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Analysis of the impact of inflation against assets and creation of an investment strategy to hedge against inflation

RESUMEN

En un momento en el que todo el mundo habla de la inflación, del efecto que tiene en las inversiones y en nuestro día a día, es crucial entender cómo protegernos a nosotros mismos y a nuestras inversiones de esta situación económica. A través de esta investigación hemos examinado las características de 5 clases de activos diferentes, a saber, renta variable, renta fija, efectivo y equivalentes de efectivo, materias primas y bienes inmuebles. Este análisis nos ha permitido explorar qué clases de activos pueden protegerse de la inflación, de modo que podamos construir una estrategia de inversión protegida de la inflación. La investigación ha concluido que las materias primas, en particular el oro, demuestran tener cualidades de cobertura frente a la inflación. Esto también se ha encontrado en el sector inmobiliario con gran fuerza y en la renta variable con menor fuerza. Si bien es necesario tener efectivo en nuestras carteras como parte de nuestros criterios de inversión, éste no ha mostrado cualidades sólidas para protegerse de la inflación, al igual que la renta fija, a excepción de los valores del Tesoro protegidos contra la inflación.

ABSTRACT

At a time when everybody talks about inflation, the effect it has on investments and on our day-to-day life it is crucial to understand how to protect ourselves and our investments from this economic situation. Through this investigation we have examine the characteristics of 5 different asset classes, these being, equities, fixed income, cash & cash equivalents, commodities, and real estate. This analysis has allowed us to explore what asset classes can hedge against inflation so that we can build an investment strategy protected from inflation. The investigation has concluded that commodities, in particular gold, prove to have qualities that hedge against inflation. This has also been found in real estate with great strengthen and in equities at a weaker force. Whilst we need to have cash in our portfolios as part of our investment criteria it has not showed strong qualities to hedge against inflation, similar to fixed income, expect for treasury inflation protected securities.

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Table 1: Similarities and Differences between 1970s and 2020s inflation crisis
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ABBREVIATIONS

ABBREVIATION	MEANING
CB	Central Bank
CD	Commercial Deposit
CPI	Consumer Price Index
ECB	European Central Bank
FED	Federal Reserve
REPO	Repurchase agreement
TIPS	Treasury Inflation Protected Securities

I. Introduction:

a. Approach and justification of the dissertation:

Inflation is one of the worst nightmares for any investor amongst risk and instability it brings reduction in purchasing power both to consumers and investments. As a consequence of this, investment returns are affected with a reduction in real returns. Amid, individual's saving also suffer a reduction in their purchasing power, therefore, the money they have is worth less, implying it can afford less things. This illustrates that it is fundamental to understand inflation's consequences on a portfolio and how to avoid and protect your portfolio from the loss of its real value and returns. It is also important to be able to know how to invest assets appropriately under inflation to beat it because our savings will lose purchasing power if kept in safe boxes.

As consumers purchasing power falls it is important to understand that investing is crucial and that having plenty of liquidity during high inflation periods is damaging and contributing to a further fall in purchasing power. This describes how it is very important to analyze the hedging quality of asset classes towards inflation as allocating our investments in an efficient and tactical way will reduce the risk of losing purchasing power in times of inflation. Moreover, this emphasizes how as borrowing money is more expensive this hurts the investment environment and therefore, as less quantity can be allocated, therefore, efficient asset allocation is crucial.

Furthermore, when inflation is high central banks will impose contractionary monetary policies to slow down the economy. Amongst these, we find increasing interest rates to reduce inflation, this is something that further contributes to loss of purchasing power in some asset classes. This highlights that is important to be able to draw out an adequate investment strategy.

Supplemented with a higher cost for borrowing money, this hurts the investment environment, as people cautiously think about their investments for example, if an individual was going to purchase two apartments as a real estate investment a needed to get a mortgage, the rise in interest rates would imply that borrowing the money is more expensive, only being able to purchase one of the apartments. This also causes wobbles in market's structure, the demand and the supply.

Investing during inflation periods is always full of uncertainties and highly unpredictable returns, which is why investors fear it so much. Every investor has as objective to at least achieve returns superior to inflation rate. Through this dissertation we will explore ways of hedging against inflation and thereby, reducing investors risk, loss of purchasing power and increasing probability of high returns by allocating assets adequately to beat inflation.

b. Objectives:

The objective of this dissertation is to be able to draw out a strategy that will hedge against inflation to protect our portfolios from inflationary risk and the consequences of it. We will be analyzing the hedging properties of the different asset classes and the effect of inflation on their returns. Amid, we will also be analyzing inflation correlations between high inflation periods, such as the 1970s inflation crisis, to explore any existing patterns in investment returns.

All of these will contribute to the main objective of the dissertation which will be the identification and definition of an investment strategy in periods of high inflation by a use of eloquent and optimal asset allocation in portfolios.

c. Methodology:

To be able to draw out a conclusion we will approach the following methodology consisting of, developing a base scenario by defining key elements such as inflation. Labelling the different asset classes there are available to invest in, so that we are able to develop an investment strategy with inflationary risk. Identifying the main inflationary events and their investment scenario correlation. Analyzing the different asset classes as hedgers against inflation and defining an optimum investment strategy when inflation is high in the economy, to avoid losing purchasing power and returns.

Firstly, as previously mentioned, it is crucial to set out and define what is inflation, its causes, consequences, and the different ways used to try to dissuade it. Through this we will be able to firmly construct the base so that we can be able to define what asset classes are appropriate to invest under an inflation scenario. Amid we will also explore how inflation affects different asset classes

Moving on, we will explore the event, known as the biggest inflation period, the 1970s inflation crisis as well as the current pandemic inflation crisis. We will follow this approach to be able to draw out any correlation between these two events, in terms of investment during high inflation, and if so, find and analyze the relationship between investments and inflation to be able to contribute to drawing out a more effective investment strategy against inflation.

To be able to draw out the investment strategy to allocate assets, we will then analyze each asset individually, according to their protectionism characteristics towards inflation. For this investigation we are going to take into account, **equities, fixed income, cash & cash equivalents, commodities and real estate**. We will explore to what extent do the properties that each asset class provide in an investment to be able to judge if they contribute to our

portfolio as safe-haven assets or rather avoid them in times of high inflation. To further understand how investments are affected by inflation, we will then evaluate how the investment atmosphere is affected by the measures taken by central banks to evade inflation. By doing this, we will be able to fully understand how investments react to inflation, both in volume and returns. This analysis will rely on different data instruments such as, related investigations or dissertations, financial articles, educational books, journal articles and websites to correctly define, analyze and evaluate asset classes and investment strategies.

Finally, after having done our investigation, we will proceed to draw an investment strategy by concluding on which assets should we allocate our portfolio when there is a scenario of high inflation in the economy.

II. Literature Review:

a. Analysis of existing dissertations

A voluminous amount of literature exists concerning the ability of different assets to hedge against inflation. According to, Lee (1999) the theory put forth in the dissertation states the negative correlation between ex post real returns and the uncertainty premium which causes the negative correlation between ex post real returns and unexpected inflation. The theory is founded on a present value model with uncertainty adjustments, where future dividends are more heavily discounted as uncertainty rises.

However, Ely (1997) challenges many studies which demonstrate that equities tend to perform poorly in times of high inflation by giving evidence of stock's qualities as hedgers against inflation in a scenario with a long-term investment horizon. Moreover, in the study done by Tiwari, Adewuyi, Awodumi and Rouband (2020), we can see how by analyzing the relationship between equities' return and inflation in the US from 1800 to 2017 with several analyses, the study concludes a weak correlation between stock real returns and inflation in the short run, whilst this relationship is strengthened in the long run, suggesting equities hedge against inflation. Adding on, Jung, Shambora and Choi (2007), studied the properties stocks have against inflation by differentiating between unexpected and expected inflation in France, Italy, UK and Germany. They found that unexpected inflation did have a negative correlation with stock returns whilst expected inflation didn't.

Moving on, Fuertes Mendoza (2023), studies how inflation impacts real returns of different asset classes (equities, fixed income, commodities, and real estate) The study also assesses if investors seek out assets that serve as a hedge against inflation by analyzing net flows in the different asset classes previously mentioned. It concludes with inflation-linked bonds as an asset to hedge against inflation, whilst conventional bond funds have experienced net outflows due to contractionary monetary policies and inflation consequences. In contrast of this, Martellini Milhau and Tarelli (2015) propose an investment strategy with nominal bonds in the absence of inflation-linked liabilities. Their analysis suggests that with a combination of long and short positions in nominal bonds we can hedge against the unexpected inflation.

Commodities as a hedge against inflation are extensively analyzed, Fulli-Lemaire (2013) links the pass-through theory with core and headline inflation to examine the characteristics that commodities and its price shocks have on protection towards inflation. Other studies such as the study of, Fahmi Ghazali, Mohd Ussdek, Hooi Lean, Taunson (2021), explore how amongst commodities Gold has the most optimum characteristics to hedge against inflation. This is explored by evaluating the relationship between gold returns and inflation in 4 of the biggest

economies, whilst, Feldstein (1983) conveys how gold and land have a positive relationship with inflation and therefore, its value will increase according to raises in inflation. Real return will be adjusted to inflation because they are linked to future changes in what the market expects to occur with inflation. Bampinas and Panagiotidis (2015) examined the long-run hedging properties of gold and silver against CPI levels in the US and UK by analyzing its real price fluctuations along history and found that Gold performed better against both headline and core inflation. Furthermore, Golitis, Gkasis and Bellos (2022), explored the relationship between Gold, Crude Oil and S&P 500. Their study concludes with gold showing strong qualities as an asset to hedge against inflation whilst crude oil and t-bills have properties that tend to incentive inflation.

All literatures explored agree that real estate presents qualities to protect portfolios from inflation and reduce inflationary risk in these. Taderera and Akinsomi (2020) have investigated the long run relationship between real estate returns and inflation in the economy to conclude whether inflation drives property prices. The study finds through a co-integration model that real estate hedges against inflation with more potential in a long-run investment horizon. Adding on, Wurtz bach, Mueller and Machi (1991), proved that real estate is a hedge against inflation but only when there are no structural problems in the market. When the market is imbalanced, such that demand and supply are not equal, inflation injects volatility into real estate returns by the impact of different types of properties and inflation. Amid, Le Moigne and Viveiros (2008) investigated real estate as a hedge against inflation. The results over the entire time demonstrate that real estate acts as a hedge against inflation, both with anticipated and unanticipated inflation. However, the high inflation climate of the sub-period from 1973 to 1984 is a major contributor to these findings.

When it comes to analyzing inflation effects on different asset classes, Fang, Liu and Roussanov (2022) explored through their study what real assets protected against inflation. This resulted in the core inflation betas of stocks being negative while energy betas are positive. They also showed how currencies, commodities, and real estate also mostly hedge against inflation driven by energy shocks. These hedging characteristics are mirrored in the prices of inflation risk: only core inflation bears a negative risk premium, and its magnitude is unique among macroeconomic risk factors in that it is constant both within and across asset classes. While low real production, consumption, and dividend payouts frequently follow periods of high core inflation, asset prices are affected by both cash-flow and discount rate channels.

b. Hypothesis

As seen, there are numerous studies demonstrating how assets act against inflation individually. Through these dissertations the qualities of assets are emphasized and analyzed to see to what

extent they can hedge against inflation and protect us from inflationary risk and the consequences of it. We can say from these studies that conclusions amongst asset classes tend to be similar, in terms of if they hedge against inflation or not. Clearly assets such as real estate and commodities seem to hedge strongly against inflation whilst others such as fixed-interest bonds don't.

However, having done this literature review we can firmly say that we can't find a dissertation drawing an investment strategy in times of high inflation. The literature found covers all aspects and consequences of inflation on assets but not on how an investor should address its investment strategy.

This study will give an additional value to all of the literature as it will create an investment strategy on asset allocation of a portfolio in a situation of high inflation. The studies found will help illustrate and analyze the characteristics of the different asset classes in terms of hedging against inflation. Amid, this investigation will sophisticatedly build on this works by potentiating the analysis of the different asset classes and will contribute on the know-how of asset allocation given the condition of inflation, to try to optimize potential returns in times of high inflation.

III. Conceptual Framework:

i. What is inflation?

Inflation is the sustained increase in prices over a period of time, (M. Mihai , Azadikhah Jahromi, & Yang, 2023). Constant growth in prices damages an economy and specially consumers and households as their purchasing power falls implying standards of living are worse off. In other words, according to the European Central Bank (2023) the value of the currency over time. If inflation persists outputs are hard to predict, (M. Mihai , Azadikhah Jahromi, & Yang, 2023) this highlights how inflation is a threat to the economy as it creates fear and level of confidence in consumers fall, leading to a fall in consumption and investment and slowing down the economy as price stability becomes very uncertain. This illustrates the importance of having price stability in economies as it can hurt them badly, which is why after the inflation crisis of the 1970s, central banks established an inflation target amongst economies of 2%.

ii. How is inflation Measured?

To measure inflation, we need to find the change in price from one year to another, or from base year to current year. When measuring inflation, all goods, and services that households consume are considered. Even though, some products are more important than others, e.g., electricity is a daily consumed product while a PC is not a daily bought product, this is adjusted using weights, allocated to products and services depending on their importance to households. According to the European Central Bank (2023) to measure inflation all products consumed by households during the year are represented in the so-called “household baskets” and annual rate of inflation is calculated by comparing the total price of the basket in a given month to the same month one year previously (or the base year in comparison to the current rate). The recorded percent change in prices is known as the Consumer Price Index (CPI), an indicator of inflation.

iii. Inflation causes:

Inflation is caused by three scenarios that are seen in the economy as explored by the Reserve Bank of Australia (2023):

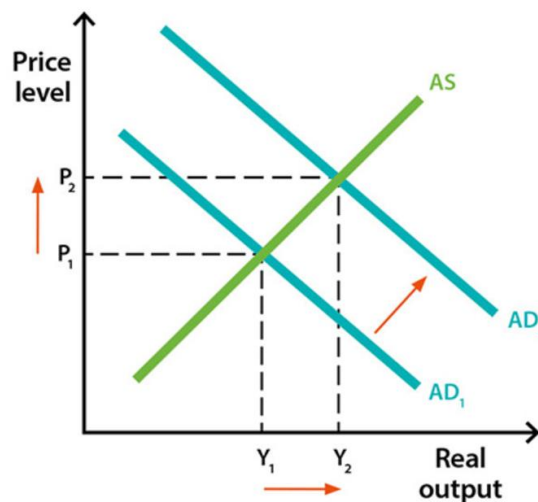
1. Demand-pull inflation:

This is when inflation surges due to an unexpected increase in aggregate demand (total demand for goods and services). This increase exceeds the aggregate supply creating an excess demand that can't be met, which leads to an increase in prices and consequently to inflation. As seen in Figure 1, there is a shift in the aggregate demand from AD1 to

AD₂ but, there is no shift in aggregate supply causing prices to rise from P₁ to P₂ and ending in inflation.

