Net Interest Margins and 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

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  - After a period of **low interest rates**, a **contractionary monetary policy** shock leads to a **significant rise in NIM**.
  - After a period of **high interest rates**, a **contractionary monetary policy** shock leads to a **fall in NIM**.

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  - Mainly due to **deposit products** rather than from loan products. Both intensive and extensive margins.
- Response of **aggregate economic activity** displays similar state-dependency:
  - **Real GDP**, consumption, and investment **fall more sharply** when a contractionary policy occurs **in low interest** versus high interest rate state.

Empirical Estimates and back-of-the-envelope

- Cumulative effect of a monetary policy shock in **low interest rate state** over three years is an **increase** in **NIM-related bank profits** of roughly 92 **billion dollars**.

- If shock occurs in **high interest rate state**, impact on NIM-related profits is a **decrease** of 98.3 **billion dollars**.

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- If shock occurs in **high interest rate state**, impact on NIM-related profits is a **decrease** of 98.3 **billion dollars**.
- Counterparts of banks save 191 billion dollars in **net interest paid** if shock occurs in **high state rather low state**.
  - These savings represent 0.9 percent of 2019 GDP.

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- **Suppose bank profits accrue to people with much lower MPC** out of liquid wealth **than people who receive interest income from banks**.

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$\implies$ in an economy with nominal rigidities, **state-dependence in NIMs creates state-dependence in response of aggregate economic activity** to a monetary policy shock.

1. Develop tractable PE competitive banking model with **customer's varying attention to saving rates** and **bank's ability to screen**.
2. Embed in a TANK GE model to explore macro implications.

Social Dynamics and Banking

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- **Fraction varies over time because of social dynamics** arising from random encounters between attentive and inattentive hh's.
  - Some inattentive hh's become attentive after meeting attentive hh's.
  - HH's are more likely to take interest in interest rates when rates are high. Search Volumes
  - So more hhs are attentive when rates are high.

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- **Main Results: PE model accounts very well quantitatively for the dynamic response of NIM to monetary policy shocks** after prolonged periods of high and low interest rates.

Aggregate Economic Activity

- Embed **banking model in DSGE TANK model where heterogeneous MPCs out-of-liquid wealth**.

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- Embed **banking model in DSGE TANK model where heterogeneous MPCs out-of-liquid wealth**.
- **State dependency** in response of deposit rates to monetary policy shock interacts with high MPC out-of-liquid wealth hh's .
- **Main Result: GE model accounts well quantitatively for state dependency in response of real GDP** to a contractionary monetary policy shock.

Related Literature

- **Role of Banks in MP transmission:** Cúrdia and Woodford [2010],Gerali et al. [2010], Driscoll and Judson [2013], Gertler and Karadi [2015], Cuciniello and Signoretti [2015], Piazzesi, Rogers, and Schneider [2019], and Bianchi and Bigio [2022]. Particularly: Drechsler, Savov, and Schnabl [2017, 2018, 2021], Begenau and Stafford [2022] and Greenwald et al. [2023].

$\Longrightarrow$ document important source of **state-dependence in banks' policy functions** which **percolates** throughout the **MP transmission to the real economy**.

- **Heterogeneous MPC out of Liquid Wealth:** Johnson, Parker, and Souleles [2006], Parker, Souleles, Johnson, and McClelland [2013], Jappelli and Pistaferri [2014], Kaplan and Violante [2014], Debortoli and Galí [2017], Kueng [2018], Auclert, Rognlie, and Straub [forthcoming], Ganong et al. [2020], and Fagereng, Holm, and Natvik [2021].

$\Longrightarrow$ provide a **tractable quantitative TANK setting** connecting **banks' rate-setting policies**, **heterogeneous MPCs out of liquid wealth** and **MP transmission**.

- **Social Dynamics:** Kelly and Gráda [2000], Carroll [2003], Iyer and Puri [2012], Burnside, Eichenbaum, and Rebelo [2016], Carroll and Wang [2023]

$\Longrightarrow$ introduce and show **relevance of social dynamics** in powering up **GE effects of monetary policy**.

Outline

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- **Empirical Analysis**
  - **Local Projection Framework**
  - **Results (NIM, Core NIM, GDP)**
  - **Robustness**

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  - **Study NIM implications**
- **TANK Model**
  - **Ingredients**
  - **Study real macro-aggregates implications**

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**.

- Compute two measures of NIM:
  - (i) **core NIM** = average loan interest income rate minus average deposit interest expense rate,
  - (ii) **overall NIM** = difference between average interest income rate minus average interest expense rate (on all assets, 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 of time around FOMC announcements.
  - Orthogonalize shock wrt contemporaneous, four lags of real GDP, PCE prices, investment and consumption, four lags of excess bond premium, and yield curve slope.
- **Measure 2:** Recursive shock measure
  - residual in a regression of FF rate on contemporaneous, four lags of lagged Real GDP, the PCE price index, and four lags of the Excess Bond Premium.

Estimation

- Local projection equation:

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

- MP_t : time t value of monetary policy shock.

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- 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.

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- 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.

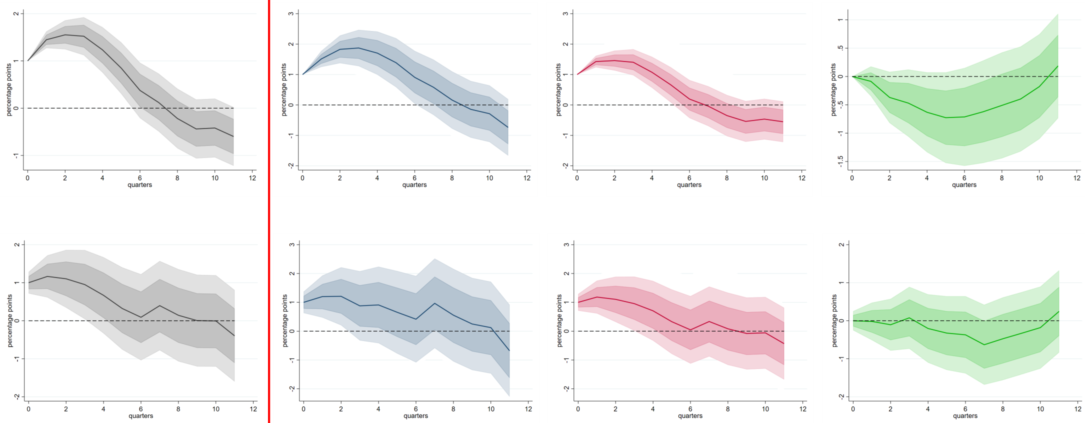
Results: FF

No State Dependence

Allowing for State Dependence

Choleski-style

Bauer & Swanson (2023)



