INFLATION

The Corrupted Thief

Inflation - The Corrupted Thief

Executive Summary

In today's global economy, fears of inflation are front and center for many. This fear is driven by massive government stimulus in response to the COVID-19 pandemic. However, many market participants nowadays haven't experienced truly unhealthy levels of inflation and therefore aren't prepared to protect themselves against it. In order to understand where this fear originates from and how one can better protect themselves from unhealthy levels of inflation, it is paramount that market participants and everyday individuals understand the ins-and-outs of inflation. In this report we break down inflation, elaborate on its causes and effects, discuss how central banks manage it, explain what it means for society, and lend insight into how anyone can protect themselves against it.

Introduction

What Is Inflation?

Inflation is an economic term that refers to a general rise in the price of goods and services in an economy. A rise in prices causes fiat currencies to lose purchasing power.

Central banks measure inflation by calculating the rise in the average price of a basket of goods and services. Because prices are a function of supply and demand, all else being constant, an increase in the money supply (i.e., greater demand) can increase the general prices of goods and services.

The inflation rate is a proxy for understanding how much the average household's cost of living rises per year. Inflation attempts to quantify how much more it costs to buy everyday goods, such as gas, groceries, hygiene products, and other common consumer goods costs relative to how much they cost in the past.

Inflation seems harmless when under control. However, it causes an insidious drain on the wealth of the consumer and is catastrophic to an economy when unmanaged. Former US President Ronald Reagan once famously said, "Inflation is as violent as a mugger, as frightening as an armed robber, and as deadly as a hitman."

Causes of Inflation

In times of uncertainty or hardship, like an economic recession, consumers don't spend like they usually do and instead opt to save. This behavioral shift is because they expect a potential loss in consumption-ability (e.g., losing a job or falling real wages).

However, there are knock-on effects: if consumers aren't spending, business production declines, employees are laid off, and people make fewer investments. These effects can create a vicious cycle that central banks often try to mitigate by increasing the money supply to stimulate consumption and investment. By pumping more money into the economy, consumers will have the confidence to spend more in businesses that, in turn, can invest in new or existing products and services. Thus, central banks reinvigorate economic activity to attempt to jumpstart economic growth. Central banks measure this growth in Gross Domestic Product (GDP), or the total value of all goods and services a country produces in a given year.

Inflation is usually a direct result of central banks creating money faster than GDP growth. However, this imbalance doesn't always lead to inflation: money can enter circulation without causing inflation. For example, increased investment enables technical innovations that are generally deflationary (i.e., causes prices of goods and services to fall); when businesses can produce goods and services at a lower cost and faster than consumers can demand them, prices fall. In other words, new money is not always frivolously spent. Some may save or pay down debt. Even though the money supply is greater than before, the velocity of money fell (i.e., the rate at which money is exchanged within an economy).

The Triangle Model

The three root causes of inflation, or what the Keynesian economist Robert J. Gordon termed the "triangle model," are demand-pull inflation, cost-push inflation, and built-in inflation.

Demand-Pull Inflation

When the demand for goods and services rises faster than productive capacity, demand-pull inflation occurs. This type of inflation is due to an increase in the supply of fiat currency and cheap credit. As more money is put into circulation and is easily accessible, both demand and prices rise.

For instance, if demand rises by 5% while productive capacity is only growing by 3%, demand will outpace supply by 2%. With more money chasing fewer goods and services, prices will naturally rise.

Demand-pull inflation has occurred many times throughout history. An infamous example took place in the UK from 1986–1991 when inflation hiked 4.6 percentage points to a nine-year high of 7.6%, caused by demand-related factors including lower interest rates, rising house prices, decreased income tax rates, and high consumer confidence.

Cost-Push Inflation

When input costs for goods and services increase, such as wages or raw materials, costpush inflation occurs. As the cost of production rises, supply decreases because fewer goods and services are available. Because supply-side factors (e.g., higher wages and higher lumber prices) have changed and demand hasn't, the producer will pass on the additional cost to consumers.

A notorious example of cost-push inflation took place in the early 1970s when the intergovernmental body known as the Organization of Petroleum Exporting Countries (OPEC) imposed higher prices on the oil market without any increase in demand, now known as the Oil Shock of 1973–1974. Though producers were earning higher profit margins in the short term, all sectors of the economy that relied on oil saw increased production costs. As a result, these parts of the economy that involve oil (e.g., transportation, plastics, construction) saw inflationary pressure on the prices of goods and services.

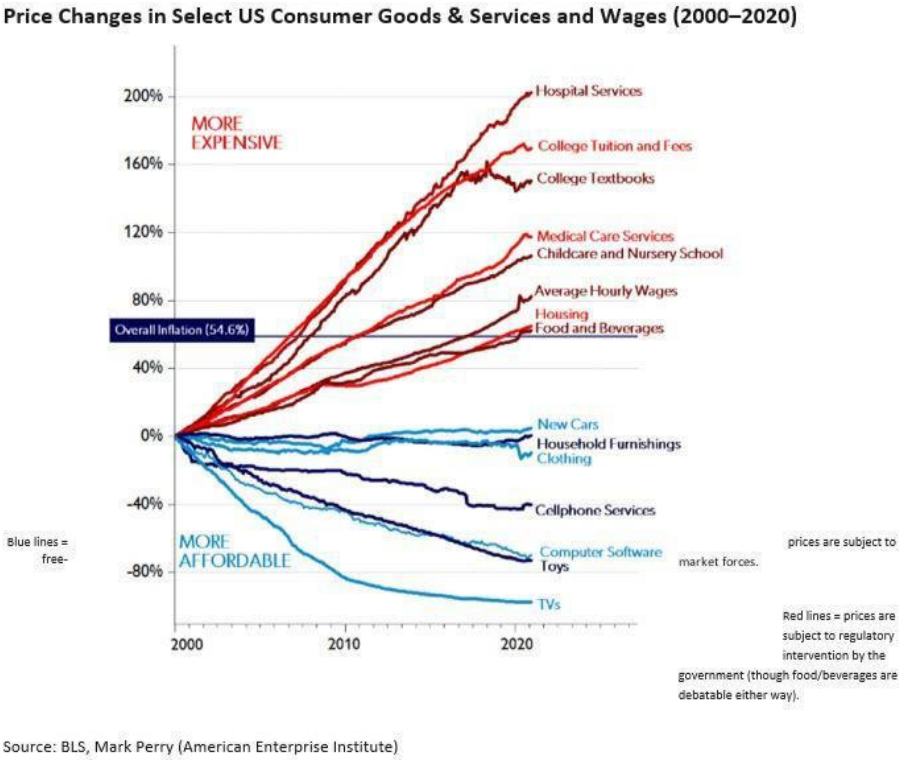
Built-In Inflation

When consumers expect inflation to keep rising, they demand higher wages. This demand results in an increase in the cost of production, which results in higher prices. A circular dependency can emerge whereby inflation spirals out of control, known as built-in inflation.

Lowest Common Denominator

Per figure 1, we can see changes in prices within various sectors in the US economy. Over the past 20 years, sectors with government intervention (education, housing, medicine) have seen prices soar.

Figure 1



Source: BLS, Mark Perry (American Enterprise Institute)

We can also see in figure 1 that competitive markets with low involvement by the government (e.g., cell phone services, toys, and TVs) have seen prices fall over the past 21 years. Net-net, it appears there is a strong correlation between governmental intervention on markets and inflationary impacts.

What Are the Effects of Inflation?

Economists from the Austrian school, such as Murray N. Rothbard or Ludwig Von Mises, contend that inflation is not a rise in the general price level but rather an increase in the supply of money and bank credit relative to the volume of goods and services. As such, they argue that inflation is outright harmful because it depreciates the value of currency, raises the cost of living, imposes an implicit tax on the poorest class of people at a relatively higher rate than the tax on the richest class of people, devalues savings and thus disincentivizes future savings, redistributes wealth and income asymmetrically, incentivizes speculation and gambling, underestimates the antifragile mechanisms of a free market system, and corrupts the morals of both the public and private sectors.