The aggregate demand function is formed by consumption, investments, government spending and net exports, this suggests that the increase in aggregate demand could be due to a rise in consumption levels, in businesses investments, government spending or net exports. To meet this extra demand firms will need to hire more workers, therefore there is a decrease in unemployment and an increase in labor this implies that companies may need to offer higher wages as there is a higher demand for workers to be able to meet rising demand. This could lead to an increase in prices by firms to be able to cover their increasing costs in labor. More jobs and higher wages will lead to further increases in aggregate demand which will lead to higher inflation.

Figure 1: Demand-pull inflation



Source: Reserve Bank of Australia, (Reserve Bank of Australia, 2023)

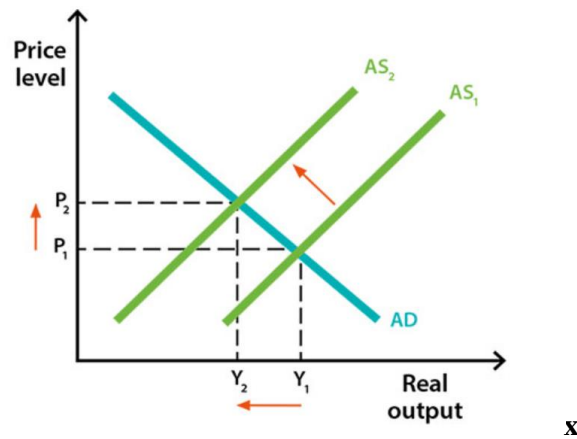
2. Cost-push inflation:

This occurs when there is an increase in the costs of the supply-side in the economy therefore there is a fall in aggregate supply, with aggregate demand remaining unchanged. Then there is an excess demand and prices will increase. As seen in Figure 2, there is a shift in aggregate supply from AS₁ to AS₂ and no shift in aggregate demand, AD, therefore this causes an increase in prices from P₁ to P₂.

When there is an increase in domestic or imported inputs, such as oil or raw materials, this increases the cost of production of firms, so they will produce a lower level of output, and thereby creating a supply shortage which does not meet with the economy's

demand. Increase in production costs can also occur when there are disruptions in specific industries such as natural disasters which have harmed all crops. This will lead to less amount, increasing prices of these raw materials and therefore, increase in production costs for firms.

Figure 2: Cost-push inflation



Source: Reserve Bank of Australia, (Reserve Bank of Australia, 2023)

3. Imported inflation and the exchange rate:

In the case of increases in imported inputs, this would be the consequence of a depreciation of domestic currency, implying abroad products become more expensive as our currency has less purchasing power. Moreover, a depreciation of domestic currency stimulates aggregate demand, as people will start consuming domestic goods, amid, exports become more competitive (cheaper for importing countries of our domestic goods) which also contributes to an increase in aggregate demand. This results in pressure on domestic production capacity and makes firms raise prices leading to inflation.

4. Inflation expectations:

Expectations of households towards inflation mark the future in markets as they influence current market decision and can lead to inflation outcomes. For example, if there are expectations of prices going to increase in the nearby future, firms may begin to raise their prices. This illustrates how expectations can manipulate the market and can cause an inflation that was not supposed to be there in the first place.

iv. Consequences of inflation

One of the most terrible consequences in inflation is that **the poor get poorer, and the rich get richer**. On the one hand, the poor lose their purchasing power, and they have to spend all their income in basic necessities and goods. On the other hand, the rich, who have investments, see how their assets increase in value. A persistent growth in prices can hurt an economy as the standard of living of households largely depends on real income therefore, they are worse off when price level grows faster as this erodes their purchasing power. To analyze in depth what is meant by **the poor get poorer, and the rich get richer**, we will see the consequences and effects that inflation have on housing prices, labor and financial markets.

v. Solutions to inflation

Different types of inflation require different approaches to withdraw the problem. Following, we will explore the mechanisms used by governments and central banks to dissuade demand-pull inflation, according to (Pettinger, 2022).

1. Tightening Monetary Policies:

When the economy is overheating, there is too much aggregate demand, central banks must reduce the money supply available to slow down the economy. This is done by:

a) Increasing interest rates:

By increasing interest rates, money borrowing becomes more expensive, this therefore disincentivizes consumption by households and investment by companies as it is more expensive. Moreover, mortgages become more expensive, therefore, there is less disposable income in households leading to a further reduction in consumption. This also leads to a higher exchange rate, as higher interest rates in the economy attract foreign money. This leads to less exports as they become less competitive and more imports which in turn reduce net exports, contributing to a lower aggregate demand. All of whom contribute into slowing down the economy.

b) Quantitative tightening:

This measure is the opposite of the so-known quantitative easing, used by the central banks after the financial crisis in 2008. By selling government bonds in central banks portfolios, they are reducing the liquidity in the economy, therefore, as there is less money supply, money becomes more expensive and this is a disincentive of consumption and investments, resulting in a slowdown of the economy.

c) Public perception:

The institutions can't tell the truth about inflation, markets would go crazy, and the economy would crash. Governments and policymakers tell individuals what they want to hear so that in return they invest at a normal rate and purchasing things at a normal level, slowing the effects of inflation on the economy, (Plissken, 2022). This implies that if inflation expectations are low, it becomes easier to control inflation.

2. Deflationary Fiscal Policies:

Moreover, other measures when the economy is overheating are taken by governments too, to slow down economies.

a) Increase taxes:

By increasing taxes governments reduce disposable income and therefore there is a reduction in spending.

b) Price controls:

Governments put limits to increases in prices when companies try to increase them due to inflation.

c) Wage control:

Limiting wage growth also contributes in stopping inflation

Adding on, (Pettinger, 2022), highlights how cost-push inflation is much difficult to control as it is fundamentally caused by supply problems, and it is more of a "luck" game.

IV. Description of asset classes and inflation relevance

To be able to analyze the characteristics of assets to hedge against inflation we first need to understand what the main consequences of both inflation and contractionary policies are due to inflation on these 5 assets that we are going to explore.

a) Equities:

i. Equities Basics:

An equity or a stock represents ownership of shares in a traded company. This implies participation in management decisions, such as profits, dividends, and potential growth strategies for the company itself. If a company bursts, equity holders are the last ones to get paid, as they need to satisfy other obligations first: debt holders and employees, so they stand at the end of the company's capital structure. Moreover, equities reflect the expectations of individuals on the market, economy, and company, (Lustig, 2014).

Equities are a growth asset yet, a very risky asset. It is the most common risk asset in portfolios. The main role they have is to deliver long-term growth also known as capital appreciation. Returns on equities are obtained by a price increase of the stock itself or by dividends attached to the stock itself and given out by the company. These prices are driven by future expectations of the company's management decisions and the results obtained from these.

There are two ways of investing in equities instruments, directly purchasing shares of a company or investing on an equity index, for example, S&P 500, which implies that the investors is investing in the 500 largest companies in the USA, according to their market capitalization (*market capitalization = number of shares * price per share*). Markets reflect the prices that are given to stocks.

When investing in a stock there are two risks that are carried along, company's risk, the unsystematic risk and the equities market risk, called the systematic risk. This last risk cannot be diversified, whilst unsystematic risk is diversified by investing in other instruments, (Lustig, 2014). This market exposure which carries the systematic risk is measured with the beta of a stock with respect to the equity market. According to the CAPM and modern portfolio theory, investors should be rewarded according to the beta a stock has, in other words, for investors to invest in riskier assets, they must be compensated.

ii. Equity pricing:

Equity prices are regulated in the market and affected by different factors which they are exposed too. Stocks are exposed to macro-economic factors that affect prices, such as interest

rates, inflation, and economic growth. These factors do not need to have a positive correlation with equities, so if there is positive economic growth, so increasing GDP, this does not imply that the consequences of this factors will lead to higher prices of stocks.

Moreover, equities are also exposed to individual's sentiment, for example, individual's expectations on the macro and micro-economic future environment. This influences the expected market return (beta) and the equity risk premium. Sentiment of individuals can be classified into two, (Lustig, 2014):

1. Fear:

When fear is high, this means that investors see a lot of risk in the equity market so therefore, assets risk premiums are higher, as investors want to be compensated for taking more risk and buying in riskier periods. Adding on, prices of stocks are lower, as people feel that the economy is doing bad. Lower prices of shares, mean potential higher returns in the future, (Lustig, 2014). Investors who invest in these times, with these characteristics expect that in the long run there will be a capital appreciation of this stocks and they will gain returns.

2. Greed:

This is the opposite reaction and consequences of fear sentiment in the market. Investors expect economy to be energetic and show positive results, therefore, there is higher demand for stocks, prices are higher as there are many investors willing to invest as they have positive expectations and assets risk premiums are lower as there is less risk in the equities market.

It is clear to say that the psychological factors are a huge factor that influences the markets, and it even gives value to the assets in the market. It regulated supply and demand and triggers bear and bull markets.

The level of liquidity in the market is another factor that influences equity prices. Liquidity is regulated in the market by policy makers, (policy makers are institutions that regulate the economy to avoid recessions when economy is speeding up too much or slowing down too much, for example, the European Central Bank (ECB) and the Fed). Too speed up the economy the policymakers use expansionary fiscal and monetary policies, implying they inject money into the economy and lower down interest rates, so that money is cheaper and more accessible to everyone, leading to volume of investments increasing. This concludes in liquidity being high, so investors can invest and disinvest with great facility. It is said that liquidity is high at the best time to invest in equities, near the end of a recession, (Yoram Lustig, 2014). This implies that equity prices are not too high, so you are no paying overvalued prices and there are opportunities of capital appreciation, consequently leading to returns in equities.

iii. Equities and Inflation:

It is thought that equities offer some degree of purchasing power protection, (Lustig, 2014), which therefore implies that their real value and their purchasing power value increases as inflation speeds up, which in some cases is true, however, inflation brings a lot of uncertainty into stock markets, something which normally has many negative outcomes in this market.

According to, (Duggan, 2023), the ideal stock market situation is where inflation is around the 2% target as this tends to provide a sustained growth in equity prices. This implies that as inflation has uncertainty and risk connotations, these are translated into the market as volatility and slower consumption. This in turn messes equities sustained growth and prices until inflation reduces or vanishes.

When inflation speeds up, this means that raw material's prices increase, so it is more costly for companies to manufacture their outputs. They too have to increase their prices to keep profit margins in line with inflation. However, there are some cases where companies already have contracts signed with suppliers which are usually fixed and can't be adjusted to inflation. This leads to the conclusion that unexpected inflation is associated with negative stocks so it's bad for equities, as prices do not increase, implying that equities do not always provide a good hedge against inflation, especially unexpected inflation, (Lustig, 2014).

We must differentiate between two types of stocks which react differently to inflation hikes. Growth stocks tend to be damaged by inflation, as they are sensitive to rising inflation rates as when company valuation is accounted, discounted rate is higher therefore leaving this figure lower down in comparison to value stocks. Having done this division amongst stock types, we must not forget to mention how utilities-related stocks have performed along history exceptionally to increasing and high inflation. The Energy Select Sector SPDR ETF (XLE) is up more than 14% over the last 12 months, and some of the top-performing stocks in the S&P 500 have been oil and gas companies, (Duggan, 2023). To be able to determine if equities are a hedge against inflation we will analyze them in depth, further along.

b) Fixed Income:

i. Bond Basics:

Fixed income instruments are debt investments that provide a return in the form of periodic payments, known as interests or coupons which the issuer of the debt is contractually obliged to pay. Under this definition, all securities which carry a contractual promise from the issuer, of making payments to the investor or bondholder, in the form of coupons and principal repayment at maturity, are considered fixed-income instruments.

Bonds are an instrument of fixed-income and form the largest securities market in the world, the bond market. In 2021, it counts for \$126.9 trillion globally. In comparison to the equity market, which counted for \$124.4 trillion, (Bowman, 2022).

A bond is a loan that the bondholder or bond purchaser lends to the bond issuer. These issuers tend to be governments, corporations, and municipalities, who tend to raise capital. As previously mentioned, bonds have contractually obliged payments which are known in advance. These periodic payments can be fixed rates or floating rates, where coupons are not fixed as coupon or interest rate changes. Moreover, there is also a final payment at maturity date, where the principal of the bond is refunded. Coupon and principal payment are an obligation carried out by the issuer of the security.

Bond issuers must ensure that individuals will buy their bond(s), in order to build up demand for it, it has to consider the current interest rate in the environment, to achieve a competitive coupon of the bond and thereby generate demand towards the bond(s). Coupons are also determined by the maturity of a bond and credit risk. The longer the maturity of the bond, the higher the coupon, as there will be more factors that could negatively impact the issuer's ability to repay the debt, for example, changes in interest rates and inflation, which could affect the bond's price.

ii. Types of bonds:

According to different characteristics bonds can be classified into 5 main groups, (Lustig, 2014):

1. Nominal / standard bonds –
Bonds which have a fixed interest rate, therefore have a fixed coupon.
2. Floating rate bonds –
Bonds which have a variable interest rate; therefore, coupons change every time there is a coupon payment as it is calculated based on the current interest rate of the market.
3. Inflation-linked bonds –
Bonds which its interest rate is linked to inflation, therefore, are protected from inflation downturns.
4. Convertible bonds –
Bonds that can be converted to equities
5. Callable bonds –
Bonds that can callable (repaid by issuer) before maturity date.

