Online Appendix to
The Impact of the 2026 Iran War on U.S. Inflation: A Scenario Analysis

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A DSGE MODEL

This appendix provides an overview of the DSGE model used to generate oil price projections. Further details about the model fit and its robustness to alternative modeling choices can be found in Kilian et al. (2026)

A.1 MODEL EQUATIONS

The model is a nonlinear stochastic growth model augmented to include oil production. Oil is used as an intermediate input by a representative firm that produces a final good. The distinguishing feature of the model is that it includes downside risk to both oil production and the macroeconomy.

Productivity and Macroeconomic Disasters Productivity growth $g_t = a_t/a_{t-1}$ follows

$$\ln g_t = \ln \bar{g} + \sigma_g \varepsilon_{g,t} - \zeta_g (v_t^g - \bar{\pi}_1^g), \quad \varepsilon_{g,t} \sim \mathbb{N}(0,1),$$

where $\bar{g}$ is the steady-state growth rate. The indicator variable v_t^g equals 1 if a macroeconomic disaster occurs and 0 otherwise. The transition matrix for v_t^g is summarized by

$$\Pr(v_{t+1}^g = 1 | v_t^g = 1) = \bar{q}^g, \quad \Pr(v_{t+1}^g = 1 | v_t^g = 0) = p_t^g,$$

where the probability of a macroeconomic disaster follows

$$\ln p_t^g = \min\{0, (1-\rho_p^g)\ln \bar{p}^g + \rho_p^g \ln p_{t-1}^g + \sigma_p^g \varepsilon_{p,t}^g\}, \quad \varepsilon_{p,t}^g \sim \mathbb{N}(0,1),$$

which ensures that p_t^g is bounded between 0 and 1. The size of the disaster is ζ_g, and $\bar{\pi}_1^g$ is the unconditional probability of the disaster, which is evaluated by simulation.

Capital is destroyed when the disaster occurs. Let k_t denote the inherited stock of capital and i_t denote investment. The capital stock evolves according to

$$k_{t+1} = e^{-\zeta_g v_{g,t+1}}((1-\delta)k_t + i_t - \phi(i_t/k_t)k_t).$$

The functional form of the adjustment cost is given by

$$\phi(i_t/k_t) = i_t/k_t - (\mu_1 + \tfrac{\mu_2}{1-1/\nu}(i_t/k_t)^{1-1/\nu}),$$

where $\mu_1 = (\bar{g} - 1 + \delta)/(1-\nu)$ and $\mu_2 = (\bar{g} - 1 + \delta)^{1/\nu}$.

Final Goods Firm A representative firm maximizes profits by choosing its investment (i_t), capital (k_{t+1}), labor (n_t), and oil (o_t) inputs. The firm produces a final good y_t using a Cobb-Douglas technology that aggregates labor and capital services, which are produced using a normalized CES production function that aggregates capital and oil.

The firm's profit maximization problem is given by

$$V_t = \max_{i_t, k_{t+1}, n_t, o_t} y_t - i_t - p_t^o o_t - w_t n_t + E_t[x_{t+1} V_{t+1}]$$

subject to

$$k_{t+1} = e^{-\zeta_g v_{g,t+1}}((1-\delta)k_t + i_t - \phi(i_t/k_t)k_t),$$
$$y_t = y_0(a_t n_t)^{1-\xi}\left((1-\alpha)(k_t/k_0)^{1-1/\sigma} + \alpha(o_t/o_0)^{1-1/\sigma}\right)^{\xi/(1-1/\sigma)},$$

where σ is the elasticity of substitution between capital and oil, δ is the depreciation rate of capital, $1-\xi$ is the share of labor in gross output, and α controls the share of oil in the capital services aggregate. The scalars y_0, k_0, and o_0 are set so that α is equal to the cost share of oil in the capital services aggregate.

