

Banks and the State-Dependent Effects of Monetary Policy

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Introduction

October 2022 - Fed rate 3.08%

US banks gain from Fed rate hikes while keeping deposit interest low

Wall St is charging more for loans but setting aside money for a possible downturn



JPMorgan reported record net interest income — the difference in what it pays on deposits and earns from loans and other assets.
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JPMorgan reported record net interest income — the difference in what it pays on deposits and earns from loans and other assets. © Getty Images

April 2024 - Fed rate at 5.33%

Net interest income may have peaked for Wall Street banks

The flipside to higher rates is people want more for their savings, too



During the first quarter, Wells paid a rate of 2.34% on its interest-bearing deposits, nearly twice what it paid a year ago © Getty Images

▶ More

This Paper

- This paper documents a novel source of state dependency in the response of economic activity to a monetary policy shock.
- A monetary policy shock has a **larger** impact on aggregate economic activity after a period of **low** interest rates than after a period of **high** interest rates.
 - ▶ Relevant variables: real GDP, consumption, investment, and the stock market.
- We document two channels by which the financial system induces state dependency in the monetary transmission mechanism.
 - ▶ Banks' net interest margins.
 - ▶ Macro aggregates.

Net interest margins (NIM)

- Response of banks' NIM to a monetary policy shock is **state-dependent**.
 - ▶ After a period of **low** Fed Funds rates, a contractionary monetary policy shock leads to a **rise** in NIM.
 - ▶ After a period of **high** Fed Funds rates, a contractionary monetary policy shock leads to a **fall** in NIM.
- This finding challenges conventional wisdom that NIMs are roughly unaffected by changes in the policy rates.
- Primary focus of this paper: understand state-dependent response of NIM to policy rate changes and the implications for the monetary transmission mechanism.

Related literature

- Role of banks in monetary policy transmission
 - ▶ Curdia and Woodford (2010), Driscoll and Judson (2013), Gertler and Karadi (2015), Piazzesi, Rogers, and Schneider (2019), and Bianchi and Bigio (2022), Buchak, Matvos, Piskorski, and Seru (2024).

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- Marginal propensity to consume out of liquid wealth and its implications for monetary policy
 - ▶ Johnson, Parker, and Souleles (2006), Parker, Souleles, Johnson, and McClelland (2013), Jappelli and Pistaferri (2014), Kaplan and Violante (2014), Debortoli and Gali (2017), Kueng (2018), Auclert, Rognlie, and Straub (2024), Ganong et al. (2020), Fagereng, Holm, and Natvik (2021).

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- Importance of social dynamics in changing people's expectations
 - ▶ Kelly and Grada (2000), Carroll (2003), Iyer and Puri (2012), Burnside, Eichenbaum, and Rebelo (2016).

Outline

- **Empirical analysis**

- ▶ Local projection framework
- ▶ Results (GDP, Stock market, NIM, Core NIM)

- **Simple competitive banking model**

- ▶ Equilibrium deposit interest rates
- ▶ Social dynamics
- ▶ Study of NIM Implications

- **TANK model**

- ▶ Key elements
- ▶ Implications for macro-aggregates

Empirical analysis

- Use detailed data from the **Consolidated Reports of Condition and Income** (Call Reports) obtained from the FDIC.
 - ▶ Reports are filed quarterly by all national banks, state-member banks, insured state-nonmember banks, and savings associations.

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- core NIM = average **loan** interest income rate minus average **deposit** interest expense rate.

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- Compute **two measures of NIM**:
- core NIM = average **loan** interest income rate minus average **deposit** interest expense rate.
- overall NIM = average interest income rate on **all assets** minus average interest expense rate on **all liabilities**.
- Quarterly data from 1985:1 to 2019:4.

Monetary policy shocks

- **Measure 1:** Bauer and Swanson (2022) shock measure

- ▶ Movements in one, two, three, and four-month ahead Eurodollar futures contracts (ED1–ED4) in a 30-minute window around FOMC announcements.
- ▶ Orthogonalize shock wrt contemporaneous, four lags of real GDP, PCE prices, investment, and consumption, four lags of excess bond premium (part of credit spread not explainable by expected default risk), and yield curve slope.

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- **Measure 2:** Recursive shock measure

- ▶ Residual from a regression of the Fed Funds rate on contemporaneous and four lags of lagged real GDP, the PCE price index, four lags of the excess bond premium, and yield curve slope.

Estimation

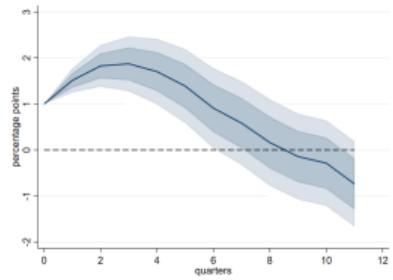
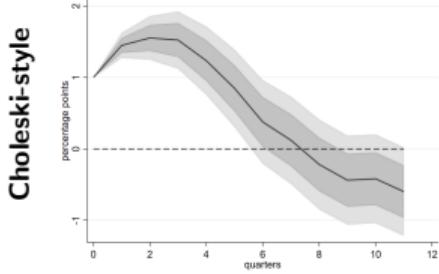
- Local projection equation

$$Y_{t+h} = \alpha_h + \beta_{0,h} MP_t + \beta_{1,h} \mathbb{I}_{\{MA(R) > \bar{R}\}} + \beta_{2,h} MP_t \times \mathbb{I}_{\{MA(R) > \bar{R}\}} \\ + A_h(L) Y_t + B_h(L) MP_t + C_h(L) Z_t + \varepsilon_{t+h} \quad h = 1, \dots, H.$$

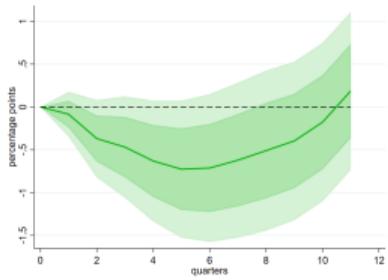
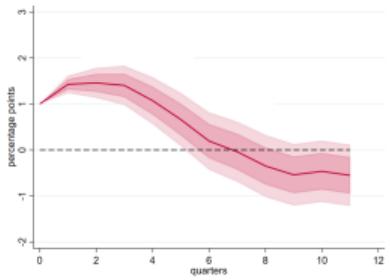
- MP_t : time t value of monetary policy shock.
- $\mathbb{I}_{\{MA(R) > \bar{R}\}}$: indicator variable that's one when average level of FF rate across last six quarters is higher than $\bar{R} = 4\%$ and zero otherwise.
- $A_h(L) Y_t$ and $B_h(L) MP_t$: values of Y_{t-j} and MP_{t-j} , $j = 1, 2, 3, 4$, $C_h(L) Z_t$: contemporaneous, 4 lags of real GDP, PCE prices, investment and consumption, 4 lags of excess bond premium, yield curve slope.

Results: FF

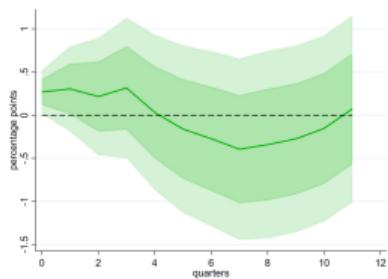
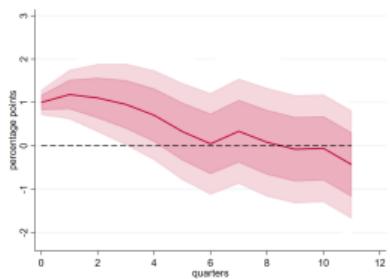
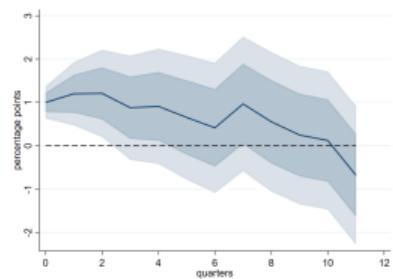
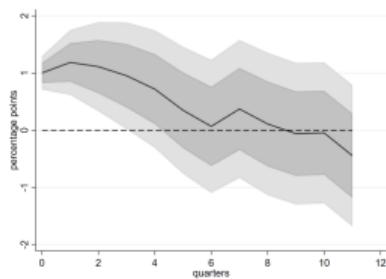
No State Dependence



Allowing for State Dependence



Bauer & Swanson (2023)



Baseline Response

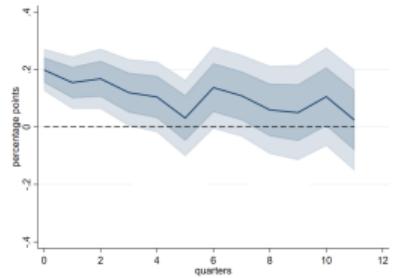
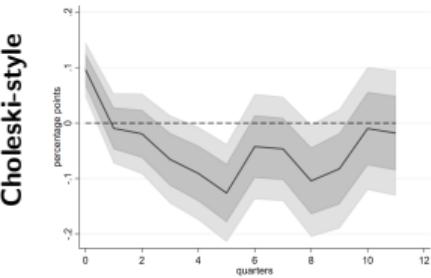
Response in low rate state

Response in high rate state

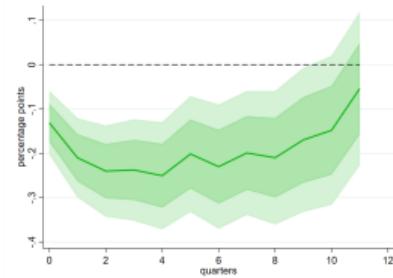
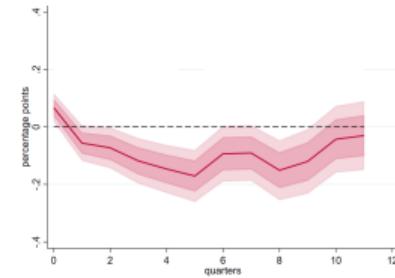
Difference Low vs High

Results: Core NIM

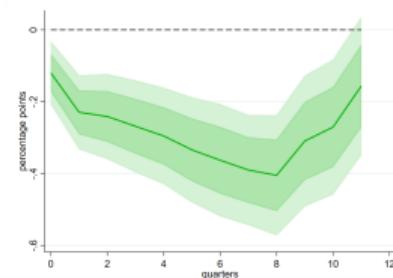
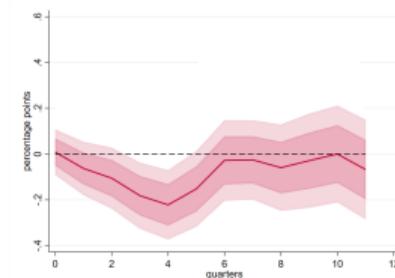
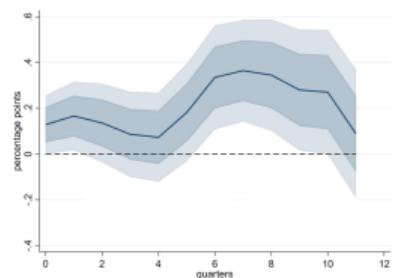
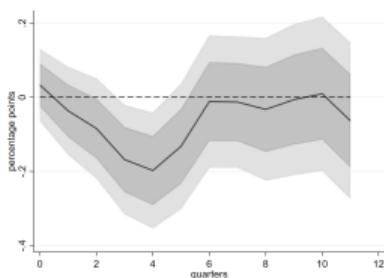
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Bauer & Swanson (2023)



Baseline Response

Response in low rate state

Response in high rate state

Difference Low vs High

Core NIM

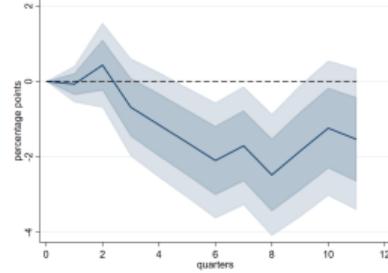
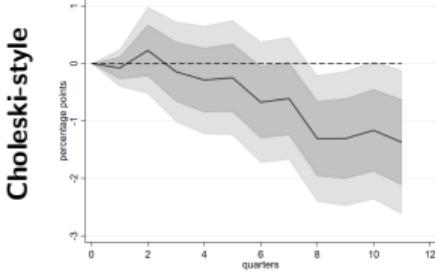
- For both shock measures, Core NIM
 - ▶ Rises when shock occurs in low state.
 - ▶ Falls when shock occurs in high state.
- Peak rise is 20 to 35 basis points, depending on shock measure.
- Peak decline is roughly 17 to 21 basis points, depending on shock measure.
- Difference between response rates is negative and statistically significant.