According to maturity bonds can be classified as:

1. Short-term Bonds (< 5 years)

2. Long-term bonds (>5 years)

iii. How to price a bond / Bond pricing

The bond price is a reflection of the price that the investors need to purchase the value. When buying a bond its prices can be higher or lower than its nominal value (face value / principal). Whilst price of a bond can change, the nominal value will always remain constant throughout the bond's lifetime. For instance, a bond's nominal value can be \$1,000, but its price today can be lower than its nominal value, \$980 or higher than its nominal value, \$1,005.

Bond prices are calculated by discounting the future cash flows of a bond, it is because of that, that the price of a bond depend on the present value of the future cash flows it will generate. These future cash flows are the future coupon payments and the principal payment at maturity. The cashflows must be discounted to an interest rate which is called *Yield to Maturity* and will lead to the current price of the bond.

Moreover, the price of a bond has an inverse relationship with the yield of itself. When interest rates in the market increase, the discounting rate, which is the yield to maturity at which we discount our future cash flows, to calculate the bond's price is higher, therefore, implying that the price of the bond will decrease. The opposite would happen if interest rate in the market decrease, implying we discount at a lower yield to maturity, thereby, the price of the bond will increase. Therefore, if a bond is sold before maturity, the investor will not receive the nominal value of the bond, it will receive the value at which the bond is trading currently at the market, which depend on the interest rate of the market. However, there is one case in which price does not suffer interest rate risk, which is when the bond is kept until maturity or if you sell it at the bond's duration, time at which the bond does not suffer from the impact of interest rate risk.

iv. Risks of fixed income investing:

Every investment carries along a certain degree of risk, whether it more risk formed or less risk formed. Therefore, different fixed income investments have different levels of risk. Fixed income investments carry along with them 3 types of risks, (Lustig, 2014):

1. Interest rate risk –

This type of risks stands for, the risk that increasing rates has on the current price of our bond. To find the current price of our bond, we must discount at the yield to maturity of the market on that current time. The higher this rate, the lower the price of the bond that we will obtain. Moreover, its yield, which are the bond's coupons become less

competitive, as in the market yields are higher at the moment, which implies why price of bond has to be lowered if we want to find buyers to buy it.

2. Inflation risk

3. Credit risk -

This type of risk is the risk of the issuer not paying or not paying all the interest, or not paying on time, also known as risk of default a bond has attached to itself.

v. Inflation and Fixed-Income:

When investing in fixed-income instruments, investors receive recurrent income, this income has a value. Investors find the real purchasing power of their returns something very important. High inflation implies that bonds lose part of their safe-haven attributes therefore, their beta must be higher to compensate the risk investors are taking.

Bond yields and prices are influenced and driven by changes in the real interest rate and in expectations of the market on inflation. These two factors affect the yield curve and therefore as we use this curve to obtain the yield to maturity to discount the future cash flows of our bond, the price of our bond. Standard bonds are made to compensate investors for expected inflation over the bond's life.

When inflation is higher than the level reflected in the bond price when purchase, the real purchasing power and real value of the bond's future cash flows fall short of expectations. If there is unexpected inflation, which leads to revisions of future expected inflation, this loss of real purchasing power can be significant. Moreover, the maturity of the bond also affected the possible inflation that can affect the bond and its real purchasing power. The longer the life of the bond the higher the inflation risk it has.

Fixed income instruments income is received as periodic coupons paid by the debtor. These stand as future cash flows paid to investors. The risk is that the real value of these cash flows can be affected by the rate of the inflation in the market. If inflation increases, as these payments are already fixed *a priori* then there is a risk as their real value decreases. However, there are inflation-linked bonds, which eliminate this risk but will underperform standard bonds, when inflation level is below expectations.

Beyond inflation affecting the purchasing power of investor by decreasing it and in the price of the bond, inflation affects bond investors in 3 main reasons, (Lustig, 2014):

1. High inflation implies bonds are less attractive investments as there is increasing uncertainty.
2. High inflation implies there is more volatility in the market and in the economy

3. High inflation affects companies and indirectly could affect the correlation between bonds and equities in portfolios.

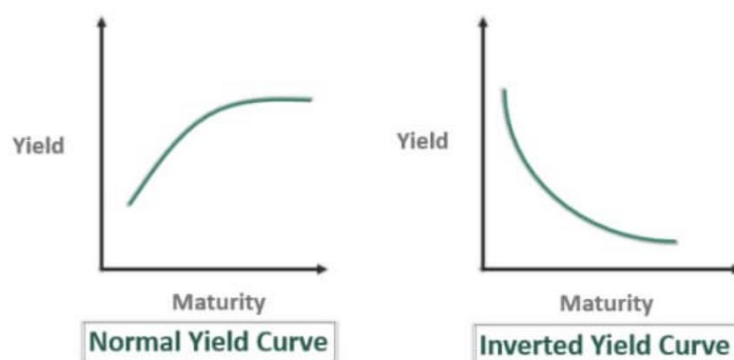
In terms of the economy and market, inflation over the last couple of decades has not been as higher as it was in most of the 20th century. Central banks had been more effective at controlling inflation therefore, bond returns have been lower than in the past.

However, in the actual economic and market environment, inflation rate in the last few years has been very uncertain, leading to the current inflation scenario that is being seen now a days. An unstoppable increasing inflation rate is affecting daily worldwide economies. The European Central Bank (ECB) and the Fed had taken infinite measures to stimulate the economy back again after the 2008 financial crisis and 2011 European sovereign debt crisis. Both started implementing drastic measures such as quantitative easing and inflating the balance sheet of central banks. To manage this measure, central banks printed out uncountable amounts of money and forgotten to focus on the inflation effects this could have in the future and only had one objective which was to stimulate the economy to achieve economic growth. This is one of the main reasons why we are now starting to pay off the consequences and effects of this measures in terms of incessant and non-stopping inflation rates.

- vi. The yield curve:

The yield curve shows the yields (interest rate) across different maturities of a similar fixed income instruments. For example, a similar bond with 3 months of lifespan, 5 years or 20 years. It also shows the relationship between the interest rate and the time to maturity of a bond. The yield curve has a rising-kind of shape as the higher the maturity of the bond the higher the yield, as more time implies more risk, therefore, investors have to be rewarded for taking that extra risk. Lenders are concerned that rising inflation, rising interest rates or potential defaults which explain why bond issuers offer lower interest rates in short-term bonds and higher interests in long-term bonds and explains why the yield curve has that increasing shape. Exceptionally, there is a case when interest rates in long-term bonds are lower than those of a short-term bond. This is known as the inverted yield curve and occurs when there is higher demand for long-term bonds than what there is for short-term bonds. This happens when there are expectations of an economic recession looming and soon to occur.

Figure 3: Yield curve vs inverted yield curve



Source: WallstreetMojo

The shape of the yield curve depends vastly on the expectations of the interest rate of the market participants and the constant risk premium. These expectations of interest rates along with an assumption that arbitrage opportunities are traded away construct the yield curve. Long term interest rate does not only reflect investors assumptions and expectations about the future interest rate in the market but also include a compensation for investing in bonds with long-term maturities and having to give up on the use and availability of their money for a longer period. This compensation is also known as liquidity premium, implying yields are higher and explaining why the yield curve slope had an upward movement.

This curve is very important for investors when they build their portfolio, as they build portfolios with different maturities and durations based on their expectations on the changes of the shape of the yield curve. The yield curve is also important in an inflation sphere-wise as it is an outlook and expectation of interest rates, which in turn are an expectation of individuals towards inflation. When the market has high inflation expectations, these are reflected in the yield curve, as interest rates begin to increase. This may lead to a scenario where we see an inverse yield curve as we are expecting high inflation, as seen in Figure 3, therefore, high interest rates, to offset inflation, which tends to be seen as a short-term situation therefore, long-term interest rates are lower than short-term ones. Implying that even though long-term interest rates tend to be higher than short-term interest ones as investors want to be rewarded for extra risk taken and erosion of money use for a longer period, if there is inflation in the current period, current interest rates will be higher as investors purchasing power is reduced therefore for bonds to be competitive, interest rates have to be higher than in the long-term to offset the inflation draw backs. We will further analyze this asset class later on to evaluate its characteristics as hedgers against inflation, (Lustig, 2014).

c) Cash and Cash Equivalence

i. Basics:

Cash is the most liquid asset and even though we might think cash is considered a “risk-free” instrument; this is not true. As seen in the past, it has not complied with increasing inflation rate and have even experienced negative real returns. Some of its benefits are described as making the investor being able to invest in upcoming opportunities immediately and provide coverage, (Lustig, 2014).

As for cash equivalents, this are known as the money market. Instruments in this market as of nature are like fixed income. However, due to their highly liquid state, they are considered cash equivalence because they are converted into cash very easily. Money market instruments include debt securities with maturities of less than a year; treasury bills, certificates of deposit (CDs) and commercial papers, Eurodollars and repurchase agreements (repos). These are known to be low risk profile assets.

ii. Types of cash & cash equivalence instruments

- T-Bills – Issued by governments to borrow money with maturity of less than a year.
- CDs – Consist of a deposit within a bank which has a maturity and interest rates. Similar to bonds.
- Commercial Paper: Short-term loans issued by corporations with maturities up to nine months.
- Repos: Consists of overnight borrowing.

iii. Cash & cash equivalence and inflation:

Cash & cash equivalence is a type of asset which has a dual approach when it comes to inflation. It is very important to have cash in our portfolios because it is a source of liquidity that provides backup in case of any unexpected events, something very typical in times of inflation when uncertainty corrodes markets. It also provides investors with the ability of being flexible and the chance to invest in surging and immediate opportunities, something very typical in times of inflation too where opportunities manifest from now were. This illustrates how based on this, cash & cash equivalents can reduce overall portfolio risk, (Lustig, 2014).

However, this asset class has a major quality which partially offsets it from hedging against inflation and makes the effects of inflation stronger than on other assets. Cash & cash equivalence has not got the qualities to keep up the pace with inflation, implying it losses purchasing power. Moreover, another effect of inflation on this asset class is that if

policymakers do not tackle it because they want to speed up the economy, interest rates will not be increase causing this asset to generate negative real returns. Therefore, based on these effects of inflation on cash & cash equivalence would be very harming for our portfolio as it would not protect it from inflation.

To be able to conclude if cash & cash equivalence is an asset that has qualities to hedge against inflation and include them in our portfolio, we will further investigate them. We will carry out an analysis of their properties in the following section.

d) Commodities

i. Basics

Commodities are another asset class that represents a distinct category of investments. Commodities are basic goods that are typically used in commerce, such as raw materials and agricultural products. Examples of commodities include crude oil, gold, wheat, coffee, and natural gas, among others, (Lustig, 2014).

Since commodities are frequently utilized as raw materials in the manufacture of other items, supply and demand factors frequently affect the prices of commodities. For instance, if a certain commodity is in short supply, its price may rise as a result of the high demand and constrained supply. On the other hand, if a commodity is oversupplied, the price may drop because of the excess supply and lower demand.

Since that commodities' performance tends to be less connected with that of more conventional asset classes like stocks and bonds, investing in them can be a good method to diversify a portfolio. Due to their propensity to increase in price in response to rising living expenses, commodities can also be used as a hedge against inflation, (Lustig, 2014).

Risks associated with commodity investing include market volatility, shifts in supply and demand, and geopolitical events. The unpredictable nature of weather patterns, natural disasters, and other uncontrolled variables also cause many commodities' prices to fluctuate.

Overall, commodities can be a desirable asset class for investors wishing to diversify their portfolios; nevertheless, before making an investment, it is crucial to thoroughly weigh the risks and potential returns.

ii. Commodities and inflation

The cost of commodities can be significantly impacted by inflation. Generally speaking, when inflation is strong, commodity prices tend to increase as well. This is due to the fact that inflation reduces the value of money's purchasing power, which can raise the demand for commodities as a store of value.

People typically spend more money on essential necessities like food, electricity, and other commodities when the cost of life increases as a result of inflation. Certain commodities may be more expensive as a result of the increased demand, which could also boost the profits for the businesses that make and sell them.

Another way that inflation can affect commodities is through changes in currency exchange rates. As inflation rises, central banks may choose to increase interest rates to help stabilize prices. This can cause the value of the currency to appreciate, which can make commodities more expensive for buyers using other currencies. Conversely, if interest rates are lowered to combat inflation, the value of the currency may decrease, making commodities more affordable for foreign buyers.

Overall, inflation can have a complex and multifaceted impact on the prices of commodities. While high inflation can lead to higher prices for commodities, it's important to note that other factors, such as supply and demand dynamics and geopolitical events, can also play a significant role in determining commodity prices.

e) Real Estate

i. Basics

Real estate represents a distinct class of investments with distinctive qualities and behavior that differs from other asset classes like stocks, bonds, or commodities. Real estate is regarded as an asset class. Investing in real estate is often viewed as a long-term strategy with the potential to produce both income and capital gains, (Lustig, 2014).

The capacity of real estate as an asset class to create diversification in an investment portfolio is one of its fundamental characteristics. Investing in real estate typically has a low correlation with other asset classes, which allows it to perform well even when other investments are underperforming. Given that it frequently generates a consistent flow of rental income, real estate can also be a desirable asset type for generating income.

ii. Real estate and inflation:

Real estate offers a hedge against inflation because it has a relatively high positive correlation with both foreseen and unforeseen inflation. It is true that the link is weaker with property prices and inflation over the short-term or unanticipated inflation since property prices do not adjust immediately to inflation, (Lustig, 2014).

When inflation increases central banks normally react by increasing interest rates, which in turn increases mortgages rates and makes properties less accessible as borrowing money becomes more expensive. This has a negative effect on demand for properties, (Lustig, 2014). However, this effect is diminished because supply of properties is also reduced as raw materials are more expensive. To be able to conclude that this asset class does hedge against inflation in both expected and unexpected scenarios we will analyze it further along in much depth.

V. Inflation Along History

To be able to purely examine the characteristics of assets in high inflation scenarios we need to explore the different inflation crisis along history. This will expand our knowledge in terms of understanding how measures taken in high inflation periods affect the macro economy and thereby, investments and asset classes.

a) 1970s Inflation Crisis

The 1970s inflation crisis is known as the worst inflation crisis, due to its high inflation rates reached in all countries around the world and to its stickiness in economy, it perdured over 10 years in the economy. During this period inflation reached a global average of 14% and it was not until well headed in the 1980s that it managed to stabilize, (Federal Reserve History, 2013).

