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Master's Thesis

Inflation and Monetary Policies in US and Euro Area

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Declaration of Academic Integrity

Paris, France

I, Mr. SINGH Satnam, student enrolled in the MSc Finance & Big Data certify that the data and information contained in the master's thesis entitled *Inflation and Monetary Policies in US and Euro Area* have not been plagiarized.

August 2022,

Satnam SINGH

Abstract

The recent surge in inflation has rekindled the debate on the effects of monetary policy on price evolution. In this master's thesis, we therefore analyze the link between monetary policies led after the Global Financial Crisis and levels of inflation over this period in US and Euro Area. Establishing an analysis framework with the study of inflation dynamic during the last 50 years and the economic theory about inflation causes, our analysis is especially based on the impacts of US Federal Reserve (Fed) and European Central Banks (ECB) quantitative easing (QE), which have represented the bulk of monetary policies since 2008. We draw the conclusion that, although inflation was at low levels during the last decade, QEs have mostly impacted financial or physical assets like stock market or real estate ("Cantillon effect"). However, we also notice that QEs have facilitated funding conditions for sovereign and private issuer with levels of debt reaching records. Having said that, a focus on current inflation shows that in addition to exogenous factors, fiscal and monetary have allowed a quick recovery of demand after the Covid Shock, recovery that supply, which was disorganized after the several lockdowns, cannot follow at the same pace in a globalized world, creating a disequilibrium.

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Last but not least, I want to thank my family for their constant support and encouragement.

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Introduction

In the economic literature, inflation is a very well-covered topic. Numerous books, articles or academic papers have been published on this subject with several analysis: effects of inflation on the overall economy[1], the "optimal" inflation rate in a certain economy[2], link between inflation and unemployment[3], link between inflation and fiscal or monetary policy[4], link between inflation and stock markets[5], etc. If questions, and sometimes concern about inflation are many, especially in countries that have known high levels of inflation in their history like Germany[6], the last 15 years where quite different with very low levels of inflation in developed countries despite highly accommodative monetary policies. In a context of weak growth rates, central banks decisions have been closely watched, especially in Europe, where the stability and even the survival of the euro was threatened by the sovereign debt crisis. Not only the economic situation was very particular, due notably to the global financial crisis in 2008, but the tools deployed by central bankers was unprecedent. The accommodative monetary policies set up have led to negative nominal interest rate in the euro zone and to historical low level in the United States (Figure 1). The idea was, as suggested by economic theory, to boost consumption by maintaining low interest rate and encourage banks to deliver more credit with advantageous funding conditions. Despite these unprecedented measures, the 2010s are characterized by what economist call "secular stagnation" (low level of growth associated with low level of inflation). Moreover, numerous criticizes have accused these accommodative monetary policies to feed speculative bubble or to increase income and wealth inequality[7].

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[1] Jones, L., and Manuelli, R., 1995. "Growth and the Effects of Inflation." Journal of Economic Dynamics and Control 19(8): 1405-1428.

[2] Roberto M. Billi & George A. Kahn, 2008. "What is the optimal inflation rate?" Economic Review, Federal Reserve Bank of Kansas City, vol. 93(Q II), pages 5-28.

[3] Friedman, M. (1977). Nobel Lecture: Inflation and Unemployment. Journal of Political Economy, 85(3), 451–472. http://www.jstor.org/stable/1830192

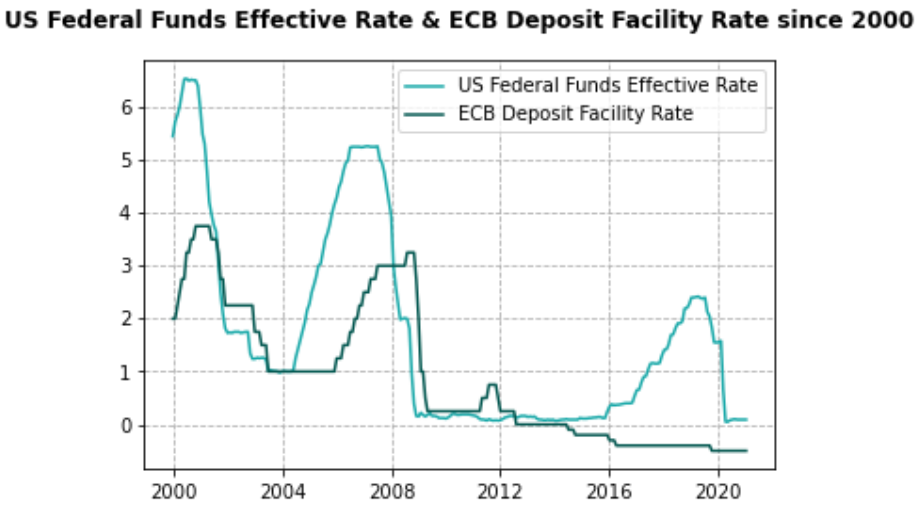
[4] Surjaningsih, Ndari; Utari, G. A. Diah; and Trisnanto, Budi (2007) "the impact of fiscal policy on the output and inflation," Bulletin of Monetary Economics and Banking: Vol. 14: No. 4, Article 4.DOI: 10.21098/bemp.v14i4

[5] Feldstein, M. (1980). Inflation and the Stock Market. The American Economic Review, 70(5), 839–847. http://www.jstor.org/stable/1805765

[6] Gregori Galofre-Vila, 2021. "The Costs of Hyperinflation: Germany 1923," Documentos de Trabajo - Lan Gaiak Departamento de Economía - Universidad Pública de Navarra 2101, Departamento de Economía - Universidad Pública de Navarra.

[7] Monetary Policy and Racial Inequality | Cato Institute

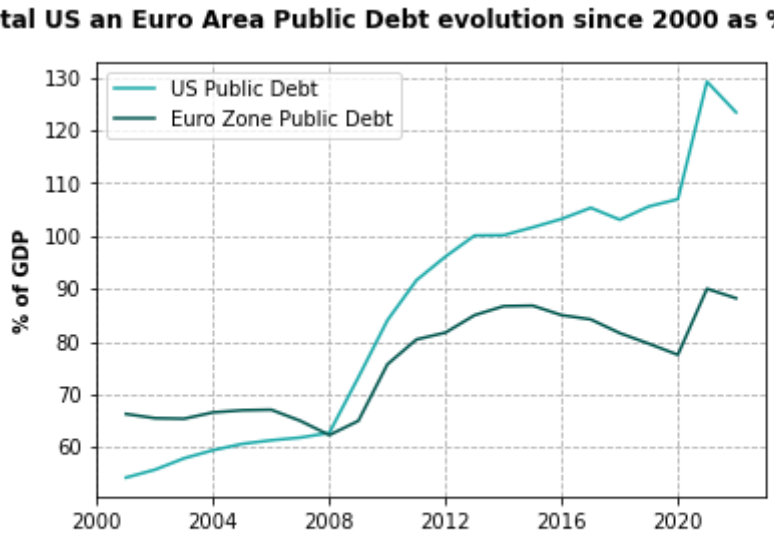
Figure 1 - Central Banks Key Interest Rate



Source : Board of Governors of the Federal Reserve System (US), Federal Funds Effective Rate [FEDFUNDS], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/FEDFUNDS
European Central Bank, ECB Deposit Facility Rate for Euro Area [ECBDFR], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/ECBDFR

After the Covid-19 shock in March 2020, US Federal Reserve (Fed) and the European Central Bank (ECB) were forced, because of economic slowdown and lockdowns, to inject massively liquidity in the financial system to help government and companies to survive. This lead, as we can see in the Figure 2, to accelerate the trend of growing debt with highest level of public debt in the US and EMU.

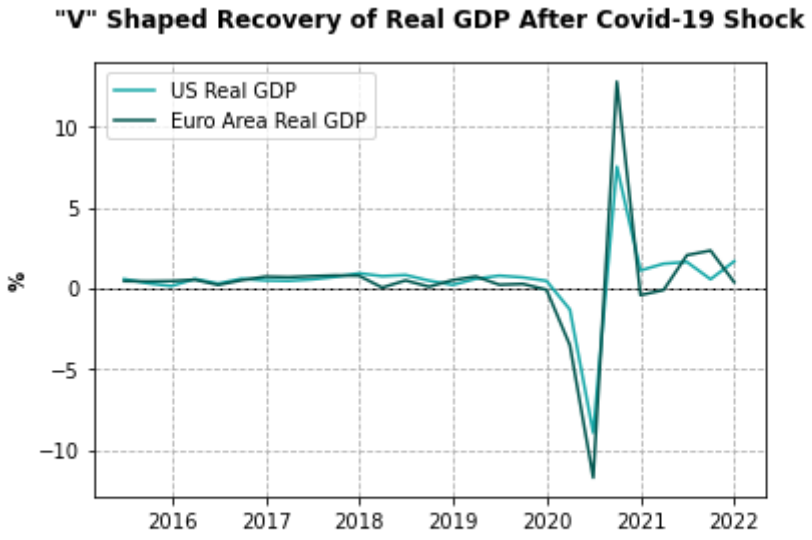
Figure 2 - Public Debt Level



Source : U.S. Office of Management and Budget and Federal Reserve Bank of St. Louis, Federal Debt: Total Public Debt as Percent of Gross Domestic Product [GFDEGDQ188S], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/GFDEGDQ188S
Eurostat; https://ec.europa.eu/eurostat/data/database

Thanks to these accommodative monetary policies but also fiscal policies deployed by government, the economic recovery was very fast both in US and Europe (Figure 3):

Figure 3 - US and Euro Area Real GDP growth

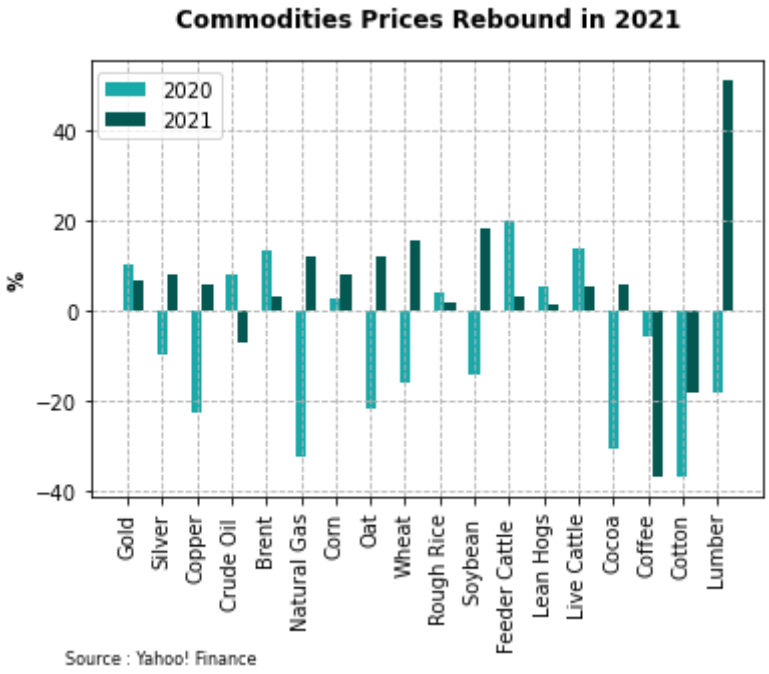


Source : U.S. Bureau of Economic Analysis, Real Gross Domestic Product [GDPC1], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/GDPC1
Eurostat, Real Gross Domestic Product (Euro/ECU series) for Euro area (19 countries) [CLVMEURSCAB1GQEA19], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/CLVMEURSCAB1GQEA19,

In the meantime, we have seen inflation rising at a fast pace. More than the intrinsic level of inflation, the comparison with the expected inflation has surprised many commentators and observers. In a first approach, the inflation was mainly due to the economic recovery: with demand recovering very quickly and supply struggling to adapt to this recovery, numerous bottleneck and shortages have affected companies. These kind of shortages and bottlenecks have affected some specific strategical market like semi-conductors but not only[8]. Inflation was also beyond expected level due to some basis effect: with the drop of demand at the climax of the crisis, many commodities prices have also drop. Then, with the recovery and commodities prices returning to their pre-crisis level, the comparison of year over year data result in a higher inflation (Figure 4).

[8] https://www.jpmorgan.com/insights/research/supply-chain-chip-shortage

Figure 4 - Commodities Prices Basis Effects in 2020 and 2021

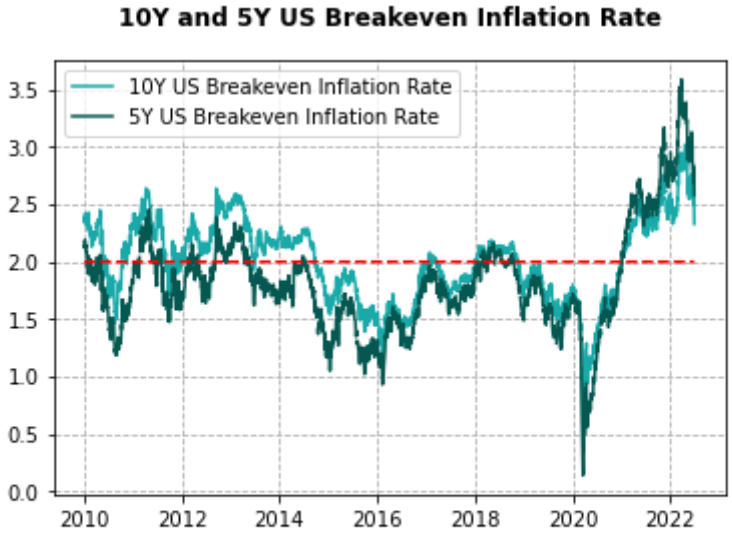


Nevertheless, we have assisted to a shift in the market narrative about inflation. While the inflation was considered "transitory"[9] by market operator and central bankers in the months following the pandemic shocks, it became, since the beginning of 2022 and especially the Ukrainian crisis a more structural issue to handle from a macro economic standpoint.

In the Figure 5, we can obeserve how the anticipation of the US inflation are priced by the market. The expectation of US inflation are clearly above pre-crisis level and, more importantly, above the target of 2% fixed by central banks.

[9] https://www.bloomberg.com/news/articles/2022-06-05/team-transitory-is-back-warning-big-rate-hikes-are-a-big-mistake

Figure 5 - 10 and 5 Years US Inflation Anticipation



Source : Federal Reserve Bank of St. Louis, 10-Year and 5-Year Breakeven Inflation Rate [T10YIE, T5YIE], retrieved from FRED, Federal Reserve Bank of St. Louis;
https://fred.stlouisfed.org/series/T10YIE
https://fred.stlouisfed.org/series/T5YIE

This shift in the narrative is quite interesting to analyze because, from a purely "transitory effect", we have jump into a fear of a scenario in which we will have to live with high inflation for a long-term. Nothing less was needed to bring back memories of the 70s, where western countries have suffered from double digits inflation rate[10] but also low levels of growth. This period of the 70s, characterized by what economist call "stagflation" (stagnation of economic growth associated with high levels of inflation), is now used as an analogy to try to understand the current inflation rise.

Indeed, some of the strong markers of the 70s are coming back in our memories: geopolitical issues (crude oil shock), supply shocks and bottlenecks, accommodative fiscal and monetary policies, fear of recession, etc. If today, political leaders are insisting on the role of the Russian and Ukrainian war[11], questions are however rising about the role of the monetary policy in the current jump of inflation. Therefore, in this master's thesis we will try to understand what the main causes of inflation are, and to be precise, check if there is a link between the monetary policies led after the Global Financial Crisis by central bankers and inflation levels in the US and Euro area.

[10] Blinder, Alan S.. "12. The Anatomy of Double-Digit Inflation in the 1970s". *Inflation: Causes and Effects*, edited by Robert E. Hall, Chicago: University of Chicago Press, 2009, pp. 261-282. https://doi.org/10.7208/9780226313252-016

[11] https://www.bloomberg.com/news/articles/2022-06-10/biden-says-he-s-focused-on-inflation-but-again-blames-putin

Before going forward in this topic, we need to understand what inflation is, how do we measure it, understand what his dynamic have been for fifty years and moreover, understand what have been said about inflation in the economic history. We will then study the features of current inflation and analyze the link between policymakers' action and inflation.