Decomposing movements in core NIM

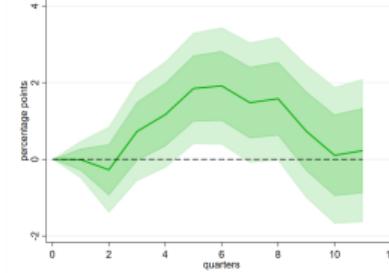
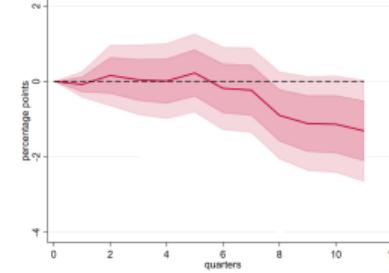
- **Intensive margin:** changes in interest rates on savings and time deposits.
- **Extensive margin:** changes in ratio of time deposits to saving deposits.
- Extensive margin plays a larger role than intensive margin.
 - ▶ a contractionary monetary policy shock induces a switch from savings deposits to time deposits.
- Less evidence of state dependence in extensive margin than intensive margin.
 - ▶ But movements in **extensive margin exacerbates impact of state dependence in intensive margin.**

Results: GDP

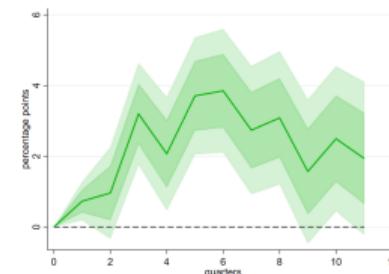
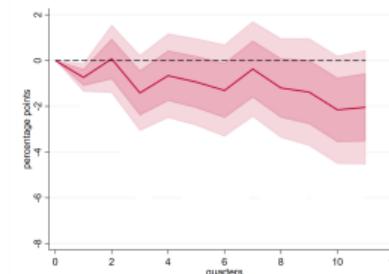
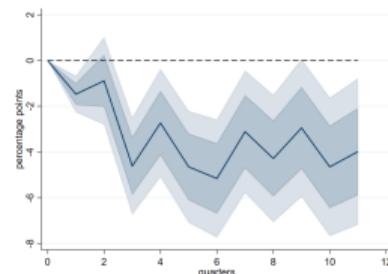
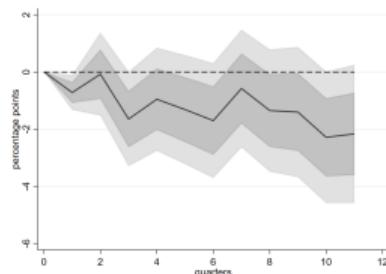
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Allowing for State Dependence



Bauer & Swanson (2023)



Baseline Response

Response in low rate state

Response in high rate state

Difference Low vs High

► Robustness: 1985-2007

► 1985-2023

► Business Cycles

► Ups and Downs

Real GDP

- A contractionary monetary policy shock induces a persistent decrease in real GDP for two to three years.
- Strong evidence of **state dependence** in response of real GDP.
- Decline in real GDP is larger when shock occurs in low interest rate state.
 - ▶ Difference in response is statistically significant for both shock measures.
- More results: consumption, investment, and inflation. Stock Market Index. 

Back-of-the-envelope calculation: NIM

- Cumulative effect of a 100 basis point monetary policy shock in low interest rate state over three years is an increase in NIM-related bank profits of roughly \$92 billion.
- If shock occurs in a high interest rate state, the impact on NIM-related profits is a decrease of \$98 billion.
- Counterparts of banks save \$190 billion in net interest paid if shock occurs in the high state rather than the low state.
 - ▶ MPC out of liquid wealth is high, somewhere between 0.20 and around 0.40 (see Carroll et al., 2017, Ganong et al., 2023).
 - ▶ So there's a differential swing in aggregate demand between \$60 billion.

A partial equilibrium model of banking

- Key features
 - ▶ Some households are **attentive**, others are **inattentive to the interest rate that they earn on bank deposits**.
 - ▶ **Banks observe household type.**
 - ▶ **Matching framework** where competitive banks invest resources to attract attentive and inattentive households.
- Initially shut down social dynamics to get intuition about mechanisms in the model.
- Then study social dynamics that govern changes in the fraction of attentive and inattentive households.

A simple competitive banking model

- Two types of hh's: attentive and inattentive to interest rates offered by banks on deposits.

$$a_t + i_t = 1.$$

- Each household has one dollar of deposits.
- A continuum of banks with measure one.
- Every period, a fraction δ of dollar deposits leave their bank due to exogenous factors.
 - ▶ So, there's δa_t and δi_t dollars belonging to attentive and inattentive customers seeking a new bank at time t .
- Banks can identify who is attentive and inattentive and can invest resources to attract both types of depositors.

A simple competitive banking model

- Banks invest $\tau_j v_j$ dollars to attract type j deposits, $j = a, i$.
 - ▶ It is more costly to attract inattentive depositors than attentive ones, i.e., $\tau_i > \tau_a$.
 - ▶ Reason: inattentive depositors are less likely to notice bank offers.
- Matches between banks and deposits of attentive and inattentive households form according to

$$m_{at} = \mu (\delta a_t)^\varsigma v_{at}^{1-\varsigma}$$

$$m_{it} = \mu (\delta i_t)^\varsigma v_{it}^{1-\varsigma}$$

where $\mu > 0$, and $\varsigma \in (0, 1)$.

- In equilibrium, all deposits find a match:

$$\delta a_t = \mu (\delta a_t)^\varsigma v_{at}^{1-\varsigma}$$

$$\delta i_t = \mu (\delta i_t)^\varsigma v_{it}^{1-\varsigma}$$

Loan rates

- Monetary authority sets policy rate, R_t , which coincides with the inter-bank borrowing and lending rate.
- Banks extend loans to firms to meet their working capital needs.
- Marginal cost of lending one dollar is constant and equal to ε^l .
- Since banks are perfectly competitive, the equilibrium lending rate, R_t^l , is

$$R_t^l = R_t + \varepsilon^l$$

Value of deposits

- Deposit markets are perfectly competitive.
- R_{at} and R_{it} : time t gross interest on deposits owned by attentive and inattentive customers
- Value to bank of dollar deposit from attentive household,

$$V_{a,t} = R_t - R_{at} + \frac{1 - \delta}{R_t} V_{a,t+1},$$

- Value to a bank of a dollar deposit from an inattentive household is,

$$V_{i,t} = R_t - R_{it} + \frac{1 - \delta}{R_t} V_{i,t+1}.$$

- Continuation values $V_{j,t+1}$, are discounted at rate R_t and multiplied by $(1 - \delta)$ to account for fraction δ of depositors that leave bank.

Zero profits

- In equilibrium, cost of attracting a dollar belonging to an attentive or inattentive depositor equals probability of obtaining that dollar of deposit multiplied by its value to the bank,

$$\tau_a = \frac{\mu (\delta a_t)^\varsigma v_{at}^{1-\varsigma}}{v_{at}} V_{a,t},$$

$$\tau_i = \frac{\mu (\delta i_t)^\varsigma v_{it}^{1-\varsigma}}{v_{it}} V_{i,t}.$$

Suppose interest rates are constant

- Value of a dollar of deposits belonging to attentive and inattentive households is given by,

$$V_a = \frac{R}{R - 1 + \delta} (R - R_a),$$

$$V_i = \frac{R}{R - 1 + \delta} (R - R_i).$$

- Using equilibrium conditions for τ_a and τ_i , we obtain spreads:

$$R - R_a = \frac{\tau_a}{\mu^{1/(1-\varsigma)}} \left(1 - \frac{1 - \delta}{R}\right)$$

$$R - R_i = \frac{\tau_i}{\mu^{1/(1-\varsigma)}} \left(1 - \frac{1 - \delta}{R}\right)$$

Interest rate spreads

- Spreads increase with R

$$\frac{d(R - R_j)}{dR} = \frac{\tau_j}{\mu^{1/(1-\varsigma)}}(1 - \delta)R^{-2}.$$

- ▶ Future profits are discounted by R .
- ▶ When R rises, **the present value (PV) of future profits** from a deposit **decreases**.
- ▶ Zero profits in equilibrium imply that current spreads must increase to compensate for this discounting effect (the PV effect).

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- ▶ Future profits are discounted by R .
- ▶ When R rises, the present value (PV) of future profits from a deposit decreases.
- ▶ Zero profits in equilibrium imply that current spreads must increase to compensate for this discounting effect (the PV effect).
- Spreads increase more when interest rates are low than when interest rates are high.
 - ▶ Consider an annuity that pays y in every period. The PV of the annuity is y/R .
 - ▶ The change in PV when R rises is $-R^{-2}y$, which is smaller when R is high.
- Since $\tau_i > \tau_a$, when R rises, the spread earned by banks on inattentive deposits increases more than the spread on attentive deposits.

Bank's NIM

$$nim_t = R_t + \varepsilon^I - (a_t R_{at} + i_t R_{it})$$

- Using the expressions for interest rate spreads in steady state,

$$nim = \varepsilon^I + \frac{\tau_i - a(\tau_i - \tau_a)}{\mu^{1/(1-\varsigma)}} \left(1 - \frac{1-\delta}{R}\right).$$

- nim_t* decreases with fraction of attentive hh's in the economy.
 - Interest rate spread earned by banks is lower for attentive hh's.
 - Banks still break even in present value terms because attentive depositors are easier to attract.
- Higher interest rates increase *nim*.
 - Reflects PV effect: current spreads rise to offset a higher discount rate on future bank profits.

Modeling attention

- A conventional way to model attention is to assume that the cost of paying attention is heterogeneous across depositors or assume rational inattention.
- However, these approach don't generate state dependence.
 - ▶ A 50 basis point change yields the same benefit, whether starting from a low or high interest rate environment, resulting in similar depositor reactions in both cases.
- For this reason, we introduce social dynamics that change the number of attentive and inattentive people over time.

► Google Trends

Social dynamics

- Laws of motion for number of attentive and inattentive hh's:

$$i_{t+1} = i_t(1 - \kappa_i) - \omega(R_t)a_t i_t(1 - \kappa_i) + \kappa_a a_t$$

$$a_{t+1} = a_t(1 - \kappa_a) + \omega(R_t)a_t i_t(1 - \kappa_i) + \kappa_i i_t$$

- Beginning of period there's $a_t i_t$ pairwise meetings between attentive and inattentive households.
 - ▶ Some inattentive households become attentive by learning about interest rate offers through conversations with attentive households.
 - ▶ Conversion rate, $\omega(R_t)$, is increasing function of annualized quarterly net interest rate.

$$\omega(R_t) = \chi (4R_t - 4)^2.$$

- ▶ A low (high) level of attentive depositors when interest rates have been low (high) for an extended period.

Social dynamics

Equations governing attentive (a_t) and inattentive (i_t) households:

$$i_{t+1} = i_t(1 - \kappa_i) - \omega(R_t)a_t i_t(1 - \kappa_i) + \kappa_a a_t,$$
$$a_{t+1} = a_t(1 - \kappa_a) + \omega(R_t)a_t i_t(1 - \kappa_i) + \kappa_i i_t.$$

- A fraction κ_a of initially attentive households becomes inattentive.
- A fraction κ_i of remaining inattentive households becomes attentive after social interaction.
- Conversions
 - ▶ Inattentive \rightarrow Attentive: $\omega(R_t)a_t i_t(1 - \kappa_i) + i_t \kappa_i$.
 - ▶ Attentive \rightarrow Inattentive: $\kappa_a a_t$.

Banking with social dynamics

- Value of a dollar deposit from an attentive household is

$$V_{a,t} = R_t - R_{at} + \frac{1-\delta}{R_t} [\kappa_a V_{i,t+1} + (1-\kappa_a) V_{a,t+1}] .$$

- Continuation value takes into account the possibility that attentive hh may become inattentive (κ_a).