Meanwhile, the Keynesian school defines inflation as an increase in the general price level caused by an increased money supply. Keynesian thinkers assert that inflation can yield a variety of positive and negative effects, including:

• [Positive] Increase in labor supply —An economy operating below its production capacity has more unused labor and resources than can be used to increase business production (i.e., economic growth). With a surplus of readily available workers, hiring competition increases, and thus it becomes unnecessary for employers to "bid" for employees by offering higher wages. In times of high unemployment, wages typically remain stagnant, and no wage inflation (i.e., the rate of change in wages) occurs. When there's low unemployment, the demand for labor exceeds the supply, and employers may need to pay higher wages to attract employees. Increasing wages forces employers to raise prices, causing further inflation.

• [Positive] Increase in aggregate demand —Because more money in circulation may lead to more spending, it can positively impact the economy by increasing demand for goods and services. This rise in aggregate demand thereby triggers more production.

• [Positive & Negative] Increase in value of scarce asset holdings / decline in value of fiat savings— Because a currency's purchasing power falls when inflation rises, so will an individual's wealth if it's parked in cash. Therefore, demand for scarce assets (e.g., bitcoin, gold, real estate) will rise.

By way of example, gold prices grew +24% in 2009 on the back of the worst financial crisis since the Great Depression, as inflationary concerns caused investors to seek safe haven assets. However, the S&P 500 rallied +26% during the same period, outpacing gold by 2%.

Though it may seem like the ETF for the S&P 500 (SPX) was the better investment choice at the time, this does not account for the amount of risk involved with investing in either asset.7 Considering the S&P 500's risk (volatility) relative to gold, it's clear that gold offered a better risk-adjusted return (i.e., less prone to a sudden drop in value while having relatively large upside potential).

Figure 2 below provides a more contemporary example on the performance of fiat currencies and scarce assets in the face of inflation by displaying the real (inflation-adjusted) purchasing power of the USD,

EUR, and GBP in contrast with USD-denominated bitcoin price. Though there are some immaterial exceptions, it's clear that major fiat currencies have steadily declined throughout the last 11 and a half years while bitcoin has inversely posted significant returns.

Figure 2

Real Purchasing Power (Inflation-Adjusted)

Year	USD	EUR	GBP	BTCUSD
2010	$1.00	€1.00	£1.00	$0.30
2011	$0.97	€0.98	£0.98	$4.85
2012	$0.95	€0.95	£0.95	$12.97
2013	$0.94	€0.93	£0.93	$698.82
2014	$0.93	€0.92	£0.91	$296.16
2015	$0.93	€0.93	£0.91	$398.59
2016	$0.91	€0.92	£0.89	$871.12
2017	$0.89	€0.91	£0.87	$12,591.24
2018	$0.87	€0.90	£0.85	$3,307.33
2019	$0.85	€0.89	£0.84	$6,123.45
2020	$0.84	€0.87	£0.84	$24,422.48
2021	$0.83	€0.86	£0.83	$30,038.12

Source: Blockchain.com, Inflationtool.com, Kraken Intelligence

[Positive & Negative] Gains/losses for debtors/creditors —Unhealthy inflation levels can weigh on creditors because the money they lend out will be worth less upon repayment. On the other hand, high inflation is a boon for debtors because the money they pay back gradually becomes less valuable. For example, if Bob borrowed $100 from the bank with a 3% annual interest rate and suddenly the economy experiences 10% inflation, Bob would pay his debts at a 7% discount in terms of purchasing power. Inflation effectively rewards borrowing and disincentivizes lending. When inflation expectations are high, assuming no central bank intervention, nominal rates will rise to offset the long-term decline in currency value for lenders.

Under the right conditions, governments are beneficiaries of inflation and will use it to their advantage when possible. Governments do so by transmitting monetary policies that increase tax revenues for the government, such as implementing tax hikes or selling bonds to issue debt. These initiatives allow central banks to effectively cause more inflation, leading to the devaluation of the debt the government owes to investors while simultaneously collecting more taxes that will help it pay off debts.

The debt-to-GDP ratio is a helpful metric for assessing a country's ability to pay off its debts. To calculate debt-to-GDP, divide government debt by the country's GDP.

Figure 3

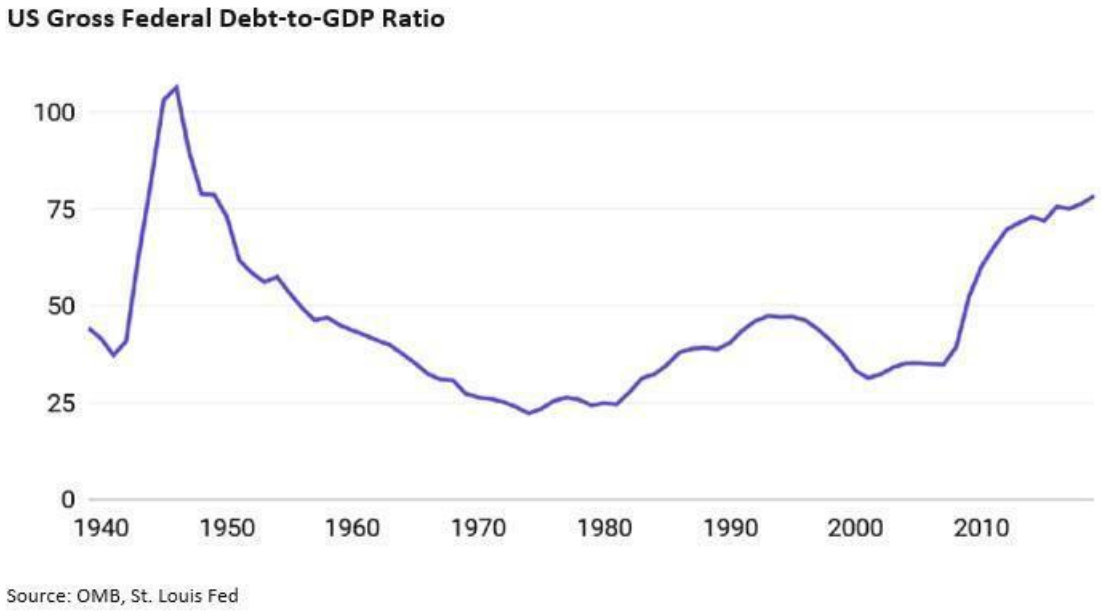
Debt-to-GDP Ratio Formula

$$\text{Debt-to-GDP Ratio} = \frac{\text{Government Debt}}{\text{Gross Domestic Product}}$$

GDP corresponds to the amount of taxable revenue a government has to help pay down debt. When debt-to-GDP is low, it means that the country is in an excellent position to pay back its debt, and when high, the government has a greater risk of defaulting.

For reference, a study conducted by the World Bank states that a ratio exceeding 77% for an extended period may result in an adverse economic impact on a country.8 At the time of writing, data from the US Bureau of Public Debt showed that the US debt-to-GDP ratio stands at a whopping 107.6% and is nearing levels last seen in 1946 following World War II (WWII) when the metric hit an all-time high of 118.9%. This is notable as the majority of that debt value was inflated away in the decades that ensued until the Debt-to-GDP hit 31.7% in 1974. Because most interest payments are fixed in nominal terms, inflation makes the current debt value diminish in real terms.

