America's Monetary Landscape in Recent Decades: A Review of Interest Rate and Inflation Dynamics

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Abstract

This article reviews US inflation and interest rate dynamics within the context of the post-2000 era, emphasizing the period from the 2008 financial crisis to the contemporary, post-COVID era marked by increased inflation, fiscal spending, and rising interest rates. The article uses various illustrations of macroeconomic factors to explain the multifaceted US inflation and interest rate dynamics such as real inflation (past and future), expected inflation, labour market characteristics, and Ben Bernanke's variation of the Taylor Rule.

Keywords: Nominal interest rate; Real interest rate; Ex-ante interest rate; Taylor Rule; Federal Funds Rate.

1. Introduction

This article aims to analyze and discuss a set of various economic variables and methodological methods pertaining to economic growth and inflation. This will be accomplished through the analysis of various graphs showcasing the relationship between two economic variables or different macroeconomic trends based on different methodological methods. The analysis and discussion of various important economic variables such as the nominal and ex-ante real interest rates, core inflation rate, unemployment rate, and growth of the employment cost index provide a broad picture of the macroeconomic state of the American economy in regard to both inflation and unemployment. This analysis can also be applied to the Canadian economy since it tends to follow American macroeconomic trends,

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especially regarding inflation and employment, due to the Canadian economy's close integration with and dependence on the American economy. The analysis and discussion of various methodologies specifically relating to the Taylor Rule and its modifications are also of paramount importance; the debate regarding the original Taylor Rule and its modifications can have future implications for Federal Reserve policy regarding nominal interest rates, which can, directly or indirectly, influence the American economy through the various economic variables mentioned above.

2. The Three Forms of Interest Rates: Nominal, Real, and Ex-ante

We will start our analysis by discussing nominal, real, and ex-ante real interest rates. Although all three of these terms refer to interest rates, there are fundamental differences between them. Firstly, the nominal interest rate refers to the target interest rate set by the Federal Reserve, which dictates the rate at which banks borrow and lend to each other overnight; this is essentially the overnight lending rate. The real interest rate is the difference between the nominal interest rate and the rate of inflation, commonly referred to as the ex-post real interest rate, which considers the effects of inflation on borrowing and lending and shows the real cost of borrowing and the real yields of lending. The ex-post real interest rate is, of course, calculated with inflation that has already happened. The ex-ante real interest rate, like the ex-post real interest rate, is the difference between the nominal interest rate and inflation; however, the inflation within this situation is ex-ante inflation or expected inflation. The nominal interest rate and the ex-ante rate of inflation work in tandem to determine the real interest rate, as shown in the Fisher equation, in which the real interest rate is equivalent to the difference between the nominal interest rate and ex-ante inflation. The real interest rate, calculated with the nominal interest rate and the ex-ante inflation rate, is a crucial economic indicator as the real interest rate can positively or negatively influence economic growth. A decrease in the real interest rate leads to lower borrowing costs, prompting increased borrowing and investment, thus boosting economic activity. Conversely, when the real interest rate rises, economic activity starts to slow down due to higher borrowing costs, leading to reduced borrowing and investment, consequently cooling down the economy. Although nominal interest rates are crucial in determining real interest rates, their impact in lowering the real interest rate is limited due to the zero lower bound required to prevent negative nominal interest rates. Under negative interest rates, banks would begin to charge interest on savings, leading many people to store cash and other assets in other places, leading to increasing costs and consumer avoidance of banks and other financial institutions. Though negative interest rates can harm an economy, certain countries have used them to stop deflationary spirals and stimulate economic growth. However, these countries used negative interest rates as an option of last resort due to the negative impacts that negative interest rates could have on an economy. Ex-ante inflation rates, on the other hand, can be as large as possible, meaning that real interest rates can go as low as possible provided that the expected inflation is high enough and the growth in the nominal inflation rate is smaller than the increase in expected inflation. There has been a lot of debate regarding the role of secular stagnation as

a determining factor in setting nominal interest rates, which, in turn, affect the real interest rates by pushing them down. "Secular stagnation" refers to an aging population and a slowdown in productivity growth, all of which contribute to a slowly stagnating economy. A stagnating economy, in turn, results in a lowering of inflation due to lower economic activity, and a lowering of inflation prompts the Federal Reserve to lower the interest rate further. This phenomenon is shown in Figure 1 below, which plots the nominal interest rate along with the ex-ante real interest rate from 2003 to 2022.