- Value of a dollar deposit from an inattentive consumer is given by

$$V_{i,t} = R_t - R_{it} + \frac{1-\delta}{R_t} ([\omega(R_t)a_t + \kappa_i] V_{a,t+1} + \{1 - [\omega(R_t)a_t + \kappa_i]\} V_{i,t+1})$$

- Takes into account the probability that inattentive household becomes a less-valuable-attentive household ($\omega(R_t)a_t + \kappa_i$).

Spreads with social dynamics

- Interest rate spread for attentive depositors is:

$$R_t - R_{at} = \frac{\tau_a}{\mu^{1/(1-\varsigma)}} - \frac{1-\delta}{R_t} \left(\kappa_a \frac{\tau_i - \tau_a}{\mu^{1/(1-\varsigma)}} + \frac{\tau_a}{\mu^{1/(1-\varsigma)}} \right).$$

- Spread is lower than in model without social dynamics.
- With probability κ_a , attentive depositors become more-valuable inattentive in the future.
- Zero profit condition \Rightarrow current spread on attentive depositors must decline.

Banking with social dynamics

- The interest rate spread for inattentive depositors is:

$$R_t - R_{it} = \frac{\tau_i}{\mu^{1/(1-\varsigma)}} - \frac{1-\delta}{R_t} \left\{ \frac{\tau_i}{\mu^{1/(1-\varsigma)}} - [\omega(R_t)a_t(1-\kappa_i) + \kappa_i] \frac{\tau_i - \tau_a}{\mu^{1/(1-\varsigma)}} \right\}.$$

- Spread is higher than in the model without social dynamics:
 - ▶ With probability, $\omega(R_t)a_t(1-\kappa_i) + \kappa_i$, inattentive depositors become attentive in the future, so current spreads must be higher to compensate for the decline in expected future profitability.
- This effect is stronger with higher interest rates, which induce a rise in $\omega(R_t)$.

NIM with social dynamics

$$nim_t = \varepsilon' + \frac{a_t \tau_a + (1 - a_t) \tau_i}{\mu^{1/(1-\varsigma)}} \left(1 - \frac{1 - \delta}{R_t} \right) + \frac{1 - \delta}{R_t} \frac{\tau_i - \tau_a}{\mu^{1/(1-\varsigma)}} (a_{t+1} - a_t).$$

- The first two terms represent the value of nim_t in an economy without social interactions.
- The third term represents the impact of social interactions on nim_t .
 - ▶ An increase in the number of attentive depositors, $a_{t+1} - a_t$, increases nim_t because the equilibrium spread on inattentive depositors rises to compensate for the higher probability that inattentive depositors will become attentive.

Interest rate effects on NIM

- Marginal impact of R_t on nim_t evaluated at steady state ($a_{t+1} = a_t$)

$$\frac{dnim_t}{dR_t} = \frac{a_t \tau_a + (1 - a_t) \tau_i}{\mu^{1/(1-\varsigma)}} (1 - \delta) R_t^{-2} + \frac{1 - \delta}{R_t} \frac{\tau_i - \tau_a}{\mu^{1/(1-\varsigma)}} \frac{da_{t+1}}{dR_t}.$$

- First effect is positive; present in model with no social dynamics
 - ▶ A rise in R_t reduces PV of future profits.
 - ▶ Zero profits \Rightarrow current interest rate spreads must rise to offset this impact.
- Second effect is also positive
 - ▶ A higher R raises $\omega(R_t)$, increasing the rate at which inattentive households become attentive due to social interaction.
 - ▶ This reduces future profits from inattentive households.
 - ▶ Therefore, the current spread on inattentive consumers must rise to compensate for this effect.

Social dynamics effects on NIM

$$\frac{dnim_t}{da_t} = -\frac{\tau_i - \tau_a}{\mu^{1/(1-\varsigma)}} \left(1 - \frac{1-\delta}{R_t}\right) + \frac{1-\delta}{R_t} \frac{\tau_i - \tau_a}{\mu^{1/(1-\varsigma)}} [\omega(R_t)(1-2a_t)(1-\kappa_i) - (\kappa_i + \kappa_a)].$$

- The first effect is negative
 - ▶ An increase in a_t lowers the average interest rate spread because the spread on deposits of attentive households is smaller than the spread on deposits from inattentive households.
 - ▶ This effect is stronger when the interest rate is high because current profits are more important than future profits.
- The second effect can be positive or negative
 - ▶ It is positive when $a_t < 0.5$ and R_t is high, as many inattentive households will become attentive.
 - ▶ It is negative when $a_t > 0.5$ and R_t because there are few inattentive households who will become attentive.

Social dynamics

- Social interactions related to R_t

$$\omega(R_t)a_t(1 - a_t)(1 - \kappa_i)$$

- Strength of interactions related to R_t are high when R_t is high and $a_t = 0.5$.
- When a_t is low, social interactions aren't very powerful because there aren't many attentive households that can interact with inattentive households.
- When a_t is high, social interactions aren't very powerful there aren't many inattentive households that can be converted into attentive households.

Key sources of state dependence

- Interest rate effects
 - ▶ When R_t rises, nim_t must rise because of the present value effect.
 - ▶ This effect is stronger when interest rates are low.
- Social dynamics effects: a_t rises
 - ▶ nim_t falls because attentive depositors are less profitable than inattentive ones.
 - ▶ This effect is stronger when interest rates are high.

Estimating the partial equilibrium model

- Partition parameters into two sets
 - Chosen a priori.
 - Estimated with Bayesian methods.

Table: Parameter set a priori

Parameter	Parameter value	Description
ϵ_I	0.005	Cost per dollar of making loans
R_L	1.015	Gross annual interest rate, low interest rate state
R_H	1.056	Gross annual interest rate, high interest rate state
T_q	200	Frequency of social interactions in a quarter of time

Estimation

- In the equilibrium equations, τ_a , τ_i , μ and ς only appear in form of the ratios $\tau_a/\mu^{\frac{1}{1-\varsigma}}$, $\tau_i/\mu^{\frac{1}{1-\varsigma}}$.
- Estimate the following parameters:

$$\chi, \kappa_a, \kappa_i, \delta, \tau_a/\mu^{\frac{1}{1-\varsigma}}, \tau_i/\mu^{\frac{1}{1-\varsigma}}$$

- Logic of the Bayesian estimation procedure is conceptually the same as in Christiano, Trabandt, and Walentin (2010)
 - ▶ Vector $\hat{\psi}$: point estimates (first 12 quarters) of impulse responses of NIM in high and low interest rate state, based on the Choleski decomposition.
 - ▶ θ_0 : true values of the model parameters,
 - ▶ $\psi(\theta)$: mapping from θ to point estimates of impulse responses of NIM in high, low interest rate states.
 - ▶ Our analysis treats $\hat{\psi}$ as observed data.

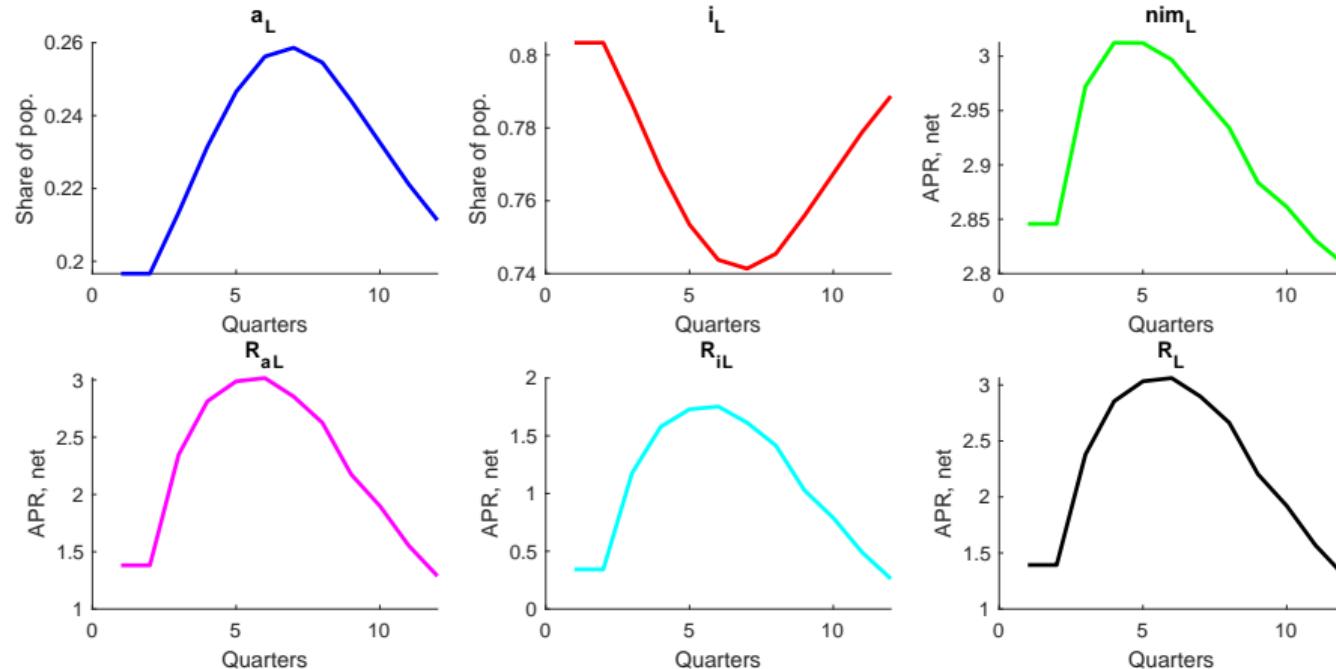
Estimation

Table: Priors and Posteriors of Parameters.

Parameter	Prior Distribution	Posterior Distribution
	D, Mean, [2.5-97.5%]	Mode, [2.5-97.5%]
Social dynamics interaction parameter, χ	G, 2.0, [0.242 5.572]	1.4561, [1.081 4.852]
Rate at which attentive become inattentive, κ_a	U, 0.5, [0.025 0.975]	0.0026, [0.002 0.011]
Rate at which inattentive become attentive, κ_i	U, 0.5, [0.025 0.975]	0.0002, [0.000 0.007]
Fraction of depositors who leave banks, δ	U, 0.5, [0.025 0.975]	0.0134, [0.008 0.020]
Cost of attracting attentive depositors, $\tau_a/\mu^{\frac{1}{1-\varsigma}}$	U, 50 , [2.5 97.5]	0.0177, [0.018 0.053]
Cost of attracting inattentive depositors, $\tau_i/\mu^{\frac{1}{1-\varsigma}}$	U, 50 , [2.5 97.5]	0.1210, [0.074 0.154]

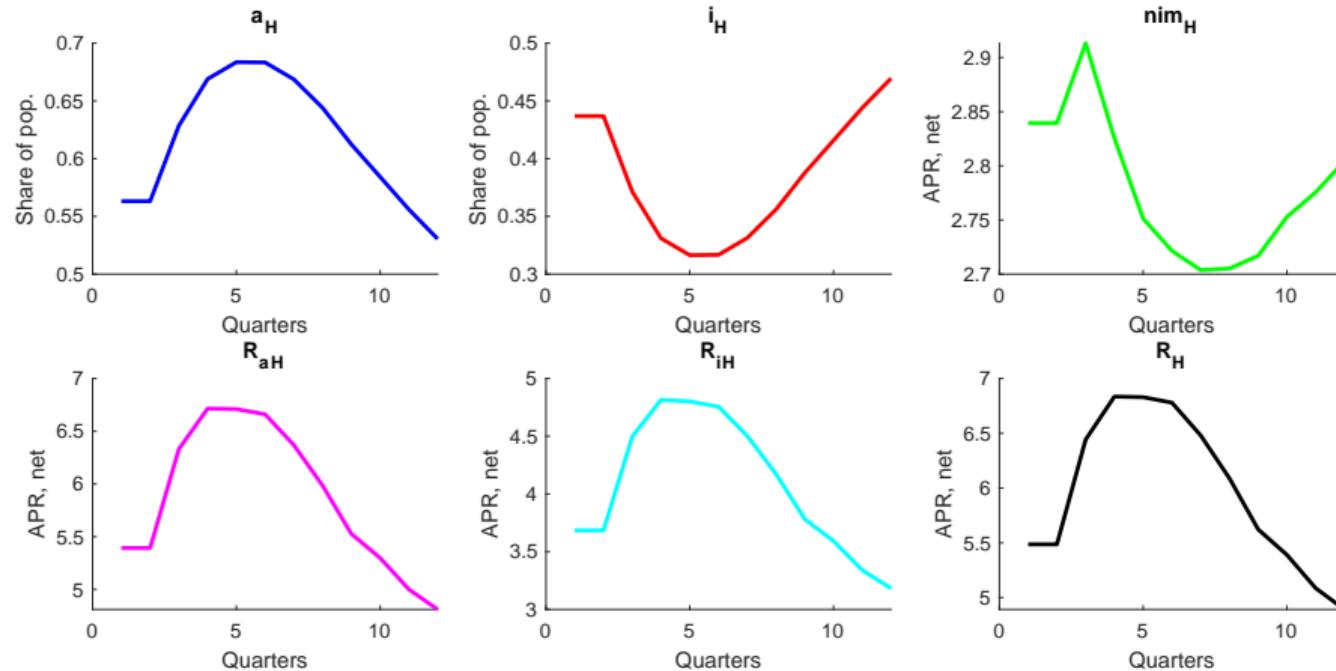
Estimation

Figure: Dynamic response to monetary policy shock in low-interest-rate state.