The first-order conditions for the firm's problem are given by

$$w_t = (1-\xi)y_t/n_t,$$
$$p_t^o = \xi\alpha \tfrac{(o_t/o_0)^{1-1/\sigma}}{(1-\alpha)(k_t/k_0)^{1-1/\sigma} + \alpha(o_t/o_0)^{1-1/\sigma}} \tfrac{y_t}{o_t},$$
$$E_t[x_{t+1} r_{t+1}^i] = 1,$$

where

$$r_{t+1}^i \equiv e^{-\zeta_g v_{g,t+1}}(r_{t+1}^k + (1-\delta+\mu_1 + \tfrac{\mu_2}{\nu-1}(i_{t+1}/k_{t+1})^{1-1/\nu})p_{t+1}^k)/p_t^k,$$
$$r_t^k \equiv \xi(1-\alpha)\tfrac{(k_t/k_0)^{1-1/\sigma}}{(1-\alpha)(k_t/k_0)^{1-1/\sigma} + \alpha(o_t/o_0)^{1-1/\sigma}} \tfrac{y_t}{k_t},$$
$$p_t^k \equiv \tfrac{1}{1-\phi'(i_t/k_t)} = \tfrac{1}{\mu_2}(\tfrac{i_t}{k_t})^{1/\nu}.$$

Oil Production and Oil Production Disasters The production of oil is given by $o_t^s = a_t^o e_t$. The permanent component, a_t^o, reflects factors that influence the productive potential of the oil sector, including the evolution of oil reserves and technological progress that increases the ability of the sector to extract oil from current reserves. We include a shock to this permanent component to allow for productivity shocks in the oil sector not related to geopolitical oil supply disruptions. We also allow a_t^o to depend on the state of the economy since productivity in oil production is assumed to be cointegrated with productivity in the rest of the economy. This allows oil production to respond to changes in oil demand. The transitory component reflects temporary changes in the production of oil driven by exogenous geopolitical events. Oil production disasters are modeled as transitory, given evidence that geopolitical supply disruptions historically have not had long-lasting effects on global oil production, as discussed in the calibration section.

The permanent component of oil production is given by

$$a_t^o = \kappa_0 g_t^{\kappa_1} \epsilon_{t-1}^{\kappa_2} a_{t-1}^o \exp(\sigma_{go}\varepsilon_{go,t}),$$

where $\epsilon_t = a_t/a_t^o$, κ_1 determines the impact response of a growth shock on a_t^o, and κ_2 affects the speed at which a_t^o converges to a_t. This setup allows for a slow response of oil production to productivity growth shocks in the rest of the economy, which is a key feature of the data.

The transitory component of global oil production is given by

$$\ln e_t = \ln \bar{e} - \zeta_e(v_t^e - \bar{\pi}_1^e).$$

The indicator variable v_t^e equals 1 if an oil production disaster occurs and 0 otherwise. The transition matrix for v_t^e is summarized by

$$\Pr(v_{t+1}^e = 1 | v_t^e = 1) = \bar{q}^e, \quad \Pr(v_{t+1}^e = 1 | v_t^e = 0) = p_t^e,$$

where the probability of an oil disaster follows

$$\ln p_t^e = (1 - \rho_p^e) \ln \bar{p}^e + \rho_p^e \ln p_{t-1}^e + \sigma_p^e \varepsilon_{p,t}^e, \quad \varepsilon_{p,t}^e \sim \mathbb{N}(0,1).$$

The size of the disaster is ζ_e, and $\bar{\pi}_1^e$ is the unconditional probability of the disaster, which is evaluated by simulation in the same way as the ergodic probability for the macroeconomic disaster.

Oil Storage A representative oil storage firm maximizes profits by choosing inventories, s_{t+1}, and how much oil to supply to the final goods firm, o_t. The firm's maximization problem is given by

$$V_t^o = \max_{o_t, s_{t+1}} \; p_t^o o_t + E_t[x_{t+1} V_{t+1}^o]$$

subject to

$$s_{t+1} = (1 - \omega)s_t + o_t^s - o_t - \tfrac{\tau}{2}\left(\tfrac{a_t}{s_t}\right)^2 a_t,$$

where ω is the cost of storage. The law of motion for s_t includes a penalty function that prevents stockouts, as they are not observed in the global oil market. The penalty function ensures $s_t > 0$.