Baseline Response

Response in low rate state

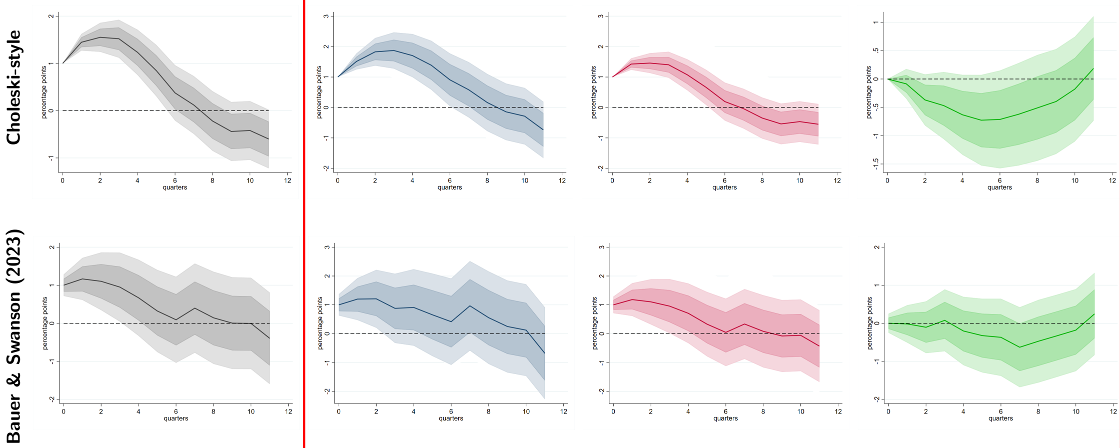
Response in high rate state

Difference Low vs High

Results: FF

No State Dependence

Allowing for State Dependence



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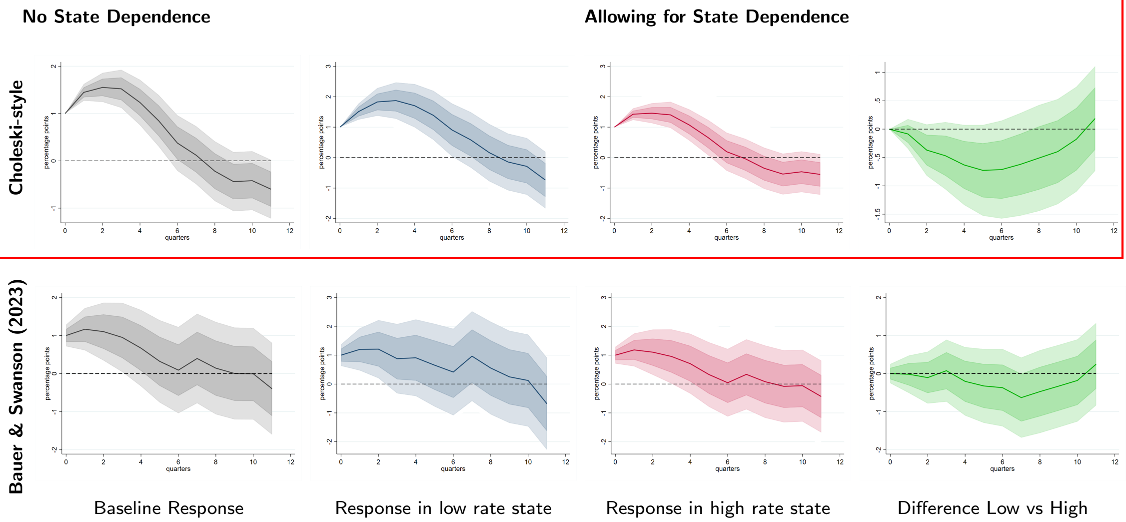

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Allowing for State Dependence
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Bauer & Swanson (2023)
percentage points
quarters
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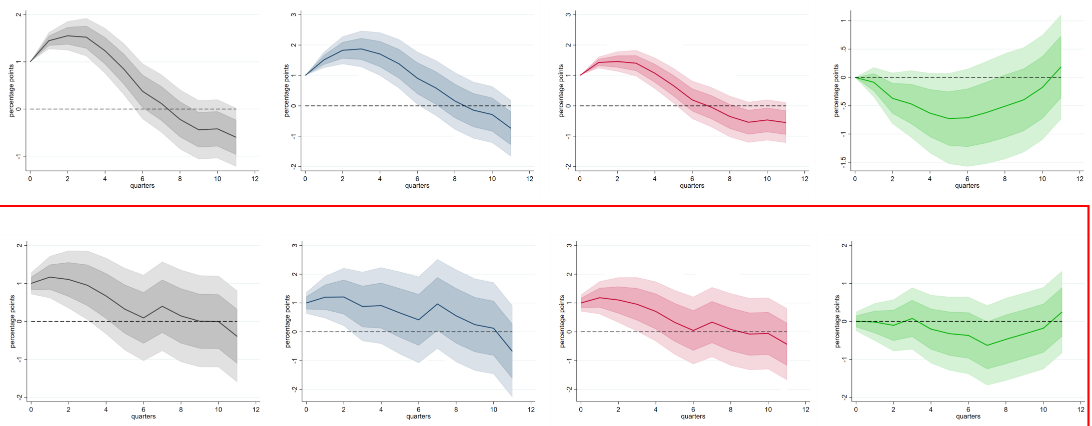

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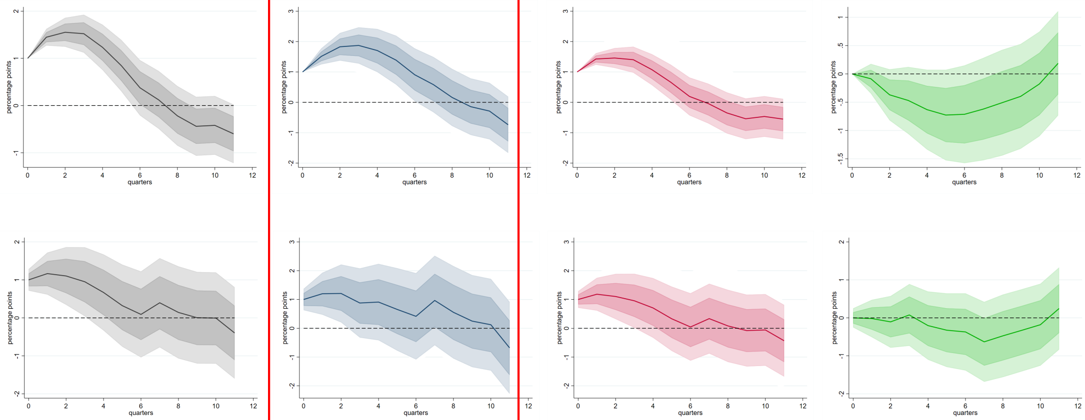

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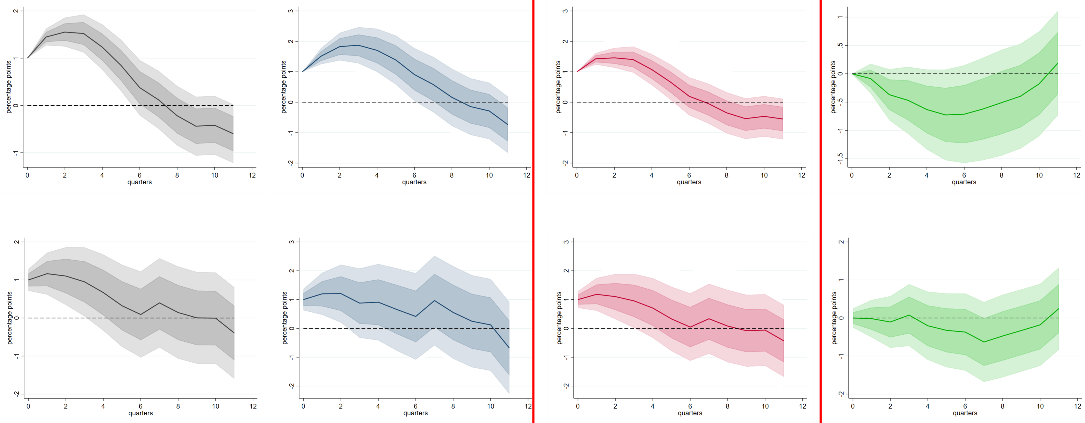

