# Active Monetary or Fiscal Policy and Stock-Bond Correlation

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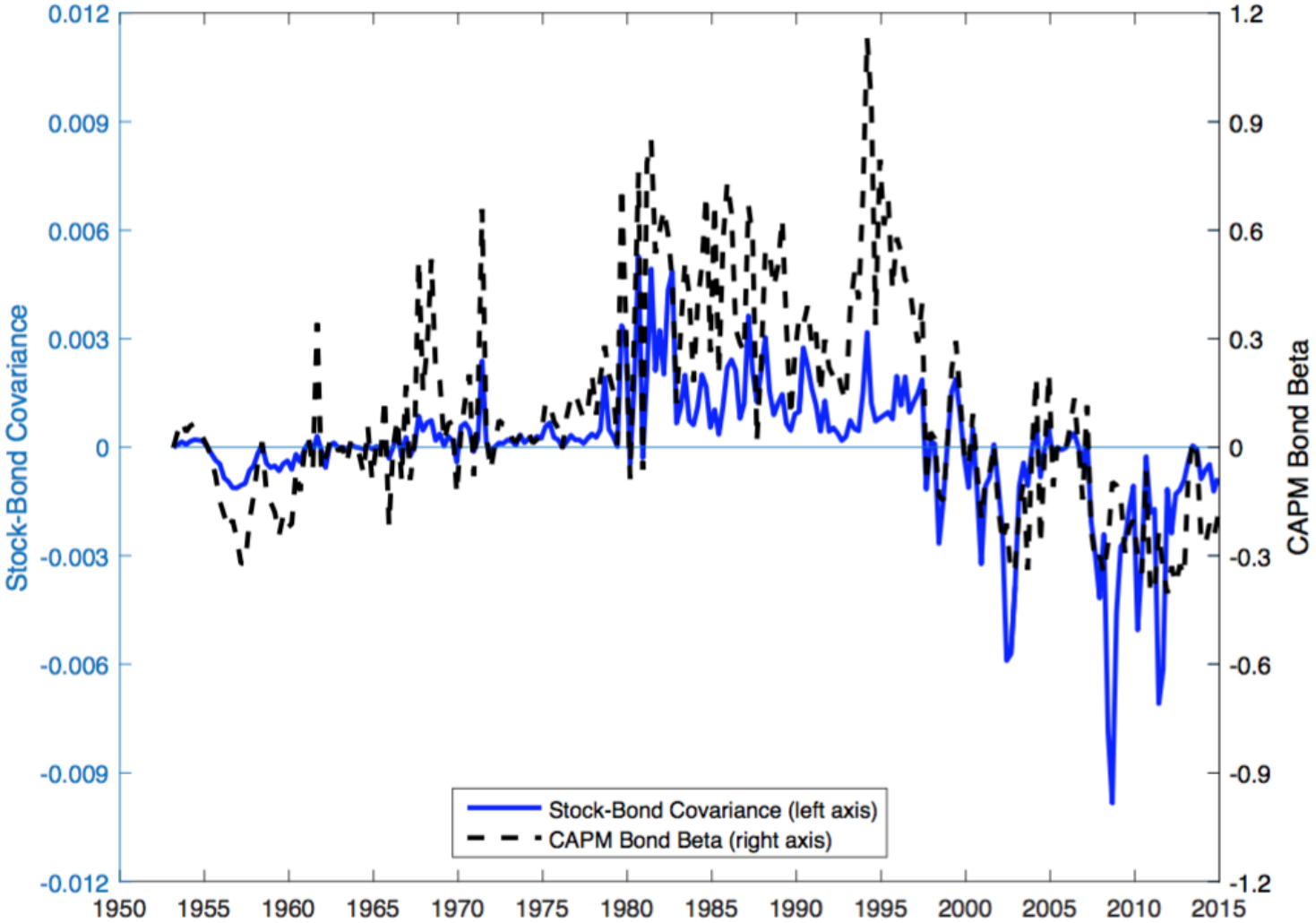
# Beta of 5-Year Treasury Bond

## Campbell, Sunderam, and Viceira (2016)



# Question

- What determines the sign of the correlation between stock and bond returns?

# Our Explanation

What we propose

- switch of monetary-fiscal activeness (regimes)
  - different shocks are amplified/mitigated by policies in different regimes
  - $\Rightarrow$ different shocks dominate in different regimes
  - different dominant shocks generate different return correlations
- coherent explanation for stock-bond correlation from 1950's until now

# Our Explanation

- The permanent technology (PT) shocks, which dominate in the AMPF regime, lead to positive stock-bond correlation
  - AMPF: active monetary and passive fiscal policy regime
- The marginal efficiency of investment (MEI) shocks, which dominate in the PMAF regime, lead to negative stock-bond correlation
  - PMAF: passive monetary and active fiscal policy regime
- The permanent technology (PT) and monetary policy (MP) shocks dominate marginal efficiency of investment (MEI) shocks in the PMPF regime, lead to slightly positive stock-bond correlation
  - PMPF: passive monetary and passive fiscal policy regime

# Outline

1. Policy Regimes
2. Model
3. Results for Regime Switching Model
4. Robustness Checks

# Outline

# Monetary Policy Regimes

## Leeper (1991)

$$i_t - i = \phi_\pi(\pi_t - \pi^*) + \phi_y(\Delta y_t - \Delta y)$$

- Active monetary policies: $\phi_\pi > 1$
  1980s and 1990s, stabilize price
- Passive monetary policies: $0 \leq \phi_\pi < 1$
  2000s, ZLB without UMP