The first-order condition for the storage firm is given by

$$1 = E_t[x_{t+1} r_{t+1}^s],$$

where

$$r_{t+1}^s \equiv ((1 - \omega + \tau(a_{t+1}/s_{t+1})^3) p_{t+1}^o)/p_t^o.$$

Household A representative household maximizes the present discounted value of utility by choosing consumption, c_t, hours worked, n_t, bond holdings, b_{t+1}, and equity shares, s_{t+1}^e, which have unit net supply. The household has Epstein-Zin recursive preferences to distinguish between risk aversion, γ, and the intertemporal elasticity of substitution, ψ.

The household's maximization problem is given by

$$J_t = \max_{c_t, n_t, s^e_{t+1}, b_{t+1}} \left((1-\beta) u_t^{1-1/\psi} + \beta (E_t[J_{t+1}^{1-\gamma}])^{\frac{1-1/\psi}{1-\gamma}} \right)^{\frac{1}{1-1/\psi}}$$

subject to

$$u_t = c_t^{\chi} (a_t(1-n_t))^{1-\chi},$$
$$c_t + p_t^e s_{t+1}^e + b_{t+1}/r_t = w_t n_t + (p_t^e + d_t^e) s_t^e + b_t,$$

where β is the discount factor, p_t^e is the equity price, r_t is the risk-free rate, w_t is the wage rate, d_t^e are dividends from firm ownership, and the Frisch elasticity of labor supply $\eta^{\lambda} = \frac{1-n_t}{n_t} \frac{1-(1-1/\psi)\chi}{1/\psi}$.

The first-order conditions for the household are given by

$$\chi w_t (1-n_t) = (1-\chi) c_t,$$
$$1 = E_t[x_{t+1} r_t],$$
$$1 = E_t[x_{t+1} r_{t+1}^e],$$

where

$$r_{t+1}^e \equiv (p_{t+1}^e + d_{t+1}^e)/p_t^e,$$
$$x_{t+1} \equiv \beta (u_{t+1}/u_t)^{1-1/\psi} (c_t/c_{t+1}) (J_{t+1}/z_t)^{1/\psi - \gamma},$$
$$z_t \equiv (E_t[J_{t+1}^{1-\gamma}])^{1/(1-\gamma)}.$$

The equity risk premium is defined as $r_t^{ex} \equiv r_t^e - r_{t-1}$.

Market Clearing The final goods firm issues debt to finance its expected asset holdings, where ϑ determines leverage. Since the Modigliani-Miller theorem holds in our model, the introduction of firm leverage only affects equity returns. There is no effect on household or firm decisions. Aggregate firm dividends are given by

$$d_t^e = d_t^f + d_t^s - \vartheta (E_{t-1} k_t - \tfrac{1}{r_t} E_t k_{t+1}),$$

where $d_t^f = y_t - i_t - p_t^o o_t - w_t n_t$ and $d_t^s = p_t^o o_t$. Asset market clearing implies that $s_t^e = 1$ and total bond issuance is given by $b_t = \vartheta E_{t-1} k_t$. Market clearing in the goods market implies $c_t + i_t = y_t$.

Due to the stochastic trend in productivity, we detrend the model by defining $\tilde{x}_t \equiv x_t/a_t$. The detrending process introduces the growth terms $g_t = a_t/a_{t-1}$ and $g_{o,t} = a_t^o/a_{t-1}^o$.

A.2 CALIBRATION Each period in the model is one quarter. The parameters shown in Table 1 are informed by moments in the data and the related literature. See Kilian et al. (2026) for additional details.