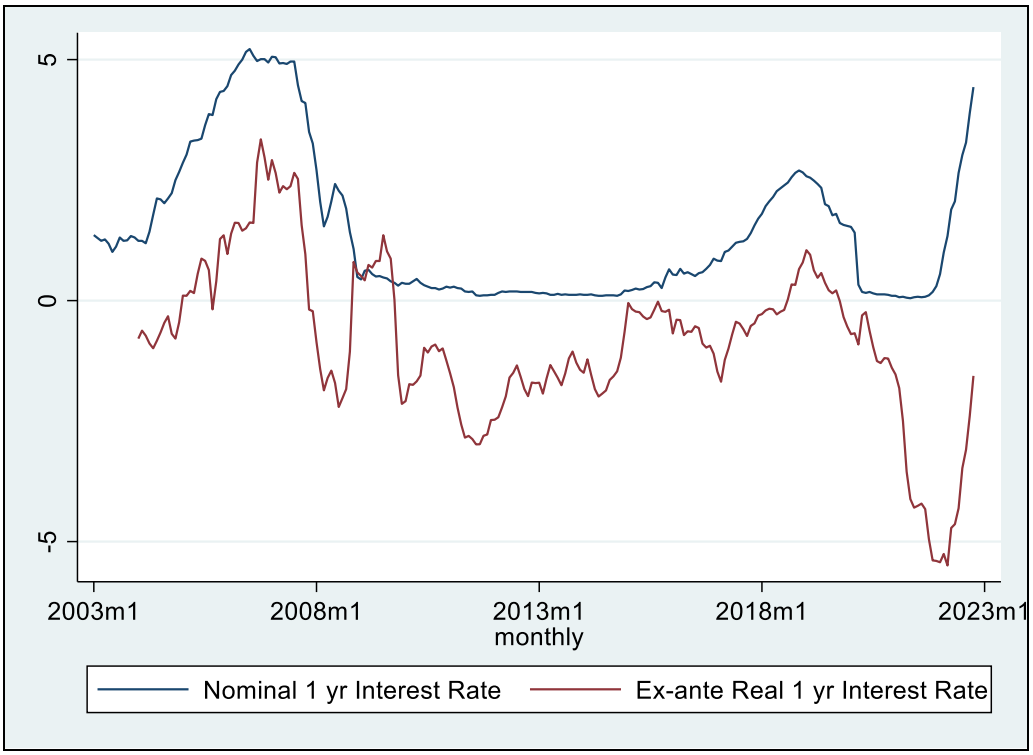

Figure 1 Nominal and Ex-ante Real Interest Rates

Source: Board of Governors of the Federal Reserve System. "Market Yield on U.S. Treasury Securities at 1-Year Constant Maturity, Quoted on an Investment Basis (GS1)." Retrieved from the Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/GS1, Accessed November 3, 2022.
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Between approximately 2009 and 2018, there was an extended period in which the ex-ante real interest was below zero due to near-zero nominal interest rates and positive expected inflation rates, with the lowest real interest rate being around negative 2.5%. Subsequently, real interest rates rose above zero following an increase in the nominal interest rate and a reduction in inflation expectations. However, after the onset of the Covid-19 pandemic, real

[1] The time series for all graphs ends on November 3rd, 2022 since this article was written on November 4th, 2022. Thus, the data used to compile the figures within this article have been dated up to November 3rd, 2022.

