

Fiscal Policy and the Monetary Transmission Mechanism

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Revisiting the Monetary Transmission Mechanism

How does monetary policy transmit to the real economy?

Does the central bank have the **tools to control inflation**?

What role does **fiscal policy** play?

This paper: study these questions in the workhorse New Keynesian model.

- **Channels:** Intertemporal substitution and wealth effect.
 - Wealth effect **quantitatively important**, even in RANK and transitory shock.
- Wealth effect tightly connected to fiscal variables.
 - Wealth effect negative iff fiscal policy contractionary.
- Control of inflation highly dependent on wealth effect and **fiscal backing**.
 - Inflation decreases only if fiscal policy contractionary.
- Relevance of **monetary-fiscal coordination** depends on slope of Phillips curve.

The Model

Standard RANK model **augmented with fiscal variables**.

Four equations: *households' intertemporal Euler equation*

$$c_t = c_{t+1} - \sigma^{-1}(i_t - \pi_{t+1} - r_n),$$

New Keynesian Phillips curve

$$\pi_t = \beta\pi_{t+1} + \kappa c_t,$$

households' intertemporal budget constraint

$$\sum_{t=0}^{\infty} \beta^t c_t = \sum_{t=0}^{\infty} \beta^t [(1 - \tau)y_t + (i_t - \pi_{t+1} - r_n) Qb + T_t] - \left(q_0 + \frac{1}{\beta} \pi_0 \right) Qb,$$

where $q_0 \equiv \sum_{t=0}^{\infty} (\beta\rho)^t (i_t - r_n) \rho$, and *resource constraint*

$$c_t = y_t.$$

Policy rules

Characterize equilibrium output and inflation for **given paths** of $\{i_t, T_t\}_{t=0}^{\infty}$.

Consistent with **any** monetary-fiscal interactions.

- **Taylor equilibrium** and **Fiscal Theory of the Price Level (FTPL)** special cases.

Given paths of policy variables \rightarrow find rules that implement them.

But only certain paths consistent with specific rules.

- E.g., standard Taylor equilibrium imposes particular restrictions.

Equilibrium

System of difference equations: Euler + Phillips curve ($\{i_t\}_{t=0}^{\infty}$ given)

Eigenvalues: $\bar{\lambda} > 1$ and $\underline{\lambda} < 1$.

Missing one terminal condition to determine equilibrium.

Our choice: [wealth effect](#).

$$\Omega_0 \equiv (1 - \beta) \left[\sum_{t=0}^{\infty} \beta^t [(1 - \tau) y_t + (i_t - \pi_{t+1} - r_n) Qb + T_t] - \left(q_0 + \frac{1}{\beta} \pi_0 \right) Qb \right]$$

Note that $(1 - \beta) \sum_{t=0}^{\infty} \beta^t c_t = \Omega_0$.

Consumption Decomposition in General Equilibrium

Proposition

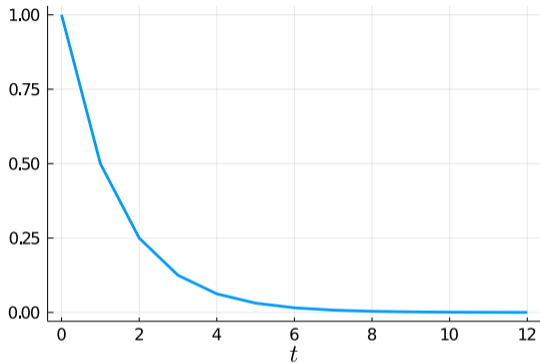
Given $\{i_t\}_{t=0}^{\infty}$, all bounded solutions of NK system generate a path of consumption given by

$$c_t = \underbrace{c_t^S}_{ISE} + \underbrace{\frac{1 - \beta\lambda}{1 - \beta} \lambda^t}_{GE \text{ multiplier}} \times \underbrace{\Omega_0}_{WE}$$

where $\{c_t^S\}_{t=0}^{\infty}$ is uniquely determined by $\{i_t\}_{t=0}^{\infty}$ and satisfies

$$\sum_{t=0}^{\infty} \beta^t c_t^S = 0.$$

Panel A: Nominal interest rate



Panel B: Consumption decomposition

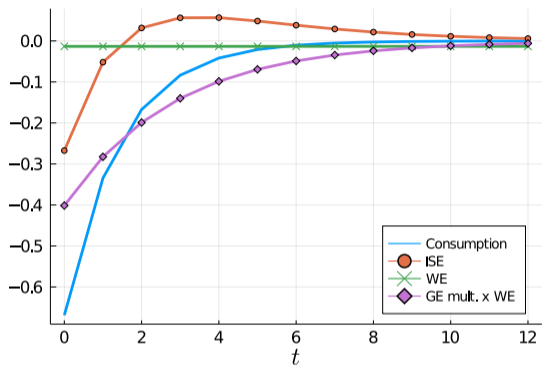


Figure: Decomposition of the consumption response to a nominal interest rate change