1. Inflation: definition and historical dynamic

1.1. Definition of Inflation

Defined as a rise of goods and services prices, inflation is considered as a loss of purchasing power:

> *"Inflation is the decline of purchasing power of a given currency over time. A quantitative estimate of the rate at which the decline in purchasing power occurs can be reflected in the increase of an average price level of a basket of selected goods and services in an economy over some period. The rise in prices, which is often expressed as a percentage, means that a unit of currency effectively buys less than it did in prior periods."*[12]

In other words, inflation represent the general dynamic of prices in a given economy, which means that a rise of only one good or service is not sufficient for call it so. Thus, inflation level helps (with some lag) to understand at which stage of the economic cycle we are (Figure 6):

Figure 6 - CPI and GDP Evolution

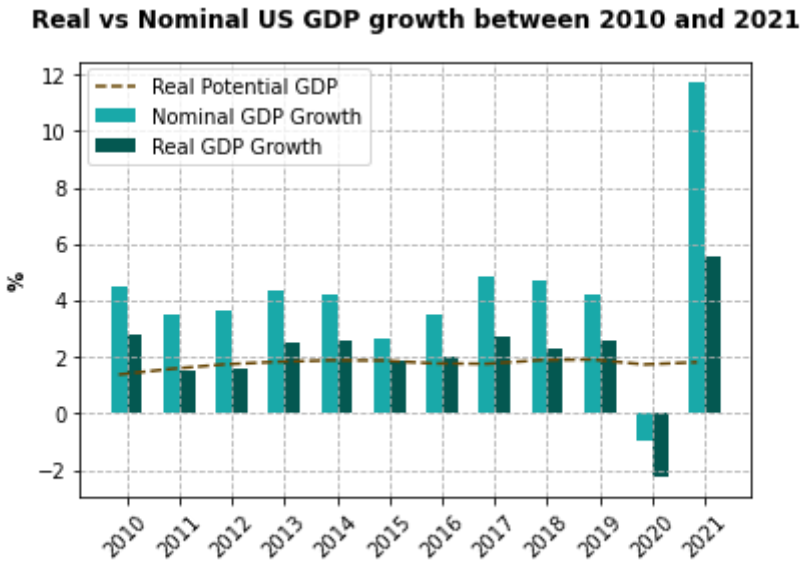
Source : U.S. Bureau of Economic Analysis, Real Gross Domestic Product [GDPC1], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/GDPC1
U.S. Bureau of Labor Statistics, Consumer Price Index for All Urban Consumers: All Items in U.S. City Average [CPIAUCSL], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/CPIAUCSL

[12] https://www.investopedia.com/terms/i/inflation.asp#:~:text=Inflation%20is%20the%20decline%20of,over%20some%20period%20of%20time.

Many reasons can be advanced to explain inflation. In the economic literature, we distinguish several types of inflations: the cost-push inflation, the demand-pull inflation, or the "monetary" type of inflation[13].

Scrutinized as much as many others macroeconomic indicators like Gross Domestic Product (GDP) or unemployment rate by government, market operators or asset managers, inflation is, in addition to being a key target monitored by central banks, a measure that allow to understand in real terms, the evolution of economic situation:

Figure 7 - US GDP Evolution



Source : U.S. Bureau of Economic Analysis, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/GDP

In the Figure 7, we can see the nominal GDP growth rate versus what we call "real GDP" growth rate, which is an inflation adjusted measure of GDP (i.e., removed from the effect of changes in general price level) that can be calculated as the following:

$$Real\ GDP = \frac{Nominal\ GDP}{\frac{GDP\ Deflator}{100}}$$

Where:

$$GDP\ Deflator = \frac{Value\ of\ current\ year\ output\ at\ current\ year\ prices}{Value\ of\ current\ year\ output\ at\ base\ year\ prices} \times 100$$

[13] We develop this topic in the part 2 of this master's thesis

Inflation is also used to measure the real performance of a financial investment:

$$Real\ Return\ Rate = \frac{(1 + Nominal\ Return\ Rate)}{(1 + Inflation\ Rate)} - 1$$

Inflation can be analyzed under two different perspectives: the headline inflation, and the core inflation.

1.1.1. Headline Inflation

Headline inflation is defined as the inflation rate of all goods and services. Headline inflation can be considered as the raw inflation rate, with no adjustment to remove goods or services that have higher volatility. Headline inflation may not accurately represent a trend because inflation spikes within some specifics sectors can happen with temporary effects.

Most of the time, observers and policymaker will then use, to complete their analysis, another indicator to better understand the dynamic of inflation: the core inflation.

1.1.2. Core Inflation

Core inflation is defined as the inflation rate of all goods and services except food and energy. These two items are excluded in the calculation of core inflation due to their high volatility. Indeed, food and energy are subject to political and geopolitical tension due to the structure of the supply (as we can see currently with the Russian and Ukrainian crisis)[14]. With climate change, food is also more exposed to climate disaster that affect supply[15] and impact prices. This is why core inflation excludes the most volatile commodities in his calculation.

Core inflation can also be a better indicator and signal of inflation trend in a country, especially if the country depends on imports of volatile raw commodities such as fossil fuels.

In cases where core inflation is low compared to the headline inflation, it can be difficult for central bank to fight against inflation because most of the inflation is imported from outside, and therefore, a tightening from the policymaker may not have the expected result and can have side effects[16].

[14] https://www.lemonde.fr/en/opinion/article/2022/07/25/ukrainian-wheat-keeping-a-fragile-agreement-alive_5991378_23.html
[15] https://www.hsbc.com/insight/topics/commodities-adapt-to-climate-change
[16] We will detail more explicitly this point in the third part of this work.

1.2. Inflation measurement

Economists use several price indices to measure the rise of prices. Price indices are usually representing the average of a basket of goods and services. We will focus here on the three main indexes followed by the financial markets.

1.2.1. Consumer Price Index

The Consumer Price Index (CPI) is a metric that allow to track inflation. This indicator measures the monthly change in price paid by households for a given basket of goods and services. CPI is generally the most commented indicator when it comes to inflation. Central bankers, but also market operators and even the public are paying special attention to CPI. For central banks, CPI is an indicator that allow to better adjust their monetary policy. For government, CPI is a sensitive topic as it represents a strategical point in citizen opinion (a high inflation can lead to political and social tension both in developed and emerging countries[17]).

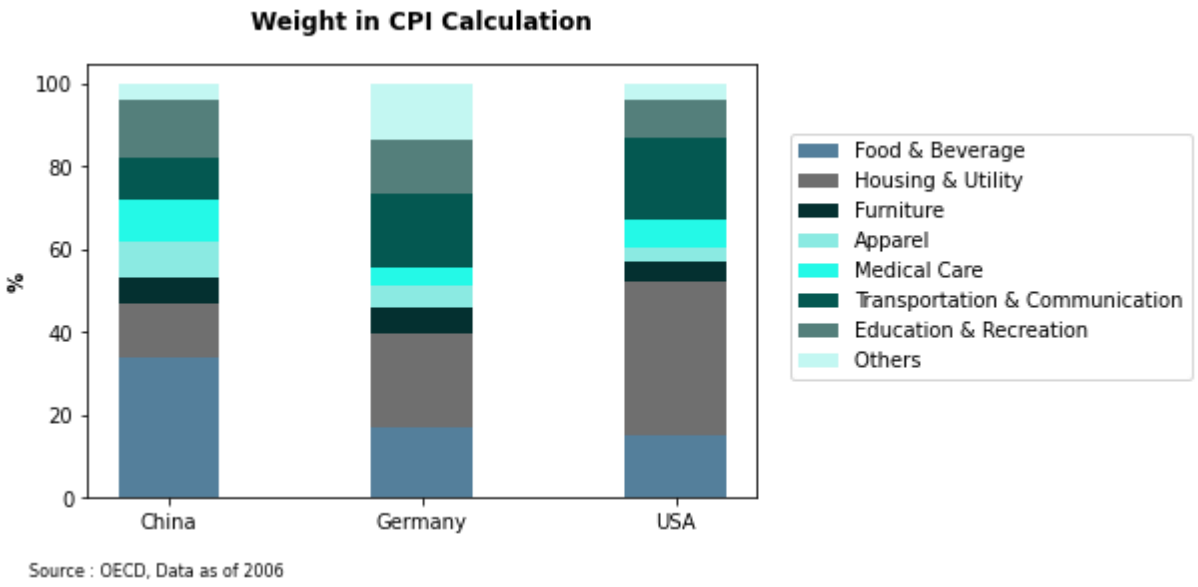
CPI is also used as a reference rate in financial market like for the Treasury Inflation Protected Securities (TIPS, bond to hedge against inflation) or some derivatives contracts like inflation swaps.

Most of the time, the CPI is calculated from consumer survey. Each country use, through their official economic statistical office, their own formula to calculate their CPI. This means that some goods (housing, food, energy, etc.) don't have the same weight in the CPI calculation for different countries. Weights are intended to reflect relative importance percentage of goods and services in total household consumption. In Europe, and especially for the Euro Area, the calculation of CPI is harmonized to ensure consistency when it comes to analysis inflation between countries. Through this common methodology, inflation data can be compared from country to country. This indicator is called Harmonized Index of Consumer Prices (HICP).

[17] https://www.cnbc.com/2022/07/21/inflation-in-sri-lanka-will-hit-70percent-says-central-banker.html https://www.lesechos.fr/economie-france/conjoncture/la-baisse-de-moral-des-francais-mauvais-signal-pour-la-consommation-1779021

Hereafter, we can see, for instance, how different countries are weighting different component in the calculus of CPI:

Figure 8 - Weighting of CPI Component



To echo to the previous dichotomy between headline and core inflation, CPI level is considered as the headline inflation while the CPI adjusted from food and energy is used as the core inflation level.

1.2.2. Personal Consumption Expenditures Price Index

The Personal Consumption Expenditures (PCE) is evaluating the consumer spending. PCE include both durable and non-durable consumption of goods and services. Based on the PCE, the Personal Consumption Expenditures Price Index (PCEPI), which is a metric that measures the change of prices from business surveys, is calculated. PCEPI can therefore be considered as more reliable and accurate indicator by policymakers.

The PCEPI can be used as a complement to the CPI, especially in US, where the CPI is calculated only on urban areas: PCEPI considers all households among the country. Also, PCEPI will cover a wider range of goods and services that makes it less volatile compared to the CPI (see part 1.3. below).

1.2.3. Production Price Index

The Production Price Index (PPI) is a metric that allow to track inflation from a different perspective than the CPI and PCEPI. As their names says, while CPI and PCEPI are taking the perspective of the consumer (i.e., the final price paid by the client), PPI is taking the point of view of producers. PPI will then measure the average change of prices experienced by the producers of several commodities.

PPI is sometimes seen as an advanced indicator of consumer price change (CPI). Indeed, for sales or earning purposes, companies are not keen to transfer the increase in their costs immediately to the clients. In this sense, the PPI can be a leading indicator of CPI. As for the CPI, PPI is calculated differently from country to country, with different weights associated to the different commodities. This is notably due to the structural difference in the industry of each country. If on the short run, PPI and CPI can take different trend, they always converge in the long-term period (see part 1.3. below).

1.3. Dynamic of Inflation in US and Europe since the 1970s

The recent rally of inflation has been very commentated and contrast with the last decades where level of inflation where low in the US and Euro zone despite accommodative monetary policies led by central bankers. But before analyzing the current situation, we need to do a recall about the evolution and trajectory of inflation since the 1970s.

To describe the trend of inflation in US and Europe during the last 40 years, we will use the indicators described in the previous section (CPI, HCPI, PPI and PCEPI).

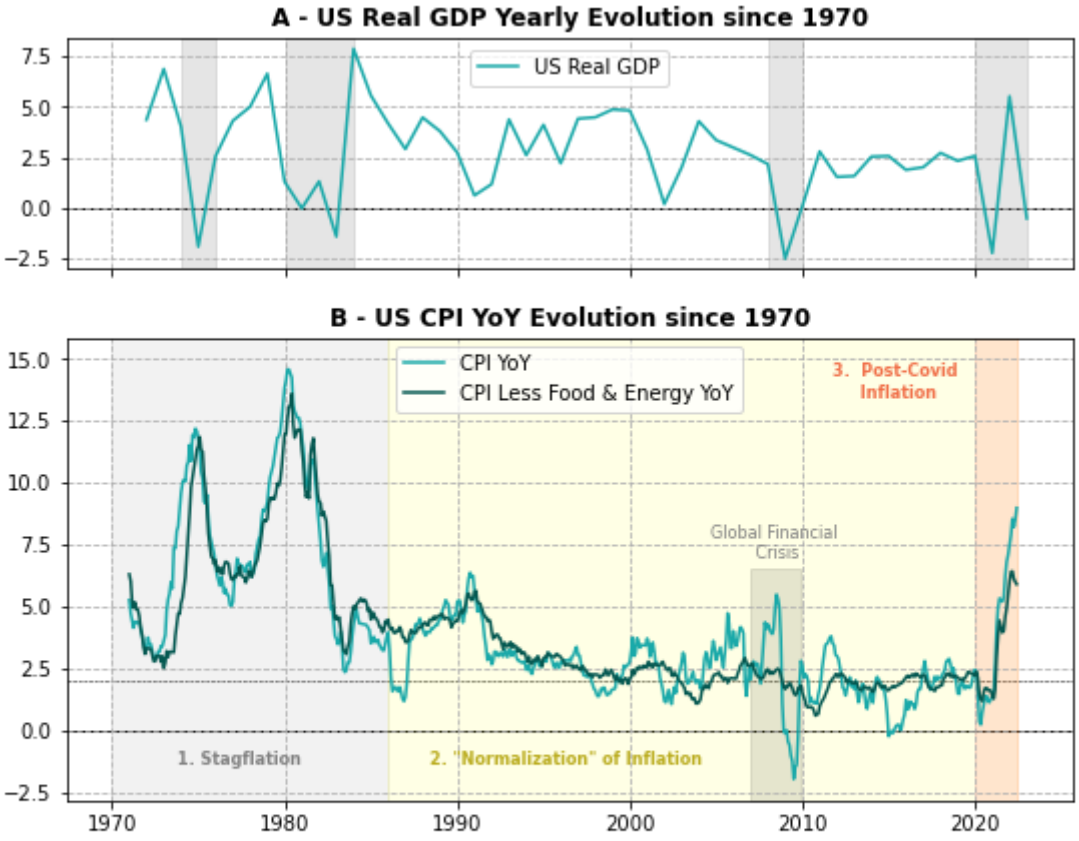
1.3.1. Dynamic of US Inflation

Starting by US inflation, we can breakdown the evolution of inflation into 3 main periods (Figure 9). The first period, going on from the of the 1970s to 1983, has seen very strong increase of price change, with double-digit inflation (Figure 9) and low level of growth (period of stagflation). Many factors explain inflation over this period. The most common reason given to explain this phenomenon is the crude oil supply shocks (Figure 10 and 11). The first shock occurs in 1973, when countries from Organization of the Petroleum Exporting Countries (OPEC) have decided, in reaction of the Kippur War, to reduce the production of crude oil, increase the prices and to put in place an embargo against the countries allied with Israel (mainly US and Netherlands). According to some economists[18], the end of the Bretton Wood Agreement, which have led to a drop of the US dollars, have also contributed to the decisions of the OPEC (oil being denominated in dollars, it has reduced the revenues of OPEC countries). In addition, some study may have explained that US have reached their "oil peak" in 1970[19], adding another catalyst that constraining the supply. The second crude oil shock occurred in 1979, with the Iranian revolution. The revolution has caused a reduction of approximatively 4%[20] of crude oil supply, which was enough to trigger a new supply shock.

[18] Hammes, D., & Wills, D. (2005). Black Gold: The End of Bretton Woods and the Oil-Price Shocks of the 1970s. The Independent Review, 9(4), 501–511. http://www.jstor.org/stable/24562081
[19] http://geoconfluences.ens-lyon.fr/glossaire/peak-oil-pic-de-hubbert/@@aws-content-pdfbook
[20] http://www.time.com/time/magazine/article/0,9171,946222,00.html

These two crude oil shocks were followed by a strong deceleration of inflation ("*double digit inflation went away by itself*"[21], Figure 9, 12 and 13).

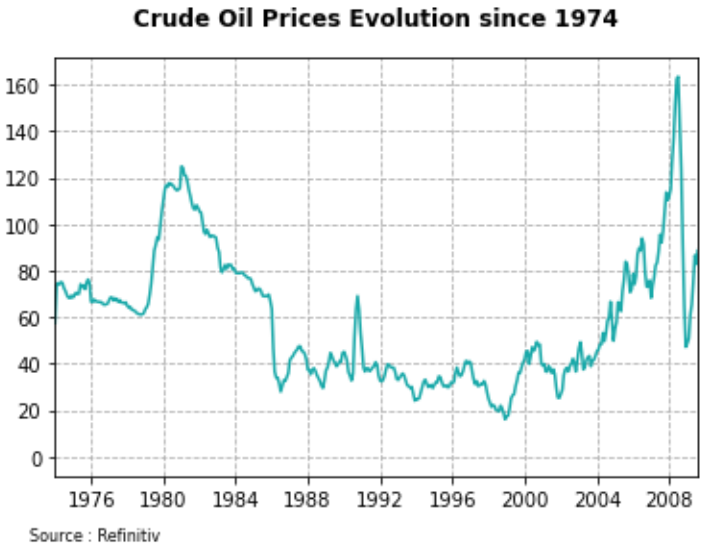
Figure 9 - Headline and Core Inflation in US (CPI)



Source : U.S. Bureau of Economic Analysis, Real Gross Domestic Product [GDPC1], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/GDPC1
U.S. Bureau of Labor Statistics, Consumer Price Index for All Urban Consumers: All Items in U.S. City Average [CPIAUCSL], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/CPIAUCSL
U.S. Bureau of Labor Statistics, Consumer Price Index for All Urban Consumers: All Items Less Food and Energy in U.S. City Average, retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/CPILFESL

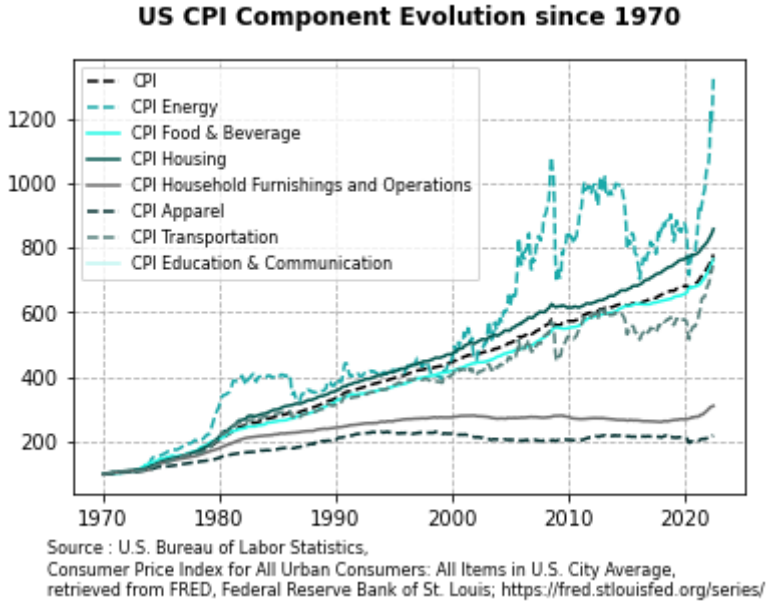
[21] Blinder, Alan S.. "12. The Anatomy of Double-Digit Inflation in the 1970s". *Inflation: Causes and Effects*, edited by Robert E. Hall, Chicago: University of Chicago Press, 2009, pp. 261-282.

