

# Monetary policy rules and asset prices: a financial cycle-augmented Taylor rule for the federal reserve's macroprudential stability framework

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**Abstract.** In response to the recurrent financial crises and persistent asset price fluctuations, policy makers have increasingly questioned the sufficiency of traditional monetary policy rules, such as the Taylor Rule, in safeguarding both asset price and financial stability. This paper explores how the basic Taylor rule, which focuses on the inflation gap and output gap, ignores the significance of U.S. financial cycles including credit expansion, housing market fluctuations and stock market volatility. It proposes an augmented Taylor rule that adds some key financial cycle indicators as an analytical tool for enhancing macroprudential stability. The paper aims to provide the Federal Reserve with a policy rule suggestion that strikes a balance between maintaining price stability and enhancing financial system robustness. Empirical results show that the augmented rule, which includes a financial cycle gap, significantly improves model fit ( $R^2 = 0.822$ ) and reveals a significant negative policy response to financial stress. Counterfactual simulations indicate that adherence to this rule could have prompted pre-emptive interest rate hikes before the 2008 crisis and deeper cuts thereafter. Welfare analysis demonstrates a 63.6% reduction in total social loss compared to the baseline Taylor rule. It concludes that systematically incorporating financial cycle indicators enhances macroprudential stability and provides a more robust framework for monetary policy, though effectiveness may be constrained at the zero lower bound.

**Keywords:** monetary policy, financial cycle, the federal reserve

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## 1. Introduction

The consequence of the global financial crisis has profoundly impacted the monetary policy situation. Traditionally, central bankers relied on monetary policy rules such as Taylor rule to guide interest rate adjustments by focusing on deviations in inflation and output gap [1]. However, over the recent decades, empirical studies have emphasised that financial markets indicators such as asset price fluctuations, credit booms, and sudden downturns in housing and stock markets have impacted on macroeconomic environment to a huge extent. These studies have led scholars and policy makers to doubt whether traditional policy frameworks are sufficient in the world where financial cycles drive economic instability. The Taylor rule, introduced by economist John Taylor in early 1990s, provides a basic and effective guideline for setting the federal funds rate based on deviations of inflation and output from their respective targets. Nevertheless, this rule's intrinsic simplicity has been criticised for ignoring the role of financial imbalances. Financial crises often occur due to not only macroeconomic imbalances but also the accumulation of vulnerabilities in financial markets. For example, long period of low interest rates can encourage excessive risk-taking behaviour in credit markets, stimulate housing bubbles and fluctuations of stock prices. Consequently, there is an occurring consensus that effective monetary policy rule nowadays has to consider these financial cycle dynamics.

This paper aims to extend the Taylor rule by integrating financial cycle indicators, especially credit growth, housing price cycles, stock market fluctuations, and financial stress indexes, into the framework. It introduces a financial cycle-augmented Taylor Rule which better serves as a macroprudential tool, helping central banks address financial imbalances before crises occurring. In addition to theoretical extension, the empirical analysis presented examines the relationships between traditional macroeconomic variables and various financial indicators. By utilising data from the Federal Reserve Economic Database (FRED) and other reputable sources, this paper explores how including these financial variables could alter the prescribed path for policy rates. The findings suggest that the integration of asset price cycles into the policy rule not only provides early warning

signals for emerging financial vulnerabilities but also improves the overall responsiveness of monetary policy to financial market developments.

The paper is structured as follows: Firstly, there is a detailed literature review on monetary policy rules, mainly focusing on the Taylor Rule, its limitations, and the emerging discourse on incorporating asset prices into policy frameworks. Secondly, the main analysis section discusses the theoretical foundations and empirical considerations for including a financial cycle factor in the Taylor rule, examines the mechanisms through which asset price fluctuations affect macroeconomic stability, and presents a comparative evaluation of the augmented rule versus traditional approaches. Finally, the policy implications and conclusion section part point out practical suggestion for central banks, discusses macroprudential policy integration, and summarises the key findings, suggesting future research avenues.

## **2. Literature review**

### **2.1. Development of traditional Taylor rule**

The Taylor rule was introduced by John B. Taylor in 1993, which contributes a progress in monetary policy implementing [1]. This rule pointed that the central banks are supposed to adjust the nominal interest rate in response to inflation gap (deviations of real inflation from target inflation) and output gap (deviations of real output from potential output). Taylor's equation provided an empirical foundation for monetary policy and made future monetary policy action predictable. This rule's widespread adoption lies in its clear guidance, the support of inflation targeting, and the ability to stabilise macroeconomic fluctuations. The majority part of research in the 1990s and early 2000s focused on the Taylor Rule's empirical performance. Some studies found when properly parameterised, this rule could reflect much of the systematic behaviour of U.S. monetary policy. Researchers such as Clarida, Gali, and Gertler [2] refined the rule further by exploring its dynamic characteristics, thereby promoting its credibility as a policy benchmark. Although the Taylor Rule was instrumental in guiding policy makers, it was never intended to serve as an all-inclusive framework of monetary policy.

