.

As mentioned before, when demand-pull and cost-push inflation are consistent, workers may start to request to better salaries. Eventually, employers that agree will face higher labour cost that is passed to the consumers in the form of higher prices, leading to a feedback loop, called price/wage spiral based on adaptive expectations. When inflation is persistent can cause people to standardise and expect it, general rise in prices becomes ‘built-in’ as it reflects past inflationary pressures.

1.1.2 Monetarist Theory

The Keynesian view was then challenged by an initially small current of thought called monetarism, led by the influential economist Milton Friedman. He insisted that "inflation is always and everywhere a monetary phenomenon" (M.F. 1963). Monetarists reinterpreted the quantity theory and believed that Monetary policy is fundamental in price stability and so it is more powerful than Fiscal policy. Contrary to the Keynesians, Monetarists believe that the role of government should be marginal and not interventionist.

Friedman contested Keynesians' view of demand excess that causes inflation if not backed up by monetary expansion. Monetarists make use of the 'crowding out' phenomenon to oppose: The government requires additional revenue to increase spending and this revenue is obtained by raising taxes or interest rates. Higher taxes can lead to reduced income and spending by individuals and businesses. Consequently, rising public spending can reduce or even remove private spending but this would not happen if money supply is increased. Monetarists also find confirmation on empirical analysis of monetary history: intervals of increase in money supply are always followed by periods of increase in price levels, direct and proportional.

1.2 Modern Inflation

Starting from this theoretical introduction it is possible to pivot towards more contemporary context. Normally today the management of monetary policy is entrusted to a central bank, an institution independent from political authority. The European Central Bank and the Federal Reserve's activity is closely linked to the monetary goals it aims to achieve and is conducted following long-term objectives and short/medium term objectives.

The central banks' primary goal is price stability and preserving purchasing power of their

currency. Inflation plays the main character here, by remaining low, stable, and predictable[1]. Most major central banks follow inflation targets over the years by changing interest rates because close-to-zero inflation is undesirable as much as unpredicted spikes in price levels. Some economists consider inflation targeting a policy to create boundaries to avoid deflation, the general decrease of prices.

In a complex economy, inflation could represent a disadvantage to be avoided for some economic agents, but for others inflation could constitute significant competitive edge. In particular, inflation allows for redistribution of resources that happens between creditors (harmed by inflation) and debtors (benefited by inflation). For example, individuals retired from work or any other one living on a fixed income are affected similarly to creditors; they are harmed by inflation as it reduces purchasing power of their monetary availability, experiencing a worst quality of life over time.

On the other hand, debtors are favoured by inflation as it reduces the real value of their debt, but only if the operation has fixed interest rate; generally, in the case of flexible interest rates, debtors are negatively affected by inflation. Underlying this position there is the common view that inflation is regressive as "the welfare cost of inflation may be substantially higher for low-income individuals relative to their high income counterparts." (Erosa and Ventura, 2022)[2].

[1] European Central Bank. "Two per Cent Inflation Target." European Central Bank, 2019, www.ecb.europa.eu/mopo/strategy/pricestab/html/index.en.html.
[2] Ventura, Gustavo Jaime, and Andres Erosa. "On Inflation as a Regressive Consumption Tax." SSRN Electronic Journal, 2022, https://doi.org/10.2139/ssrn.199168.

1.2.1 Measuring inflation

Both the European Central Bank (ECB) and the Federal Reserve (Fed) in the United States employ various metrics and indices to calculate and monitor inflation rates within their respective regions.

In all European countries the Harmonised Index of Consumer Prices (HICP) (harmonised, to guarantee that the data can be compared across nations), is used to measure consumer price inflation[3]. HICP measures changes over time in the price of a group of typical consumer goods and services. The structure of the HICP has been strategically designed to ensure the universality of the overall shopping basket across countries, while also acknowledging variations in consumption patterns within the euro area. Notably, there are products that exhibit distinct popularity across different regions or nations in Europe. To accommodate these regional preferences, each product is assigned a specific "weight" in the national shopping basket, aligning with its proportional contribution to households' expenditures in the respective country.

[4]

HICP Inflation rate reached 30-years-peak in October 2022 with an Annual % change of 10.6.

[3] European Central Bank. “Measuring Inflation - HICP.” European Central Bank, 2023, www.ecb.europa.eu/stats/macroeconomic_and_sectoral/hicp/html/index.en.html.
[4] Eurostat. “Inflation in the Euro Area.” Ec.europa.eu, 2023

By breaking down the components of euro area inflation, energy has been by far the components that weighted the most, with an annual rate of 34.9% in November. Whilst moving further to 2023 Food and beverages has the highest impact with a 7.5% annual rate.

Alternatively, the Federal Reserve's main measure of prices in the U.S. is the Personal Consumption Expenditures Price Index. The PCE describes the U.S. inflation by observing changes in the cost of living for households, tracking prices of baskets of good and services, each with different weightings. To correctly capture the monthly expenditure patterns of an average household, it is crucial to consider appropriate weightings. For instance, if the cost of gasoline increases while the price of any food item decreases in a specific month, the significance lies in the weight assigned to each category. Given that gasoline constitutes a larger proportion of a family's monthly expenses, its weighting in the calculation of Personal Consumption Expenditure (PCE) is more substantial[5].

[6]

Total PCE (% change from previous year) price index shows an increase peak in June 2022 of 7.11%. Similarly to the eurozone (as usual when talking about inflation), breaking down the price index, energy and food prices have a major contribution to inflation.

[5] Curry, Benjamin, and Michael Adams. "What Is PCE? How Does It Track Inflation? – Forbes Advisor." Www.forbes.com, 30 Nov. 2020

[6] U.S. Bureau of Economic Analysis. "Personal Consumption Expenditures: Chain-Type Price Index." FRED, Federal Reserve Bank of St. Louis, 1 Jan. 1959, fred.stlouisfed.org/series/PCEPI#0.

Figure 1 and figure 2 clearly shows an economic interdependency between the two elements under consideration but further analysis of the economic scenario will follow.

1.3 Inflation on the rise: Understanding the causes

After years of stable flow of inflation in the majority of both advanced and developing economies, in 2022 the world's economy did witness the fastest inflation in a generation. The standard economic models used by official and private sector forecasters failed to anticipate the inflation coming and some argued the overreliance on such systems, contesting policymakers to utilise standard statistical instruments to predict today's very different economic environment hit by events outside of the economic models.

1.3.1 Price dynamics in Covid-19 pandemic

To better understand the causes of contemporary economic scenario it is necessary to start from the COVID-19 pandemic which resonated throughout 2020 and 2021 and reminded everyone how the global economy still needs to defend against systemic shocks. An incalculable event for economic agents and originally exogenous to the economic models; unprecedented due to its scale and expansion across the world. The COVID-19 economic crisis is different from others: all economic giants were hit all at once, the G7 nations and China. The Coronavirus outbreak led most countries to implement full or partial lockdown in order to reduce the spread of the virus. Unemployment rate in the United States increased to 8.1% of total labour force in 2020 from the 3.7% of the 2019, the phenomenon was much more pronounced than in Europe[7]. Economic activity slowed down, with

[7] The World Bank. "Unemployment, Total (% of Total Labor Force) (Modeled ILO Estimate) - United States | Data." Data.worldbank.org, data.worldbank.org/indicator/SL.UEM.TOTL.ZS?locations=US.

concurrent reduction of supply and a collapse of aggregate demand. Euro Area and United States real GDPs regressed in one of the largest contraptions of the last 70 years with a declining trend in global growth[8].

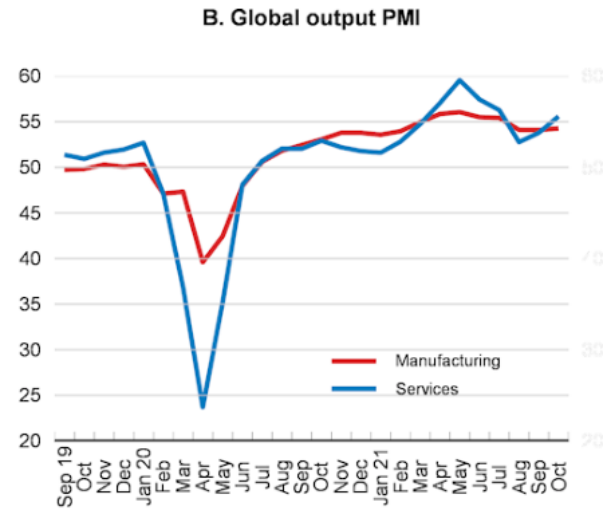
It became known that many businesses had reduced their production and their supply of goods. Entire sections of the global value chain were heavily pressured to shut down or to limit normal capacity. Because of this when the fast and strong recover arrived and a consequent spectacularly high demand - further fuelled by fiscal stimulus - many production agents where not ready to respond due to the natural rigidity of increasing volume of production and employment; higher prices was the result.

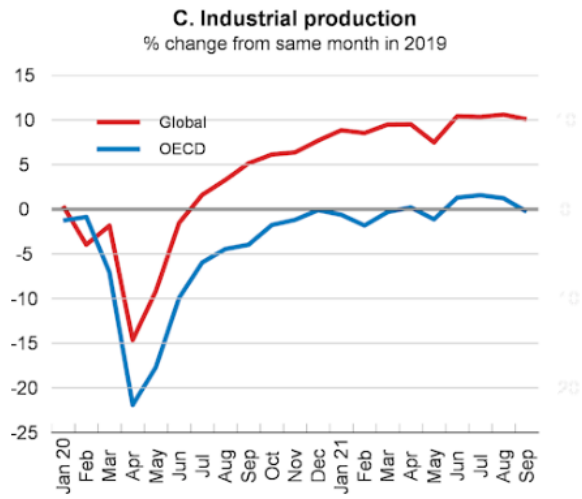
Global trade volume decreased deeply in 2020 and underlined how much modern manufacturing and goods fabrications rely on sourcing materials and commodities from foreign traders to match better prices or manage risks in GVCs[9]. The discussion about pros and cons of global supply interrelated networks tightened with some countries even proposing incentives to re-locate domestically the production process.

Global manufacture and service offering contracted sharply, but differently. In the spring of 2020, both in the US and the Euro area but recovered afterwards in the second half the year.

[8] IMF staff estimates. International Monetary Fund. "World Economic Outlook, October" 2022, April 2023, October 2023

[9] VOXeu. Localising Value Chains in the Post-COVID World Would Add to the Economic Losses and Make Domestic Economies More Vulnerable." CEPR, cepr.org/voxeu/columns/localising-value-chains-post-covid-world-would-add-economic-losses-and-make-domestic.

