Limits to Domestic Monetary Policy: When Central Banks Diverge

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Abstract

The high degree of financial and economic integration implies that monetary policy decisions by major central banks have substantial cross-border effects. This paper studies how divergence across major central banks shapes the transmission of domestic monetary policy. Using state-dependent local projections, I show that the transmission of European Central Bank (ECB) policy reverses when Federal Reserve (Fed) monetary policy is of the opposite sign. During U.S. monetary expansions, an ECB tightening attracts capital inflows to the euro area and overturns its contractionary effects on output and inflation. By contrast, a Fed tightening is contractionary regardless of ECB policy. A two-country New Keynesian DSGE model rationalizes these findings. The model augments a standard framework with financial frictions via a global investor and assumes (i) the U.S. dollar is the dominant international funding currency, (ii) a no-arbitrage condition links returns on home and foreign capital, and (iii) uncovered interest parity fails due to frictions in international asset markets. In this environment, an easier U.S. policy lowers dollar funding costs and generates asymmetric cross-border spillovers that condition the transmission of ECB policy.

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Keywords: monetary policy transmission; international monetary spillovers; policy divergence; state-dependent local projections; dollar dominance.

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1 Introduction

The high degree of financial and economic integration in the modern globalized world means that monetary policy decisions by major central banks have substantial cross-border effects. As an open economy, the euro area both generates and absorbs monetary policy spillovers (see, among others, Ca'Zorzi et al. (2023); Georgiadis and Gräb (2016); Jarociński (2022); Miranda-Agrippino and Nenova (2022)). Among these external influences, U.S. monetary policy plays a crucial role in shaping financial conditions and real economic activity within the euro area. Empirical evidence suggests that changes in U.S. monetary policy induce significant contractions in euro-area economic activity, often with a magnitude comparable to the domestic effects in the United States (Ca'Zorzi et al. (2023)). Consequently, accounting for such international spillovers is essential for a comprehensive assessment of monetary policy transmission within the euro area.

The policy relevance of accounting for U.S. monetary policy became particularly salient in mid-2024. As the European Central Bank (ECB) initiated an easing cycle while the U.S. Federal Reserve (Fed) maintained a restrictive stance, a transatlantic monetary policy divergence emerged after a prolonged period of synchronization. This divergence prompted an explicit debate among European policymakers regarding the feasibility and limitations of policy rates "decoupling". Public remarks revealed contrasting perspectives among european central bankers: some officials emphasized the ECB's independent mandate, others suggested that tighter global financial conditions required additional easing, while a third perspective cautioned that a widening interest-rate differential could destabilize capital flows. These divergent assessments motivate the central research question of this paper: Does this monetary policy divergence matters for the transmission of ECB monetary policy?

The contribution of the paper is twofold. First, the central empirical finding is that the transmission of ECB policy weakens—and can even flip sign—when Fed policy moves in the opposite direction. During U.S. monetary expansions, cheaper dollar funding relaxes the global investor's balance-sheet constraint and enables a reach-for-yield reallocation toward higher-return euro-area assets: an ECB tightening then attracts capital inflows and produces sign-reversed responses in domestic activity and prices—output and inflation rise when the standard benchmark would predict declines. By contrast, when policy directions are aligned, an ECB tightening yields conventional contractionary effects on output and prices. From the U.S. perspective, a Fed tightening remains contractionary regardless of the ECB's monetary policy. Second, to rationalize these findings, the paper develops a two-country New Keynesian DSGE model with financial frictions operating through a global investor. The framework attributes the asymmetric limits on ECB transmission during policy divergence to three elements: (i) the dominant role of the U.S. dollar as the global funding currency, so dollar funding costs directly affect investor balance sheets and generate strong spillovers from the United States; (ii) a no-arbitrage condition that equalizes returns on home and foreign capital, creating a tight financial linkage across economies and a powerful contagion mechanism; and (iii) imperfect international financial markets that break uncovered interest parity (UIP), preventing the exchange rate insulation from foreign spillovers.

The empirical analysis begins by studying how ECB monetary policy transmits to domestic variables using the local projections (LP) methodology of Jordà (2005). Within a linear LP framework, the results first confirm standard theoretical predictions: an ECB tightening shock reduces output, lowers inflation, decreases equity valuations, raises corporate spreads, and appreciates the euro. Extending the analysis to allow for state dependence reveals significant asymmetries contingent on U.S. monetary policy. When U.S. policy is expansionary, an ECB tightening instead yields increases in equity valuations, a narrowing of corporate spreads, and higher activity and inflation. By contrast, when U.S. policy is aligned or neutral, the responses remain conventional and are statistically stronger than in the linear specification. Conducting the same exercise from the U.S. perspective shows that, when the Fed tightens during ECB easing, the one-year government bond yield, equity prices, the excess bond premium, and the real effective exchange rate (REER) react more strongly—yet in directions consistent with a tightening. Industrial production and consumer prices, however, behave similarly across states.

Motivated by these empirical results, I build a two-country New Keynesian Dynamic Stochastic General Equilibrium (NK-DSGE) model. The goal is to explain why the transmission of ECB policy weakens—or can even reverse sign—when the Fed eases. The standard open-economy NK framework is a natural starting point but cannot match this fact on its own. The literature shows that U.S. monetary policy spillovers operate primarily through financial conditions (Miranda-Agrippino and Hélene Rey (2020)) and highlights two key elements to capture them: the failure of UIP and the prevalence of dollar debt on domestic intermediaries' balance sheets (Akinci and Queralto (2024); Hélène Rey (2016)). In the model, these ingredients do generate spillovers, but they are not sufficient to reproduce the sign reversal in ECB transmission documented in the data. A stronger cross-border transmission mechanism is therefore required.

To provide this mechanism, I introduce a global investor who intermediates across countries. The investor raises dollar funding in both economies and holds a single portfolio of claims on capital installed at Home (euro area) and Foreign (U.S.) countries. The investor's optimality conditions imply a no-arbitrage relation that links returns on Home and Foreign capital. Combined with dollar funding and incomplete international asset markets, this linkage transmits foreign monetary policy into domestic financial conditions and produces the asymmetric spillovers observed in the data.

The model therefore rests on three features: (i) the U.S. dollar is the dominant international funding currency; (ii) a no-arbitrage condition links returns on Home and Foreign capital; and (iii) UIP fails due to frictions in international asset markets. Taken together, these features imply that a U.S. monetary easing compresses funding costs and strengthens intermediaries' balance sheets. Reaching for yield, investors reallocate toward euro-area assets precisely when the ECB tightens, thereby limiting the domestic transmission of policy.

I use the model as a laboratory to study monetary policy shocks at home and abroad. To isolate dollar dominance as the only asymmetry, the two economies are assumed symmetric in size and trade. I compare a Home tightening under a neutral Foreign policy with the same tightening when the Foreign economy eases.

When the Home central bank tightens while Foreign policy is neutral, transmission is standard and contractionary. The policy rate rises, expected real rates increase, and consumption and investment fall. Marginal costs decline, inflation falls, asset valuations drop, investor net worth and the capital stock decrease, the corporate spread widens, and the Home currency appreciates.

By contrast, if the Foreign economy eases at the same time, global dollar funding becomes cheaper. The investor's effective funding rate falls and the market value of installed capital rises, strengthening balance sheets. Net worth increases, credit premia compress, and portfolios shift toward euro-area assets. Investment and the capital stock expand, output moves above steady state, and the corporate spread narrows—even though the path of the Home policy rate is similar across stances. The real exchange rate appreciates more, but not enough to offset the foreign easing[1]; the international funding channel dominates the domestic intertemporal channel[2], so the exchange rate does not fully buffer the spillover.

From the Foreign perspective, a monetary tightening is contractionary under either Home stance. Because the Foreign currency serves as the global funding currency, a Foreign tightening raises the global funding cost and tightens financial conditions directly.

The role of cross-border intermediation is central. Under capital autarky—where each country has its own investor who only holds domestic capital—the attenuation of Home

[1]The real exchange rate appreciation is limited by a UIP wedge.

[2]Intertemporal trade-off: consumption vs savings.

transmission largely disappears. To obtain similar limits on Home policy in that setting, one would need an unusually large UIP wedge so that a Home tightening is accompanied by a real-exchange-rate depreciation; it is this depreciation that would work through expenditure-switching to offset the contraction, a requirement that is at odds with standard calibrations and absent in the data.

Finally, when the UIP wedge is shut down, the real exchange rate moves one-for-one with the ex-ante real interest-rate differential. In that case, a Home tightening is unambiguously contractionary—output, investment, and the capital stock fall, and inflation declines—and the flexible exchange rate again acts as an effective buffer against foreign shocks.

Related Literature. This paper contributes to the literature on the transmission of monetary policy in a open economy context both empirically and theoretically. Empirically, it contributes to the large literature on cross-border monetary policy spillovers, and in particular, of major central banks like the ECB and the Fed. Numerous studies document how U.S. monetary policy significantly influences global financial conditions, international trade, capital flows, and economic activity abroad, (see, among others, Dées and Galesi (2021); Degasperi et al. (2020); Georgiadis and Jarocinski (2023); Iacoviello and Navarro (2019); Kalemli-Özcan (2019); Miranda-Agrippino and Nenova (2022); Miranda-Agrippino and Hélene Rey (2020); Hélène Rey (2016)). These findings highlight the Federal Reserve's dominant role in shaping global financial cycles and underscore the limitations of flexible exchange rates in insulating foreign economies from its monetary influences.

Specifically focusing on the two major central banks—the Federal Reserve (Fed) and the European Central Bank (ECB)—Ca'Zorzi et al. (2023) analyze pure conventional monetary policy shocks and document significant asymmetry in transatlantic spillovers. They find that Fed monetary policy shocks have a significant impact on euro-area financial conditions and real activity. In contrast, ECB monetary policy shocks have no comparable effects on the U.S. economy. Similarly, Jarociński (2022) claims that there is a co-movement in U.S. and German government bond yields following ECB policy announcements, attributing it primarily to ECB information shocks rather than pure monetary policy shocks. His findings indicate that there are no direct transatlantic spillovers from ECB monetary policy actions; instead, spillovers occur due to ECB information shocks. Finally, regarding unconventional monetary policy, Miranda-Agrippino and Nenova (2022) do find international financial spillovers from ECB shocks similar to those from Fed actions.

My analysis complements and extends these insights by investigating how the euro area monetary policy transmission varies depending on the direction of U.S. monetary policy shocks, with a focus on state-dependent interactions. Specifically, I examine the differential impact on euro area monetary transmission when monetary policy shocks in the euro area and the U.S. move in opposite directions—such as when the ECB tightens while the Fed eases, or vice versa.

In line, Hauzenberger et al. (2023) study the transmission of ECB monetary policy conditional on the stance of U.S. monetary policy, they employ a smooth transition VAR (ST-VAR) framework to examine how euro area monetary policy shocks affect financial market indicators—specifically, government bond yields and inflation swaps. Their analysis conditions on the U.S. monetary policy stance, measured by deviations of the federal funds rate from its natural rate estimate. For nominal bond yields, they find that contractionary ECB monetary policy initially exerts stronger effects when the Federal Reserve maintains an expansionary stance. However, these effects reverse after two weeks due to subsequent capital inflows into the euro area economy. Regarding inflation swaps, they report minimal differences conditional on the U.S. policy stance. In contrast, my analysis focuses explicitly on monthly macroeconomic variables and defines states differently, based on the sign of contemporaneous U.S. monetary policy shocks. By explicitly examining scenarios in which ECB and Fed monetary policy shocks move in opposite directions, my study offers distinct empirical insights into how bilateral monetary policy interactions shape euro area macroeconomic outcomes.