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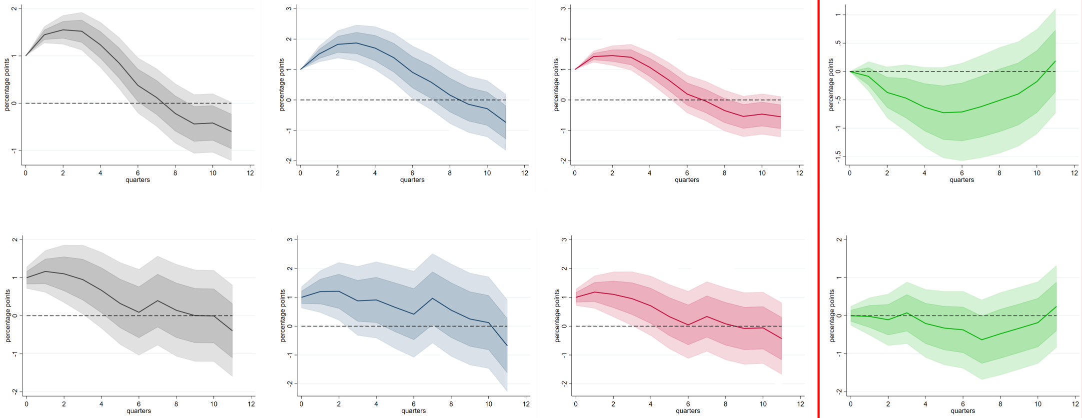

Baseline Response | Response in low rate state | Response in high rate state | Difference Low vs High

Results: Core NIM

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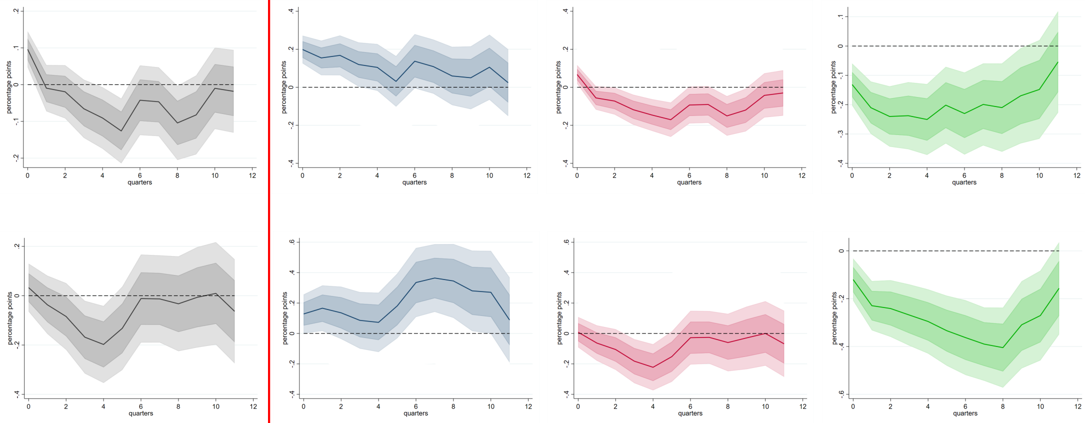

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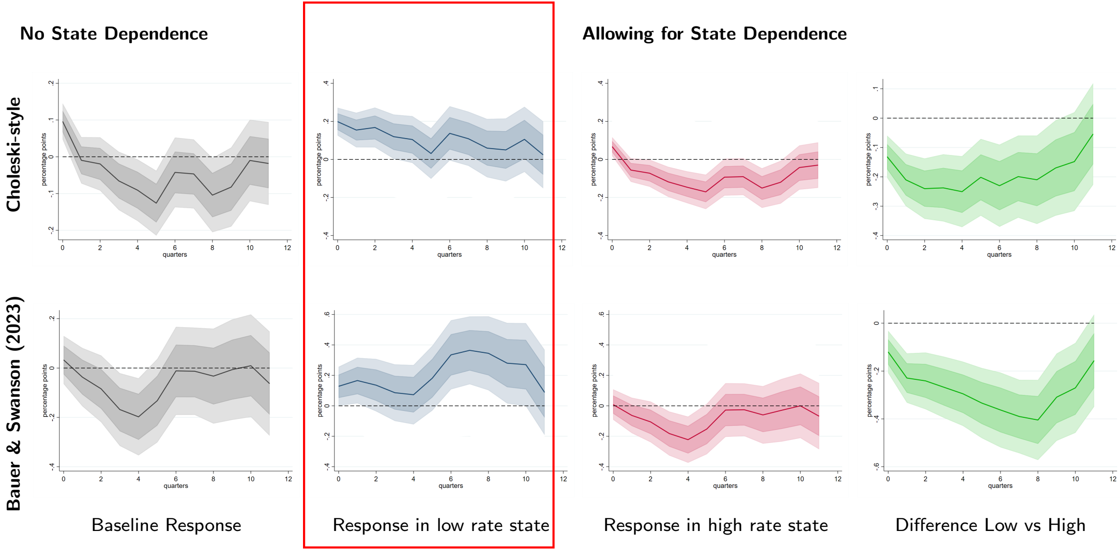

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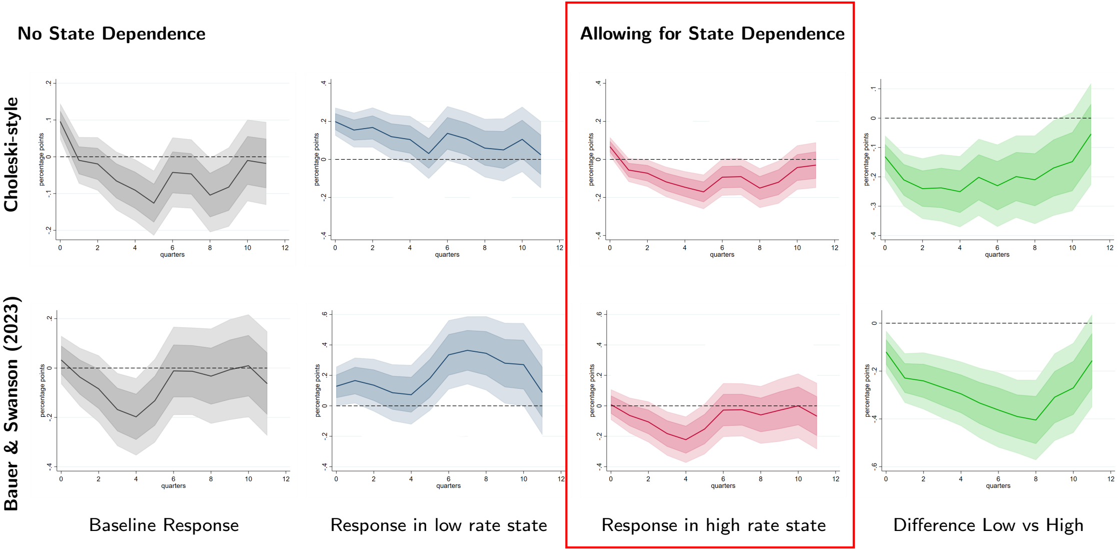

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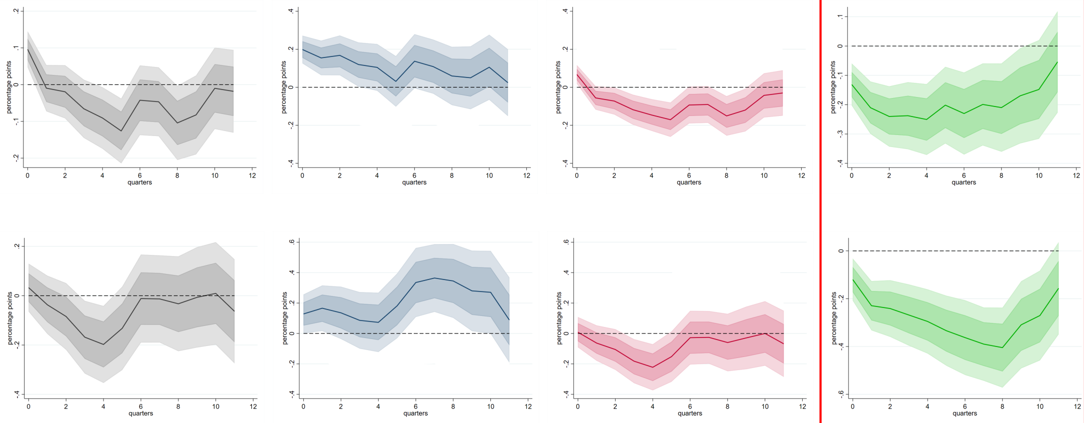