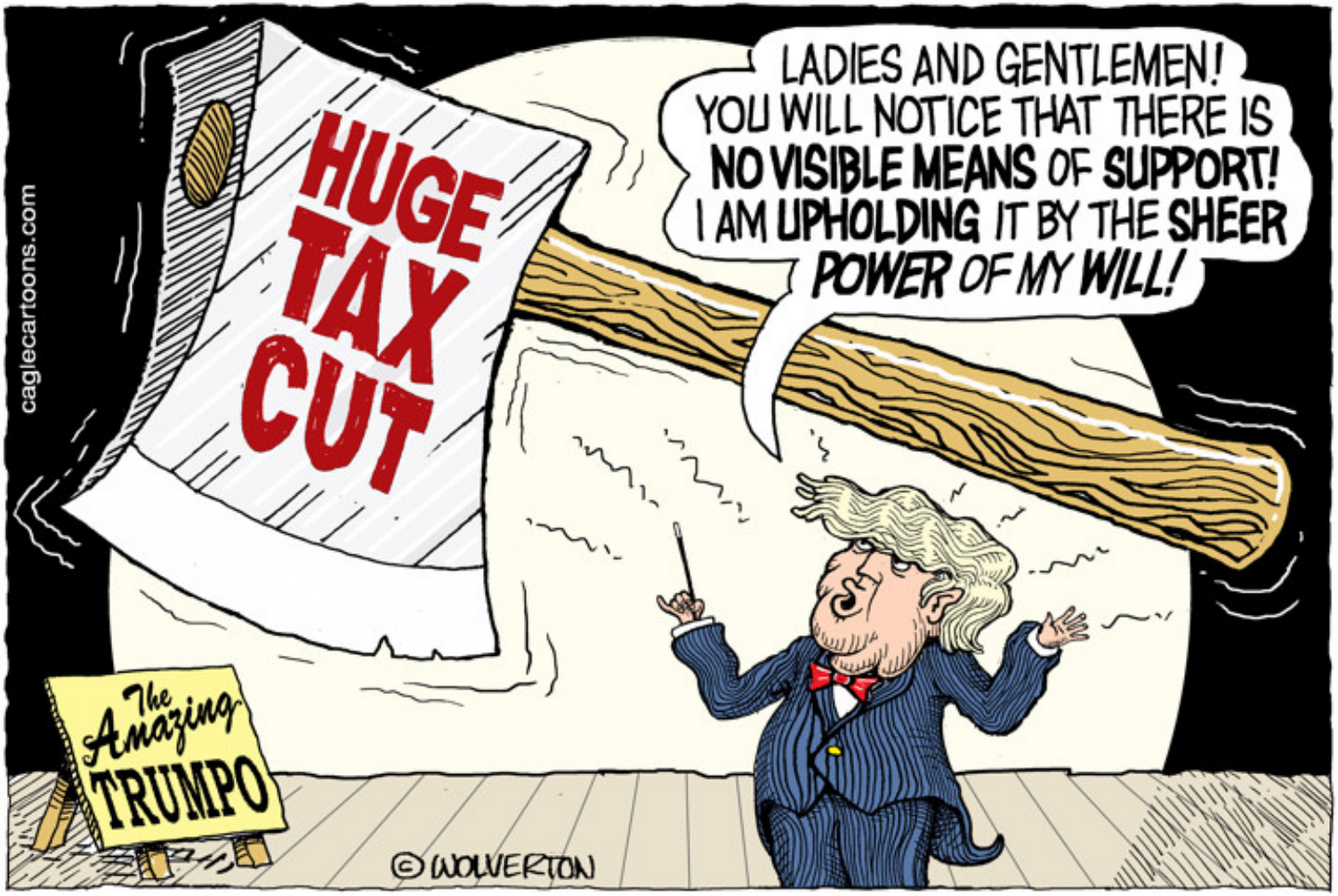
# Fiscal Policy Regimes

## Leeper (1991)

$$\tau_t - \tau = \varsigma_b(b^{\infty}_{t-1} - b^{\infty}) + \varsigma_g(g_{yt} - g_y) + \varsigma_y(y_t - y),$$

- Passive fiscal policies: $\varsigma_b > 0$
  normal times, stabilize government bond
- Active fiscal policies: $\varsigma_b = 0$
  wars or big recessions (Korean War, Vietnam War), stabilize price

# Fiscal Regimes



# Government budget constraint

$$\underbrace{G_t - T_t}_{\text{real deficit}} = \frac{\tilde{B}_t - \overbrace{R_t^B \tilde{B}_{t-1}}^{\text{existing nominal liability}}}{P_t}$$

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$$\Rightarrow g_t - \tau_t = \frac{\tilde{b}_t}{Y_t} - \frac{R_t^B}{\Pi_t} \frac{\tilde{b}_{t-1}}{Y_{t-1}} \frac{Y_{t-1}}{Y_t}$$

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- Passive fiscal policy: $\frac{\tilde{b}_{t-1}}{Y_{t-1}} \uparrow \Rightarrow \tau_t \uparrow \Rightarrow$ BC balances again, nothing else changes

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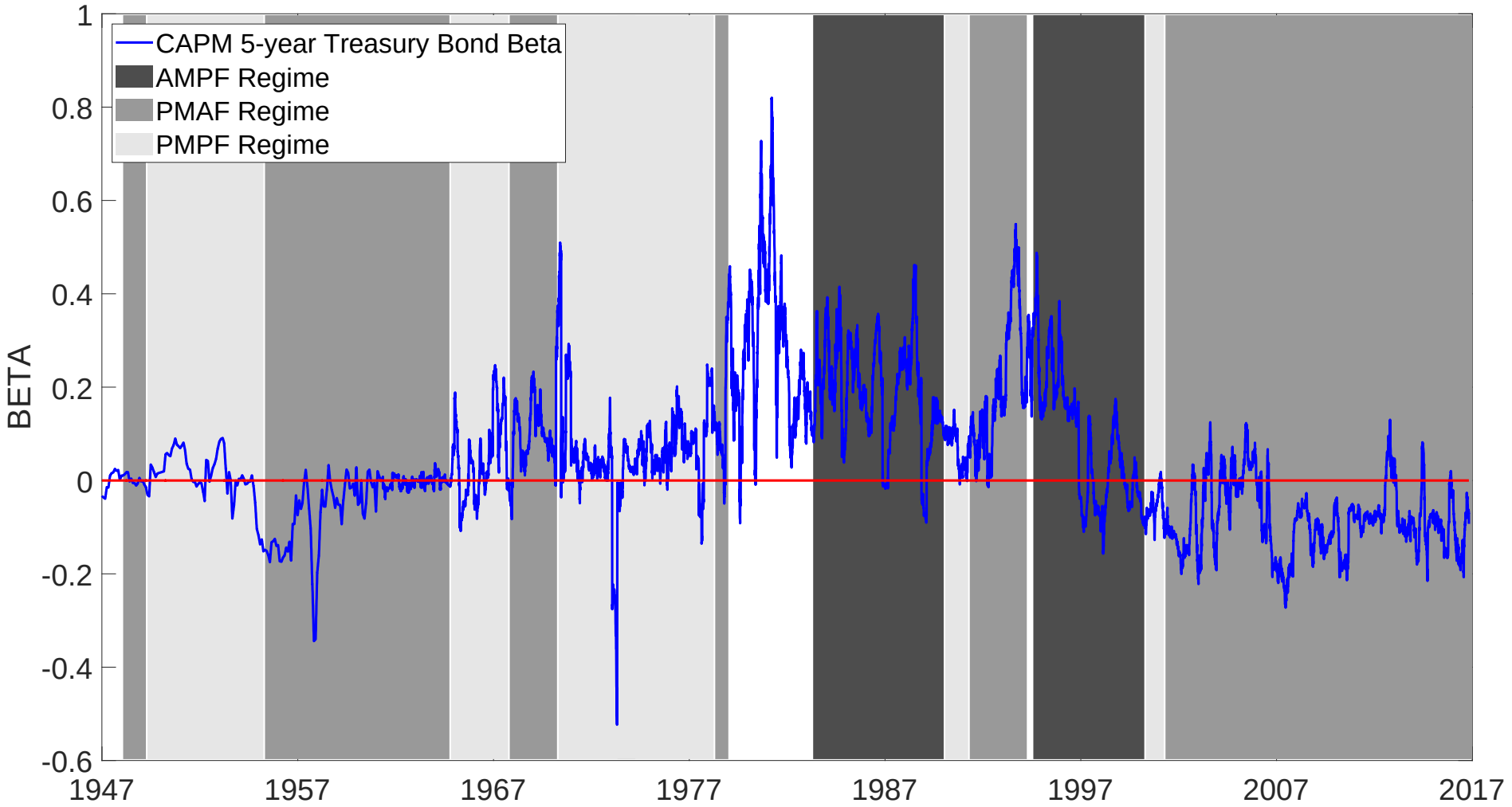
- Passive fiscal policy: $\frac{\tilde{b}_{t-1}}{Y_{t-1}} \uparrow \Rightarrow \tau_t \uparrow \Rightarrow$ BC balances again, nothing else changes
- Active fiscal policy: $\frac{\tilde{b}_{t-1}}{Y_{t-1}} \uparrow \Rightarrow \tau_t$ does not change $\Rightarrow \Pi_t$ has to $\uparrow$ to offset the increase in liability $\Rightarrow$ BC balances again due to inflation