Estimation

Figure: Dynamic response to monetary policy shock in high-interest-rate state.

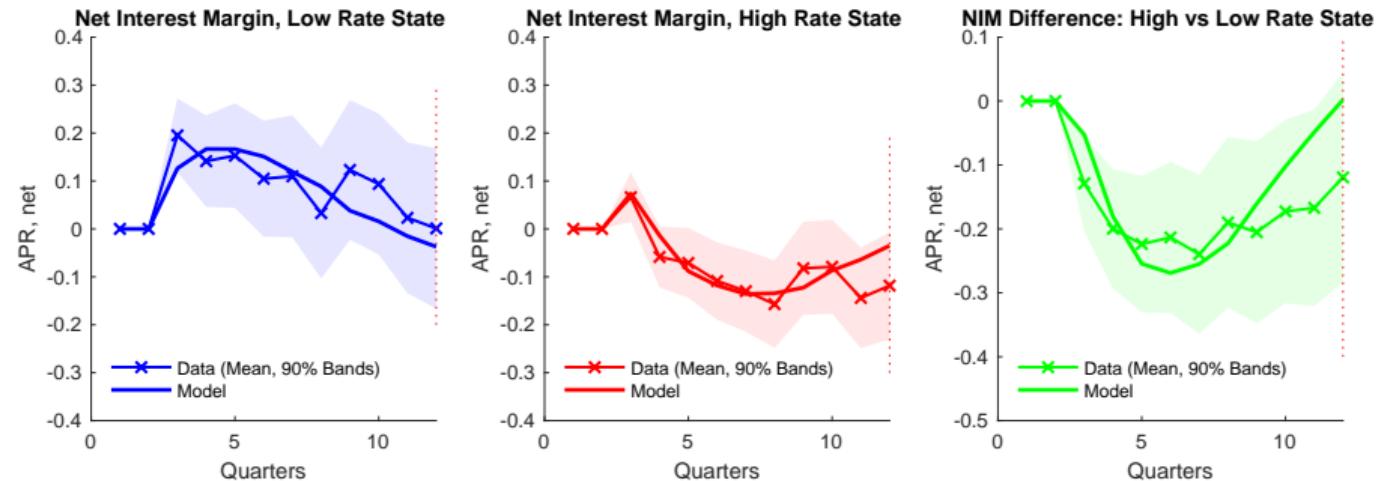


Intuition

- Low interest rate steady state
 - ▶ The number of attentive households is low and social dynamics are not very important.
 - ▶ When interest rates rise, the present value effect dominates and nim_t has to rise.
- High interest rate steady state
 - ▶ The present value effect is weaker.
 - ▶ The number of attentive households is high (around 0.5, so social dynamics are very powerful) so a_t rises and nim_t falls.

Model and data responses

Figure: Dynamic response to monetary policy shock in high and low interest rate states.



Model and data responses without social dynamics ($\chi = 0$)

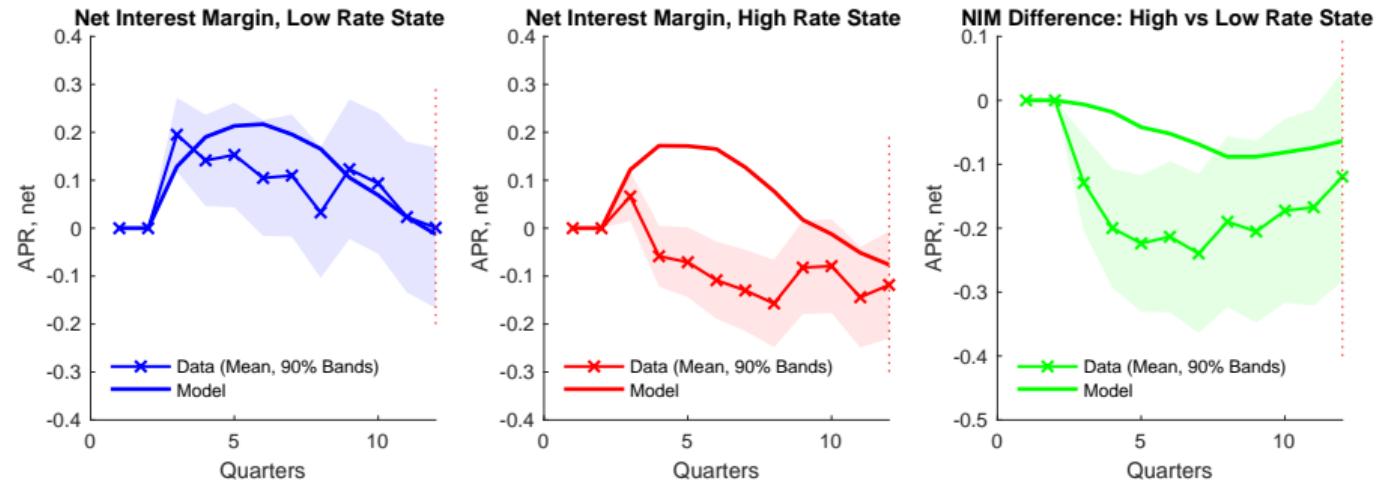


Figure: Dynamic response to monetary policy shock in high and low interest rate states.

- Key Take-Away: Attentive/Inattentive dynamics rationalizes the state-dependence in NIM responses to monetary policy.

Model and data responses without social dynamics ($\chi = 0$)

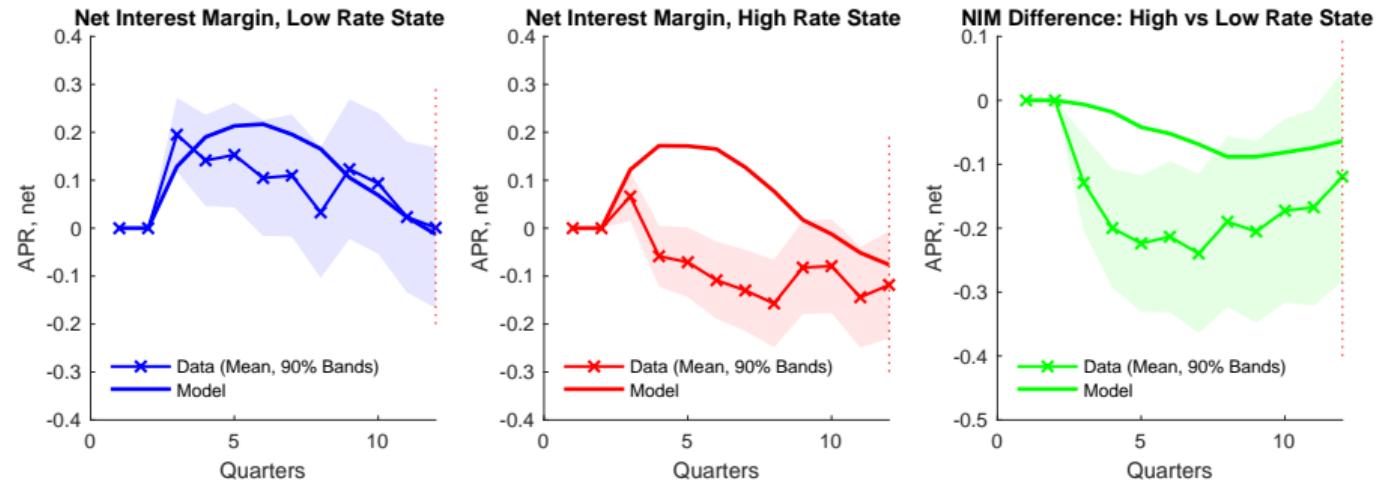


Figure: Dynamic response to monetary policy shock in high and low interest rate states.

- Key Take-Away: Attentive/Inattentive dynamics rationalizes the state-dependence in NIM responses to monetary policy.
- What about GDP and the other real aggregates?

TANK model

- Two types of households
 - ▶ Hand-to-mouth and optimizing agents in fixed fractions
 - ▶ Hand-to-mouth agents can be attentive or inattentive while optimizing agents are always attentive.
 - ▶ Optimizing agents have habit formation.

TANK model

- Two types of households
 - ▶ Hand-to-mouth and optimizing agents in fixed fractions
 - ▶ Hand-to-mouth agents can be attentive or inattentive while optimizing agents are always attentive.
 - ▶ Optimizing agents have habit formation.
- Production sector of the economy as in Christiano, Eichenbaum, and Evans (2005)
 - ▶ Sticky prices
 - ▶ Sticky wages
 - ▶ Investment adjustment costs.
 - ▶ Variable capital utilization
- Retailers must borrow nominal wage and capital services bills from banks at the beginning of the period and repay loans at the end of period t after receiving revenues.

State dependent effects of monetary policy in GE

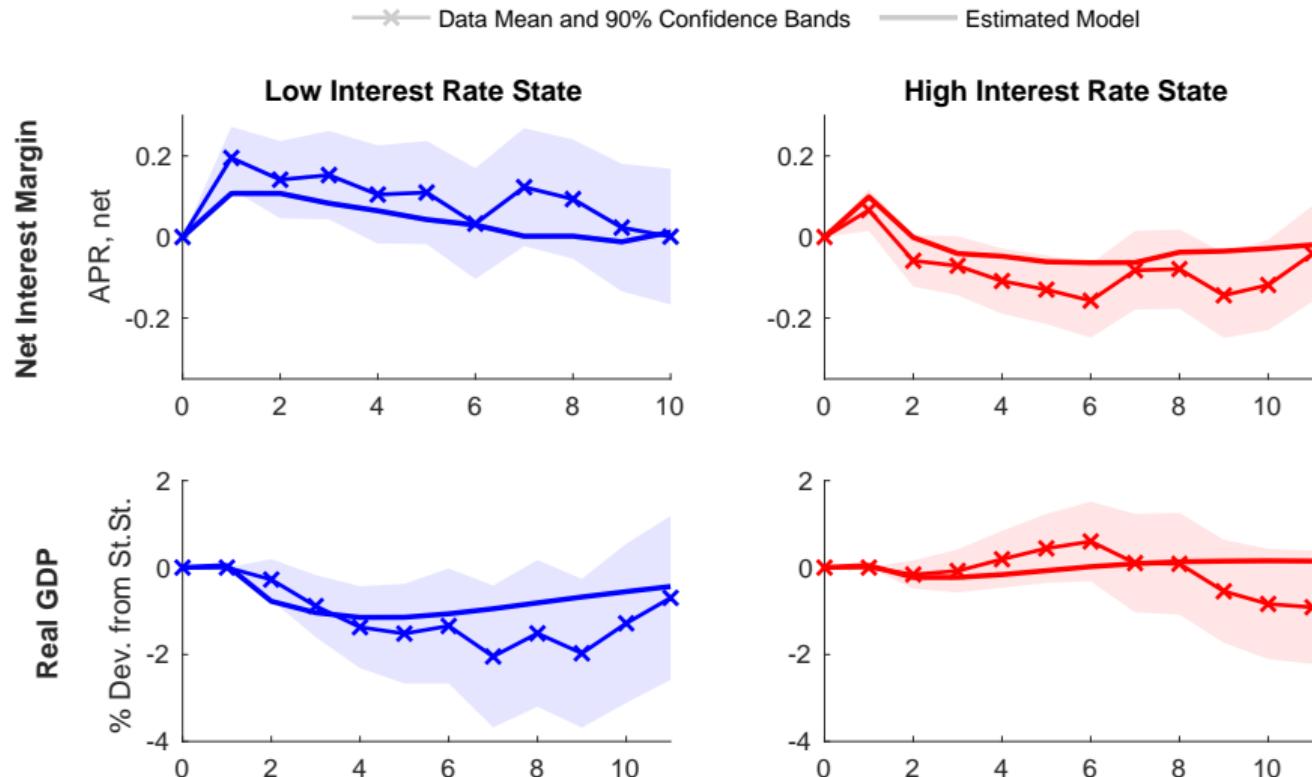
- Construct our “high state” by setting the annualized inflation target to 4%.
- Construct our “low state” by setting the annualized inflation target to 0%.
- Calibrate the steady-state value of the annualized real rate $r^* = 1.5\%$, with $\beta = 0.9963$.