### **2.2. Limitations of traditional Taylor rule**

Although Taylor is successful to some extends, evident limitations also exist. The main criticism focuses on its narrow attention of inflation and output gaps which overlooks other important financial variables [3]. Critics argue that by ignoring asset price fluctuations—such as those observed in housing markets and stock markets—the Taylor Rule may mislead to pro-cyclical policies. When asset price booms, monetary policy may remain too accommodative which inadvertently fuels bubbles. By contrast, policy might overcorrect in recession and exacerbate economic contraction. Some other studies also indirectly supported the limitation. For instance, a study by International Monetary Fund in 2008 focused on extending the standard New Keynesian dynamic stochastic general equilibrium (DSGE) model tried to incorporate a financial system [4] and suggested when financial instability lagged effect inflation and output, a central bank with instant response is more likely to achieve a faster return than the central bank who simply consider the contemporaneous inflation and output gaps. This finding demonstrated that a comprehensive framework incorporating financial system is more effective and efficient in addressing financial instability than the traditional Taylor Rule.

### **2.3. Considerations of financial cycle**

The financial crisis in 2008 shifted the focus among economists and policy makers. There was a growing consensus that the central bank's mandate should extend beyond single inflation stabilisation to encompass financial stability as well. For example, Borio and Zhu [5] introduced the "risk-taking channel", demonstrating that prolonged low interest rates incentivise excessive leverage and risk accumulation, amplifying financial cycles. Since then, the Bank for International Settlements (BIS) and some other international monetary organisations have proposed the incorporation of financial stability target into monetary policy rules. It triggered substantial research exploring the inter-effect between asset prices, financial cycles, and macroeconomy. A series of papers during the 2010s examined the role of asset price dynamics in monetary policy. Notably, studies by Drehmann, Borio and Tsatsaronis [6] argued that financial cycles—extended periods of credit expansion and asset price inflation—could lead to resources misallocations and financial distress. These ideas provided a foundation for incorporating financial cycle indicators into policy making benchmark.

### **2.4. Development of augmented policy rules**

By realising the limitations of the traditional monetary policy rule, researchers suggested various modifications to incorporate financial indicators to address the gap. A potential modification is financial cycle-augmented rule, which integrates asset price

measures into policy rule. Gali [7] integrated asset price bubbles into a New Keynesian DSGE model, showing that rules responding to financial gaps reduce macroeconomic volatility. This augmented rule indicated that central banks should not only respond to deviations in inflation and output gaps but also to deviations in asset prices from their long-term trends. Similarly, Roskelley [8] demonstrated that incorporating bond yield principal components into the Taylor rule improves its predictive power for monetary policy adjustments, particularly during periods of uncertainty. Theoretically, such an approach could help central bank tighten monetary policy before the periods of skyrocket asset price inflation and reducing the probability of bubble occurring. Theoretical models in both monetary policy and financial stability strengthen this augmented rule. These studies basically indicate that incorporating asset price factors can improve policy effectiveness and macroeconomic stability.

## 2.5. Empirical studies on asset prices and macroprudential stability

Empirical studies provided supportive evidence for the incorporation of asset prices in monetary policy rules. Some studies illustrated that asset price fluctuations contain early warning signals for financial instability. For instance, Reinhart and Rogoff [9] found that in the period of booming asset price inflation is usually followed by severe recessions. Meta-analyses of DSGE models, such as those by Quint and Rabanal [10], confirmed that combining monetary policy with macroprudential tools (e.g., countercyclical capital buffers) enhances welfare by mitigating crisis risks. Consensus suggested that although asset price is an essential building block although it cannot be the sole determinant of monetary policy alone. The literature suggested an idea that asset price dynamics are treated as an additional factor. When it is combined with traditional indicators, it offers a more robust measure of systemic risk.

In summary, the literature reveals a clear viewpoint: although the traditional Taylor Rule instrumentally promoted transparency and predictability, it failed to adequately address the complexities of financial systems in the real world. The experience of the 2008 crisis and following research emphasised the demand for an augmented framework that integrates asset price dynamics and financial cycles. Even if it is still controversial regarding the best methods for measuring and incorporating these factors, there is growing supports for a more comprehensive approach to monetary policy. The Financial Cycle-Augmented Taylor Rule represents a promising avenue for future research and policy innovation which can potentially enhance macroprudential stability in the complex financial environment.