The Taylor Equilibrium

Proposition

Suppose that $\{i_t\}_{t=0}^{\infty}$ was generated by a Taylor rule and $\varepsilon_t = \mathcal{O}(\psi^t)$, where $\psi < \underline{\lambda}$. Then, the equilibrium path of consumption is the *unique purely forward-looking solution* of the NK system. The wealth effect is

$$\Omega_0^{Taylor} = -(1 - \beta) \frac{\sigma^{-1}}{\bar{\lambda} - \underline{\lambda}} \sum_{s=0}^{\infty} \left(\frac{\bar{\lambda}}{\underline{\lambda}^s} - \frac{\underline{\lambda}}{\bar{\lambda}^s} \right) \left(i_s^{Taylor} - r_n \right).$$

If $\varepsilon_t = \psi \varepsilon_{t-1}$ with $\psi \in (0, \underline{\lambda})$ and ε_0 given, then

$$i_t^{Taylor} = r_n + \psi^t \nu \varepsilon_0,$$

with $\nu > 0$.

Inflation

Proposition

In the bounded solutions of the NK system, inflation is given by

$$\pi_t = \pi_t^S + \frac{\kappa}{1 - \beta} \lambda^t \Omega_0,$$

where $\{\pi_t^S\}_{t=0}^\infty$ is uniquely determined by $\{i_t\}_{t=0}^\infty$. In $t = 0$,

$$\pi_0 = \frac{\kappa}{1 - \beta} \Omega_0.$$

New insight: In any solution of RANK, π_0 proportional to wealth effect.

NKPC forward looking: inflation depends on **future** rather than **current** consumption.

Moreover, π_t^S has Neo-Fisherian properties:

$$\frac{\partial \pi_t^S}{\partial i_s} > 0.$$

Consumption, Inflation and Ω_0

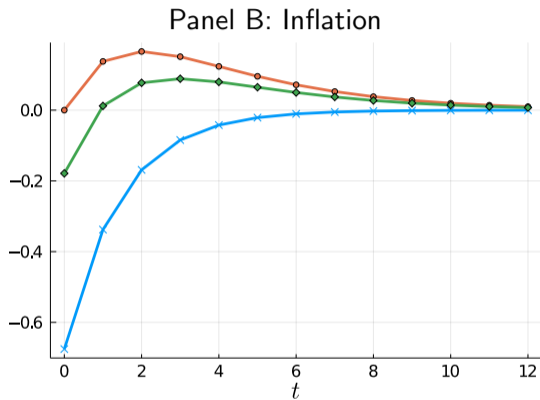
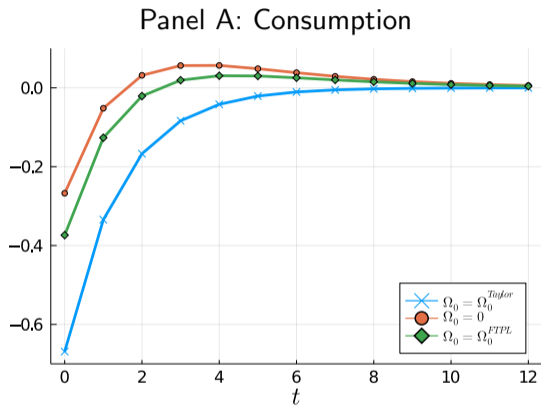


Figure: Consumption and inflation response to a nominal interest rate change

How is the **wealth effect** determined?