Baseline Response | Response in low rate state | Response in high rate state | Difference Low vs High

Results: 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

No State Dependence

Allowing for State Dependence

Choleski-style

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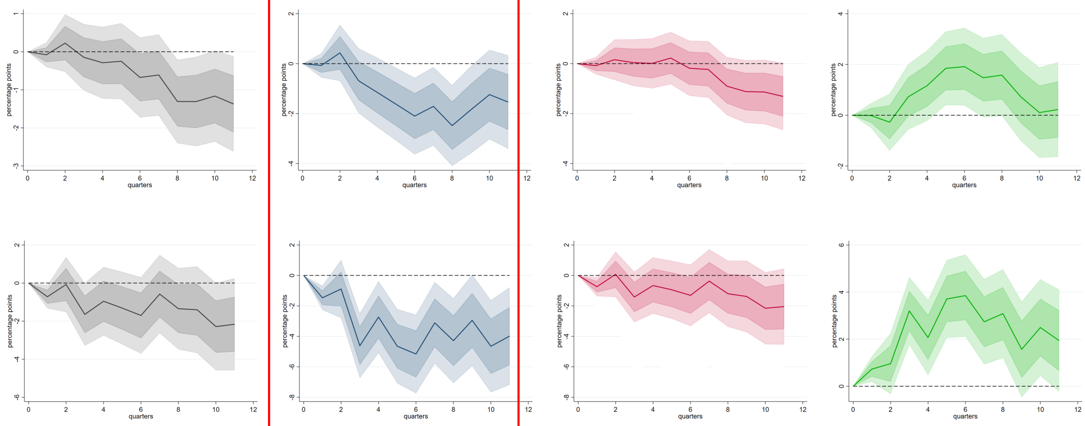

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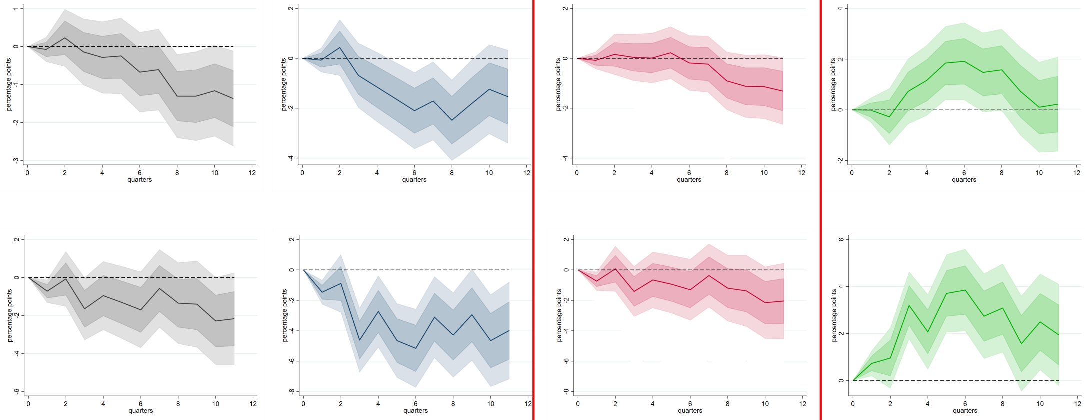

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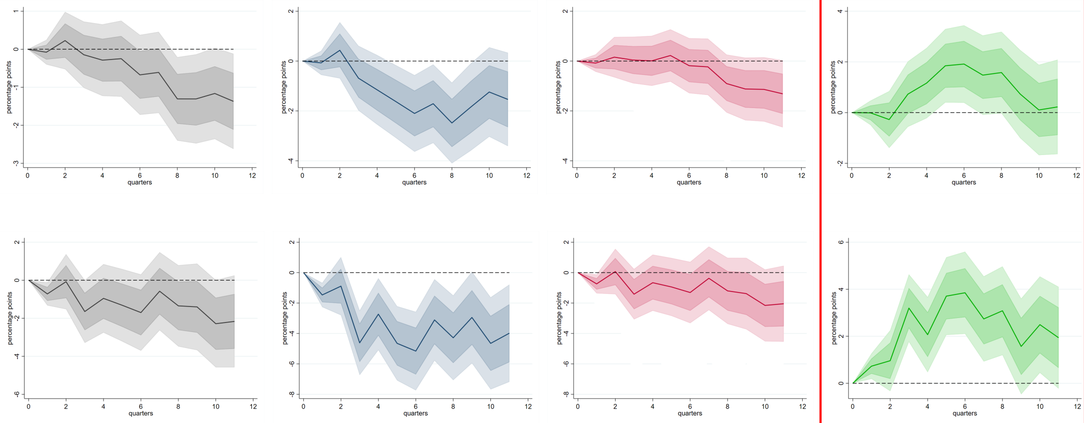

Baseline Response | Response in low rate state | Response in high rate state | Difference Low vs High

Results: GDP

- A **contractionary monetary policy shock induces a persistent decrease in real GDP for roughly two years**.
- Strong evidence of state dependence in response of real GDP.
- **Decline in real GDP is larger when shock occurs in low state.**
  - **Difference in response is statistically significant** for both shock measures.
- **Parallels our findings about state dependence in response of NIM** to a contractionary monetary policy shock.
- **More results:** Consumption, Investment and Inflation.

Robustness

- **Methodology:**
  - Different interest rate thresholds for state variable, controls and lags. Equally weighting ba
  - Alternative interaction with indicator variable contractionary vs expansionary MP. Tenreyro and Thwaites [2016]
- **Banking Variables:**
  - Transaction Accounts and Foreign Deposit Accounts.
  - Average Income Rate earned on assets and average rate paid on liabilities
  - Robustness with aggregates Ratewatch data on selected loan and deposit products.
- **Aggregate Variables:**
  - Durable, Non-Durable, Services Consumption
  - S&P500, Case-Shiller House Price Index, Excess Bond Premium and Yield Curve Slope.
- **Micro-Data Exercise (kicked out of the paper):**
  - Bank Level Data (Call Reports)
  - Bank and Product Level Data (Ratewatch)

A partial equilibrium model of banking

- Key features
  - (i) **some hh's are attentive**, **others are inattentive** to interest rate they earn on bank deposits,
  - (ii) **banks can screen and consider this variation** when valuing household deposits.
  - (iii) a **matching framework** in which competitive banks invest resources to attract attentive, inattentive hh's.
- Initially shut down social dynamics to get intuition for mechanisms in model.
- Then study social dynamics that govern changes in fraction of attentive and inattentive hh's.

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.

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  - So, there's δa_t and δi_t dollars belonging to attentive and inattentive customers seeking a new bank at time t.

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- 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, **can invest resources to attract the two types of depositors**.

A simple competitive banking model

- **Costs** $\tau_j v_j$ dollars **to attract** v_j **dollars of type** j deposits, $j = a, i$.
  - It's **more costly to attract inattentive** depositors than attentive, i.e., $\tau_i > \tau_a$.
  - Reason: **inattentive depositors are less likely to notice** bank offers.