interest rates decreased significantly past negative 5% due to near-zero nominal interest rates and significant increases in ex-ante inflation due to quantitative easing, government stimulus, supply chain issues, and the energy crisis from the Russo-Ukrainian war. From 2009 to 2018, the real interest rate did not persistently stay below negative 2%, and it eventually increased as time progressed, even though the nominal interest rate stayed near zero. By extension, the real interest rate failed to stay below negative 2% due to the lowering of inflation expectations, which increases the real interest rate when the nominal rate stays near zero. One reason for this is the population's increasing confidence in the Federal Reserve's ability to tame inflation. Thus, people expected progressively lower inflation in the future, increasing real interest rates over time. Another reason is that lower inflation expectations may have been due to the economic stagnation of the period, which required near-zero nominal rates to maintain normal economic growth, indicating forces similar to secular stagnation. A strong economy with a tight labour market results in inflation which, if high enough, increases inflation due to the expectation of future inflation. On the contrary, over a prolonged period, stagnant economic growth results in expectations of further stagnation and unchanging inflation rates, necessitating progressively lower interest rates over time to spur economic growth. This phenomenon creates a policy issue for the Federal Reserve if it wants to keep real interests down to a certain level since the Federal Reserve is constrained by the fact that the nominal inflation rate can only go so far without being equal to or less than zero; accordingly, to lower the real interest rates the central bank would have to influence inflation expectations. If constrained by the zero lower bound on the nominal rate, the central bank could lower the interest rates by quantitative easing or direct cash stimulus. Direct cash stimulus, like the aid relief checks sent to millions of Americans during the COVID-19 pandemic, increases demand, inflation, and thus inflation expectations. Similarly, quantitative easing pushes up the price of financial assets such as stocks and derivatives since the Federal Reserve's purchase of bonds with reserves leads to increases in the price of bonds relative to stocks. As such, stocks and other financial assets become more attractive and expensive. As Figure 1 shows, this phenomenon occurred during the COVID-19 pandemic, with quantitative easing and cash stimuli significantly increasing inflation and decreasing the real interest rate due to inflation expectations running hot within the economy.

As of November 2022, inflation resulting from quantitative easing and cash stimuli from the COVID-19 pandemic, coupled with supply chain issues and an energy crisis, is putting pressure on the Federal Reserve to prevent entrenched inflation expectations. "Entrenched inflation expectations" refer to a situation where current inflation fuels future inflation. This happens because businesses and economic actors anticipate higher future inflation and consequently raise their prices, prompting others to do the same. This cycle perpetuates ever-increasing prices. If this phenomenon goes unchecked, public confidence in the Federal Reserve's credibility would decline, exacerbating inflationary expectations and resulting in lower real interest rates. Thus, to prevent inflation from becoming entrenched, the Federal Reserve must increase the nominal rate by more than the increase in inflation to push up the real interest rate. This principle is referred to as the Taylor Rule. Figure 1 shows that the Federal Reserve significantly raised the nominal interest rate over the past year. This action successfully increased the real interest rate, which rose notably towards the end of 2023. By raising the nominal interest rate by more than the inflation rate (a proxy for future inflation in the Fisher

equation), the Federal Reserve has effectively increased the real interest rate. This indicates that the Federal Reserve is adhering to the Taylor Rule.

3. Expectations of Future Inflation and Bond Yields

This section will discuss and analyze inflation expectations and their effects on bond yields, as shown in Figure 2.