## 3. Empirical analysis of augmented Taylor rule

### 3.1. Theoretical foundations of an augmented Taylor rule

#### 3.1.1. The traditional Taylor rule

The traditional Taylor rule is a policy guideline that suggests setting the nominal interest rate based on the divergence of actual inflation from the target rate and actual output from its potential level. Mathematically, the standard form is expressed as:

$$i_t = r^* + \pi_t + 0.5 (\pi_t - \pi^*) + 0.5 (y_t - y_t^*)$$

where:

$i_t$  is the nominal interest rate,

$r^*$  is the equilibrium real rate,

$\pi_t$  is the current inflation rate,

$\pi^*$  is the target inflation rate,

$(y_t - y_t^*)$  is the output gap

One of the main limitations of the traditional Taylor rule is its lack of sensitivity to financial imbalances. Asset markets, particularly housing and equities, have displayed a propensity to experience bubbles that are not captured by inflation or output deviations. During the lead-up to the 2008 crisis, rapidly rising asset prices were not adequately reflected in the policy rate prescribed by the Taylor rule, contributing to an environment of excessive credit growth and risk-taking. Financial cycles, unlike business cycles, tend to be protracted and can extend well beyond the typical duration of economic fluctuations. They capture the evolution of credit, leverage, and asset prices over long horizons. By not considering these dimensions, the traditional Taylor rule may inadvertently foster conditions conducive to systemic risk. Consequently, a modified rule that integrates a measure of asset price deviations from their long-term trend is imperative.

### 3.1.2. Modelling the financial cycle-augmented Taylor rule

To address these shortcomings, an augmented rule that incorporates a financial cycle variable could be proposed. An extended equation of Taylor rule can be expressed as:

$$i_t = r^* + \pi_t + \alpha (\pi_t - \pi^*) + \beta (y_t - y_t^*) + \theta (F_t - F^*)$$

$F_t$  is a financial cycle index which represents a measure of financial cycle conditions, such as deviations in asset prices (e.g., house or equity prices) from their long-term trend, and  $F^*$  is the neutral level of this indicator. The coefficient  $\theta$  captures the sensitivity of the policy rate to financial imbalances.

This formulation allows central banks to react not only to inflation and output gaps but also to signs of financial exuberance or distress. The inclusion of  $\theta(F_t - F^*)$  is designed to mitigate the risk of asset bubbles and promote macroprudential stability. When asset prices deviate substantially from their long-run equilibrium—either upwards or downwards—the augmented rule mandates a corresponding adjustment in the policy rate.

## 3.2. Regression analysis of the augmented Taylor rule

### 3.2.1. Data selection

The empirical analysis of the Financial Cycle-Augmented Taylor Rule requires robust datasets capturing macroeconomic indicators as well as financial market variables. To make the result effective significantly, the time range selected is a 30-year range from 1990 to 2019 which covers 2-3 business cycles as well as the financial crisis in 2008. For the US economy, key data series include:

Macroeconomic Indicators:

Inflation rates ( $\pi_t$ ): measured by Personal Consumption Expenditures Excluding Food and Energy quarter-over-quarter rate

Output Gap ( $y_t - y_t^*$ ): measured by real GDP minus real potential GDP

Interest rates ( $i_t$ ): measured by federal funds rate

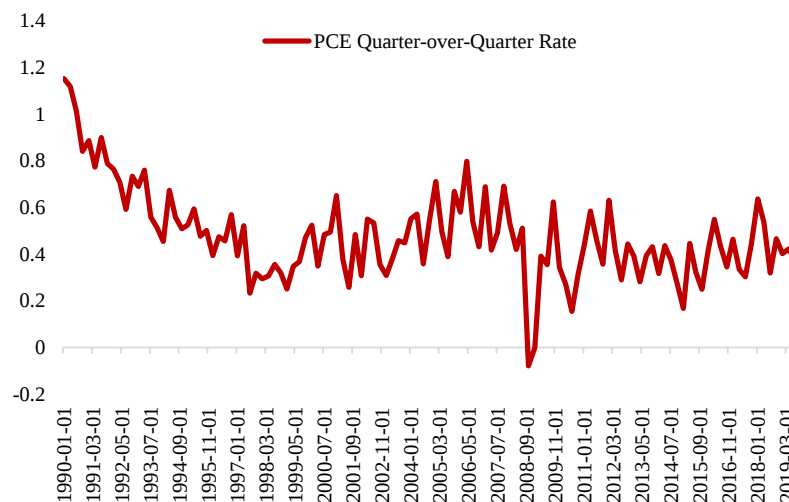
Financial Cycle Index ( $F_t$ ) Components:

Credit-to-GDP Gap: bank credit as a percentage of GDP

Housing price Cycle: measured by FHFA Housing Price Index

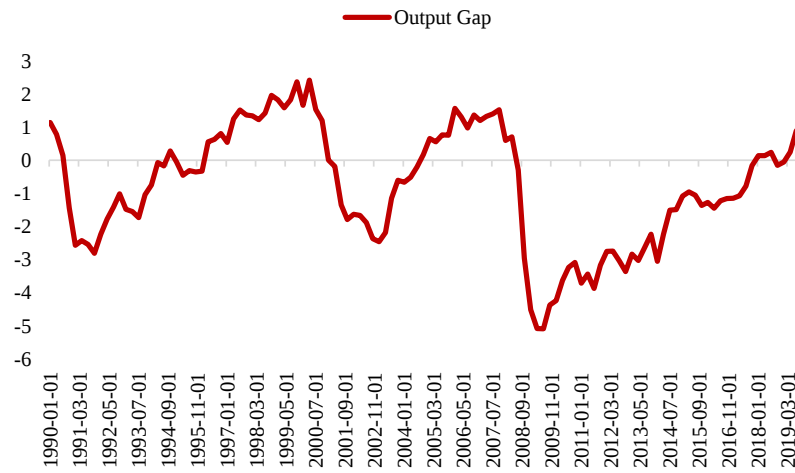
Stock market index: HP-filtered deviations of the S&P 500 index

Financial Stress Index: measured by Chicago fed national financial conditions index



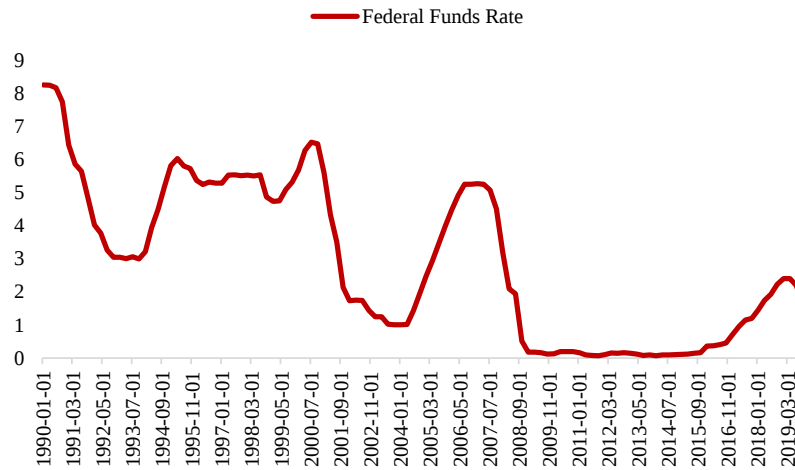
**Figure 1.** PCE quarter-over- quarter rate from 1990 to 2019

Source: Federal Reserve Economic Data



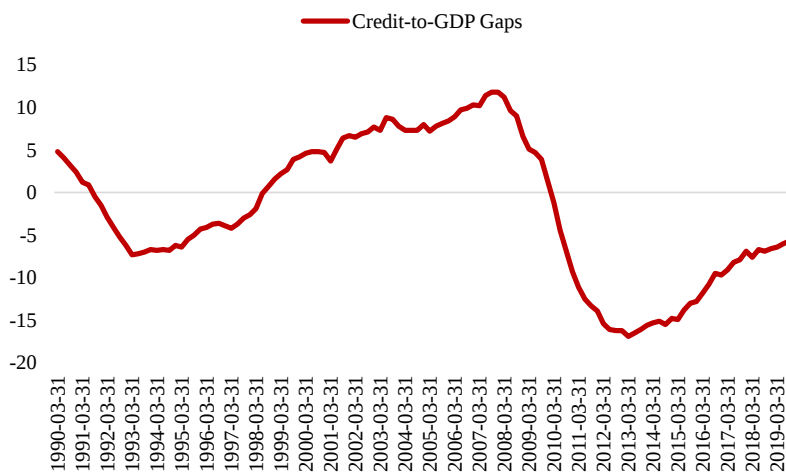
**Figure 2.** Output gap from 1990 to 2019

Source: Federal Reserve Economic Data



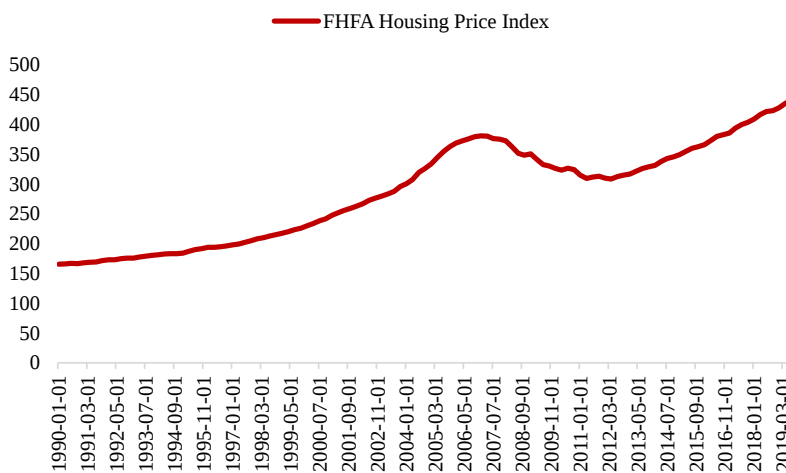
**Figure 3.** Federal funds rate from 1990 to 2019