State dependent effects of monetary policy in GE

- Construct our “high state” by setting the annualized inflation target to 4%.
- Construct our “low state” by setting the annualized inflation target to 0%.
- Calibrate the steady-state value of the annualized real rate $r^* = 1.5\%$, with $\beta = 0.9963$.
- The steady-state nominal rate is 5.5% for the “high state” and 1.5% for the “low state.”
 - ▶ These values align with empirical averages of the federal funds rate in high and low-rate subsamples.
- Then, feed a sequence of MIT shocks into the Taylor rule so that R_t in the high and low scenarios matches those estimated using the Choleski monetary policy shock.

▶ Calibration

State-dependent effects of monetary policy in GE



Conclusion

- Impact of monetary policy shocks on economy varies depending on whether they occur after a period of low or high interest rates.
- This state dependence is evident in banking sector profitability measures and key macroeconomic variables (GDP, consumption, and investment).
- Empirical findings can be reconciled in a GE TANK model featuring competitive banks with three key characteristics.
 - ▶ Banks optimize their rate-setting policies accounting for attentive and inattentive customers.
 - ▶ Attentive vs inattentive customers change as a function of the level of interest rates.
 - ▶ State dependence affects broader economy due to households with MPC to consume out of liquid wealth.

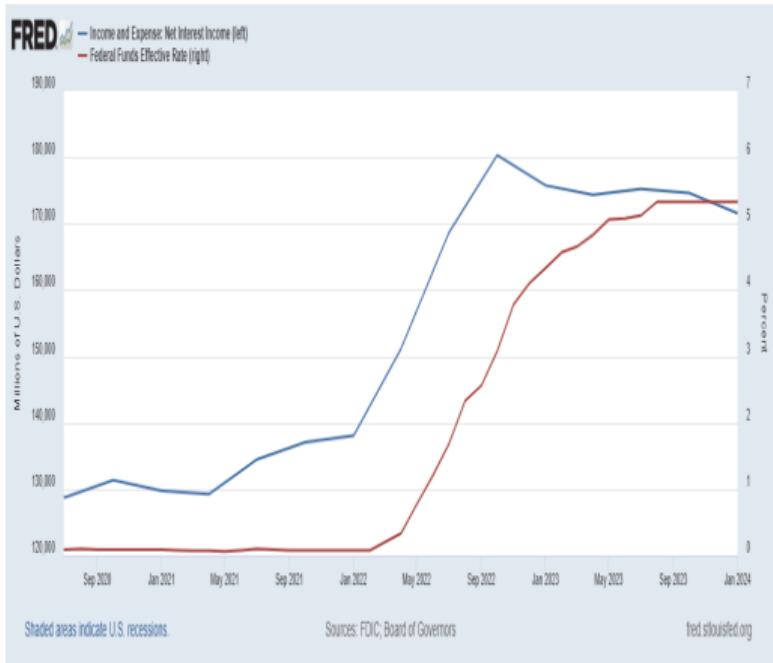
Appendix

APPENDIX

References

Introduction

Federal Funds Rate and Banks' NIMs



July 2024 - Fed rate at 5.33%

US banks get Main Street blues as savers balk at low rates

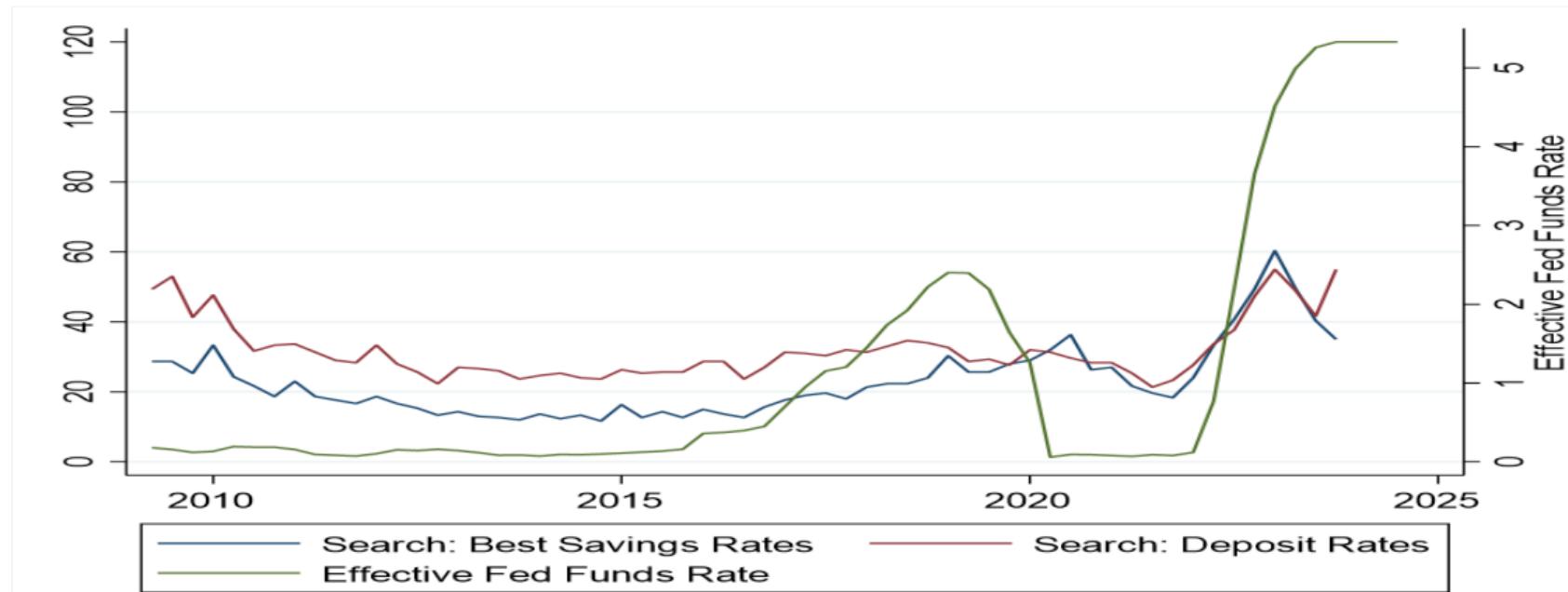
The longer the Fed keeps rates on hold, the more incentive Americans have to move their money to higher-yield products



The four biggest US banks delivered a record high last year of more than \$253bn in combined net interest income — but it is a feat that is unlikely to be repeated © FT montage/Bloomberg/AP/Reuters

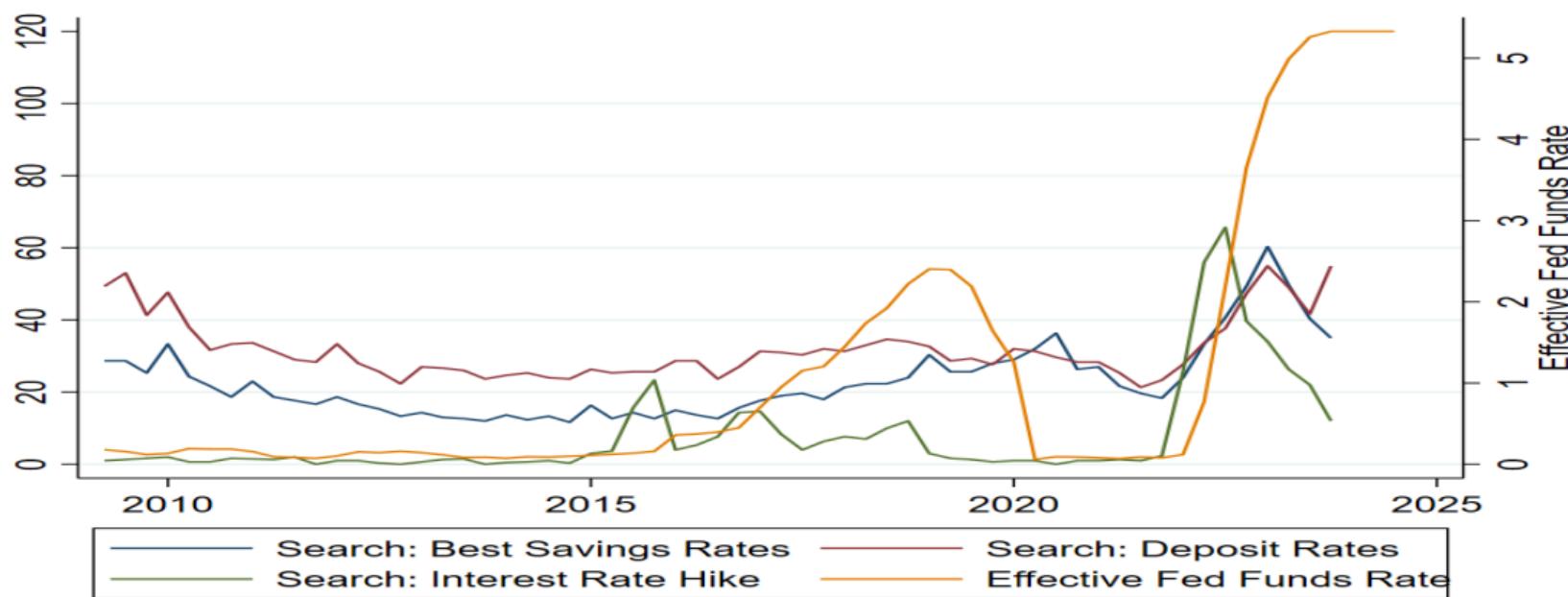
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Google Trends: Searching Saving Products



▶ back

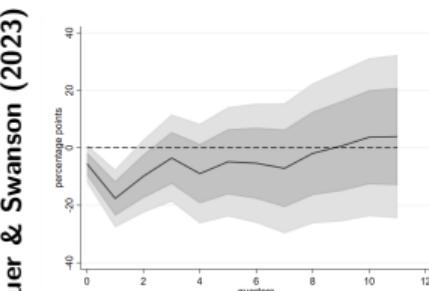
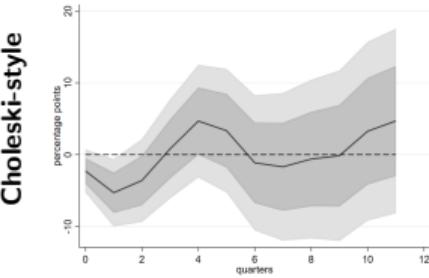
Google Trends: Searching Saving Products vs searching for Monetary Policy Stance



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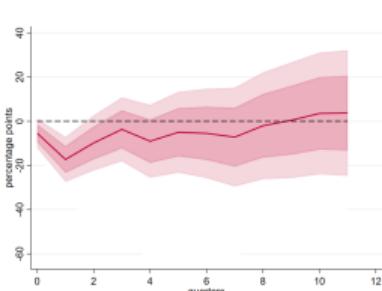
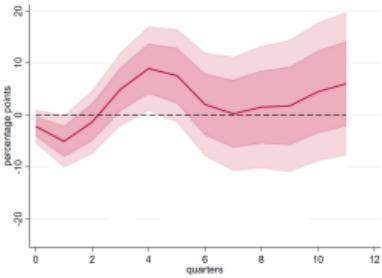
Real S&P500

No State Dependence

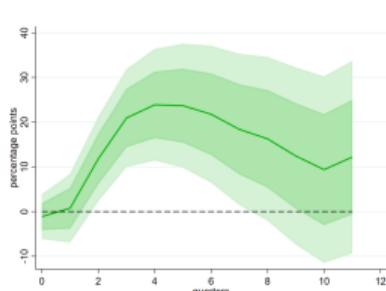
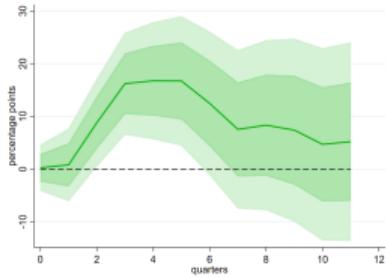


Baseline Response

Allowing for State Dependence



Response in low rate state



Difference Low vs High

Back-of-the-envelope calculation: stock market

- After 12 quarters, S&P is down by roughly 10% after a **100 basis points** contractionary monetary policy shock which occurs in the **low** interest rate state.
 - At the end of 2019, the market capitalization of the S&P was roughly \$28 trillion.
 - So the fall implies a fall in wealth of roughly **\$2.8 trillion**.
- After 12 quarters, the S&P is down by roughly 4% after **100 basis points** contractionary monetary policy shock which occurs in the **high** interest rate state.
 - So the fall implies a fall in wealth of roughly **\$1.2 trillion**.