Figure 2 plots the 5-year breakeven inflation rate alongside the 5-year Treasury Difference. The 5-year breakeven inflation rate reflects expectations of future inflation over the next five years. The 5-year Treasury Difference represents the difference between the yields on 5-year constant maturity Treasuries and 5-year inflation-indexed constant maturity Treasuries. The two graph lines follow an identical course, indicating that the 5-year Treasury Difference accurately represents the 5-year breakeven inflation rate. This suggests that the 5-year Treasury Difference corresponds to anticipated inflation, with inflation-protected securities effectively hedging against future inflation. Consequently, these securities incorporate expected future inflation into their yields. The data reveal two notable movements in the graphs: one during the US financial crisis of 2007-2008 and another during the inflationary period of 2022. During the financial crisis of 2007-2008, the American economy experienced a large recession due to the bursting of the housing bubble, which crippled both demand and spending within the economy. Due to the massive decreases in demand and spending, future inflation expectations decreased substantially as people developed a bleak economic outlook. A bleak economic outlook leads to lower inflation expectations as a stagnating economy in the future means lower future demand and, thus, lower future inflation. This sharp drop in expected inflation, as shown by the 5-year breakeven inflation rate, quickly rose again around 2009, signaling an increase in future inflation expectations. This may have been due to the fact that during the financial crisis of 2007-2008, the Federal Reserve dropped the nominal interest rate significantly, decreasing the real interest rate (as shown in Figure 1). This drop in the nominal interest rate made the public perceive that future inflation would increase, making future borrowing and investing easier and resulting in increased demand and economic growth. After the COVID-19 pandemic and up to November 3rd, 2022, the American economy experienced high inflation due to numerous factors, two of which are fiscal spending and quantitative easing during the COVID-19 pandemic. These two factors led to an overheating of the American economy. The American economy now has a tight labour market and better than expected economic growth but suffers from high inflation due to the boom in demand and spending post-COVID. After the American government's quantitative easing and fiscal spending during the pandemic, inflation began to grow substantially. Future inflation expectations began to grow along with it as the economy became increasingly heated and the Federal Reserve did not intervene to increase interest rates to tame inflation.

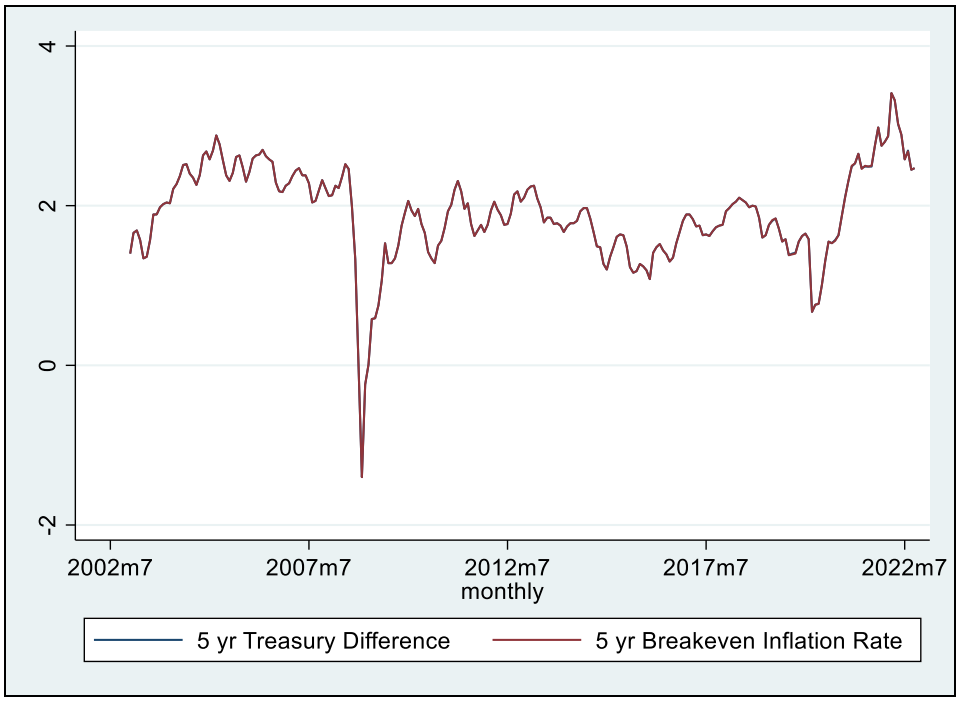

Figure 2 5-Year Breakeven Inflation Rate and 5-Year Treasury Yield Difference

Source: Board of Governors of the Federal Reserve System. "Market Yield on U.S. Treasury Securities at 5-Year Constant Maturity, Quoted on an Investment Basis (GS5)." Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/GS5, Accessed November 3, 2022.
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Figure 2 shows the 5-year breakeven rate of inflation rising significantly at the start of the COVID-19 pandemic and peaking sometime in 2022 before dropping back down. The decline in the 5-year breakeven inflation rate may be attributed to the Federal Reserve's aggressive interest rate hikes, thereby increasing the real interest rate and preventing inflation from becoming entrenched. This is shown in Figure 2, with the 5-year breakeven inflation rate starting to decrease after its peak in 2022.