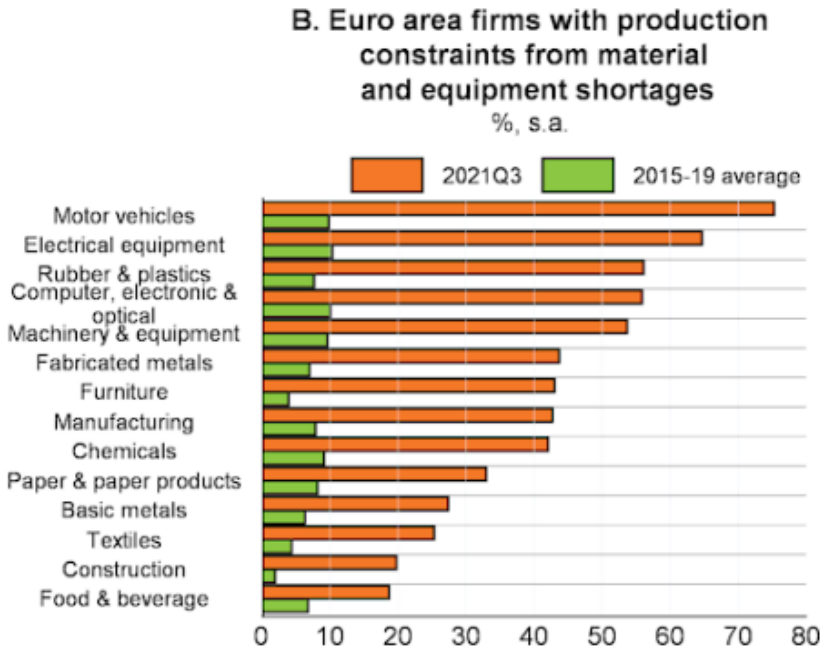




[10]

The recovery was more marked in some industries more than others highlighting an important factor for the analysis: Consumer spending on durables has surged in advanced economies. Motor vehicles markets as well as electronics devices went back to the pre-pandemic volume as of December 2020 to adapt toward a new social organization of smart working and telematic learning; they had a heavy contribution on core personal consumption expenditure (PCE) inflation in 2021. What these markets have in common is the prominent usage of semiconductors that exacerbated difficulties in supply chains and logistics of the chip production: the 2020-23 global chip shortage has been a worldwide crisis and led to major price increases.

[10] Figures 1.3 ‘The momentum of the recovery has eased’ OECD Economic Outlook, Volume 2021 Issue 2. 2021



[11]

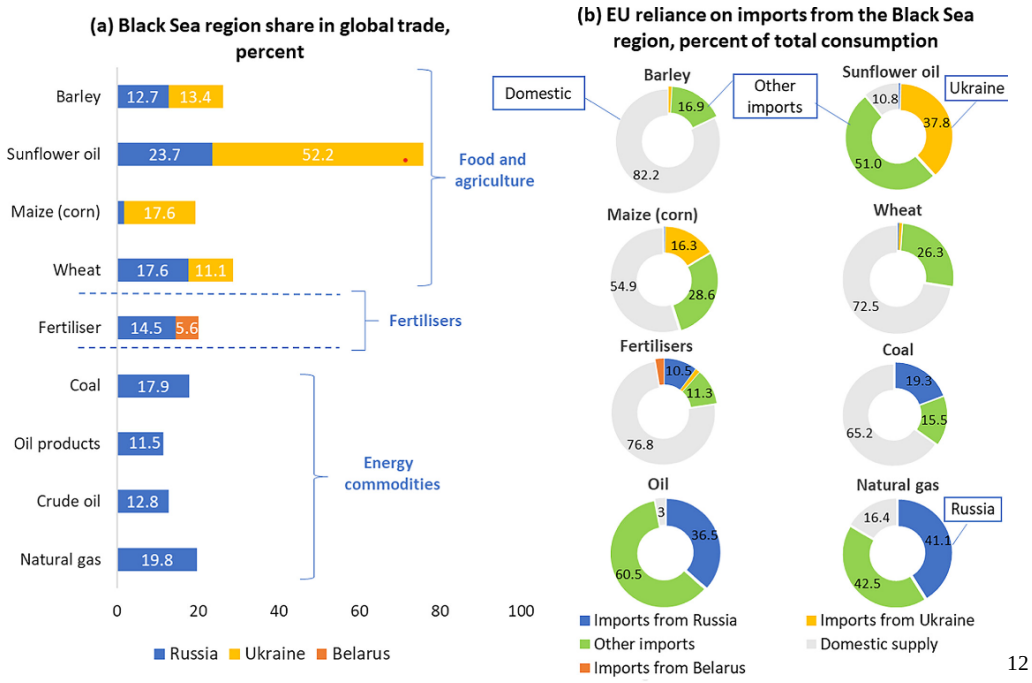
The continuous outbreaks of new variants have prolonged some supply constraints and introduced new ones, contributing to the visible loss of momentum in recent economic indicators. The ongoing global spread of the COVID-19 that year, with its shutdowns and other sanitary restrictions, has continued to fuel supply disruptions that were hindering recovery, further pressuring price levels. Many key naval ports and airports were closed or with limited activity, creating bottlenecks in global shipping and slowing down vessels traffic. Supply disruptions will not to be resolved before the second part of 2022.

1.3.2 Price dynamics in the Russo-Ukrainian War

As the pandemic was fading away, in February 2022 Russia invaded Ukraine, marking the start of a large and complex conflict. A war of this scale had not been seen on the European soil since the second World War and brought severe consequences on the

[11] Figure 1.7. Supply chain disruptions are affecting many firms and are expected to persist. OECD Economic Outlook, Volume 2021 Issue 2. 2021

European and international energy and food markets as the two actors are large commodity exporters with Russian's abundant oil reserves and Ukraine's agricultural resources. Another unpredictable and exogenous shock to the economy, disrupting global supplies of essential commodities and pushing prices. Inflationary pressures did hit firmly real incomes and spending, with a significant impact on vulnerable households. The invasion worsened geopolitical tensions globally, leading to uncertainty in financial markets.



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The severe disruption of grain and similar exports from Ukraine caused a supply-shock in the agricultural commodities market. The closure of the Azov Sea to merchant cargo ship and military clashes on Black Sea area and ports lead the way to an almost total halt of Ukrainian exports in the first half of 2022[13]. Later the same year, the European Commission

[12] Chepeliev, et al. "The War in Ukraine, Food Security and the Role for Europe." EuroChoices, vol. 22, no. 1, 1 Apr. 2023, https://doi.org/10.1111/1746-692x.12389.
[13] Caprile, Anna, et al. Russia's War on Ukraine: Impact on Global Food Security and EU Response. 2022.

took different ‘Trade facilitation’ measures to facilitate transmission and trade of Ukrainian goods to bypass war obstructions.

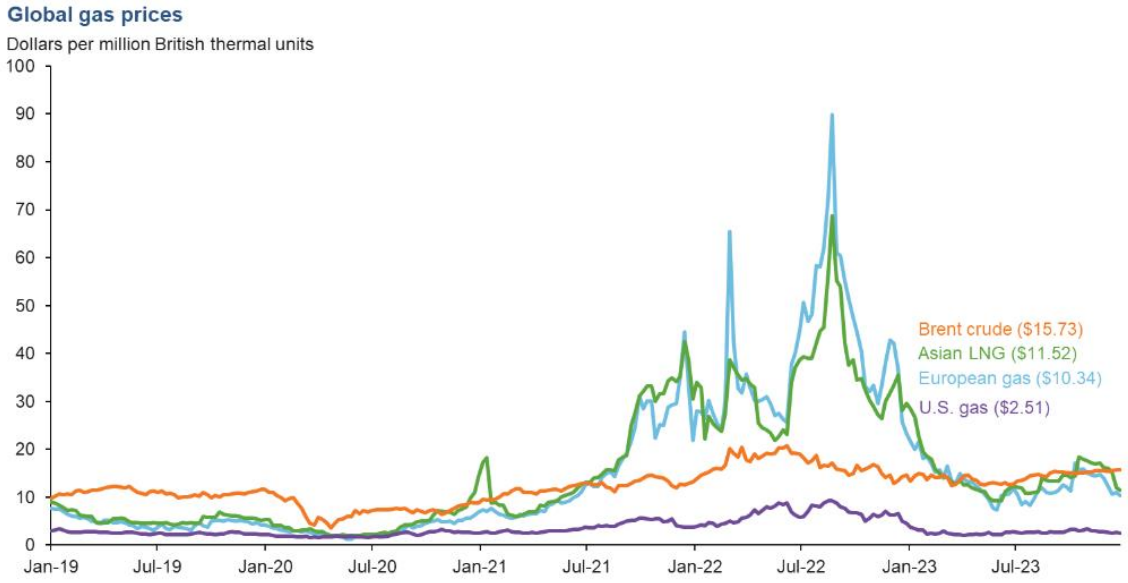
1.3.2B Western response

In response to the Russian invasion of Ukraine, most of the OECD (Organisation for Economic Co-operation and Development) countries prepared punishing sanctions against Russia that targeted financial markets and service sectors exports and transactions, as well as reducing imports from Russian fossil fuels, its primary source of foreign exchange. Western countries closed its ports and limited air traffic to Russia’s merchant fleet, prohibited all operations with the Russian Central Bank and banned several Russian and Belarusian banks to make or receive SWIFT Transactions.

A long list of goods and services were banned to export from EU to Russia and *vice versa*, it is important to cite goods as crude oil, coal and other solid fossil fuels or raw materials.

On late 2022 finance ministers of the G7 and later the European Union agreed to Cap the crude oil price to remove added value and harsh Russian revenues’ condition. The price cap was mainly on oil and products imported by sea and was set at $60/bbl for crude oil, $45/bbl for discounted petroleum products and $100/bbl for premium petroleum products.[14]

[14] “EU Sanctions against Russia Explained.” Www.consilium.europa.eu, www.consilium.europa.eu/en/policies/sanctions/restrictive-measures-against-russia-over-ukraine/sanctions-against-russia-explained/#oilban.



NOTE: LNG refers to liquefied natural gas. The European gas price is from the Dutch TTF, and the U.S. gas price is from Henry Hub. Prices are nominal.

[15]

However, restrictions were reduced or null for pharmaceuticals, medical, food and agricultural products, humanitarian aid.

While these measures alone could not be enough to stop the war, Western sanctions and limitation tried to weakens Russia's ability to finance the combat and military equipment as the Russian economy is heavily funded by oil and gas revenues.