Source: Federal Reserve Economic Data



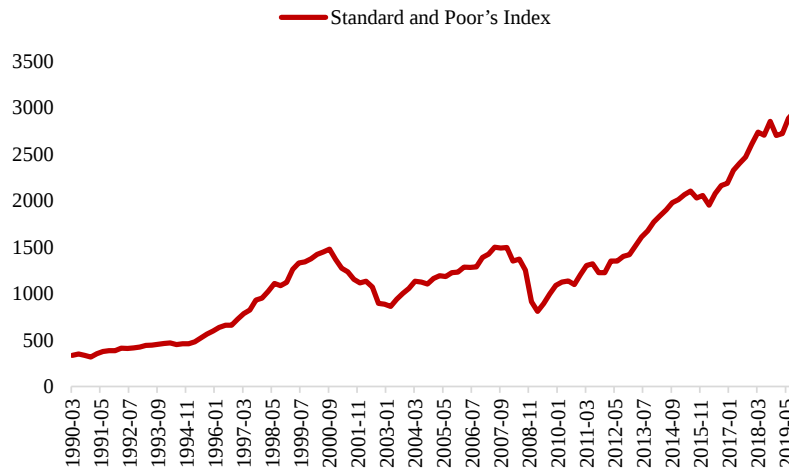
**Figure 4.** Credit-to-GDP gaps from 1990 to 2019

Source: Bank for International Settlements



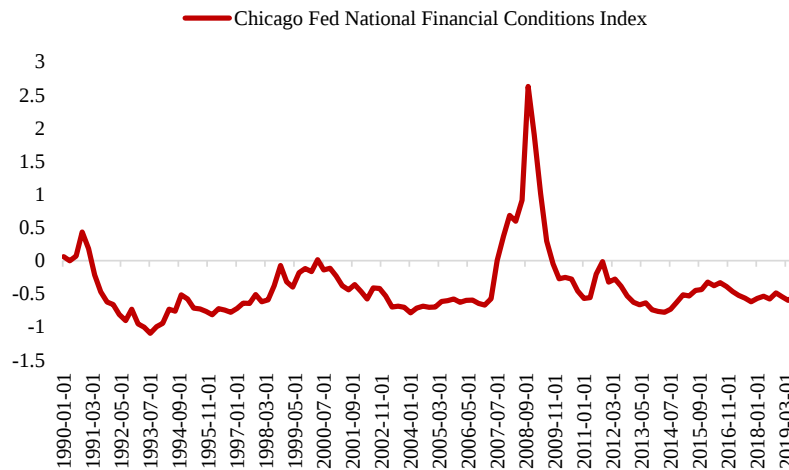
**Figure 5.** FHFA housing price index from 1990 to 2019

Source: Federal Reserve Economic Data



**Figure 6.** Standard and poor's index from 1990 to 2019

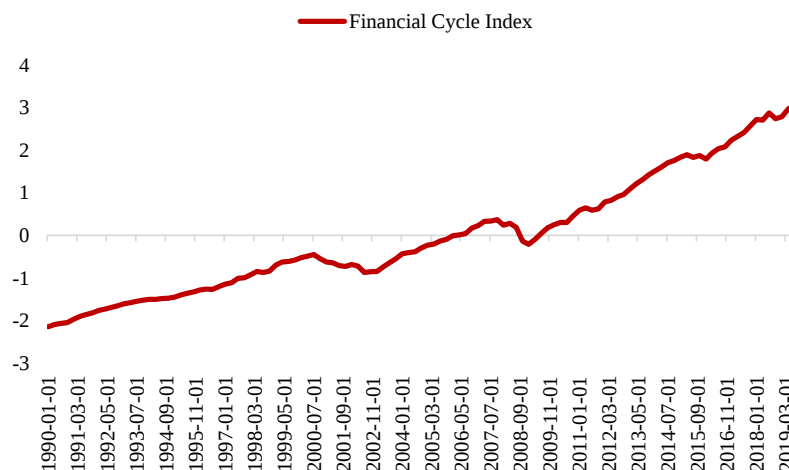
Source: Federal Reserve Economic Data



**Figure 7.** Chicago fed national financial conditions index from 1990 to 2019

Source: Federal Reserve Economic Data

In order to reduce the dimensional differences among various data, all component data are transformed into Z-scores. The Financial Cycle Index is constructed based on the Z score of component indicators, using Principal Component Analysis (PCA) which simplifies complex datasets by reducing their dimensions but retains variability as much as possible simultaneously [11].