# Beta of 5-Year Treasury Bond



# Outline

# Main Features of the Model

A medium scale DSGE model with

- nominal rigidities
- recursive preferences
- monetary-fiscal policy regime switch
- 4 exogenous structural shocks
  - permanent technology shock (PT)
  - marginal efficiency of investment shock (MEI)
  - monetary policy shock (MP)
  - fiscal policy shock (FP)

▸ Monetary & fiscal policies ▸ Stock & bond returns

# Outline

# Variance Decomposition

Table: **Variance Decomposition (Business Cycle Frequency, in %)**

AMPF/PMAF/PMPF

| Variables | Shocks | | | |
|---|---|---|---|---|
| | PT | MEI | MP | FP |
| $R_s^c$ | 60.66 / 29.48 / 40.40 | 4.92 / 61.13 / 33.76 | 34.42 / 9.16 / 25.01 | 0.00 / 0.22 / 0.83 |
| $R_b^\$$ | 53.40 / 3.87 / 22.90 | 0.61 / 60.13 / 26.90 | 43.44 / 35.68 / 47.09 | 2.55 / 0.32 / 3.10 |

# Positive PT Shock

technology $\uparrow \rightarrow$

- consumption and output $\uparrow\uparrow$

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- consumption and output $\uparrow\uparrow$
- - AMPF regime

  $\rightarrow$ marginal cost of production $\downarrow \rightarrow$ inflation $\downarrow \xrightarrow{\text{AM},\phi_\pi>1}$ nominal interest rate $\downarrow\downarrow \rightarrow$ real interest rate $\downarrow \rightarrow$ consumption and output $\uparrow$

  $\Rightarrow$ consumption and output $\uparrow\uparrow\uparrow$

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  - PMAF regime

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- consumption and output $\uparrow\uparrow$
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  - PMPF regime

    $\rightarrow$ lies between the AMPF and PMAF regimes

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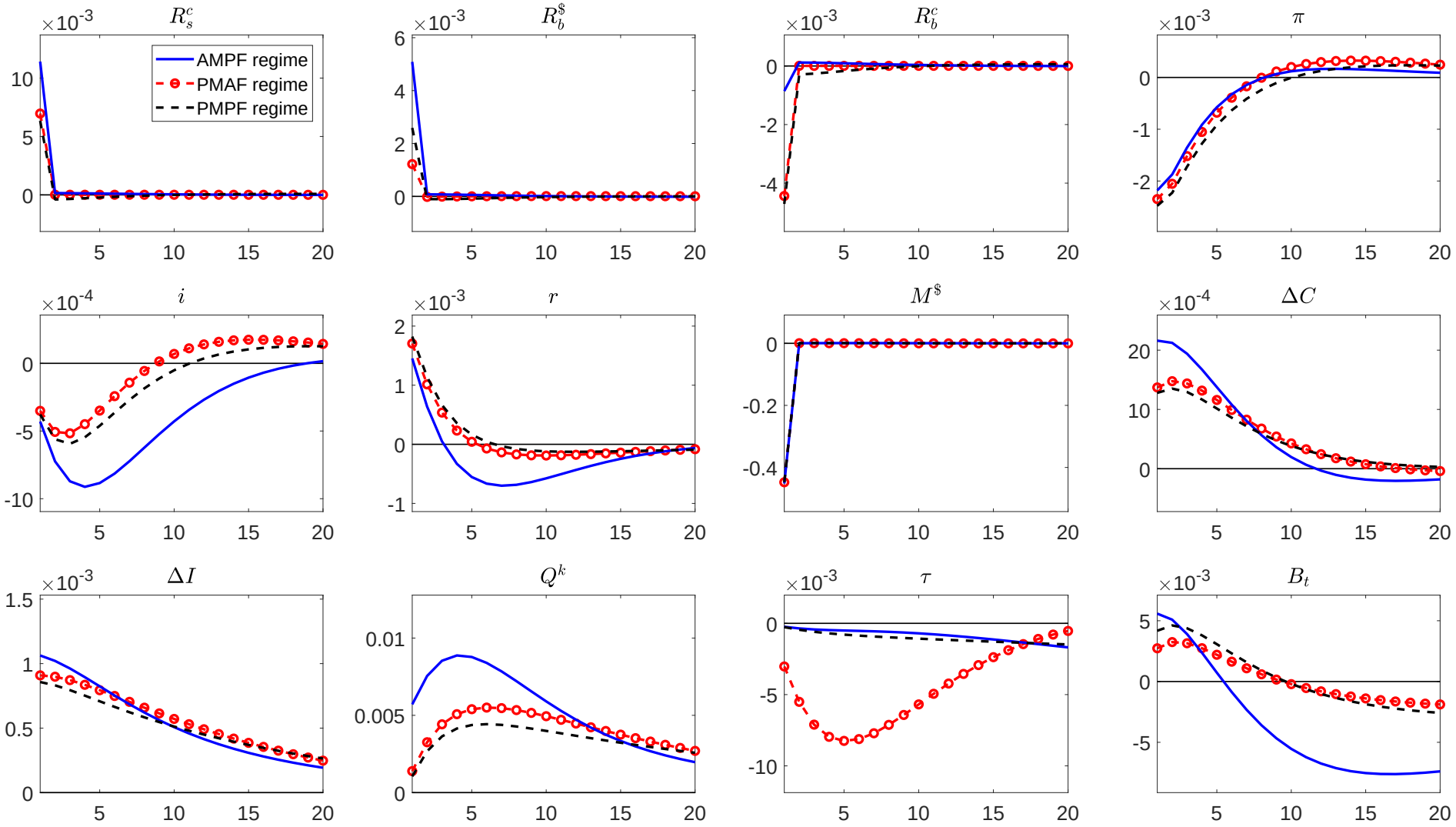

# Positive MEI Shock

- AMPF regime

  marginal efficiency of investment $\uparrow \rightarrow$ investment (demand) $\uparrow$ output $\uparrow \rightarrow$ labor, wage $\uparrow$ inflation $\uparrow \xrightarrow{\text{AM},\phi_\pi>1}$ nominal interest rate $\uparrow\uparrow \rightarrow$ long-term bond return $\downarrow$