For what we are interested in, it is crucial to understand that this scenario sets into an already complex background of economic difficulties from the pandemic. Since the start of the war, fears of interference in the supply of raw material and fossil fuels already brought a general increase in price levels firstly on these material markets, but then had a snowball effect on many other sectors for the natural relevance that fossil fuels and commodities have on our economy. The progressive reduction of import from Russia led European countries to buy Liquified Natural Gas (LNG) from spot markets feeding wholesale Gas prices in Europe, causing electricity prices to rise. In addition, coal prices reached record highs since

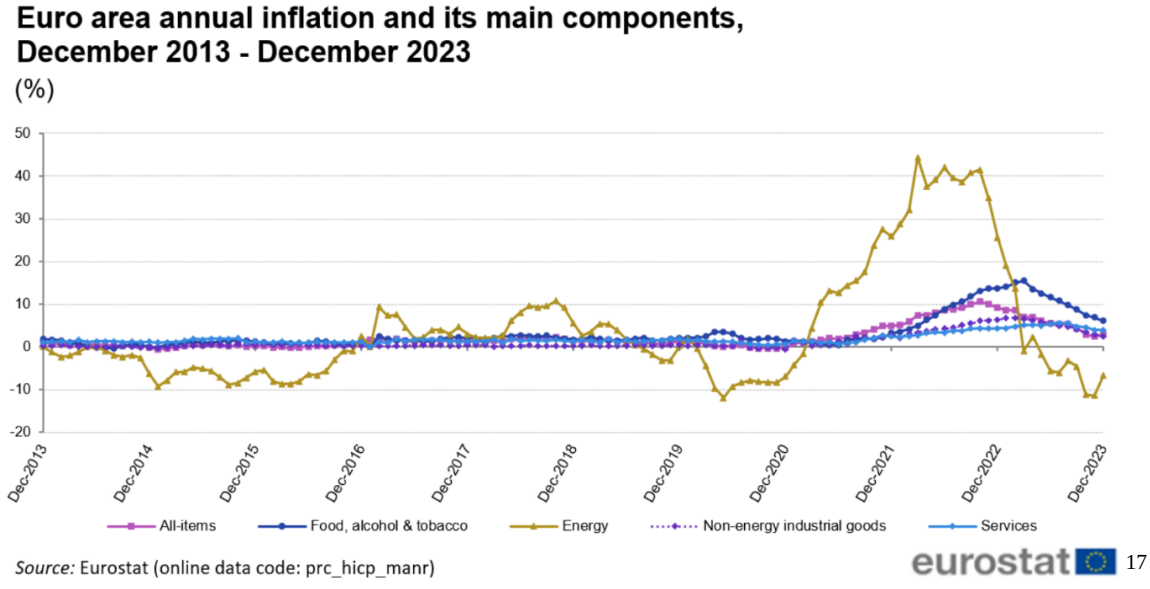
[15] "Energy Indicators, January 2024." Www.dallasfed.org, data from Bloomberg

many countries and industries switched the energy production from gas to coal or petroleum.

1.4 Breaking down inflation in EU and the US

While it seems that inflation was caused by similar factors in these two macro-regions, the analysis up to now is only partial as the underlying sources root differently across the regions. Notably, in the United States, the surge in prices can be attributed to a sharp rise in demand, while the eurozone has experienced inflation primarily due to challenges in the supply chain of some commodities or services.

By breaking down the components of euro area inflation peaks, energy has been by far the components that weighted the most, with an annual rate of 34.9% in November[16]. Whilst moving further to 2023 Food and beverages has the highest impact with a 7.5% annual rate.



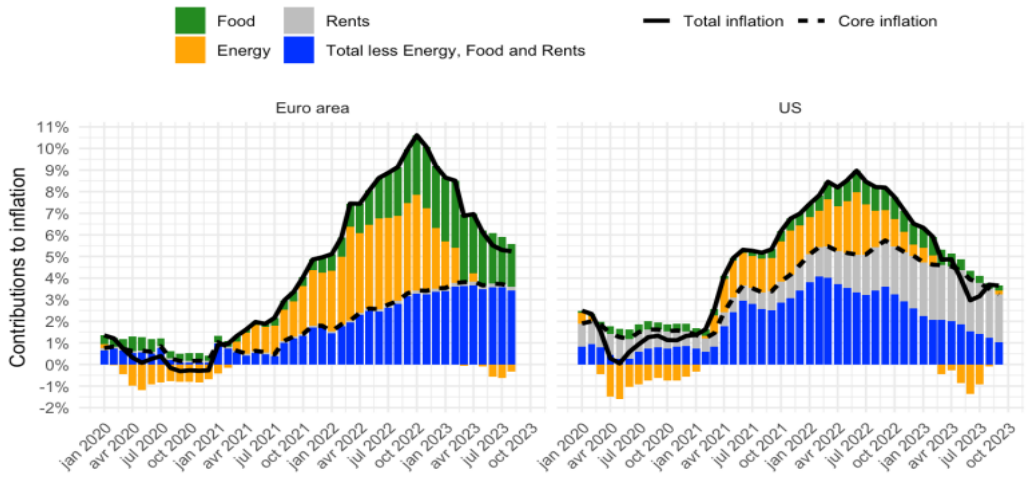
[17]

If we compare the statistics of European inflation divided by components with those from the United States, it is clear that energy had a way heavier impact on the euro area price

[16] Eurostat. Flash Estimate - December 2022 Euro Area Annual Inflation down to 9.2%. Jan. 2023
[17] Eurostat. "Inflation in the Euro Area." Ec.europa.eu

levels, at least initially. The exports of Russian commodities and energy-related materials and products are traded more in Europe than in the US and therefore their price spikes weighed more on the European consumption basket. For reference energy prices in the United States went from $1.6/MWh in the summer months of 2020 to a peak of $8.8/MWh two years later. On the other hand, the Dutch Title Transfer Facility prices showed that energy in Europe in August 2022 costed 48 times more than May 2020. It is well established that the distance between two countries (or economic regions) proportionally impacts the level of their economic relation. This gravitational model is true not only for trade relations but also extend fluctuations during recessions and crises.

Figure 3: Contributions to inflation



[18]

1.4.1 Fiscal policies and effects on inflation

The war and consequent energy prices shock, along with the economy getting back on track after the pandemic, caused inflation in the euro area to stay persistent at high levels, beyond the yearly goal of 2%. High inflation can impose serious costs on the economy and on vulnerable people. In the present environment fiscal policies are needed to support the

[18] Blot, Geerolf. Are Inflation Dynamics Different in the Euro Area and the United States? 2023. ECON committee

poorest and mitigate the shocks. Monetary policies could be hardly received by consumers in critical markets of primary importance like energy and food. Many European countries resorted to measures like energy subsidies, tax reductions, and price limits to soften the blow of recent energy price surges on people's earnings due to inflation. Such power can greatly benefit the public and defend the weakest by supporting parts of the economy. However, if not well orchestrated, such policies could create significant problems when they lead to inflation or financial and macroeconomic instability.

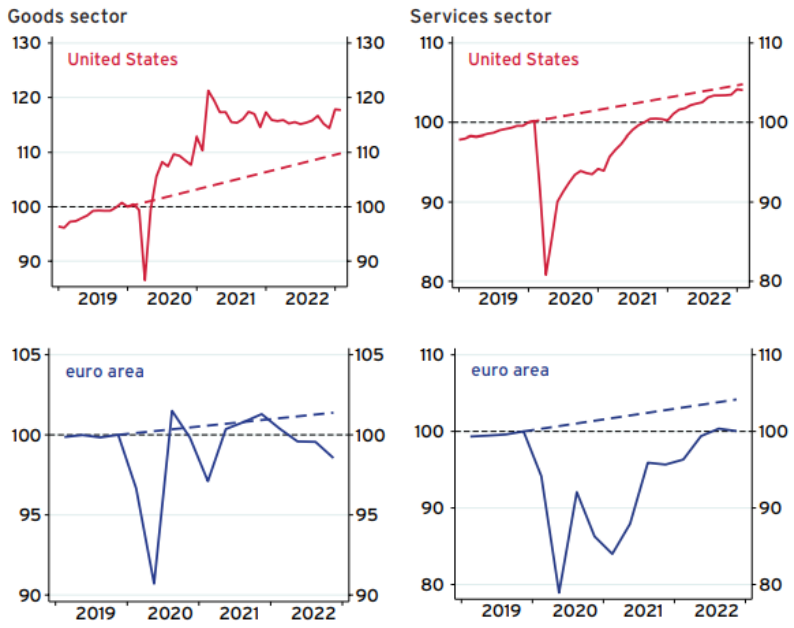
Recent policy initiatives (like the US Inflation Reduction Act and NextGenerationEU) brought a stronger-than-expected boost in investments; while higher investments promote global growth and trade, they also contribute to drive inflation upwards.

The IMF proposed a model[19] to analyse the effects on expected and realized inflation of mentioned energy subsidies in Europe: fiscal relief measures implemented had the effect of lowering eurozone inflation by 0.9 percentage points in 2022. This trend continued into 2023, with a reduction of another half percentage point in inflation. Even though these measures help to add pressures on demand, the effects on core inflation are counterbalanced by the alleviation of supply-chain costs.

On the other hand, Fiscal policy in the United States was adopted more aggressively reflecting a national deficit extended up to -10% of GDP in 2020, the largest fiscal expansion since the New Deal[20]. The difference of public deficit management with the euro area could explain why in Europe the aggregate demand remained stably below pre-pandemic levels in the second half of 2022 while the in US it recovered sharply. The rapid resurgence of

[19] IMF. "World Economic Outlook, October 2023: Navigating Global Divergences." IMF, Oct. 2023, www.imf.org/en/Publications/WEO/Issues/2023/10/10/world-economic-outlook-october-2023.
[20] Federal Reserve Bank of St. Louis, and U.S. Office of Management and Budget. "Federal Surplus or Deficit [-] as Percent of Gross Domestic Product." FRED, Federal Reserve Bank of St. Louis, 1 Jan. 1929, fred.stlouisfed.org/series/FYFSGDA188S.

American demand occurred in a period in which the global supply was obstructed by new pandemic waves of COVID variants. This imbalance led to bottlenecks within international value chains, resulting in a widespread increase in the prices of goods. One possible scenario was heatedly discussed for the short term, and it is that expansionary fiscal policy in the US, if unchanged (unlikely to happen for political reasons and given the elections on the horizon), could keep the inflationary pressures up and forcing monetary policy to be restrictive.



Source: US Bureau of Economic Analysis and estimates based on Eurostat.
Note: dashed lines show pre-pandemic trends.

[21]

[21] Visco, Ignazio, Bank of Italy. Monetary Policy and the Return of Inflation. CEPR publication April 2023

Chapter 2

The global economic setting described needs to be addressed. Inflation spikes far from targets could have severe consequences on the public. Central banks use monetary policy to manage economic challenges and achieve their primary goal of price stability, turning down inflation to its target, generally by steering interest rates.

What is the relationship between the monetary policy in Europe and in the United States and their currencies exchange rate?

The key theorems and models on which our analysis will develop are going to be described in this section[22].