Figure 4



At least three factors contributed to the government's debt being inflated away following the war:

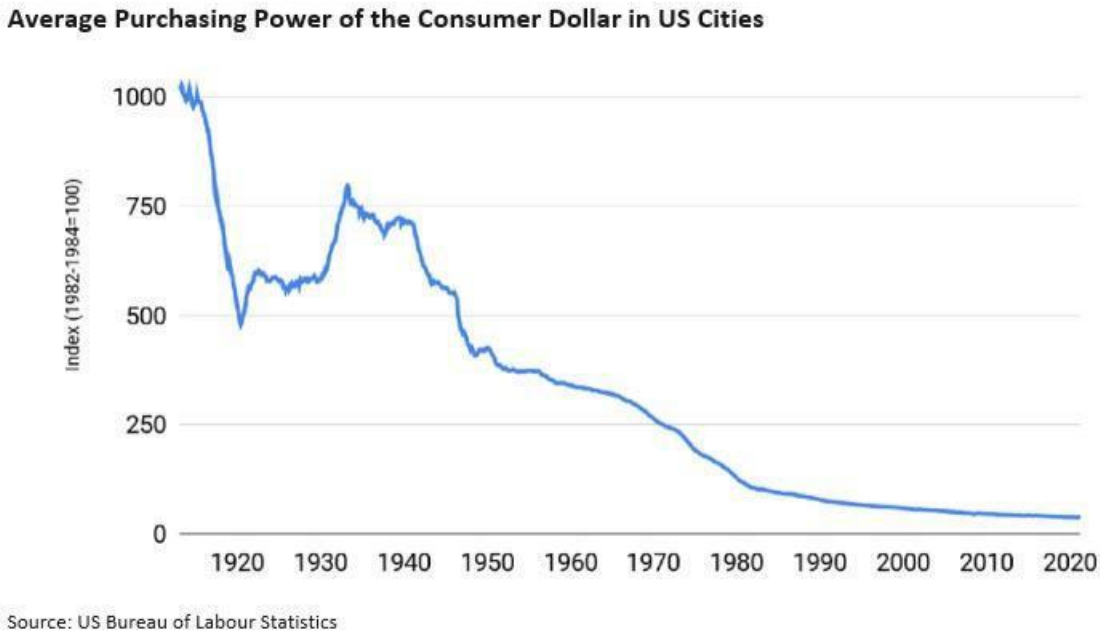
1. The economy rapidly expanded at an average pace of +3.75% per year from the late 1940s to the late 1950s, which translated to massive tax revenues. Also, US manufacturers saw little international competition as the war destroyed German, UK, and Japanese factories.

2. After the war, the US government rolled back price controls, causing inflation to soar and thus bringing in more tax revenue to pay down depreciating debt.10 Because government bonds yielded significantly less than the +76% rise in prices between 1941 and 1951, real government debt obligations fell sharply.

3. The average duration of debt in 1947 was more than ten years, about twice today's average time.

• **[Negative] Decline in purchasing power**—The most blatant impact of inflation is that necessities such as food and shelter become more expensive. Because consumers will purchase goods or services in anticipation of higher prices, prices rise further, and purchasing power falls. Those with lower socioeconomic status are the ones most impacted and must undergo material lifestyle changes.

Figure 5



What Happens When Inflation Gets Out of Control?

History has consistently shown that too much inflation is detrimental to an economy. When the money supply expands too much, it causes rapid, excessive, and out-of-control price increases of +50% or more per month—or hyperinflation. Hyperinflation usually occurs when a central bank expands the money supply too much and too fast during tough economic times.

Hyperinflation negatively impacts an economy in several ways, such as:

• The native currency's value falls relative to others and has significantly less purchasing power.

• Consumers stockpile goods in anticipation of higher prices, causing supply shortages.

• Consumers withdraw deposits and stop depositing money at banks, thereby limiting lenders' ability to operate.

• Less production and spending means less tax revenue, forcing governments to run a budget deficit and limit social services.

Venezuela, Hungary, and Zimbabwe are some examples of countries that have experienced periods of hyperinflation. Hungary experienced the worst case of hyperinflation in human history following WWII in 1946. At the time, the daily inflation rate was over 200%, meaning the average price of goods and services was doubling every 8 hours. The government stopped collecting taxes altogether because just a few hours of delay in paying taxes could decimate its value. Workers had to pay the price of this hyperinflation as real wages fell −80%, forcing them and their families into abject poverty amidst a devastating supply shock. Moreover, hyperinflation eradicated creditors because loans lost their value before debtors repaid them.

Figure 6

Highest Hyperinflation Events Throughout History

Country	Currency	Time Period	Annual Inflation Rate	Daily Inflation Rate	Time for Prices to Double	Highest Denomination
Hungary	Hungarian pengő	Jul-1946	4.19×1016%	207.2%	14.82 hours	100 quintillion (1020)
Zimbabwe	Zimbabwe dollar	Nov-2008	7.96×1010%	98.0%	24.35 hours	100 trillion (1014)
Yugoslavia	Yugoslav dinar	Jan-1994	3.13×108%	64.6%	1.39 days	500 billion (5×1011)
Republika Srpska	Republika Srpska dinar	Jan-1994	2.97×108%	64.4%	1.40 days	50 billion (5×1010)
Germany	German Papiermark	Oct-1923	29,500%	20.9%	3.65 days	100 trillion (1014)
Greece	Greek drachma	Oct-1944	13,800%	17.9%	4.21 days	100 billion (1011)
China	Chinese yuan	Apr-1949	5,070%	14.1%	5.27 days	6 billion
Armenia	Armenian dram and Russian ruble	Nov-1993	438%	5.8%	12.36 days	50,000 (ruble)
Turkmenistan	Turkmenistan manat	Nov-1993	429%	5.7%	12.48 days	500
Taiwan (Japanese rule)	Taiwanese yen	Aug-1945	399%	5.5%	12.94 days	1,000

Source: Wikipedia, Kraken Intelligence

Figure 7

Highest Denomination of the Zimbabwe Dollar in 2008

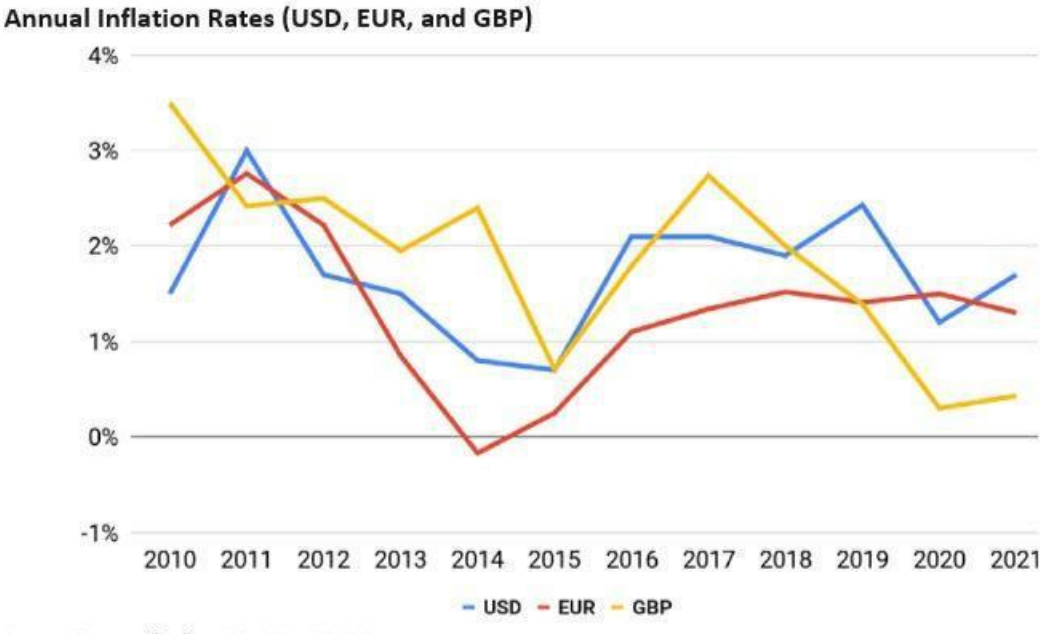
Source: Wikimedia

Monetary Policy: Keeping Inflation Under Control

Central banks are known as "lenders of last resort" because they're responsible for providing financial capital to commercial banks for both day-to-day business operations and during periods of financial turmoil. Specifically, they're responsible for maintaining full employment and managing reasonable rates of inflation.

Most central banks closely monitor the inflation rate and set an annual inflation target of roughly 2–3%, which they believe promotes a certain level of spending while stimulating sustainable economic growth.