Figure 10 - Crude Oil Shocks Impact



An analysis of CPI evolution by component shows that most of the increase of CPI in US from 1970 to 1985 is due to energy prices increasing (Figure 11). Housing together with food and beverage also have a significant impact:

Figure 11 - Breakdown of US CPI Evolution



But if we explore more deeply the reason of this double-digit inflation during the seventies, other factors appear. Indeed, after the World War II, a high period of economic expansion has start. This period, called “the glorious thirty”, which lead to full employment and strong growth in the US and industrialized countries, was characterized by the development of globalization and Keynesian type of fiscal and monetary policies. Demand-

side policies reached their limits with the overheating of the economy at the end of 1960s and the beginning of 1970s. With the end of Bretton Woods Agreement acting as a catalyst of a "regime shift", the financial globalization took place. As a consequence, most of the asset were therefore priced on financial market, especially foreign exchange rate (floating exchange rate). Considering all of this, some economists see the oil shocks describe above as not the main reason of the stagflation, pointing instead to the role of monetary policies[22]

At the end of the 1970s, the worsening of the inflation and unemployment rate have definitively marked the end of these Keynesian era policies and the beginning of a more liberal stance in developed countries. The election of liberal political leader in the US and UK led to the "liberal shift" (privatization, competition, deregulation, reduction of the role of the government in the economy, etc.).

In 1979, to fight against inflation, Paul Volcker, newly appointed as the Federal Reserve (Fed) chairman, decided, based on monetarist theory (see below part 2.4) to limit the growth of money supply and to increase interest rate. These measures will help to "win" the fight against inflation (with a drop of price change from 13.5% in 1981 to 3.2% in 1983). But this overcome of inflation happened at the cost of a severe recession in 1982 et 1983 (Figure 9).

The end of the stagflation opened a new era that was characterized by what we call "normalization" of inflation since 1985 (Figure 9), i.e., a decreasing inflation over time (also called disinflation[23]). Except from 1990 to 1991, period marked by the gulf war, and again, tension on crude oil supply, the inflation was constantly decreasing over the time. the 1990s witnessed a particularly large decline of inflation, with, at the beginning of 2000 millennium, a level near to 2%, the target of inflation of central banks. During the 2000s, we can also note that, even though we observe a decline of inflation right after, the Global Financial Crisis (GFC) has not modified structurally the trend of inflation (prices tend to decrease during a crisis due notably to a conjunctural drop of the demand). The 2010s are even more noticeable with inflation very near or below the target of 2% of the central bank and, in 2014 a risk of deflation.

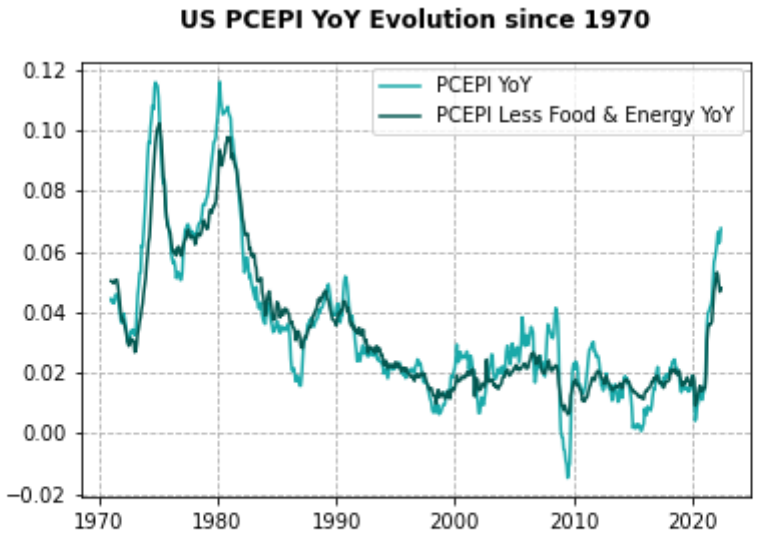
[22] Barsky, R.B. et Kilian, L., 2002. "Do we really know that oil caused great stagflation? A monetary alternative". NBER Macroeconomics Annual 16, 137–197.

[23] Disinflation is used to describe a decreasing inflation (i.e., positive inflation, but with a decrease over time)

The third part to be underlined is the current one, that we called “post covid inflation”. We will develop the main features of this period in the third part of this work. But to establish a quick framework of the situation, the inflation is mostly due to the quick recovery of demand after the covid-19 shock that result in shortage, disorganization and bottleneck of supply chain, basis effect, or geopolitical tensions.

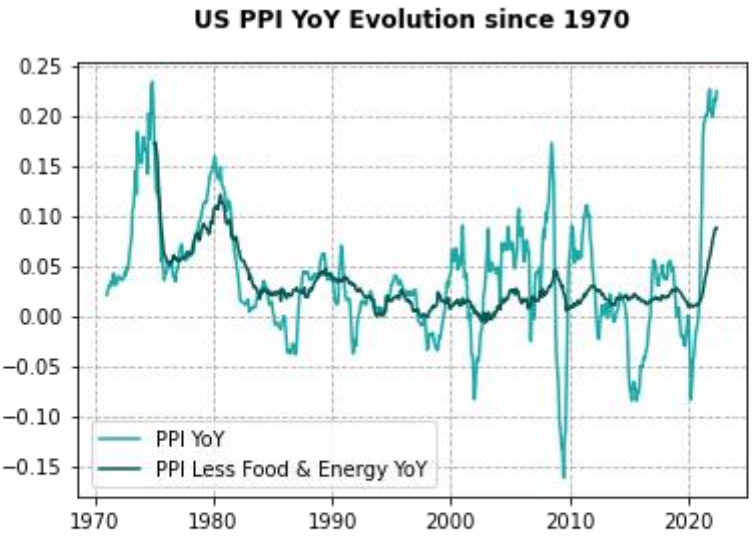
All the observation made about US inflation previously over these different periods can be confirmed through all the different perspectives (consumption with PCEPI and production with PPI, Figure 12 and 13). We can also confirm our previous remarks about core inflation being less volatile than headline inflation and note a significant much more volatility in headline PPI evolution.

Figure 12 - Headline and Core Inflation in US (PCEPI)



Source : U.S. Bureau of Economic Analysis, Personal Consumption Expenditures: Chain-type Price Index [PCEPI], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/PCEPI
U.S. Bureau of Economic Analysis, Personal Consumption Expenditures Excluding Food and Energy (Chain-Type Price Index) [PCEPILFE], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/PCEPILFE

Figure 13 - Headline and Core Inflation in US (PPI)



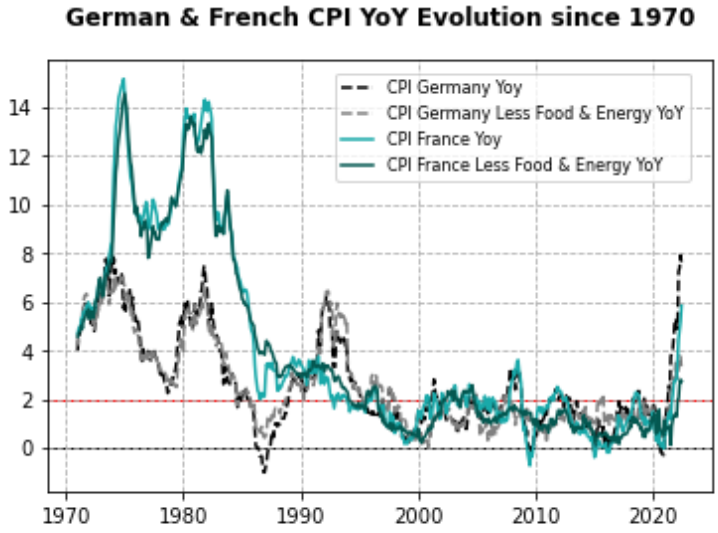
Source : U.S. Bureau of Labor Statistics, Producer Price Index by Commodity: All Commodities [PPIACO], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/PPIACO
U.S. Bureau of Labor Statistics, Producer Price Index by Commodity: Final Demand: Finished Goods Less Foods and Energy [WPSFD4131], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/WPSFD4131

1.3.2. Dynamic of Euro Area Inflation

Similarly to US, the Euro Area inflation can be breakdown in 3 main periods (Figure 14 and 15). Here, for data availability purpose, we will only display HICP data starting from 2000 (Figure 15). But as an example, we can use, to complete the analysis, the CPI values for 2 countries having an important weight in euro zone like France and Germany as a *proxy* (Figure 14).

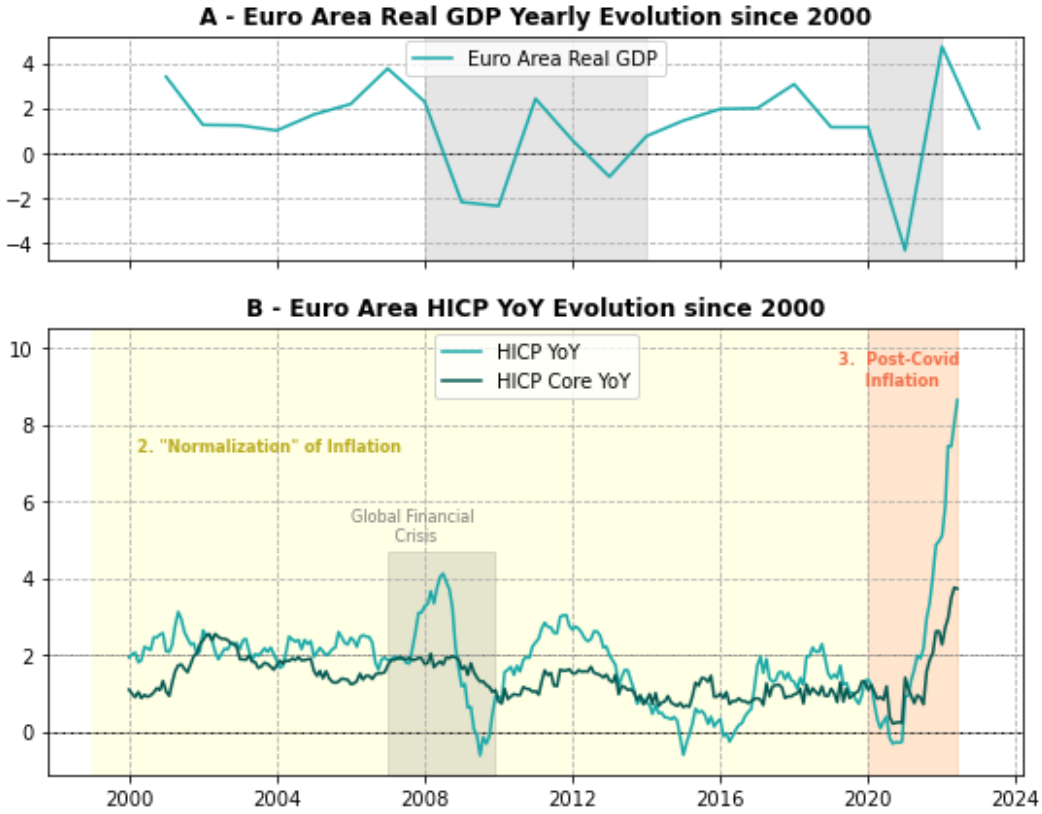
During the first period of stagflation characterized when describing the US inflation, European countries also have undergone the two crude oil shock of 1973 and 1979. We can notice that France has undergone the situation far more than Germany (Figure 14) with double digit inflation. Reasons of the inflation (that we will not develop again hereafter) are the same as for the US: end of Bretton Woods Agreement, too high labor costs in a context of increasing globalization when Asian countries with lower labor and material costs are beginning to compete with developed countries, limits of Keynesian fiscal policies, etc.

Figure 14 - Germany & France Inflation (CPI)



Source : Organization for Economic Co-operation and Development,
Consumer Price Index of All Items in Germany and France,
retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/

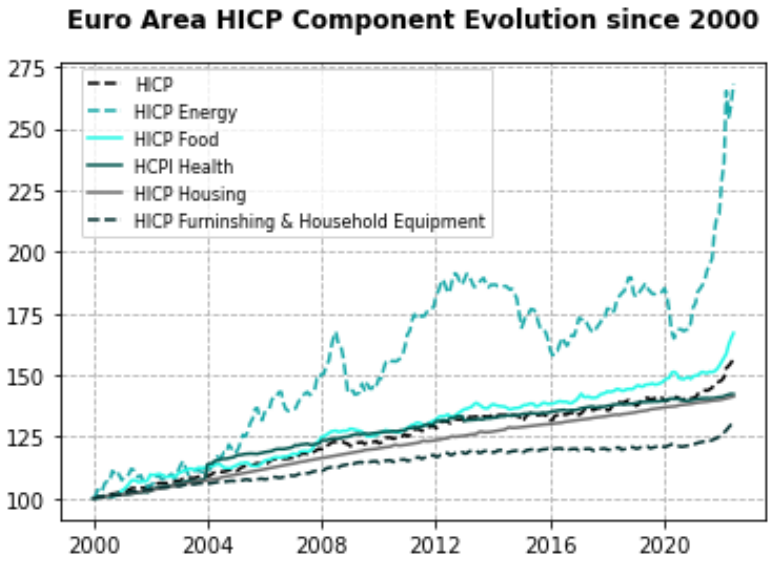
Figure 15 - Headline and Core Inflation in Euro Area (HCPI)



Source : Eurostat, Real Gross Domestic Product (Euro/ECU series) for Euro area (19 countries) [CLVMEURSCAB1GQEA19],
retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/CLVMEURSCAB1GQEA19
Eurostat, Harmonized Index of Consumer Prices: All Items for Euro area (19 countries) [CP0000EZ19M086NEST],
retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/CP0000EZ19M086NEST
Organization for Economic Co-operation and Development, Consumer Price Index: Harmonized Prices:
Total All Items Less Food, Energy, Tobacco, and Alcohol for the Euro Area [CPHPLA01EZM661N],
retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/CPHPLA01EZM661N

The Euro Area has also experienced a stage of “normalization” of inflation after the stagflation period. We observe a high drop of inflation both in Germany and France, at the end of 1980s. In that sense, Euro Area has struggled more with inflation: while US inflation was back near to the 3% level in 1983, this level has been only reached in 1985 in Germany and at the end of the 1980s for France. This large disinflation was quite stable during the 2000s and again, the Global Financial Crisis did not change structurally the trend of inflation in Euro Area. During the 2010s, the core inflation was well established below the target of 2% of the ECB. As for the US, the headline inflation was in negative territory in 2014 (deflation).

Figure 16 - Breakdown of Euro Area HICP Evolution

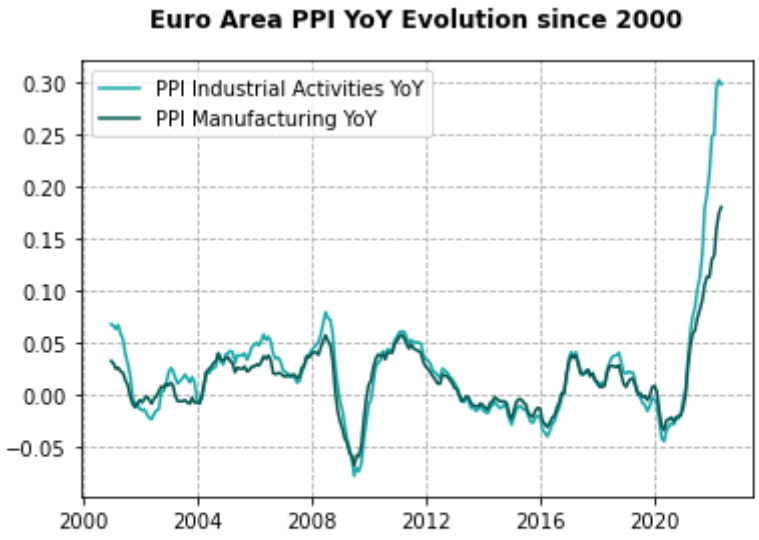


Source : Eurostat, Harmonized Index of Consumer Prices,
retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/

After the covid-19 shock, euro zone countries have also started to experience a high level of price change with kind of a “synchronization” of inflation in US and Europe. If we will develop this topic in the third part of this work, we can already make some interesting preliminary observations about the post covid inflation. US core inflation is currently higher (relatively to headline inflation) in US than in the Euro Area, this is notably due to the proximity of Europe to the Ukrainian conflict and the fact that Europe is dependent of external fossil fuel imports. Remarks made about US headline inflation being more volatile than the core inflation are also true for the euro zone headline and core inflation.