After having introduced the present economic scenario and the foundational understanding of inflation and its multifaceted causes, we need a crucial link that is the practical framework of international finance[23]. These concepts offer a lens for viewing the impact of inflation on international financial relations through monetary policy and provide the theoretical stage essential for understanding currency valuation and exchange rate movements.

2.1 Foreign Exchange Market

The set of markets where it is possible to buy, sell or convert currencies is called foreign exchange market, also known as forex or FX. The market is over-the-counter (trades occur between the two parts directly) with many types of participants and is the largest and the

[22] Krugman, Paul R, et al. International Economics : Theory and Policy. 11th ed., Upper Saddle River, Pearson, 2018.
[23] Krugman, Paul R, et al. International Economics : Theory and Policy. 11th ed., Upper Saddle River, Pearson, 2018.

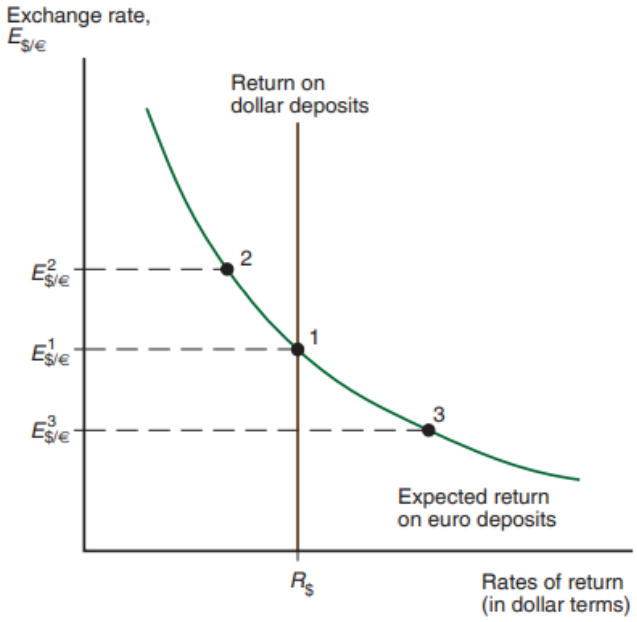
most liquid market by a large amount. The primary function is to facilitate the exchange of currencies pairs (one bought, one sold) and it plays a critical role in the global economy.

The demand of one currency deposit is influenced by the rate of return on that currency deposit: the rate of return is the percentage change in value that asset will have in a period of time; it takes the name 'real rate of return' if inflation adjusted. To compare rate of returns of two different currencies it is opportune to consider not only the interest rate but also the expected rate of appreciation or depreciation between the two. The foreign exchange market model we introduce finds its equilibrium when deposits of one currency offer the same return of the counterpart. This equality is called interest parity and implies that arbitrage is not possible as two assumptions happens: capital mobility as trading occur on a daily basis and perfect substitutability regardless of the currency denomination, then with similarities in riskiness and liquidity.

If we take as example the Euro and the US Dollar, the interest parity equilibrium says:

$$R_{\$} = R_{€} + \frac{E^{e}_{\frac{\$}{€}} - E_{\frac{\$}{€}}}{E_{\frac{\$}{€}}}$$

In the environment we described before, if such equation did not hold then the market will adjust until equality is achieved again as all investors will prefer the currency deposit with better return and disdain the other, driving demand and prices of currency. This will continue to happen up to the equilibrium.



[24]

The graph above is a visual representation of the equilibrium of the foreign exchange market at point 1 using dollar as the base currency. When dollar interest rate $R_\$$ (the vertical line), the euro interest rate $R_€$ and the expected USD/EUR exchange rate $E^e_{\frac{\$}{€}}$ are all given, the relation between the return on euro deposits (in $ terms) and the exchange rate is expressed by the downward sloping green curve as the value of the first depends on the value of currency pair.

2.2 Law of One Price

As we transition towards addressing the research question it is necessary to start from the Law of One Price, an economic concept stating that identical goods will have same price in different frictionless competitive markets where there are no transaction costs, transportation costs, or other barriers, in terms of a same currency. By taking as example a

[24] Krugman, Paul R, et al. International Economics : Theory and Policy. 11th ed. Figure14-4, Upper Saddle River, Pearson, 2018.

good X sold at price $P_€$ in the Euro zone and at price $P_\$$ in the United States and an Exchange Rate $E_{\frac{\$}{€}}$ we can state that:

$$P_\$ = E_{\frac{\$}{€}} \times P_€$$

If the equation would not subsist, customers would buy good X only at the lowest price, eventual entrepreneurs would buy the same to resell at the more expensive market to profit, an arbitrage opportunity would be created. Cheapest seller would tend to increase prices due to strong demand and the most expensive will decrease prices for the opposite. Prices would adjust until the Law of One Price equality is achieved.

2.3 Purchasing Power Parity

Since the Law of One Price needs conditions that are difficult to find in empirical analysis, the Purchasing Power Parity (PPP) was defined, according to which it is not prices of goods in individual locations that change but the exchange rate itself. Basically, it is an application of the Law of One Price but for all good and services, or a selected characteristic basket, due to the fact that focusing the calculations on a single item or product might result in significant empirical inaccuracy:

$$E_{\frac{\$}{€}} = \frac{P_\$}{P_€}$$

where $P_\$$ is the price of certain basket in US and $P_€$ is the price of the same basket in EU. For example, if the price level in the United States is 200$ and the same basket price level in the euro area is 400€, PPP implies that the $/€ exchange rate is 200$/400€ = 1$=2€, so people in both locations have the same purchasing power with their currencies with the right

exchange rate, 2€ buy the same amount of goods as 1$. The determination of the PPP exchange rate heavily relies on the chosen group of items. As the assumptions for the law of one price need to hold, items selected are required to be easily traded and readily available in the locations at issue.

The PPP exchange rate will not align completely with the market exchange rate, as the second is more susceptible to volatility due to demand fluctuations at each location, foreign exchange market exchange rates are the most appropriate choice when financial flows are involved. Because PPP exchange rates tend to be stickier and are not affected by tariffs, they are used for certain international comparisons, countries' GDPs for example could be weighed on PPP.

Purchasing Power Parity comes in two forms, the one discussed before is Absolute PPP; the Relative PPP is a dynamic version of the first and predicts that changes in exchange rates will are related with changes in prices over time, for example when inflation is relatively higher for domestic country than in the foreign one, then there will be an increase in the exchange rate and therefore domestic currency depreciate:

$$\frac{\left(E_{\frac{\$}{€},t} - E_{\frac{\$}{€},t-1}\right)}{E_{\frac{\$}{€},t-1}} = \pi_{US,t} - \pi_{EU,t}$$

where $E_{\frac{\$}{€}}$ is US$/EUR exchange rate and π_t is the inflation rate from period t-1 to t.

The introduction of the Purchasing Power Parity theory marked a pivotal shift, orienting exchange rate analysis towards the differences in purchasing power between two currencies The debate on the empirical relevance of the relative PPP and the consequent relationship between price levels and the exchange rates that it describes is still open today. Many

different indexes were introduced in order to rationalize differences in prices of similar good across countries, like the Big Mac index. Most of the studies does not support appropriate empirical evidence of PPP, usually highlighting that the irrational assumptions, such as zero trade barriers and transaction costs, taxes, tariffs, can not be avoided even with the most appropriate data selection.

2.4 Fisher Effect

One important economic theory we encounter is the Fisher Effect, named after Irving Fisher, the economist that first observed and explained the essential relation between interest rates and the inflation rate.

This relationship or equality is true in the context of a constantly growing money supply as in the case of the Fed[25] and the Ecb[26] that have consistently adopted expansionary monetary policies until 2022 and if the individuals expect relative PPP to hold. It is necessary to specify that the real and nominal interest rate differs: the nominal interest rate refers to the amount of currency that grows for the lender while the real interest rate is considered to be inflation-adjusted and so retains the same purchasing power. The Fisher hypothesis derives from the interest parity condition explained before and proposes that the real interest rate has no correlation with the monetary growth and therefore the nominal interest rate will adjust only based on expected inflation rate:

$$R_{\$} - R_{€} = \frac{E^{e}_{\frac{\$}{€}} - E_{\frac{\$}{€}}}{E_{\frac{\$}{€}}} = \pi^{e}_{US} - \pi^{e}_{EU} \quad \rightarrow \quad R_{\$} - R_{€} = \pi^{e}_{US} - \pi^{e}_{EU}$$

[25] "Monetary Aggregates and Their Components: M3 for the United States." FRED, Federal Reserve Bank of St. Louis, fred.stlouisfed.org/series/MABMM301USM189S.
[26] "Monetary Aggregates | ECB Data Portal." Data.ecb.europa.eu, data.ecb.europa.eu/publications/money-credit-and-banking/3031796.

This equation now tells us that the relative rate of return offered by one currency, will equal the relative rate of inflation. To hold the equation in equilibrium we can say that changes in expected inflation will rise one-to-one alongside the nominal interest rate leaving the real interest unchanged.

The Fisher neutrality hypothesis has been evaluated for different economic periods and different currencies, but the results reached divergent opinions; the Fisher effect seems to find strong empirical correlations only in periods when interest rates and inflation both show linear progressions (Mishkin 1992)[27].

2.5 Short-run and Long-run effects

With the correct foundational introduction of essential theory assumptions, we can now delve on understanding the effects of monetary policies to contrast inflation.

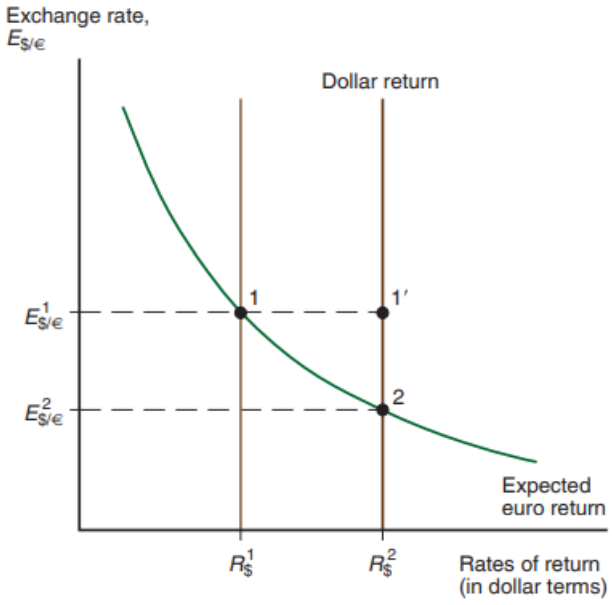
Central banks can employ several tool and strategies to counteract inflation, the most common approach of modern economics is to steer interest rates. When increasing interest rates, central banks aim to reduce liquidity in the economy thereby discouraging spending and borrowing as they become more costly. The general effect of such monetary policy is to slowdown the economic activity on multiple levels and reduce demand pressures to help curb inflation.