▶ back

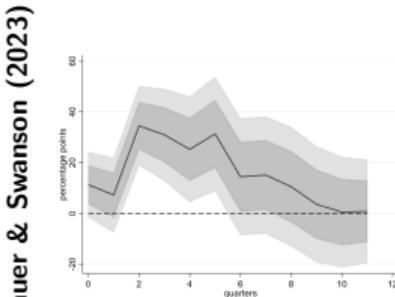
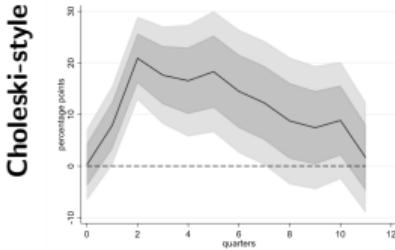
Back-of-the-envelope calculation: stock market

- Difference in the fall in stock market wealth induced by a policy shock in the low interest versus the high interest state is **\$1.6 trillion**.
- Di Maggio, Kermani and Majlesi (2020) and Chodorow-Reich, Nenov and Simsek (2021) estimate the MPC out of stock market wealth is roughly **3%**.
- This estimate implies a differential fall in demand of **\$48 billion**.

▶ back

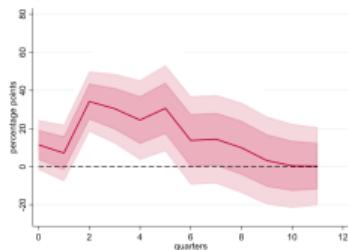
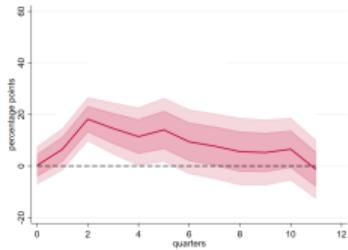
Extensive Margin

No State Dependence

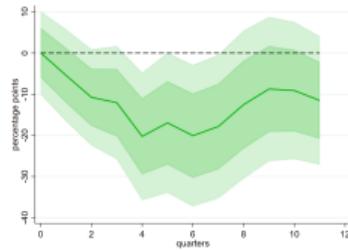


Baseline Response

Allowing for State Dependence



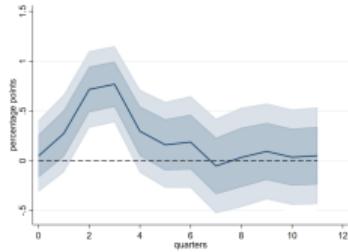
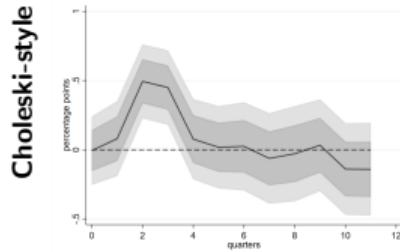
Response in low rate state



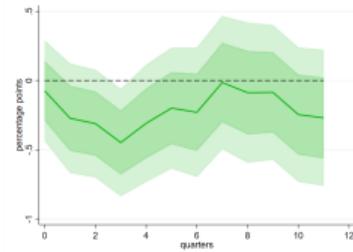
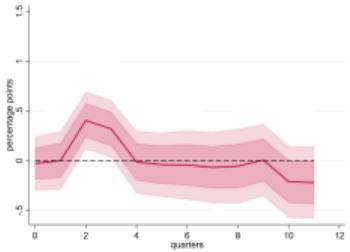
Difference Low vs High

Intensive Margin

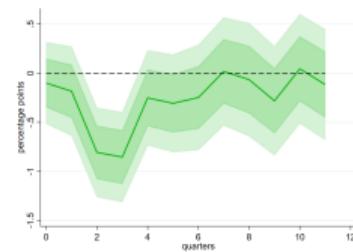
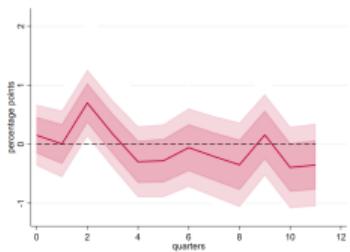
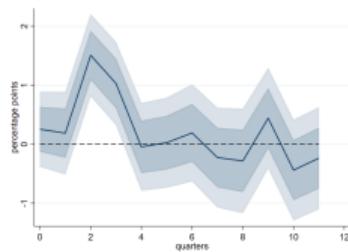
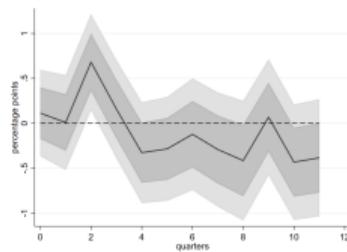
No State Dependence



Allowing for State Dependence



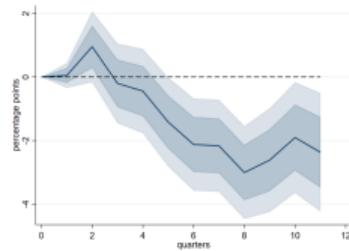
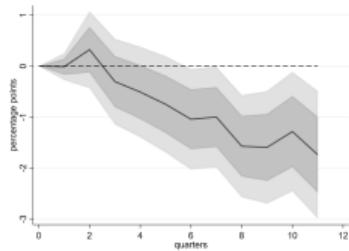
Bauer & Swanson (2023)



Consumption

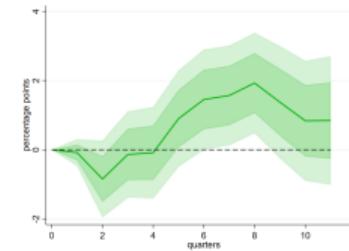
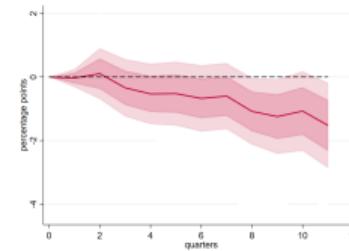
No State Dependence

Choleski-style



Allowing for State Dependence

Bauer & Swanson (2023)



Baseline Response

Response in low rate state

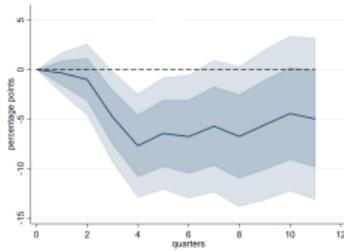
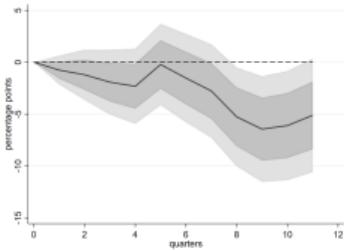
Response in high rate state

Difference Low vs High

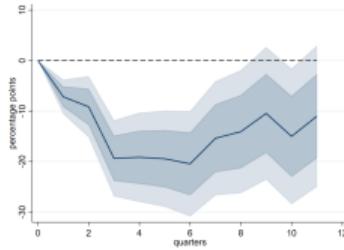
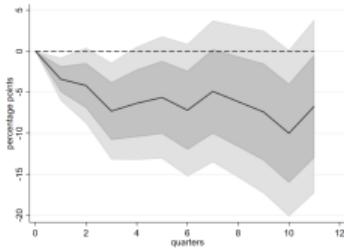
Investments

No State Dependence

Choleski-style

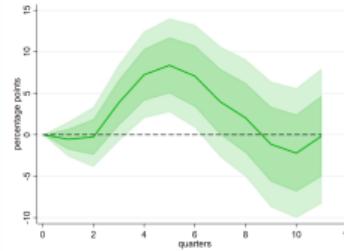
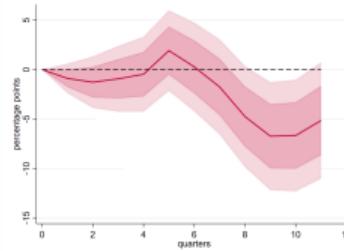


Bauer & Swanson (2023)

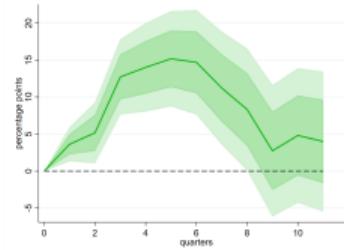
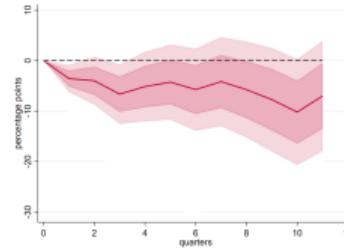


Allowing for State Dependence

Choleski-style



Bauer & Swanson (2023)



Baseline Response

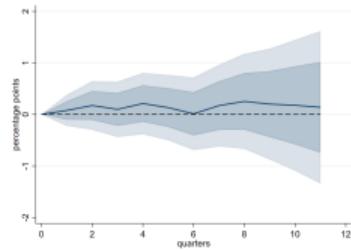
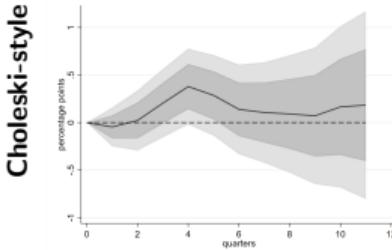
Response in low rate state

Response in high rate state

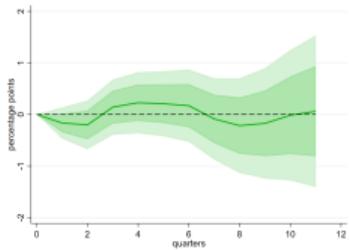
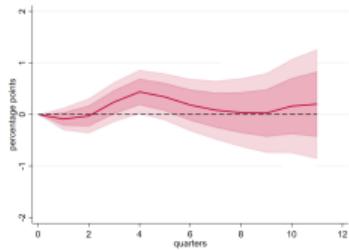
Difference Low vs High

Inflation

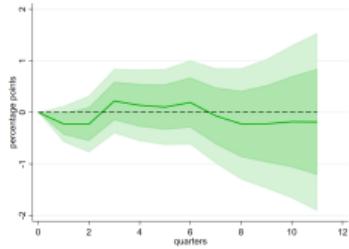
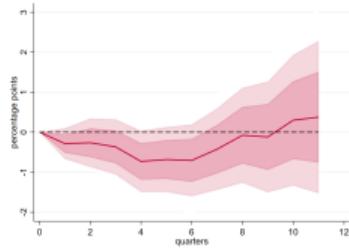
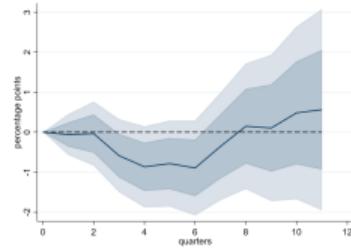
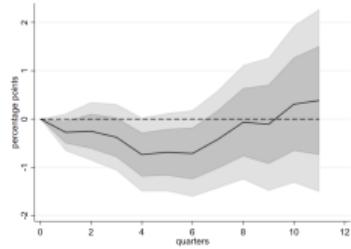
No State Dependence