**Figure 8.** Financial cycle index from 1990 to 2019

### 3.2.2. Modelling and regression

#### 3.2.2.1. Baseline Taylor rule estimation

$$i_t - r^* = \alpha (\pi_t - \pi^*) + \beta (y_t - y_t^*) + \epsilon_t$$

Where:

$i_t$  is federal funds rate

$r^*$  is equilibrium real interest rate (assumed to be 2%)

$\pi_t$  is inflation rate

$\pi^*$  is Inflation target (2%)

$(y_t - y_t^*)$  is output gap

To eliminate the potential effects of heteroscedasticity, the regression is based on heteroskedasticity-robust. The regression result table is as follows:

**Table 1.** Regression result of baseline Taylor rule

Linear regression							
	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
z_rate_gap							
z_inflation_gap	.414	.058	7.13	0	.299	.529	***
z_output_gap	.607	.058	10.45	0	.492	.722	***
Constant	0	.057	-0.00	1	-.113	.113	
Mean dependent var		-0.000			SD dependent var	1.000	
R-squared		0.613			Number of obs	120	
F-test		92.665			Prob > F	0.000	
Akaike crit. (AIC)		231.620			Bayesian crit. (BIC)	239.982	

\*\*\* p<.01, \*\* p<.05, \* p<.1

The coefficient between inflation gap and federal funds rate is 0.414 and coefficient between output gap and federal funds rate is 0.607 which represents the regression result roughly consistent with the traditional Taylor Rule which defines 0.5 respectively.



### 3.2.2.2. Financial cycle-augmented Taylor rule estimation

The augmented rule is modelled by including the financial cycle gap  $(F_t - F^*)$  :

$$i_t - r^* = \alpha (\pi_t - \pi^*) + \beta (y_t - y_t^*) + \theta (F_t - F^*) + \epsilon_t$$

Where:

$i_t$  is federal funds rate

$r^*$  is equilibrium real interest rate (assumed to be 2%)

$\pi_t$  is inflation rate

$\pi^*$  is Inflation target (2%)

$(y_t - y_t^*)$  is output gap

$F^*$  represents the neutral level of the financial cycle index, estimated by HP-filtered deviations

$(F_t - F^*)$  is financial cycle gap

The regression result table is as follows:

**Table 2.** Regression result of augmented Taylor rule

Linear regression							
	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
z_rate_gap							
z_inflation_gap	.188	.044	4.26	0	.101	.275	***
z_output_gap	.571	.04	14.38	0	.493	.65	***
z_f_gap	-.514	.044	-11.66	0	-.601	-.426	***
Constant	0	.039	-0.00	1	-.077	.077	
Mean dependent var		-0.000		SD dependent var	1.000		
R-squared		0.822		Number of obs	120		
F-test		178.418		Prob > F	0.000		
Akaike crit. (AIC)		140.504		Bayesian crit. (BIC)	151.654		

\*\*\* p<.01, \*\* p<.05, \* p<.1

The baseline regression (Table 1) shows that the Federal Reserve historically placed greater weight on output gaps ( $\beta=0.607$ ) than inflation gaps ( $\alpha=0.414$ ), consistent with the Taylor rule's dual mandate. However, in the augmented model (Table 2), the inclusion of the financial cycle gap ( $\theta=-0.514$ ) significantly alters policy responsiveness: a one-standard-deviation increase in financial stress corresponds to a 51.4 basis point reduction in the federal funds rate. This suggests that policymakers implicitly reacted to financial instability even before 2008, though such responses were not formalised in the traditional rule.

### 3.2.3. Robustness test

In order to further test the effectiveness of augmented rule, the whole time period can be divided into two sub-periods based on the time point of the financial crisis in 2008. The regression results of two sub-periods are as follows:

**Table 3.** Two sub-periods regression result of augmented Taylor rule

	(1)	(2)
VARIABLES	z_rate_gap	z_rate_gap
z_inflation_gap	0.187*** (0.0607)	0.0326 (0.0466)
z_output_gap	0.726*** (0.0733)	0.355*** (0.0522)
z_f_gap	-0.926*** (0.132)	-0.121* (0.0700)
Constant	-0.354*** (0.110)	-0.578*** (0.103)
Observations	72	48
R-squared	0.671	0.629

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The second column is the regression results before 2008 and the third column is the regression results of 2008 onwards. From the two-period regression results, it is observed that prior to 2008, the p-values of the inflation gap, output gap, and financial index gap were all below 0.05. This statistical significance indicates the robustness of the rule and reflects that the Federal Reserve's interest rate decisions responded to financial conditions. However, after 2008, due to the occurrence of the financial crisis, the p-value of the financial index gap exceeded 0.05, reaching 0.092. The decrease in statistical significance reflects that, after 2008, the Federal Reserve's interest rate decisions began to deviate from financial conditions. The diminished significance of the financial cycle variable post-2008 may reflect the constraints of the zero lower bound on conventional monetary policy [12]. With the nominal rates around zero, the Federal Reserve changed to use unconventional tools like quantitative easing which is not captured by the Taylor rule framework. It weakens the linkage between financial cycle indicators and rate decisions. For instance, quantitative easing stabilized markets through Treasury and Mortgage-Backed Securities purchases but failed to directly address cyclical deviations in housing or credit markets [13].