Table 1: Baseline model calibration at a quarterly frequency

Parameter	Value	Target
Discount Factor (β)	0.997	$E(r)$
Risk Aversion (γ)	10	Gao et al. (2022), Croce (2014)
Intertemporal Substitution Elasticity (ψ)	2	Gao et al. (2022), Croce (2014)
Frisch Labor Supply Elasticity (η^λ)	2	Peterman (2016), Basu-Bundick (2017)
Capital-Oil Elasticity of Substitution (σ)	0.105	$SD(\Delta p^o)$
Capital Depreciation Rate (δ)	0.025	Depreciation on fixed assets, durables
Capital-Oil Share of Production (ξ)	0.4043	Avg. labor share of income
Investment Adjustment Cost (ν)	3.3	$SD(\Delta i)$
Oil Storage Cost (ω)	0.025	Casassus et al. (2018), Gao et al. (2022)
Oil Production Weight (α)	0.134	$E[o/y]$
Oil Inventory Stockout Cost (τ)	0.00001	$E[s/o]$
Average Growth Rate ($\bar{g}$)	1.0039	$E(\Delta y)$
Firm Leverage (ϑ)	0.9	$SD(r^{ex})$
Elasticity of Oil Supply to TFP (κ_1)	0	Newell and Prest (2019)
Oil Supply Adjustment Speed to TFP (κ_2)	0.05	Half life of 3.5 years
Growth Shock SD (σ_g)	0.0095	$SD(\Delta y)$
Oil Production Growth Shock SD (σ_{go})	0.011	$SD(\Delta o^s)$
Growth Disaster Size (ζ_g)	0.018	$E(r^{ex})$
Prob. of Entering Growth Disaster ($\bar{p}_g$)	0.005	Occurs in expectation every 50 years
Prob. of Remaining in Growth Disaster ($\bar{q}_g$)	0.9	Gourio (2012)
Growth Disaster Prob. Persistence (ρ_{pg})	0.8	$AC(\mathcal{U}_y)$
Growth Disaster Prob. Shock SD (σ_{pg})	0.9	$SD(\mathcal{U}_y)$
Oil Production Disaster Size (ζ_e)	0.20	Avg. peak decline in oil prod. disasters
Prob. of Entering Oil Disaster ($\bar{p}_e$)	0.02	Avg. frequency of oil prod. disasters
Prob. of Remaining in Oil Disaster ($\bar{q}_e$)	0.67	Avg. duration of oil prod. disasters
Oil Disaster Prob. Persistence (ρ_{pe})	0.5	$AC(\mathcal{U}_{p^o})$
Oil Disaster Prob. Shock SD (σ_{pe})	1.4	$SD(\mathcal{U}_{p^o})$

B DATA SOURCES

We use the following time-series provided by Haver Analytics:

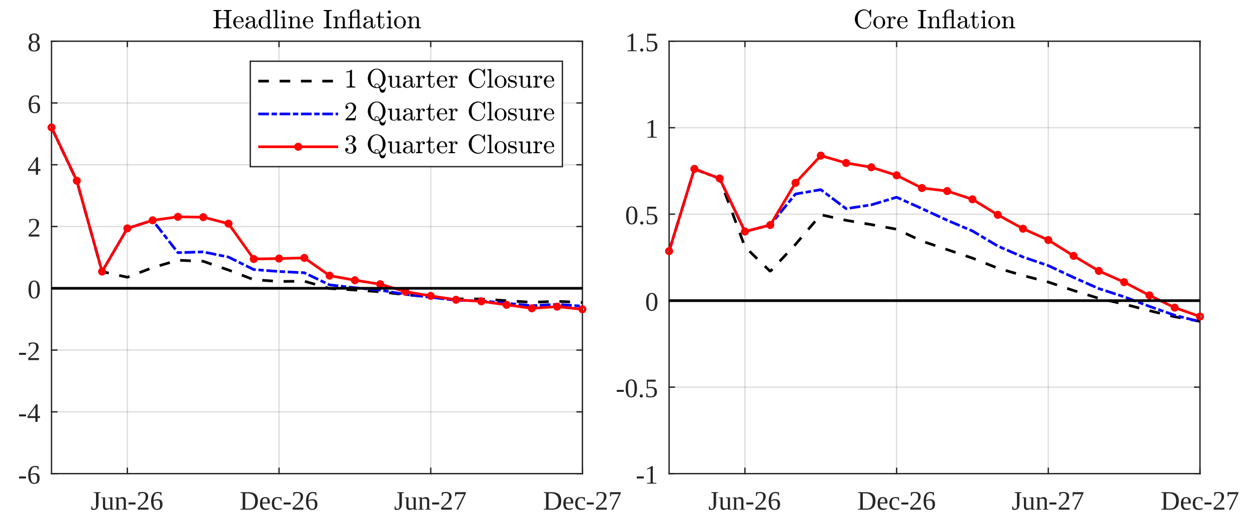
1. **Personal Consumption Expenditures: Chain Price Index**,
   Monthly, Seasonally Adjusted, Index (JCM@USNA)
2. **Personal Consumption Expenditures excluding Food and Energy: Chain Price Index**,
   Monthly, Seasonally Adjusted, Index (JCXFEM@USNA)
3. **Retail Motor Gasoline Price, Unleaded Regular Gasoline**,
   Monthly, Dollars per Gallon, published in the EIA's *Monthly Energy Review*,
   Table 9.4 (PUSSGMWG@USENERGY)
4. **Survey Research Center at the University of Michigan: Expected Inflation Rate, Next Year**, Monthly, Percent (CINF1@USECON)
5. **Survey Research Center at the University of Michigan: Expected Inflation Rate, Next 5 Years**, Monthly, Percent (CINF5@USECON)
6. **WTI Front-Month Futures Price**,
   Daily, Dollars per Barrel, published by CME (PZTEXF1@DAILY)