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- PMAF regime

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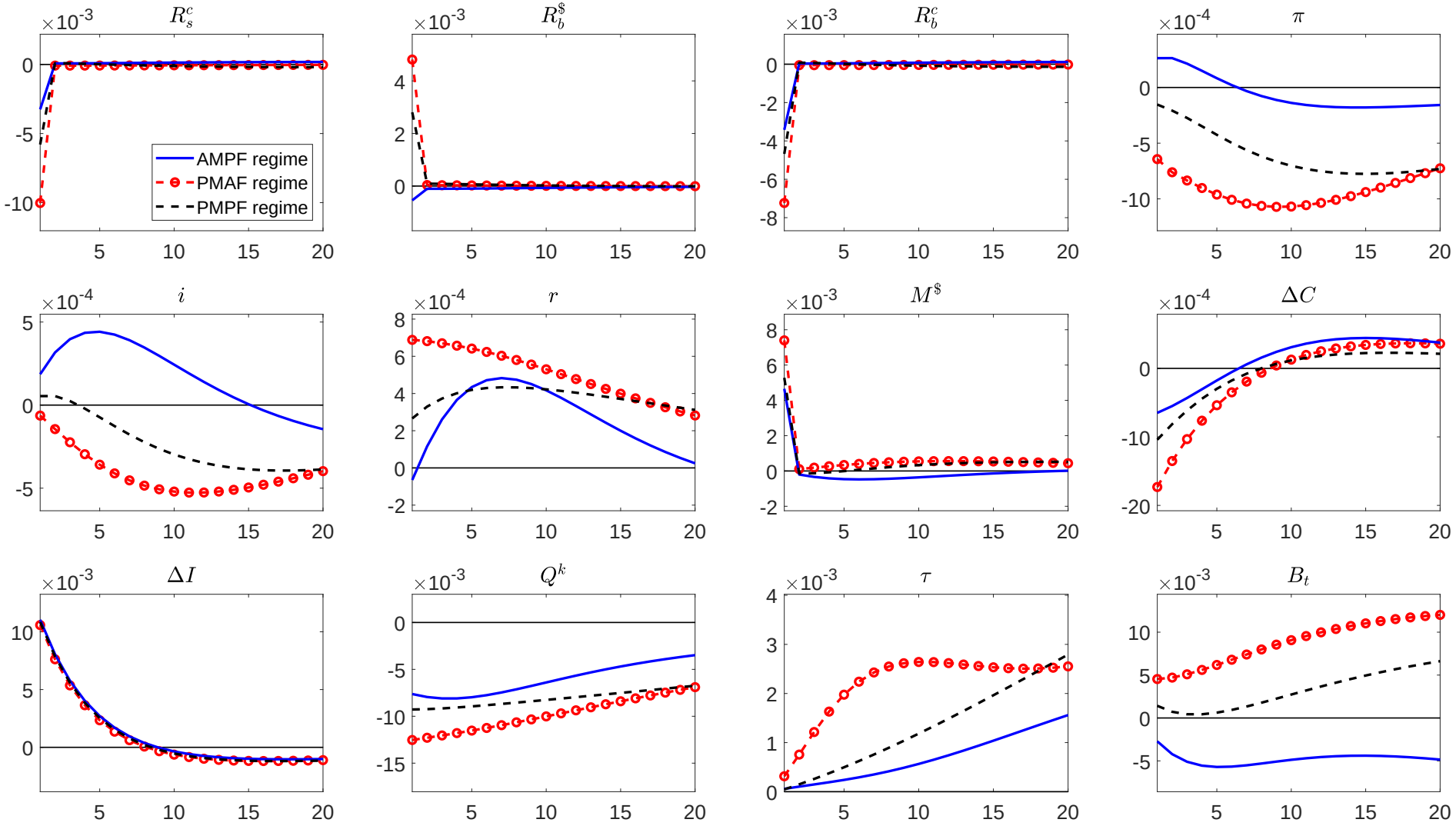


▸ correlation matrix

# Positive MP Shock

- Under ALL three regimes, policy rate $\uparrow \rightarrow$ depresses the economy $\rightarrow$

$$\begin{cases} \text{consumption} \downarrow \rightarrow \text{stock return} \downarrow \\ \text{long-term interest rate} \uparrow \rightarrow \text{long-term bond return} \downarrow \end{cases}$$

▸ More impulse responses

# Correlation Matrix

Table: **Bond-Stock Return Correlation — All Shocks**

AMPF/PMAF/PMPF

| Variables | $R_s^c$ | $R_b^\$$ | $R_b^c$ | $\pi$ | $\Delta C$ | $M$ |
|---|---|---|---|---|---|---|
| $R_s^c$ | 1.00 | 0.82 / -0.32 / 0.05 | 0.64 / 0.51 / 0.69 | -0.39 / -0.05 / 0.07 | 0.55 / 0.51 / 0.51 | -0.71 / -0.54 / -0.42 |
| $R_b^\$$ | | 1.00 | 0.42 / -0.47 / -0.22 | -0.36 / -0.15 / -0.18 | 0.47 / -0.16 / 0.00 | -0.71 / -0.19 / -0.40 |
| $R_b^c$ | | | 1.00 | 0.06 / 0.30 / 0.37 | 0.34 / 0.24 / 0.30 | 0.08 / 0.45 / 0.36 |
| $\pi$ | | | | 1.00 | -0.69 / -0.29 / -0.17 | 0.57 / 0.37 / 0.38 |
| $\Delta C$ | | | | | 1.00 | -0.40 / -0.30 / -0.28 |
| $M$ | | | | | | 1.00 |

# Correlation Matrix

Table: **Bond-Stock Return Correlation without the PT Shock**

AMPF/PMAF/PMPF

| Variables | $R_s^c$ | $R_b^\$$ | $R_b^c$ | $\pi$ | $\Delta C$ | $M$ |
|---|---|---|---|---|---|---|
| $R_s^c$ | 1.00 | 0.65 / -0.51 / -0.20 | 0.99 / 1.00 / 0.99 | 0.05 / 0.19 / 0.28 | 0.62 / 0.61 / 0.64 | -0.89 / -0.90 / -0.91 |
| $R_b^\$$ | | 1.00 | 0.69 / -0.44 / -0.14 | 0.19 / -0.10 / -0.07 | 0.42 / -0.31 / -0.12 | -0.64 / 0.37 / 0.07 |
| $R_b^c$ | | | 1.00 | 0.05 / 0.18 / 0.27 | 0.62 / 0.61 / 0.64 | -0.92 / -0.92 / -0.93 |
| $\pi$ | | | | 1.00 | -0.09 / 0.11 / 0.32 | 0.12 / 0.14 / 0.00 |
| $\Delta C$ | | | | | 1.00 | -0.50 / -0.49 / -0.52 |
| $M$ | | | | | | 1.00 |

# Correlation Matrix

Table: **Bond-Stock Return Correlation without the MEI Shock**

AMPF/PMAF/PMPF

| Variables | $R_s^c$ | $R_b^\$$ | $R_b^c$ | $\pi$ | $\Delta C$ | $M$ |
|---|---|---|---|---|---|---|
| $R_s^c$ | 1.00 | 0.97 / 0.70 / 0.77 | 0.52 / -0.33 / 0.21 | -0.42 / -0.49 / -0.20 | 0.56 / 0.44 / 0.42 | -0.79 / -0.86 / -0.67 |
| $R_b^\$$ | | 1.00 | 0.55 / 0.32 / 0.19 | -0.39 / -0.15 / -0.23 | 0.55 / 0.29 / 0.31 | -0.73 / -0.32 / -0.53 |
| $R_b^c$ | | | 1.00 | 0.16 / 0.48 / 0.49 | 0.29 / -0.15 / -0.02 | 0.12 / 0.76 / 0.58 |
| $\pi$ | | | | 1.00 | -0.73 / -0.73 / -0.59 | 0.61 / 0.59 / 0.55 |
| $\Delta C$ | | | | | 1.00 | -0.44 / -0.38 / -0.37 |
| $M$ | | | | | | 1.00 |