4. Signs from Macroeconomic Indicators

Figure 3 graphs multiple economic variables and indicators such as the Unemployment Rate, Employment Cost Index Growth rate, Core CPI Inflation Rate, Ex-Ante Inflation Rate, and the 5-Year Breakeven Inflation Rate.

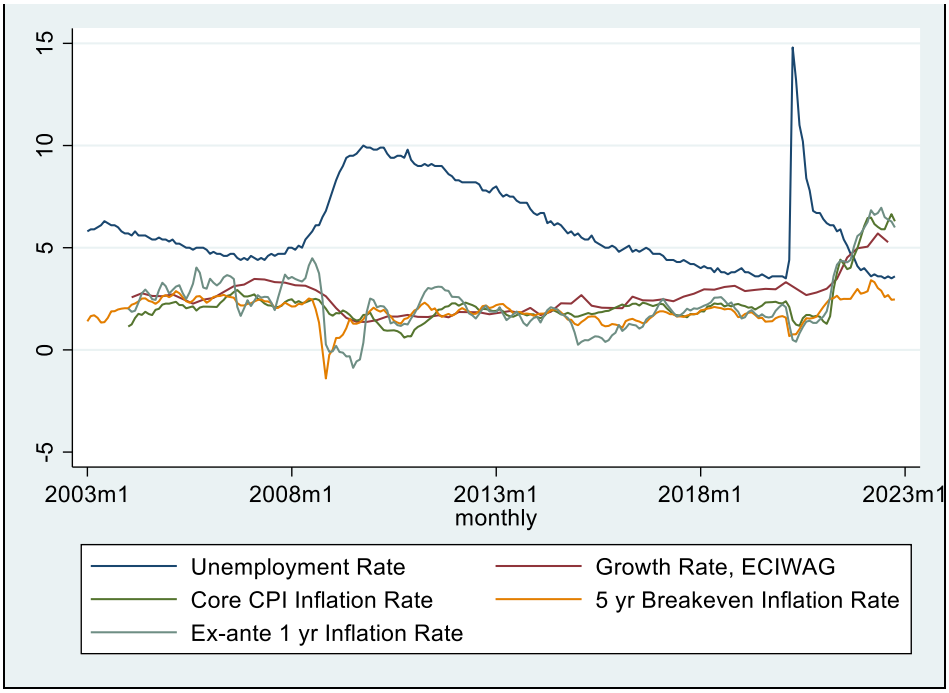

Figure 3 Unemployment Rate, Employment Cost Index Growth Rate (Growth Rate, ECIWAG), Core CPI Inflation Rate, Ex-ante Inflation Rate, and the 5-Year Breakeven Inflation Rate

Source: U.S. Bureau of Labor Statistics. "Unemployment Rate (UNRATE)." Retrieved from the Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/UNRATE, Accessed November 3, 2022.
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U.S. Bureau of Labor Statistics. "Employment Cost Index: Wages and Salaries: Private Industry Workers (ECIWAG)." Retrieved from the Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/ECIWAG, Accessed November 3, 2022. [2]

For this article, the calculation of the CPI inflation rate uses core data because core data excludes energy and food prices, which are subject to high volatility. Looking at the graph, we can first compare the 5-year breakeven inflation rate to the 1-year ex-ante inflation rate. As of today, the 5-year breakeven inflation rate is noticeably lower than the ex-ante 1-year inflation rate, showing that future inflation expectations are higher in the short term than in the long term. In contrast, before the substantial increase in interest rates, the 5-year breakeven inflation rate and the ex-ante 1-year inflation rate followed a similar pattern and trend. The percentage difference between them was minimal, indicating a perception of inflation stability prior to the Federal Reserve's substantial interest rate hikes. With unemployment levels reaching lows of the pre-pandemic era and the growth rate of business costs — in terms of wages and salaries — reaching unprecedented highs since 2003, the labour market displays signs of tightness, as shown by Figure 3. Although the labour market is tight and the