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- **Matches between banks and deposits** of attentive and inattentive hh's form according to

$$m_{at} = \mu \left(\delta a_t\right)^{\alpha} v_{at}^{1-\alpha},$$
$$m_{it} = \mu \left(\delta i_t\right)^{\alpha} v_{it}^{1-\alpha}$$

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

A simple competitive banking model

- In equilibrium (EQ), **all deposits find a match** so $v_{at} = \delta a_t$ and $v_{it}=\delta i_t$.
- Deposit markets are perfectly competitive, so banks have **zero profits** (ZP).
- By ZP we have $\tau_{j,t} = \frac{\mu(\delta j_t)^{\varsigma} v_{jt}^{1-\varsigma}}{v_{jt}} V_{j,t}$ and hence by EQ $\tau_j = \mu V_{j,t}$.

Value of Deposits

- Value to bank of dollar deposit from attentive household:

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

- $R_t - R_{at}$: spread or profit per dollar of deposits owned by an attentive household that banks earn.

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

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- Value to a bank of a dollar deposit from an inattentive household is
$$V_{i,t} = R_t - R_{it} + \frac{1-\delta}{R_t} V_{i,t+1}.$$

Interest-Rate Spreads

$$R - R_a = \frac{\tau_a}{\mu}\left(1 - \frac{1-\delta}{R}\right), R - R_i = \frac{\tau_i}{\mu}\left(1 - \frac{1-\delta}{R}\right)$$

- **Spreads increase with** R (when $R \Uparrow$, PV(profits) $\Downarrow$, Zero-Profit $\Rightarrow$Spreads $\Uparrow$)

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- **Spreads increase more when interest rates are low** than when interest rates are high.
  - Consider an annuity that pays y in every period. PV of annuity is y/R. Change in PV when R rises is $-R^{-2}y$, which is lower when R is high.

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  - Consider an annuity that pays y in every period. PV of annuity is y/R. Change in PV when R rises is $-R^{-2}y$, which is lower when R is high.
- Note: since $\tau_i > \tau_a$, when R rises, **spread earned by banks on inattentive deposits increases more** than attentive deposits.

$\Longrightarrow$**Attentive depositors benefit more** from a rise in FF rate than inattentive depositors.

NIM

- Assume perfect pass-through on asset side rates. Equilibrium lending rate is $R^l = R + \varepsilon^l$. More
- Bank's NIM is given by

$$nim_t = \varepsilon^l + a_t \left(R_t - R_{at}\right) + i_t \left(R_t - R_{it}\right).$$

- nim_t decreases with fraction of attentive hh's in the economy.
- Reason: interest rate spread earned by banks is lower for attentive hh's.

Social Dynamics

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

$$
\begin{aligned}
a_{t+1} &= a_t(1-\kappa_a) + \omega(R_t)a_t i_t + \kappa_i i_t \\
i_{t+1} &= i_t(1-\kappa_i) - \omega(R_t)a_t i_t + \kappa_a a_t
\end{aligned}
$$

- **Exogenous transitions:**
  - Fraction κ_a of attentive hh's become inattentive, and viceversa.

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\end{aligned}
$$

- **Exogenous transitions:**
  - Fraction κ_a of attentive hh's become inattentive, and viceversa.
- **Endogenous transitions arising from social interactions:**
  - Each period there's $a_t i_t$ **pairwise meetings** with intensity $\omega(R_t) = \chi\,(4R_t - 4)^2$
  - **Note:** strenght is maximal when $a_t = 0.5$ and minimal when a_t approaches 0 or 1.

Banking with Social Dynamics

- Value of a dollar deposit from an attentive household is

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

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

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

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

- Takes into account 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:

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

- **Spread is lower** than in model **without social dynamics:**
  - **Attentive depositors** with probability κ_a become more-valuable-inattentive in the future. ZP: **current spread on these customers must decline wrt previous.**

Spreads with social dynamics

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  - **Attentive depositors** with probability κ_a become more-valuable-inattentive in the future. ZP: **current spread on these customers must decline wrt previous.**

- The interest rate spread for **inattentive depositors** is:

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

- **Spread is higher than** in model **without social dynamics** for the same reasoning.
- **Stronger effect with higher interest rate** as $\omega(R_t)$, is higher.

NIM with social dynamics

$$nim_t = \varepsilon^l + \frac{a_t \tau_a + (1 - a_t)\tau_i}{\mu} \left(1 - \frac{1-\delta}{R_t}\right) + \frac{1-\delta}{R_t} \frac{\tau_i - \tau_a}{\mu} (a_{t+1} - a_t).$$

- **First two terms equal** the value of nim_t in an economy **without social interactions**.
- **Third term:** impact of social interactions on nim_t.
  - $\Uparrow a_{t+1} - a_t \Rightarrow nim_t \Uparrow$ because inattentive spread rises to compensate for higher probability of becoming attentive.

NIM with social dynamics

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

- **First effect** of a rise in a_t is **negative**:
  - Increase in a_t lowers average interest rate spread.

NIM with social dynamics

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

- **First effect** of a rise in a_t is **negative**:
  - Increase in a_t lowers average interest rate spread.
- **Second effect** fundamental for **state dependence** in nim_t.
  - Effect is positive when $a_t < 0.5$ and R_t is high: many inattentive hh's will become attentive.
  - $\Uparrow$ inattentive, $\Downarrow$ future profits, by ZP current margins $\Uparrow$ to compensate.

NIM with social dynamics

- Marginal impact of R_t on nim_t:

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

  where

$$\frac{da_{t+1}}{dR_t} = \omega'(R_t)a_t(1-a_t) = 32\chi(R_t - 1)a_t(1-a_t).$$

- **First effect is positive** and stems from change in discount rate:
  - A rise in R_t reduces PV of future profits. ZP: current interest rate spreads **must rise** to offset this impact.

NIM with social dynamics

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

- **Second effect is negative:**
  - Consider future losses occurring when some inattentive depositors become attentive.
  - PV of these losses declines when R_t increases.
  - So current spread on inattentive deposits **must increase by less** to compensate.

- **Third effect is positive:**
  - Higher R raises $\omega(R_t)$, at which inattentive hh's become attentive. Future profits from inattentive hh's $\Downarrow$
  - So, current spread on inattentive consumers **must rise to compensate** for that effect.

Calibration

- Calibrate our banking model parameters:
  - (i) $R_{i,t}, R_{a,t}$are never lower than one.
  - (ii) Spreads $R_t - R_{i,t}, R_t - R_{a,t}$ are also always non-negative
  - (iii) Theoretical impulse responses of core NIMs to a 100 b.p. monetary policy shock are as close as possible to their empirical counterparts associated with Bauer and Swanson shock measure .

Calibration

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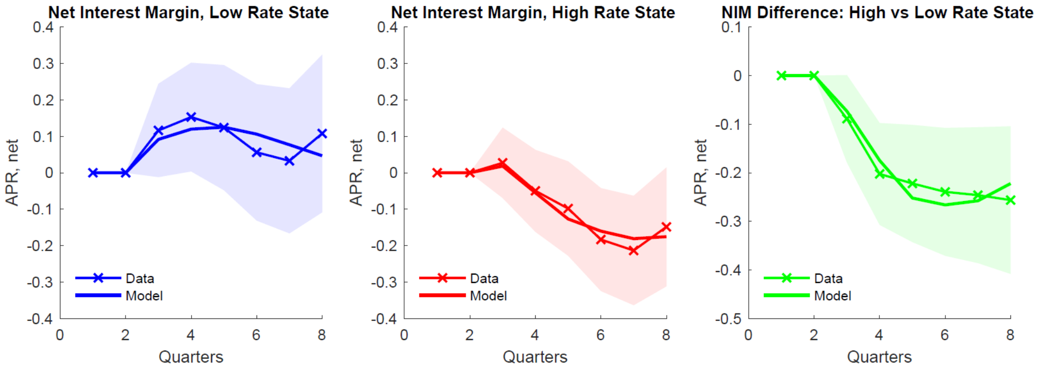
  - (iii) Theoretical impulse responses of core NIMs to a 100 b.p. monetary policy shock are as close as possible to their empirical counterparts associated with Bauer and Swanson shock measure .
- Assume social dynamics take place on a daily basis but economic interactions occur at the end of the quarter (200 social interactions a quarter).
- In progress: formal estimation.