# Outline

# Robustness

Our results hold for

- Effective lower bound regime:

$$\phi_\pi,\ \phi_y \to 0$$

- Constant relative risk aversion (CRRA) preference

$$M_{t,t+1} = \beta_t \frac{U'(C_{t+1})}{U'(C_t)}$$

- No habit formation

$$C_{h,t} = C_t - b\bar{C}_{t-1}, \quad b = 0$$

▸ Appendix

# Conclusion

- Monetary-fiscal policy regime matters:
  - PT shock dominates in determining the return dynamics under AMPF, and leads to positive $\beta$ for nominal long-term Treasury bonds
  - MEI shock dominates in determining the return dynamics under PMAF, and leads to negative $\beta$ for nominal long-term Treasury bonds
  - PT and MP shocks dominate the MEI shock in determining the return dynamics under PMPF, and leads to slightly positive $\beta$ for nominal long-term Treasury bonds

# Policies

- Monetary policy:

$$R_t = R_{t-1}^{\phi_{R,s}} \left[ R \left( \frac{\Pi_t}{\Pi_t^*} \right)^{\phi_{\pi,s}} \left( \frac{Y_t}{Y_{t-1} \exp(\mu^{z^+})} \right)^{\phi_y,s} \right]^{1-\phi_{R,s}} \epsilon_{R,t}^{\sigma_{R,t}}$$

- Fiscal policy:

$$\tilde{\tau}_t = \phi_{\tau,s} \tilde{\tau}_{t-1} + (1 - \phi_{\tau,s}) \left[ \varsigma_{b,s} \tilde{b}_{t-1}^{\infty} + \varsigma_{g,s} \tilde{g}_{yt} + \varsigma_{y,s} \hat{y}_t \right] + \sigma_\tau e_{\tau,t}$$

  where $\tilde{\tau}_t \equiv T_t/Y_t - T/Y$

- constant government-spending-to-GDP ratio
- Government budget constraint:

$$\frac{Q_t^{\infty} B_t^{\infty}}{P_t} = R_t^B \frac{Q_{t-1}^{\infty} B_{t-1}^{\infty}}{P_t} + G_t - T_t$$

# Monetary/Fiscal Policy Mix

- AMPF regime: $\phi_\pi > 1$ and $\varsigma_b > \beta^{-1} - 1$
- PMAF regime: $\phi_\pi < 1$ and $\varsigma_b < \beta^{-1} - 1$
- PMPF regime: $\phi_\pi < 1$ and $\varsigma_b > \beta^{-1} - 1$

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# Stock Returns

- Stock price: $S_t^c = P_t C_t^\lambda + \mathbb{E}_t \left[ M_{t,t+1}^{\$} S_{t+1}^c \right]$
- Excess stock return: $R_{s,t}^c = \frac{S_t^c}{S_{t-1}^c - P_{t-1} C_{t-1}^\lambda} - R_{t-1}$

# Long-term Government Bond

$$
\begin{aligned}
Q_t^{\infty} &= \mathbb{E}_t\left[\sum_{s=1}^{\infty} M_{t,t+s}^{\$}\rho^{s-1}\right] = \mathbb{E}_t\left[M_{t,t+1}^{\$}\left(1+\rho Q_{t+1}^{\infty}\right)\right] \\
R_t^B &= \frac{1+\rho Q_t^{\infty}}{Q_{t-1}^{\infty}}
\end{aligned}
$$

- $B_t^{\infty}$: amount issued at $t$, infinity coupon payments, starting from $t+1$ with \$1 and decaying every period at rate $\rho$
- yield: $\frac{1}{Q_t^{\infty}} - (1-\rho)$
- effective duration (5 years): $\frac{1}{1-\rho/(1+y_d)}$