Theoretically, this paper contributes to the open-economy literature that identifies financial integration as a central channel for international spillovers. This work features global financial intermediaries that allocate funds across countries (e.g., Dedola and Lombardo (2012); Faia (2007); Kollmann (2013)) and emphasizes exchange-rate dynamics and UIP deviations arising from imperfect financial markets as key drivers of financial contagion (e.g., Akinci and Queralto (2024); Caldara et al. (2024); Gabaix and Maggiori (2015); Itskhoki and Mukhin (2021)). Building on this foundation, my model examines the case in which central banks experience monetary-policy shocks of opposite sign and delineates the assumptions under which the model reproduces the empirical patterns documented in the data.

To the best of my knowledge, the only existing study that similarly investigates the nonlinear interactions of monetary policy shocks both empirically and theoretically is Caldara et al. (2024), which analyzes simultaneous contractionary monetary policy shocks across multiple advanced economies. They demonstrate that synchronized tightening results in more substantial financial tightening and stronger economic effects compared to asynchronous tightening. In contrast, my paper explicitly explores bilateral interactions between the euro area and the U.S., providing detailed empirical evidence on how monetary policy shocks of opposite signs across these two major economies influence monetary transmission within the euro area.

The remainder of this paper is structured as follows. Section 2 presents the empirical evidence in detail. Section 3 describes the theoretical framework, Section 4 explains the calibration, Section 5 analyzes the model dynamics highlighting the key assumptions and mechanisms driving the results, and Section 6 concludes with directions for future research.

2 Empirical analysis

This section presents the empirical findings. I study how euro area monetary policy shocks propagate to macroeconomic and financial variables, and whether this transmission changes when the Federal Reserve's monetary policy shock has the opposite sign. I estimate impulse responses using local projections developed by Jordà (2005) and extend the specification to a state-dependent framework following Ramey and Zubairy (2018). The linear model serves as a benchmark; the central hypothesis is that the transmission of ECB shocks is state-dependent rather than constant.

2.1 Methodology

Linear Model. The linear specification follows the standard local projections framework:

$$y_{t+h} = \alpha_h + \beta_h \, \epsilon_t + \sum_{l=1}^{L} \delta_{h,l} \, x_{t-l} + \mu_{t+h}, \quad \text{for } h = 0, 1, 2, \ldots, H. \tag{1}$$

Where y_{t+h} is the vector of dependent variables measured at horizon h after the shock, α_h is a constant term specific to horizon h. The term ϵ_t captures the identified euro area monetary policy shock, while x_{t-l} is a vector of control variables[3]. To correct for potential serial correlation in the residuals, I compute standard errors using the Newey-West procedure.

State-Dependent Model. To account for possible asymmetries in the transmission of monetary policy, I adopt a state-dependent local projection (LP) framework. In this setup, a dummy variable I_{t-1} indicates the state of U.S. monetary policy at time $t-1$. Specifically, I_{t-1} takes the value of one if U.S. monetary policy is easing at $t-1$ and zero otherwise. Because euro area and U.S. monetary policy announcements can occur at different times

[3]It includes lags of the dependent variables, lags of the commodity price index and lags of the global financial cycle.

within a month, taking the state at $t-1$ ensures that it was already in place when the ECB policy shock hit. The nonlinear specification is:

$$y_{t+h} = I_{t-1}\left[\alpha_h^E + \beta_h^E \epsilon_t + \sum_{l=1}^{L} \delta_{h,l}^E x_{t-l}\right] + (1-I_{t-1})\left[\alpha_h^{TN} + \beta_h^{TN} \epsilon_t + \sum_{l=1}^{L} \delta_{h,l}^{TN} x_{t-l}\right] + \mu_{t+h} \quad (2)$$

For $h = 0, 1, 2, \ldots, H$, the superscripts refer to the two distinct states of U.S. monetary policy. The "Easing State" (superscript E) corresponds to periods when U.S. monetary policy is easing ($I_{t-1} = 1$), while the "Tightening/Neutral State" (superscript TN) denotes all other periods ($I_{t-1} = 0$). Consequently, the set of coefficients $\{\alpha_h^E, \beta_h^E, \delta_{h,l}^E\}$ governs the euro area dynamics during the Easing State, while $\{\alpha_h^{TN}, \beta_h^{TN}, \delta_{h,l}^{TN}\}$ captures the dynamics during the Tightening/Neutral State.

This specification is highly flexible, as it allows the entire dynamic structure of the economy—including the system's autoregressive dynamics (i.e., the propagation of past shocks) captured by the coefficients on the control variables, $\delta_{h,l}$—to vary with the state of U.S. monetary policy. This generality makes the model robust to potential changes in the underlying economic mechanisms, such as shifts in inflation persistence or output dynamics, that may coincide with the U.S. policy stance. For completeness and as a robustness check, the appendix presents results from a more parsimonious model. In that alternative specification, only the economy's direct sensitivity to the monetary policy shock (β_h) is state-dependent, while the propagation dynamics ($\delta_{h,l}$) are constrained to be constant across both states.

2.2 Data

I use monthly euro area data from January 1999 to October 2023.[4] The baseline specifications include: the log of industrial production, the log of the Harmonised Index of Consumer Prices (HICP), the German one-year government bond yield to capture the safest one-year interest rate,[5] the EURO STOXX 50 equity index, the ICE BofA Euro High Yield option-adjusted spread, and the real exchange rate. I also include a commodity price index and the global financial cycle factor of Miranda-Agrippino and Hélene Rey (2020) as controls. Data sources, transformations, and series definitions are detailed in the Appendix A.

Euro area monetary policy surprises are taken from Jarociński and Karadi (2020), who utilize high-frequency instruments around ECB announcements, in line with recent work on

[4] The sample is constrained by the availability of the high-frequency monetary policy instrument. Following Altavilla et al. (2019), I also report results for a sample starting in January 2002 to enhance robustness.

[5] As in Jarociński and Karadi (2020), this is a valid measure of monetary policy also during zero lower bound periods

external instrument identification. The authors note that each announcement can simultaneously convey information about monetary policy and the central bank's economic outlook (i.e., a "central bank information shock"). They propose two approaches—"poor man's sign restriction" and "rotational sign restriction"—to isolate the pure monetary policy shock from the broader announcement effects[6]. Following Ca'Zorzi et al. (2023), I use the shocks obtained under the poor-man's approach, as they claim that it is a better instrument for the ECB monetary policy shocks.

To capture state dependence, I measure the stance of U.S. monetary policy. For the state-dependent estimation to be consistent, the state must be exogenous with respect to the contemporaneous ECB shock Gonçalves et al. (2024). I therefore use the high-frequency U.S. monetary policy shocks of Bauer and Swanson (2023)[7].

Although Ca'Zorzi et al. (2023) argue that the Jarociński and Karadi (2020) instruments for the U.S. and the euro area are contemporaneously exogenous, my setting requires that the U.S. stance be realized before the ECB shock occurs; in the sample, ECB meetings take place earlier within the same month about 82% of the time. Accordingly, I define the state using the U.S. shock at $t-1$. With this timing, the Jarociński and Karadi (2020) U.S. instrument is positively correlated (about 0.2) with the selected ECB instrument, whereas the Bauer and Swanson (2023) shocks are uncorrelated at any lead or lag. In state-dependent local projections, the state indicator must be orthogonal to the contemporaneous policy shock $\varepsilon_t^{\mathrm{ECB}}$; otherwise, the average shock differs across states and the estimated β_h are biased. Because the Jarociński and Karadi (2020) U.S. series remains positively correlated with the ECB shock even at the one-month lead that defines the state, it would violate this orthogonality condition, whereas the Bauer and Swanson (2023) series does not. I therefore adopt the latter for the state. Concretely, I define a binary indicator equal to one if the U.S. shock at $t-1$ is negative (expansionary) and zero otherwise (neutral or tightening). In the data, this occurs in 86 months.

2.3 Empirical results

Figure 1 reports linear local–projection impulse responses to a 25 basis point contractionary monetary policy shock in the euro area. All responses are shown with 68% confidence bands,

[6] In the case of "poor-man" the assumption is that the interest rate shock is either a monetary policy shock or a central bank information shock whereas the "rotational sign restriction" assumes that interest rate shock contains both.

[7] High-frequency shocks identify unanticipated policy changes; policy rates themselves are endogenous objects.

and the baseline specification includes one lag of controls. The results are consistent with standard theoretical predictions: output, consumer prices, and equity valuations decline, while corporate credit spreads widen. The increase in spreads indicates tighter credit conditions that restrain corporate borrowing. The euro appreciates, consistent with higher relative euro-area yields following the tightening.

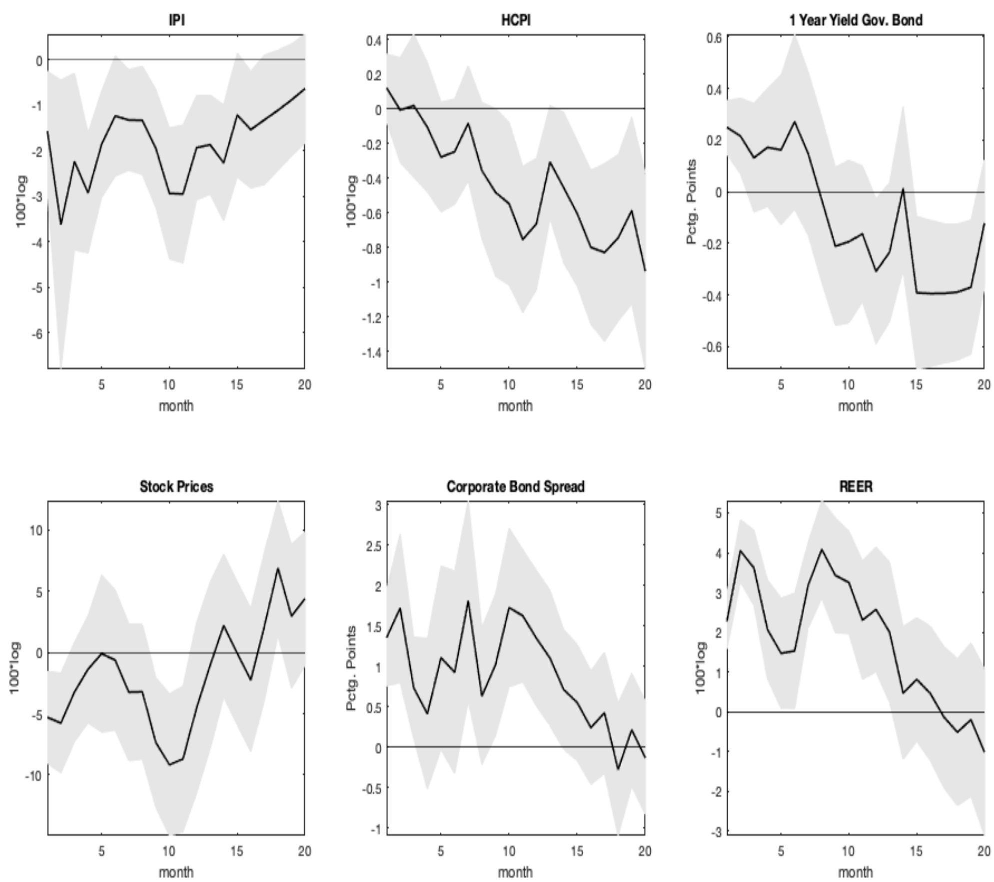

Figure 1: Impulse Responses to 25 Basis Points Euro Area Monetary Policy Shock

Note: 68% confidence intervals are shown.