At this point it is possible to make distinction between short-run and long-run effects of an increase in interest rates as it is indispensable for our analysis. In the shorter terms, prices do not have enough time to adjust to market conditions and are rigid, sticky. For example, the foreign exchange market model examined heretofore had crucial assumptions that described

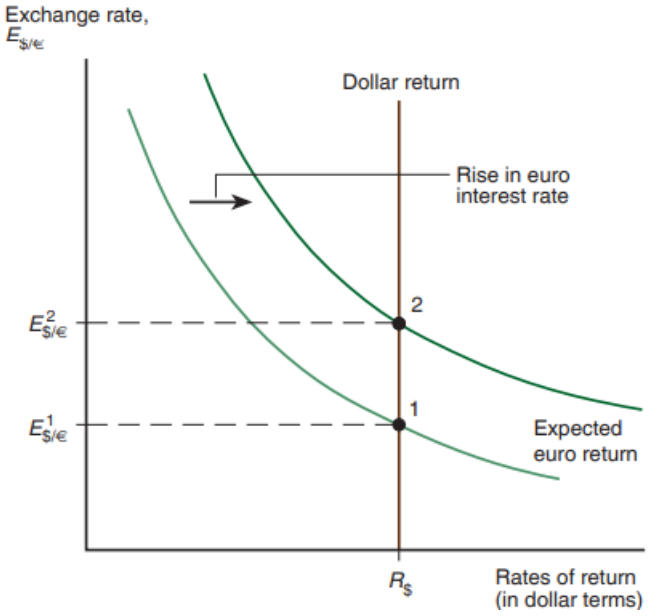
[27] Mishkin, Frederic S. "Is the Fisher Effect for Real?" Journal of Monetary Economics, vol. 30, no. 2, Nov. 1992, pp. 195–215, https://doi.org/10.1016/0304-3932(92)90060-f.

it as a short-run model with price stickiness where currency prices do note change on a daily basis, unlike what happens in real markets; it follows that inflation is null and nominal rate of return equals real rate of return.

In this scenario, we can see how fundamental monetary policy affects the model of foreign exchange market: we set the dollar as base currency and construct the same graph as before.



The figure above shows what happens when the rate of return on dollar deposits rises from $R^1_\$$ to $R^2_\$$. The market will reach the new equilibrium at point 2 with the new exchange rate $E^2_{\$/€}$ identifying an appreciation of the dollar.



[28]

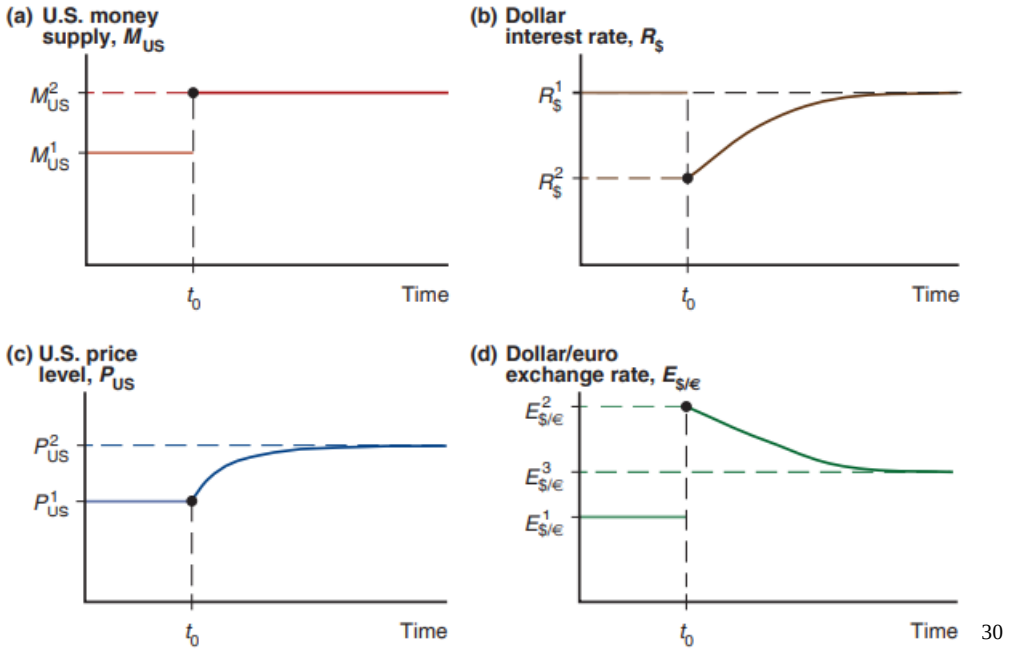
This other representation of the forex market model reveal the effect of an increase in the interest rate of the opposite currency; the downward-sloping green line (the expected return on euro deposits, measured in terms of dollars) shifts rightward causing a parallel appreciation of the European currency from $E^1_{\$/€}$ to $E^2_{\$/€}$ as return on dollar deposits remain unchanged and market will reach equilibrium by eliminating the excess supply of dollar assets. In this case, the currency with higher interest rates on deposits will appreciate as foreign investors will increase the demand for it and match higher returns.[29]

This examination shows that a currency will appreciate against others when interest rates on that currency deposits increases but it is crucial to remember that the assumptions we made are often unrealistic or with little empiric evidence even with appropriate data selection.

[28] Krugman, Paul R, et al. International Economics : Theory and Policy. 11th ed. Figures 14-5, 14-6, Upper Saddle River, Pearson, 2018.

[29] Mathai, Koshy. "Monetary Policy: Stabilizing Prices and Output." International Monetary Fund, 2022, www.imf.org/en/Publications/fandd/issues/Series/Back-to-Basics/Monetary-Policy.

In this framework it is opportune to cite the work of Rüdiger Dornbusch that following the New Keynesian school introduced the theory of an Overshooting model in 1976 starting from the same interest rate parity analysis mentioned – that according to the author is the main link between international currency markets – adding the concept of expectations about exchange rates. The Overshoot is a dynamic that manifest how exchange rates and prices do not move at the same pace. Regarding this last part, following a change in monetary policy, the exchange rate will receive a stronger fluctuation in the short-run, exceeding the equilibrium level in the foreign exchange market initially, only to adjust in the medium- to long-run, caused by the real nature of reactive financial markets and volatility of the exchange rates. On the other hand, prices on markets like the labour markets or goods and services, are generally more rigid, reaching the equilibrium point more gradually than currency pairs without needing to over-adjust.



[30] Krugman, Paul R, et al. International Economics : Theory and Policy. 11th ed. Figure 15-14, Upper Saddle River, Pearson, 2018.

The main contribution of this theory is that for the first time it was possible to determine the different effects of lags in markets adjustments without appealing to irrational assumptions far from empirical analysis and accurately describing exchange rates behaviours from short to longer terms, while showing the reasons behind currency prices volatility.

On the other hand, the Fisher effect implications on the long run is behind a seemingly absurd phenomenon that monetary approach predicts currency depreciation in foreign exchange markets when interest rates on its deposits rises relative to the foreign currencies. This dissimilarity reflects the first warnings on assumptions of theoretic models and the importance of the factors that brought the interest rates to change as they can affect differently the exchange markets. The monetary approach to the exchange rates proposed by the PPP might be too simple to reflect reality and give accurate predictions in the longest term but we can reduce margins of errors by extending the PPP theory and introducing the concept of real exchange rates.

2.6 Real exchange rates

The real exchange rate (RER) between two currencies is the product of the nominal exchange rate (the cost of one currency in term of the other) and the ratio of price levels between the two countries in analysis. This extension of the PPP theorem excludes the absolute part of it and therefore the basket of goods used to determine the theory does not require to be identical. It is required instead to have an accurate representation of what drives a country's demand of its own monetary supply. We can define P_{US} as a price in dollar terms of an unchanging basket of commodities generally requested over a short period of time of US households and in the respective way, we define P_{EU}. It follows that

commodities produced domestically will weigh heavily on the corresponding price level. Now we can define the real USD/EUR exchange rate as $q_{\$/€}$: the price in dollar terms of the European basket relative to the price of US basket.

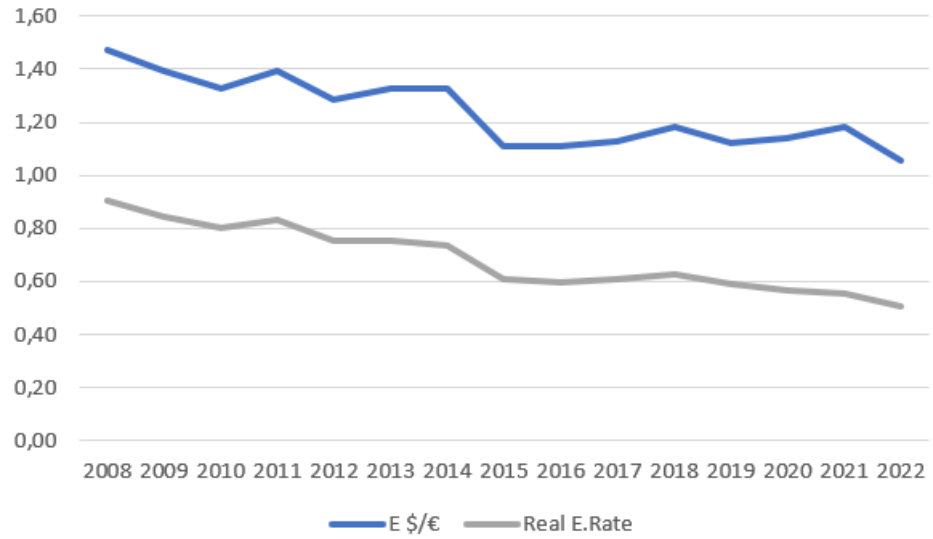
$$q_{\$/€} = \frac{(E_{\frac{\$}{€}} \times P_{EU})}{P_{US}}$$

We can try to make a numerical example based on real analytics to visualize how this theory adapt to the current scenario. We operate with OECD dataset of Final consumption expenditure of households in national currency expressed in millions[31] as the reference for price levels and the Exchange rates over the years[32]. For the first calculation of the experiment, we take as example the 2016 data: P_{US} = 12.338.566, P_{EU} = 6.671.106 and the price of 1 € is 1,11 $. The real exchange rate would then be:

$$q_{\$/€} = \frac{(1{,}11 \times 6.671.106)}{12.338.566} = 0{,}59875$$

With the important limitations of the data selected and the approximations made, the result might seem odd and far from being a good predictor for the long run exchange rate but when we put together and visualize data collected in the same way for other years, we obtain the following result:

[31] OECD. "5. Final Consumption Expenditure of Households." Stats.oecd.org, stats.oecd.org/viewhtml.aspx?datasetcode=SNA_TABLE5&lang=en.
[32] OECD. "Conversion Rates - Exchange Rates - OECD Data." TheOECD, 2012, data.oecd.org/conversion/exchange-rates.htm.