Quantitative Exercize

- **Compute equilibrium response** of nim_t to a temporary rise in policy rate.
- **Begin from two steady states** corresponding to **low** interest rate, $R = 1.015$, and a **high** interest rate, $R = 1.056$.
- **Consider dynamic response** of nim_t to a temporary rise in interest rates, **beginning in these two steady states.**
- Policy rate responses to MP shocks derived from empirical estimates.

Model and Data Responses



▸ Calibration ▸ Intuition

GE effects: Banking in a TANK model

- Two types of Households: **Hand-to-Mouth and Optimizing agents**. Fractions are fixed.

GE effects: Banking in a TANK model

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- **Retailer must borrow nominal wage and capital services bills** from banks at the beginning of the period. Repays at end of period t after receiving revenues.

- i^{ith} firm's real marginal cost is $s_{i,t} = \left(\frac{1}{1-\alpha}\right)\left(\frac{1}{\alpha}\right)^{\alpha}\left(\mathbf{R}_t^{\mathbf{d}} r_t^k\right)^{\alpha}\left(\mathbf{R}_t^{\mathbf{d}} w_t\right)^{1-\alpha}$

GE effects: Banking in a TANK model

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- Reduced form **wage stikyness**: $w_t = \gamma w_{t-1} + (1-\gamma)w^{SS} + (1-\gamma)Ld_t/Ld^{SS}$. (See Christiano et al. [2016] for equivalence with micro-founded alternatives.)

Hand-to-mouth Households

- The economy has a fraction ϕ of hand-to-mouth hh's who **may be attentive or inattentive**.

- Hand-to-mouth hh of type $j = \{i, a\}$ maximizes

$$E_t \sum_{l=0}^{\infty} \beta^t \left\{ \left[ln(C^H_{j,t+l} - bC^H_{j,t+l-1}) \right] - \psi \frac{(N^H_{j,t+l})^{1+\eta}}{1+\eta} \right\}$$

subject to **budget constraint**

$$P_t C^H_{j,t} = R_{j,t} W_t N^H_{j,t} + \Psi_t.$$

- Note: **HH's wages are deposited at bank**, available to be used for consumption at end of period.

- Since employment is demand determined and the budget constraint holds with equality, the preferences of the hand-to-mouth hh's are irrelevant.

Optimizing Households

- For simplicity, we assume that all of PIH hh's are attentive. **Results not sensitive** due to **consumption smoothing**.

- Maximizes lifetime utility:

$$U_t = E_t \sum_{l=0}^{\infty} \beta^t \left\{ \left[ln(C^P_{t+l} - bC^P_{t+l-1}) \right] - \psi \frac{(N^P_{t+l})^{1+\eta}}{1+\eta} \right\}, \tag{1}$$

subject to budget constraint:

$$P_t C^P_t + I_t + \delta(u_t \bar{K}_t) = R^a_t W_t N^P_t + R^K_t u_t \bar{K}_t + \Phi_t + \Psi_t. \tag{2}$$

- Capital utilization; Depreciation depending on utilization; Quadratic Investment Adj Costs.

Experiment Design

- **Replicate** PE **experiment** in GE model **to study macro-aggregate effects**.

- **Issue: Taylor Rule** determines R_t, can't directly feed two different interest rate paths.

Experiment Design

- **Replicate** PE **experiment** in GE model **to study macro-aggregate effects**.
- **Issue: Taylor Rule** determines R_t, can't directly feed two different interest rate paths.
- Construct an **observationally equivalent specification**.
  - **Constant** steady state **real** rate, determined by β. Generate **two** steady state **nominal** rates corresponding to **different steady state inflation rates**.
  - **Level of nominal interest rate only matters for the social dynamics** and **the banking block**.

Monetary policy and our experiment

- Construct our **“high state”** by setting annualized inflation target to 4%.

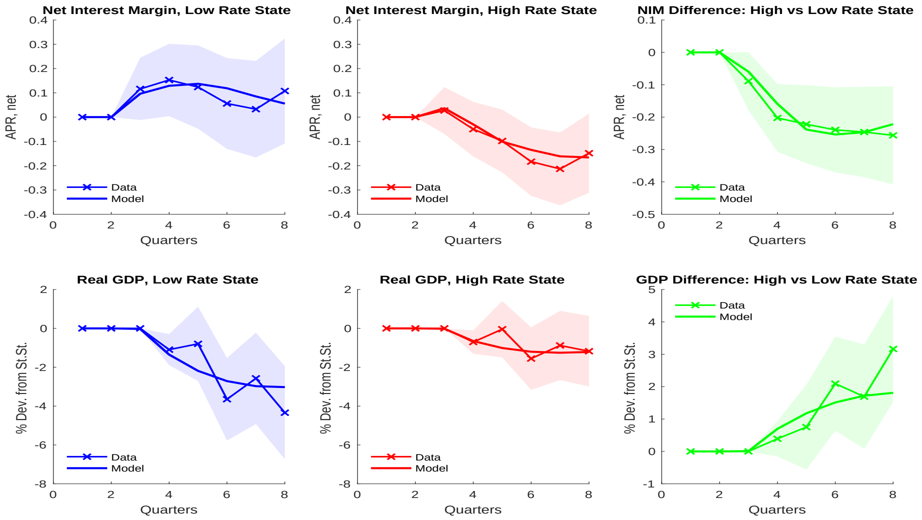
- Construct our **“low state”** by setting or annualized inflation target to 0%.

Monetary policy and our experiment

- Construct our **"high state"** by setting annualized inflation target to 4%.
- Construct our **"low state"** by setting or annualized inflation target to 0%.
- **Calibrate steady state value of annualized real rate $r^* = 1.5\%$, $\beta = 0.9963$.**
- Delivers a **steady state nominal rate of 5.5% and 1.5%** , respectively, for the "high state" and "low state".
  - Empirical averages of FF rate in high, low rate subsamples.
- Then feed in sequence of MIT shocks to Taylor rule so that R_t in the high and low scenarios are the same those estimated using Bauer and Swanson shock.

Calibration

GE Responses. Empirical vs Model.



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 two 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 **heterogeneous MPCs out of liquid wealth**.

THANKS!

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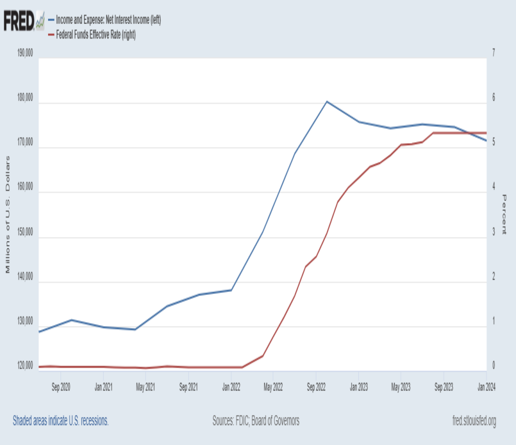
Appendix