After World War Two, governments across the global had as main objective to promote greater economic growth and maximum employment, production and purchasing power, as after the war economies were devastated and hit hard.

To achieve these objectives, they went after the Philips curve, which consisted of having high inflation so that there was low unemployment. To achieve this low unemployment, based on the Philips curve, there had to be high inflation. Moreover, to achieve maximum production and purchasing power, in other words, to speed up the economy after the war, governments started implementing massive expansionary monetary policies programs, where interest rates were stable. This made borrowing money be cheap and that would incentive investments and consumption and governments were injecting more and more money into the economy, via issuing bonds.

Amid, Breton Woods, a global monetary system agreed by 1944, with 44 countries across the world participating in it, where a fixed exchange rate was induced. However, this seemed to be incompatible with domestic goals of these nations, which consisted of pursuing monetary policies that promised to march up the Philips curve and by this means, complying with the objectives.

At the beginning of the 1970s, the tide begins to change and overuse of monetary policies was beginning to overheat the economy with unemployment not falling. In 1973, the world suffers a dramatic oil crisis due to an Arab oil embargo takes places. Crude oil prices quadrupled, illustrating how costs of raw materials increased resulting in productions costs of companies increasing.

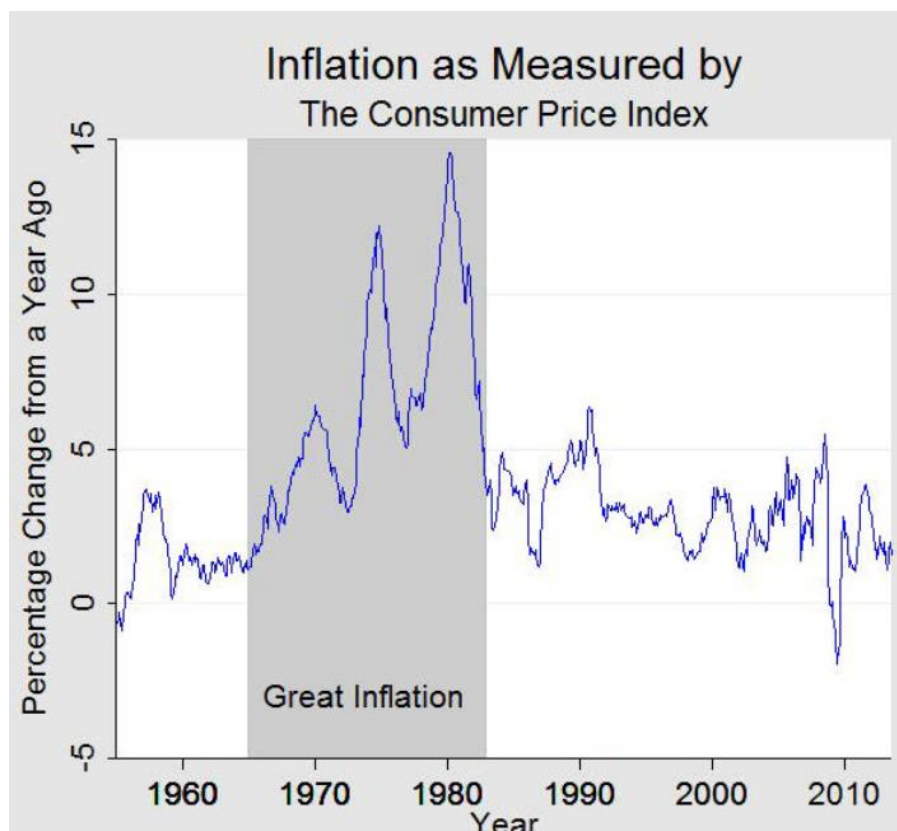
The strong use of monetary policies was causing prices to increase as there was too much money circulating in the economy. The oil crisis made supply fall, creating excess demand

which was not being met. The pursue for achieving the ideal situation that the Philips curve suggested ended up in the creation of sticky inflation and high unemployment. This led to an era of stagflation where there was barely any economic growth and average unemployment rate globally of 8%.

A second energy crisis took place in 1979, with the Iranian revolution, causing oil prices to triple. This second cost-push inflation further added to inflation pressure, hitting a global average inflation of 14% in 1980. It was not until 1985 when after several attempts and measures such as wage and price controls, inflation began to fall.

As seen in Figure 4, in comparison to inflation over the rest of the years, inflation reached unimaginable levels. It increased and decreased in matter of months, which caused many instabilities across markets.

Figure 4: Inflation as Measured by the Consumer Price Index



Source: Federal Reserve Public Data

Due to this terrible crisis, central banks across the globe introduced the target inflation of 2%, which is crucial for stability in the economy and for achieving maximum employment and sustained long-term growth.

b) Current situation of inflation in the global economy

In 2020 when a shocking and very unknown event changed our lives and especially our lifestyles forever, the COVID-19, entering a pandemic-induces economic slowdown. (Rogoff, 2022). Policymakers began to impose extent expansionary monetary policies to speed up the economy after the lockdown as they feared a pandemic-driven recession, where massive spending programs were implemented around the world in the early stages of the pandemic. Governments and central banks were only worried about jump-starting their economies again and missed out on the inflationary risks that their expenditure programs could lead to. However, this has created rather than a helpful scenario a rebound effect. This has resulted in an increase in money supply and in turn an increase in demand for goods and services. The worldwide economy finds itself in a high inflation environment. For example, in the first quarter of 2022, the US GDP fell by -0.4% and in May 2022 its inflation surpassed a rate of 8.6%, (Plissken, 2022).

Moreover, there have been other events which had not been anticipated and which nobody saw coming which have caused further trouble to inflation rates. A couple of months after, the COVID-19 caused significant disruptions to global supply chains, resulting in shortages of certain goods and raw materials, which led to an increase in the price of these goods as demand outstripped supply. Amid, Russia invaded Ukraine, causing severe problems to the supply chain, as Ukraine is one of the largest providers of raw goods such as wheat and cereals, expanding the supply issues and raising prices of goods even more. Adding on, prices of energy and certain commodities, such as copper, also saw sharply increases due to a combination of supply constraints due to the war in Ukraine and increasing demand. This therefore left the economic scenario in a quite dramatic situation, as these unimaginable and unplanned events forced central banks and governments to take measures to control this inflation which had further burst due to unseeable future events back in the day however, these decisions risked the safety of economic growth and development. To sum up, it can be said that the actual inflation situation is a result of both cost-push inflation and demand-pull inflation.

Coming from a three-decade-period in which prices have grown slowly and of easy money lending, (Plissken, 2022), this inflation which struck after the pandemic has caught everyone by surprise. The low interest rate atmosphere gave the facility and option both at corporate and individual levels to obtain money easily and cheap, which made households consume more and businesses to invest large amounts of money. These negative and zero interest rates in the economies have caused an asset price bubble which has artificially inflated prices of assets, (Plissken, 2022). This has led to a consequence of inflating everything in the economy from real estate, stocks, bonds, commodities to cryptocurrencies. Institutions and policy makers across the

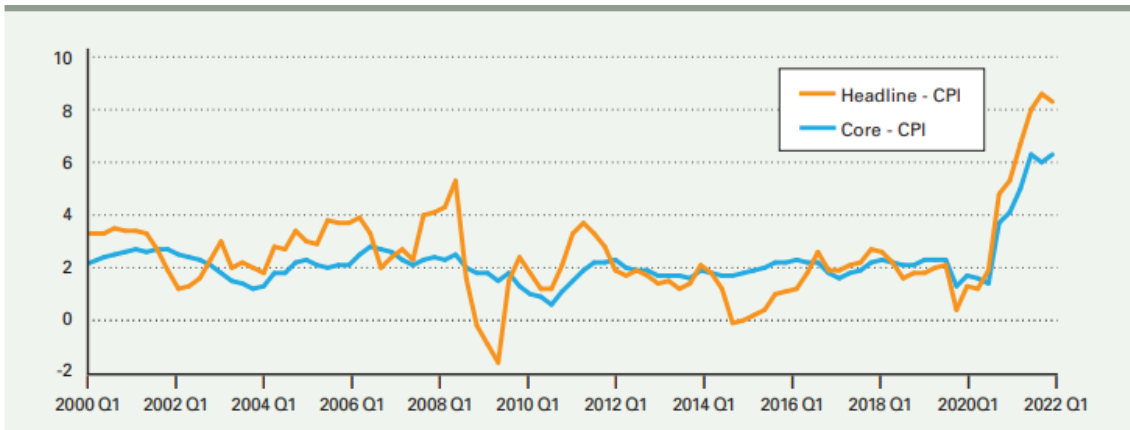
world are putting all their weapons into battling this unstoppable inflation. In fact, it is recognized as the biggest challenge and threat that all countries are facing at the moment, it is not global warming, it is inflation.

Inflation was first noticed in spring of 2021 in USA, however, central banks across the world preferred not to act immediately. This unstoppable inflation made central banks take measures as the economy was speeding up too much. It was first addressed by the Fed, In March 2022, it increased interest rates for the first time in a long time, by 0.25% and have been raised five times so far in 2022. These actions have influenced mortgage rates causing mortgage loans to suffer a 77% increase in their monthly payments, (M. Mihai , Azadikhah Jahromi, & Yang, 2023). The ECB followed this measure in 2022. When it began to increase its interest rates and inflation had already been rising sharply for over a year. It is unquestionable to ask, if central banks acted too long and waited far too much time in order to battle inflation and now, they find themselves in a tense situation where they have to be careful, they need to control inflation without tipping their economies, and leading the world into a deep recession, due to the hikes in interest rates which could prevent economic growth.

In 2021, the Fed and US economists predicted that inflation would be transitory, (M. Mihai , Azadikhah Jahromi, & Yang, 2023) however, far from right, nearly two years later inflation lays down in the daily economy, damaging households, and businesses every day. The persistent effect of inflation left an inflation of 8.2% in September 2022, in the US economy, (M. Mihai , Azadikhah Jahromi, & Yang, 2023),. This has been the highest level reached in the last 40 years in the economy, which has created a vastly widespread threat to the stability and growth of the world world economy, and consequently to the world economy, as the US economy is one of, if not the world leading economy.

According to a report published in the third quarter of 2022 in the US by the Bureau of Labor Statistics (BLS), consumer price index (CPI) report showed that the highest increase in monthly prices were in the shelter, food, and medical industry in headline inflation (M. Mihai , Azadikhah Jahromi, & Yang, 2023). This suggests how both volatile components (which are excluded in core inflation and include in headline inflation) and non-volatile components are suffering from this persistent inflation. As seen in Figure 5, core inflation in 2022 Q1 was at 6.2% and headline inflation reached 8.2%. This highlights how price shocks in commodities have contaminated the prices of the rest of the goods in the economy.

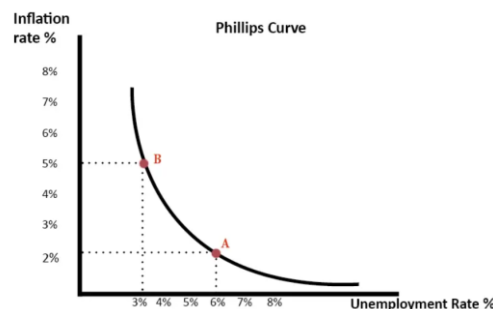
Figure 5: Headline and Core Inflation in the US



Source: U.S. Bureau of Labor Statistics (fred.stlouisfed.org).

The current high inflation and low unemployment in the US sends signals of an overheating economy. In fact, the Phillips curve, represents this exact scenario, highlighting that there is a negative correlation between wage inflation and unemployment rate. As observed in the Philip’s curve, Figure 6, it is implied that as unemployment rate falls, there is a “stimulus” in inflation rate, as the economy is speeding. This emphasizes how after the pandemic, the surge in the increase of aggregate demand in economies, led to a fall in unemployment rate, impacting on inflation rate by making it increase.

Figure 6: Phillips Curve



Source: *Economics Help*

Speaking in terms of the housing market, price increases in real estate have been very sharp, due to demand growth and supply shortages. This has affected overall inflation as CPI measures the cost of the market basket of a typical urban family and housing prices count for 40% of the basket, (M. Mihai , Azadikhah Jahromi, & Yang, 2023). This highlights how increasing prices of houses have affected what is considered as an average family and thereby indirectly affected lifestyle quality and household well-being. Due to this, record-high prices have been experienced, increasing by over 13% over the past year.

In terms of individual investments, inflation has left consumers in a terrible situation as the effects of it have implied less disposable income to be able to carry out investments. In this sense, mortgages increase of its payments and houses outrageous prices have stricken out many individuals out of investing in real estate currently, as mortgages are too expensive, and they have less disposable income.

The increase of interest rates however, has implied a higher costs for businesses, as borrowing money is more expensive, this then leads to stopping long term investments planned and unemployment levels rise, implying why central banks have been very cautious when hiking interest rates as these put economic risk on the verge as pushing interest rates risks creating a deep recession and this will hit hard on low-income people, young individuals amongst other many groups across the economies.

Taking this into an investment scenario, inflation has left consequence in investments and markets. Coming off 2022's negative results for stocks and bonds, investors may still face a challenging environment in 2023 given the persistent nature of inflation and the Fed's response to it, states X. This illustrates how volatility has invaded markets and how we are facing a period of "one day incredible gains, the next vastly losses", implying that markets are very unpredictable and uncontrollable in the short term therefore, it has to be considered whether any adjustments are needed to portfolios, generally, a long-term strategy. Considered a long investment horizon, inflation could potentially provide a very precious investment opportunity to people with cash available in certain asset classes. During inflation we see many moments of undervalued assets due to the current economic situation, which are opportunities and create the ideal scenario of any investor "buy low, sell high". This again, will most likely work when having long-term investment horizons as in the short-term these assets could recover their value for a short period but, it is purely speculation of the markets.

c) Correlation between the major inflation events

It is remarkable to mention how the current inflation crisis that we are happening to live today could be similar in certain ways to the 1970s inflation crisis, (Rogoff, 2022). The main highlight is in supply shocks as one of the large contributors to the causes of these inflation crisis. In the COVID-19 inflation crisis, supply chain disruptions after lockdown made economies suffer terribly as increasing aggregate demand could not be met thereby, increasing prices of goods and services. Moreover, the world faced an enormous shock with Russia's invasion of Ukraine which was translated to markets. Whilst in the 1970s inflation crisis, another huge shock was suffered, with the OPEC oil embargo of 1973-74, hugely exacerbating problems in global supply chains. In both episodes, government and central banks policies were based on Keynesian-oriented stimulus policies with supply side economics all but forgotten. This

suggests how printing money and increasing its supply in economy to stimulate it and to make a flash and quick image of economic growth, which is actually not being sustained but just something ephemeral holds with itself huge inflationary risks, as seen in both scenarios, when fueling too much money into the economy amid to low interest rates, implying money is very cheap, this will cause a huge increase in demand, from both consumers and corporates. If we add supply constraints which can't meet the requirements of the demand, this will lead to increases in the price of products and services, all these ending in unstoppable inflation as seen in both occasions. This emphasizes how inflation bursts when there are disruptions in supply and increasing demand.