Figure 2 presents state-dependent impulse responses to the same euro area shock.[8] Confidence bands are again 68%. For these estimates, I assume the economy remains in a given state at all horizons h.

[8]The shock is standardized to 25 basis points in the linear model. In the nonlinear model, the realized interest-rate increase is approximately 54 basis points when the U.S. is easing and about 18 basis points otherwise.

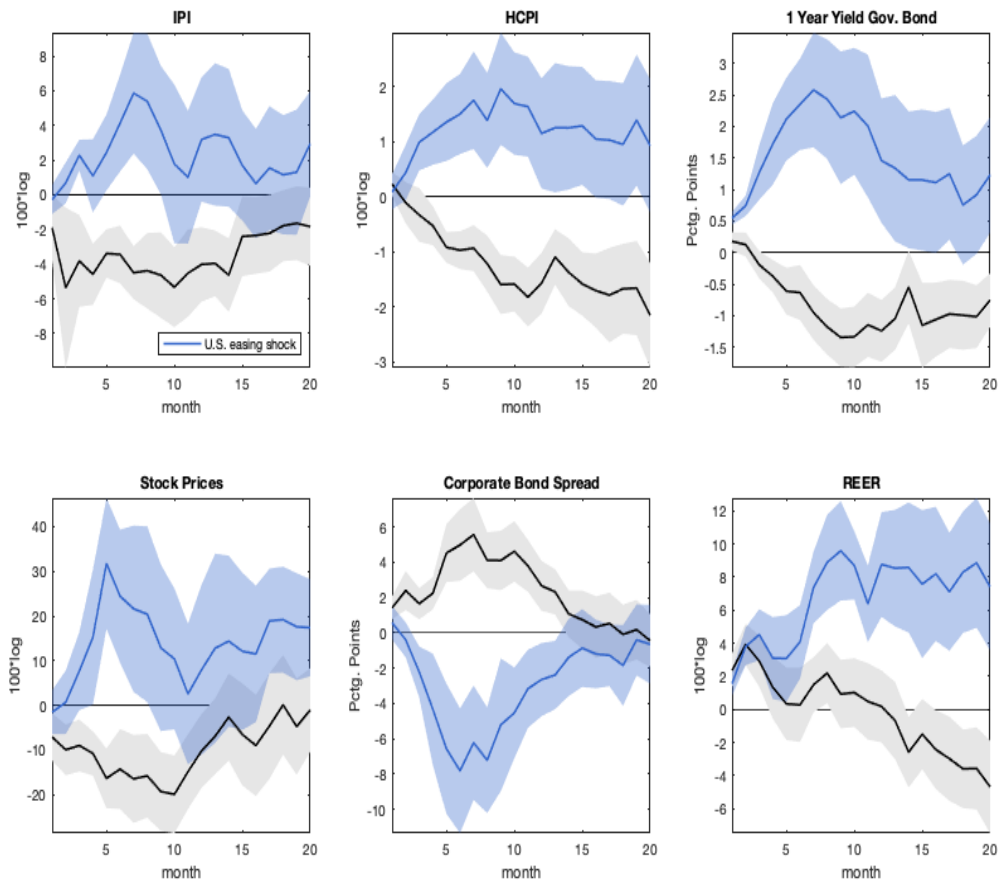

Figure 2: State-dependent impulse responses to the same monetary policy shock under different U.S. monetary policy states.

Note: 68% confidence intervals. Blue lines indicate when U.S. monetary policy is easing. The shock is standardized to 25 basis points in the linear model.

When the Federal Reserve is easing (there is a negative U.S. monetary policy shock), a contractionary ECB shock produces counterintuitive responses in euro area financial and macroeconomic variables: equity valuations rise, corporate credit spreads narrow, and both activity and inflation increase. The asymmetric policy surprises—higher-than-expected rates in the euro area alongside lower-than-expected rates in the U.S.—are associated with a stronger euro appreciation and plausibly induce capital inflows toward the euro area. Under a simple Taylor-rule interpretation, the joint behavior of activity and prices implies an even larger increase in the policy rate.

These results suggest that an ECB tightening coinciding with a negative U.S. monetary policy shock can be counterproductive: possible cross-border portfolio rebalancing and capital movements may offset, or even reverse, the usual contractionary effects of an ECB tightening.

By contrast, in the other state—when the U.S. shock is zero or of the same sign as the ECB shock—the impulse responses broadly match standard predictions. Moreover, effects are larger in magnitude and more precisely estimated than in the linear model, mitigating the potential inflation puzzle in the baseline specification.

Robustness. A range of robustness checks—varying lag structures, employing alternative monetary policy instruments, and using alternative samples—yields similar results. Full details are provided in the Appendix A.

2.4 Analysis for the United States

I apply the same empirical framework to the United States to study the transmission of Federal Reserve monetary policy shocks and whether it depends on the contemporaneous stance of euro-area policy. I estimate linear and state-dependent local projection models analogous to those used for the euro area.[9]

Figure 3 reports linear impulse responses to a 25 basis points contractionary U.S. monetary policy shock with 68% confidence intervals. The responses accord with standard predictions: activity contracts, prices decline, credit spreads widen, and the dollar appreciates.

[9] The state variable is measured at time t because euro-area shocks are ordered before U.S. shocks within the same month. The set of variables and controls mirrors the euro-area specification.

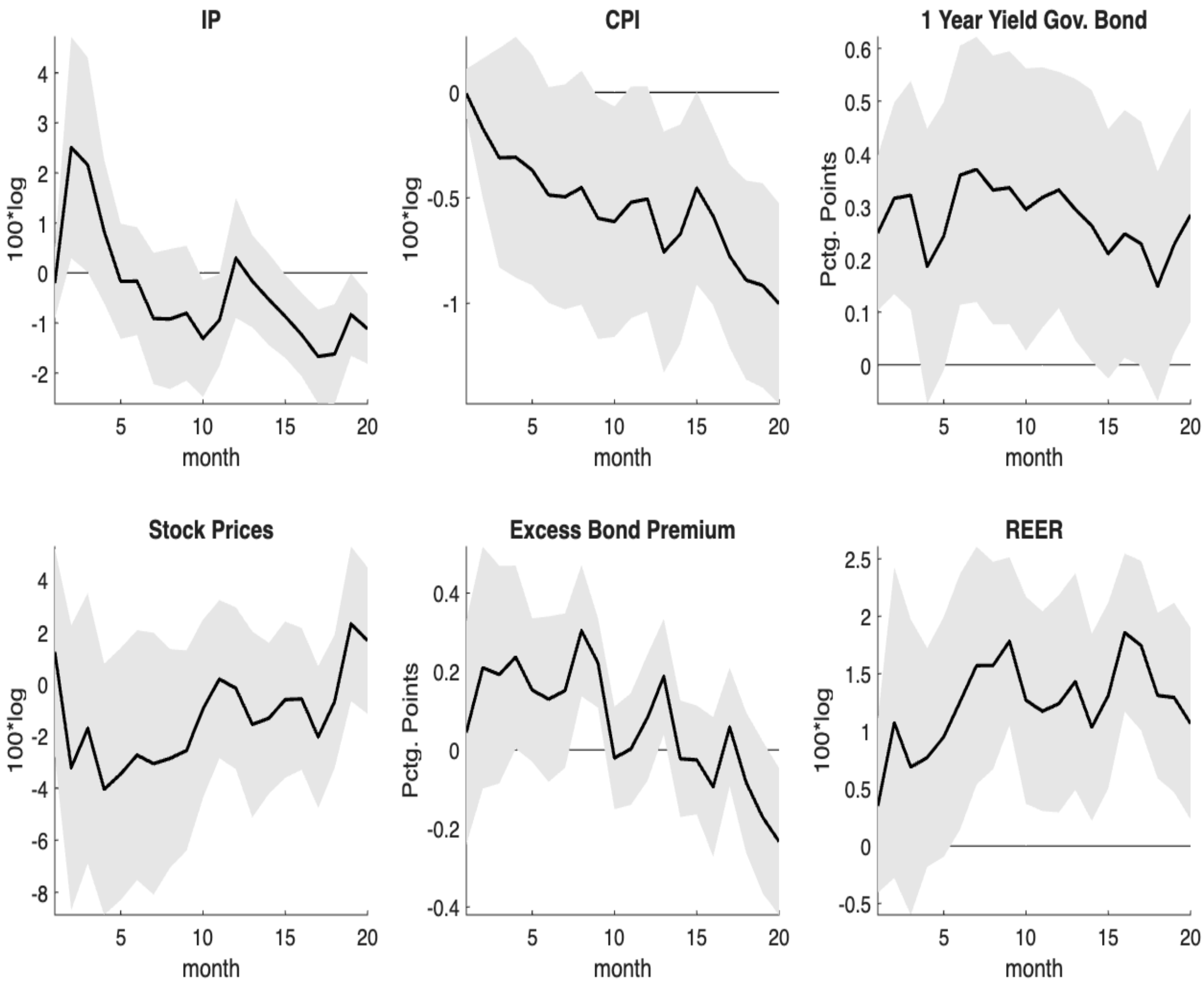

Figure 3: Impulse responses to a 25 basis points U.S. monetary policy tightening

Note: 68% confidence intervals.

Figure 4 shows the state-dependent results, distinguishing periods when the ECB shock is of the opposite sign (ECB easing) from all other periods. Financial variables display some state dependence: when the Fed tightens during ECB easing, the 1-year government bond yield, equity prices, the excess bond premium, and the REER react more strongly, though in directions consistent with a tightening. In contrast, the responses of industrial production and the CPI are similar across states, with overlapping confidence intervals.[10]

[10]The ECB-easing state contains 63 observations, which increases sampling uncertainty.