### 3.2.4. Policy simulation and welfare analysis

#### 3.2.4.1. Counterfactual simulation

Counterfactual data of the same time series can be simulated by augmented model with regressed coefficient:

$$i_t = r^* + \pi_t + 0.188 (\pi_t - \pi^*) + 0.571 (y_t - y_t^*) - 0.514 (F_t - F^*)$$

Where:

$i_t$  is federal funds rate

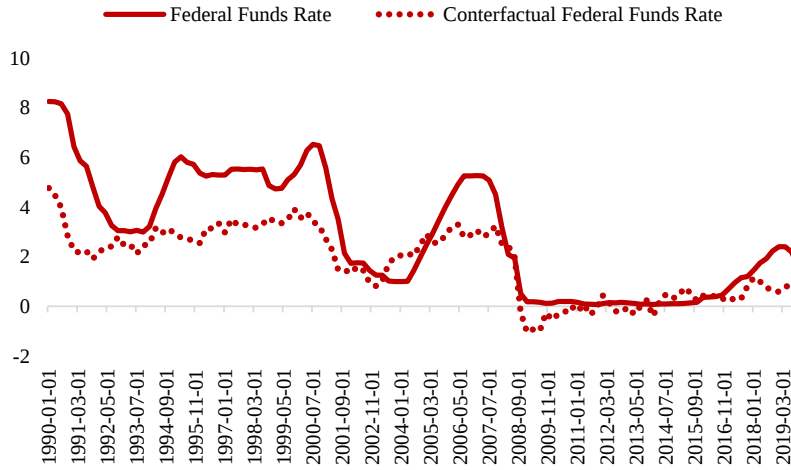
$r^*$  is equilibrium real interest rate (assumed to be 2%)

$\pi_t$  is inflation rate

$\pi^*$  is inflation target (2%)

$(y_t - y_t^*)$  is output gap

$(F_t - F^*)$  is financial cycle gap



**Figure 9.** Factual and counterfactual federal funds rate from 1990 to 2019

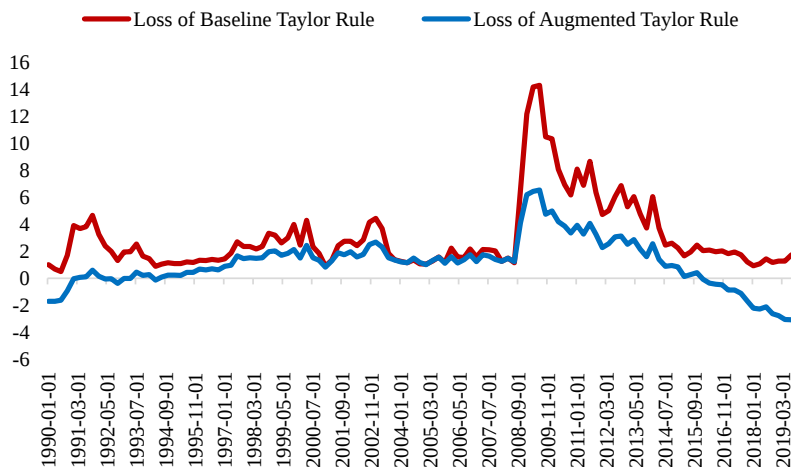
The counterfactual simulation indicates that following the augmented rule in early-2000s could raise interest rates by 0.5–1.2 percentage points before 2006, potentially curbing mortgage-driven credit expansion. By contrast, during the 2008 crisis, the rule could advocate deeper rate cuts, complementing the Fed's quantitative easing programs. These findings align with Borio and Disyatat [3], who argue that financial cycle-augmented frameworks improve crisis prevention.

#### 3.2.4.2. Welfare analysis

The loss function defined here extends the traditional Taylor rule framework by incorporating the financial cycle gap ( $F_t - F^*$ ) to reflect the importance of financial stability objectives. It can be expressed as:

$$L = \sum_{n=0}^t \left[ \lambda_{\pi} (\pi_t - \pi^*)^2 + \lambda_y (y_t - y_t^*)^2 + \lambda_F (F_t - F^*)^2 \right]$$

Where  $\lambda_{\pi}=0.188$ ,  $\lambda_y=0.571$ ,  $\lambda_F=-0.514$



**Figure 10.** Social loss of baseline Taylor rule and augmented Taylor rule from 1990 to 2019

Based on U.S. economic data from 1990 to 2019, the total social welfare loss under the Baseline Taylor rule was 365. This loss was reduced to 132.8 under the Augmented Taylor Rule, representing a 63.63% decrease (Figure 10). Additionally, the loss of Augmented Taylor Rule is lower than the loss of Baseline Taylor Rule most of the time, which is also displayed by the figure.