If we were to analyze if there is some type of spread amongst the two major inflation events seen in the economy, it is a good beginning line to take off from the starting point or situation of the global economies in both periods of major inflation.

The crisis of 1970s had a very rough starting point, much like the pandemic inflation. Both starting points take off with governments that part from difficult situations were economies have been forced to stop. In the pandemic we were all obliged to stay home, which stopped the economic cycle and WW2 made economies stop too. Therefore, both starting points are similar in the sense that governments wanted to implement measures to reactivate the economy, to achieve economic growth, low unemployment, and high production.

Governments in both events have used similar measures, which come up to being expansionary monetary policies, where they injected money into the economy and had low or stable interest rates so that borrowing money is cheaper, all being stimulus of consumption, investments, and exports, which boost aggregate demand. The problem comes in when these monetary policies are used in an abusive way. Overconsumption in the economy is created and this increases aggregate demand which in turn supply can't cover, leading to an increase in prices, which is what occurred in both scenarios. Illustrating how demand-pull inflation attacked the economy in both cases

Amid, in both situations there is a cost-push inflation involved too, in the 1970s Inflation Crisis, there were two oil shortages, a decrease in supply of raw materials, imply an increase in production costs, which led to an increase in prices. In the case of the pandemic inflation crisis, as the economy had been stopped for several months, when people were able to go out of their homes and monetary policies had taken planes, money was very cheap so there was an uncalculated drastic boost in demand which could not be covered with supply and production had to be reactivated causing disruptions in the supply chain, which meant that this increase in aggregate demand could not be satisfied. This describes why in both cases inflation has boosted up so abruptly and ferociously.

The main differences come in with unemployment, which is why this crisis will not reach the 1970s crisis and inflation will not be sticky, in fact, after measures being applied by central banks, we are slowly beginning to see decrease in inflation across the economies. In the 1970s crisis unemployment was roasting whilst in the current pandemic inflation crisis unemployment levels are being quite cautious and not surveilling very high levels.

Table 1: Similarities and Differences between 1970s and 2020s Inflation crisis

1970	2020
Similarities	
Commodity price surge due to the oil price's shock	Commodity price surge due to supply constraints caused by pandemic and Russia-Ukrainian war
Tightening monetary policy: raise in interest rates	Tightening monetary policy: raise in interest rates
Differences	
Commodity price jumps outrageous	Commodity price jumps high but more contained than 1970s
Multiple measures to combat inflation not just increasing interest rates, such as: employment and economic growth targets. Implemented Breton Woods System, which aimed to support economic activity and price stability.	Central banks only pursue inflation target at the moment, so the only measure taken has been an increase in interest rates.

VI. Analyzing of asset classes to hedge against inflation

Inflation scenarios in the economy can make a challenging investing situation and may lead to both winning and losing outcomes in investor's portfolios. The main threat of inflation is that it reduces consumers purchasing power, implying that what they were able to afford yesterday, today they can't as prices are increasing at a faster rate than what their income is increasing at. For example, even if interest rates go up to 5%, if there is an inflation of 8% you have a -3% return, (Plissken, 2022). The most known general idea or strategy in investment terms is to invest rather than staying with cash so that we avoid purchasing power losses. This illustrates how the main goal of investing in inflation times is to not lose the real value of our assets, whether cash, real estate, fixed income, commodities, or stocks.

It is said that in inflation there are two types of investors, which are classified upon their strategies, (Plissken, 2022):

1. Long-term investors:

This investor profile is known for selecting or picking up bargains to build a strong portfolio of undervalued investment. They buy assets which have a lower price than their real or "correct" price and hold them up in their portfolios for a long-term period until they have revaluated so that when they sell them, they are able to make a profit. Therefore, these types of assets have a long-term growth potential. However, these investors know that in the short-term (months or even years) their assets in their portfolios will most probably continue losing value as inflation reaches its peak. They do not mind facing temporary losses as these types of assets will recover its value as price stabilizes in the economy and inflation decreases.

2. Short-term Traders and Speculators:

This type of investor makes money by hands on and making very precise trades, (Plissken, 2022). This stands for trades in the same day, or in an interval of a few hours, for example, they buy a stock at 9am and sell it at 10am with a 5% increase of the acquiring price and make a return. However, this stock at 3pm could have fall by 8%, which implies that these types of trading strategies are very speculative.

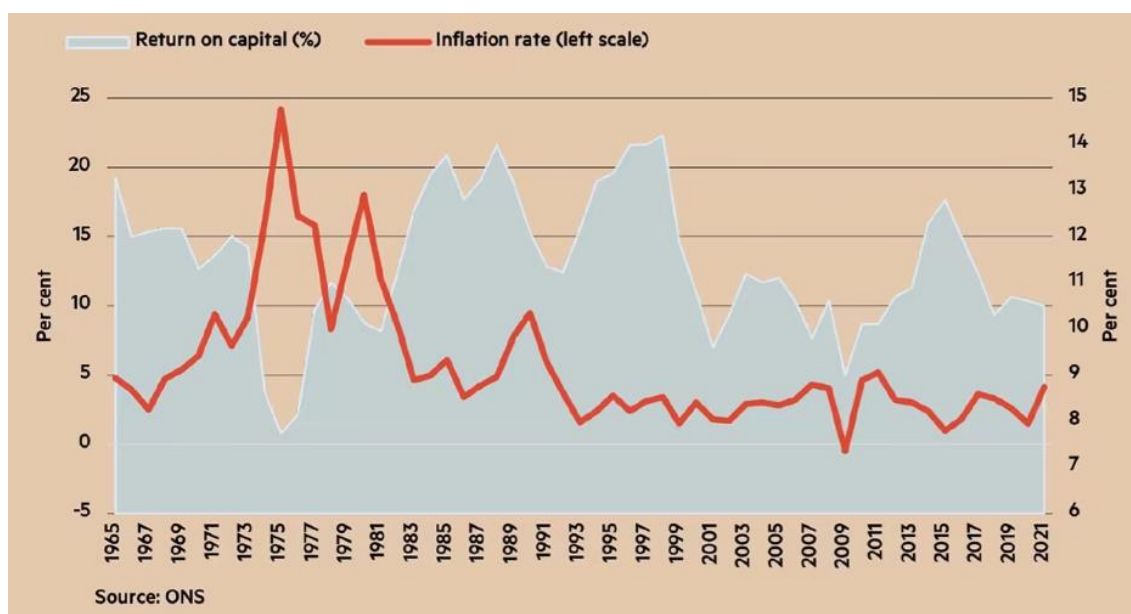
Following, to be able to create an optimal strategy to hedge against inflation we will analyze hedge strategies of asset classes and their hedge properties towards inflation.

a. An inflation hedge strategy with Equities

Equities have always been associated to the theory that if inflation increases, business just increase their prices to adjust to inflation and overcome profit losses. However, as seen in

Figure 7 we can see how in every inflation peak, return on capital of companies fall, so the real question here which we will further analyze is up to what point this theory gives equities that safe-haven characteristic to be able to hedge against inflation.

Figure 7: Return on capital versus inflation



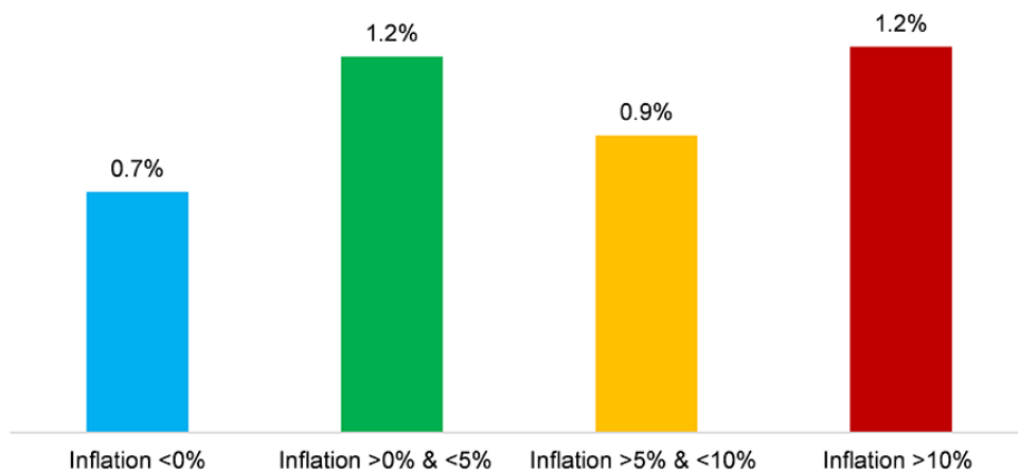
Source: ONS

Firstly, (Rabener, 2021), states that it is clear that equities are a safer option than other instruments such as fixed-interest bonds, which provide no hedge at all. However, even though increasing prices could be a mechanism for equities to not lose value, we can see how Bearbull (2022) challenges this theory as being a cliché as they supposedly have pricing power or the ability of increasing prices without modifying (decreasing) sales volumes. When individual's expectations are of high inflation, price power of firms disappear as the economy will sooner or later slowdown, causing profitability of companies to be on the verge and consequently equities return falling and affected by extra volatility. However, as (Rabener, 2021) mentions much before this time arrives, equities will have already suffered a few falls as when investors expect inflation they tend to sell, when there is too much supply little demand, equity prices fall, damaging equity returns.

Most researchers have found that higher inflation has generally correlated with lower equity valuations, (Zucchi, 2023). As seen in Figure 8, when inflation starts increasing from the 2% target, stocks return in the US fall. The US market tends to lead the rest of the economy; therefore, this happens in the rest of equity markets in the globe. We can see how if inflation surpasses the 5% range returns fall 0.5%. They continue falling even further by 0.3% when inflation increases beyond 10%. This illustrates how equities are fragile when hedging against

inflation in the short-term period, which can even be a couple of years. This does not mean all stock's value go down; some will of course increase but they are all doomed of volatility and on a given morning a stock can increase its returns by 6% but the next hour these can go down by 9%, for example. Investing in stocks while there is high inflation in the economy turns out to be a matter of luck and pure speculation when having short-term horizons, they do not protect portfolios from inflation in the short term. They indulge a lot of volatility and variances in portfolios increase significantly making them less attractive and riskier.

Figure 8: Real Monthly US equity returns vs inflation levels



*Source: FRED, Kenneth R. French Data Library, FactorResearch via CFA Institute
Enterprising Investor, (Rabener, 2021).*

However, there is one case where equities are a good hedge against inflation and even beats inflation, according to, (Thrasher, 2023). When there is inflation in the economy, it is very certain that stocks prices will at different moments reach very low levels or reach low prices in comparison to previous years. This is an opportunity of investment when having a long-horizon scheme. The ideal situation is to buy low and sell high, in other words being able to find low priced stocks which are undervalued, something that happens a lot during high inflation as investors tend to sell due to their emotions and expectations of recession. Eventually after a long-term period they sell high when stocks had recovered their “true” value.

At the beginning, when there are expectations of inflation and consequently high inflation struck the economy, stocks will tend to see falls in prices. However, when the economy goes back to itself, things go back to normality and inflation reaches a stabilized figure, stocks will recover its value. It is then when it's time to sell as we would then have positive returns. This hedge against inflation could match better a description of opportunistic investment which not

all investors can do as many need to sell stocks and many can't have long-time investment horizons, which in this case could be years.

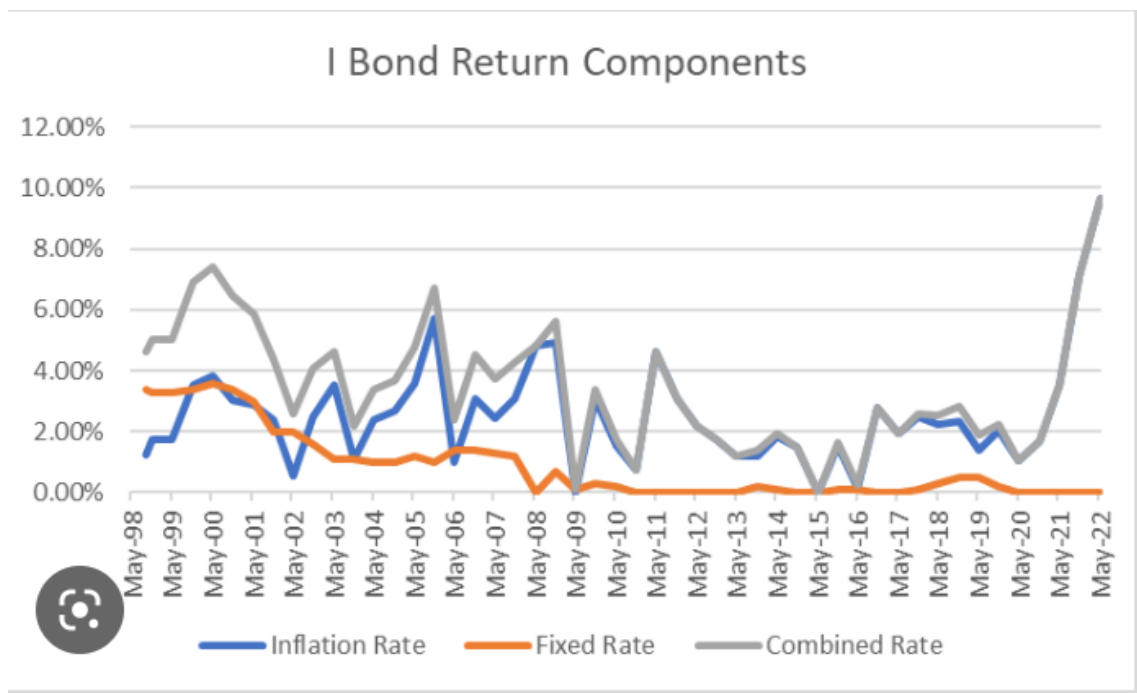
b. An inflation hedge strategy with Bonds

Fixed-interest bonds provide no protection against inflation as they provide a fixed payment which can be affected by inflation as so its prices. For example, if a fixed-payment bond pays out a coupon of 3% and inflation is 5%, we would be in a balance of -2%, therefore we would not be beating inflation with our bond and our purchasing power will see reductions.