Figure 8



Source: Bureau of Labour Statistics, Statista

Notably, central banks haven't always set inflation targets. Germany and Switzerland first used inflation targeting in the mid-1970s to revive the economy following the collapse of Bretton Woods. Roughly 20 years later, Canada, the UK, Sweden, New Zealand, and Australia followed suit in adopting the inflation targeting policy, along with many emerging economies. The US didn't adopt inflation targeting until January 2012 after the fallout of the 2008–2009 financial crisis (the Great Recession).

A central bank also acts as the regulatory authority of a country's monetary policy and controls the production, distribution, and reduction of the nation's money supply. Put simply, a country's central bank maintains the integrity of the banking system and prevents it from falling apart; this is done by either expanding or shrinking the money supply and providing liquidity buffers as needed.

The process by which central banks control the money supply varies depending on the central bank and the nation's economic situation. Some of the most common methods that central banks utilize to control the money supply include:

• Changing the central bank's discount rate

(i.e., interest rate between the central bank and domestic banks)

• Setting reserve requirements

(i.e., the amount of money a bank is required to hold against customer deposits)

• Conducting open market operations

(i.e., buying/selling US treasuries, reverse repos, quantitative easing)

Modifying the Discount Rate

Central banks can't directly set interest rates for loans such as mortgages, personal loans, or auto loans, which is known as the "lending rate." However, central banks do have the power to influence the lending rate by modifying the discount rate. Central banks change these rates to incentivize borrowing (monetary expansion) or lending (monetary contraction) to control economic growth.

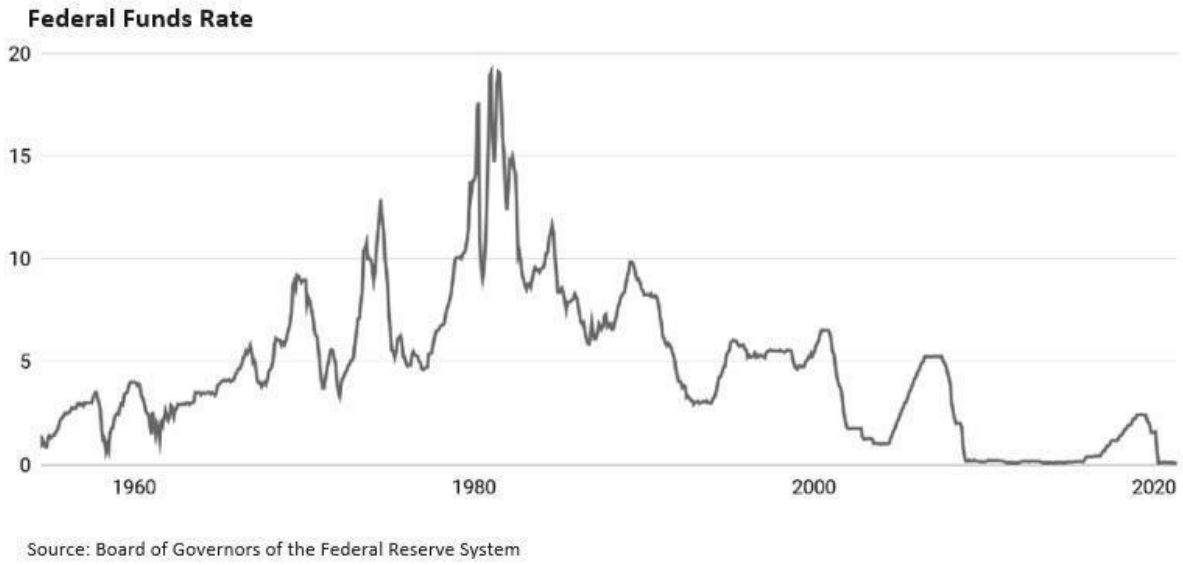
If the discount rate is low, borrowing from the central bank is less expensive, and thus banks can lend to customers at a lower rate. Lower rates tend to increase borrowing and consequently the quantity of money in circulation, which can stimulate economic growth. However, central banks should theoretically refrain from keeping rates too low for too long to avoid excessive inflation. If a central bank wants to decrease borrowing and incentivize saving because an economy is growing too fast, it can increase the discount rate.

Bank Reserve Requirement

Another common way central banks manage the money supply is by adjusting the bank reserve requirement. Reducing the reserve requirement allows commercial banks to use the surplus to lend out more money. On the other hand, the central bank can reduce money in circulation by increasing the reserve requirement.

In the US, when a bank runs low on reserves and needs to meet the reserve requirement, it will borrow funds from another bank overnight and pay the federal funds rate. Notably, the federal funds rate impacts all lending markets because of the cost associated with borrowing from other banks. For instance, if it is expensive for a bank to borrow from another bank, financial institutions will logically charge its customers an even higher interest rate. Alternatively, suppose it doesn't cost much for a bank to borrow from one of its peers. In that case, financial institutions will offer their customers loans at a lower interest rate to compete in a market where money is cheaply available. As a result, the federal funds rate directly influences the lending rate.

Figure 9



This practice of banks creating loans in excess of customer deposits is known as fractional-reserve banking. While the US reserve requirement tends to vary depending on factors such as the type of financial institution and existing economic conditions, it is usually somewhere between 5–10%. However, the Federal Reserve Board lowered reserve requirements ratios to a historic low of 0% on March 15, 2020, in response to the first outbreak of the COVID-19 pandemic.

The tricky part about fractional-reserve banking is that it allows for the multiplication of money created from nothing. For example, assume a bank starts with $0, and it receives a $100 deposit. The bank now has $100 in reserves. At the current reserve requirement in the US, the bank can lend out the full $100 to other individuals or institutions and thus insert an additional $100 into the economy. The borrower then might take their $100 to another bank to deposit, where it will be lent out once again and increase the number of dollars in circulation even further in a feedback loop. This economic phenomenon is known as the “multiplier effect.”

If a country’s financial stability is in question, depositors may seek to withdraw their funds from a bank out of fear that the bank could become insolvent, known as a bank run. Bank runs have occurred repeatedly since the advent of banking, including during the Great Depression and the 2008–09 financial crisis. Bank runs create negative feedback loops that can quickly bankrupt banks and contribute to a

systemic financial crisis or collapse. Though banks have significant safeguards in place to prevent bank runs, they are still a genuine possibility; the last bank run occurred in May 2019 against MetroBank.

Some economists argue that while fractional-reserve banking has its risks, it is not definitively inflationary and can stimulate economic growth. This scenario is especially true when lending fuels technological innovation, which is deflationary.

Open Market Operations

Central banks, such as the US Federal Reserve ("the Fed"), also influence interest rates by conducting open market operations where they buy and sell government or privatelyissued securities (e.g., corporate bonds) on the open market. These operations create artificial supply or demand that drives interest rates towards its target. When the Fed wants to increase the money supply and drive economic growth, it credits its member banks' balance sheet with funds in exchange for US Treasuries and other securities sold in the open market. However, the Fed doesn't physically exchange capital with its member banks. The ECB similarly controls interest rates through the European Overnight Index Average (Eonia), the average overnight reference rate for which European banks lend to one another in euros. These purchases and balance sheet credits mean that banks now have more money on hand to lend out to customers at a low interest rate, thus increasing the circulating money supply. Most importantly, this new money provides cheap credit to individuals and businesses who can use this newly acquired debt to make purchases or investments.

If the economy is expanding at an unsustainable rate, the Fed will reduce the money supply by selling Treasury bonds from its account on the open market and will raise interest rates. Fewer dollars and higher interest rates means it's more costly to borrow, and the incentive to save is greater. In both instances, the Fed has in-house traders who constantly adjust the bank's securities and credit daily to keep the federal funds rate in line with its target.