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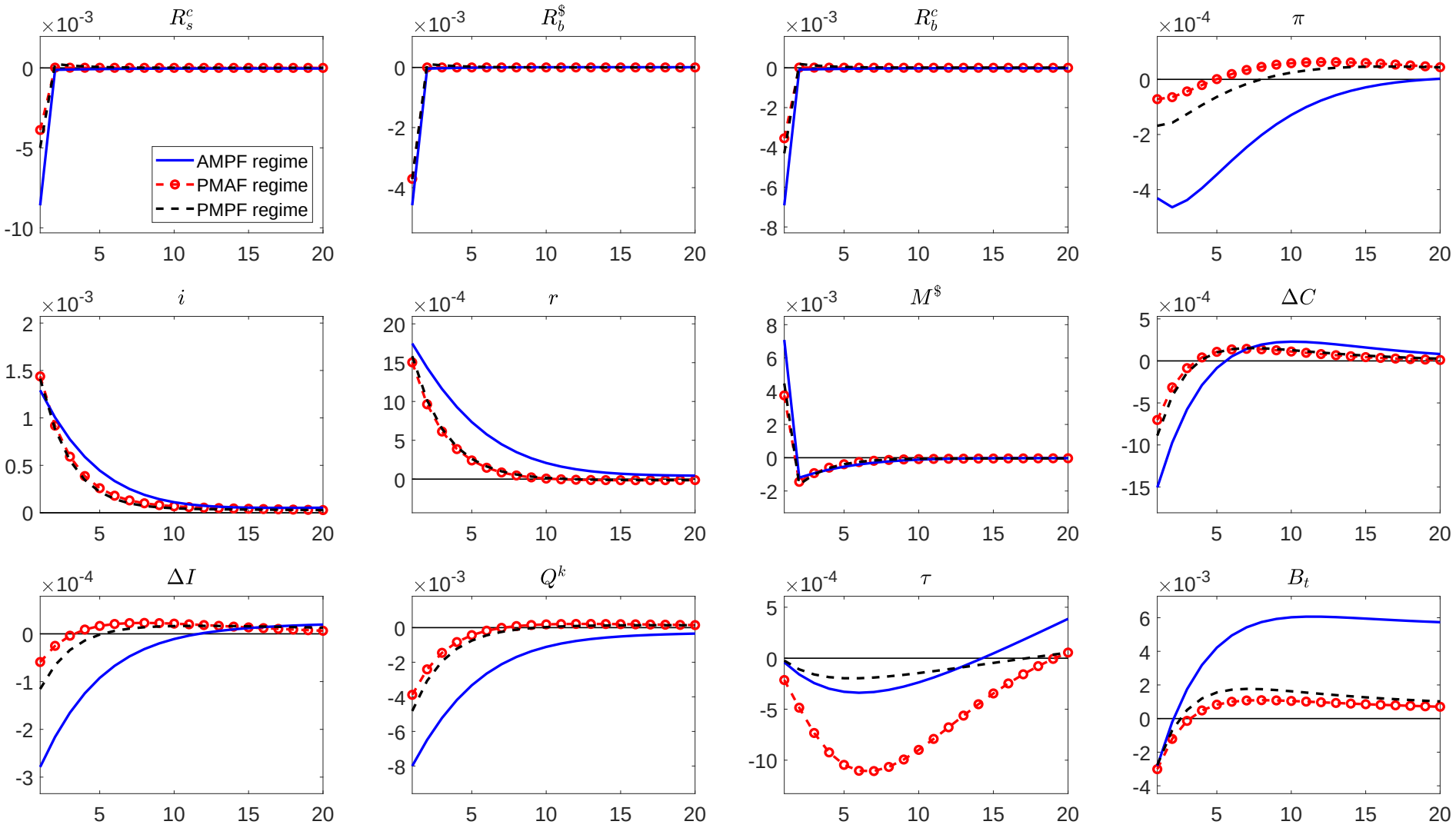
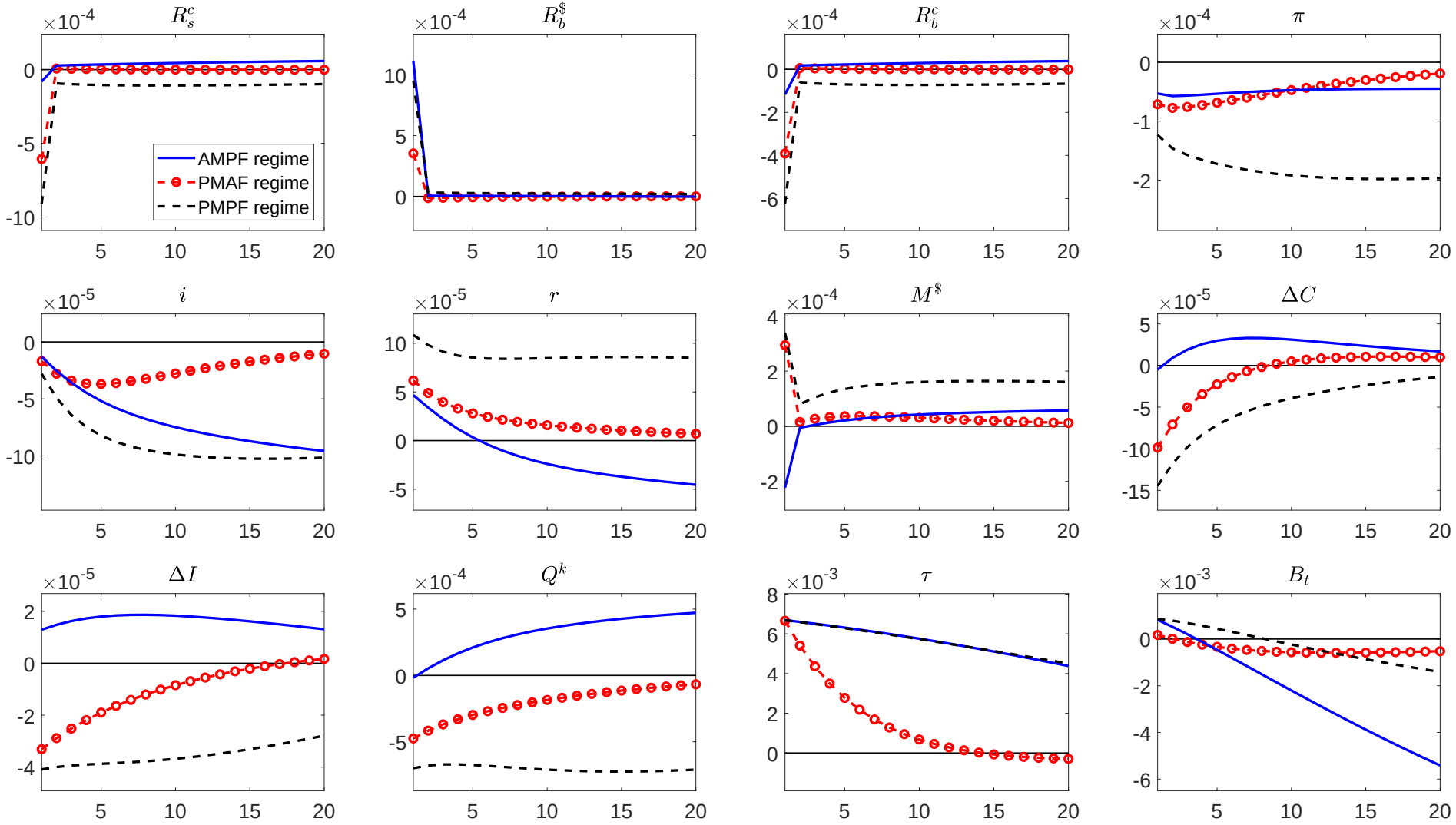
# Positive MP Shock