We also use the following data series:

1. **Cost share of crude oil in the retail price of gasoline**, Monthly, percent, from the U.S. EIA's Gasoline Pump Components History: Crude oil (percentage), https://www.eia.gov/petroleum/gasdiesel/gaspump_hist.php

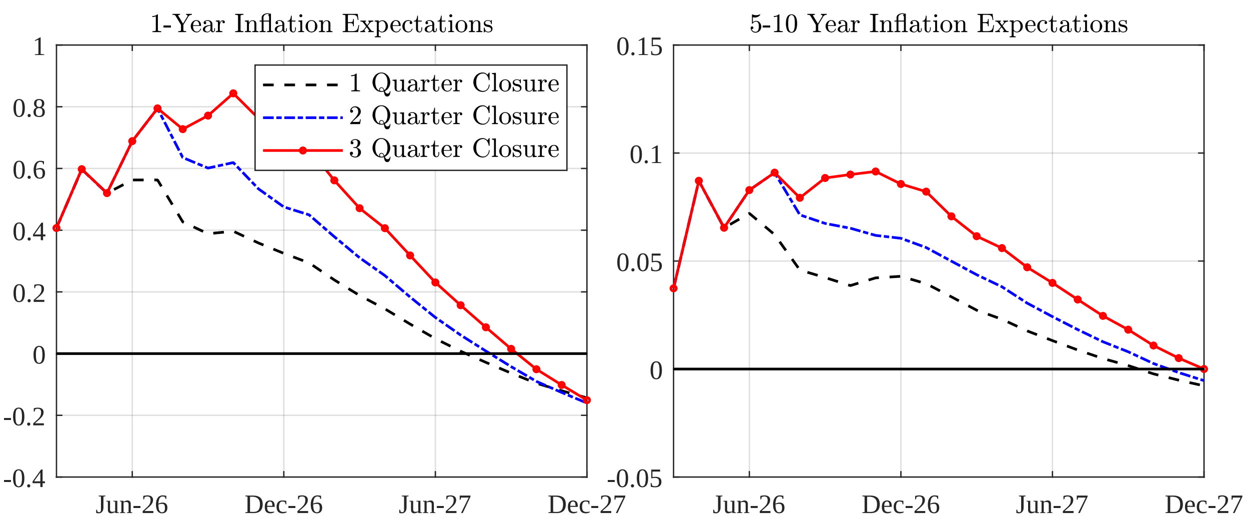
C FIGURES FOR ALTERNATIVE SCENARIOS

Figure 1: Projections of PCE inflation under scenario 1 (percentage points)