The Fiscal Determination of the Wealth Effect

Recall that

$$\Omega_0 = (1 - \beta) \left[\sum_{t=0}^{\infty} \beta^t [(1 - \tau) y_t + (i_t - \pi_{t+1} - r_n) Qb + T_t] - \left(q_0 + \frac{1}{\beta} \pi_0 \right) Qb \right]$$

Spending-income spiral and **spending-inflation spiral**:

$$(1 - \beta) \sum_{t=0}^{\infty} \beta^t y_t = \Omega_0 \quad \text{and} \quad \pi_t = \pi_t^S + \frac{\kappa}{1 - \beta} \lambda^t \Omega_0.$$

Proposition (The Fiscal Keynesian Cross)

Suppose $\tau > 0$ or $b > 0$ (or both). Then

$$\Omega_0 = \frac{1 - \beta}{\tau + \left(\frac{1}{\beta} + \frac{1}{1 - \beta \lambda} \right) \kappa Qb} \left[\sum_{t=0}^{\infty} \beta^t (\lambda^{t+1} - \rho^{t+1}) (i_t - r_n) Qb + \sum_{t=0}^{\infty} \beta^t T_t \right].$$

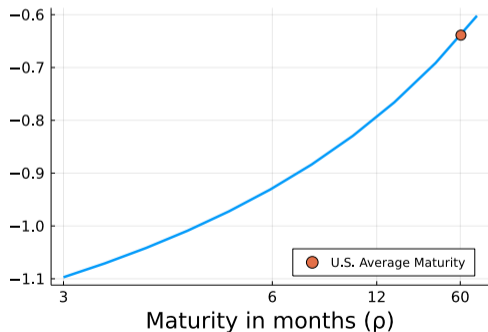
Incorporating **fiscal variables** is crucial to get the magnitude of the **wealth effect**.

Fiscal Backing and the Wealth Effect

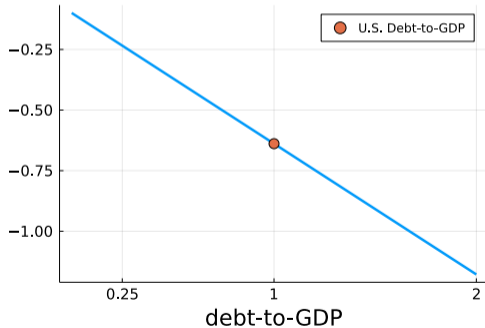
Fiscal Keynesian Cross recovers fiscal backing necessary to *sustain* equilibrium:

$$\sum_{t=0}^{\infty} \beta^t T_t = \frac{\tau + \left(\frac{1}{\beta} + \frac{1}{1-\beta\lambda} \right) \kappa Qb}{1-\beta} \Omega_0 - \sum_{t=0}^{\infty} \beta^t (\underline{\lambda}^{t+1} - \rho^{t+1}) (i_t - r_n) Qb$$

Panel A: Transfers and debt maturity



Panel B: Transfers and level of debt



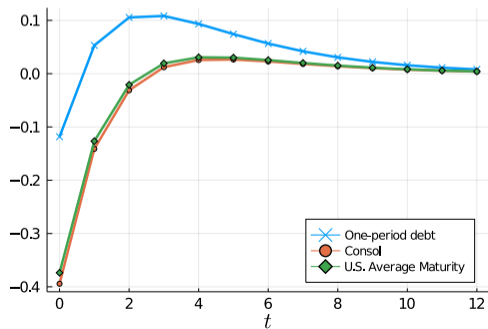
Wealth Effect in the FTPL

Proposition

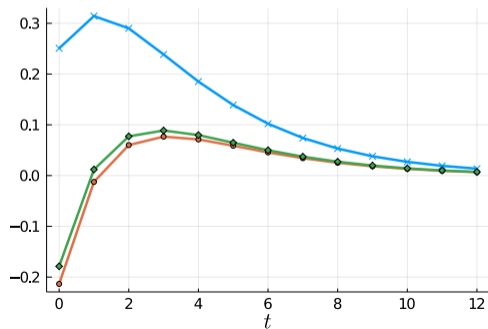
Suppose $b > 0$ and $\sum_{t=0}^{\infty} \beta^t s_t = 0$. Then,