# Positive FP Shock

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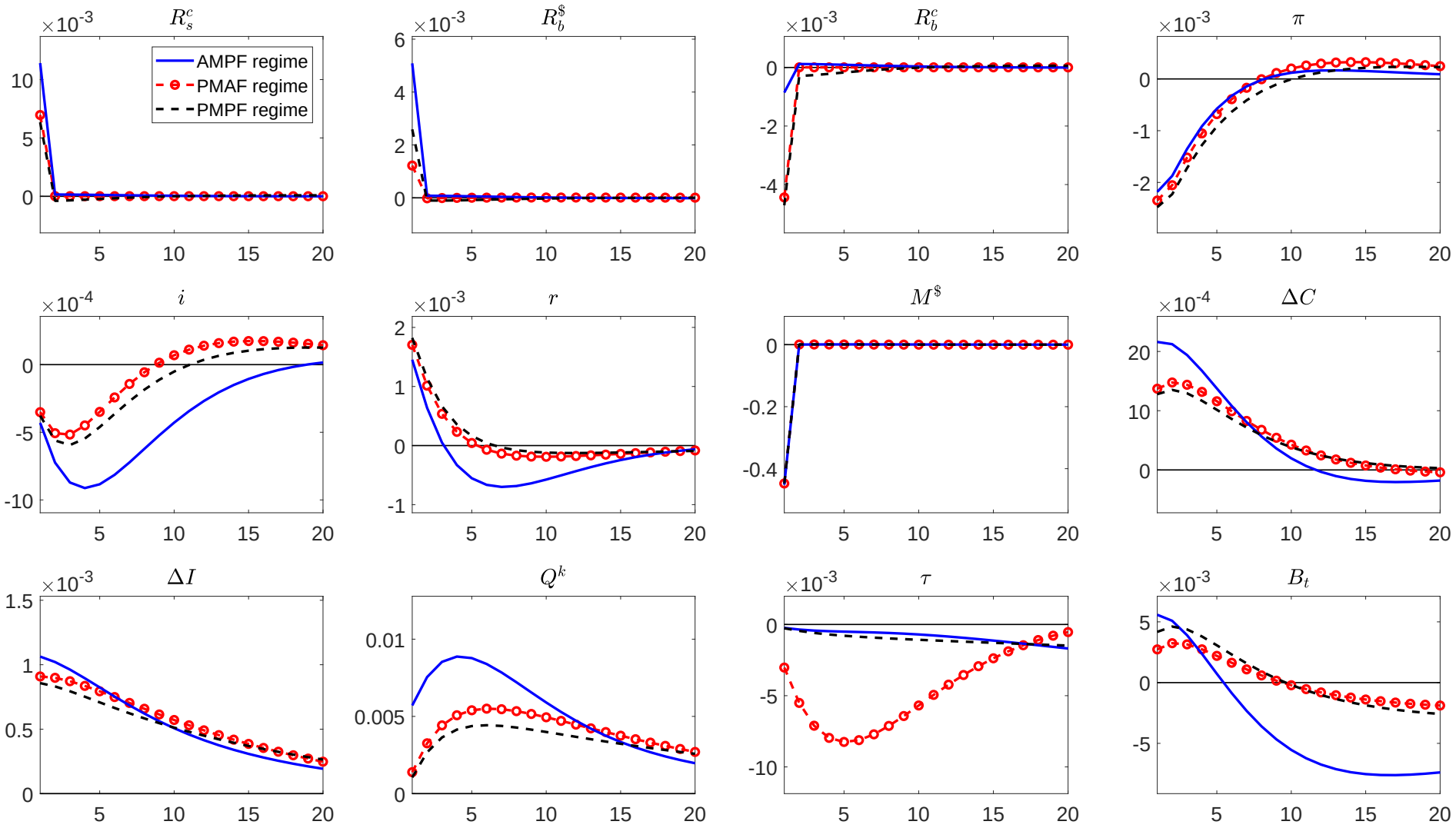
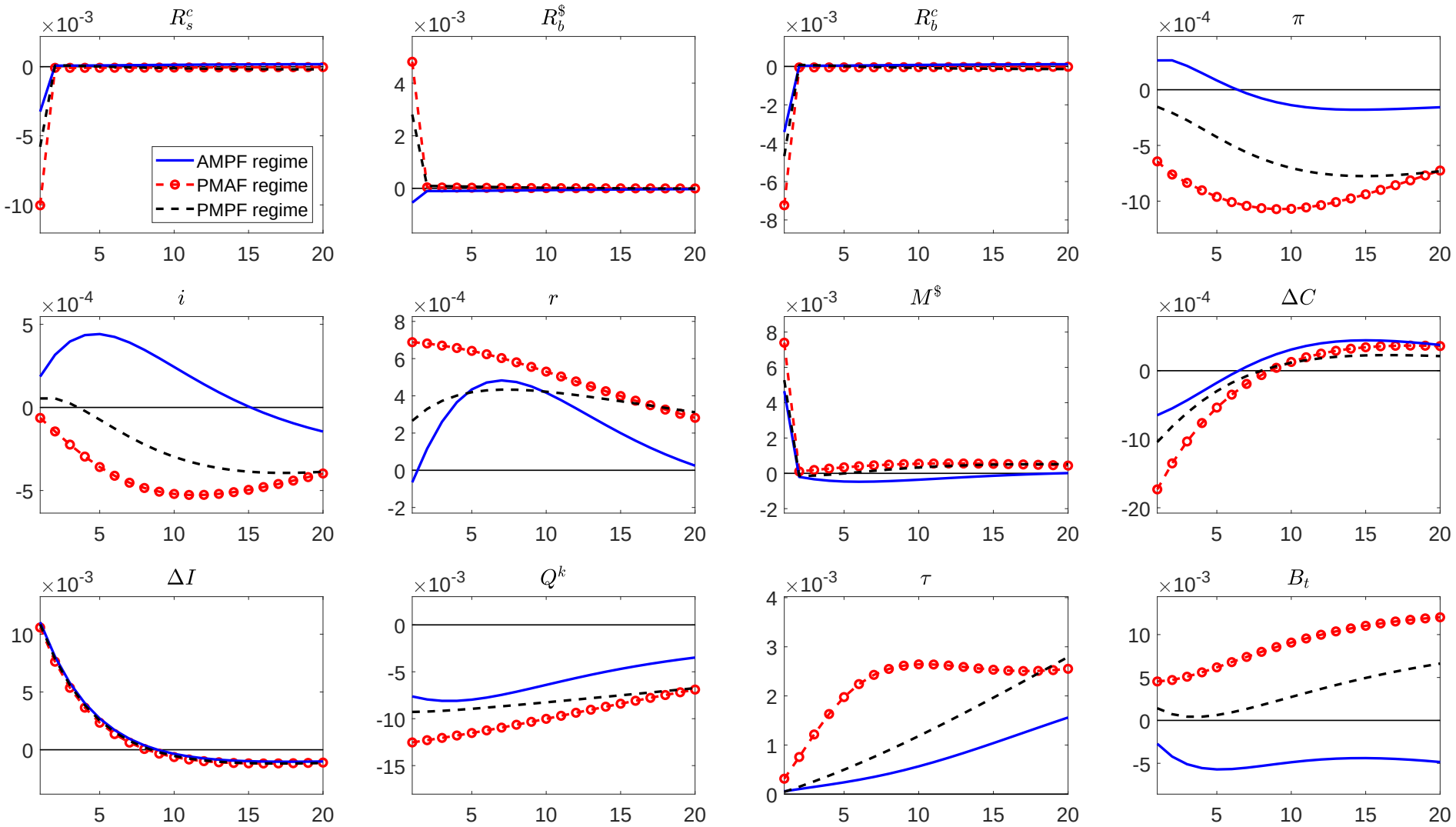
# Positive PT Shock — CRRA