This experiment could prove the real exchange rate formula to be an appropriate but not accurate representation on the long run of the exchange rate.

When going back to the theory behind this equation we can see how a rise in $q_{\$/€}$ is going to reflect a reduction in the dollar purchasing power in the respect of Europe relative to its purchasing power in the United States because the price of European goods expressed in dollar terms, rise relative to price of American goods. A reduction in a nation's RER indicates that its exports are becoming cheaper and its imports more expensive, therefore gaining competitive edge over the trade foreign partner. The core idea revolves around the behaviour of a currency in response to real exchange rates fluctuations; overvalued currencies are pushed to reduce value compared to foreign ones, and undervalued currencies do the opposite as RER predicts. Real exchange rates can be used to compare the value of currencies in relation to each other over time by considering the effect that inflation has, offering a good observation over the relationship between exchange rates and price levels.

2.7 Applications

For the last part of this theoretical examination, we try to observe briefly how values of real exchange rates are affected by demand and supply when PPP does not hold.
If we imagine a scenario where total global spending on, for example, American products increases relative to that on European products. This could be originated from various factors, such as the increasing demand in the US brought from the aggressive fiscal intervention of the last year as explained at the end of the first chapter. Such an increase in the world's aggregate demand for US products compared to that for European products leads to a value of demand that exceeds the equilibrium level for the existing real exchange rate. When this happens, the relative price of American goods and services in terms of the European's will be pressured to increase: US non-tradables will rise and in the prices of US tradables, especially those consumed heavily within the United States, compared to European tradables. These shifts contribute to a reduction in the real exchange rate and therefore we can conclude that the initial increased demand in US production leads to a long-term appreciation of the dollar.

Chapter 3

As we get closer to conclusions, we are transitioning from theoretical constructs to real-world applications, focusing on how central banks' monetary policies over the past few years have been instrumental in countering inflation and subsequently influencing the EUR/USD exchange rate.

We have already mentioned that central banks achieve price stability through monetary policy and influencing interest rates.

Price stability is crucial to create conditions of stable economic growth and stable financial system.

The point of moving interest rates in modern economics is contested but generally we can say that higher interest rates slow down investments and consumption, therefore causing disinflation. Conversely, lower interest rates stimulate spending and economic growth when inflation is low. These fluctuations of rates have an indirect consequence on households and businesses as they influence other interest rates in the economy, such as interest growing on variable rate loans or on savings accounts.

As mentioned in the very first part, when individuals have a variable rate mortgage, an increase in interest rates can have an immediate and significant effect on their disposable income. As interest rates rise, the cost of service of these mortgages increases, therefore reducing the amount of money homeowners have available for other expenditures. They will find themselves with less cash to spend. This reduction in cash spending can lead to a cautious approach from businesses regarding price increases, as consumer demand weakens. Such prudence in raising prices is a factor that contributes to lowering inflation.

In addition, when both fixed and variable mortgage rates become more expensive, the overall cost of buying a home for example increases. This escalation in home-buying costs can lead to a decrease in housing demand, resulting in a fall of house prices. Those homeowners that witness a decline in their property values, may feel poorer, a phenomenon known as the wealth effect. This perceived reduction in wealth often leads to a decrease in consumer spending, contributing to a slowdown in the rate of inflation.

Besides this, as interest rates increases, businesses will find more difficulties to borrow and invest. This heightened cost of borrowing acts as a deterrent to investment, leading businesses to scale back or delay their investment plans. Consequently, this reduction in investment results in diminished economic activity, slowing down the pace of business growth and development. With businesses investing less, the demand for labour often decreases, leading to slower employment growth or, in some cases, reductions in workforce.

Beyond interest rates, central banks reach their goals on inflation through various policy tools. These include adjusting the money supply via open market operations, modifying reserve requirements for some types of commercial banks and altering their policy rate, monitoring and regulating the integrity of the financial system through supervision and through stress tests to assess risks.

3.1 European Central Bank: Monetary policy and instruments

Constant and stable price levels are a priority for Europe and for the European Central Bank as it is set in the Treaty on the Functioning of the European Union[33]. Aiming for 2% inflation is considered by the ECB's Governing Council as the best way to maintain price stability. The 2% target is pursued symmetrically as both above- or below-target deviations are evenly undesirable[34].

The economic background shown in the first part of this elaborate, calls out for an action of the central banks. Starting from July 2022, the Governing Council of the

[33] European Parliament. “European Monetary Policy | Fact Sheets on the European Union | European Parliament.” Europa.eu, May 2019, www.europarl.europa.eu/factsheets/en/sheet/86/european-monetary-policy.
[34] European Central Bank. “Strategy.” Www.ecb.europa.eu, 10 Nov. 2021, www.ecb.europa.eu/mopo/strategy/html/index.it.html.

ECB decided to raise the three key ECB interest rates – the primary monetary policy instrument – by 50 basis points.

[35]

Date (with effect from)		Deposit facility	Main refinancing operations		Marginal lending facility
			Fixed rate tenders Fixed rate	Variable rate tenders Minimum bid rate	
2023	20 Sep.	4.00	4.50	-	4.75
2023	2 Aug.	3.75	4.25	-	4.50
2023	21 Jun.	3.50	4.00	-	4.25
2023	10 May	3.25	3.75	-	4.00
2023	22 Mar.	3.00	3.50	-	3.75
2023	8 Feb.	2.50	3.00	-	3.25
2022	21 Dec.	2.00	2.50	-	2.75
2022	2 Nov.	1.50	2.00	-	2.25
2022	14 Sep.	0.75	1.25	-	1.50
2022	27 Jul.	0.00	0.50	-	0.75
2019	18 Sep.	−0.50	0.00	-	0.25
2016	16 Mar.	−0.40	0.00	-	0.25
2015	9 Dec.	−0.30	0.05	-	0.30
2014	10 Sep.	−0.20	0.05	-	0.30
	11 Jun.	−0.10	0.15	-	0.40
2013	13 Nov.	0.00	0.25	-	0.75
	8 May.	0.00	0.50	-	1.00
2012	11 Jul.	0.00	0.75	-	1.50

[36]

[35] European Central Bank. “ECB Deposit Facility Rate for Euro Area.” FRED, Federal Reserve Bank of St. Louis, fred.stlouisfed.org/series/ECBDFR#.
[36] European Central Bank. “Key ECB Interest Rates.” European Central Bank, 2023, www.ecb.europa.eu/stats/policy_and_exchange_rates/key_ecb_interest_rates/html/index.en.html

• The rate on the main refinancing operations (MRO): The cost at which commercial banks can borrow money from the ECB, these operations can happen on a weekly basis and define the core of liquidity of the European banking system.

• The rate on deposit facility: The predetermined rate on deposits that commercial banks can make overnight with ECB. It is essentially in opposition with the MRO as this instrument is needed for banks to store excess liquidity with the ECB. This rate is always lower than the MRO rate. This rate has been negative before the 2022 general increases as the BCE encouraged banks to lend more instead of holding onto their funds. It reached positive 4% in 2023.

• The rate on the marginal lending facility: This rate is applied to overnight loans that credit institutions can take from the central bank. The marginal lending facility serves as a safety valve for banks that need additional liquidity on a short-term basis but cannot obtain it from the market. It is typically higher than the MRO rate in order to discourage banks from using this facility regularly and encourage them to manage their liquidity more efficiently. This final pair of rates defines a lower and upper bound rate for money markets.

It was clear from the ECB press conference in July 2022 that this first increase in interest rates would not have been the last. After years of near-zero interest rates on the main refinancing operations, it increased to 4.5% as of September 2023. The constant increase in interest rates stops from that moment. In December 2023 Christine Lagarde, president of the ECB states that the Governing Council decided to keep the three key ECB interest rates unchanged[37]. This discontinuation occurs as a

[37] European Central Bank. “Monetary Policy Decisions.” Www.ecb.europa.eu, 14 Dec. 2023, www.ecb.europa.eu/press/pr/date/2023/html/ecb.mp231214~9846e62f62.en.html.

consequence of the past rates increases that continue to be transmitted forcefully to the economy. Inflation has dropped in the last months of 2023, but it is forecast to increase again slightly in the close future but not permanently or for longer periods. Overall, Eurosystem' staff expect headline inflation to average around 5.4 percentage points in 2023, 2.7 in 2024, 2.1 in 2025 and 1.9 in 2026[38]. These statistics received a downward revision compared to projections calculated in September, especially for 2024.

3.2 Federal Reserve: Monetary policy and instruments

Decisions about monetary policy in the United States are made at meetings of the Federal Open Market Committee (FOMC). Also in this case price stability is a crucial mandate set in the shaping of policy goals. A low and stable inflation at 2% yearly rate is the target and this is achieved through adjusting federal interest rates[39].

The Federal Reserve initiated a significant departure from its previous "easy money" approach, which had been in place since the 2008 financial crisis, a period of super-low rates contested by some economists as it contributed to widening inequality and speculative-asset bubbles[40]. This policy is known as Zero Interest Rate Policy (ZIRP) initially aimed to stimulate spending and job creation by making borrowing inexpensive. However, this led investors to seek higher returns through riskier

[38], European Central Bank. "Eurosystem Staff Macroeconomic Projections for the Euro Area, December 2023." Www.ecb.europa.eu, 14 Dec. 2023, www.ecb.europa.eu/pub/projections/html/ecb.projections202312_eurosystemstaff~9a39ab5088.en.html, https://doi.org/10.2866/682.

[39] Board of Governors of the Federal Reserve System. "Federal Reserve Board - Monetary Policy: What Are Its Goals? How Does It Work?" Board of Governors of the Federal Reserve System, 29 July 2021, www.federalreserve.gov/monetarypolicy/monetary-policy-what-are-its-goals-how-does-it-work.htm.

[40] Karma, Rogé. "The Era of Easy Money Is Over. That's a Good Thing." The Atlantic, 11 Dec. 2023, www.theatlantic.com/ideas/archive/2023/12/higher-interest-rates-fed-economy/676282/. Accessed 7 Feb. 2024.

investments, contributing to what some call “the everything bubble” and shaped the American economic system around the close-to-zero interest policy.