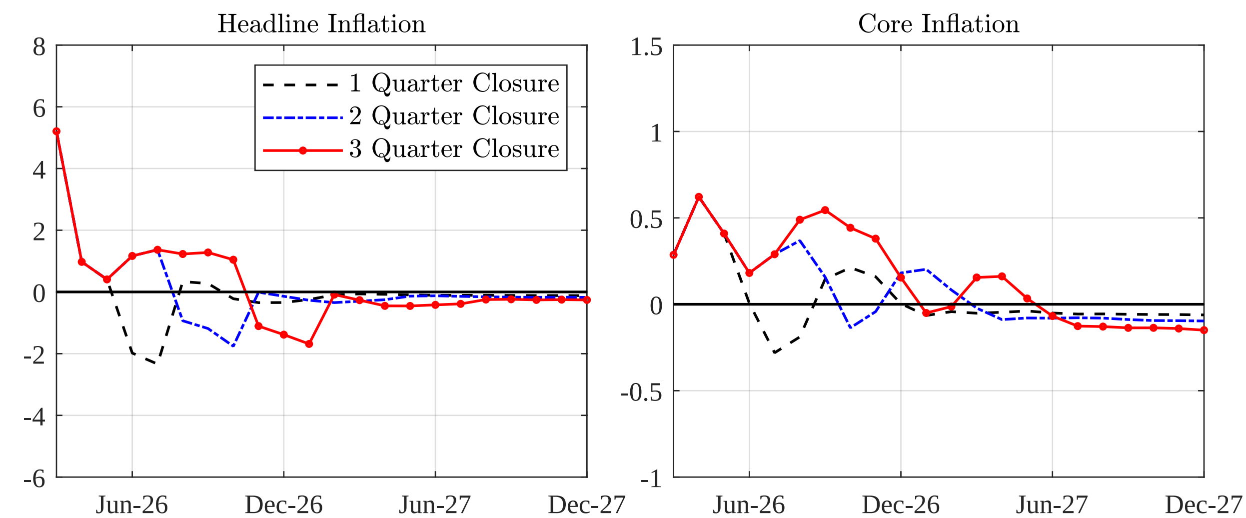
Notes: All inflation rates are annualized.

Figure 2: Projections for inflation expectations under scenario 1 (percentage points)



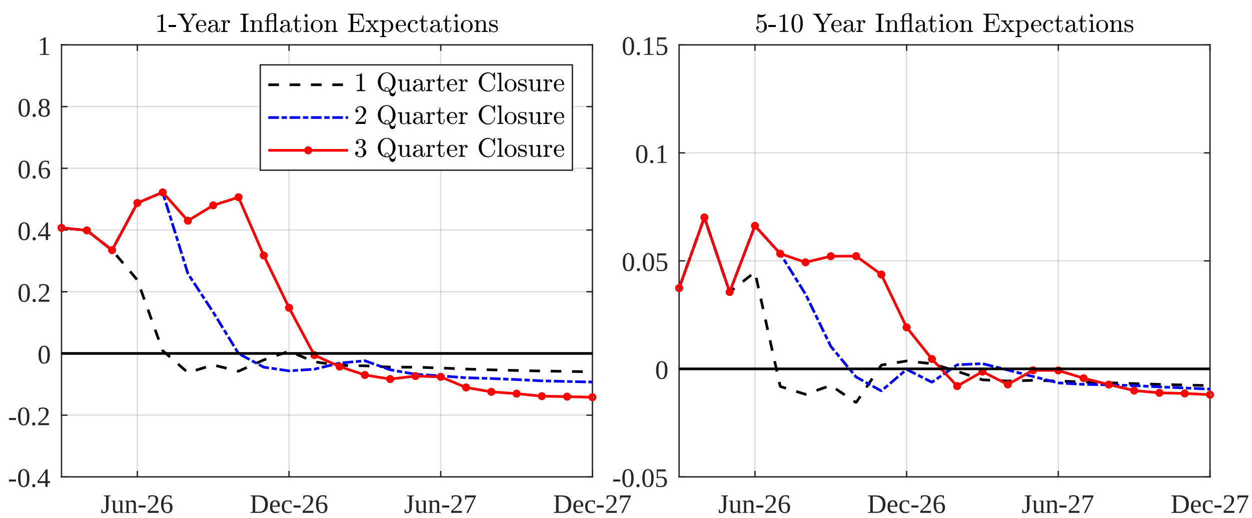
Notes: All inflation rates are annualized.