This result demonstrates that incorporating the financial cycle gap  $(F_t - F^*)$  significantly enhances the forward-looking capability of monetary policy.

## 4. Policy suggestions

### 4.1. Enhanced early warning mechanism

The empirical analysis reveals that deviations in the financial cycle index  $(F_t - F^*)$  significantly influence adjustments to the federal funds rate ( $\square = -0.514$ ,  $p < 0.01$ ). To translate this insight into practical framework, the Federal Reserve should establish a dynamic threshold trigger mechanism. It is suggested to automatically raise the policy rate by 50–75 basis points when the financial cycle index exceeds 1.5 standard deviations from its long-term trend such as the housing price deviation observed in 2005, as shown in Figure 9. Additionally, a tiered response strategy is also complemented: during a mild deviation case ( $|F_t - F^*| < 1\sigma$ ), it is suggested to fine-tune liquidity through open market operations, leveraging unconventional tools as proposed by Bernanke [13]. For a moderate deviation ( $1\sigma < |F_t - F^*| < 2\sigma$ ), warrant activating countercyclical capital buffers to bolster bank resilience would be sufficient [14]. A severe deviation ( $|F_t - F^*| \geq 2\sigma$ ) demands combining interest rate hikes with macroprudential tools (e.g., capping high-risk mortgage ratios) to avoid overburdening a single policy tool [10].

### 4.2. Coordinating interest rate rules with financial stability mandate

The regression results highlight the augmented rule's priority in balancing dual mandates. The baseline Taylor rule prioritises output gaps ( $\square = 0.607$ ) over inflation gaps ( $\square = 0.414$ ), while the incorporation of the financial cycle gap reduces the weight of inflation gap to 0.188. To optimise this synergy, policy makers are suggested to establish a dynamic recalibrating target weights during financial stress period. For instance, when the Chicago Fed's Financial Conditions Index (NFCI) exceeds 0.5, the weight on the financial cycle gap ( $\square$ ) could be increased from -0.514 to -0.7. It temporarily reduces the output gap weight to prioritise systemic risk issue [3]. Concurrently, abnormal yield curve flattening (e.g., 10Y-2Y spread  $< 0.5\%$ ) needs interventions like "Operation Twist" to curb maturity mismatch-driven credit bubbles, as advocated by Taylor [15].

### 4.3. Refining transparency of the financial cycle index

The construction and communication of the financial cycle index also needs to be refined. Although the PCA-derived index effectively aggregates variables like housing prices and credit-to-GDP gaps, its weighting lacks theoretical rigor. Adopting Borio and Lowe's [16] financial imbalance index methodology which dynamically assigns weights based on variables' predictive power for crises would enhance robustness. Additionally, quarterly Financial Stability Target Reports, modelled on the ECB's transparency practices, should detail index computations and policy rationales to mitigate market misinterpretation [17].

## 5. Conclusions

This study empirically validates the effectiveness of the financial cycle-augmented Taylor rule from three perspectives. Firstly, the augmented framework demonstrates outstanding crisis prevention—counterfactual simulations indicate that pre-emptive rate hikes of 0.5-1.2 percentage points in early 2000s could have eased the subprime bubble, while post-2008 rate cuts would have synergised with quantitative easing to stabilise markets (Figure 9). Secondly, welfare gains are substantial, minimizing the extended loss function  $L = \sum_{n=0}^t [\lambda_\pi (\pi_t - \pi^*)^2 + \lambda_y (y_t - y_t^*)^2 + \lambda_F (F_t - F^*)^2]$  reduces total social losses by 63.63%, driven largely by the financial cycle term's ( $\lambda_F = -0.514$ ) capacity to dampen tail risks (Figure 10). Thirdly, operational challenges persist, particularly under zero lower bound constraints. During 2008–2019, the augmented rule's effectiveness weakened ( $\theta = -0.121$ ,  $p = 0.092$ ), needing innovations like "shadow rates" or direct targeting of financial condition indices [18].

Future studies are supposed to address two issues. Firstly, high-frequency financial stress indices based on alternative data—such as real-time credit card spending or the volatility of real estate investment trusts—can enhance policy responsiveness [19]. Secondly, international coordination through institutions like the Bank for International Settlements is crucial for aligning financial cycle monitoring and preventing destabilizing "beggar-thy-neighbor" policies [20]. By bridging these gaps, an enhanced Taylor rule could evolve into a globally resilient framework that balances price stability and financial stability in an increasingly interconnected economy.

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