To complete the analysis, we can observe that PPI has followed the same trend as the HCPI (Figure 17). We can however notice that Euro Area PPI was less volatile than the US CPI.

Figure 17 - Inflation in Euro Area (PPI)



Source : Organization for Economic Co-operation and Development,
Producer Prices Index: Economic Activities: Total Industrial Activities for the Euro Area [PIEATI01EZM661N],
retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/PIEATI01EZM661N
Organization for Economic Co-operation and Development,
Producer Prices Index: Economic Activities: Total Manufacturing for the Euro Area [PIEAMP01EZM661N],
retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/PIEAMP01EZM661N

To sum up all the observations, we can distinguish three main cycles of inflation during the last fifty years. The first one, that is nowadays highly used to establish an analogy with current situation, is the stagflation. The period of stagflation, with double digit inflation and low level of growth, was due notably to oil crisis but also because of the policies led after the World War II. Once US and European countries have "resolved" the issue of inflation (with desynchronization), the following thirty years were stamped by low level of inflation (disinflation). The Global Financial Crisis has not modified structurally this trend of this decreasing inflation.

Not only the inflation was at a low level constantly decreasing for 40 years but it was considered extinct in some developed countries[24]. Moreover, this low level of inflation has even led to a fear of deflation[25] especially in Europe, where in 2014, the price curve was flirting with negative HICP value.

This decrease of inflation and the fear of deflation is even more surprising that the 2010s has been a very particular decade regarding monetary policy. Indeed, the 2010s

[24] https://www.stlouisfed.org/publications/regional-economist/first-quarter-2018/why-inflation-so-low
[25] https://www.letemps.ch/economie/deflation-choc-energetique-grand-ecart-bce

inflation data cannot be commentated without a recap about all new unconventional tools deployed both by the US Federal Reserve and the European Central Banks to revive struggling economies after the subprime crisis and the sovereign debt crisis in Europe[26].

[26] We develop this topic in the third part of this work

2. Inflation in economic theory

For a long time, barter was the only means of payment. To obtain a product, a buyer had to be able to exchange one for another, with all the disadvantages that this could require. One of these disadvantages was about the indivisibility of goods: a buyer could not, for example, exchange half an apple for a pear. On the other hand, for large volume payments, storage and the perishable nature of a commodity quickly became problematic, requiring either a suitable storage place or rapid consumption. But the main disadvantage of barter comes from its nature. It requires a double coincidence of needs (the seller must be interested in what you offer in exchange) which is very restrictive. To overcome these constraints, a universal good, accepted by all, must be able to be exchanged for any type of merchandise. This is precisely the role that money will play.

The first type of money to be developed was metallic money. It was manufactured, as its name indicates it, starting from metals which are generally precious. Traces of the first payments in metallic money were found in Lydia (old country of Asia Minor). However, it is mainly under the impulse of the Greeks and the Romans, that the use of metallic money will be developed. Silver and gold then became, thanks to their "unalterable" characteristics, official currencies and inaugurated a bi-metallic monetary system that would last for several centuries. Despite its great efficiency, metallic money quickly reached its limits. As the stocks of these precious metals were not infinite, shortages occurred and the quantity of money in circulation quickly became insufficient. To get around this problem, China conceived a second type of money in the 6th century. This one is no longer based on precious metals, but on paper. The value of the money was indicated on banknotes and allowed for the exchange of all types of goods. In fact, money loses all intrinsic value. Its acceptance, and therefore its value, is based solely on the trust placed in it by its users: this is what is known as fiduciary money. The use of these two types of money (metallic and fiduciary) will spread widely in the different civilizations and will gradually replace barter, constituting a major progress. As an intermediary for exchanges, a unit of economic account and a store of value, money made up for the major shortcomings of barter and facilitated exchanges. Exchanges were thus centralized, and merchants no longer necessarily needed to travel with their goods.

The use of “paper” money will intensify and spread from the 16th century. It is widely accepted today and constitutes one of the bases of the current economic and financial system. However, gold has not disappeared, it was used for a long time as a standard for currencies and remains, even today, an important tangible asset for central banks and investors. It should also be noted that although today money has replaced barter, these two methods of payment have in fact coexisted to a large extent throughout history.

The development of fiduciary money has been possible due to the emergence of new actors: commercial banks. It is during the Antiquity in Mesopotamia that we find the traces of the first banks. In Ur and Babylon, banks were set up in the middle of temples and facilitated trade through the lending of goods. As usury was forbidden, the activity remained very controlled by religion and the first operations were relatively simple. Under the Roman Empire, the banking activity became stronger and left the religious framework: private bankers took over. The privatization of the banking activity represents a key stage: from this moment on, new services are developed. Deposits and loans, which help to economic development, are the key services offered by the banks. These services lead to a mismatch between the stocks of physical money available (mostly metallic) and fiduciary money available in the economy. Banks therefore began to participate directly in the financing of exchanges. This financing took the form of loans granted to merchants and navigators who led maritime expeditions (the products brought back then served as a guarantee in case the loan was not repaid). It is notably through this means that Italy became a leading banking center. With the experience they had acquired in the commercial field, the banks understood the need to be present in the main European trading centers (Amsterdam, Antwerp, Bruges, etc.). These places the greatest houses (the Medicis and Peruzzi of Florence, the Spinola of Genoa, the Fugger and Welser of Augsburg) set up branches everywhere in Europe. Banks will then maintain a close relationship with money[27]. The fractional-reserve banking that will born from the development of banks is at the center of our current monetary and financial system. It is also an essential channel for central banks to transmit monetary policy.

[27] https://www.lesechos.fr/idees-debats/leadership-management/1657-la-fin-des-fugger-banquiers-de-leurope-1783384

The appearance of banks and fiduciary money was accompanied by an unprecedented economic phenomenon that will lead Romans to reinvent their monetary system in the 3rd century or even to the end of Spanish leadership in the 16th century: inflation. In history, inflation do not appear as a recurrent or "systematic" issue but more as a consequence of a disequilibrium in economy.

Different interpretations have been established on the root of this disequilibrium. The most common interpretation is coming from the monetary perspective. Symbolize by the famous quote of Milton Friedman, *"Inflation is always and everywhere a monetary phenomenon"*, this theory explain inflation by an inadequate increase in the money supply. In their analysis, the monetarist also focusses on the role of velocity of money (i.e., "*the frequency at which one unit of currency is used to purchase domestically- produced goods and services within a given time period"*[28]*)* and the role of central banks in the conduct of their monetary policies. On the other hand, Keynes explain that inflation can be a monetary phenomenon only if the economy is in a full employment situation and use all their production capacities. According to him, inflation is due to a mismatch between supply and demand when supply is at its full capacity. Another perspective analyze inflation from a cost perspective. Considering this theory, which is at the crossroads of those mentioned above, wages growing faster than the productivity, debt cost, or even cost of imports, are at the origin of inflation. Let's see how all these theories help us to understand inflation.

[28] https://fred.stlouisfed.org/series/M2V#:~:text=The%20velocity%20of%20money%20is,services%20per%20unit%20of%20time.

2.1. Quantity Theory of Money

Monetarist-type theories were one the first to be developed to explain inflationary phenomena. In the 16th century, we are witnessing an 8-fold increase in gold and silver in Europe. The Kingdom of Spain, which is the wealthiest nation in Europe, will become poorer due to a high inflation. At that time, economists consider that inflation is mainly due to monetary manipulation (like in the Roman empire when the quantity of precious metals in gold, silver and bronze coins is reduced whereas the nominal value stay constant). J. Bodin, a French economist of the 16th century, will bring another analysis and make a link between the quantity of money available and the rise of prices[29]. His analysis shows that, pushed by mercantilist doctrine, and more precisely bullionism (a Spanish version of mercantilism), that considered that the wealth of nation is linked to the quantity of gold owned, Spanish have accumulated massive quantity of gold from their colonies. Moreover, to keep their wealth, they consider that gold should not be exchange with foreign countries. This massive flood of money in circulation in the economy will lead to inflation. Among the explanation bring by Jean Bodin, the excess of gold in circulation, was one the main reason explaining inflation. The massive inflow of precious metals has led, according to him, to inflation and the drop of money value.

During the 17th and 18th century, other economists and philosophers from Scottish Enlightenment (like William Petty or David Hume) will produce study and analysis that goes on the direction of J. Bodin conclusions. John Locke, another English philosopher, will detail the mechanism of trimming of money that leads to a flight of money out of the country. Richard Cantillon, and Irish economist, will describe the mechanism where an increase of money supply exercise a progressive and differentiated impacts on prices (also known as "Cantillon effect"). The Cantillon effect describes the inequal effect of monetary policies on the economy. This is because the newly created money is not distributed simultaneously or evenly throughout the population. The process of monetary expansion therefore involves a transfer of wealth. He developed this idea by studying the massive arrival of gold in Spain from the South American colonies in the 16th century. According to him, the abundance of precious metals caused inflation because price increases spread all over the economy from

[29] https://www.lemonde.fr/economie/article/2010/06/28/jean-bodin-et-la-premiere-mesure-de-l-inflation-par-jacques-marie-vaslin_1379775_3234.html

its entry point. In this case, he attributes the Spanish inflation to the price increase of king's suppliers. Moreover, the "Cantillon effect" shows that the more a sector or an asset is close to the money supply creation, the more this sector or asset will see its prices increases.

In the 19th century, David Ricardo, a British classical economist, will attributes the rise in the price of gold, and the inflation that his country is experiencing, to an excessive issue of money. He explains that the overall value of goods to be exchanged in the economy is determined by the available stock of metal. Inflation can therefore only come from an increase in gold stock or from the multiplication of the means of payment. He will advocate that the issuance of banknote should be limited and backed by the stock of gold to guarantee its value.

All these observations made by J. Bodin, W. Petty, J. Locke, D. Hume, or D. Ricardo will lead to the formulation of the Quantity Theory of Money by Irving Fisher in the beginning of the 20th century.

Result of all the previous monetarist observations, Quantity Theory of Money (QTM), which states that the price level is proportional to the total stock of money supply, can be describe by the following formula developed by Irvin Fisher in 1907.

$$MV = PT$$

Where:

$$M = Total\ Stock\ of\ Money$$

$$V = Velocity\ of\ Money$$

$$P = Prices\ Level$$

$$T = Amount\ of\ Transaction$$

This formula shows that if the increase of the $Total\ Stock\ of\ Money$ (M) is greater than production level of a country (with $V, Velocity\ of\ Money$ being constant), the $Prices\ Level$ (P) will also increase so the global value of all exchanges (PT) will be equal to the variation of $Total\ Stock\ of\ Money$ (M). The theory assumes that T and V are exogenous. T being determined by law of supply-demand and V being determined by behaviors and institutions. In other words, if the money supply (M) rise by 10%, Prices (P) will also rise by 10%. It results from this formula that any increase (disconnected from the

real production) in the total stock of money will cause inflation. According to the QTM, the level of inflation can be therefore driven by the control of the total stock of money.

The Quantity Theory of Money implies a dichotomy between real sphere and monetary sphere. For QTM supporters, this dichotomy means that, as explain above, the variation of money supply only impact nominal variable in the economy such as prices and not the real production or the level of supply. QTM therefore defined money as "neutral": money is only a "veil" that covers the real economy. Variations in the quantity of money in circulation have no impact on the level of production and only affect the general price level. There is no demand for money for its own sake: money only serves to be transformed into demand for real goods or services.

To consider more precisely the QTM, another very similar equation, that distinguish the deposit from the fiduciary money (banknote and coins) is used (both deposit and fiduciary money have their own velocity):

$$MV + M'V' = PT$$

Where:

$$M = Total\ Stock\ of\ Fiduciary\ Money$$

$$V = Velocity\ of\ Fiduciary\ Money$$

$$M' = Total\ Stock\ of\ Deposit$$

$$V' = Velocity\ of\ Deposit\ Stock$$

$$P = Prices\ Level$$

$$T = Amount\ of\ Transaction$$

2.2. Cambridge equation

The Cambridge equation (which is stated below) is an alternative version of the Quantity Theory of Money. If, as the QTM, the Cambridge equation also tries to establish a link between the total stock of money and the level of prices, it brings a new approach by considering the money demand instead of supply.

$$M = kPY$$

Where:

$$M = Total\ Stock\ of\ Money$$

$$k = \ Coefficient\ reflecting\ monetary\ behaviours^{30}$$

$$P = Prices\ Level$$

$$Y = Real\ National\ Income$$

In the Cambridge equation, the velocity of money is equal to the inverse of k such as:

$$M\frac{1}{k} = PY$$

The equation of Cambridge has been developed by economists associated with Cambridge University (A. Marshall, Pigou, Robertson or even Keynes). According to them, there can be a demand of money for itself, meaning that economic agent can be keen to hold cash for its features (security, non-synchronization between revenues and expenses, etc.). In this approach, money is also a store of value, which can be desired for its own sake, and whose circulation or not depends in part on the desire of economic agents to hold liquidity.

This equation therefore highlights the fact that the quantity of money demanded influences the money supply in circulation.

2.3. Keynesian theory of inflation

In the traditional historic economic literature, the 20th century saw a refocusing of debates around two blocks: one made up of Keynesians, the other made up of classical and neoclassical economists (who form, by the way, a very heterogeneous group). Behind the opposition between these two blocks of economists, we often find disagreements around the idea that the economy is self-adjusting in the long run ("invisible hand"[31] of Adam Smith). Keynes assume that economy is not self-adjusting and therefore, intervention of public authorities is needed to prevent and correct market failures. The debate also turns about the opposition between supply and demand. Keynesians are opposed to a theory developed by J-B. Say in 1803 that *"supply creates its own demand"* and thinks that demand-side policies are better to stimulate economic growth. Moreover, Keynesians do not adhere

[30] The value of k can be different depending on the authors.

[31] Adam Smith, Recherches sur la nature et les causes de la richesse des nations, Livre IV, ch. 2, 1776 ; d'après réédition, éd. Flammarion, 1991, tome II p. 42-43.

to the QTM theory and consider that an expansion of total stock of money do have effects on the production. In their view, monetary creation can help to boost growth and employment. On the opposite side, a reduction in the money supply will lead to an increase in the interest rate (at constant money demand). This leads to a reduction in investment and thus in demand, which has a negative impact on the level of production. If an increase in total stock of money lead to inflation, it would be due to the incapacity of the supply to adapt to the demand (because adjustment will be made from prices instead by the produced quantity). They thus reject the dichotomy between real and monetary sphere by considering that money is not neutral.

For Keynes, money is demanded for its own sake. He distinguishes, more precisely, three reasons for holding money: transaction, precautionary and speculative reasons. This imply that, if economic agents have more money at their disposal, they will be keener to spent or invest, which will lead to an economic stimulation. From the QTM, Keynes also criticizes the hypothesis considering the stability of the velocity of money. According to him, an increase in the money supply led to a decrease of the velocity of money but can also change depending on the degree of confidence of economic agents. As well as the interest rate, the degree of confidence of economic agents will also determine the liquidity preference. Therefore, explain Keynesians, velocity of money cannot be stable. What matter the most in the Keynesian analysis is the marginal propension to consume (the share of a household's disposable income that is spent on consumption, the only stable element of the Keynesianism system).

Based on the work of Philips (see part 2.6 below), Keynesian also believe that if any inflation occurs in economy it will helps to reach full employment. This theory, as we have seen in the part 1.3., did not work during the stagflation of the 1970s.

2.4. Friedman and the monetarist

"*Inflation is always and everywhere a monetary phenomenon*"[32]

Monetarist theory has started to be developed at the beginning of 1960s under the impulse of Milton Friedman and in opposition to Keynesian theory. In line with the Quantity Theory of Money, monetarists think that an increase of money supply will necessarily lead to inflation, if this increase is not accompanied by a proportional increase in production. Moreover, monetarist also recognize the "neutrality" of money: monetary policies have no impact on production. But monetarists offer a slightly different analysis from the original proponents of the quantity theory of money. They admit that, on the short term, an increase of money supply can have an impact on demand (this idea will be subject to debate between monetarist later). The reasoning behind this idea is that when there is an increase in the money supply, economic agents will have an excess of cash that will be immediately spent. But in the long term, inflation will erode this "gain" of purchasing power. In that sense, the monetarists abandon the dichotomy between real and monetary sphere.

Milton Friedman have specified the demand of money through the following formula:

$$\frac{M^d}{P} = f(y, w; RM, RB, RE, Gp; u)$$

Where:

$$M^d = Total\ Stock\ of\ Money\ Demanded$$

$$P = Prices\ Level$$

$$y = Real\ Income$$

$$w = Ratio\ of\ Non\ Human\ to\ Human\ Wealth$$

$$RM = Expected\ Nominal\ Rate\ Return\ on\ Money$$

$$RB = Expected\ Nominal\ Rate\ Return\ on\ Bonds$$

$$RE = Expected\ Nominal\ Rate\ Return\ on\ Equities$$

$$Gp = Inflation\ Expected\ Rate$$

$$u = All\ other\ variable\ that\ can\ impact\ the\ utility\ attached\ to\ the\ services\ of\ money$$

[32] https://www.frbsf.org/our-district/press/presidents-speeches/williams-speeches/2012/july/williams-monetary-policy-money-inflation/#_ftn1

Moreover, while monetarists admit a variation in the velocity of money (notably through the theory of permanent income[33]), they refute the idea of an instability of the velocity of money, as the Keynesians assert.