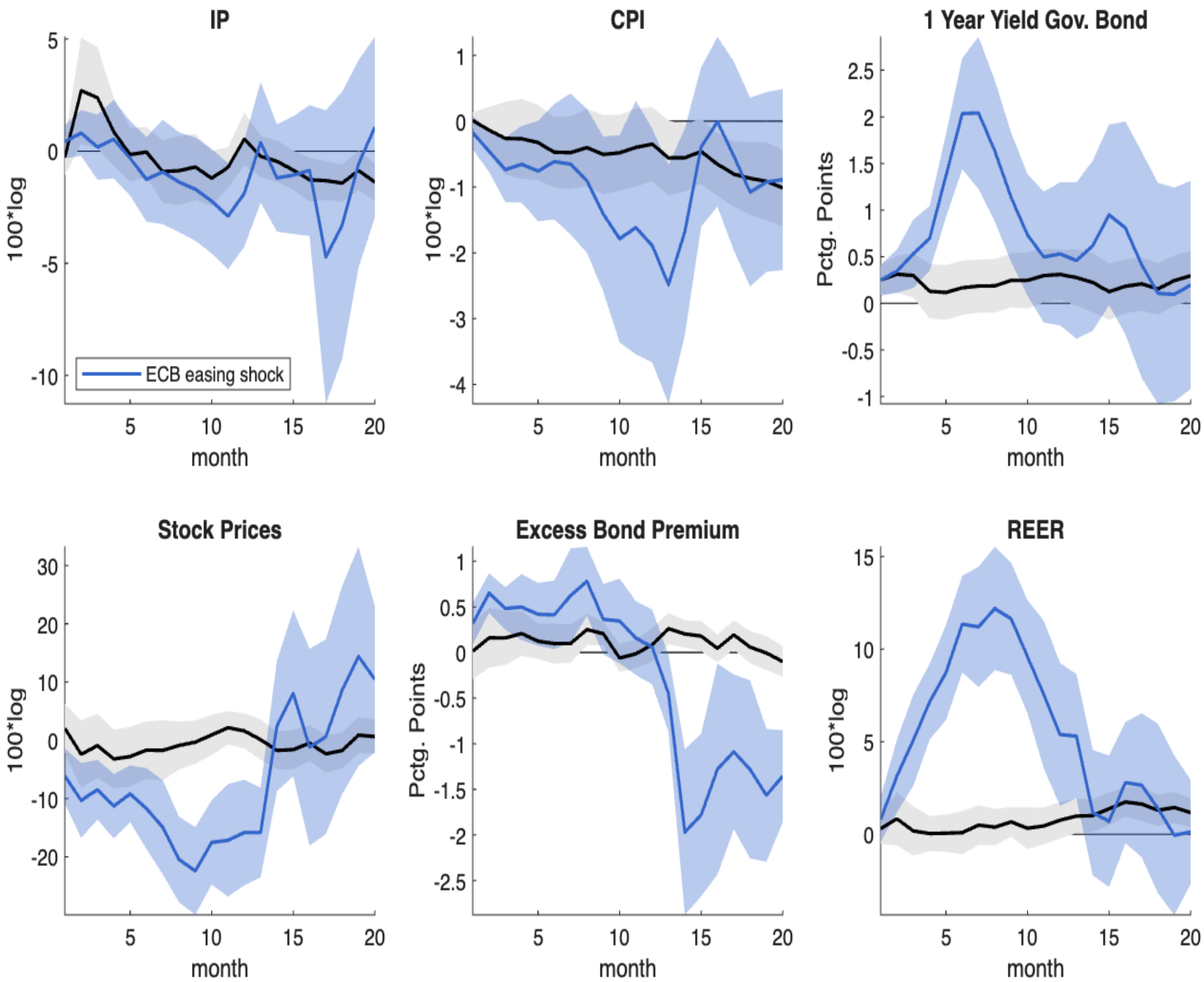

Figure 4: State-dependent impulse responses to a U.S. monetary policy tightening

Note: 68% confidence intervals. Blue lines denote periods with ECB easing.

Overall, a U.S. monetary tightening is contractionary in both states. The transmission to core real and price variables does not materially differ depending on whether the euro area is simultaneously easing or tightening. This result is consistent with existing empirical evidence and suggests limited spillovers from ECB shocks to the U.S. economy.

2.5 Discussion

The results underscore that international monetary spillovers are central to assessing domestic transmission. In particular, when the Federal Reserve eases while the ECB tightens, the transmission of ECB policy is markedly attenuated, yielding unconventional responses in euro-area financial markets and macroeconomic aggregates. This configuration is policy-relevant and, to my knowledge, has not been systematically studied.

To interpret these reduced-form findings and make the mechanism explicit, a structural framework is required. A standard two-country New Keynesian model with frictionless, complete international financial markets offers limited scope for cross-border monetary transmission. In that environment—akin to a Mundell–Fleming setting with a strong exchange-rate channel—foreign monetary shocks generate offsetting forces on domestic demand.[11] For example, in this setting, when the foreign economy experiences a positive policy-rate shock. The higher foreign interest rate depresses foreign consumption via a negative wealth effect, which in turn lowers foreign demand for home goods (a contractionary spillover for the home economy). At the same time, the foreign currency appreciates, making home exports cheaper in foreign currency terms; this induces a substitution toward imports, raising foreign demand for home goods. Under conventional calibrations, these wealth and substitution effects largely offset each other in equilibrium, so trade-based spillovers are small.

Moreover, because financial frictions are absent in this benchmark, there is no role for financial spillovers—precisely the channel the empirical literature highlights as central for U.S. monetary policy spillovers e.g., Miranda-Agrippino and Hélene Rey (2020). Recent work argues that imperfect financial markets are essential to generate meaningful spillovers, with particular emphasis on dollar intermediation, balance-sheet channels, and the failure of uncovered interest parity e.g., Akinci and Queralto (2024). While these ingredients move the model in the right direction, they are not sufficient to reproduce the novel patterns documented here.

I therefore introduce an additional, tighter financial linkage between countries: cross-border financial integration operating through asset-price equalization, as proposed by Kollmann et al. (2011), Dedola and Lombardo (2012), and Caldara et al. (2024). Embedding this feature allows international risk pricing to co-determine domestic financial conditions. The model then produces the asymmetric transmission pattern in the data—ECB tightening is muted when the Fed eases—by reshaping capital flows, risk premia, and the exchange-rate response in a way the frictionless benchmark cannot. The next section presents the model and details its key mechanisms.

[11] See Hélène Rey (2016) for discussion.

3 The Model

I develop a two-country New Keynesian model with a global investor. The framework extends Clarida et al. (2002); Corsetti and Pesenti (2005); Pappa (2004) and incorporates financial frictions following Dedola and Lombardo (2012). Departing from their setup, I assume a single global investor that intermediates across countries, raises dollar funding in both economies, and holds portfolio of claims on capital installed at home and abroad. The key features are: (i) the U.S. dollar is the international funding currency; (ii) a no-arbitrage condition links risk-adjusted returns on home and foreign capital; and (iii) uncovered interest parity (UIP) fails due to financial frictions.

The home country (H) is the euro area; the foreign country (F) is the United States. In addition to the global investor, each economy is populated by households, final-goods producers, intermediate-goods producers, capital producers, and a monetary authority.

I assume the two economies are symmetric in size and trade openness, and that firms set prices in their own currency (producer-currency pricing). These assumptions isolate *dollar dominance* in international financial markets as the central asymmetry underpinning the empirical results.

In each country, households consume a composite final good assembled from home and foreign varieties. Final goods are produced under perfect competition by combining a continuum of differentiated intermediate inputs. The final good is used for both consumption and investment, with capital accumulation subject to standard adjustment costs. Intermediate firms operate under monopolistic competition and face quadratic price-adjustment costs.

3.1 Households

A representative Home household chooses sequences for consumption c_t, hours worked l_t, real risk–free bonds denominated in Home currency, b_t, and real U.S.–dollar deposits d_t to maximize expected lifetime utility:

$$\max_{\{c_t, l_t, b_t, d_t\}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{(c_t - hc_{t-1})^{1-\sigma}}{1-\sigma} - \psi \frac{l_t^{1+\varphi}}{1+\varphi} \right].$$

where $\beta \in (0,1)$ is the discount factor, $h \in [0,1)$ captures external habits in consumption, $\sigma > 0$ is the inverse intertemporal elasticity of substitution, $\psi > 0$ scales the disutility of work, and $\varphi > 0$ is the inverse Frisch elasticity of labor supply.

The household's problem is subject to the sequence of budget constraints—expressed in units of the Home final good—for all t:

$$c_t + b_t + e_t d_t = w_t l_t + \frac{R_{t-1}}{\pi_t} b_{t-1} + e_t \frac{R^*_{t-1}}{\pi^*_t} d_{t-1} - e_t \frac{\Phi^D}{2} (d_t - d^{ss})^2 + tr_t + \Pi_t.$$

with w_t the real wage, R_{t-1} the gross nominal return on Home bonds, and $\pi_t \equiv P_t/P_{t-1}$ gross Home CPI inflation. Dollar deposits yield the gross nominal return R^*_{t-1} and are deflated by Foreign CPI inflation $\pi^*_t \equiv P^*_t/P^*_{t-1}$.[12] The real exchange rate is

$$e_t \equiv \frac{E_t P^*_t}{P_t},$$

where E_t is the nominal exchange rate (Home currency per unit of Foreign currency). Thus $e_t d_t$ is the value, in Home goods, of the household's real dollar position, and $e_t(R^*_{t-1}/\pi^*_t)d_{t-1}$ is its real payoff. The terms tr_t and Π_t denote lump–sum transfers and profits rebated by firms and investors. Finally, the household pays a quadratic portfolio–adjustment cost to pin down the steady–state net foreign asset position and to allow for a risk–premium wedge that breaks uncovered interest parity (UIP); this is standard in open–economy models such as Benigno (2009). Then, Home households pay a quadratic adjustment cost when they change their real dollar position relative to its steady state value, d^{ss}.

The representative Foreign household solves an analogous problem. The optimality conditions for Home and Foreign are:

Home (H).

$$\lambda_t = (c_t - hc_{t-1})^{-\sigma} - \beta h\,(c_{t+1} - hc_t)^{-\sigma} \tag{3}$$

$$\psi\,\ell_t^{\varphi} = \lambda_t\,w_t \tag{4}$$

$$1 = \beta\,\mathbb{E}_t\left[\frac{\lambda_{t+1}}{\lambda_t}\,\frac{R_t}{\pi_{t+1}}\right] \tag{5}$$

$$1 = \beta\,\mathbb{E}_t\left[\frac{\lambda_{t+1}}{\lambda_t}\,\frac{R^*_t}{\pi^*_{t+1}}\,\frac{e_{t+1}}{e_t}\right] \;-\; \Phi^D\,(d_t - d^{ss}). \tag{6}$$

[12]An asterisk denotes Foreign variables.

Foreign (F).

$$\lambda_t^* = (c_t^* - hc_{t-1}^*)^{-\sigma} - \beta h\,(c_{t+1}^* - hc_t^*)^{-\sigma}, \tag{7}$$

$$\psi\,(\ell_t^*)^{\varphi} = \lambda_t^*\,w_t^*, \tag{8}$$

$$1 = \beta\,\mathbb{E}_t\left[\frac{\lambda_{t+1}^*}{\lambda_t^*}\,\frac{R_t^*}{\pi_{t+1}^*}\right]. \tag{9}$$

3.2 Final good producer

A representative Home final–good firm is perfectly competitive and produces y_t by combining a Home bundle y_{Ht} and a Foreign bundle y_{Ft} via a CES aggregator:

$$y_t = \left[\omega^{\frac{1}{\theta}}\,y_{Ht}^{\frac{\theta-1}{\theta}} + (1-\omega)^{\frac{1}{\theta}}\,y_{Ft}^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}},$$

where $\omega \in (0,1)$ captures Home bias and $\theta > 0$ is the trade elasticity. Each bundle is a CES over a unit mass of differentiated varieties:

$$y_{Ht} = \left[\int_0^1 y_{Ht}(i)^{\frac{\varepsilon-1}{\varepsilon}}\,di\right]^{\frac{\varepsilon}{\varepsilon-1}},$$

$$y_{Ft} = \left[\int_0^1 y_{Ft}(i)^{\frac{\varepsilon-1}{\varepsilon}}\,di\right]^{\frac{\varepsilon}{\varepsilon-1}},$$

with $\varepsilon > 1$ the substitution elasticity. Cost minimization implies the CPI and bundle demands:

$$P_t = \left[\omega\,P_{Ht}^{1-\theta} + (1-\omega)\,P_{Ft}^{1-\theta}\right]^{\frac{1}{1-\theta}},$$

$$y_{Ht} = \omega\left(\tfrac{P_{Ht}}{P_t}\right)^{-\theta} y_t,$$

$$y_{Ft} = (1-\omega)\left(\tfrac{P_{Ft}}{P_t}\right)^{-\theta} y_t.$$

For the Foreign final–good firm, the cost-minimizing conditions are

$$P_t^* = \left[\omega\,(P_{Ft}^*)^{1-\theta} + (1-\omega)\,(P_{Ht}^*)^{1-\theta}\right]^{\frac{1}{1-\theta}},$$

$$y^*_{Ft} = \omega\left(\tfrac{P^*_{Ft}}{P^*_t}\right)^{-\theta} y^*_t,$$
$$y^*_{Ht} = (1-\omega)\left(\tfrac{P^*_{Ht}}{P^*_t}\right)^{-\theta} y^*_t.$$