However, there is one type of bond which hedges against inflation. These are known as Treasury Inflation Protected Securities (TIPS). These bonds adjust to the inflation rate of the economy. This in comparison to other types of bonds which are not adjusted to inflation provide a hedge against inflation, seeming reasonable to allocate part of our portfolio to this type of fixed-income instrument.

Adding on, there are another inflationary-linked bond called, I-Bonds, which are treasury bonds that pay interest in two ways, bond holders receive a fixed-interest payment and additionally another that will be adjusted to inflation rate. As seen in Figure 9, we can see how these bonds are providing returns in order to ride along inflation rate in the economy, which illustrates how this type of investment, apart from being the most secure of all types of asset investments, is adapted to inflation meaning that we are protecting our portfolio from risk of potential losses caused by high inflation.

Figure 9: I Bond Return Components versus Inflation Rate



Source: Smith Partners Wealth Management

Another way of accounting these types of bonds into our portfolio to hedge against inflation at a higher degree would be by investing at bond's ETF, (Li Cain, 2022). This would provide a more significant hedging investment strategy against inflation as investing in an ETF means we are investing in different bonds, therefore we are achieving more diversification in our portfolio and reducing inflationary risk further. In terms of increasing even more protectionism in the portfolio, we should invest in government bonds rather than corporate bonds as they provide less risk.

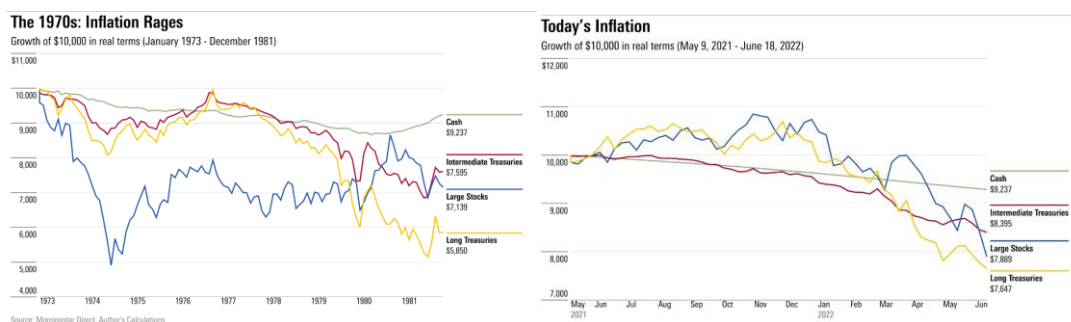
c. An inflation hedge strategy with Cash & Cash Equivalents

Cash & Cash Equivalents carry amongst itself a big oxymoron; cash will not see a decline in its value when there is high inflation, meaning that 100 euros today will still be 100 euros tomorrow. However, what those 100 euros buy today will not buy tomorrow. We could say cash has a hypocritic quality as if we keep part of our portfolio as cash, we will not lose money, but we will lose purchasing power. This oxymoron challenges the hedging qualities of cash & cash equivalence and imply the exploitation needed to be done, in order to identify if keeping part of our portfolio as cash would help us hedge against inflation.

Firstly, cash & cash equivalence is crucial for unpredictable situations and short-term goals, illustrating how this asset class serves as an "emergency reserve". As inflation leads to a reduction in purchasing power, we need part of our portfolio as cash so that we have the resources ready to cover any unexpected bills that our salary can no longer cover or even a job loss, consequence from rising inflation. "You generally want three to six month's worth of living expenses in cash", (Ermeij, 2022). Cash & cash equivalents are therefore crucial to meet with our short-term obligations and hedge against inflation in the short-term. Based on this reasoning then, when having long-term investment horizons we should avoid it, as cash does not have that growing quality that other assets have.

Moving on, we might think cash leaves our portfolios unprotected however, during inflation cycles, cash has always resulted in the most stable asset, in terms of real growth, showing relative successes, (Rekenthaler, 2022). As we can see in Figure 10 and Figure 11, in what is known as the two world's biggest inflation crisis, cash's value has showed in both cases to be the most solid of all asset classes. We can see how in both periods cash is the asset which has decrease by the smallest amount in terms of growth, from \$10,000 to \$9,237 in both cases. In fact, in the 1970s inflation crisis, cash's real returns, beat those from stocks and bonds.

Figure 10 and 11: Asset Growth in 1970s Inflation Crisis vs Today's inflation



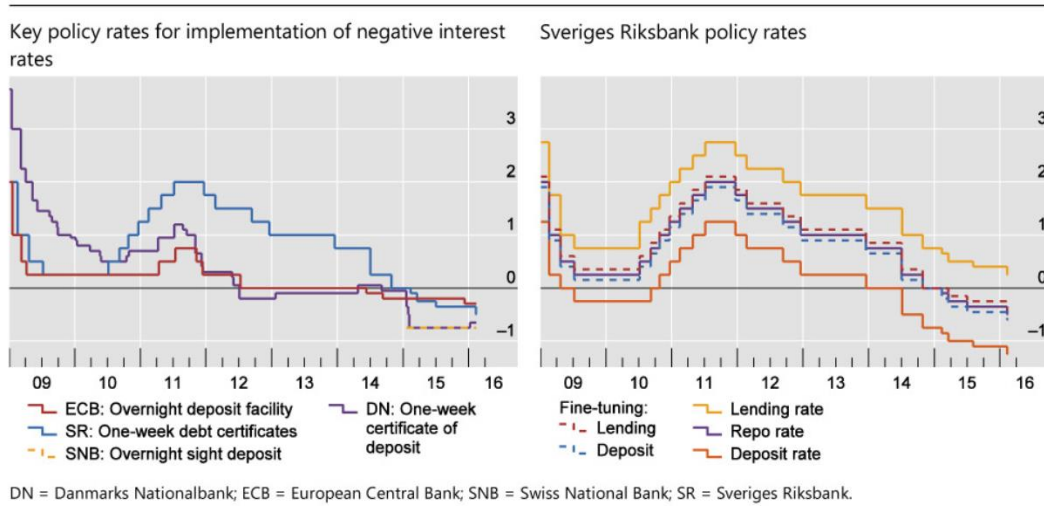
Source: Morningstar, (Rekenthaler, 2022).

Despite this positive quality cash has showed of being the less volatile asset as far as growth concerns, this growth is negative which implies that cash fails to generate a positive return under inflation, explaining why we describe cash's success in inflation as relative. When hedging against inflation cash lacks from properties to adjust its real value to inflation. In fact, the opposite happens, and its purchasing power decreases. Therefore, to investors, based on this fact, cash would not protect our portfolio from inflation but protect us from the macroeconomic factors of inflation, such as job loss, amongst others.

Continuing, in contrast of what has recently been mentioned, we cannot forget to emphasize the role of interest rates in cash & cash equivalences. "If there is high inflation and interest rates are low, cash is a disastrous hedge against inflation", (Longeval, 2022). If interest rates are not being increased by central banks to control high inflation, then there will be no increase in interest rates of marketable securities, such as deposit rates, interest rates paid in treasury-bills etc. therefore, investing in cash & cash equivalence will only result in negative returns. In this case, Cash & Cash Equivalence will not protect our portfolio from inflation as it is not being able to beat inflation so we will not invest in the money market.

However, the opposite happens when interest rates are increased in times of high inflation, marketable securities will act according to interest rates and their returns will increase. This implies that the money market adjusts to inflation rate which prevents the investor from losing purchasing power. This eliminates inflationary risk emphasizing cash & cash equivalence seems a good option to invest in times of inflation. As we can see in Figure 12 as central banks lower interest rates so does deposit rate, repo and lending rate fall and as interest rate is increased by central banks, so does deposit, repo and lending rate increase. This positive relationship suggesting that if we were to leave part of our portfolio as cash in deposits, or treasury-bills, commercial papers, MMF rates and CD, theoretically, cash & cash equivalence would protect our portfolio from inflation.

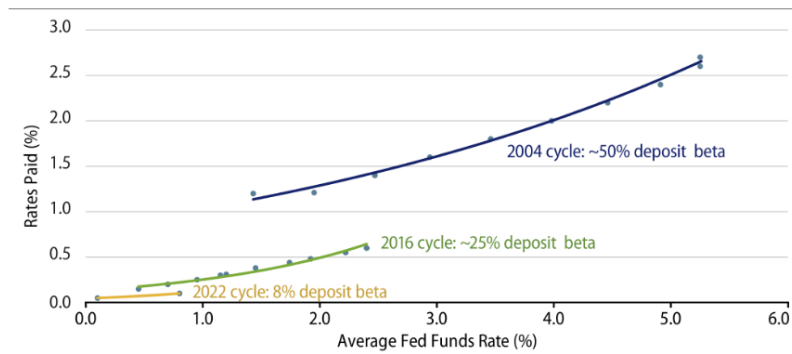
Figure 12: Relationship between interest rates and money market yields (returns)



Source: Denmark National Data via BIS, (Bech & Malkhozov, 2016)

Despite, what has previously been mentioned about cash & cash equivalence being susceptible to inflation and showing hedging qualities against it when interest rates increase, we can't forget to mention that the interest rate paid by banks tend to not be as high or increase proportionally to interest rates. This problem limits the capacity for Cash & Cash Equivalence as a hedge against inflation. "In fact, the record-high deposit balances have led to betas that were below market expectations in the current central bank rate-tightening cycle, and this will be especially true for non-operational deposits with the largest banks as well as deposits from retail customers", (Straker, Schucking, & Angerer, 2022) We can see in Figure 13, how the deposit beta in 2022 has been much lower than those from other periods with lower inflation, such as in 2016 and 2004. The deposit beta, which shows the US bank deposit interest rates, have showed a, which illustrate that cash & cash equivalence is not an asset we can fully use as safeguards from inflation because there is a lot of uncertainty whether money market instruments such as bank deposits will increase as much as expected or increase according to interest rates hikes, to protect our portfolio against inflation.

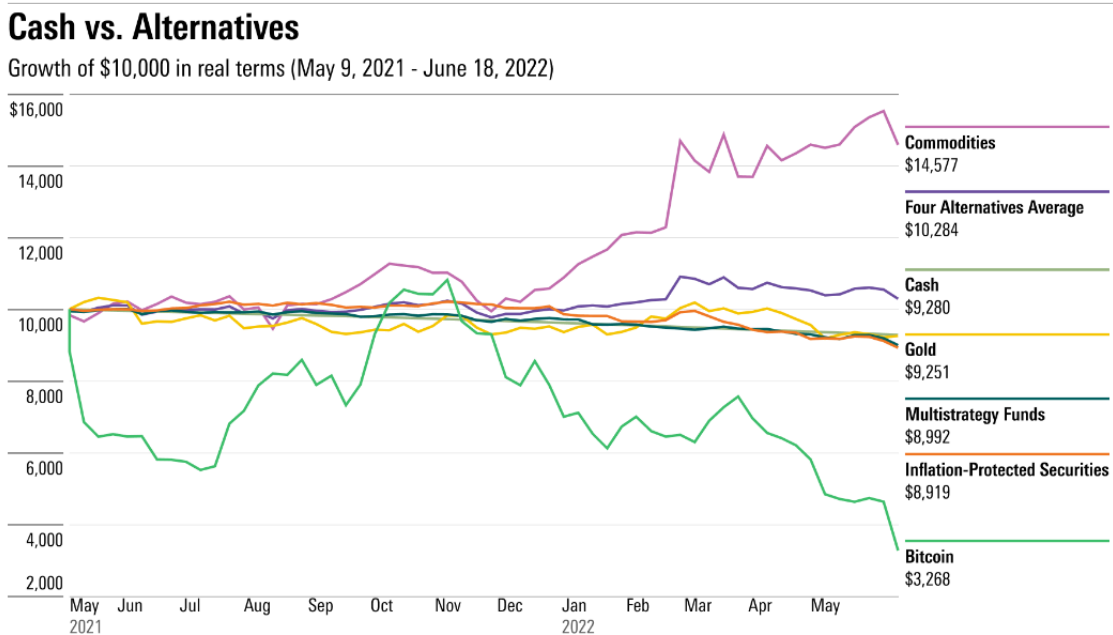
Figure 13: Relationship between Fed’s funds rate and interest paid in 2004, 2016 and 2022.



Source: SNL, Credit Suisse. Represents selected universe of large US traditional banks. Deposit repricer beta is measured as the cumulative change in total cost of deposits relative to the change in average fed funds rate over the tightening cycle. Total cost of deposits includes interest and non-interest-bearing balances via, Western Asset, (Straker, Schucking, & Angerer, 2022).

Finally, if we were to compare cash & cash equivalence’s performance with alternative asset’s performance, this being commodities, gold, funds, cryptocurrencies, and Inflation-protected securities, as seen in Figure 14 cash does not hold hedging properties when inflation is persistent, (Rekenthaler, 2022).

Figure 14: Cash performance in inflation vs alternative’s performance



Source: Morningstar, (Rekenthaler, 2022).

We can therefore conclude that cash will be necessary in the short-term, to meet with short-term obligations. It is relatively safe to invest in this asset class when central banks increase interest rates and the interest rates paid out in the money market beat inflation rate. However, as this is not always the case because money markets sometimes tend to see increase interest rates lower than expected and not beating inflation, then in this situation cash & cash equivalence would leave our portfolio unprotected. Moreover, when inflation is persistent and we intent to leave part of our portfolio in cash we will find ourselves in a situation of negative returns and therefore cash & cash equivalence will not be safe-haven asset to hedge against inflation.

d. An inflation hedge strategy with Commodities

Commodities are considered to offer potentially strong and nominal returns and are a source of performance enhancement on a risk-adjusted basis as they are potentially decorrelated from other standard asset classes such as bonds and equities, which show a negative correlation when invested with commodities. Moreover, commodities seem to offer inflation hedging properties which we will proceed to analyze. However, this does not imply that it is all shine and bright, commodities too have showed a long history very sharp and dramatic downturns.