# Positive MEI Shock — CRRA



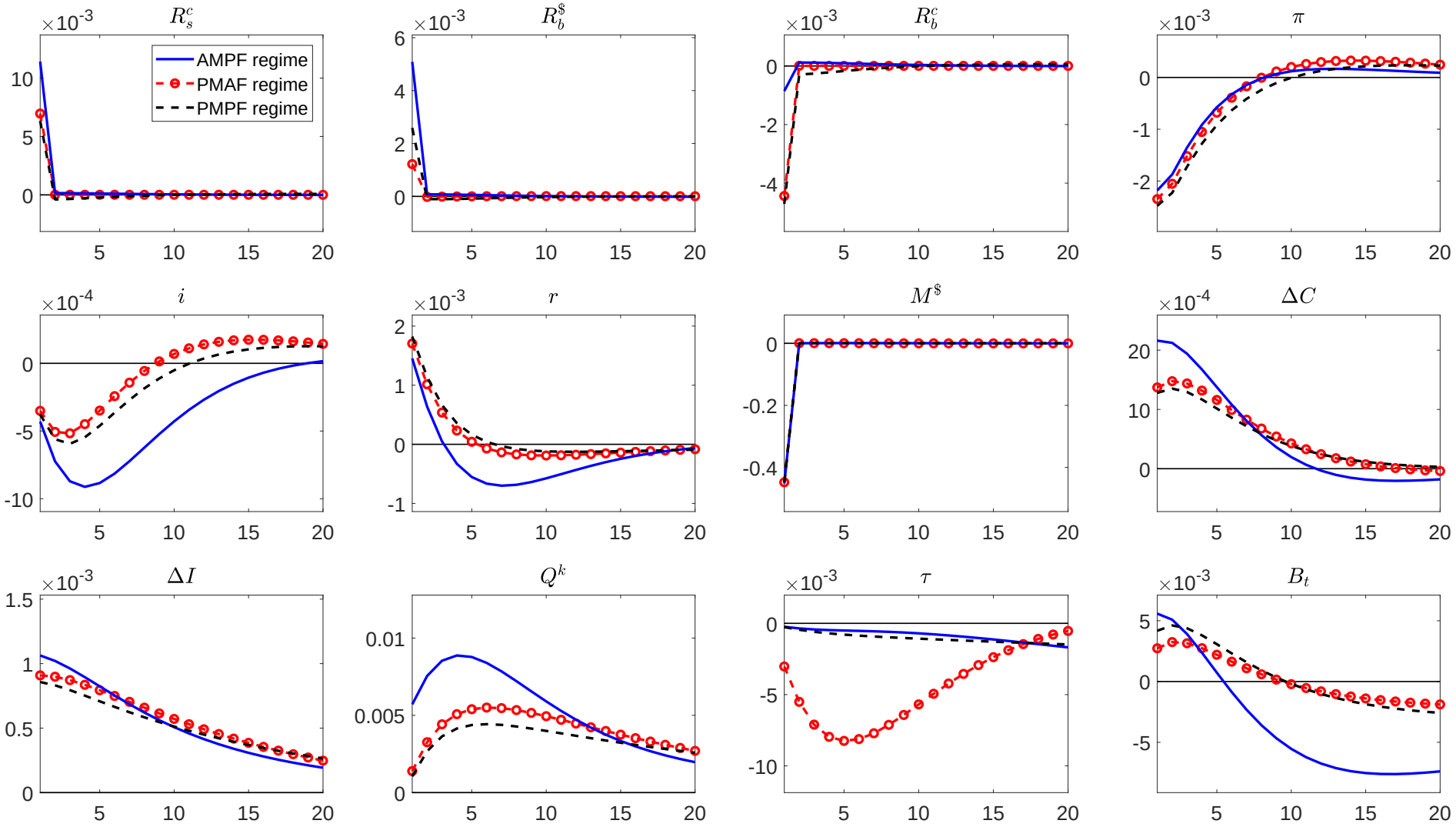
# Correlation Matrix

Table: **Bond-Stock Return Correlation — CRRA**

AMPF/PMAF/PMPF

| Variables | $R_s^c$ | $R_b^\$$ | $R_b^c$ | $\pi$ | $\Delta C$ | $M$ |
|---|---|---|---|---|---|---|
| $R_s^c$ | 1.00 | 0.82 / -0.32 / 0.07 | 0.63 / 0.50 / 0.67 | -0.40 / -0.06 / 0.06 | 0.55 / 0.51 / 0.51 | -0.71 / -0.54 / -0.44 |
| $R_b^\$$ | | 1.00 | 0.42 / -0.47 / -0.21 | -0.36 / -0.15 / -0.17 | 0.47 / -0.15 / 0.02 | -0.71 / -0.19 / -0.41 |
| $R_b^c$ | | | 1.00 | 0.06 / 0.30 / 0.37 | 0.35 / 0.24 / 0.30 | 0.09 / 0.46 / 0.36 |
| $\pi$ | | | | 1.00 | -0.69 / -0.30 / -0.18 | 0.57 / 0.37 / 0.38 |
| $\Delta C$ | | | | | 1.00 | -0.39 / -0.29 / -0.29 |
| $M$ | | | | | | 1.00 |

# Positive PT Shock — No Habit



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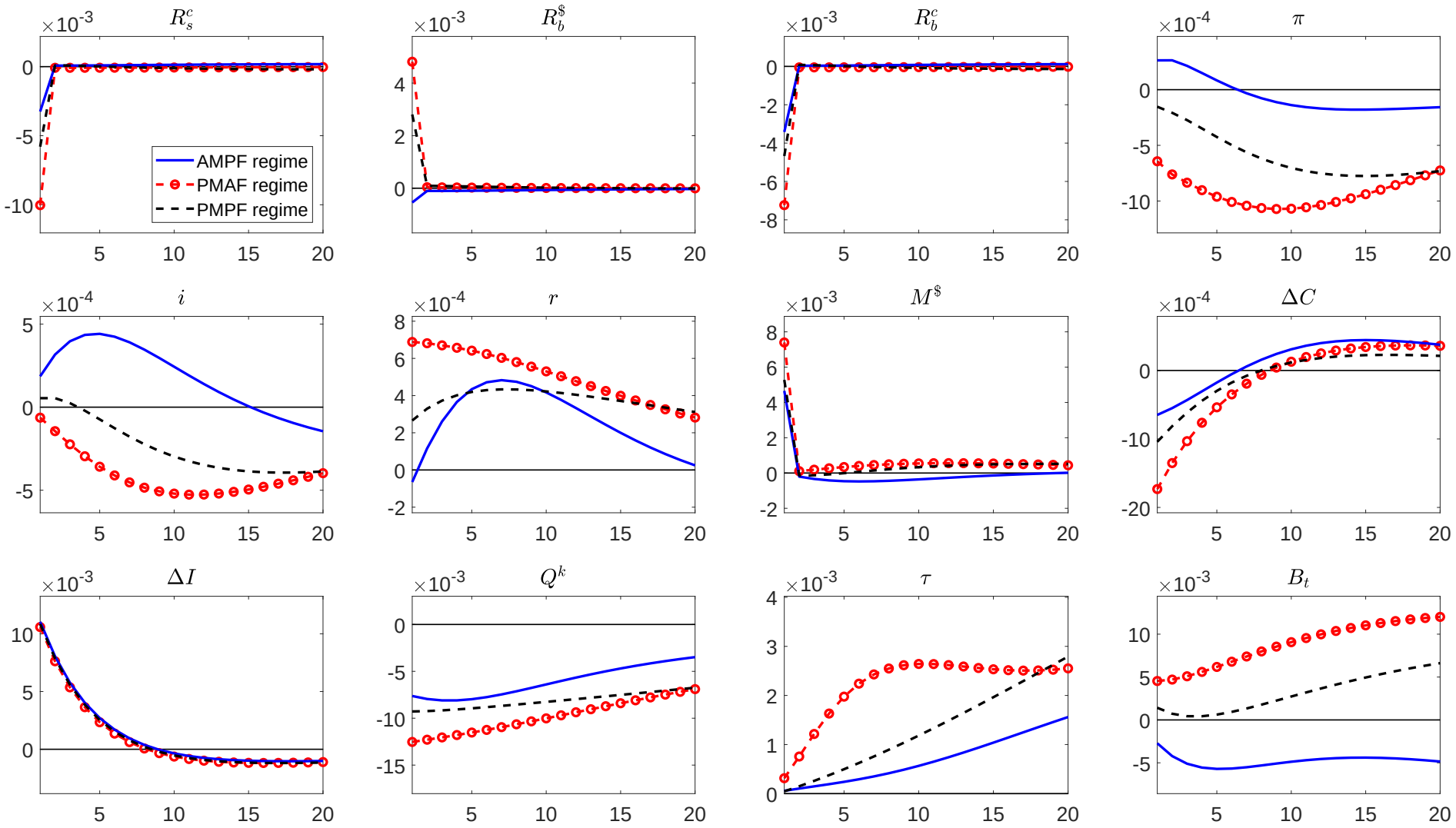

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| $R_b^\$$ | | 1.00 | 0.42 / -0.47 / -0.22 | -0.37 / -0.15 / -0.18 | 0.47 / -0.15 / 0.01 | -0.71 / -0.19 / -0.41 |
| $R_b^c$ | | | 1.00 | 0.06 / 0.30 / 0.37 | 0.35 / 0.24 / 0.30 | 0.09 / 0.45 / 0.36 |
| $\pi$ | | | | 1.00 | -0.69 / -0.29 / -0.17 | 0.57 / 0.37 / 0.39 |
| $\Delta C$ | | | | | 1.00 | -0.39 / -0.29 / -0.29 |
| $M$ | | | | | | 1.00 |

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