3.3 Intermediate–good producer

There is a continuum of Home intermediate firms indexed by $i \in [0,1]$. Each firm produces a differentiated variety and sells to both Home and Foreign final–good producers. Technology is Cobb–Douglas:

$$\bar{y}_t(i) \;=\; y_{Ht}(i) + y^*_{Ht}(i) \;=\; a_t\left(k_{t-1}(i)\right)^{\alpha}\left(l_t(i)\right)^{1-\alpha}, \tag{10}$$

where total factor productivity follows

$$\log a_t \;=\; (1-\rho_a)\log\bar{a} \;+\; \rho_a\log a_{t-1} \;+\; \varepsilon^a_t, \qquad \varepsilon^a_t \sim \mathcal{N}(0,\sigma_a^2).$$

Demand for variety i from the Home and Foreign final–good sectors is

$$y_{Ht}(i) = y_{Ht}\left(\frac{P_{Ht}(i)}{P_{Ht}}\right)^{-\varepsilon}, \tag{11}$$
$$y^*_{Ht}(i) = y^*_{Ht}\left(\frac{P^*_{Ht}(i)}{P^*_{Ht}}\right)^{-\varepsilon}. \tag{12}$$

Changing prices involves Rotemberg (1982) quadratic costs:

$$AC_t(i) = \frac{\Phi_P}{2}\left(\frac{P_{Ht}(i)}{P_{H,t-1}(i)} - \bar{\pi}\right)^2 P_{Ht}\,\bar{y}_t,$$

Firm i chooses $\{P_{Ht}(i),\, l_t(i),\, k_{t-1}(i)\}$ to maximize discounted real profits (expressed in terms of the domestic CPI), using the households' discount factor,

$$\max_{\substack{\{P_{Ht}(i), l_t(i), k_{t-1}(i),\\ \bar{y}_t(i), y_{Ht}(i), y^*_{Ht}(i)\}}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \Lambda_{0,t}\left[\frac{P_{Ht}(i)}{P_t}\,\bar{y}_t(i) \;-\; w_t\, l_t(i) \;-\; z_t\, k_{t-1}(i) \;-\; \frac{AC_t(i)}{P_t}\right].$$

subject to (10)–(12). Let mc_t denote the real marginal cost (in units of the Home final good). In a symmetric equilibrium, the optimality conditions are:

$$w_t = (1-\alpha)\, mc_t \,\frac{\bar{y}_t}{l_t},$$
$$z_t = \alpha\, mc_t \,\frac{\bar{y}_t}{k_{t-1}},$$

Price setting (Rotemberg NKPC):

$$1-\varepsilon+\varepsilon\,\frac{mc_t}{p_{Ht}} \;=\; \Phi_P(\pi_{Ht}-\bar{\pi})\,\pi_{Ht} \;-\; \Phi_P\,\beta\,\mathbb{E}_t\!\left[\frac{\lambda_{t+1}}{\lambda_t}\;(\pi_{H,t+1}-\bar{\pi})\;\pi_{H,t+1}\,\frac{\overline{y}_{t+1}}{\overline{y}_t}\right].$$

Foreign intermediate firms' optimality conditions are analogous and imply:

$$w_t^* = (1-\alpha)\, mc_t^* \,\frac{\bar{y}_t^*}{l_t^*},$$
$$z_t^* = \alpha\, mc_t^* \,\frac{\bar{y}_t^*}{k_{t-1}^*},$$

Price setting (Rotemberg NKPC):

$$1-\varepsilon+\varepsilon\,\frac{mc_t^*}{p_{Ft}^*} \;=\; \Phi_P(\pi_{Ft}^*-\bar{\pi}^*)\,\pi_{Ft}^* \;-\; \Phi_P\,\beta\,\mathbb{E}_t\!\left[\frac{\lambda_{t+1}^*}{\lambda_t^*}\;\left(\pi_{F,t+1}^*-\bar{\pi}^*\right)\;\pi_{F,t+1}^*\,\frac{\overline{y}_{t+1}^*}{\overline{y}_t^*}\right].$$

3.4 Capital–good producers

In each country, a perfectly competitive capital–good producer uses installed capital and investment to create new capital. New capital is sold to entrepreneurs at the beginning of period t at the real price q_t and repurchased (net of depreciation) at the end of period $t+1$. Investment is subject to adjustment costs as in Christiano et al. (2005):

$$s\!\left(\frac{I_t}{I_{t-1}}\right) = \frac{\Phi^I}{2}\left(\frac{I_t}{I_{t-1}}-1\right)^2,$$

The representative producer solves:

$$\max_{\{I_t\}}\;\; \mathbb{E}_0\sum_{t=0}^{\infty}\beta^t\frac{\lambda_t}{\lambda_0}\left\{q_t\!\left[1-s\!\left(\tfrac{I_t}{I_{t-1}}\right)\right] I_t - I_t\right\} \quad \text{s.t.} \quad k_t = (1-\delta)\,k_{t-1} + \left[1-s\!\left(\tfrac{I_t}{I_{t-1}}\right)\right] I_t,$$

where δ is the depreciation rate. Home and Foreign capital–good producers solve analogous problems.

3.5 Global investor

The investor sector is close to Dedola and Lombardo (2012), but in this paper, there is a single global investor (entrepreneur). It borrows short term from a global financial intermediary that collects dollar deposits from Home and Foreign households. The investor uses these funds to purchase installed capital from capital–good producers at the end of period t and rents it to firms in both countries during $t+1$, selling the undepreciated capital back at the prevailing price thereafter.

Let k_{t+1} and k^*_{t+1} denote units of installed capital for use in Home and Foreign, respectively. The investor finances purchases with internal net worth n^e_t and real dollar debt d^e_t. The balance sheet constraint at t is

$$\frac{q_t k_{t+1}}{e_t} \; + \; q^*_t k^*_{t+1} \; = \; n^e_t \; + \; d^e_t, \tag{13}$$

where q_t and q^*_t are the prices of installed capital and e_t is the real exchange rate.

The representative investor chooses k_{t+1} and k^*_{t+1} to maximize discounted profits:

$$\max_{\{k_{t+1},\, k^*_{t+1}\}} \quad \sum_{i=0}^{\infty} \mathbb{E}_t \, \beta^i \, \frac{\lambda^*_{t+i}}{\lambda^*_t} \Big[\frac{z_{t+i}\, k_{t+i}}{e_{t+i}} + z^*_{t+i}\, k^*_{t+i} - \frac{q_{t+i}}{e_{t+i}} (k_{t+1+i} - (1-\delta) k_{t+i}) \\ - q^*_{t+i}\big(k^*_{t+1+i} - (1-\delta) k^*_{t+i}\big) - R^d_{t-1+i} \, \frac{d^e_{t-1+i}}{\pi^*_{t+i}} + d^e_{t+i} \Big],$$

subject to (13). The gross real payoffs (in units of each country's final good) on one unit of installed capital are

$$R^K_{t+1} \; \equiv \; \frac{z_{t+1} \; + \; q_{t+1}(1-\delta)}{q_t}, \qquad R^{K*}_{t+1} \; \equiv \; \frac{z^*_{t+1} \; + \; q^*_{t+1}(1-\delta)}{q^*_t},$$

with z_{t+1} and z^*_{t+1} the rental rates of capital.

External finance carries a leverage–dependent premium; financial frictions are in the spirit of Bernanke et al. (1999), implemented in a tractable reduced form following Gilchrist (2003). The nominal dollar funding rate the investor faces is

$$R^d_t \; = \; \chi\!\left(\frac{d^e_t}{n^e_t},\, \varepsilon_t\right) \, R^*_t,$$

where R^*_t denotes the U.S. nominal risk–free rate, $\chi(\cdot) \geq 1$ is the external–finance premium increasing in leverage d^e_t/n^e_t and shifted by a financial shock ε_t, d^e_t is the investor's dollar debt, and n_t^e its net worth. In steady state, $\chi(\cdot)$ is normalized so that the premium is unity, and deviations capture time–varying funding conditions in global dollar markets.

The no–arbitrage conditions equate expected discounted returns on Home and Foreign capital to the common (dollar) funding cost:

$$\mathbb{E}_t\left[\beta\,\frac{\lambda_{t+1}^*}{\lambda_t^*}\,\frac{e_t}{e_{t+1}}\,R_{t+1}^K\right] = \mathbb{E}_t\left[\beta\,\frac{\lambda_{t+1}^*}{\lambda_t^*}\,\frac{R_t^d}{\pi_{t+1}^*}\right], \tag{14}$$

$$\mathbb{E}_t\left[\beta\,\frac{\lambda_{t+1}^*}{\lambda_t^*}\,R_{t+1}^{K*}\right] = \mathbb{E}_t\left[\beta\,\frac{\lambda_{t+1}^*}{\lambda_t^*}\,\frac{R_t^d}{\pi_{t+1}^*}\right]. \tag{15}$$

Then, combining equations 14 and 15,

$$\mathbb{E}_t\left[\beta\,\frac{\lambda_{t+1}^*}{\lambda_t^*}\,\frac{e_t}{e_{t+1}}\,R_{t+1}^K\right] = \mathbb{E}_t\left[\beta\,\frac{\lambda_{t+1}^*}{\lambda_t^*}\,R_{t+1}^{K*}\right] \tag{16}$$

The expected excess returns on U.S. and euro-area assets are tightly linked through the same funding channel.

Finally, the evolution of investors' net worth n_t^e—reflecting their equity stake—is given by

$$n_t^e = \Gamma^e\left(\mathrm{rk}_t^* k_{t-1}^* q_{t-1}^* + \mathrm{rk}_t\,\frac{e_{t-1}}{e_t}\,\frac{k_{t-1}q_{t-1}}{e_{t-1}} - \frac{r_{t-1}^d}{\pi_t^*}\,d_{t-1}^e\right) + (1-\Gamma^e)\,W^e.$$

Here, Γ^e denotes the survival probability (so $1-\Gamma^e$ is the exit share). Exiting entrepreneurs transfer their net worth to households, and households fund incoming entrepreneurs with W^e. The parameter $\Gamma^e \in (0,1)$ ensures a well-defined steady state.