APPENDIX

Introduction

Federal Funds Rate and Banks' NIMs



July 2024 - Fed rate at 5.33%

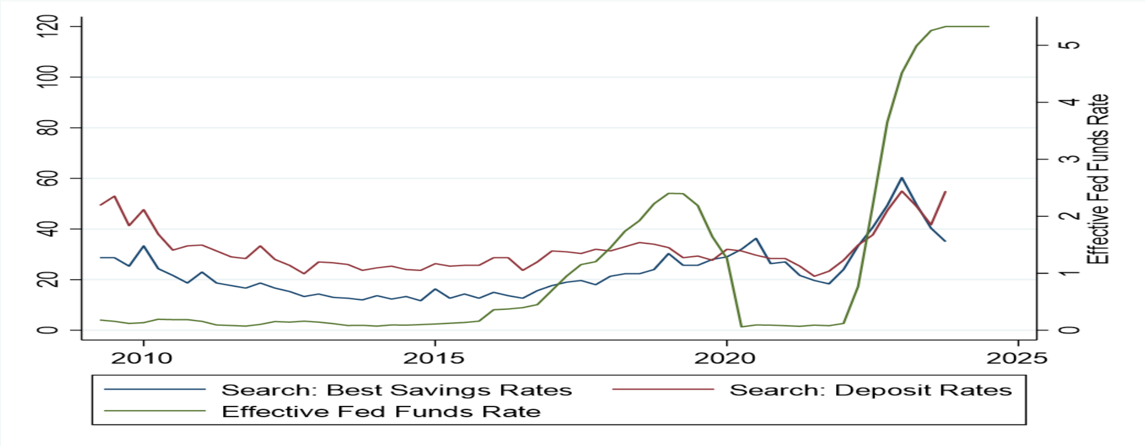
US banks get Main Street blues as savers balk at low rates

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

back

Google Trends: Searching Saving Products



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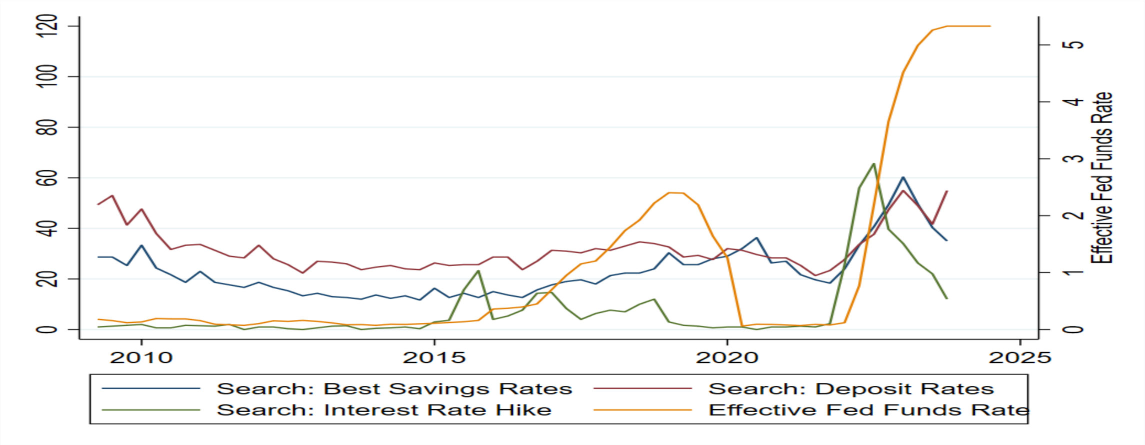
Google Trends: Searching Saving Products vs searching for Monetary Policy Stance



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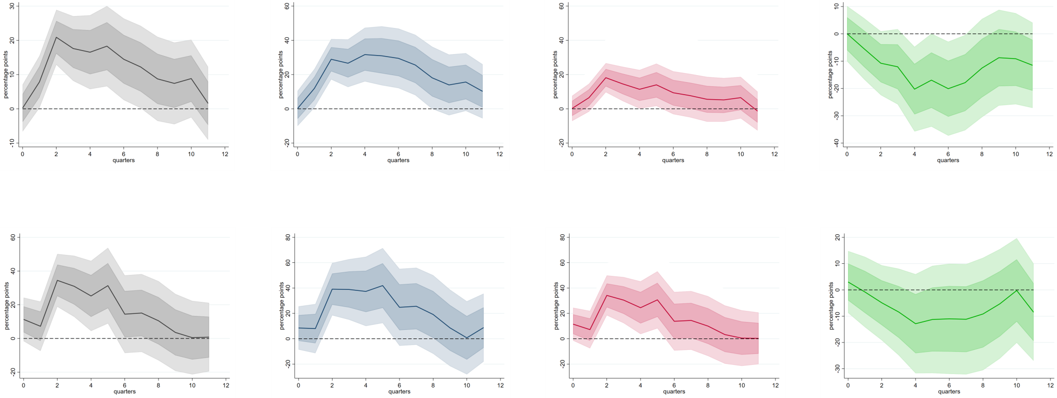
Extensive Margin

No State Dependence **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

Intensive Margin

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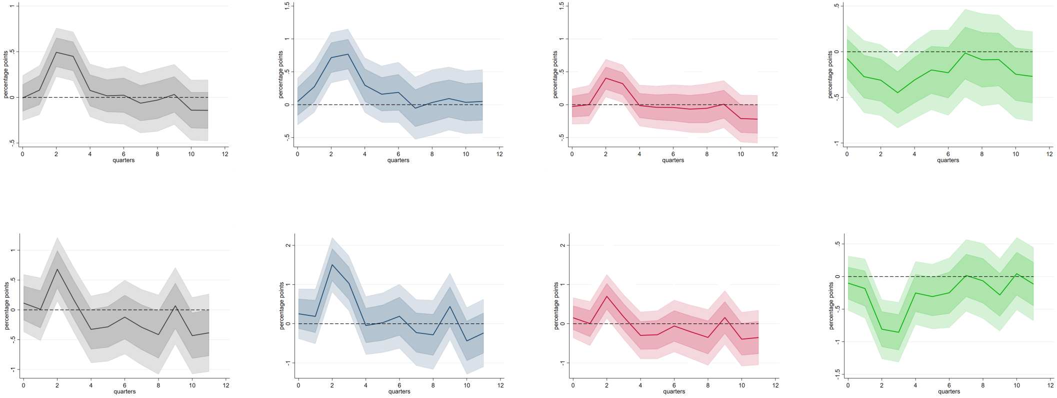


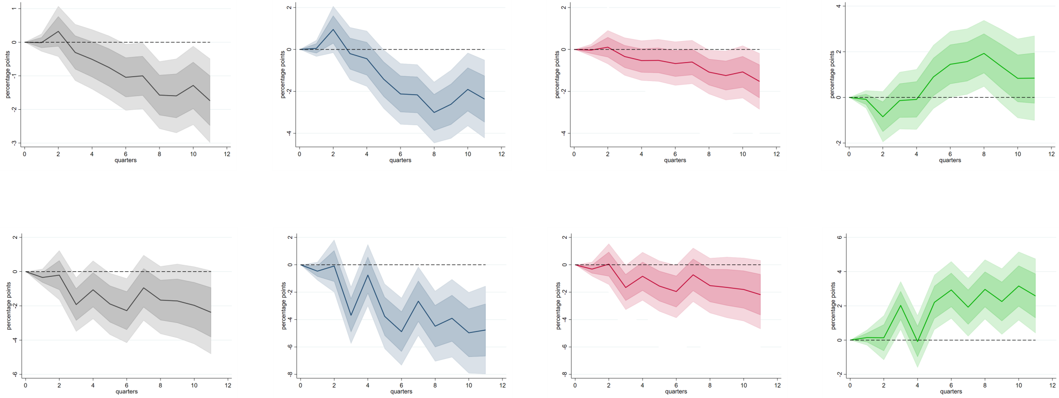
Baseline Response | Response in low rate state | Response in high rate state | Difference Low vs High

Consumption

No State Dependence **Allowing for State Dependence**

Choleski-style

Bauer & Swanson (2023)