[2] There are three sources cited for Figure 3 as two of the graphs within Figure 3, "5 yr Breakeven Inflation Rate" and "Ex-ante 1 yr Inflation Rate", have been previously cited under Figure 2 and Figure 1 respectively.

employment cost index has peaked, Figure 3 shows that the growth of the employment cost index is starting to slow down, and the unemployment rate begins to bottom out. This is indicative of the effectiveness of the Federal Reserve rate hikes which have made borrowing and investing more costly, leading to less demand and more unemployment in the economy; this, in turn, leads to a surplus of workers and cheapens labour. Although we have yet to see this on a large scale, the decrease in the employment cost index and the decreasing growth rate of the unemployment rate indicate that the Federal Reserve's interest hikes are starting to show the desired effect on the economy as less demand, and thus fewer jobs, means not only cheaper labour prices but also less inflation as demand is decreased overall.

5. Bernanke's Variations of the Taylor Rule

Since the introduction of the Taylor Rule by John Taylor, there have been numerous debates regarding whether this rule, a methodological process for the Federal Reserve to set interest rates, is a perfect "one size fits all" approach to setting interest rates, or whether it should be further modified to take into account different long-term phenomena such as secular stagnation, for example. Former Federal Reserve chairman Ben Bernanke is a proponent of modifying the Taylor Rule. Bernanke discusses the original Taylor Rule in a blog in which he sets out the following formula (Bernanke 2015):

$$r = p + .5y + .5(p - 2) + 2 \quad (1)$$

r represents the nominal federal funds rate, **p** represents the inflation rate, and **y** represents the output gap, measured by the percent deviance of real GDP from potential GDP. Bernanke's proposed modification to the original Taylor Rule would be to increase the coefficient of the GDP output gap from 0.5 to 1, thus giving it more weight. Ceteris paribus, this results in a higher nominal federal funds rate when the economy is in a boom cycle, in which real GDP is higher than potential GDP, as compared to the original Taylor Rule. Conversely, when the economy is in a bust cycle, in which real GDP is less than potential GDP, the Bernanke modification leads to a lower federal funds rate compared to the original Taylor Rule. We can see this at work by looking at Figure 4.