The main benefit of allocating part of your portfolio into commodities is normally described as investing in an asset class with equity-like returns and low correlation with traditional equity-bond-cash portfolios, known as diversification benefits, optimization benefits and inflation hedging capacities benefits.

1. Energy & Oil

To begin with we are going to explore the so-called “pass-through” theory to allocate commodities, in this case, energy and oil in order to see if these hedge against inflation when creating a strategy to protect our portfolio from inflation and reduce risk as much as possible.

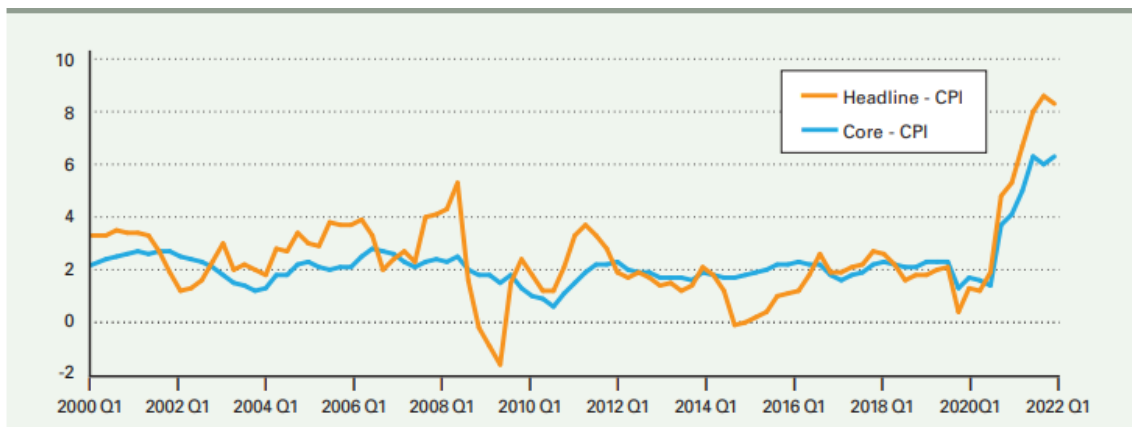
It has always been thought (before the inflation crisis in 1970-1980) that oil price shocks (drastic and rapid increases in energy prices) are a sign of inflation and that this rise in prices of commodities are contagious and spread amongst the rest of the goods and services of the economy. This is known as the pass-through theory of inflation as, (Fulli-Lemaire, 2012) describes it. It was believed that these price shocks were a signal of macroeconomic chaos, resulting in inflation, restrictive monetary policies, (money was expensive and supply was limited) and there was a drop in output and economic growth.

The 1970s oil crisis fed on this theory of headline inflation or oil price shocks generating core line inflation. In other terms, it was always believed that oil price shocks, showed in headline inflation, then lead to core line inflation. However, according to (Fulli-Lemaire, 2012) the transmission of oil price shocks into core inflation had ceased, thereby greatly differentiating the

behavior of core and headline inflation, have adopted a much less noticeable role as generators of macroeconomic volatility due to a reduction in economic intensity of oil use and the impact of favorable exchange rates as the latest oil shock had been demand-driven, according to, (Fulli-Lemaire, 2012).

In contrast to (Fulli-Lemaire, 2012), this relationship between Core Inflation and Headline Inflation had been seen in the current inflation the economy is suffering. As observed in Figure 15, whilst before this current inflation breakdown there was no evidence of a pass-through situation since the 1970s inflation crisis, this however has changed and from 2016 up to now we can see how determine commodity prices have been in inflationary process of the economy, highlighting evidence to back up the pass-through theory. We can see how as Headline Inflation increases so does Core Inflation, therefore implying that there is a correlation on commodities' prices increasing and the rest of the goods and services, when commodities suffer a price shock this contaminates prices of goods and services, thereby resulting in effects on the Core Inflation.

Figure 15: Headline and Core Inflation in the US



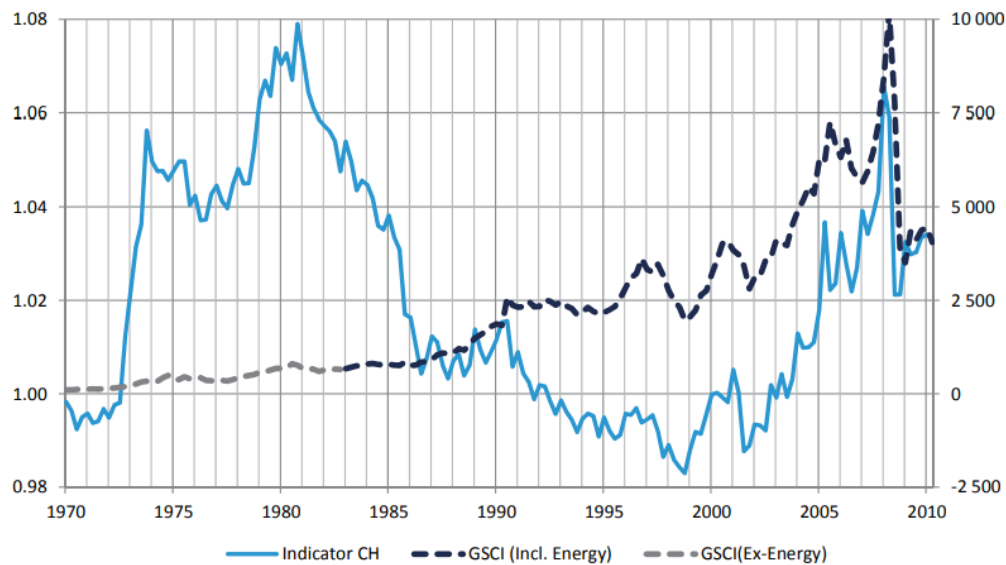
Source: U.S. Bureau of Labor Statistics, (Statistics, 2023)

Based on the pass-through theory, where commodities price shocks impact on core inflation, we are going to strategically allocate these to create an investing strategy which hedges against inflation that creates a safety net to reduce the impact of inflation on our portfolio. When energy price shocks lead to an increase in Core inflation rather than a stable and maintained level of Core inflation, then the general price of the economy adapts, diminishing the hedging potential of commodities as there is a pass through of energy price shocks to other goods and services. In this case, we must opt to adapt a long position in commodities in the first part of the cycle where Core inflation is trying to catch up with the Headline inflation. In the second part of the cycle, where general prices in the economy have adapted to those of energy, we should opt for a short position in our commodities and substitute them with other types of assets which would hedge against the rising Core inflation.

However, if there is no evidence of a pass-through impact from Headline inflation to Core inflation commodities become a very good hedging asset against inflation, creating potential reduces in inflationary risk of portfolios. In this case, we should invest in energy commodities as they protect our portfolio from inflation because they will provide higher returns than investing in other asset classes, as they are increasing at a higher pace than other goods and services in the economy, reflected by the magnitudes of Headline inflation and Core inflation, which in this case have no relationship, thereby implying that as Headline inflation increases Core inflation remains quite stable or increases at a slower pace as it is less responsive to Headline spikes. This highlights that inflation can be mostly observed or is mostly impacting commodities as these are adapting to inflation in economy whilst the rest of goods and services prices aren't therefore, commodities offer higher returns in comparison to the rest of asset classes, which tend to be underlying assets of the other goods and services of the economy.

To conclude, as observed in Figure 16, since the 1980s we can see that if the pass-through theory is evident, which implies that the differential between Headline inflation and Core inflation is smaller, reflected as *Indicator CH* in Figure 16, the returns of commodities are smaller, because price increase is adjusted to all goods and services in the economy however, if the pass-through theory is not reflected in inflation, which occurs when the differential between Headline inflation and Core inflation is higher, commodities have a higher return, provided by the GSCI TR index in Figure 16, proving that when there is no correlation between these two and there is inflation in the economy, to hedge against it, we have to allocate part of our portfolio on energy stocks. There for to maintain purchasing power, we must invest in energy commodities when there is no pass-through evidence, of headline inflation affecting core inflation as we will obtain higher returns and in effect protect our portfolios against inflation and we must diversify our portfolios, in terms of allocating our portfolios amongst different asset classes and not emphasize energy commodities, as when there is pass-through evidence, commodities don't hedge against inflation as their returns become similar to those of other assets. However, we must not forget that recent trends in the economy are reluctant to a reduce in oil as the world is reducing its dependence on fossil fuels. So while the energy sector has been a good bet against inflation historically, that trend may not persist going forward.

Figure 16: A Comparison of the GSCI TR index and the CH indicator



Source: *An Inflation Hedging Strategy with Commodities: A Core Driven Global Macro*, (Fulli-Lemaire, 2012)

2. Gold

It has been said that gold tends to maintain its purchasing power value under extreme and uncertainty conditions in the economy, such as inflation.

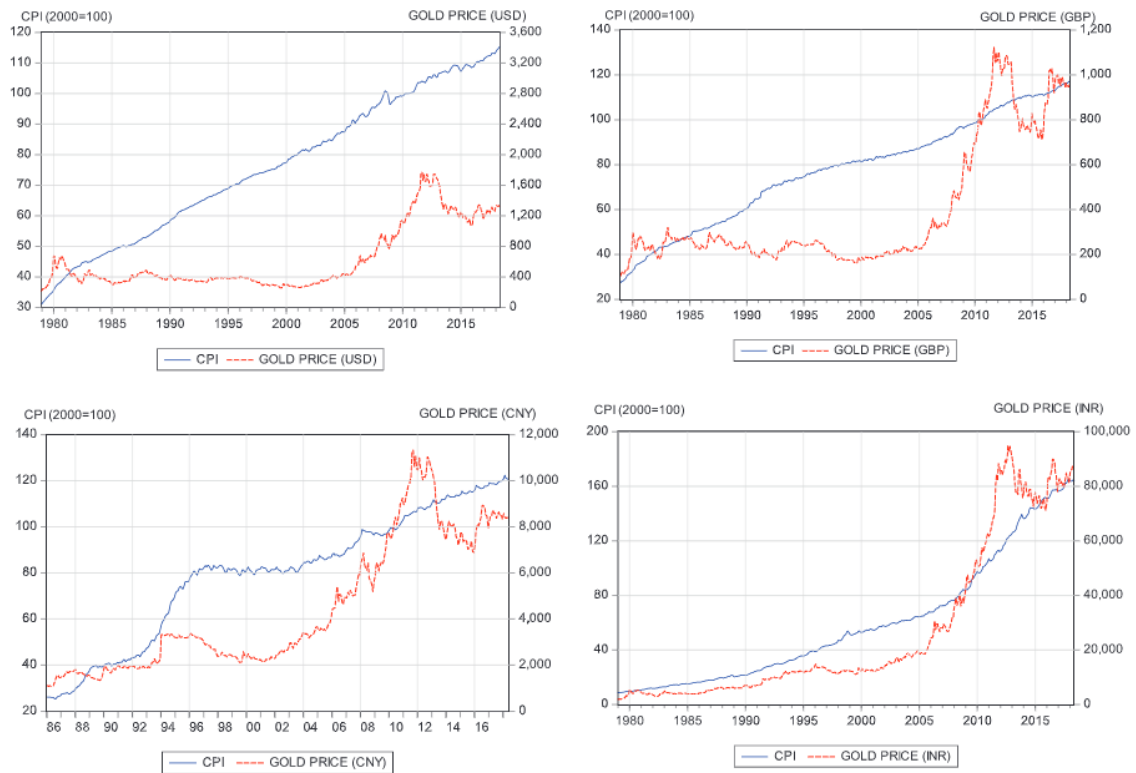
Gold is viewed in the economy by individuals as a high-precious metal, which is associated to especial occasions such as weddings and have luxurious connotations such as exclusivity and limited. All of this contributes to the price of gold as added value and is why some economists believe it is overvalued but why it also tends to have a high price in comparison to many other metals, commodities or goods which are used much more often and across a large range of sectors. Due to the high value, it has, gold is seen by investors as a reliable and safe haven asset.

Moreover, since gold is a physical asset and its value is un-contingent on the decisions of a single government or central bank, it is sensible that investors view gold as the best alternative in a “worst-case scenario” as (Mohd Fahmi Ghazali, 2021) explains. This implies that investors tend to position themselves in the worst possible outcome, even though this may not finally take place, highlighting how investors, in time of uncertainty and high inflation expectations, will move their asset allocation from riskier assets to the least possible riskier assets, which will in turn favor what are considered safe-haven assets, gold being one of them.

Gold is considered such a strong safe-haven asset as there is a great certainty that its price seems to have a positive price relationship. In figure 17, we can see the relationship of inflation

and gold, in other words the effect that inflation (measured with CPI) has on the effect of the gold price depending on CPI or in other words, the effect of inflation towards gold price. According to, (Fahmi Ghazali, Fasyah Mohd Mussdek, Hooi Lean, & W. Taunson), after studying countries which value and use gold in different ways, all have concluded in the same, there is some sort of relationship between gold prices and inflation but, not fully determine.

Figure 17: CPI and Gold Price Evolution in US, UK, China and India



Source: Does Gold Still Shelter Inflation, and, if so, When? Evidence From Four Countries, (Fahmi Ghazali, Fasyah Mohd Mussdek, Hooi Lean, & W. Taunson)

As we can recall from Figure 17, there is some sort of positive correlation between price of gold and inflation. To analyze this correlation, we will take time into account and will separate short-term gold investments and long-term gold investments as a hedge from inflation risk, gold prices show a positive correlation with CPI and on a long-term analysis, we can see how gold prices increase accordingly to CPI increases and how the increase is somewhat stable. As seen in Figure 17 in all 4 countries in the long term, prices of gold increase, as do CPI. We can therefore say that CPI and gold prices are integrated and thus support the long run inflation hedge of gold. This illustrates how gold maintains its purchasing power over long periods of time. However, short term investments on gold to protect portfolios from inflation, does not provide the complete hedge we are looking for. As for example, in China we can see the volatility of gold prices in several short-term periods such as from 2006 to 2007. We can also

see this short-term volatility in the other three countries, US shows constant gold prices changes as CPI increases when we get short term periods of investment such as from 2008 to 2009, or in the UK from 2015 to 2016 and in India from 2017 to 2018, amongst many other short-term periods where we can see fluctuations in prices of gold. This illustrates how gold is a very safe-haven asset when investment horizons are long but may induce into volatility and inflationary risk in short term investment horizons.