3.6 Monetary authority

In each country, the central bank sets the short-term nominal interest rate with a Taylor rule that responds to domestic producer-price inflation, as is standard in the literature:

$$\frac{R_t}{\bar{R}} = \left(\frac{R_{t-1}}{\bar{R}}\right)^{\rho_r}\left(\frac{\pi_{Ht}}{\bar{\pi}}\right)^{(1-\rho_r)\,\phi_\pi}\exp(\varepsilon_t^m),$$

$$\frac{R_t^*}{\bar{R}^*} = \left(\frac{R_{t-1}^*}{\bar{R}^*}\right)^{\rho_r}\left(\frac{\pi_{Ft}^*}{\bar{\pi}^*}\right)^{(1-\rho_r)\,\phi_\pi}\exp(\varepsilon_t^{m*}).$$

Here $\bar{R}$ and $\bar{R}^*$ are the steady-state interest rates, and $\bar{\pi}$ and $\bar{\pi}^*$ are the inflation targets.

Monetary policy shocks are i.i.d. normal,

$$\varepsilon_t^m \sim \mathcal{N}(0, \sigma_m^2), \qquad \varepsilon_t^{m*} \sim \mathcal{N}(0, {\sigma_{m*}}^2).$$

3.7 Market clearing

Market clearing in the goods and investment market requires:

$$\bar{y}_t = y_{H,t} + \frac{\kappa_P}{2}\,(\pi_{H,t} - \bar{\pi})^2\,\bar{y}_t + \frac{N_f}{N_h}\,y_{H,t}^*, \tag{17}$$

$$\bar{y}_t^* = y_{F,t}^* + \frac{\kappa_P}{2}\,(\pi_{F,t}^* - \bar{\pi}^*)^2\,\bar{y}_t^* + \frac{N_h}{N_f}\,y_{F,t}. \tag{18}$$

Market clearing for deposits require:

$$d_t^e = \frac{N_h}{N_f}\,d_t + d_t^*. \tag{19}$$

and the balance of payment equation:

$$y_t^* = p_{F,t}^*\,\bar{y}_t^*\Big(1 - \frac{\kappa_P}{2}\,(\pi_{F,t}^* - \bar{\pi}^*)^2\Big) - \frac{q_t}{e_t}\,k_t + \frac{k_{t-1}}{e_t}(z_t + q_t(1-\delta)) + d_t - \frac{R_{t-1}^*}{\pi_t^*}\,d_{t-1}. \tag{20}$$

Where the right-hand side comprises: the Foreign GDP net of Rotemberg price-adjustment costs, the net factor income from claims on Home capital, where k_{t-1} earns rental z_t and resale value $q_t(1-\delta)$, and new purchases $q_t k_t$ are deducted, all converted into Foreign-real units via division by e_t; and the change in Home households' real dollar deposit position, $d_t - (R_{t-1}^*/\pi_t^*)d_{t-1}$.

The complete equilibrium equations are presented in the Appendix B.

4 Calibration

The model is solved by log–linearization around a deterministic steady state and calibrated in line with standard open-economy New Keynesian practice. Table 1 reports the baseline parameterization.

I consider two symmetric economic blocks. Population shares are set to $\mathcal{N}_H = \mathcal{N}_F = 0.5$, so each economy accounts for one half of world GDP (normalization). Output levels and gross inflation are normalized to one in steady state.

Households have CRRA preferences with external habits. The risk-aversion coefficient is $\sigma = 2$ and the habit parameter is $h = h^* = 0.8$, consistent with Justiniano et al. (2010). The inverse Frisch elasticity is $\varphi = 1$, and the disutility-of-labor scale is normalized to $\psi = 1$. Quarterly discount factors are $\beta = \beta^* = 0.9975$, which imply a steady-state gross real rate of approximately $1/\beta \approx 1.0025$ per quarter (about 1% per year), following Caldara et al. (2024).

Technology and nominal adjustment follow standard choices. The capital share is $\alpha = 0.33$ and the quarterly depreciation rate is $\delta = 0.025$. Price setting features Rotemberg adjustment costs with $\Phi^p = 150$, calibrated to deliver a New Keynesian Phillips-curve slope of about 0.03, as in Caldara et al. (2024). The elasticity across differentiated varieties is $\varepsilon = 6$, which implies an average gross markup $\varepsilon/(\varepsilon - 1) = 1.20$. Exogenous productivity follows AR(1) processes with persistence $\rho_a = 0.8$ in both countries.

The trade block is parsimonious. Home bias parameters are $\omega = \omega^* = 0.85$, consistent with import shares near 15%. The Armington trade elasticity is set to $\theta = 1.5$, which is conventional.

Portfolio rebalancing in deposits is smoothed with a quadratic adjustment cost $\Phi^D = 0.5$, and steady-state home deposits are set to $d^{ss} = 1.5$ to match the external position of the euro area v.s. the U.S., investment faces standard adjustment costs with $\Phi^I = 0.5$. Monetary policy follows a Taylor rule with interest-rate smoothing $\rho_r = 0.8$ and an inflation response $\varphi_\pi = 1.5$, ensuring determinacy. With $\pi^{ss} = 1$, the implied quarterly steady-state nominal rate is $R^{ss} = \pi^{ss}/\beta \approx 1.0025$ (and analogously abroad).

Financial intermediation is calibrated following Dedola and Lombardo (2012). Entrepreneurs survive with probability $\Gamma^e = 0.95$ and begin each period with initial net worth $W^e = 0.03$. Steady-state leverage targets a debt-to-net-worth ratio $\overline{D/N}^{ss} = 0.5$. The gross steady-state credit spread is $\bar{\chi} = 1.0164$ (about 1.64% per quarter), its elasticity with respect to leverage is $\chi_e = 0.04$, and the spread shock follows an AR(1) with persistence $\rho_{fs} = 0.8$.

Table 1: Parameter values

Parameter	Symbol	Value	Target/Source
Country size	$\mathcal{N}_H$, $\mathcal{N}_F$	0.5, 0.5	Normalization
Discount factor	β, β^*	0.9975, 0.9975	Caldara et al. (2024)
CRRA coefficient	σ	2	Standard
Inverse Frisch elasticity	φ	1	Standard
Habit parameter	h, h^*	0.8, 0.8	Justiniano et al. (2010)
Disutility of labor	ψ	1	Standard
Home bias	ω, ω^*	0.85, 0.85	U.S. import share 15%
Trade elasticity	θ	1.5	Standard
TFP persistence	ρ_a	0.8	Standard
TFP levels	$\bar{A}$, $\bar{A}^*$	0.2778, 0.3018	Normalization output
Capital depreciation	δ	0.025	Standard
Capital share	α	0.33	Standard
Rotemberg price cost	Φ^p	150	Phillips curve slope 0.03
Variety elasticity	ε	6	Markup 20%
Steady-state inflation	π^{ss}, $(\pi^{ss})^*$	1, 1	Normalization
Investment adj. cost	Φ^I	0.5	Standard
Deposit adj. cost	Φ^D	0.5	Standard
Home deposits	d^{ss}	1.5	EA trade surplus
Taylor coef. on inflation	φ_π	1.5	Standard
Interest-rate smoothing	ρ_r	0.8	Standard
Entrepreneur survival	Γ^e	0.95	Dedola and Lombardo (2012)
Initial entrepreneur wealth	W^e	0.03	Debt-to-net-worth
Debt-to-net-worth	$\overline{\frac{D}{N}}^{ss}$	0.5	Standard
Spread	$\bar{\chi}$	1.0164	Dedola and Lombardo (2012)
Spread elasticity	χ_e	0.04	Dedola and Lombardo (2012)
Spread shock persistence	ρ_{fs}	0.8	Standard

5 Model Dynamics

This section analyzes the propagation of a contractionary monetary policy shock in the Home economy under two alternative stances of Foreign policy: *Neutral* and *Opposite*, where "Neutral" means that there is no shock in the Foreign policy rate and "Opposite" denotes a simultaneous easing by the Foreign monetary authority by the same magnitude. The exercise's goal is that Home variables are consistent with the euro area, and the Foreign policy shock is consistent with the Fed shock used in the empirical analysis. Figure 5 reports impulse responses to a shock to the Home Taylor rule for Home output, inflation, the policy rate, net worth, the capital stock, the real exchange rate, and the corporate spread as deviations from their steady-state values. The blue lines represent the case of neutral Foreign policy, and the red lines represent the case when the Foreign policy interest rate recieves a negative shock.

When the Home economy tightens and the Foreign policy is neutral, the model generates conventional New Keynesian dynamics consistent with a contractionary monetary policy shock. The Home policy rate rises on impact and mean-reverts due to interest-rate smoothing. Expected real rates increase, depressing Home consumption through the Euler equation and Home investment; marginal costs fall and Home inflation declines. The net worth of the global investor contracts as the valuation of its assets (installed capital) falls and, therefore, this high leverage makes the Home corporate spread widen; the Home capital stock therefore declines, reinforcing the downturn through balance-sheet amplification. The Home real exchange rate appreciates on impact in line with higher relative short-term rates.

On the other hand, when the Home economy tightens while the Foreign monetary authority eases (red lines), the responses to the joint effect of policy divergence reproduce counterintuitive dynamics similar to the empirical facts. The global dollar funding rate R_t^* falls and compresses the investor's effective funding cost; lower R_t^d improves cash flows and the value of installed capital, raises investor net worth, and narrows the Home corporate spread. Because required returns on capital positions are tied to the common dollar funding cost through the return-equalization conditions, and because the real exchange rate cannot adjust one-to-one to the difference between interest rates, capital moves toward Home assets as well. Home investment and the Home capital stock rise rather than fall, and Home output increases. Home inflation becomes less negative—and can turn positive—as stronger demand and lower credit premia offset the direct disinflationary force of higher Home rates. The Home real exchange rate appreciates more than under a neutral Foreign stance, consistent with portfolio inflows into Home assets, but is still not sufficient to buffer international spillovers. Hence, when the exchange rate does not fully accommodate interest-rate differentials, the international funding channel can overturn the domestic Euler channel, matching the expansionary Home responses observed under opposite-sign shocks in the data.