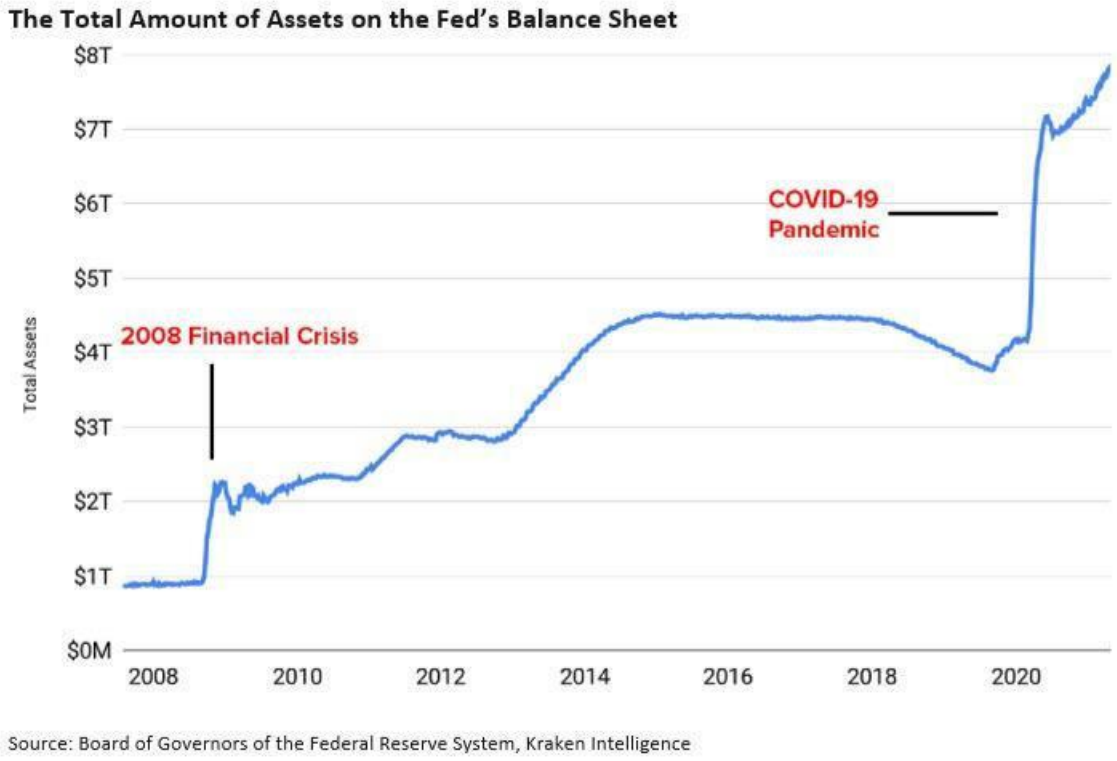
Quantitative Easing/Tightening

When open market operations fail, central banks will specifically purchase long-term government bonds from member banks and reinvest proceeds back into the same securities—or what is known as Quantitative Easing (QE). This unconventional monetary policy tool spurs economic growth by injecting money into the economy through asset purchases. Conversely, central banks conduct Quantitative Tightening (QT) to reduce the central bank's balance sheet by slowing the pace of reinvestment of proceeds from maturing bonds. In both cases, the goal is to influence economic growth by altering the money supply.

The Fed recently took unprecedented stimulus relief action in response to COVID-19 via aggressive open market operations and QE, among other stimulus efforts. The Fed's QE strategy in March 2020 was to buy at least $500B in Treasury securities and $200B in government-guaranteed, mortgage-backed securities over "the coming months." The Fed indefinitely expanded the QE strategy a week later, noting that it would buy long-term securities "in the amounts needed to support smooth market functioning and effective transmission of monetary policy to broader financial conditions." Though the operations

were successful through May, the central bank announced it would begin buying $80M per month in Treasury bonds and $40B in residential and commercial mortgage-backed securities in early June 2020.20 Since March 2020, the Fed's balance sheet has exploded nearly 2x its size to around $8T due to its massive purchasing efforts on the open market.

Figure 10



When it comes to QE, the ECB lends money to governments and commercial banks in the eurozone on a short-term basis (usually three months). This method is different from how the Federal Reserve purchases long-dated treasury bonds. For example, the Fed implemented aggressive QE in the 2008 recession while the ECB incrementally increased the maturity of its bank loans from three months to three years. The ECB also eased requirements on its loan collateral multiple times, giving European banks easier access to the ECB's reserve money as they were made available on a full-allotment basis (i.e., banks have unlimited access to the central bank's liquidity). However, it appears the central banks are starting to converge on their crisis management strategies as the ECB introduced QE in March 2015.

Repurchase Agreement (Repo) Operations

A repurchase agreement (repo) is where a central bank sells short-term securities to investors, typically overnight, and repurchases them the following day or week at a slight premium (i.e., the implicit overnight interest rate). The central bank effectively borrows, and the other party is lending at the implicit overnight interest rate. This operation is known as a repo to the seller and a reverse repo for the buyer.

The most recent example of repo operations was in response to the COVID-19 pandemic; the ECB set up a Eurosystem repo facility in June 2020 to provide euro liquidity to no-neurozone central banks (EUREP). This system allowed the ECB to arrange repo lines with several non-eurozone central banks, including Hungary, Albania, and Serbia, to conduct more repos. These repo lines allow the ECB to better address euro liquidity shortages in non-eurozone countries by lending euros to these foreign central banks. As a result, the ECB mitigates downward pressure on eurozone markets and economies that might adversely impact the implementation of monetary policy.

How Is Inflation Measured?

United States

Consumer Price Index (CPI)

The Bureau of Labor Statistics' (BLS) Consumer Price Index (CPI) is the most commonly used measure of inflation. It tracks the change in the cost of living by calculating the weighted average of price changes in a basket of consumer goods and services. This basket attempts to reflect common consumer spending behaviors by mimicking the usual products and services purchased. The US CPI rose 5% year-over-year as of the time of press, the fastest pace since August 2008.

Figure 11

Coverage of CPI Statistics

Consumers		Basket of Goods & Services		
Who's Included	Who's Excluded	What's Included		What's Excluded
Professionals	Non-metro or rural populations	Housing	Medical Care	Investments (e.g., stocks, bonds, real estate)
Self-employed individuals	Farm families	Apparel	Food and Beverages	Savings
Unemployed individuals	Armed forces	Transportation	Misc. Goods & Services (e.g., haircut)	Life Insurance
People with income below the federal poverty threshold	Incarcerated individuals	Education & Communication	Excise Tax	Income Tax
Retired people	People in mental hospitals	Recreation	Sales Tax	Social Security Tax

Source: The Bureau of Labour Statistics (BLS)

To calculate the CPI, the BLS will contact service establishments, doctors offices, retail stores, and rental units, among others, to record the prices of roughly 80,000 goods and services and compare its findings to 1984; a CPI of 100 implies inflation is at levels last seen in 1984.

Figure 12

CPI Inflation Formula

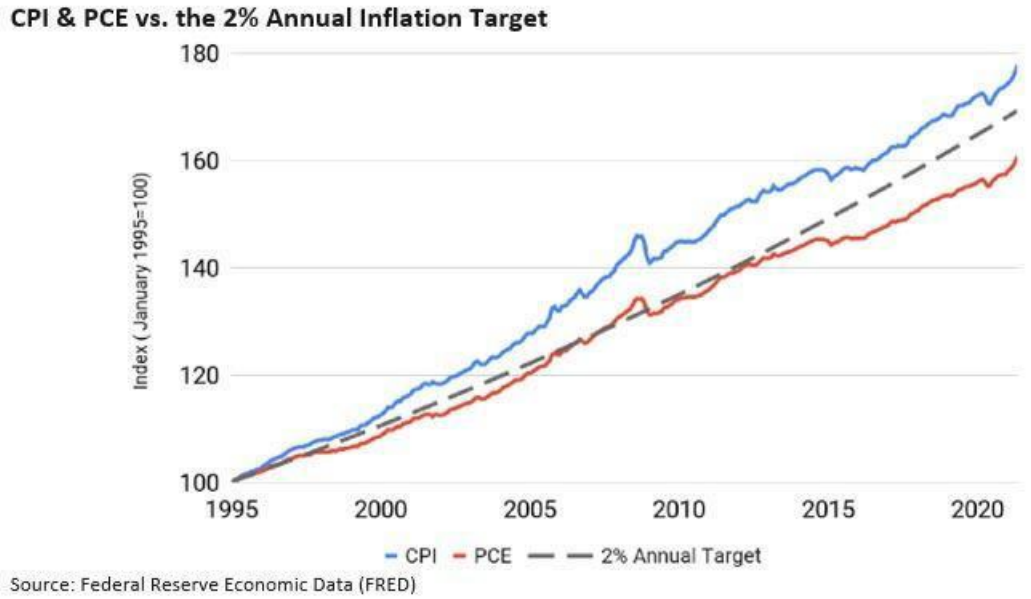
$$\text{Inflation Rate (as a \%)} = \left(\frac{\text{Final CPI Value}}{\text{Initial CPI Value}}\right) \times 100$$

Personal Consumption Expenditures (PCE)

Like CPI, the Bureau of Economic Analysis has a Personal Consumption Expenditures (PCE) index that seeks to measure inflation by gauging the change in price of business goods and services.