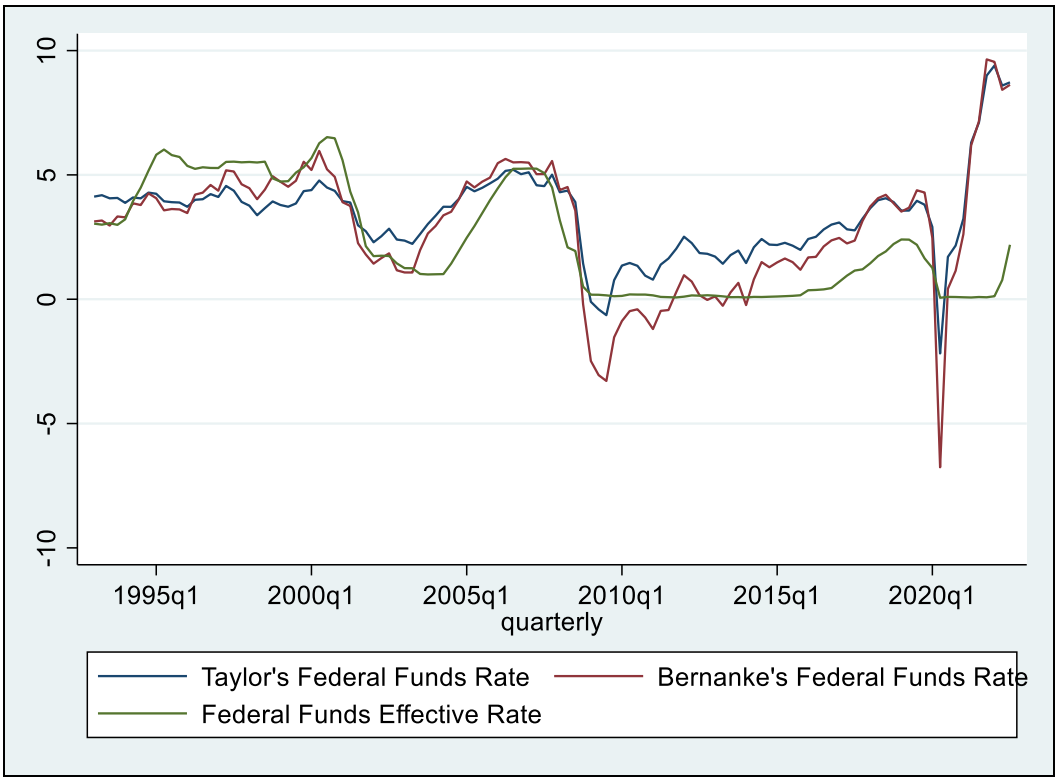

Figure 4 Federal Funds Effective Rate, Taylor's Federal Fund Rate, and Bernanke's Federal Funds Rate

Source: Board of Governors of the Federal Reserve System. "Federal Funds Effective Rate (FEDFUNDS)." Retrieved from the Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/FEDFUNDS, Accessed November 3, 2022.

U.S. Bureau of Economic Analysis. "Real Gross Domestic Product (GDPC1)." Retrieved from Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/GDPC1, Accessed November 3, 2022

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Figure 4 shows the federal funds rates according to the original Taylor Rule, Bernanke's modification of the Taylor Rule, and the actual federal funds rate of the time. In times when real GDP is less than potential GDP, such as during the financial crisis of 2007-2008 and the COVID-19 pandemic, Bernanke's modified Taylor Rule results in a lower federal funds rate than the original Taylor Rule by significant margins since it coalesced with the period of the great recession within the American economy. Yet, even during the time after the financial crisis of 2007-2008 to the onset of the COVID-19 pandemic, Bernanke's modified Taylor Rule results in lower federal funds rates, which can be indicative of secular stagnation as the real GDP remained below potential GDP (Wessel et al., 2021). However, this indication of secular stagnation is not definitive, as the difference between the federal funds rate based on the original Taylor Rule and the modified Taylor Rule began to shrink after the financial crisis and reached nearly zero before the COVID-19 pandemic, showing that real GDP was catching up to

potential GDP. Presently, both versions of the Taylor Rule are very similar in value, with the graphs having little difference between them, showing that real GDP is close to potential GDP. However, those values are substantially higher than the current federal funds rate, as shown in Figure 4. Nonetheless, confidence in the Federal Reserve should be upheld; as described by Ben Bernanke in his blog post, the Taylor Rule is more of a rule of thumb than a concrete method for calculating the federal funds rate.

Our previous discussion of Bernanke's modification of the Taylor Rule revolved around the modification of the GDP output gap coefficient. However, the modification of the equilibrium neutral rate and its indications are worth discussing as well.