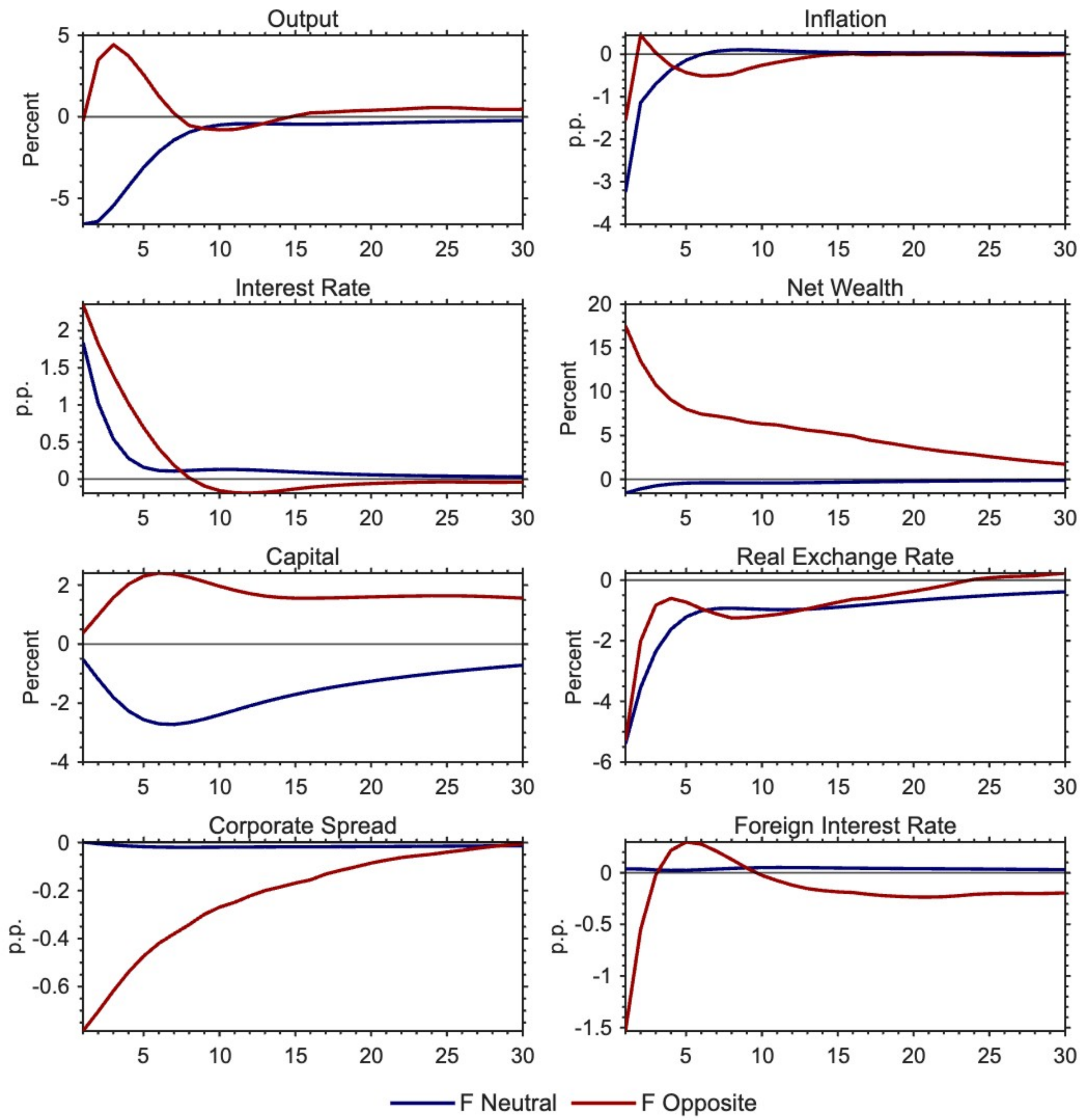

Figure 5: Model Home variables impulse responses to a Home monetary tightening under alternative Foreign policy stances.

Note. The panels report the impulse responses of selected model variables. Blue: Foreign Neutral. Red: Foreign Easing. Interest-rate and spread responses are in percentage points. Real quantities and the real exchange rate are in percent deviations from the steady state. Each period is one quarter.

5.1 Closing the UIP wedge

This subsection imposes a UIP condition by shutting down the wedges that generate deviations from parity in the baseline—namely, the household portfolio friction and the leverage-dependent funding premium. Practically, the deposit adjustment cost is set to zero. Then equation 6 from households' maximization problem becomes:

$$1 = \beta \, \mathbb{E}_t \left[\frac{\lambda_{t+1}}{\lambda_t} \frac{R_t^*}{\pi_{t+1}^*} \frac{e_{t+1}}{e_t} \right]$$

Combining with domestic bonds first order condition, equation 5,

$$\beta \, \mathbb{E}_t \left[\frac{\lambda_{t+1}}{\lambda_t} \frac{R_t}{\pi_{t+1}} \right] = \beta \, \mathbb{E}_t \left[\frac{\lambda_{t+1}}{\lambda_t} \frac{R_t^*}{\pi_{t+1}^*} \frac{e_{t+1}}{e_t} \right]$$

And log-linearizing, it yields to:

$$\mathbb{E}_t \Delta \log e_{t+1} = \big(\log R_t - \log R_t^* \big) - \big(\log \pi_{t+1} - \log \pi_{t+1}^* \big).$$

Where $\Delta \log e_{t+1} \equiv \log e_{t+1} - \log e_t$. The real exchange rate then moves one-for-one with the ex-ante real interest-rate differential.

Figure 6 replicates the baseline experiment: a Home tightening under (i) a neutral Foreign stance and (ii) a simultaneous easing of the Foreign policy rate. When UIP holds, a positive shock to the Home policy rate is *unambiguously contractionary*: output, investment, and the capital stock decline, and inflation falls. In this environment, the flexible exchange rate adjusts to the real interest-rate differential and effectively insulates the Home economy from Foreign spillovers.

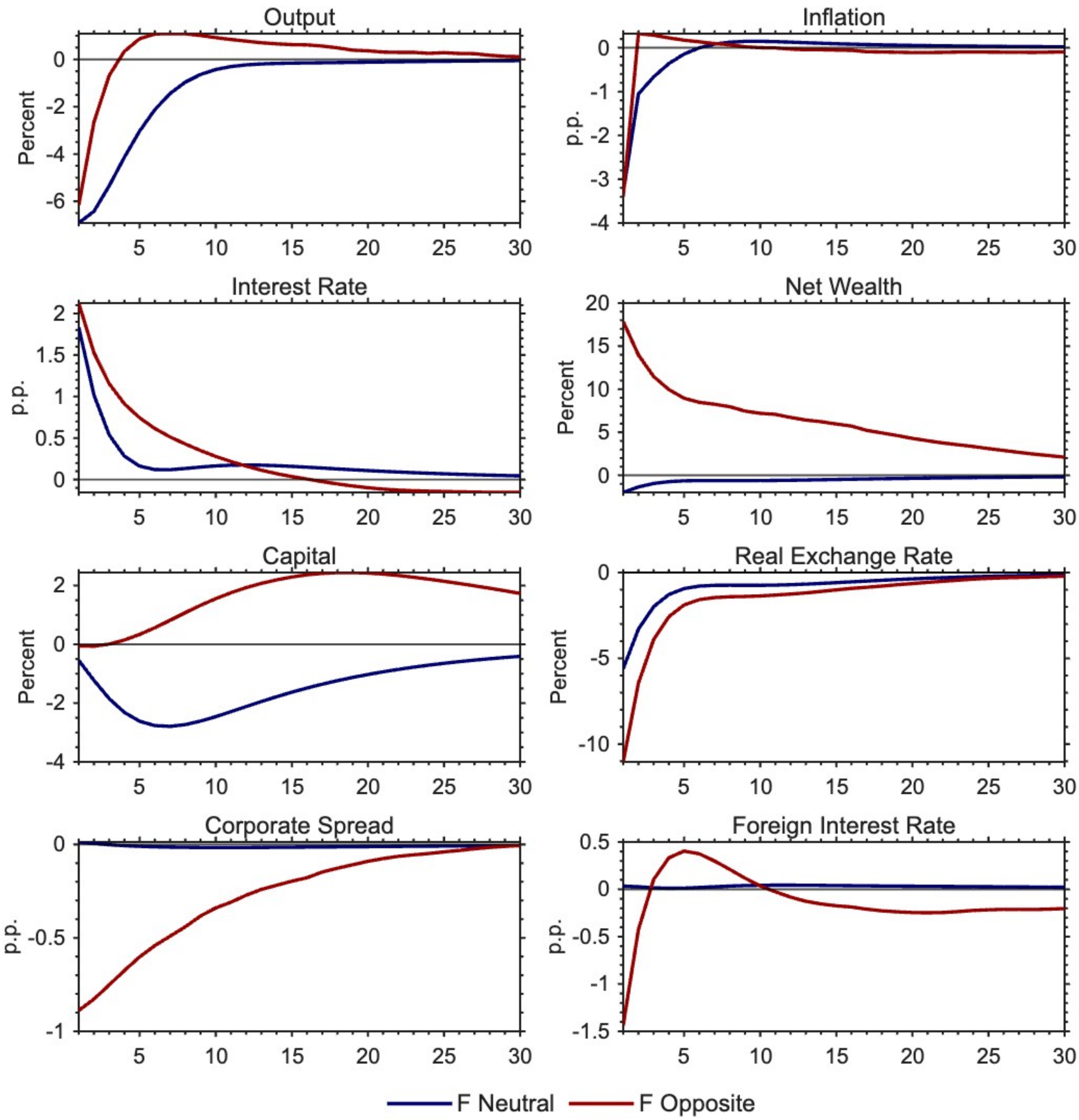

Figure 6: Model Home variables impulse responses to a Home monetary tightening under alternative Foreign policy stances. UIP holds.

Note. The panels report the impulse responses of selected model variables. Blue: Foreign Neutral. Red: Foreign Easing. Interest-rate and spread responses are in percentage points. Real quantities and the real exchange rate are in percent deviations from the steady state. Each period is one quarter.

As mentioned in Section 2.5, the literature has emphasized the failure of UIP to generate monetary policy spillovers. Then, when it is not the case, the classic closed-economy demand-driven channel dominates and output and inflation fall when there is an increase in the domestic interest rate despite relaxed global financial conditions.

It is outside the scope of this paper to show that UIP fails between the euro area and the U.S.; the literature on this is large, and many well-known puzzles are found in the data. For example, Galí (2020) claim that expectations of interest-rate differentials in the near (distant) future are shown to have much larger (smaller) effects on the real exchange rate than are implied by UIP for U.S., euro-area, and UK data.

5.2 Capital autarky

In this section, I keep the model's core structure and substitute the global representative investor with country-specific entrepreneurs. Each country is populated by an entrepreneur who holds only domestic capital only.

At time t, the Home entrepreneur purchases installed capital from Home capital-good producers at price q_t, rents it to Home intermediate-goods producers in $t+1$ at rental rate z_{t+1}, and sells the undepreciated stock back to capital-good producers at price q_{t+1}. The Foreign entrepreneur behaves analogously with Foreign producers.

Following the literature (see Section 2.5), the Home entrepreneur borrows in the Foreign currency (the U.S. dollar), so dollar intermediation, balance-sheet channels, and the failure of UIP remain. However, because balance sheets are segmented across countries, required returns on Home and Foreign capital are no longer tightly linked: each entrepreneur discounts payoffs with its own domestic stochastic discount factor. Consequently, the no-arbitrage condition 16 no longer applies, and 14–15 are replaced by:

$$\mathbb{E}_t\left[\beta\,\frac{\lambda_{t+1}}{\lambda_t}\,R^K_{t+1}\right] = \mathbb{E}_t\left[\beta\,\frac{\lambda_{t+1}}{\lambda_t}\,\frac{e_{t+1}}{e_t}\,\frac{R^d_t}{\pi^*_{t+1}}\right], \tag{21}$$

$$\mathbb{E}_t\left[\beta\,\frac{\lambda^*_{t+1}}{\lambda^*_t}\,R^{K*}_{t+1}\right] = \mathbb{E}_t\left[\beta\,\frac{\lambda^*_{t+1}}{\lambda^*_t}\,\frac{R^d_t}{\pi^*_{t+1}}\right]. \tag{22}$$

Figure 7 reports the impulse responses of Home variables to a Home tightening under a neutral Foreign stance and under a simultaneous Foreign easing. With a neutral Foreign stance, the responses are conventional for a domestic rate increase. Under Foreign easing, a strong sign flip in the impulse responses emerges, but the UIP wedge now induces an *increase* in the real exchange rate—i.e., a depreciation of the Home currency—after a Home tightening, which contradicts the data. Calibrations forced to deliver a Home currency appreciation in this environment fail to reproduce the empirical patterns in Home quantities and prices. This contrast highlights that, without cross-border intermediation through a unified investor balance sheet, the limits on Home transmission documented in the baseline largely disappear.