Because the government and central bank focus on different inflation measures, they utilize other price indexes. For instance, the government uses the CPI to make inflation adjustments to certain benefits (e.g., Social Security), while the Fed focuses on the PCE. Historically, PCE has come in lower than CPI. The US PCE increased by 1.2 percentage points month-over-month to 3.6% at the time of press, up from 1.4% in January 2021.

Figure 13



The Fed previously used the CPI to measure inflation before January 2012 but switched to the PCE index. The index responds dynamically to changing consumer preferences because expenditure weights can vary as people substitute goods and services for others, it includes a more comprehensive list of goods and services, and the Fed can revise historical data to reflect new data.

Figure 14

Key Differences Between CPI and PCE

CPI	PCE
Sources data from the BLS' household surveys	Sources data from GDP report and businesses
Includes health care services paid by employer sponsored health insurance, Medicare, and Medicaid	Only includes medical services paid for directly by consumers
Measures goods and services bought by all US households and non-profit organizations	Measures all urban households
More vulnerable to categories with wide price swings such as computers and gas	Less volatile
More popular	Not as popular
Historical data revision not possible	Historical data can be revised to reflect new conditions
Less comprehensive list of expenditures	More comprehensive list of expenditures
Calculation rarely changes	Calculation changes dynamically to shifting consumer preferences
Includes food, oil, gas and energy prices	Excludes volatile oil, gas, and food prices

Source: Kraken Intelligence, BLS, BEA

Eurozone

Harmonized Index of Consumer Prices (HICP)

The ECB's Harmonized Index of Consumer Prices (HICP) measures the change in the prices of consumer goods and services acquired over time, used or paid for by eurozone households. The HICP includes most consumer goods and services purchased (e.g., food, newspapers, petrol, durable goods such as clothing, PCs, washing machines, and services such as hairdressing, insurance, and rented housing).

The biggest difference between the HICP and the US CPI is that the HICP doesn't cover expenditure on owner-occupied housing. The US CPI calculates "rental-equivalent" costs for owner-occupied housing, while the HICP considers such expenditure as investment and excludes it from the index. Also, the HICP differs from the US CPI in that it attempts to incorporate rural consumers, while the US focuses on the urban population. However, the HICP does not accurately include rural consumers in its index since it only uses rural samples for creating scalable weights. The HICP reading rose +0.4% month-over-month to 2% at the time of press, its highest level in over two years.

China

Consumer Price Index (CPI)

China measures inflation via its own CPI, which focuses on often-consumed goods and services, such as groceries, clothes, rent, power, phone services, recreational activities, and raw materials (e.g., gas, oil, lumber), as well as federal fees and taxes. Though the country has never disclosed the index's exact weightings, estimates suggest that food, tobacco, and alcohol account for roughly 30%. China's CPI rose from -0.3% at the start of the year to

1.3% at the time of writing, its biggest year-over-year increase in eight months.

Producer Price Index (PPI)

Although CPI measures price changes from the consumer's perspective, China's producer price index (PPI) measures price movements from the seller's perspective. The PPI does this by tracking changes in the prices that manufacturers charge wholesalers (i.e., factory gate prices). China's PPI is typically a leading indicator of changes in the nation's CPI because it foreshadows the potential price levels of many goods and services before they reach the market. In essence, the PPI is a gauge of industrial profitability. The nation's PPI rose 2.2 percentage points month-over-month to 9% at the time of press, the highest level in over 12 years due to rising commodity prices.

The Common Criticisms of How Inflation Is Calculated

United States

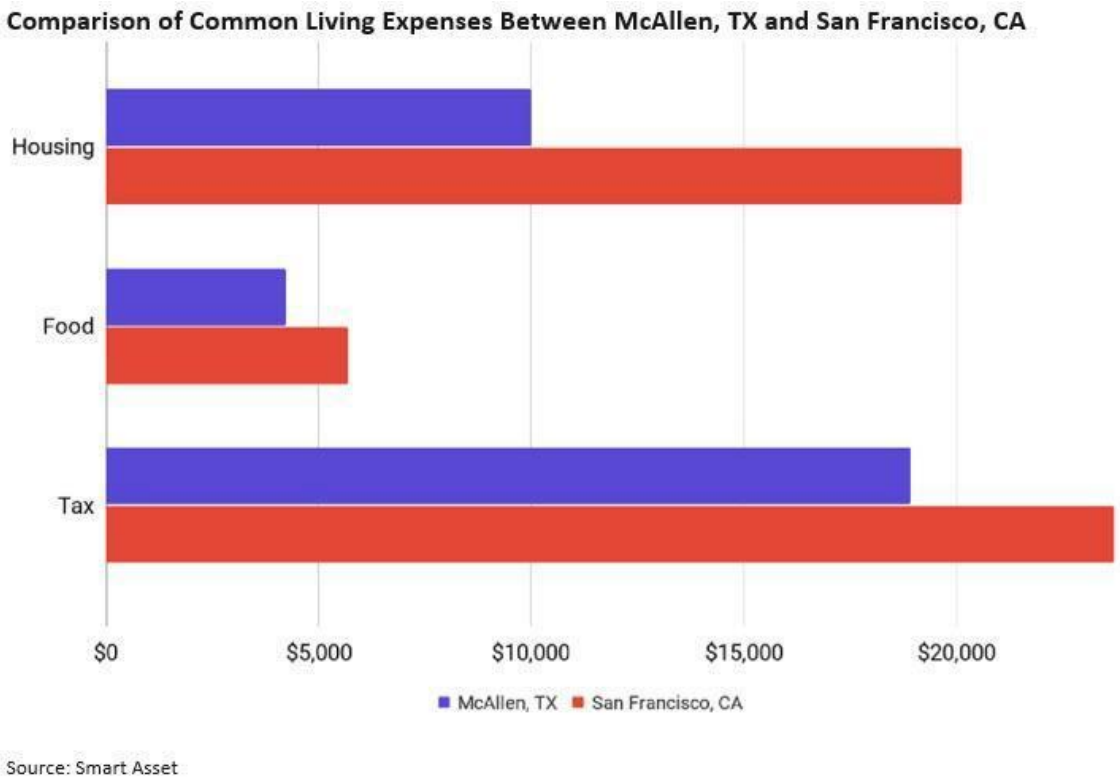
Skeptics have long argued that calculations for the CPI and other measures of inflation are flawed. These arguments range from questionable economic incentives to outdated methodologies. In particular, skeptics believe that the inflation figures that the US government and Fed throw around are incorrect for the following reasons:

• The government has incentives to suggest inflation is lower because it affects public programs that use inflation as a benchmark to set policy. Because the CPI determines the incomes of tens of millions of Americans living off government programs (e.g., food stamp recipients, Social Security beneficiaries, military and federal Civil Service retirees, and children on school lunch programs), the inflation reading directly affects the amount of money the government must spend on these income payments to keep pace with the cost of living. Therefore, a higher CPI is more costly and less manageable to the government than a lower CPI, especially when a government is deeply indebted.

• Consumer spending habits may change with the economy, but the CPI doesn't account for substitution. Therefore, the government may overestimate inflation; even the BLS freely admits the flaws of the substitution effect.

• The CPI doesn't capture the regional price differences and variations in buying patterns across different groups, e.g., citizens living in expensive areas such as San Francisco will have different spending habits than those living in cheaper locations such as Wyoming.36 Not accounting for this difference can result in a lower inflation reading.