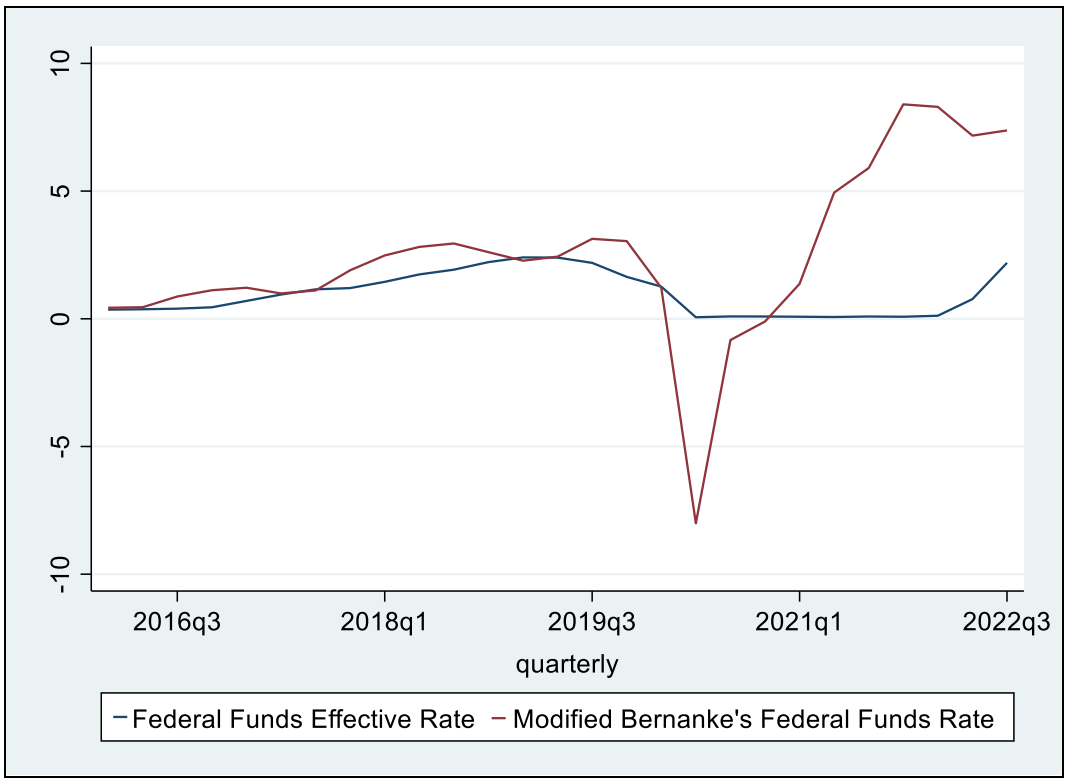

Figure 5 Federal Funds Effective Rate and Bernanke's Modified Federal Funds Rate
Note: Board of Governors of the Federal Reserve System and author's own calculation.

Figure 5 shows the actual federal funds rates alongside federal funds rates stemming from Bernanke's modified Taylor Rule with a new real equilibrium neutral rate of 0.75 instead of 2. This new modification to the already modified Taylor Rule would mean that, ceteris paribus, the federal funds rate is lower than what it would be compared to the original Taylor Rule and Bernanke's original modification of the Taylor Rule. This rings true when Figures 5 and 4 are compared with the newest modification of the Taylor Rule with a new real equilibrium neutral rate following closely with the Federal Reserve effective funds rate, suggesting that the Federal Reserve indeed followed this type of methodology in setting interest rates, or a method which yields similar results in setting the federal funds rate. This methodology yields higher employment rates and increased demand within the economy, which may be the reason why this method, or one similar to it, may have been used to set the federal funds rate from around

2015 to 2021, as the economy was still recovering from the financial crisis of 2007-2008. The risk of inflation was minimal due to the stagnating nature of the economy.

6. Conclusion

This article presented in-depth illustrations of various monetary and economic variables related to the labour market, calculated through varying methodologies. These variables were used to discuss four facets of contemporary rates of inflation: the prospects of future inflation, the effectiveness of Federal Reserve policies in reducing entrenched inflation expectations, the role of the labour market in the context of contemporary inflation, and debates surrounding modifications to Taylor's Rule and its implications. This article found that the Federal Reserve has been increasing the nominal interest rate faster than the expected inflation rate, causing an increase in real interest rates. As suggested in the discussion, the success of this policy is shown by the decrease in future inflation expectations, measured through the 5-year breakeven inflation rate. Furthermore, this article discussed the labour market within the context of inflation, showing how the labour market is extremely tight but starting to loosen with increasing rates of unemployment and the growth rate of costs for businesses, showing the effectiveness of the Federal Reserve in blunting aggregate demand within the economy via increases in unemployment and business costs. Lastly, this article found that, up until the COVID-19 pandemic, the Federal Reserve's monetary policy seemed to be following Bernanke's modified version of the Taylor Rule, with more of an emphasis placed on achieving employment and demand and growth, which is crucial in an era of increasing secular stagnation.

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