Friedman has, in addition, extended his thinking about how a monetary policy should be led. He is in favor to the establishment of fixed rules about monetary policies. Friedman thinks that the money supply should grow at a rate equal to the long-term growth rate of the economy because any "excess" of monetary creation will lead to inflation.

Going further, he also pushes the idea that central banks should be abolished. Indeed, Friedman argues that the Great Depression in the US in the 1930s was caused by a wrong monetary policy of the Federal Reserve. According to him, the Fed was at fault for not countering the drop of the money supply when it should have done exactly the opposite[34].

Monetary theory and their critics of Keynesianism will particularly echo in the 1970s when western countries were fighting double digit inflation. As seen previously in this work (see part 1.3.), monetarist theory has been used in the beginning of 1980s by Paul Volcker, the Fed's chairman, to fight -successfully- against inflation.

2.5. Modern Monetary Theory

Modern Monetary Theory (MMT) brings a new framework in the way of analyzing monetary perspective. The central idea of MMT is that money is a public monopoly. Therefore, any country that is sovereign with respect to its currency should control its currency. Behind this idea, MMT defenders argues that government should print as much money as needed to finance all investments and states projects. MMT preconize a monetization of public debt. The proponents of MMT, however, admit that monetary creation cannot be unlimited because of the availability of real resources, like workers or construction supplies.

Main critics about MMT highlights the fact that if such policies were led, public debt would explode, leading to questions about the sustainability and solvency of the debt.

[33] https://www.investopedia.com/terms/p/permanent-income-hypothesis.asp
[34] M. Friedman and A.J. Schwartz, Monetary History of the United States, 1867–1960, 1963

Moreover, as described above with the other monetary theory, this would lead to a very high inflation in countries where this kind of policy would be applied.

In response to these critics, MMT defenders shed light another underlying idea of this theory. If the monetary creation is in the hand of government, credit default of the country cannot happen because they can finance public deficit by printing more money. MMT defenders often use the example of Japan, which have the most important public debt (as % of GDP) in the western world[35] and experiencing deflation for 20 years[36]. Moreover, in the MMT framework, inflation can be controlled through the tax policies. By rising taxes, government can limit the capacity of private economic agents to spent and consume. This would allow the public authorities to avoid overheating of the economy and limit risk of galloping inflation.

After the Global Financial Crisis in 2008, central banks in Europe and US have deployed many Quantitative Easing (QE) programs. The main target of QE is to facilitate funding conditions to economic agents by purchasing a specific amount of financial assets (government bonds, corporate bonds or even stocks). QEs programs were also launched during the covid crisis to help government to finance their public deficit[37]. If QE is not directly considered as part of MMT (because central bank can sell securities bought on the market before their maturities dates), the central idea is quite the same.

2.6. Inflation from a labor cost perspective

The core idea behind the inflation caused by labor cost is that the wages are growing faster than the productivity. This increase of remuneration will encourage companies to raise their prices (notably to maintain their margin), which will itself encourage workers to ask salary increase. In fact, this creates an inflationary process that is self-sustaining. If on the short term this kind of inflationary process can help to preserve growth and employment (because inflation of labor cost extends to the whole economy and leads to an increase of national revenue), on the long run it is harmful to the economy.

[35] https://fr.statista.com/infographie/17989/dette-publique-en-pourcentage-du-pib/#:~:text=Quant%20au%20Japon%2C%20pourtant%20synonyme,int%C3%A9rieur%20brut%20l'ann%C3%A9e%20derni%C3%A8re.

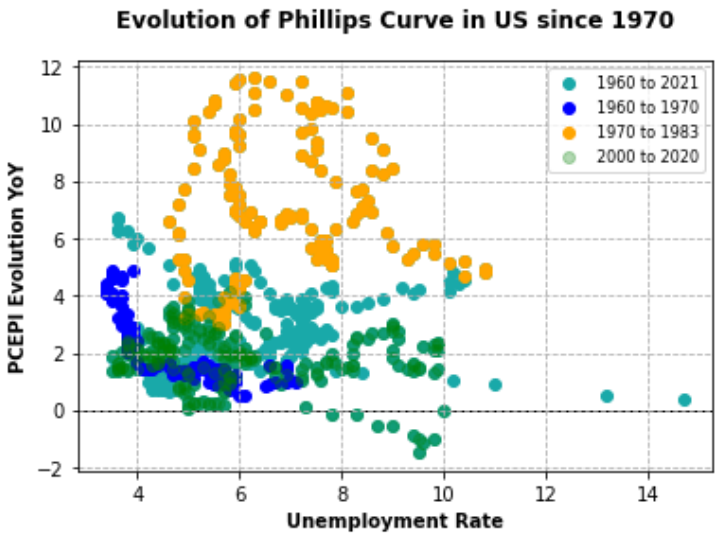
[36] https://www.lemonde.fr/economie/article/2022/03/28/le-japon-pays-de-la-deflation-redecouvre-la-hausse-des-prix_6119468_3234.html

[37] We develop this idea in the third part of this work.

In 1958, A.W. Phillips, an economist, has published an analysis showing an inverse correlation between variation of nominal wages and unemployment rate in Great Britain between 1851 and 1957[38]. Phillips' work will be taken up in 1960 and extended to the analysis of the link between inflation and the unemployment rate. A Keynesian interpretation of the Phillips curve tend to validate the fact that increase of monetary supply (and the increase of demand implied) will be inflationist only if the production is used at fully capacity. Monetarist, on the other hand, critic the idea that a long-term relationship could exist between nominal variation of wages and unemployment rate. To support their demonstration, monetarist use the example of the “monetary illusion”. “Monetary illusion” corresponds to the fact that economic agent’s reason in nominal term instead of real term. Therefore, according to monetarists, if on the short term, inflation can push workers to increase their “supply” (because they see a nominal increase of wages), on the long run, they will find out that the nominal increase of their revenues is not enough to cover inflation.

As seen previously in this work, the 1970s were period with high inflation and growing unemployment in US and Europe which have invalidate the relation of Phillips curve (Figure 18). Despite this episode, the following period (“normalization of inflation”, see part 1.3) has seen a decrease of the wage’s variation (mainly due to the international worker competition) and a stagnation of employment leading to a “comeback” of Philips Curve

Figure 18 - Phillips Curve



Source : U.S. Bureau of Labor Statistics, Unemployment Rate [UNRATE],
retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/UNRATE
U.S. Bureau of Economic Analysis, Personal Consumption Expenditures: Chain-type Price Index [PCEPI],
retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/PCEPI

[38] https://www.stlouisfed.org/open-vault/2020/january/what-is-phillips-curve-why-flattened

3. Analysis of current inflation

3.1. Features of current inflation

In the previous parts of this work, we have introduced some of the key elements about the current inflation (called "Post-Covid Inflation" in the part 1.3. above). Drivers were many: basis effects due to Covid shock, geopolitical issue, supply or demand shock, bottlenecks or even shortage. But to really qualify inflation and its characteristics, we must go into the detail of inflation figures. We will focus on the breakdown of inflation major aggregates (headline and core) but also in the subset of underlying inflation. Moreover, the analysis of inflation and his components will allow us to shed light the differences between US and Euro Area rising prices.

3.1.1. US Inflation

Since the Covid-19 shock, inflation has increased at a very fast pace, from a level near to zero at the climax of the crisis to 9% in the end of June (Figure 19). This is the first time since the 1980s that inflation reach such a level (Figure 9 and 19).

The first semester of 2020 has been marked by a drop of energy prices. With lockdowns in most of the western countries and in China, travels (demand) have been significantly reduced, which have affected prices of energy, especially crude oil. Oil price has even reached negative price on some derivatives contracts at the end of April 2020[39]. Among the main component of inflation, apparel and transportation were also factors in the decline of inflation. Food and beverage, housing, education and communication, or household furnishing and operations remains quite stable during the pandemic and did not seem to have impact inflation strongly (Figure 19).

Starting 2021, the first basis effects came forward. With the mains decrease factors (energy and transportation) back to their pre-crisis level, inflation began to exceed 2%, the target of central bank (Figure 19). Not only, these factors were back to their pre-crisis levels, they also start to rise and remain significantly high during 2021. Combined with this

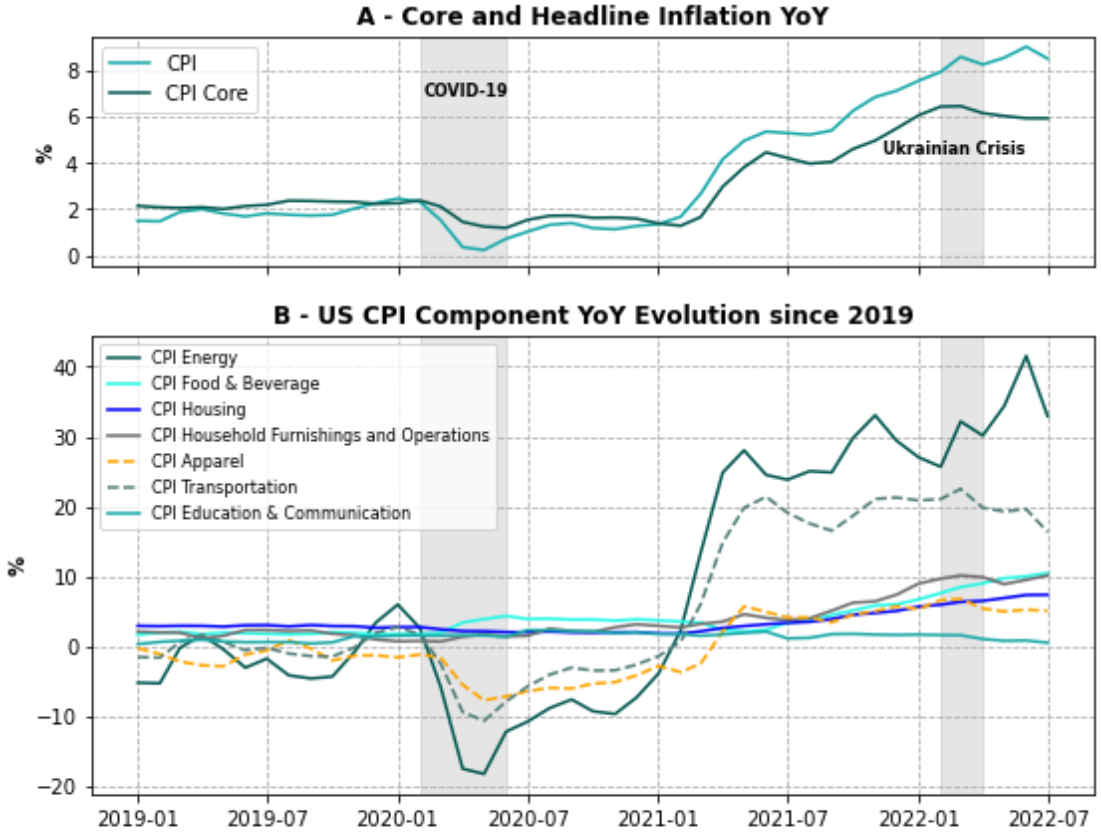
[39] https://www.lesechos.fr/finance-marches/marches-financiers/petrole-le-brut-americain-devisse-en-asie-1196311

phenomenon, other CPI component like food and beverage or household furnishing and operation have started to increase also. At the end of July 2021, most of the basis effects were erased. Still, at this time inflation was not considered as critical by the Federal Reserve (Fed) even if it has become a matter of concern[40].

The occurrence of the Russia and Ukrainian war did not seem to have considerably impacted the inflation component, except the energy sector, that have increase again in the following months. The only main component to remain stable during the whole period is the education and communication sector.

We can notice that even if the main contributor to inflation after the covid shock is energy, core inflation is also increasing at a very high pace and well above the 2% target of the Federal Reserve.

Figure 19 - Breakdown of US CPI Evolution After Covid-19 Shock

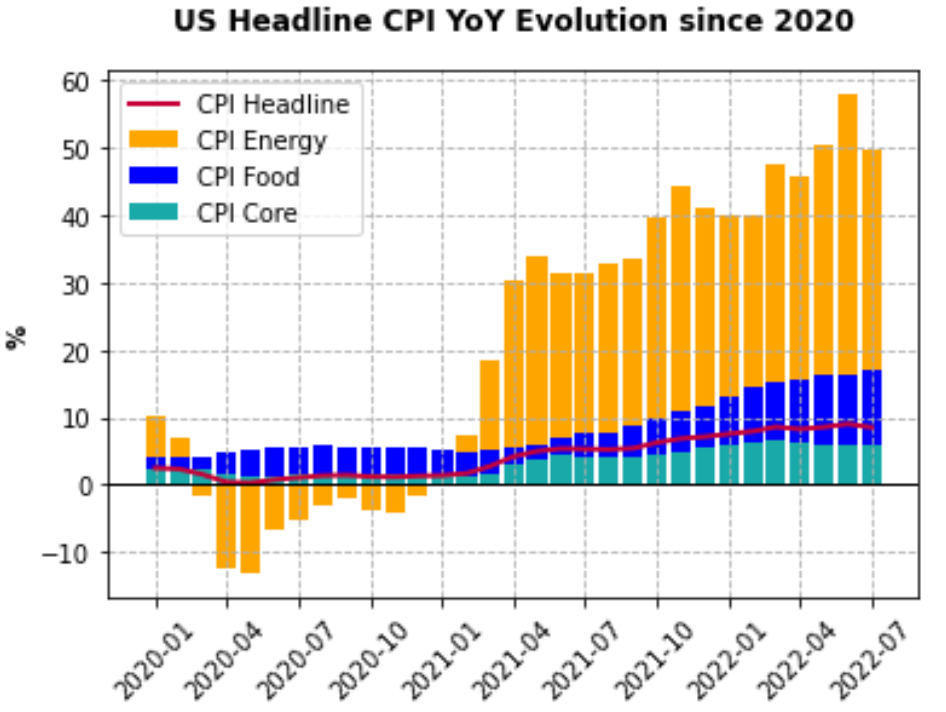


Source : U.S. Bureau of Labor Statistics,
Consumer Price Index for All Urban Consumers: All Items in U.S. City Average,
retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/

[40] https://www.bloomberg.com/news/articles/2021-08-23/jackson-hole-2021-us-inflation-rate-covid-upend-powell-fed-policy-revolution#:~:text=And%20it's%20set%20out%20a,exceed%202%25%20for%20some%20time.

If we analyze the headline inflation, we can establish the same observation as above. From figure 20 we can see that the main contributor was the energy sectors. Food also starts to contribute to the headline inflation starting 2021. We can notice a slight difference between the contribution of these two factors to the inflation. While energy has a huge impact that seem to replicate each month, food has a different pattern. Food contribution to CPI is indeed increasing over time, even if this increase is lower than the energy one. In addition to that, we also see core inflation rising month after month, which confirm our previous comments.

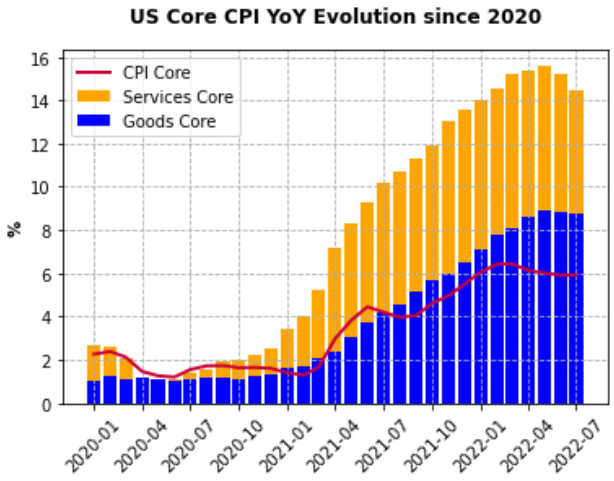
Figure 20 - Breakdown of US Headline Inflation After Covid-19 Shock



Source : U.S. Bureau of Labor Statistics,
Consumer Price Index for All Urban Consumers: All Items in U.S. City Average,
retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/

On the other hand, analysis of core inflation shows that core goods and services have increased significantly starting 2021. Both have registered similar level of growth, with however, core goods taking a higher place in the contribution to the core CPI starting 2021 (Figure 21). From a year-to-date perspective, core goods inflation remains high and stabilizing from April 2022 while core services are declining. The level is even down from a year-to-date perspective after a long increasing rally from July 2021.