Figure 15



Source: Smart Asset

• The CPI inadequately represents certain expenditures, e.g., the index includes outof-pocket medical expenses but not the portion of medical costs sent by insurance companies and government healthcare programs.

• The omission of productive investment assets (e.g., stocks, bonds, and real estate) conceals declines in an essential component of purchasing power. CPI may measure increases in the price of consumption assets, but it doesn't account for reductions in the dollar's purchasing power against productive capital assets. For example, the total market capitalization of the US stock market since the start of 2020 has increased by +30%, driven by aggressive money creation efforts.

Eurozone

Much like the US, skeptics have long claimed that the HICP isn't entirely accurate. The Boskin Commission identified problems with the HICP in 1996, including product substitution, the treatment of new products, and quality adjustment. This issue is likely because the HICP methodology does not ensure standardization (i.e., harmony) of the quality adjustment process, the entry of new products, or the analysis of missing prices. Critics argue these issues cause significant price differences across countries. While the most considerable criticism of the HICP is likely in its exclusion of the cost of owner-occupied housing, ECB president Christine Lagarde hinted in early 2020 that the central bank might soon include it in the HICP calculation.

China

Though the National Bureau of Statistics of China has defended its CPI as a reliable metric for gauging the change in prices, the most frequently discussed concern is the indicator's drastic underestimation of overall price pressures in China's economy. This problem is due to the government not giving enough weight to housing prices and has caused great concern as China's housing market has surged for years to a whopping $52T market. Additionally, some critics argue that the basket does not always reflect changes in consumer preferences as the basket is only adjusted every five years (last updated in 2020). Much of the remaining criticisms about China's CPI measurement have unsurprisingly pointed to a lack of trust in the government.

Hedging: Learn to Protect Your Wealth

To protect against inflation-driven loss of purchasing power, investors look to own assets that appreciate with inflation. These assets include gold, stocks, real estate, and, more recently, bitcoin. Assets purchased to protect wealth against rising inflation are referred to as "inflation hedges" and have been part of many individuals' portfolios for many reasons.

Gold

Gold has a rich history of price stability and a proven track record of resilience during economic downturns. Additionally, gold has been praised for its sound monetary properties, including its scarcity, cost of production (i.e., difficult to inflate supply), durability, divisibility, and fungibility—making it an attractive store of value and a "safe haven" asset.

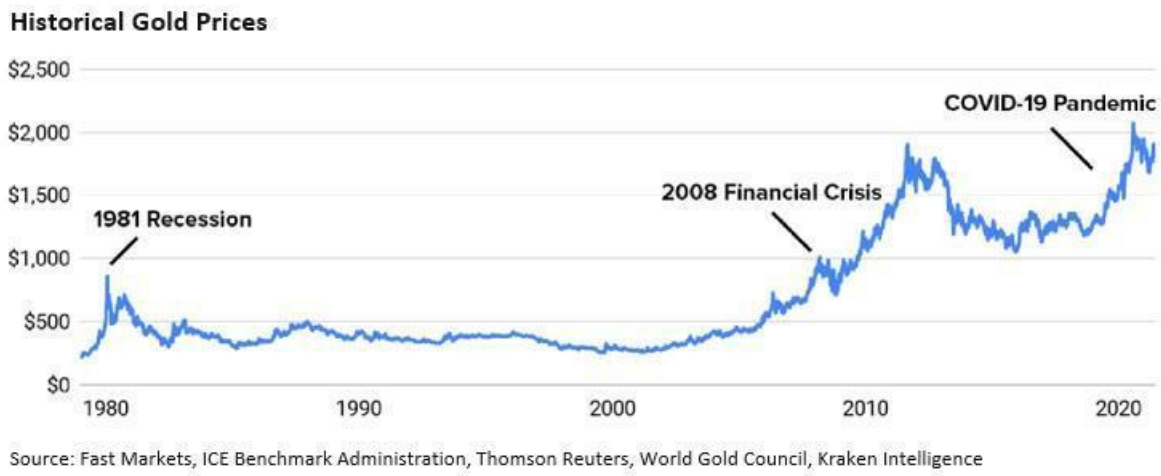
For example, the bullion outperformed virtually all other assets when inflation was high under the Carter and Nixon administrations. Pundits contend that Richard Nixon, the 37th US president (1969–1974), nearly destroyed the US economy via his poor attempts to remedy mild inflation with wage and price controls, as well as removing the US gold standard. By the end of his tenure, inflation hit double digits, and gold was up +350% since the start of his first term.

Under Jimmy Carter, the 39th US President (1977–1981), inflation got as high as roughly

18% following the naming of Paul Volcker as Chairman of the Federal Reserve Board. Volcker attempted to end double-digit inflation by raising the federal funds rate to unprecedented levels. This extensive period of extremely high interest rates is now known as the "Volcker Shock" and was the primary driver of the 1981 recession. Between Carter's inauguration and the end of his tenure, gold prices rose +148% as people flocked to the safe haven asset to protect their wealth.

Between major economic downturns, gold prices have historically trended lower before consolidating and then rallying higher as the next economic downturn begins to surface. Figure 16 describes how gold rapidly appreciates ahead of significant downturns before retracing lower and consolidating.

Figure 16



Source: Fast Markets, ICE Benchmark Administration, Thomson Reuters, World Gold Council, Kraken Intelligence

Bitcoin

Bitcoin is often referred to as digital gold because its underlying computer code ensures many of the same properties of gold. Like gold, bitcoin is also highly scarce, supply inflation-resistant, divisible, durable, and highly fungible. Bitcoin is hailed as an inflation hedge because it isn't subject to the uncertainty of a central bank's monetary policy. Instead, Bitcoin creator Satoshi Nakamoto determined the crypto asset's supply inflation schedule at the time of inception, and any changes to it would have to be voted in by the community rather than a centralized authority.

Moreover, it seems that the "smart money" is buying up bitcoin in troves since late last year, including legendary investor Paul Tudor Jones, MicroStrategy's Michael Saylor, and Tesla's Elon Musk. These billionaires, among others, have added billions of dollars worth of bitcoin to their company's Treasury reserves and personal investment portfolios to hedge against impending inflation. Institutions and renowned investors have historically stayed away from investing in bitcoin, citing claims that it is a risky and speculative asset. Though before the COVID-19 pandemic, bitcoin was too inexperienced to be an inflation hedge, its rapidly growing reputation—as evidenced by "smart money" buying into the asset—will likely solidify its spot as one of the best inflation hedges for the foreseeable future.