Prior to 2022, the Fed had maintained a fed funds target rate within the range of 0.00% to 0.25%. However, responding to a surge in inflation in 2022, the Fed altered its course and implemented a more restrictive monetary policy. This shift led to a rapid series of rate hikes throughout the latter part of 2022 and into 2023 through these monetary policy instruments[41]:

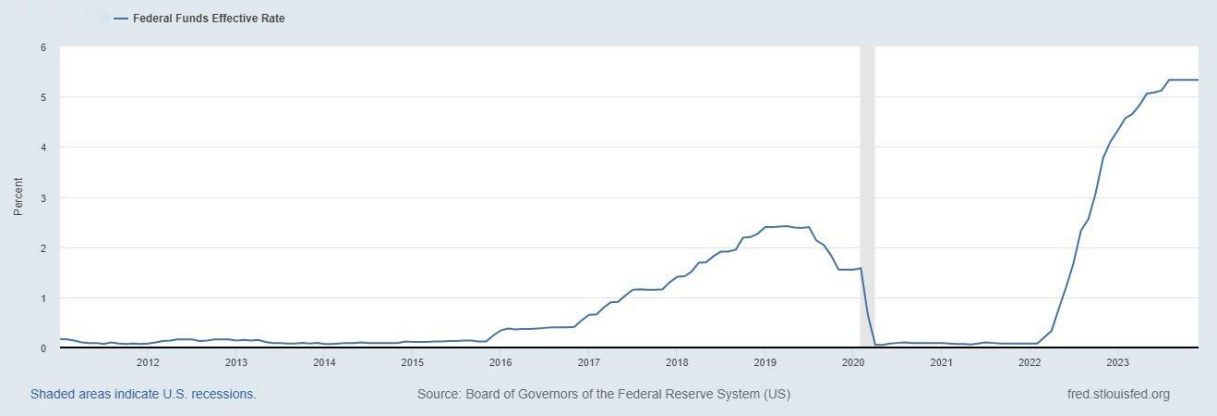
• Interest on reserves: the rate that banks can earn on deposits held in reserves accounts at the Fed. Similarly to the European rate on deposit facility, it sets a lower bound, a reservation rate that offers a risk free-free option to banks that will not loan money at a lower rate, as this is guaranteed by the central bank. It is the primary instruments that the Federal Reserve uses to steer federal funds rate.

• Reserve requirements: A tool to regulate the limit of reserves that banks must hold. By adjusting this parameter, the United States central bank can directly affect the amount of funds that banks have available to lend. Raising requirements reduces economic activity and help to cool down inflation.

• Discount rate: The primary credit rate, as this is the rate that Fed charges for lending to banks through the Discount Window Lending[42]. It creates an upper bound to the federal funds rate because banks will not borrow at a higher rate than the Fed’s one.

[41] “How the Fed Implements Monetary Policy with Its Tools: In Plain English.” Www.stlouisfed.org, www.stlouisfed.org/in-plain-english/the-fed-implements-monetary-policy#:~:text=The%20key%20tools%20of%20monetary.
[42] “The Fed - Discount Window Lending.” Www.federalreserve.gov, www.federalreserve.gov/regreform/discount-window.htm.

• Reverse Repurchase Agreement Operations: An RRP is a tool that Fed offer to provide support to the stability of federal funds rate as not all agents of the fed funds market are able to earn interest on Fed's reserve accounts. The interest paid by the Federal Reserve on such transaction is implied by the difference between the sale price and the repurchase price, along with the duration of the contract. This tool, in tandem with the first instrument presented, is essential to set the lower bound of federal funds rate.



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Starting back in March 2022, federal interest rate increased eleven times starting from 0.8% to above 5% in 2023 where it remained steady since, for three consecutive meetings up to now (First months of 2024); the highest federal rate in two decades. Now that inflation appears tamed, in addition to the behaviour of the last meetings, the Fed will likely reverse course, or at least stop raising interest rates. An increasing number of Fed officials project that rates will stay here for most of 2024 and could decrease of a small portion in 2025. A new period of super-low interest rates might be in a distant future.

[43] Board of Governors of the Federal Reserve System (US). "Federal Funds Effective Rate." FRED, Federal Reserve Bank of St. Louis, 2023, fred.stlouisfed.org/series/FEDFUNDS#.

3.3 Comparative Analysis

To follow on the monetary policies that central banks in exam are establishing for the current economic scenario, we need a crucial link. As said, monetary policies aim to influence demand and therefore inflation dynamics, but inflation could be of different types. In the first chapter we defined two types of inflation that economists generally disentangle as demand-driven or supply-driven. With the adjustment of interest rates and the subsequent tightening of economic conditions, central banks will preserve price stability and disinflation only in the case of demand-driven inflation which affect GDP and price levels in a similar way. Monetary policy is not as efficient in contrasting inflation caused by supply shocks that has opposite correlations with GDP and price levels. The classic New Keynesian view of moving interest rates one-to-one with the inflation rate showed to be outdated in the modern economy. Trying to reach inflation targets by increasing interest rates in an environment where price spikes are caused by supply disruptions will have devastating causes on the GDP growth and the economic pace without reaching disinflation needs, ultimately bringing potential recession.

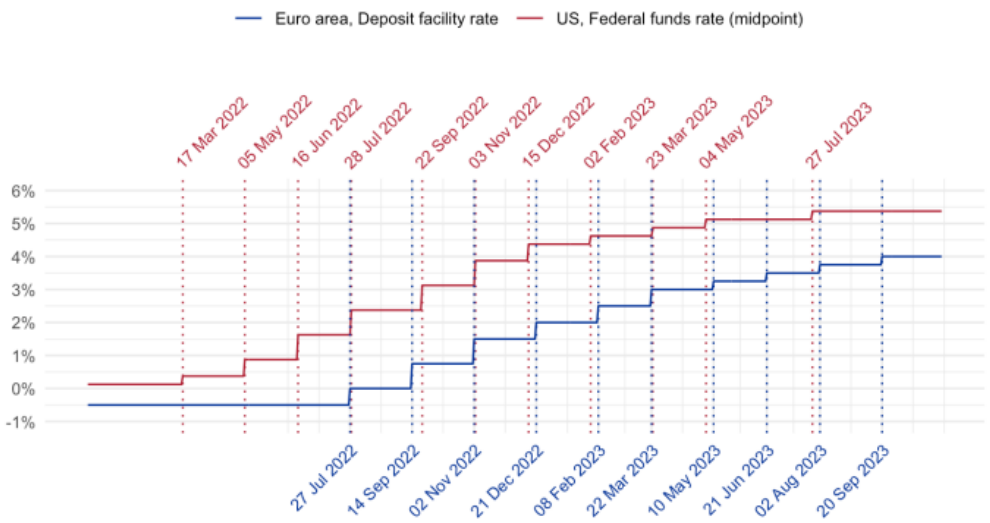
With these preliminary remarks we can link to the actual economic conditions of the United States and the Euro zone to understand that different causes of inflation could lead to different policies decisions in the future and therefore differently affecting the exchange rate.

In the two macro regions, inflation was not caused by one single factor but both demand and supply shocks where persistent in two economies, even if with different

weights[44]. We already broke down inflation dynamics, but it is needed to repeat that at first, the pandemic brought an initial supply disruption that impacted similarly in the US and in EU, followed by a spike in domestic demand after the reopenings. The main difference was caused by the aggressive fiscal stimulus and government spending in the US that further exacerbated demand pressures while the Russo-Ukrainian war supply shocks impacted more the European economy. The persistence of supply-driven inflation in Europe, underscores the need for understanding causes of inflationary pressures. As evidenced in the early 2022, the escalation in prices, particularly in food and energy sectors post the Ukraine invasion, mainly originated from supply-side problems. In such framework, monetary policy needs to be complemented or even substituted from fiscal and structural policies and reforms aimed at directly addressing the underlying supply issues. These measures usually fall outside the perimeter of actions that a central bank operates and are typically responsibility of governments.

Now that the background is clear we already see the bigger picture. Monetary policy of European Central Bank and the Federal Reserve has been similar over the last years. After a decade of close to zero interest rates, they increased to respond to inflationary pressures.

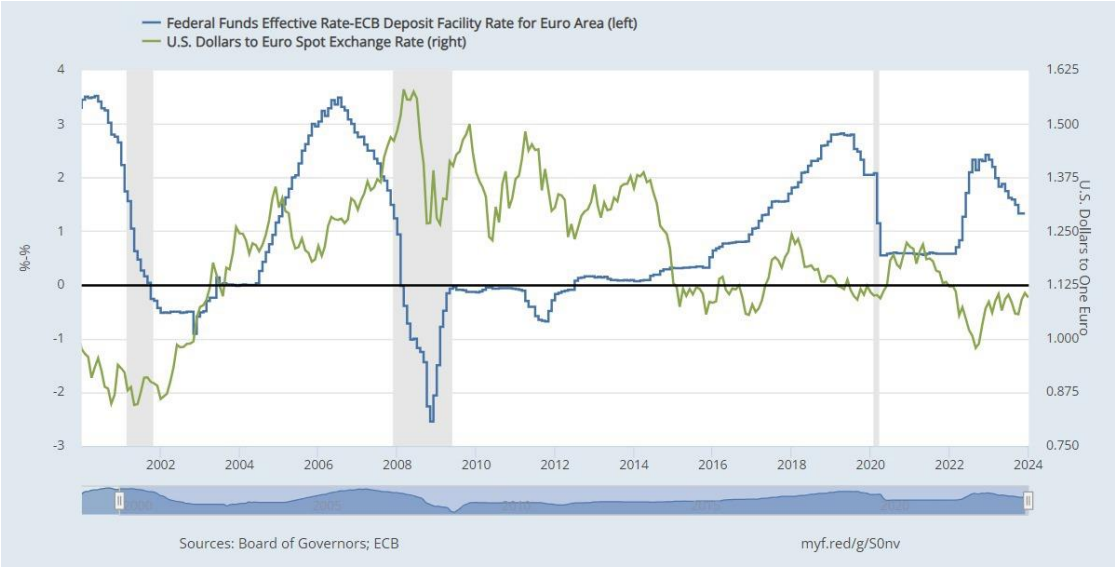
[44] Firat, Melih , and Otso Hao. "Demand vs. Supply Decomposition of Inflation: Cross-Country Evidence with Applications." IMF, 17 Oct. 2023, www.imf.org/en/Publications/WP/Issues/2023/09/28/Demand-vs-539665.



[45]

If we consider the theory mentioned in the second part of the elaborate, this in-tandem approach to interest rates gives a first glance at how the exchange rate determination is a complex phenomenon. We stated before that higher relative interest rate on one currency deposits normally leads to appreciation; this happens because investors will be attracted by higher returns ultimately increasing demand for currency with higher returns. This was the case on the dollar/euro exchange rate until the second part of the 2022 where the dollar was appreciating in the respect of the European currency, alongside the Federal funds rate being higher than the Euro area deposit facility rate. In addition, this could have been cause be the latency that European Central Banks showed in restricting monetary policy in line with the Fed's decisions in March 2022. The euro achieved parity with the US dollar for the first time in nearly 20 years in July 2022. This means that the exchange rate reached $1.00 per euro, probably a case of overshooting as announced in the second part of the elaborate. After this day it continued to decrease up to a multi-decade low of 0.97 but then rebounded up again. It is now stable near $1.10 per euro.