Allowing for State Dependence

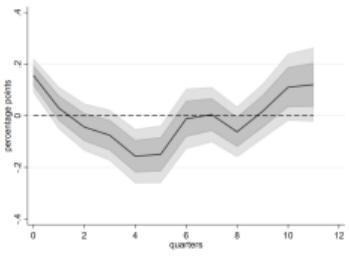


Bauer & Swanson (2023)

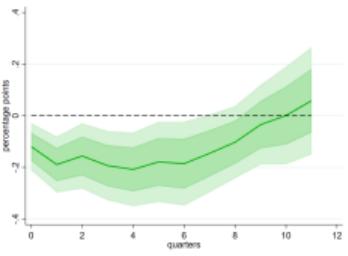
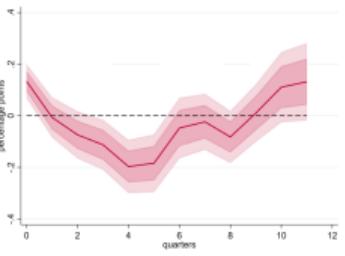
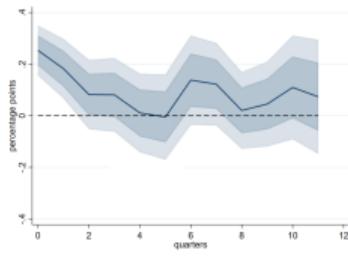


Core NIM Robustness: Sample 1985-2007

No State Dependence

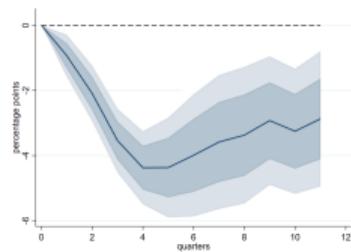
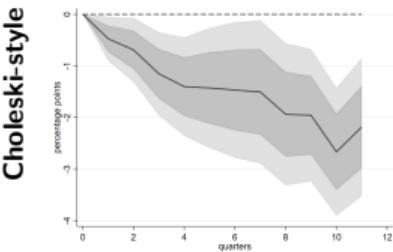


Allowing for State Dependence

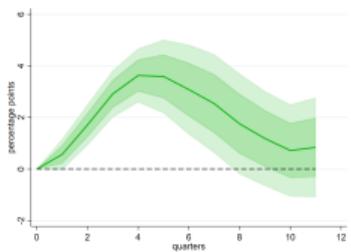
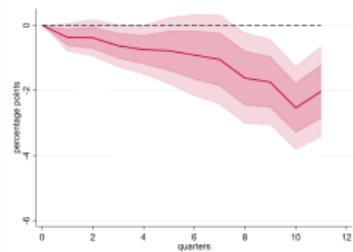


Real GDP Robustness: Sample 1985-2007

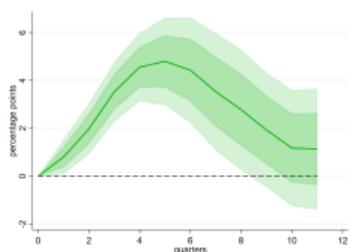
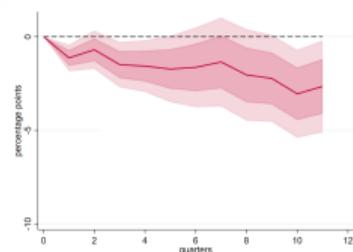
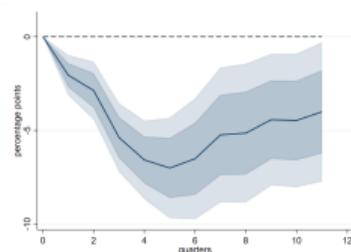
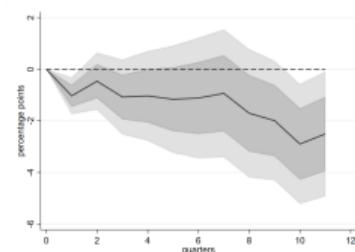
No State Dependence



Allowing for State Dependence



Bauer & Swanson (2023)



Baseline Response

Response in low rate state

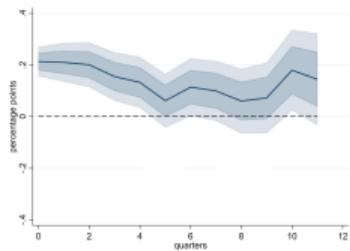
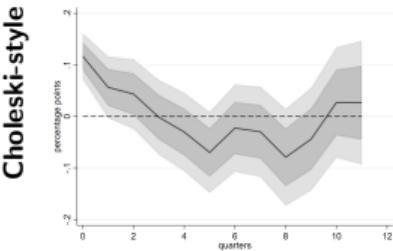
Response in high rate state

Difference Low vs High

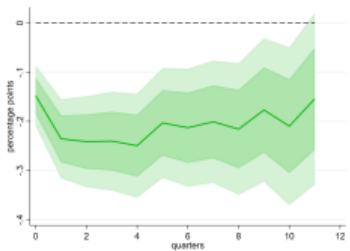
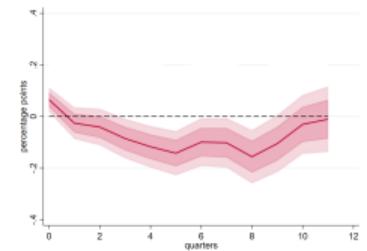
▶ back

Core NIM Robustness: Sample 1985-2023

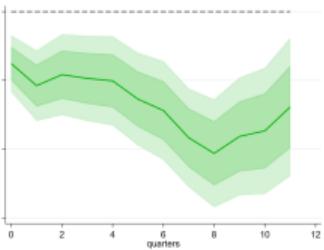
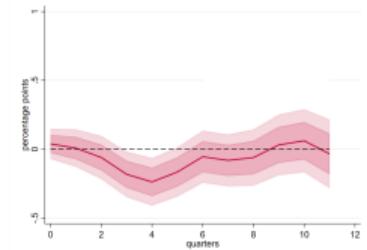
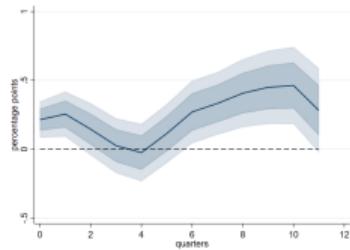
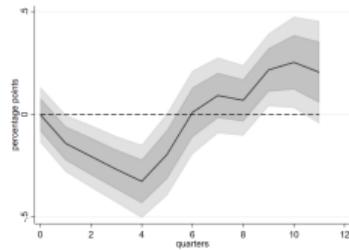
No State Dependence



Allowing for State Dependence



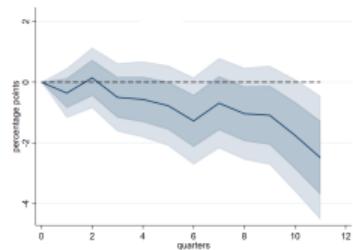
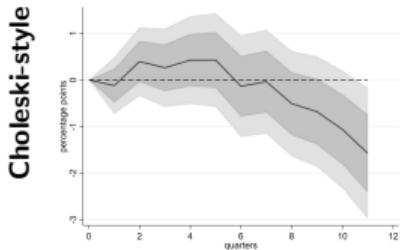
Bauer & Swanson (2023)



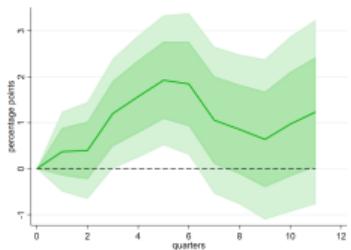
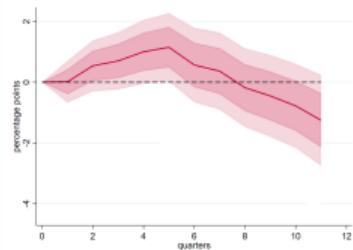
▶ back

Real GDP Robustness: Sample 1985-2023

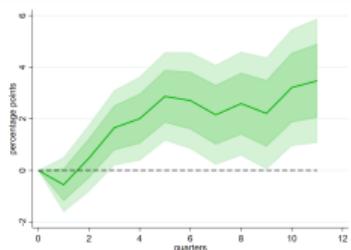
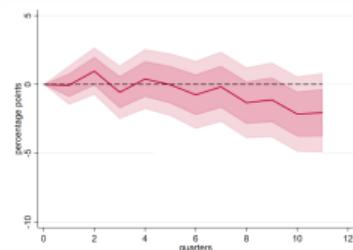
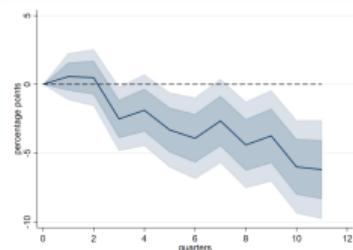
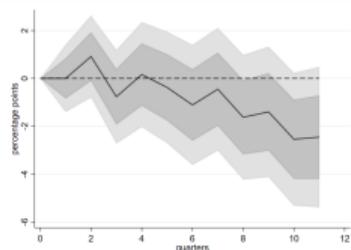
No State Dependence



Allowing for State Dependence



Bauer & Swanson (2023)



Baseline Response

Response in low rate state

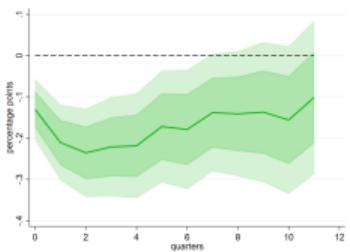
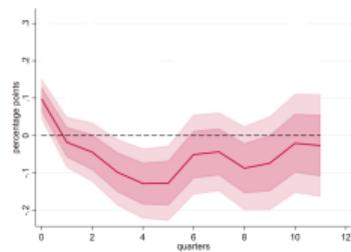
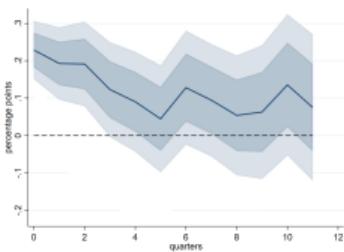
Response in high rate state

Difference Low vs High

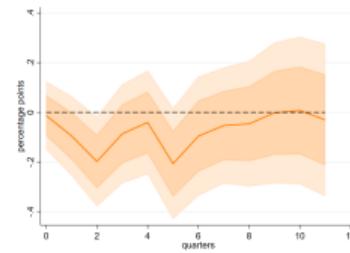
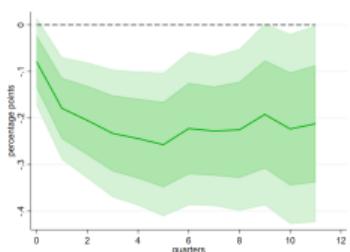
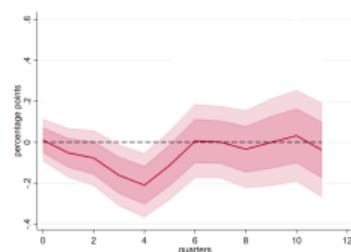
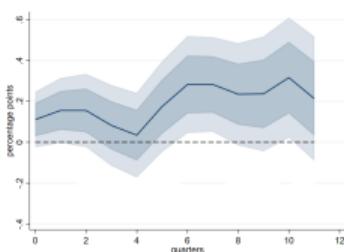
▶ back

Core NIM Robustness: Business Cycles

Choleski-style



Bauer & Swanson (2023)



Response in low rate state

Response in high rate state

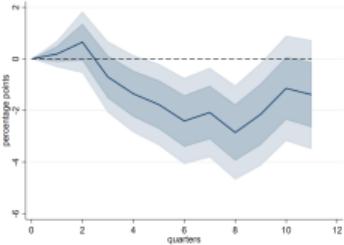
Difference Low vs High

Difference Recessions vs Expansion

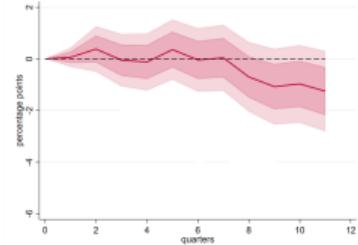
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Real GDP Robustness: Business Cycles