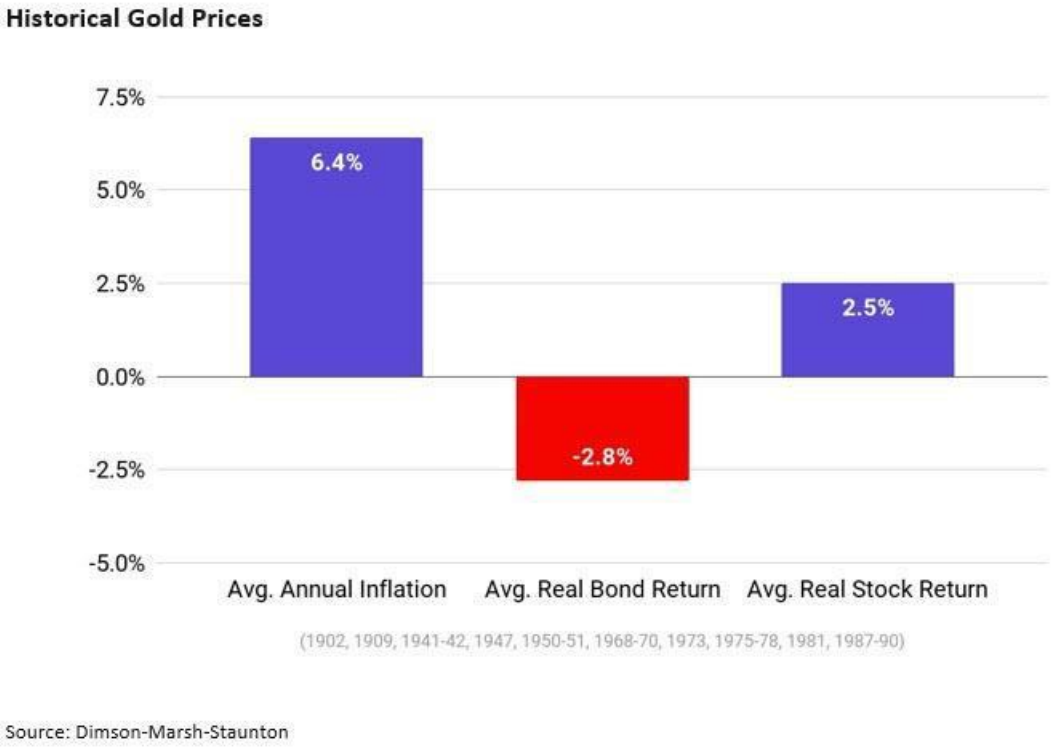
Stocks & Bonds

The relationship between inflation and equity prices is not uniform because stocks and the companies issuing them differ. While every stock should be evaluated on its own merits, many contend that value stocks (i.e., shares trading at a lower valuation relative to the company's fundamentals, such as dividends, earnings, or sales) may do better than growth stocks (i.e., stocks that are expected to outperform the market) when inflation is high. This theory stems from investors assessing growth stocks based on their present value of future earnings. When growth in inflation or interest rates starts pacing faster than expected, it reduces the current value of future cash flows. Stocks that can defend high dividend payments, including many value stocks, are likely to outperform because their yield is relatively attractive.

Stocks can appreciate with inflation because it can stimulate job growth, investors may seek to hedge by converting cash into stocks, and revenues increase with inflation following an adjustment period.

Assuming high inflation is considered a rate greater than the average for post-gold linked currency exchange in the US since 1971 (i.e., 4.4%), stocks have on average fared significantly better than bonds during times of high inflation throughout history.

Figure 17



Out of these 20 years of high inflation, bonds have yielded a positive return for only six years (30%) while stocks finished higher for 11 (55%). However, one should note that the average return for stocks (+2.5%) was still less than the average inflation rate (6.4%) during these 20 years. Although stocks are typically a better inflation hedge than bonds and fiat currency, they have struggled to completely protect one's wealth from inflation in the past.

Inflation can also adversely affect stock prices because declining consumer spending during general economic slowdowns leads to lower revenue and profits that weigh on share prices. Also, increases in input costs (cost-push inflation) can decrease profit rates and force businesses to falter as it takes companies several quarters to pass along input costs to consumers.

Real Estate

Investing in real estate or real estate investment trusts (REITs) is another popular inflation hedge because property values tend to increase along with the cost of renting. This property value rise occurs because input costs (e.g., raw construction material such as lumber) rise with inflation, and higher interest rates brought by rising inflation will push builders to demand higher home prices to offset borrowing costs. All these dynamics create a positive feedback loop that acts as a tailwind for property owners.

However, real estate prices don't always rise when inflation is high. Because rental income generally grows less than inflation, there will likely be no material appreciation in real estate prices if rising interest rates push up capitalization rates (i.e., the rate of return expected to be generated on a real estate investment property). According to MIT's Department of Economics, only retail property incomes have historically kept up with inflation. In contrast, industrial and apartment incomes have only partially offset the increase in inflation and office property incomes have barely increased, if at all.

Figure 18

Real Estate CPI Elasticities (1Q1978 - 4Q2016)

Property type	Income	Value
Retail	1.02	1.07
Industrial	0.7	0.91
Apartment	0.56	0.98
Office	0.18	0.74

Source: Economics.MIT.edu

Property value has historically performed better as retail and apartment properties proved to be complete inflation hedges, industrial property was a nearly complete inflation hedge, and office properties only provided a partial inflation hedge.

Inflation-Linked Bonds

Inflation-linked bonds, such as the US Treasury inflation-protected securities (TIPS), are bonds designed to increase in value with the pace of inflation. TIPS track the CPI, and its principal amount will reset according to modifications in the index, meaning it will increase with inflation and decrease with deflation. TIPS are often viewed as a "risk-free" investment because the investors always receive at least the original principal at maturity.

These securities won't yield high returns but often outperform Treasuries during periods of unexpectedly high inflation. For instance, following the 2008 financial crisis when inflation was high, the iShares TIPS Bond exchange-traded fund (ETF) increased by +33% through late 2012. Although they go by different names, many countries such as India, Canada, and the US issue inflation-adjusted bonds like the TIPs.

Figure 19

List of Pros and Cons for TIPS

Pros	Cons
The principal amount increases with inflation	Interest rate offered is usually lower than most fixed-income bonds without an inflation adjustment
Interest payments increase as inflation increases since the rate is calculated based on the adjusted principal balance	When inflation is low, the utility of holding TIPS decreases
"Risk free" investment; investors are always paid at least their original principal at maturity	Investors may be subject to higher taxes on increased coupon payments

Conclusion

As we have already alluded to, understanding the economic phenomenon that is inflation isn't just for economists, market participants, and the intellectually curious, but for everyone. Inflation is paradoxically a silent friend and a silent foe; it can serve as a financial tailwind for some and a painfully relentless wealth destroyer for many others. Not only can inflation be devastating to businesses and individuals when it gets out of hand, particularly when times are already tough, but it can be a powerful force of good for governments.

In the past, we've seen governments and central banks attempt to control inflation by employing contractionary monetary policy, such as modifying the central bank's discount rate, changing the bank reserve requirement, and conducting open market operations. But, when governments and central banks fail to keep a tight leash on inflation and rely on arguably inefficient measures of inflation, then businesses, economies, and even livelihoods can be in great danger. Because of what seems to be government and central bank's innate tendency to push inflation to detrimentally elevated levels, individuals have learned over time how to better store their wealth to protect themselves against abnormally high levels of inflation. While assets like gold, real estate, inflation-adjusted bonds, and some stocks have proven to be useful hedges against inflation, the emergence of bitcoin and crypto assets has some market participants questioning how to protect one's wealth in today's modern-day economy. This shift in belief and thinking is evident by institutional investors, such as MicroStrategy's Michael Saylor, Bridgewater's Ray Dalio, and legendary investor Paul Tudor Jones, outright vocalizing support for bitcoin.

Needless to say, while there is no telling what lies ahead, fortune favors the bold. By understanding the ins & outs of inflation and the multitude of tools one can use against reckless monetary policies, one can better protect their wealth and truly be better off.

Disclaimer

The information in this report is provided by, and is the sole opinion of, Satoshi Pioneers's research desk. The information is provided as general market commentary and should not be the basis for making investment decisions or be construed as investment advice with respect to any digital asset or the issuers thereof. Trading digital assets involves significant risk. Any person considering trading digital assets should seek independent advice on the suitability of any particular digital asset. Satoshi Pioneers does not guarantee the accuracy or completeness of the information provided in this report, does not control, endorse or adopt any third party content, and accepts no liability of any kind arising from the use of any information contained in the report, including without limitation, any loss of profit. Satoshi Pioneers expressly disclaims all warranties of accuracy, completeness, merchantability or fitness for a particular purpose with respect to the information in this report. Satoshi Pioneers shall not be responsible for any risks associated with accessing third party websites, including the use of hyperlinks. All market prices, data and other information are based upon selected public market data, reflect prevailing conditions, and research's views as of this date, all of which are subject to change without notice. This report has not been prepared in accordance with the legal requirements designed to promote the independence of investment research and is not subject to any prohibition on dealing ahead of the dissemination of investment research. Satoshi Pioneers and its affiliates hold positions in digital assets and may now or in the future hold a position in the subject of this research. This report is not directed or intended for distribution to, or use by, any person or entity who is a citizen or resident of, or located in a jurisdiction where such distribution or use would be contrary to applicable law or that would subject Satoshi Pioneers and/or its affiliates to any registration or licensing requirement. The digital assets described herein may or may not be eligible for sale in all jurisdictions.