$$\frac{\partial \Omega_0}{\partial i_t} < 0 \iff \rho > \underline{\lambda}.$$

Panel A: Consumption



Panel B: Inflation



Wealth Effect and price stickiness

Importance of WE depends on κ

→ importance of monetary-fiscal coordination depends on κ

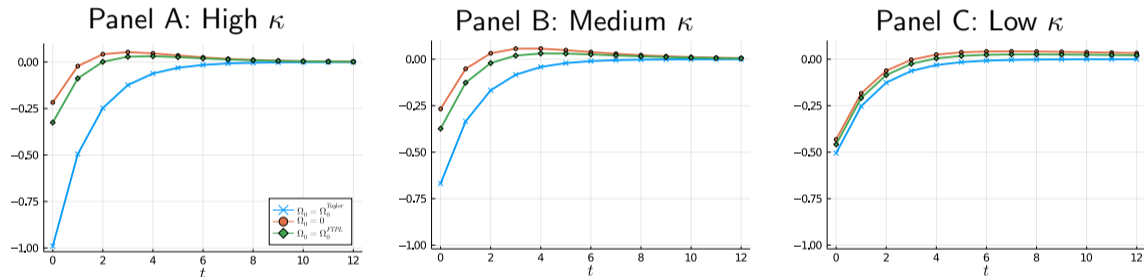


Figure: Consumption response to a monetary shock for various values of κ and Ω_0

Inflation

In the paper: All results extend to RANK with capital.

Fiscal Policy in a Liquidity Trap

Assume

$$r_{nt} = \begin{cases} -r_n & t \leq T, \\ r_n & t > T \end{cases}$$

and

$$i_t = \begin{cases} 0 & t \leq T^*, \\ r_n & t > T^* \end{cases}$$

Standard Liquidity Trap Equilibrium (SLTE): $c_t = \pi_t = 0$ and $i_t = r_n \forall t \geq T^* + 1$.

Liquidity Trap Equilibrium I: SLTE

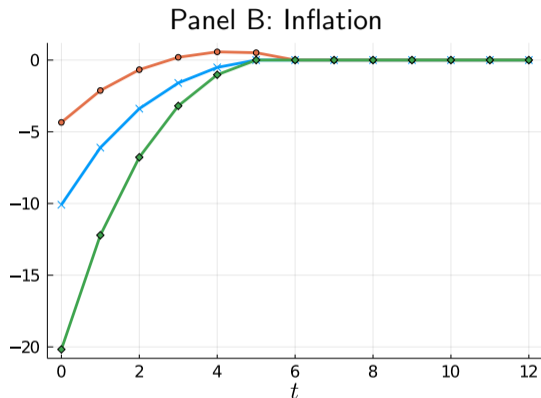
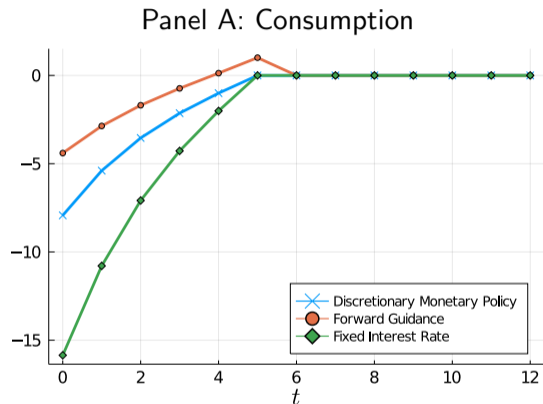


Figure: Consumption and inflation response in a liquidity trap in the SLTE.

Liquidity Trap Equilibrium II: FTPL

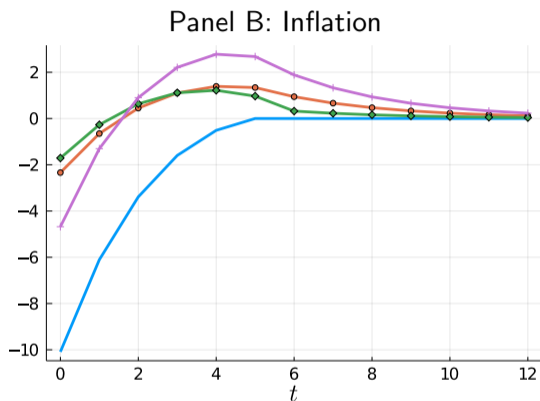
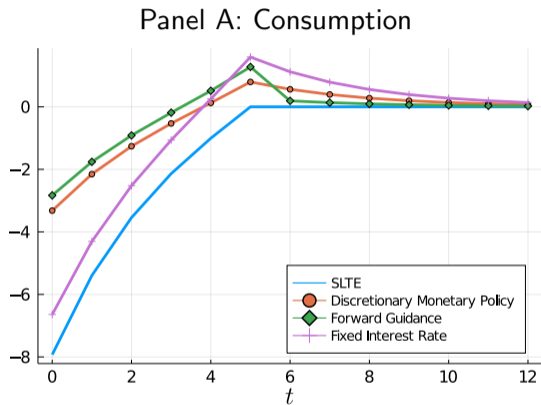


Figure: Consumption and inflation response in a liquidity trap in the FTPL equilibrium.