Figure 3: Projections of PCE inflation under scenario 2 (percentage points)



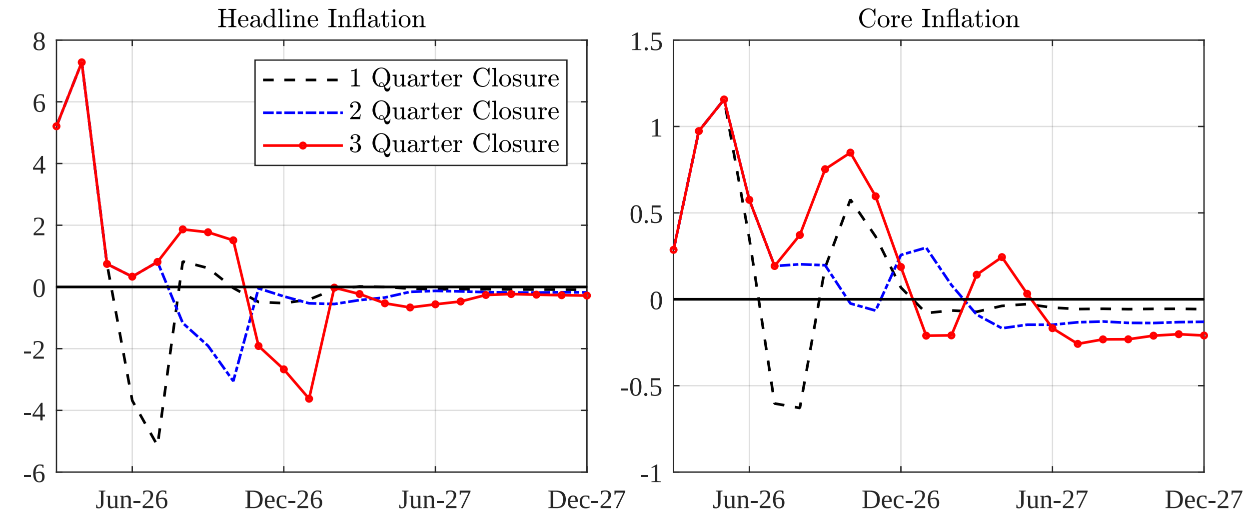
Notes: All inflation rates are annualized.

Figure 4: Projections for inflation expectations under scenario 2 (percentage points)



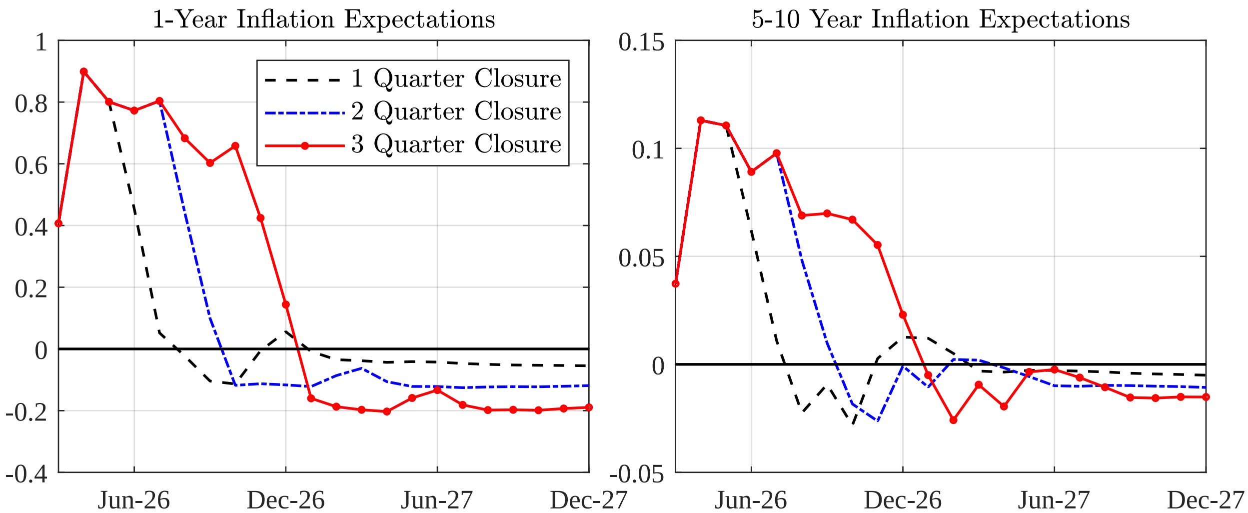
Notes: All inflation rates are annualized.

Figure 5: Projections of PCE inflation under scenario 3 (percentage points)



Notes: All inflation rates are annualized.

Figure 6: Projections for inflation expectations under scenario 3 (percentage points)



Notes: All inflation rates are annualized.

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