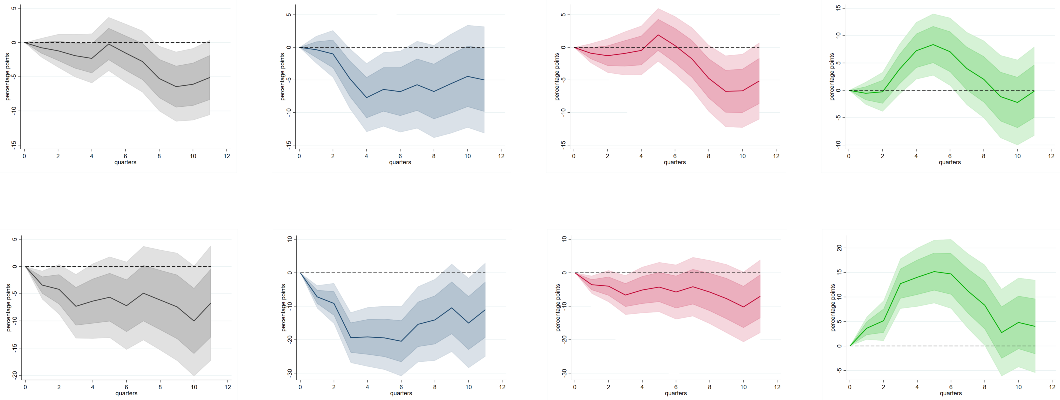
Baseline Response | Response in low rate state | Response in high rate state | Difference Low vs High

Investments

No State Dependence | **Allowing for State Dependence**

Choleski-style

Bauer & Swanson (2023)



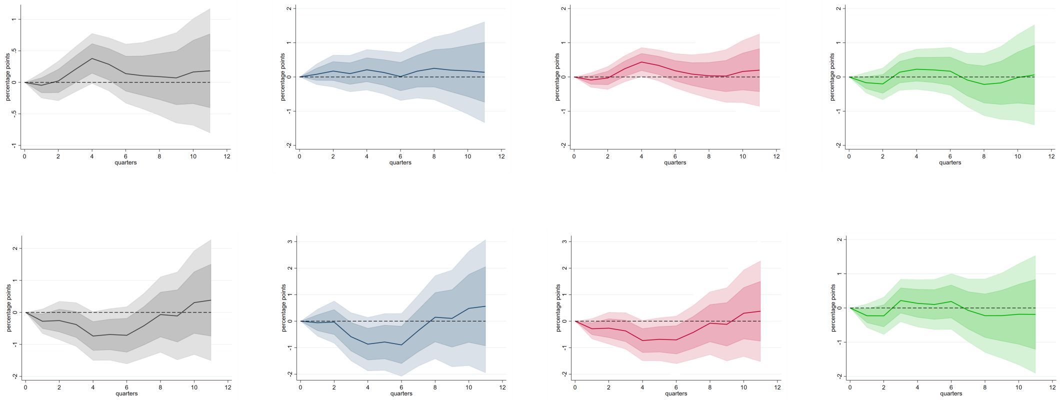
Baseline Response | Response in low rate state | Response in high rate state | Difference Low vs High

Inflation

No State Dependence **Allowing for State Dependence**

Choleski-style

Bauer & Swanson (2023)



Baseline Response | Response in low rate state | Response in high rate state | Difference Low vs High

Lending Rate

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

$$R^l = R + \varepsilon^l. \tag{3}$$

back

Banking model calibration

Parameter	Parameter value	Description
κ_i	0.0008	Rate at which inattentive become attentive
κ_a	0.0029	Rate at which attentive become inattentive
χ	1.2173	Social dynamics interaction parameter
τ_a/μ	0.0123	Cost of attracting attentive depositors/matching function parameter
τ_i/μ	0.1333	Cost of attracting inattentive depositors/matching function parameter
δ	0.0237	Fraction of depositors who leave banks for exogenous reasons
R_L	1.015	Gross annual interest rate, low interest rate state
R_H	1.056	Gross annual interest rate, high interest rate state
ϵ_l	0.005	Cost per dollar of making loans
T_q	200	Frequency of social interactions in a quarter of time

back

Wage determination

- CET (2016): estimated versions of three models of wage determination have virtually identical implications for macroeconomic aggregates:
  - Search and matching matching model with Hall and Milgrom wage bargaining.
  - Calvo-style sticky wages.
  - Reduced-form specification of nominal wages embodying inertia.

- We adopt last model and assume that after a shock, nominal wages evolve according to

$$w_t = \gamma w_{t-1} + (1-\gamma) w^{SS} + (1-\gamma) Ld_t / Ld^{SS}.$$

- Employment is demand determined, hh's vary their work in proportion to their steady state values to satisfy demand.

back

Capital and Investment

- $\bar{K}_t$: beginning of period physical capital stock. Standard capital low of motion. Note: $K_t = u_t \bar{K}_t$
- Φ_t and Ψ_t: profits from monopolistically competitive firms and lump-sum taxes, respectively.
- $\delta(u_t)\bar{K}_t$: cost, in units of consumption goods, of setting utilization rate to u_t. Quadratic Investment adjustment costs.

$$\bar{K}_{t+1} = (1 - \delta(u_t))\bar{K}_t + F(I_t, I_{t-1}). \tag{4}$$

$$F(I_t, I_{t-1}) = \left[1 - S\left(\frac{I_t}{I_{t-1}}\right)\right] I_t$$

where

$$S\left(\frac{I_t}{I_{t-1}}\right) = \frac{s_I}{2}\left(\frac{I_t}{I_{t-1}} - 1\right)^2.$$

back

Model responses beginning from low interest rate state

- A rise in R_t leads to a substantial increase in fraction of attentive hh's.
- Deposit rates rise but by less than loan interest rate.
- Policy shock induces a substantial increase in nim_t.

- Intuition
  - PV effect is stronger when R_t is low.
  - There's a high level of inattentive depositors, a substantial fraction of which will become attentive in the future.
  - Those types of customers will be less profitable in future.
  - Creates substantial upward pressure on current nim_t to ensure zero profits in equilibrium.

back

Model responses beginning from high interest rate state

- Intuition
  - Impact of a rise in R on PV on PV future profits is weaker when R_t is high.
  - Since most depositors are attentive, banks have few inattentive depositors who will turn attentive in future.
  - So, a small number of customers will become attentive in future.
  - Those types of customers are less profitable for the bank in future, creating upward pressure on current nim_t to counteract that effect.
  - Since there's few such customers, rise in nim_t that's required to have zero profits in equilibrium is small.

- Rise in R_{at} is very large.
  - Since nim_t is dominated by the high share of attentive hh's, nim_t doesn't react much to change in FF rate.

back

B-TANK Calibration

Parameter	Parameter value	Description	Parameter	Parameter value	Description
β	0.9963	discount factor	ϕ^P	0.85	Calvo stickyness for retail firms
bb	0.8	habit formation	γ_1	0.99	wage stikyness
ϕ	0.75	share of Non-Hand-to-Mouth	ρ_1^r	0.4	Taylor rule: persistance first coefficient
χ^N	0.5	labour disutility scale	ρ_2^r	0.4	Taylor rule: persistance second coefficient
η	1	inverse Frish Elasticity	θ^Π	1.5	Taylor rule: inflation gap reaction
ψ_K	1.25	investment adjustment cost scale	θ^y	0	Taylor rule: output gap reaction
δ_0	0.025	capital depreciation	σ^r	0.0025	Taylor rule: shock standard deviation
δ_1	0.047	capital depreciation due to utilization (linear)	$\bar{\Pi}$	1.01 or 1	Taylor rule: inflation Target (High and Low)
δ_2	0.001	capital depreciation due to utilization (quadratic)	ρ^A	0.9	Technology process: persistance
α	1/3	capital share	σ^A	0.01	Technology process: shock standard deviation
ε^P	11	demand elast. for retail firms	G/Y	0.18	Steady State ratio of Government Spending to Output

back