Fiscal Backing in Discretionary SLTE: PV of transfers decrease by 10% of annual output.

Do Heterogeneous MPCs and Redistribution Change the Channels?

Not fundamentally.

Proposition

Given $\{i_t\}_{t=0}^{\infty}$, all bounded solutions of TANK generate a path of consumption that is given by

$$c_t = \underbrace{c_t^S}_{ISE} + \underbrace{c_t^T}_{Fiscal\ redistribution} + \underbrace{\frac{1-\beta\lambda}{1-\beta}\lambda^t}_{GE\ multiplier} \times \underbrace{\Omega_0}_{WE}$$

where $\{c_t^S\}_{t=0}^{\infty}$ is uniquely determined by $\{i_t\}_{t=0}^{\infty}$,

$$c_t^T = \frac{\omega\chi_T}{1-\omega\chi_Y} \frac{1-\beta\lambda}{\bar{\lambda}-\lambda} \lambda^t \left[\sum_{s=0}^{t-1} \left(\frac{\bar{\lambda}}{\lambda^s} - \frac{\lambda}{\lambda^s} \right) (T_{h,s+1} - T_{h,s}) + \sum_{s=t}^{\infty} \left(\frac{1-\beta\bar{\lambda}}{1-\beta\lambda} \left(\frac{\bar{\lambda}}{\lambda} \right)^t - 1 \right) \frac{\lambda}{\lambda^s} (T_{h,s+1} - T_{h,s}) \right],$$

and $\sum_{t=0}^{\infty} \beta^t c_t^S = \sum_{t=0}^{\infty} \beta^t c_t^T = 0$.

Bonus: Quantify Fiscal Backing in the Data (Caramp & Silva, 2021b)

Augment standard estimation of IRFs to a monetary shock with **fiscal variables**.

Caramp & Silva (2021b) build rich model with aggregate risk and household heterogeneity.

Calculate fiscal backing from data. Consistent with standard Taylor? No...

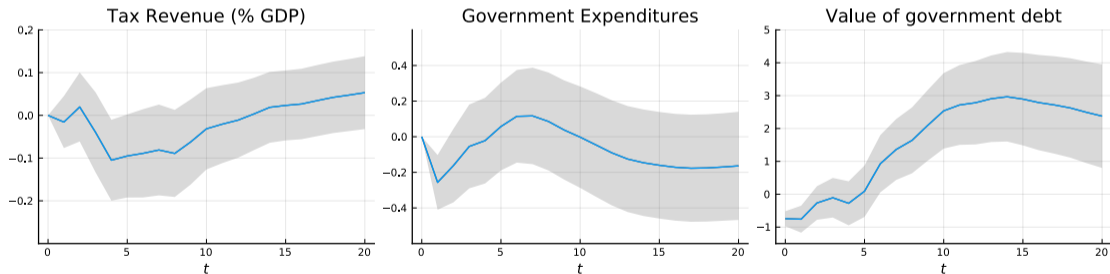
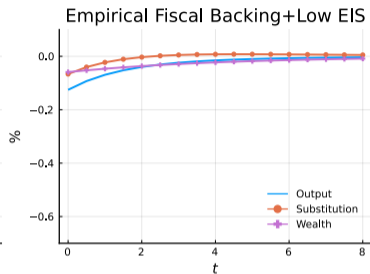
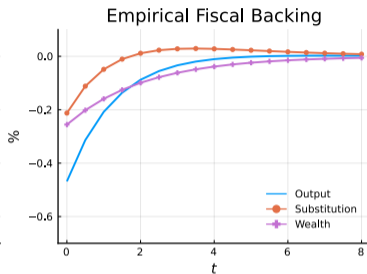
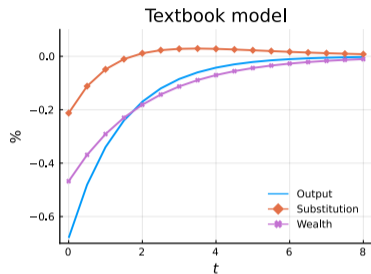


Figure: Estimated fiscal response to a monetary policy shock

Absent fiscal backing, missing amplification channels



Caramp & Silva (2021b) include two channels to compensate missing fiscal backing:

- 1 Aggregate risk
- 2 Heterogeneous portfolios and private debt

We cannot study monetary policy without including fiscal policy!