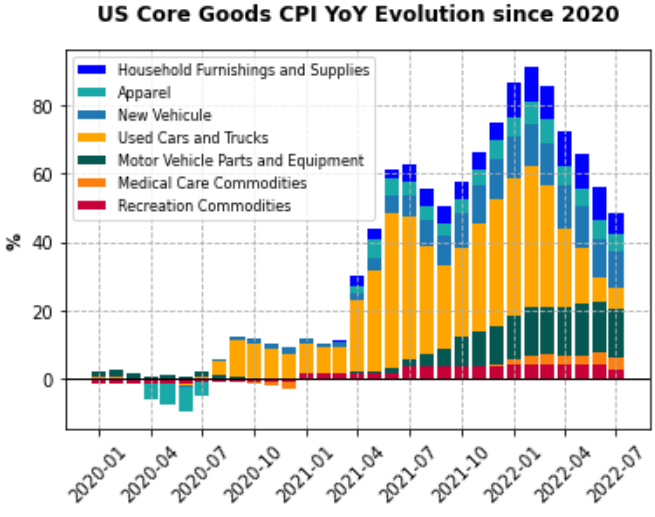
Figure 21 - Breakdown of US Core Inflation After Covid-19 Shock



Source : U.S. Bureau of Labor Statistics,
Consumer Price Index for All Urban Consumers: All Items in U.S. City Average,
retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/

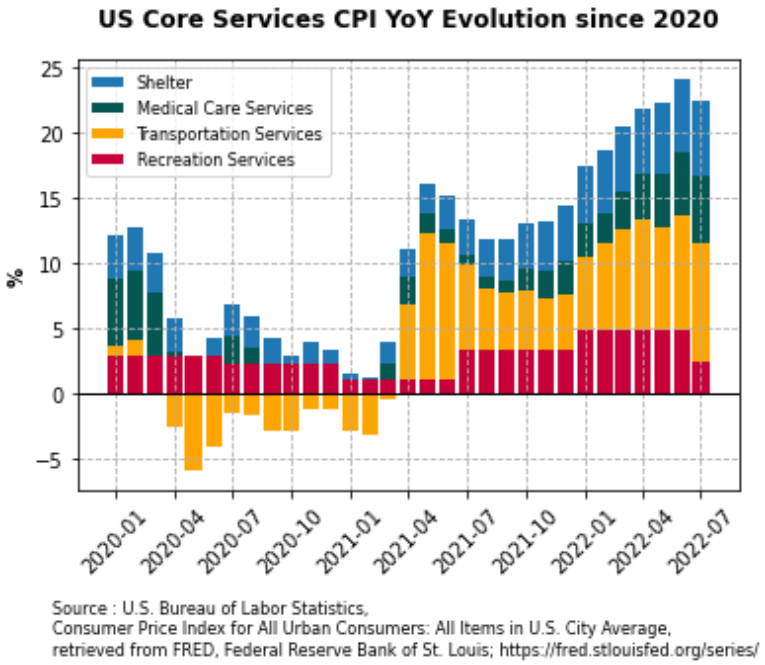
Breakdown of core goods (Figure 22) allow us to better understand the dynamic of core inflation and its main contributors. Very quickly after the Covid-19 shock used cars and trucks have seen their prices rise with an important variation of almost 10% in September 2020 (Figure 22). The increase of cars and trucks prices have continued during the following month. The increase became more and more important. From April 2021, other factors have started to contribute to the core inflation rise. Household furnishings and supplies together with apparel and new vehicle. The automotive sector has had a major role in the increase of core inflation with motor vehicle parts and equipment increasing from July 2021. Recreation commodities also have been part of the increase of core CPI, with rise of 4% until July 2022.

Figure 22 - Breakdown of US Core Goods Inflation After Covid-19 Shock



Source : U.S. Bureau of Labor Statistics,
Consumer Price Index for All Urban Consumers: All Items in U.S. City Average,
retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/

Figure 23 - Breakdown of US Core Services Inflation After Covid-19 Shock



Source : U.S. Bureau of Labor Statistics,
Consumer Price Index for All Urban Consumers: All Items in U.S. City Average,
retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/

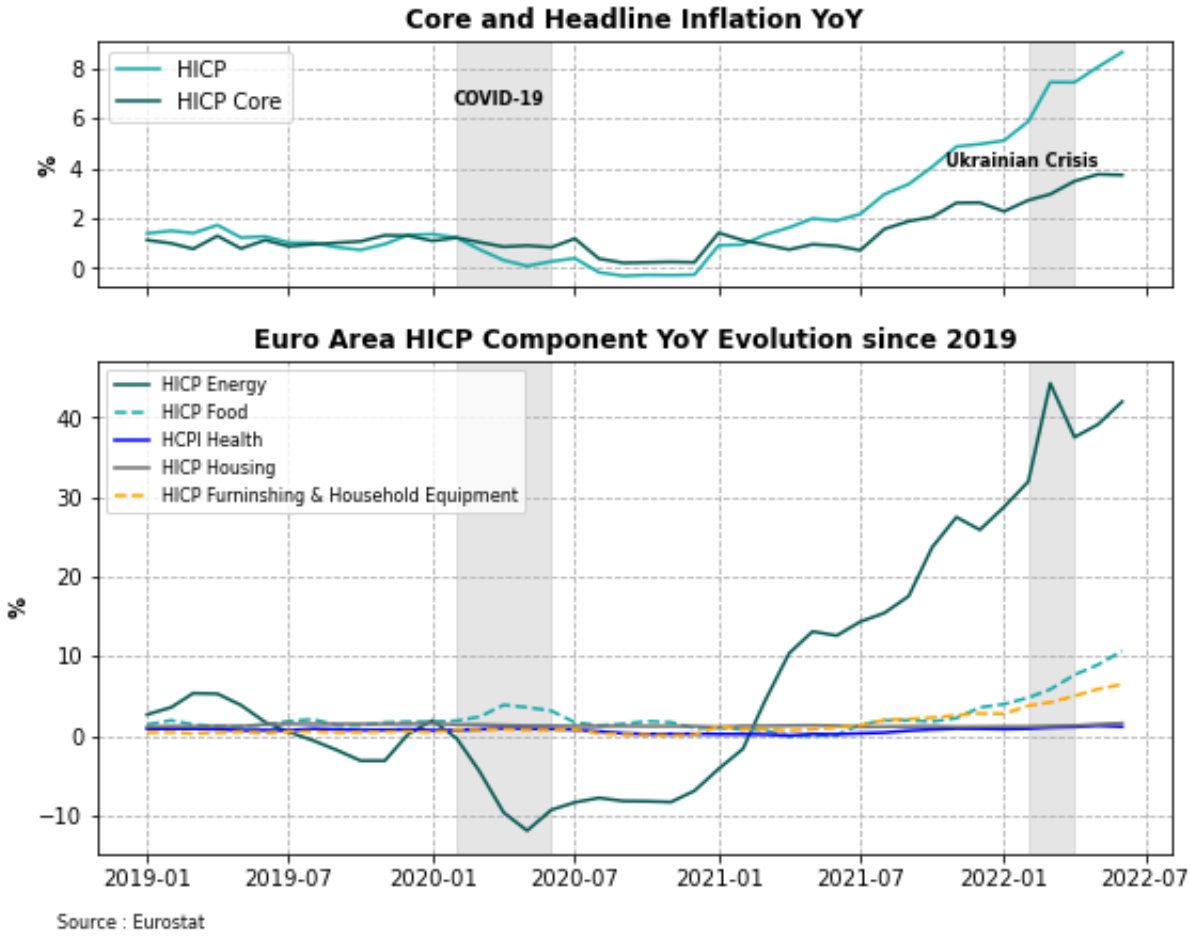
The breakdown of core services inflation shows a different pattern than the core goods. Inflation of core services is distributed in a more diversified way. First, we can notice that before the Covid-19 shock, shelter, medical care and recreation services were at important levels. Then with the occurrence of the pandemic, all these components significantly drop, especially transportation services. It's interesting to note that recreation service did not fell and remains stable until 2021. From 2021, these components start to rise again with even higher levels than the pre-pandemic shock. The most important contribution came from transportation services, which has decline on the second quarter of 2021 but regain strength starting 2022. Shelter also has an increasing contribution with no significant sign of decline. To lesser extent, medical services need to be considered as part in the increase of core services inflation.

To sum up all the observations made about US Inflation, both headline and core inflation have reached important level. Headline inflation is highly impacted by the regain of demand after the covid and the need of energy. This need is under even higher pressure since the Ukrainian and Russian war has started. The main concern is about the core inflation, which is driven by both core goods and core services. Inflation appeared to have spread to many sectors of the economy.

3.1.2. Euro Area Inflation

When analyzing Euro Area Inflation, we can notice some strong different markers and type of inflation compared to US inflation. One of the most obvious elements is the core inflation (Figure 24). While core inflation has reached 6% at the end of June 2022, the level is only at 4% in the Euro Area. We notice the same mechanism as for the US inflation regarding energy. While prices have drop significantly during the pandemic due to lack of demand, prices were back at their pre-crisis level very quickly, overtaking by the way the simple "basis effect". Euro Area inflation seems to be mostly guided by external factors like energy. Euro Area is indeed a major importer of energy[41] and the Ukrainian crisis have contributed to the increase of energy prices. Food, in a less extent also contributed to the rise of prices. Furnishing and household equipment came as the third element to have impacted inflation.

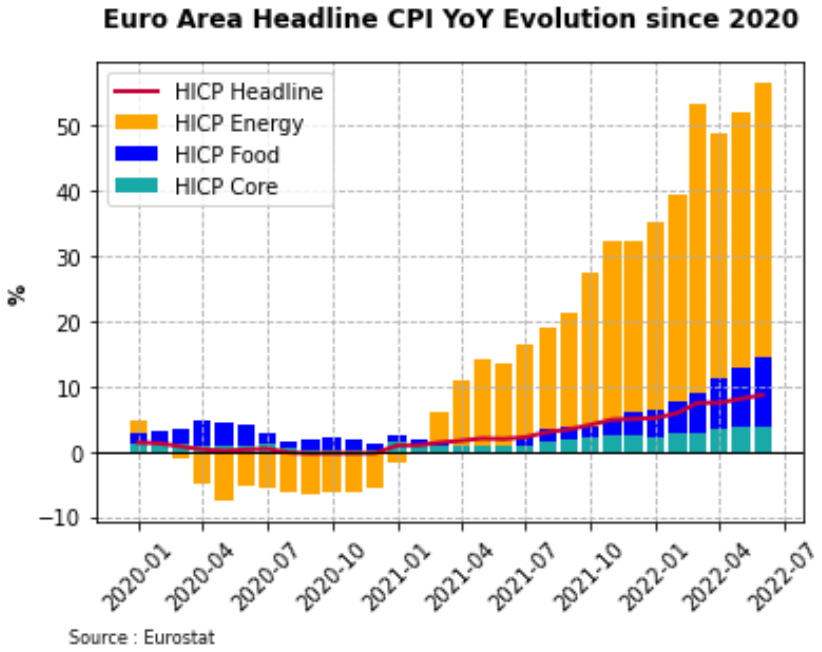
Figure 24 - Breakdown of Euro Area HCPI Evolution After Covid-19 Shock



[41] https://ec.europa.eu/eurostat/cache/infographs/energy/bloc-2c.html

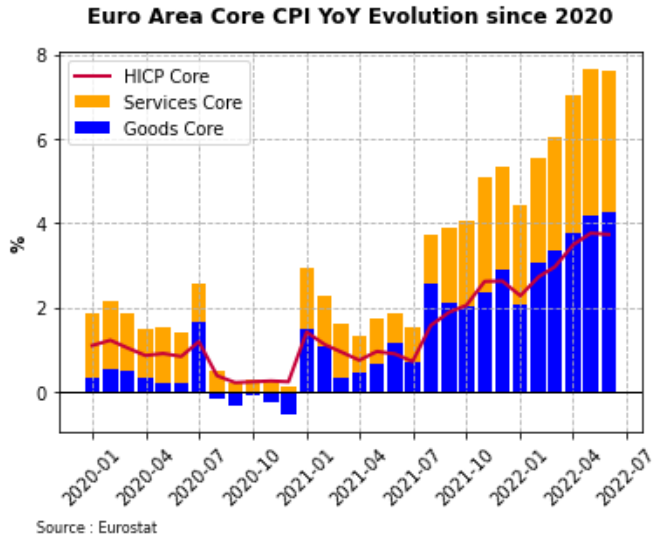
Same as for the US inflation, the breakdown of headline inflation shows a massive impact from energy prices (Figure 25). We should however notice that the impact of energy prices rising is more important in Euro Area than in the US (since Euro area depend on external import). Food is also gaining a significant part since 2021 but still much lower than energy. Core inflation is rising above the ECB target of 2%, but stay, as described above, lower to the US Core Inflation.

Figure 25 - Breakdown of Euro Area Headline Inflation After Covid-19 Shock



Analysis of Euro Area core inflation shows a different pattern than the US core inflation (Figure 21 and 26). While the increase of both goods and services is quite “linear” in the US, it is more disparate in Euro Area. Before the covid shock, core services had a much more contribution to the core inflation than goods. Core goods were even in negative territory after the triggering of pandemic. Then from 2021, core services start again to increase higher than core goods. Since summer 2021 both components have a significant impact in Euro Area core inflation.

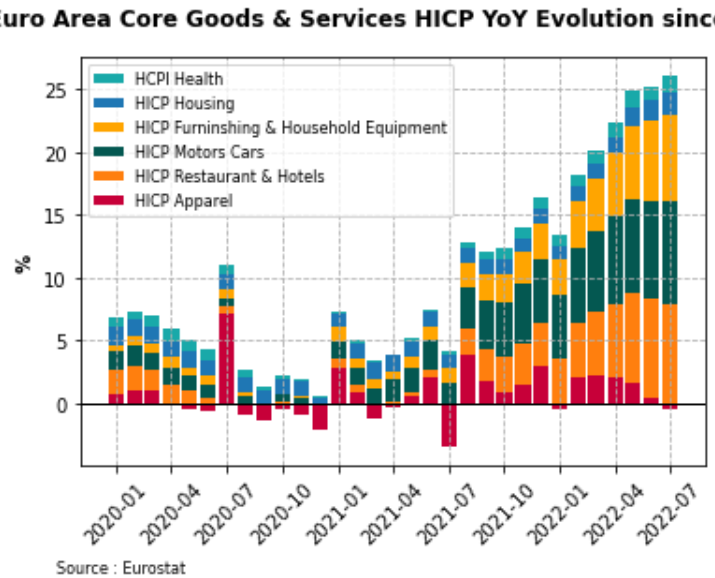
Figure 26 - Breakdown of Euro Area Core Inflation After Covid-19



If we go deeper in the analysis of core goods and services (split data between core goods and core services were not available), we can observe again a very disparate distribution (Figure 27). As for the other inflation perspective, we notice a decrease of all components in the beginning of covid crisis with, although, a spike in apparel prices right after.

In general way, we can observe that most of the goods and services have started to rise at the beginning of 2021, with restaurants and hotel prices, and motors cars being the principals' drivers. From January 2022, furnishing and household equipment also became one of the main contributors to core inflation increase.

Figure 27 - Breakdown of Euro Area Core Goods and Services Inflation After Covid-19 Shock



To synthetize all comments, both US and Euro Area are facing levels of inflation that were not reached since the 1980s. However, we can shed light differences between the two area. The main difference concerns the core inflation level versus the headline inflation level. In the US, core inflation is higher than core inflation in Euro Area. This discrepancy is mainly due to the fact that Europe is a major importer of energy. The analysis of core inflation also shows that both goods and services contribute to this increase, with however a distribution very different between all goods and services. These discrepancies can explain the difference stance of ECB and Fed: while Fed has already proceeded to 4 interest rate rise ECB have only raise his interest rate one time[42].