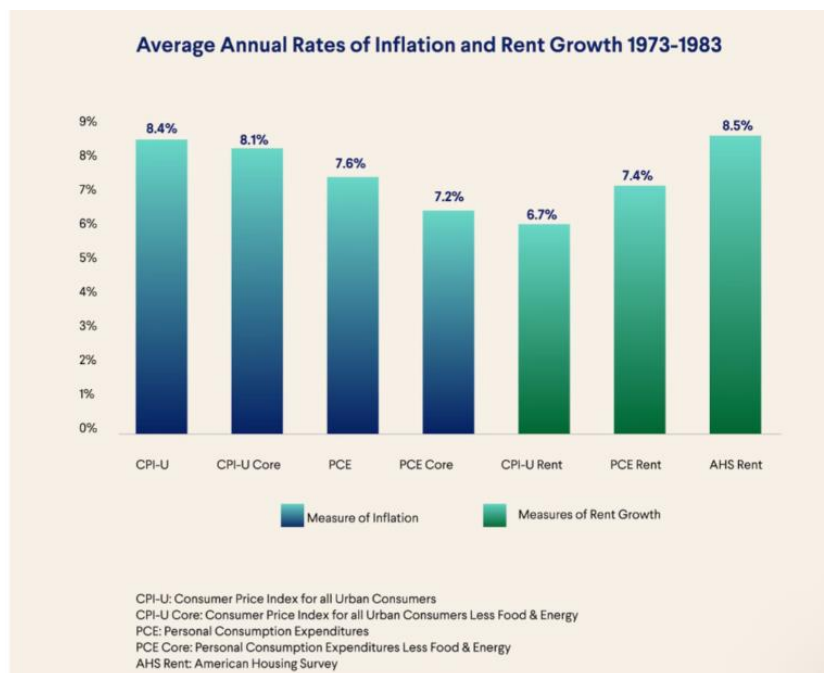
Furthermore, Equity markets, before this inflation period, have surged a period of huge profit where markets only when up. This has affected spot price of silver and gold (Spot prices of a commodities, is the price at which a commodity could be transacted and delivered, right now), (Plissken, 2022). This implies that gold spot price is very important because if it increases it a sign of weakening currencies as gold is the back of that countries have for the money that they have circulating or printed into their economies. Silver spot price is also very important as thousands of industries depend on it, from electric cars, to smartphones, solar panels, computers etc. therefore, sectors which rely on silver, rely on low spot prices because it implies low silver prices, and this results in higher profits than if prices were high.

Hence, gold is less volatile than the other assets during high inflation due to the long-term positive correlation it has with CPI. Gold is therefore effective as a long-term hedge against inflation as it retains inflation hedging properties, despite considerable fluctuations in the short term.

e. An inflation hedge strategy with Real Estate

Real Estate has always been believed to be a safe-haven asset when it comes to protect our portfolios. Along history it has always proven to provide at least a partial hedge against inflation, (Equitymultiple, 2022), even in 1970s crisis world record high unemployment. As seen in Figure 18, when inflation came to a record high, CPI for all Urban Consumers (CPI-U) marked 8.4% whilst CPI-U rent was not far behind with 6.7%. This implies that real estate's real growth does not lag far behind price increases, making it in this sense an asset to hedge against inflation.

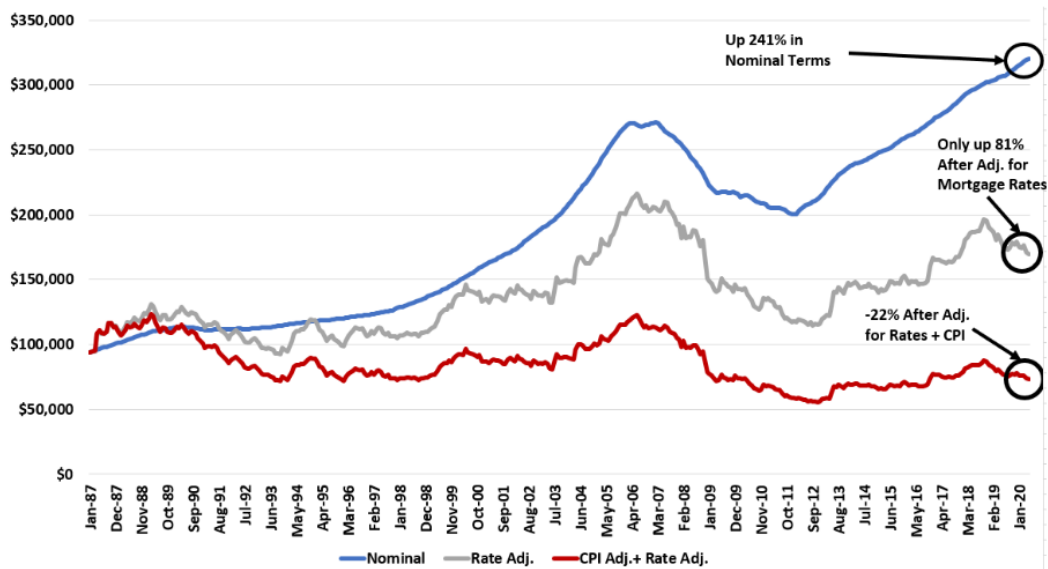
Figure 18: Average annual rates of inflation and rent growth



Source: PREA, NCREIF – PREA Quarterly, Fall 2021 via Equitymultiple (Equitymultiple , 2022)

Firstly, real estate prices are impacted by 3 things, location, inflation, and mortgage’s rates, (Schwarz, 2020). As we can see in Figure 19, nominal prices in the housing market after adjustments of mortgage rates and inflation, prices go down from 241% to -22%. Illustrating real estate as protective as inflation contributes to raising its prices therefore, adjusting its real value. Amid, interest raise hikes to control inflation also contribute to higher house pricing, making this asset protect our portfolios from inflation’s consequences.

Figure 19: Nominal price of housing market vs adjusted price



Source: *Bounded Finance*, (Schwarz, 2020)

Moving on, real estate is strongly defined by market structure, in terms of supply and demand. This illustrates that it holds intrinsic value as it is a “scarce” asset. We define real estate as scarce because there are certain areas, special in cities where there is a lack of terrain to build on. This makes the real estate market be very much influenced by the power of supply and demand. Amid, demand in real estate does not tend to fall when inflation rises which reduces the effect that inflation has on real estate prices, (Equitymultiple , 2022). In fact, commodities, such as aluminum used for building properties, making house prices raise. Based on this we can conclude that there is a positive relationship between growth in property value and inflation. As we can see in Figure 20, the effects of a 1% increase in inflation on property value is positive. For example, apartments grow in value by c.1.1% or offices which grow c.1.24%. Based on Figure X there are even some types of properties which beat the 1% increase in inflation, leading to positive returns.

Figure 20: Growth in property value vs inflation



Source: Multi-Housing News, October 2020, via Equitymultiple (Equitymultiple , 2022).

A proven wealth-building tool would be income-producing properties, (Grimes, 2022). An option for this consists of investing directly on real estate and obtaining an income from the rental of the property. This income protects us from inflation as it tends to keep up its paces with inflation or in cases surpasses it, (Grimes, 2022). In case of having done the real estate investment with leverage and mortgage payments fixed, as inflation increases, and following the trend that seen in rental prices up to date, so does the price for renting the property, obtaining a higher internal rate of return. Moreover, real estate managers can further hedge against inflation with real estate by managing rental properties by the following techniques that make rent prices increase as inflation increases, (Equitymultiple , 2022).

- a. CPI indexation: Contracts done with rent payments which are revised as CPI changes. This was something seen a lot in the 1970s, (Equitymultiple , 2022).
- b. Periodical rent reviews on leases. (Equitymultiple , 2022).
- c. Shifting operating and capital improvements costs to tenants: shift some of costs of improving the property to the tenant. (Equitymultiple , 2022).

Based on this strategy, if income-producing real estate is well managed, then this asset class is efficient in terms of hedging against inflation.

Moreover, we can't forget to mention the effects that interest rates have on real estate. When there is high inflation in the economy, as previously mentioned, central banks will tend to apply interest rates hikes. On the one hand, this will make borrowing money more expensive which will negatively affect investors of real estate highly leveraged with variable rate mortgages. Even though we have seen that value of properties tend to increase when there is high inflation,

high interest rates in highly leveraged investments will reduce the returns. On the other hand, higher interest rates could price would-be homebuyers out of the single-family housing market, causing them to remain renters for longer”, (J.P. Morgan, 2023). This make us conclude that real estate, especially income-producing real estate is an asset class with many strengths towards fighting inflationary risks in our portfolios.

VII. Conclusion

a. Evaluation of strategies and creation of optimal strategy:

It is obvious that creating the investment strategy to evade inflationary risk and to prevent exposure of our portfolios to inflation is rather difficult because there is a lot of uncertainty linked with inflation. We can, however, try to reach an optimum investment strategy or try to reduce the risk of inflation which a portfolio has. Based on the explored strategies we can draw out an optimum strategy to hedge against inflation and reduce inflationary risk in our portfolios. The main result we want to obtain from this protection against inflation is to maintain purchasing power by allocating amongst different asset classes and thereby our returns not being affected by inflation.

The second factor is the individuals that participate in the market and their emotions. Markets tend to be the reflection of the expectations of individuals upon the economic future events and economy's situation, at the end of the day, markets are influenced and driven by individuals believes, expectations and emotions because this impacts decision making of an investor and thereby play a decisive role in the choice of safe-haven assets. Amid, risk, pressure and high uncertainty affect these emotional human being factors.

To begin with, it is crucial to point out that to be able to aim for an investment strategy that protects the portfolio from inflationary risk it is obligatory to diversify. Diversification stands for investing in a variety of assets with different risk and return characteristics as part of a risk management strategy. The main advantage of diversification is that it reduces overall risk by dispersing it over the different assets in a portfolio. In times of inflation in the economy, diversification is fundamental to reduce potential losses as there is more volatility in the markets therefore, we are going to build an optimum investment strategy based on the diversification principal.

Based on the research done, we can see how each asset class behaves when there is inflation and have determined their level of protection against inflation, which thereby determines our optimal investment strategy.

After an extent analysis, we will create a division for equities. This division will consist in short-term investment horizons investors and long-term investment horizons investors. Investing in stocks in high times of inflation result most probably in assuming a lot of risk, as they are fully packed with volatility and therefore, illustrating potential losses as something very veridic. Therefore, if our investments count with short-term horizons, we may be lucky and buy and sell in the same day and end up with gains however, as inflation and equities seem to be negatively correlated, this is very improbable. This emphasizes how short-term investors or speculators should not invest part of their portfolio in equities. However, this differs with long-

term investors, who can maintain stocks in their portfolios for a long period. Generally, equity prices will suffer from price shocks when there is high inflation. This illustrates how low prices are a great investment opportunity for long-term investment horizons investors and a good protection against inflation as when they will sell the equities (in a couple of years from now) the prices of stocks will have adjusted to inflation and will have recovered its value, therefore obtained positive returns and achieved what all investors want, buying low and selling high.

Moving along, it is important to include some fixed income in our portfolios as they are the safest asset investment. When inflation hits, we must not invest in fixed-payment coupons as there is a high risk of this coupon rate being surpassed by the inflation rate, meaning we would be losing purchasing power. We however have inflation-linked bonds which tend to be favorable in period where the inflation in the economy is high as they adjust themselves to the current inflation rate. The optimum way of investing in fixed income, whilst reducing risk as much as possible and protecting our portfolio from inflation would be by investing in a bond's ETF as by this we are managing to protect our portfolio from inflationary risk further as we are allocating our money throughout more different bonds than rather just a few.

Even though cash & cash equivalents at first sight seems like a non-protective asset during times of inflation we need to have a small proportion of our portfolio as cash. Firstly, because in the short-term it covers unexpected living costs. Secondly, in case there was inflation and interest rates were increasing, if money markets' rates were increasing accordingly and thereby beating inflation, this asset class is a good hedge against inflation. If the case was that interest rates were not being raised, then money markets do not provide a hedge against inflation so we would not invest in them.

When looking to hedge against inflation, we must invest part of our portfolio in commodities such as energy and gold. We must invest in energy commodities when there is no pass-through of inflation from headline inflation to core inflation because energy commodities will give us high returns, which are adjusted to inflation levels, whilst stocks with underlying assets, of goods and services will not give us high returns. We must also invest in gold due to the high value and sticky prices it has in the economy. As gold is a physical asset and preciously-connotated then it has additional value, which in return is a good hedge against inflation when we as investors have a long investment horizon.

To conclude, real estate is a crucial asset in all portfolios in times of high inflation. As we have seen properties provide certain benefits in times of high inflation. Its value appreciates meaning it keeps up with inflation so there is no purchasing power loss. Even though, contractionary monetary policies could raise risks in portfolios as cost of money increases so this could lead to a fall in demand for properties, the market structure of real estate has proven to have a demand

that surpasses supply even in high inflation times. Adding on, inflation pushes all prices in the housing market including rents. This leads us to our second conclusion, to optimize our portfolio returns in times of high inflation, we need to invest part of our portfolio in income-generating properties.

Therefore, from this investigation we have obtained the following results in terms of asset allocation of our portfolio:

- 1) Equities if we have a long-term investment horizon as they have proven to be resistant to inflation in long-term periods.
- 2) Fixed income adjusted to inflation as the rest of instruments do not provide a hedge against inflation.
- 3) We need to have a proportion of our portfolio as cash to be able to cover unexpected expenses.
- 4) Commodities especially gold, as they show strong qualities to hedge against inflation.
- 5) Real Estate, especially income-generating properties as they appreciate its value as inflation raises.

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