Appendix: Hicksian Demand

The Hicksian demand solves:

$$\min_{\{C_t\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \prod_{s=0}^{t-1} \left(\frac{P_{s+1}/P_s}{1+i_s} \right) C_t$$

subject to $\sum_{t=0}^{\infty} \beta^t \frac{C_t^{1-\sigma}}{1-\sigma} \geq \bar{U}$. Solving and log-linearizing around steady-state:

$$c_t^H = \frac{1}{\sigma} \sum_{s=0}^{t-1} (i_s - \pi_{s+1} - r_n) - \frac{1}{\sigma} \sum_{s=0}^{\infty} \beta^{s+1} (i_s - \pi_{s+1} - r_n).$$

Properties: *i)* $\sum_{t=0}^{\infty} \beta^t c_t^H = 0$; *ii)* $c_t^H = c_{t+1}^H - \sigma^{-1}(i_t - \pi_{t+1} - r_n)$.

$\{c_t^S, \pi_t^S\}_{t=0}^{\infty}$ is the **unique** solution to

$$c_t = c_{t+1} - \sigma^{-1}(i_t - \pi_{t+1} - r_n), \quad \pi_t = \beta\pi_{t+1} + \kappa c_t,$$

and $\sum_{t=0}^{\infty} \beta^t c_t = 0$. [◀ Back](#)

Calibration

We adopt a standard calibration of the NK model:

$$\beta = 0.99,$$

$$\sigma = 1,$$

$$\kappa = 0.1275,$$

$$\rho_r = 0.5,$$

$$i_0 - r_n = 25bps,$$

$$\rho = 62 \text{ months},$$

$$\tau = 0.3,$$

$$Qb = 100\% \text{ of GDP.}$$

Observational Equivalence

Suppose the shock follows

$$\varepsilon_t = [\chi\psi^t + (1 - \chi)\Delta^t]\varepsilon_0.$$

This is an ARMA(2,1).

Proposition

Suppose that the nominal interest rate follows an AR(1) and the monetary shocks follow an ARMA(2,1). Then, any solution of NK model can be obtained as a Taylor equilibrium.

Comparison with Cochrane (2017)

The standard equilibrium. Unique purely forward-looking solution to NK system.

The backward-stable equilibrium.

$$\lim_{t \rightarrow -\infty} \pi_t = 0 \iff \Omega_0 = (1 - \beta) \frac{\sigma^{-1}}{\lambda - \underline{\lambda}} \sum_{s=0}^{\infty} \frac{\lambda}{\lambda^s} (i_s - r_n) > 0$$

The no-inflation-jump equilibrium. $\pi_0 = 0 \iff \Omega_0 = 0$.

Wealth Effect and price stickiness: Inflation

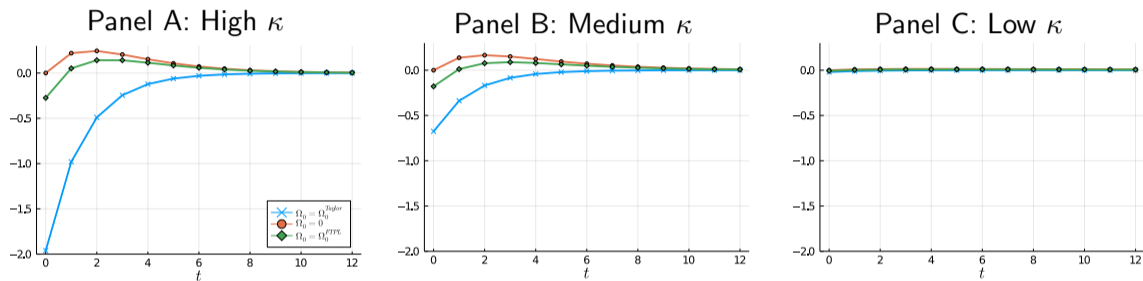


Figure: Inflation response to a monetary shock for various values of κ and Ω_0