[45] Blot, Christophe, and François Geerolf. Are Inflation Dynamics Different in the Euro Area and the United States? 2023.



[46]

We can see in the graph above that the USD/EUR exchange rate tends to fall when the difference between Federal Funds effective rate and ECB Deposit Facility rate is positive: higher interest rates for Dollar deposit causes currency appreciation as said. By taking into analysis the last period we are studying, it is shown a very first response of the exchange rate to the monetary policies of central banks. The Federal Reserve increased interest rates slightly before than the ECB (March vs July), and at a higher rate, as shown with the first spike of the blue line in 2022[47]. Such movement finds confirmation in the green line as appreciation of the US dollar against the euro. Afterwards the ECB did respond by decreasing the difference (Federal Funds effective rate – ECB deposit facility rate) that resulted in a subsequent appreciation of Euro. It is necessary to say that the causes are multiple and not only correlated to the monetary policy, for example some analysts confirm that the run of dollar was mostly

[46] Miguel Faria-e-Castro and Samuel Jordan-Wood. The Dollar and Euro Exchange Rates Break Even | FRED Blog. fredblog.stlouisfed.org/2022/08/the-dollar-and-euro-exchange-rates-break-even/#:~:text=The%20euro%20hit%20%E2%80%9Cparity%E2%80%9D%20with.
[47] Whelan, Karl."Comparing Fed and ECB Monetary Policies." European Parliament, www.europarl.europa.eu/RegData/etudes/IDAN/2023/755707/IPOL_IDA(2023)755707_EN.pdf.

caused by the better response of American economy, the currency market and currency investors responded rapidly to official feedback in the US (reports of Bureau of Labour Statistics and reports on inflation). The dollar performed positively not only in the respect of the European currency, the US dollar index – that resumes the value of the US dollar in relation to a basket of other currencies – reached highest points of the last two decades supported by multiple investors looking for safe havens in an uncertain global economy.

3.4 Projections

Exchange rates are generally not pursued by central banks' policy. In other words, the ECB' and the Fed's agenda does not aim to directly influence exchange rates through their monetary policy operations[48]. The major economies grouped in the G20 have committed to step back from currency wars, not targeting exchange rates for competitive purposes, while also avoiding any form of protectionism. Exchange rates are mostly observed and analysed when shaping the monetary policy as they have direct and indirect effects on price stability and international trade.

Besides this, the macroeconomic divergencies of the Euro area and the United States is increasing and could manifest a potential risk going ahead.

The different fights vs inflation that they are witnessing could lead to disunite monetary policies between the two therefore risking prominent fluctuations on the exchange rate.

[48], European Central Bank. "Qual è Il Ruolo Dei Tassi Di Cambio?" European Central Bank, 18 Nov. 2021, www.ecb.europa.eu/ecb/educational/explainers/tell-me-more/html/role_of_exchange_rates.it.html.

The fact that inflation is considered to decrease faster or more smoothly in the US – even with an expansionary policy that has not stopped or a substantial increase in unemployment – could lead to a decrease in the Federal funds rate sooner rather than later.

On the other hand, the strong response of the American economy and the resilience showed by overseas labour market over the period of high interest rates could lead to encourage a higher-for-longer approach that some economists embrace after decades of being near-zero. In particular, the overall labour market seems strong in the US, unemployment is touching the 50-year low, and salaries are steadily growing; answer to that could be found in the Inflation Reduction Act. It is hard to make accurate previsions out of these two analyses, but the future of Federal rates is open to debate.

In the opposite way, the weaker economic prospect in Europe must dodge the risk of an imminent recession and for this reason has more urgence to decrease interest rates while focusing on the supply-side difficulties with other instruments. Moreover, the different monetary system of Europe in the respect of the United States federal organization, highlights diverging difficulties rising among European members; inflation trends differently, as well as economic growth, turning on the light on a monetary policy that hardly adapt across countries that could eventually add to already existing trade imbalances problems[49].

If the scenario of monetary policies turning down interest rates in tandem between the two macro agents we are analysing would not happen, it could add pression to euro

[49] Whelan, et al. Comparative Analysis of Monetary Policy and Inflation Dynamics in the Euro Area and the United States. Nov. 2023, https://www.europarl.europa.eu/RegData/etudes/STUD/2023/747832/IPOL_STU(2023)747832_EN.pdf

depreciation versus the American currency, exacerbating inflationary pressures in Europe.

In September 2023 inflation seemed to have landed in United States, while still running in Europe. This condition protracted up until December 2023 but then inflation hinted to rise slightly again. Until clear signs of disinflation glowing durably, monetary policy needs to remain restrictive as OECD suggests. Central banks will not decrease interest rates before leaving the danger zone.

Some indicators and forecasters predicted a federal funds cut already in the March 2024 but while approaching that date, the probability of a first decrease of Federal Funds rate passed from a 90% to 10% (CME FedWatch tool). Federal Reserve Chair Jerome Powell announced to proceed carefully through the first part of 2024 waiting greater confidence on the inflation slowing down but leaving an opening for Fed's cut in May 2024[50]. After the positive results of the American economy in September 2023 some even predicted six consecutive interest rates reductions but now monetary policy in the US is not expected to alleviate more than four times.

The OECD projections view relieved federal funds rate from the second half of 2024 up until a 4% by the end of 2025, but the pre-pandemic near-zero interest rates are far in the future[51].

The same organization forecasts that the key interest rates in Europe will not change until the first part of 2025. The predictions and the official communications received a different approach than the American mentioned; in December 2023, President of

[50] Goodkind, Nicole. "Fed Chair Powell: The "Time Is Coming" for a Rate Cut | CNN Business." CNN, 5 Feb. 2024, edition.cnn.com/2024/02/04/economy/powell-interview-interest-rates-inflation/index.html.
[51] OECD. OECD Economic Outlook, Volume 2023 Issue 2: Preliminary Version. OECD ILibrary, Paris, Organisation for Economic Co-operation and Development, 2023, www.oecd-ilibrary.org/economics/oecd-economic-outlook/volume-2023/issue-2_7a5f73ce-en.

the ECB, Christine Lagarde, initially stated that a rate cut was not in the close future agenda as inflation was showing resilience; after this, as 2024 arrived, Ms. Lagarde introduced the possibility for interest rates inverting the route in summer of the same year. The debate of interest rates cut in Europe is heated as some see the urgence in cutting rates to avoid recession and others see the process of taming inflation not concluded.

The dual scenario of future monetary policies consists in a harder landing for the European economy as it is obliged to lower rates with the economy showing weaknesses while the Fed keep the restrictive monetary policy following the higher-for-longer theory. At this point there is no need to believe that easier projections are less likely to happen.

3.5 Final remarks

The intricacies we found in determining the dollar/euro exchange rate give emphasis on the complexity of currency prices determination. The theoretical assumptions we made are not enough to establish a strong correlation between monetary policy of ECB and Fed in response to the exogenous shocks, and the corresponding currencies exchange rate.

The determination of exchange rates has evolved significantly over the years, reflecting the dynamic nature of modern economics[52]. Initially, it was commonly believed that exchange rates were directly related to price levels. Policymakers recognized early that increasing interest rates could appreciate the domestic currency,

[52] Karakostas, Emmanouil. "The Significance of the Exchange Rates: A Survey of the Literature." Modern Economy, vol. 12, no. 11, 2021, pp. 1628–1647, https://doi.org/10.4236/me.2021.1211082. Accessed 28 Dec. 2021.

a notion that gained further support with the advancement of financial markets. As global economic conditions changed and international trade and currency exchanges became more fluid, these theories were disproved again. It became clear that no single theory could fully account for the fluctuations in exchange rates. Over the course of the last century multiple economic theories dawned and set, neutralizing each other on the different dynamics of the theory and empirical evidence, short term and long term, price rigidity, exogenous or endogenous variables affecting the economy. New economic theories if the last two decades, offer a third perspective to the Keynes-Friedman essential debate and argues that exchange rate fluctuations could have long lasting effects by altering businesses' investment capabilities, affecting the productivity growth, and shapes the competitive edge firms have in global trading markets, as well as their dependence on either foreign or domestic savings to fund their operations[53]. Attempts of international cooperation post-world-wars failed and highlighted the request of stable exchange rate system and contributed to add variables to the complexity[54].

The exchange rates regime that characterises the dollar and the euro exchange rate is described as non-fixed or not pegged. Free-floating or independently floating regime where the equilibrium price is set by the supply and the demand of currencies in the foreign exchange market. Most central banks of advanced economies, like the

[53] Capriata, William, et al. "The Exchange Rate in Orthodox, Keynesian and New Developmentalism Theoretical Models: A Literature Review." Brazilian Journal of Political Economy, vol. 41, no. 2, 2021, pp. 220–235, www.scielo.br/scielo.php?script=sci_arttext&pid=S0101-31572021000200220&lng=en&nrm=iso&tlng=en#B56, https://doi.org/10.1590/0101-31572021-3126. Accessed 6 May 2021.
[54] Burange, L, and Rucha Ranadive. "THE EVOLUTION of EXCHANGE RATE REGIMES: A REVIEW." Department of Economics, University of Mumbai, Working Papers, vol. UDE 36, 1 Sept. 2011.

European Central Bank and the Federal Reserve remain reluctant to assess policy objective on managing exchange rates[55].

The journey – from a simple price relationship to purchasing power, interest rate effects, and financial systems enhancements – illustrates the evolving nature of economic thought and the continuous research for a more accurate picture of currency price dynamics.

Conclusions

In this elaborate we aimed to analyse the relationship between the monetary policy of the recent economic scenario with multiple exogenous shocks and the exchange rate between the US dollar and the Euro.

The path started in understanding the causes behind inflation spikes and economic vulnerabilities surfaced since the Covid-19 outbreak and the Russo-Ukrainian war.

Different dynamics in inflation and in resilience showed by the European system and the overseas counterpart evidenced different approach to the corrective policies.

The determination of exchange rates is complex, it presents a multiple and intricate challenge and was heatedly debated of the course of modern economic analysis. Throughout this thesis, we have tried to dissect and understand the mechanisms at play starting from the theoretical assumptions of international finance. Yet as revealed by the literature, theoretical findings serve more as indicators rather than definitive predictors caused by the importance of assumptions. This observation

[55] IMF. "Classification of Exchange Rate Arrangements and Monetary Policy Frameworks -- as of June 30, 2004." Imf.org, 2019, www.imf.org/external/np/mfd/er/2004/eng/0604.htm.

underscores the complexity of currency markets, where a multitude of factors interact simultaneously, and economic theories diverge.

Considering these findings, it becomes evident that any analysis of exchange rate determination must be approached with a degree of humility and an acknowledgment of the limitations inherent in our predictive capabilities.

As the global economic organization continues to evolve, our understanding and methodologies for analysing exchange rates must follow the same route.

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