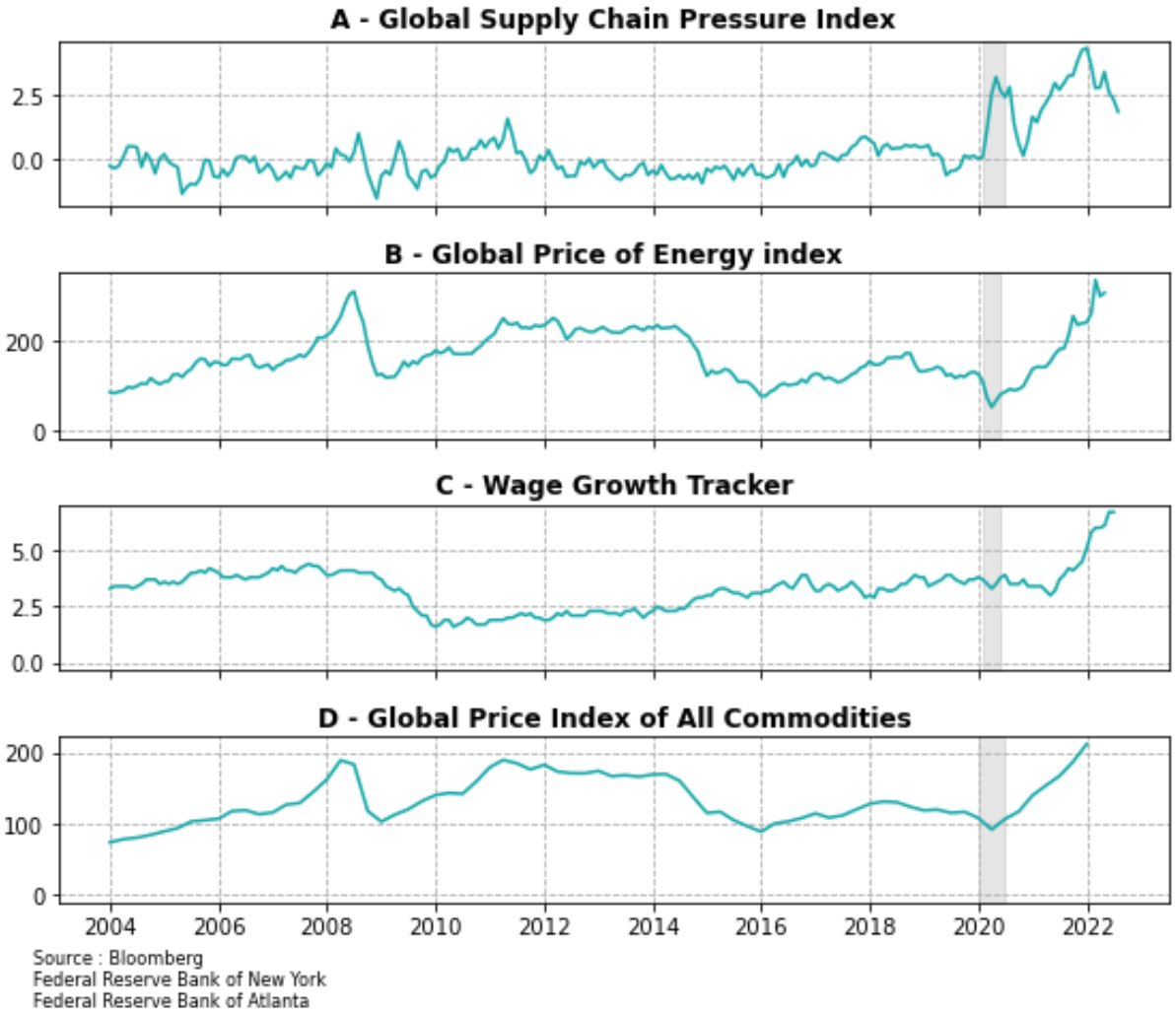
If we now focus on the causes of this inflation, various elements have to be taken into account. First, the multiplication of lockdowns all over the world have considerably impacted supply chains. In a globalized world, where all commercials' exchanges are interconnected, it has led to a desynchronization of supply chains (Figure 28 – A). This particularly the case for China, which have applied a very restrictive "zero-covid" policy. As a symbol of the perturbation of supply chain, the price containers have jumped from 950$ in October 2020 to 10 000$ in January 2021[43]. Another element that we have already mentioned previously is the high increase of energy prices (Figure 28 – B). Wage growth tracker, which is a measure of the nominal wage growth of individuals, have also followed the same path but with some lag (Figure 28 – C). Part of this phenomenon can be attributed to the "Great Resignation". A trend that has pushed workers to resign from their jobs causing a shortage of manpower. Wage growth implies that companies have increase their costs. These costs have been then transferred to the consumer (PPI increase have been passed through the consumer gradually). Having said that, all graphs from figure 28 shows one central element: a high increase of demand after Covid-19 shock.

This analysis might show that monetary policies did not appears as central root of inflation. However, we should be aware that excess of liquidity from central banks and accommodative fiscal policies have led to a very strong recovery of demand. This demand could not be satisfied by supply, which was under pressure do to major issues of supply

[42] https://www.latribune.fr/opinions/tribunes/fed-et-bce-deux-rythmes-mais-une-meme-strategie-contre-l-inflation-922244.html
[43] https://www.lsa-conso.fr/la-folle-inflationdu-prix-des-containers,373673

chain side notably and was under pressure of growing commodities (especially energy) and labor costs.

Figure 28 - Post-Covid Inflation Catalyst



Source : Bloomberg
Federal Reserve Bank of New York
Federal Reserve Bank of Atlanta

Another factor that we have not mentioned yet is the psychological aspect of inflation. Indeed, for most of us, inflation is a forgotten phenomenon. The comparison and the so-called common points that we find with the inflation of the 70s maintains a pressure on the anticipation and on the behavior of economic agents. The comeback of inflation - and its perception- in media or in the political universe led to a self-sustaining process that amplify inflation[44]. Psychological aspect is even more important in a context of high liquidity.

[44] Blanqué, P. (2022), La psychologie de l'inflation fait son effet, Amundi Investment Talks,avil 2022.
Blanqué, P. (2021), Ten weeks into Covid-19. Psyche, Money and Narratives. An interpretation of the crisis, Paris, Economica.

3.2. Monetary policies in Europe and US since Global Financial Crisis

In the part 1.3 we have highlighted the fact that, despite widely accommodative policies, inflation was at very low levels during de 2010s. But what exactly were these policies? For what purpose were they carried out? How unconventional were the measures deployed?

One of the main turning points of the last 20 years was the occurrence of the *Global Financial Crisis* (GFC), considered as the worst economic crisis since the *Great Depression* of 1929. In US, the real GDP fell about 4% from its peak in 2007 fourth quarter to its low in 2009 second quarter (Figure 9). The unemployment rate rises from 5% in December 2007 to 9.5% in June 2009 with a peak at 10% in October 2009. In Euro Zone, the real GDP fell about 4% in the second semester of 2008 and beginning of 2009 while the unemployment rate overtakes the level of 8%. Not all countries of the area were affected the same way. Southern countries of Euro Area were more impacted than Germany for instance.

To boost recessionary economies, government and central banks have deployed unprecedent accommodative monetary and fiscal policies. The goals of these policies were to boost economic growth, reduce unemployment and bring back inflation to the long-term target of 2%. To understand why these monetary policies were launched, we first need to understand the goals of both Federal Reserve (Fed) and European Central Bank (ECB). US congress has assigned three targets to the Federal Reserve: full employment, prices stability (i.e., controlled inflation over the time) and moderate long-term interest rates. Within the euro zone, ECB have only one principal mission since his creation in 1998: stability of prices.

Considering their mandates and more broadly their role in the preservation of the global financial system, central banks intervened very quickly when the financial markets start to collapse during the GFC. Interest rate, one of their most important tools, have been drastically reduced by both Fed and ECB (Figure 1).

To ensure that this reduction of interest rate could have a long-term impact, central banks also start to provide a “forward guidance” to the market. “Forward guidance” is essentially a communication tool used by central banks to orientate the anticipations of economic agents. When the Federal Reserve is announcing that the Fed Funds rate will stay

low "*for some time*"[45] or for "*an extended period*"[46] in 2008 and 2009, it tries to influence the behavior of economic agents and extend the effect of easing funding conditions. Forward guidance is considered as a non-conventional monetary tool.

In addition to these measures, central banks launched, as early as 2008, some asset purchasing program, also known as Quantitative easing (QE). The aim of QE is to maintain easy funding conditions to economic agents by purchasing a specific amount of financial assets (government bonds, corporate bonds or even stocks). QE is considered as a liquidity injection in the financial system and a non-conventional monetary policy tool.

In US, the first QEs programs were started in 2008 under the name of Large-Scale Asset Purchase (LSAP). This program has allowed Federal Reserve to purchased 600 billion dollars US of agency mortgage-backed securities (MBS) and was completed by other QE until the total purchase amount reached 1.75 trillion dollars[47] at the end of 2010. The LSAP will be extended into three rounds until 2014 with 4.5 trillion dollars of net assets purchased[48]. During the pandemic of Covid-19, the Federal Reserve has launched a QE for an amount of 2 trillion dollars.

In Euro Zone, the first QE program will be launched in 2009 with a Covered Bond Purchase Program (CBPP1), to reviving the covered bond market, a one the primary source of financing for banks in Europe. With the occurrence of the Greek crisis in 2010 and 2011 (Greece was near to sovereign default) and the contagion over the rest of southern European countries (Spain, Portugal, Italy, or Ireland), the ECB will start a Securities Market Program (SMP) to try to limit the widening of sovereign debt interest rate and the divergence of financing conditions. The SMP will help to appease the sovereign bonds secondary market. The ECB will also renew CBPP program in 2010 (CBPP2 2010 to 2012). SMP is not considered as a "full" QE program because ECB ask, in return of the purchase,

[45] https://www.federalreserve.gov/newsevents/pressreleases/monetary20081216b.htm
[46] https://www.federalreserve.gov/newsevents/pressreleases/monetary20091216a.htm
https://www.federalreservehistory.org/essays/great-recession-of-200709#:~:text=Initially%2C%20the%20Fed%20employed%20%E2%80%9Ctraditional,in%20September%20to%20December%202008.
[47] https://www.federalreservehistory.org/essays/great-recession-of-200709#:~:text=Initially%2C%20the%20Fed%20employed%20%E2%80%9Ctraditional,in%20September%20to%20December%202008.
[48] https://www.nytimes.com/2014/10/30/upshot/the-fed-has-not-stopped-trying-to-stimulate-the-economy.html?rref=upshot&abt=0002&abg=1

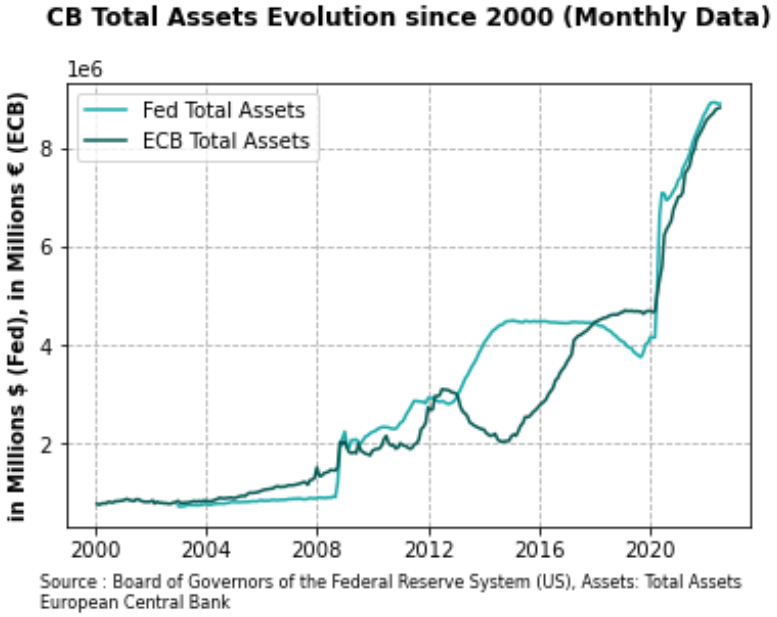
deposits for an amount equal to the amount of government bonds. This way of intervening is called "sterilization". With the intensification of the sovereign debt crisis, the ECB also had granted special funding conditions to commercial bank through a 3-year Long Term Refinancing Operation (LTRO). In total, two LTRO program were launched, one in 2011 and another one in 2012. The sovereign debt crisis has also been a recall about how important the credibility of central banker was. In July 2012, at the climax of sovereign debt crisis, Mario Draghi, the President of ECB, will declare during a conference in London, that he is ready to do "*whatever it takes to preserve the euro*"[49]. By implying an unlimited support, M. Draghi has reduced the pressure on sovereign interest rate of the countries concerned. These words from M. Draghi, were followed by the announcement of a new program called "Outright Monetary Transactions" (OMT). This program, which consist of to intervene on the sovereign debt secondary market was slightly different from the SMP. It was unlimited, transparent (breakdown by country and average duration of purchases were published) and require some technical conditions before activation. However, if the OMT has helped to reduce the volatility of the market, it has never been used and no purchases were made. One year later (in July 2013), the ECB start to provide a forward guidance, when the fear of deflation starts to arrive, saying that it "*expected interest rates to remain low for an extended period*"[50]. Further monetary easing was then made. An Asset Purchasing Program (APP) will be added in the scope of ECB. The APP consist of to buy sovereign bond of Euro Area countries but also corporate bonds and asset-backed-securities. The purpose of the APP was to stabilize the euro zone and bring back the inflation level at 2%. Among the other measure taken, key interest rates were reduced (deposit facility rate drop to -0.40%, Figure 1) and a Targeted Longer-Term Refinancing Operation (TLTRO) plan will be launched in 2016. The APP will be stopped in 2018 but will be renewed in 2019 for an unlimited period. In response to the Covid crisis in 2020, the ECB have extended by 120 billion € the APP. Moreover, a Pandemic Emergency Purchase Program (PEPP) has been prepared. The PEPP will enlarge the capacity of ECB to intervene of the market (by adding Greece in the eligible countries but also deleting the rule of less than 33% of government debt can be hold by ECB).

[49] https://www.youtube.com/watch?v=tB2CM2ngpQg
[50] https://www.ecb.europa.eu/press/pressconf/2013/html/is130704.en.html

We should also highlight that, all over the deployment of these monetary policy, forward guidance was continuously updated by ECB and the Fed.

The conclusion we can draw from the post GFC monetary policies is that use of QEs, interest rates and forward guidance were the principals' tools used by the Federal Reserve and the ECB to fight against economic depression and conjunctural factors (like the sovereign debt crisis in Europe, or deflation). In the end, these policies and especially QEs had a massive impact on the balance sheet of the FED and the ECB (Figure 29)

Figure 29 - Federal Reserve and ECB Asset Evolution



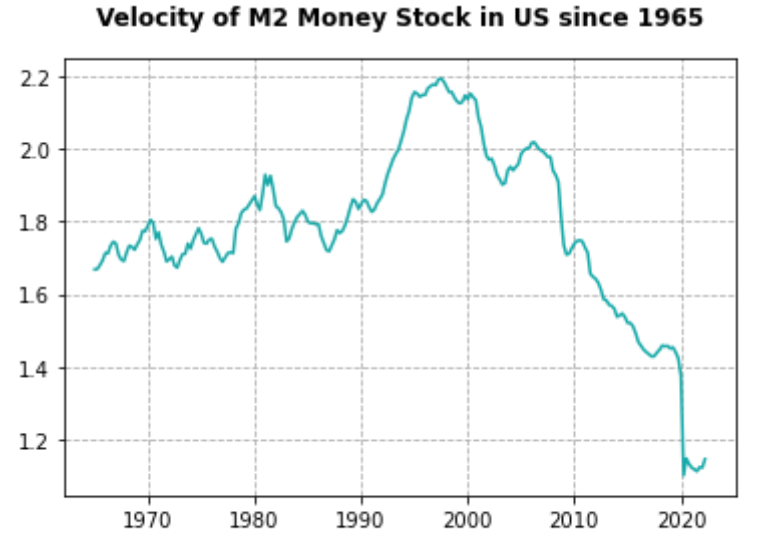
We have voluntarily omitted the fiscal policies here, but the reader needs to be aware that in the meantime lots of fiscal policies were deployed in Europe and US, especially after the covid crisis. These fiscal policies were made possible due to the exceptional financing condition describe above but mainly because the Federal Reserve and the ECB have launched massive QE. At the end, central banks have monetized public debt especially after the Covid crisis. If QEs are not directly qualified as Modern Monetary Theory describe in part 2, it has conduct to finance public deficit, which is pretty much the same target of MMT.

3.3. Link between monetary policies and inflation

Now that we have establish a framework around the dynamic and features of inflation, around what economic literature says about it and around what have been central banks actions during the last decade, we will try to explore the link between monetary policies and inflation.

If we take a monetarist prism, the massive injection of liquidity through the QEs during 2010s should have caused a very high inflation. But as we have seen earlier, 2010s are mostly characterized by disinflation. One of the elements of answer to low inflation despite highly accommodative policies is to be found on the side of velocity of money. Indeed, if we go back to the QTM theory, velocity of money is stable, and any increase of money supply led to an increase of inflation. However, the observation of velocity of money in US show that it has constantly and significantly decrease since the middle of 1990s (Figure 30).