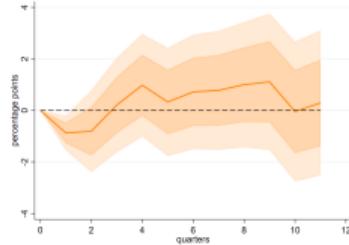
Choleski-style



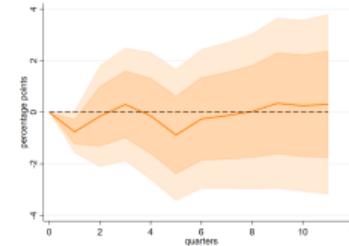
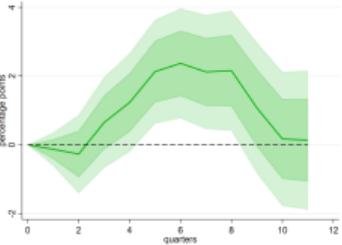
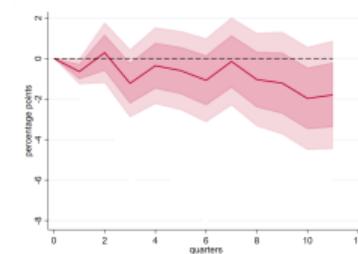
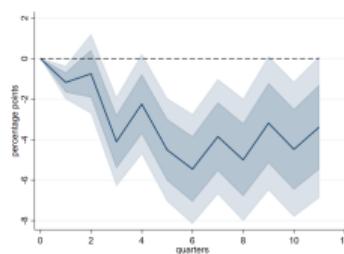
Level Interaction Term



NBER Recession Interaction Term

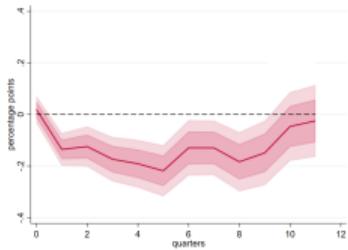
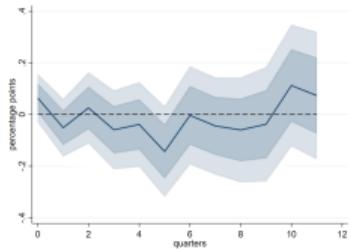


Bauer & Swanson (2023)

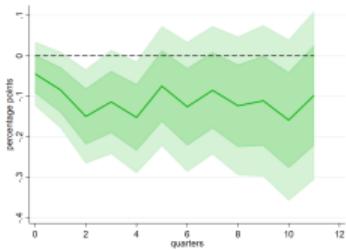


Core NIM Robustness: Ups and Downs

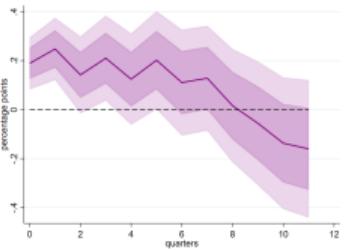
State Dependence from the Interest Rate Level



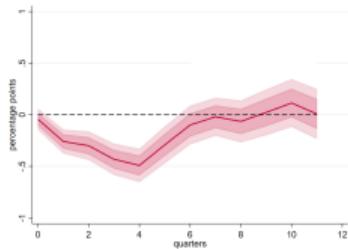
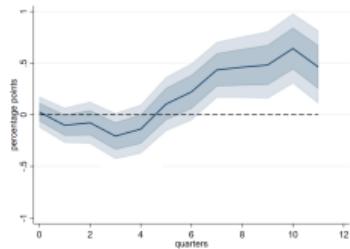
Level Interaction Term



Sign Interaction Term



Bauer & Swanson (2023)



Response in low rate state

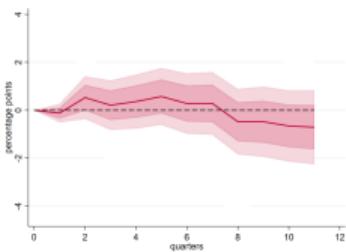
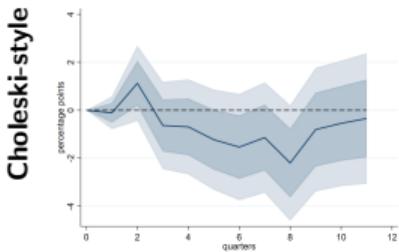
Response in high rate state

Difference Low vs High

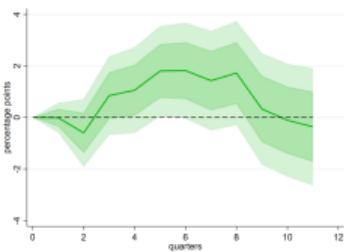
Difference Recessions vs Expansion

Real GDP Robustness: Ups and Downs

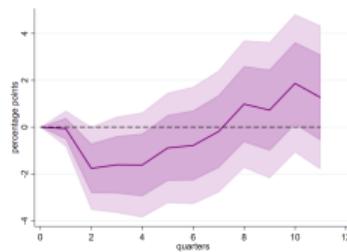
State Dependence from the Interest Rate Level



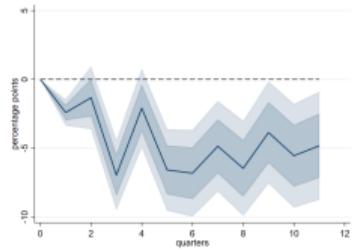
Level Interaction Term



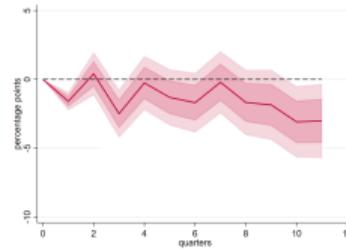
Sign Interaction Term



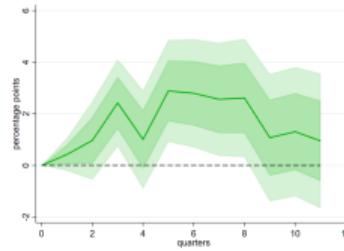
Bauer & Swanson (2023)



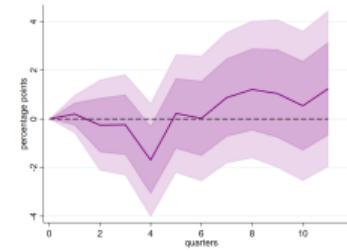
Response in low rate state



Response in high rate state



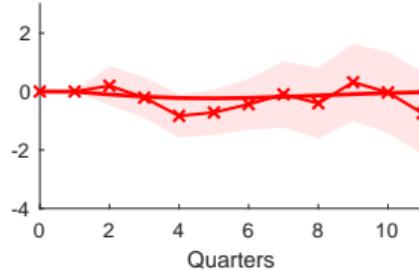
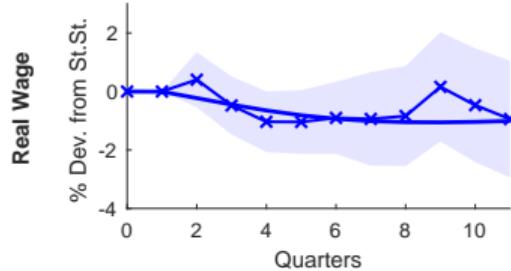
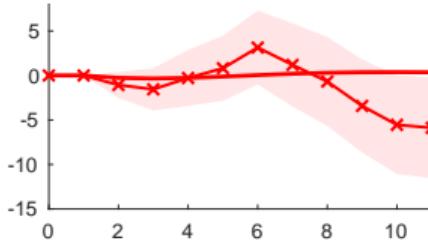
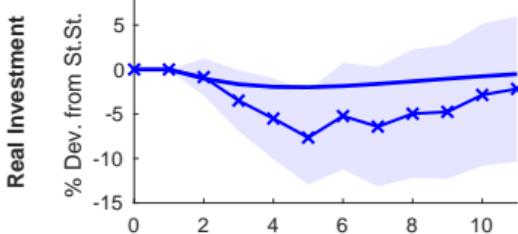
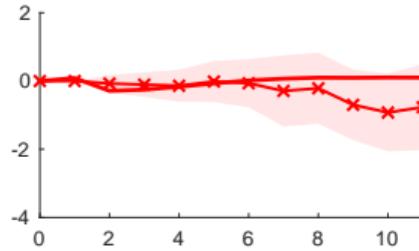
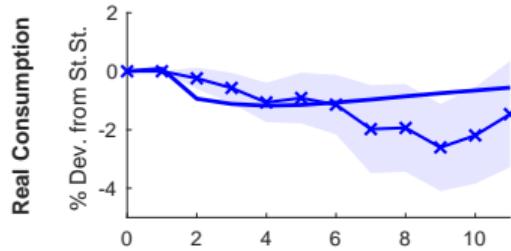
Difference Low vs High



Difference Ups vs Downs

▶ back

GE IRFs: Consumption Investments and Wages



Estimation

- Specify uniform priors for all elements of θ and then compute the posterior distribution for θ given $\hat{\psi}$ using Bayes' rule.
 - ▶ Use a Gamma prior for χ and Uniform (0, 100) priors for $\tau_a/\mu^{\frac{1}{1-\varsigma}}$ and $\tau_i/\mu^{\frac{1}{1-\varsigma}}$, as well as Uniform (0, 1) priors for κ_a , κ_i , and δ .
- Only consider parameter values θ in model estimation such that:
 - ▶ $R_{i,t}$ and $R_{a,t}$ are never lower than one after a monetary policy shock in either of the two states considered.
 - ▶ Spreads $R_t - R_{i,t}$ and $R_t - R_{a,t}$ are always non-negative, and $R_{a,t} \geq R_{i,t}$.

▶ back

Priors and Posteriors

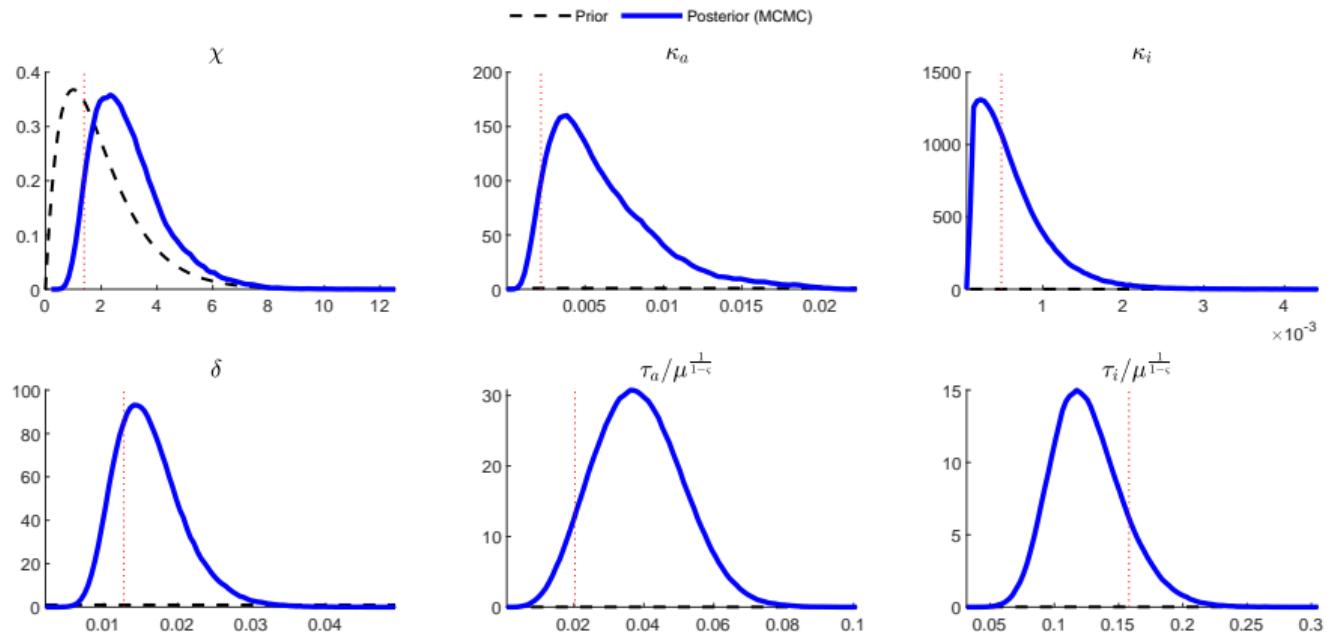


Figure: Priors and Posteriors of Estimated Parameters.

End of Appendix

THANKS!!