Figure 30 - Velocity of Money in US



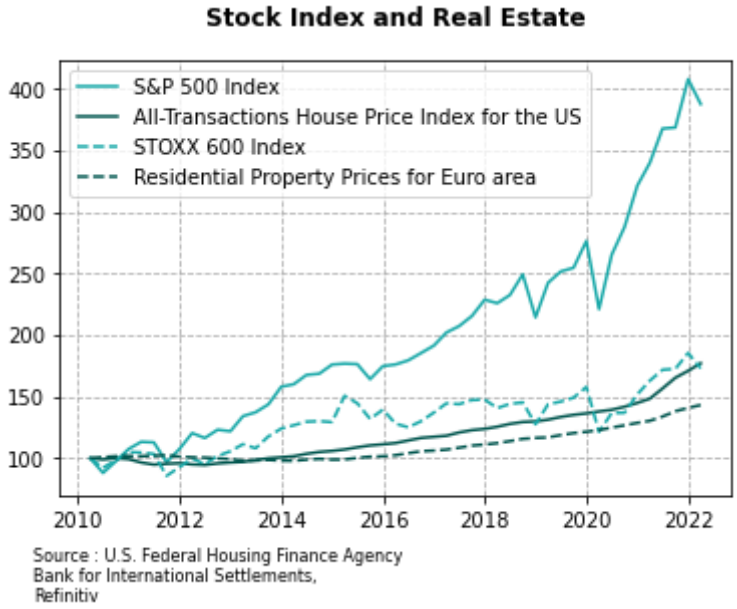
Source : Federal Reserve Bank of St. Louis, Velocity of M2 Money Stock [M2V], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/M2V

Moreover, we need to nuance our conclusion about low levels of inflation during the 2010s. If, as explained in the part 1.3., there has been no general increase of prices during the last decade, some assets were subject to high inflation such as they have been qualified as speculative bubble[51]. This is particularly the case for stock market but even real estate (Figure 31). This suggests that we should resonate with a dual perception of velocity: velocity

[51] https://www.propertyshark.com/Real-Estate-Reports/2021/03/29/us-home-price-evolution-2009-2019/

in real sphere and velocity in financial sphere[52]. In this case, the velocity of real sphere (basically goods and services) has been very low while the velocity of financial sphere has increase. In other interpretation, due to the low level of economic growth during the last decade all the excess of liquidity have been deployed in the financial sphere. Referring to what we have describe in the part 2.1, we can also link this to the "Cantillon effect", with money creation leading to relative price increase. Indeed, the combination of QEs and low interest rate have pushed the valuation of financial assets with saving invested mainly in risky asset due to the TINA effect ("There Is No Alternative"[53])

Figure 31 - Real Estate Price and Stock Index Evolution



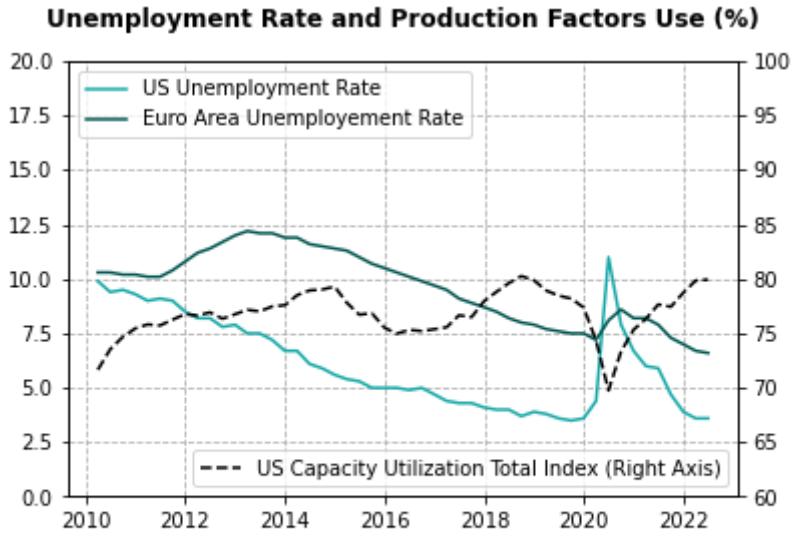
From a Keynesian perspective, money supply growth led to inflation when supply is at his maximum potential. A brief analysis of this aspect of the production helps us to draw some conclusion. In both US and Euro Area, unemployment rates were quite high during the first half of the 2010s (Figure 32). US have known a better situation than the euro zone by reaching in 2017 an unemployment rate near to 4%, considered as the full employment rate. The unemployment rate of Euro Area has stayed at a level above 7%, which is quite high. These figures of unemployment must be placed in a context of globalization and high

[52] Blanqué, P. (2021), Money and its velocity matter: the great comeback of the quantity equation of money in an era of regime shift, Amundi Discussion Paper No.52, December

[53] "TINA Effect is a phenomenon in which stocks rise only because investors see no viable alternative place to put their money. In particular, during times when bonds are performing poorly, stocks appear to be the only choice." https://www.investopedia.com/terms/t/tina-there-no-alternative.asp

international competition, with some countries providing very low labor cost. It also echoes to our comments made on the Phillips curve in the part 2.6. Another indicator can help us to evaluate the level of use of production factor: US capacity utilization index (Figure 32). According to the board of Federal Reserve, the capacity utilization rate *"can implicitly describe how efficiently the factors of production are being used".* Together, unemployment rates and capacity utilization index show that production was not at his full capacity in both zone and below its maximal potential, which brings another explanation of low inflation.

Figure 32 - Supply Capacity Production



Source : U.S. Bureau of Labor Statistics
Board of Governors of the Federal Reserve System (US),
Organization for Economic Co-operation and Development

To complete our analysis, we can, through basics linear regression, study the link between QEs and different financial variables (Figure 33 and 34).

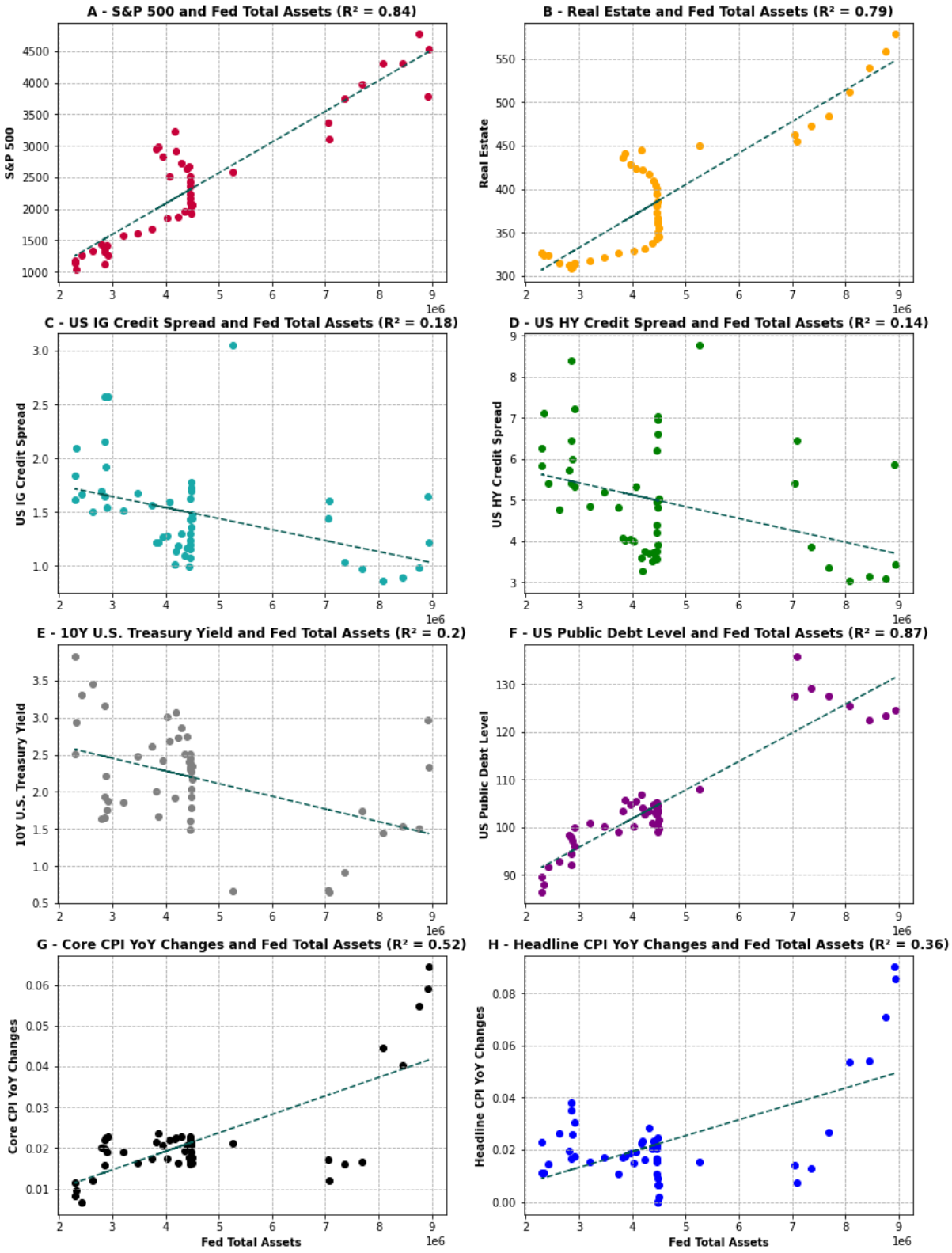
For the US, we are using in the figure 33 the total amount of Federal Reserve assets with the following data:

A. S&P 500 Index level for stock market
B. All-Transactions House Price Index for the United States for real estate
C. ICE BofA US Corporate Index for Investment Grade (IG) credit spread
D. ICE BofA US High Yield Index for High Yield (HY) credit spread
E. U.S. 10 Year Treasury
F. US Public debt level
G. Core CPI YoY Evolution
H. Headline CPI YoY Evolution

For the Euro Area, we are using in the figure 34 the following data:

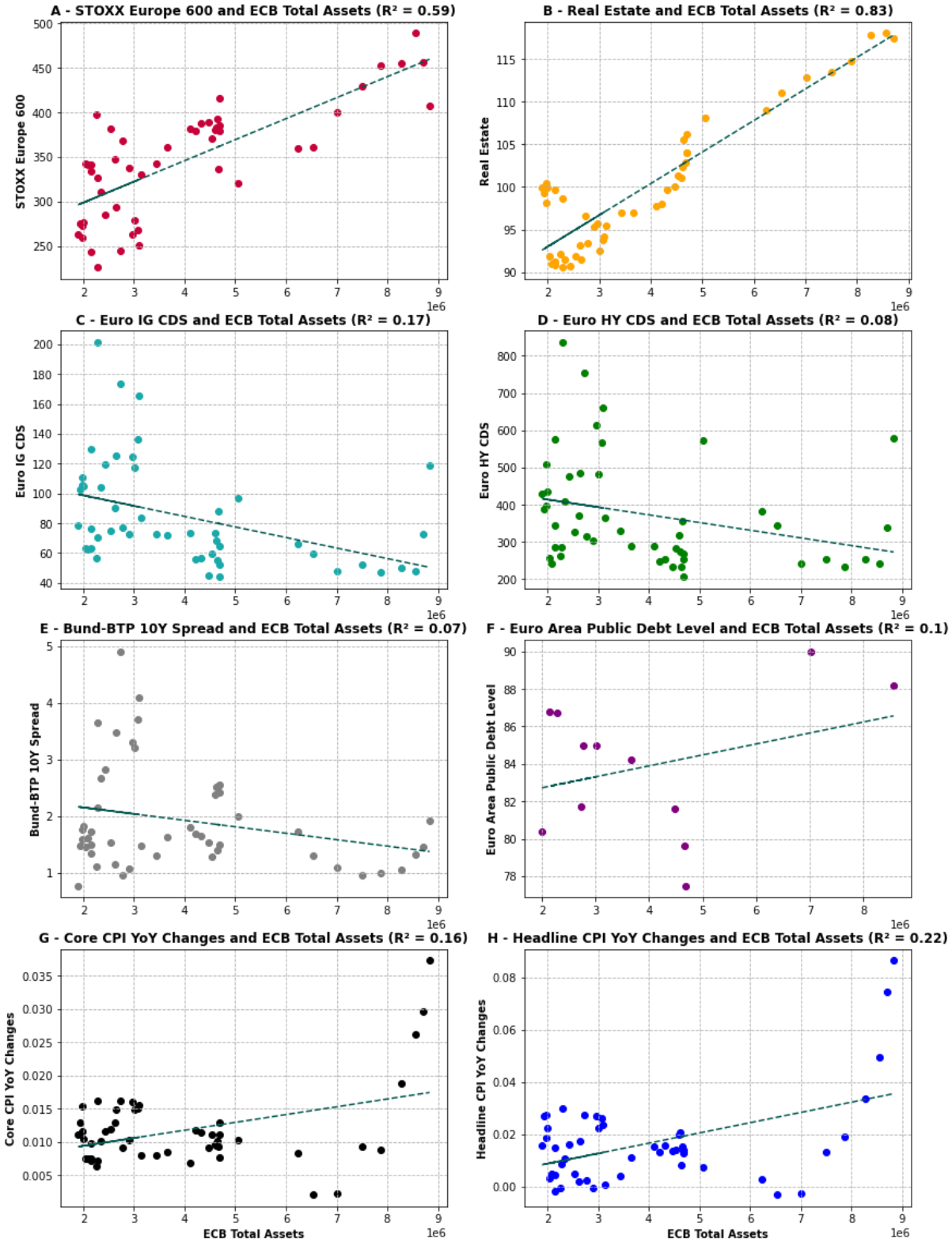
A. STOXX Europe 600 index level for stock market
B. Real Residential Property Prices for Euro area
C. DS ITRAXX EUROPE 5Y – CDS Index
D. DS ITRAXX XOVER 5Y - CDS index
E. Spread between 10Y Italy sovereign rate (BTP) and 10Y German sovereign rate (Bund)
F. Euro Area Public debt level
G. Core HICP YoY Evolution
H. Headline HICP YoY Evolution

Figure 33 - Fed QEs Impacts



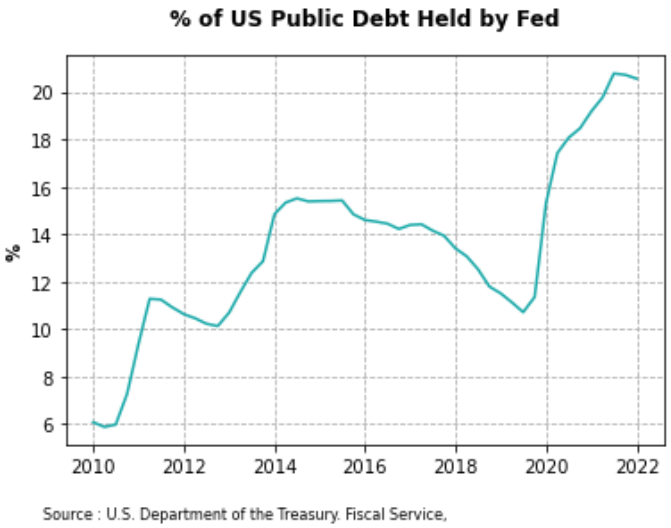
Source : Refinitiv
U.S. Federal Housing Finance Agency
U.S. Bureau of Labor Statistics
U.S. Department of the Treasury

Figure 34 - ECB QEs Impacts



Source : Refinitiv
Bank for International Settlements
World Bank
Eurostat

Figure 35 - US Public Debt Held by Federal Reserve



Source : U.S. Department of the Treasury. Fiscal Service,

Takeaways from this analysis are several. First, it confirms our previous observation that monetary policies have led to an increase of financial and physical asset prices in both US and Euro Area (Figure 33 A-B and Figure 34 A-B). R^2 score indicates that this link is stronger in US than in Euro zone. On the corporate debt side, even if we observe a light linear relationship between central banks asset rise, the R^2 score suggest that QEs have not impacted so much the corporate bonds market. Again, the relationship is weaker in Euro Area compared to the US. Nevertheless, we should mention that lower interest rates have favored lower graded issuer to access debt market. QEs seems to have not affect so much neither the US 10 years treasury yield. However, we can observe through the figure 35 that the share of public debt hold by Federal reserve has risen during the last decade and especially after the covid crisis, which can explain the high link observed in the Figure 33 – F between Fed balance sheet expansion and US public debt. Due to a lack of data and disparity of eurozone, we did not observe this link in Europe. For the Euro zone, we use the 10Y spread between the Bund and BTP as a *proxy* (Figure 34 – E). Finally, the relationship between central banks assets and CPI (and HICP for euro zone) -core or headline- also suggest a linear relation but with low R^2. This must be nuanced by our comments made to qualify inflation during the 2010s.

All relationship describe above are more or less significant considering our R^2 score, but it helps however to denote a trend and a link between Fed and ECB balance sheet expansion and our different financial variable.

Conclusion

The monetary policies implemented in the post GFC period have been extremely accommodative without producing any major success -inflation failed to reach the target of 2% and growth rates were lows- suggesting that policymaker's action did not have any impact on inflation. Considering economic theory about inflation, this may have been perceived as an anomaly. With unprecedent expansion of Fed and ECB balance sheet and interest rates below or near to 0%, the disinflation during the 2010s has been indeed surprising for many commentators. Nevertheless, we have observed during the last decade a substantial increase of some physical and financial asset prices (real estate or stocks notably) that bring back the idea of relative price change in economy due to monetary expansion (Cantillon effect). Weak velocity of money has appeared as a one of the main characteristics of the stagnation years, together and combined with high unemployment rate that have not pushed labor cost. Moreover, the analysis of QEs launches has shed light a link, more or less important, with financial data such as corporate and sovereign yield. If the Covid-19 has been seen as a "black swan"[54] type of event, there has been a certain sense of continuity with the fiscal and monetary policies deployed to preserve the economy and the financial system. Covid shock has, however, marked a rupture of the secular stagnation trend in US and Euro Area economies, and a shift through a new monetary, economic, and financial regime[55]. Beyond GDP growth and unemployment rate, the period of recovery from the pandemic crisis is distinguished by the growing inflation. This inflation has multiple causes, from supply chain perturbation to skyrocketing energy prices. Post-Covid inflation is also at the crossroads of major turning points. Whether these turning points are economic, social, ecological, or even geopolitical, it marks kind of rupture point compared to the last 15 years. It forces a monetary tightening but also a rethinking of fiscal policy. This rethinking embraces multiple dimensions. Inflation introduces a new variable in a current context where the ecological crisis will need massive investments, where the social claims are high, and where inter-state power relations are shifting on the global stage. In a certain way, the post covid inflation rehabilitates the Quantity Theory of Money (QTM) and question the "illusion" and

[54] https://corporatefinanceinstitute.com/resources/knowledge/finance/black-swan-event/
[55] Blanqué, P. (2019), The Road Back to the 70's. Implications for Investors, Amundi Insights Paper, juin.

"myth"[56] of the Modern Monetary Theory (MMT). The easing of sovereign funding conditions has indeed led to unprecedent levels of public debts and deficits. With interest rate hikes affecting economic activity, the question of sustainability of debt, private or public, is now at the center of debates. In Euro Zone, monetary tightening also questions the capacity of the ECB to prevent fragmentation and divergences between northern and southern countries. This will require a high flexibility from central banks.

[56] Blanqué, P. (2022), The myth of the fiscal free lunch: beware of the trap. An investor's viewpoint, Amundi Discussion Paper, No.53, June 2022

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