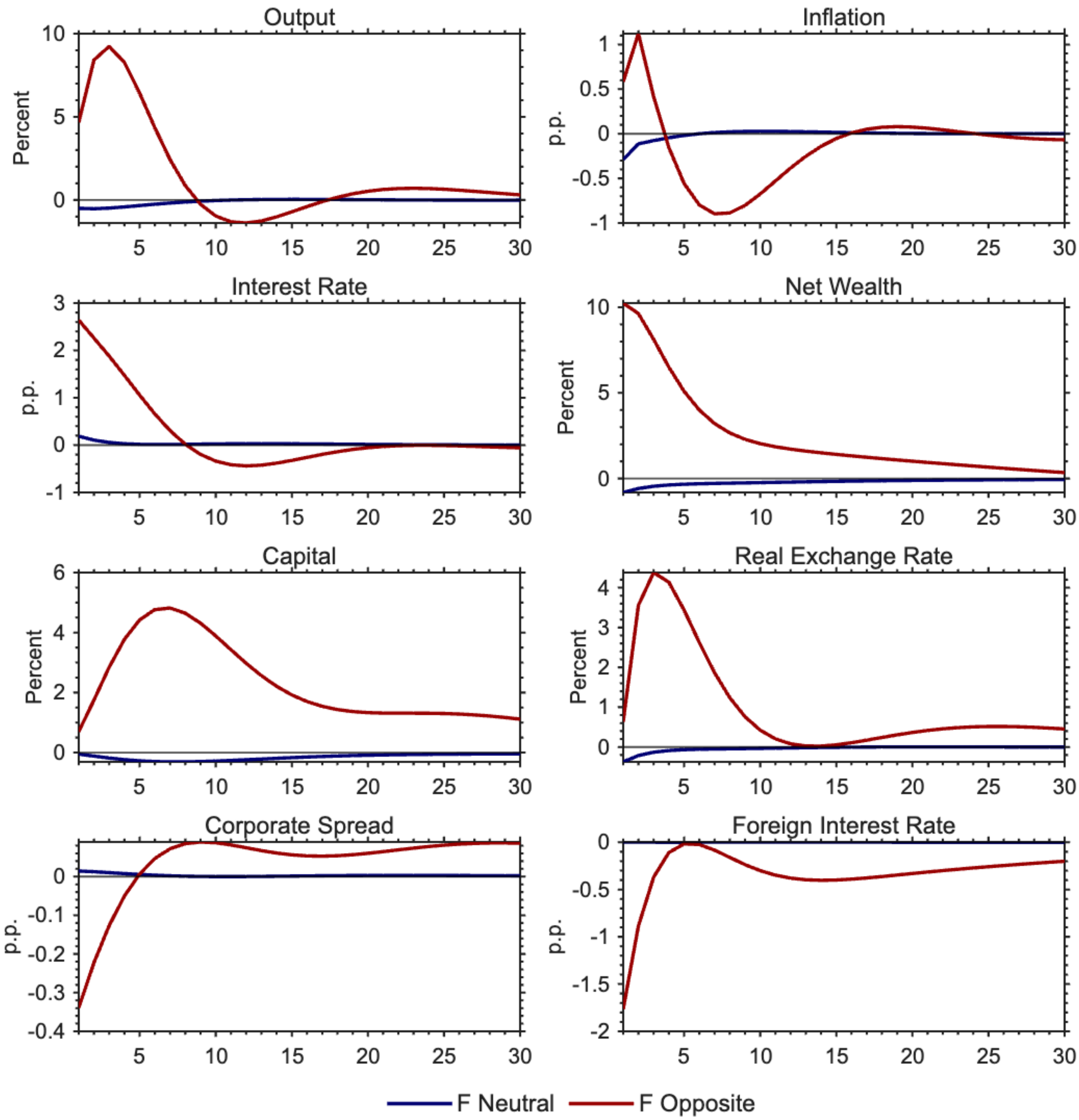

Figure 7: Model Home variables impulse responses to a Home monetary tightening under alternative Foreign policy stances. Capital autarky.

Note. The panels report the impulse responses of selected model variables. Blue: Foreign Neutral. Red: Foreign Easing. Interest-rate and spread responses are in percentage points. Real quantities and the real exchange rate are in percent deviations from the steady state. Each period is one quarter.

5.3 Foreign economy dynamics

For completeness, I report the same analysis but from the Foreign perspective. Now, the analysis implies a Foreign monetary policy tightening shock under neutral and easing Home monetary policies. Because the Foreign currency is the dominant international funding currency, a Foreign tightening raises the global dollar funding rate and directly tightens domestic financial conditions. In both Home stances—Neutral and Easing—Foreign output and investment decline, marginal costs fall, and therefore Foreign inflation falls as well. Investor net worth contracts as asset values fall, leverage rises, and the external-finance premium widens, producing higher credit spreads. The exchange rate depreciates in real terms (a stronger Foreign currency)[13].

Quantitatively, the responses display only limited sensitivity to the contemporaneous Home stance and are sometimes null. A Home easing does not overturn the contractionary impact of higher Foreign real rates. This pattern mirrors the empirical evidence that U.S. monetary policy shocks are reliably contractionary for its domestic variables, with comparatively modest feedback from euro-area policy. Figure 8 plots the corresponding impulse responses.

[13] The real exchange rate is expressed in terms of the Home currency.

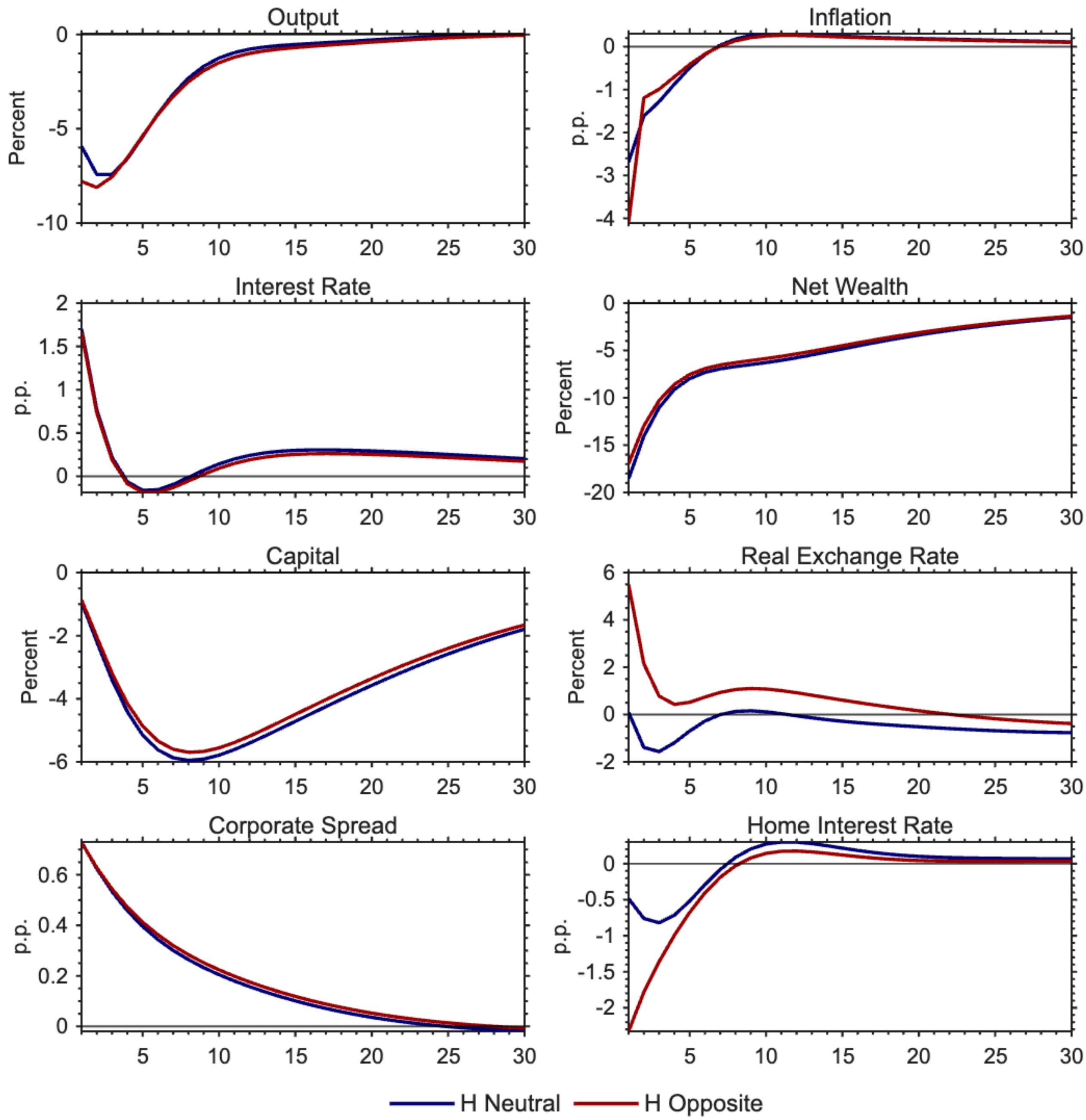

Figure 8: Model Foreign variables impulse responses to a Foreign monetary tightening under alternative Home policy stances.

Note. The panels report the impulse responses of selected model variables. Blue: Home Neutral. Red: Home Easing. Interest-rate and spread responses are in percentage points. Real quantities and the real exchange rate are in percent deviations from the steady state. Each period is one quarter.

6 Conclusion

This paper shows that the transmission of euro-area monetary policy is state-dependent with respect to U.S. monetary policy. Using local projections, I document that a contractionary ECB shock delivers conventional effects when U.S. policy is neutral or aligned, but its impact is substantially attenuated—and may even reverse in sign across financial and macroeconomic variables—when the Fed simultaneously eases. A complementary exercise from the U.S. perspective indicates that a Fed tightening remains unambiguously contractionary regardless of the ECB's monetary policy, underscoring an asymmetry linked to the dollar's global role.

To rationalize these patterns, I develop a two-country New Keynesian model in which (i) the U.S. dollar is the dominant international funding currency, (ii) a no-arbitrage condition links risk-adjusted returns on home and foreign capital, and (iii) UIP fails due to frictions in international asset markets. In this environment, easier U.S. policy lowers dollar funding costs, compresses global risk premia, and triggers a portfolio reallocation toward euro-area assets that offsets—and in some dimensions overturns—the standard contractionary effects of an ECB tightening. When cross-border intermediation is limited or UIP holds exactly, this attenuation largely disappears, reinforcing the interpretation that the funding channel is central.

The contribution is twofold. Empirically, the paper establishes that euro-area monetary transmission is contingent on U.S. policy and, in particular, is nonstandard when the two diverge. Theoretically, it offers a tractable mechanism that nests this asymmetry within a standard open-economy framework, clarifying how dominant-currency funding and cross-border arbitrage interact with deviations from UIP to shape domestic outcomes.

These findings have several implications. First, standard assessments of the transmission of euro-area policy should be conditioned on U.S. policy. Second, during episodes of transatlantic divergence, monetary autonomy may be more limited than suggested by closed-economy benchmarks, raising the value of complementary tools.

The most relevant direction for future work is to analyze optimal policy and central-bank interaction in this setting. A welfare-based evaluation of policy under divergence would clarify when and how monetary authorities should adjust their reaction functions. Finally, the assessment of the effectiveness of particular policies—such as at the zero lower bound—is another relevant direction.

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Appendix A: Empirical Analysis

Description of Variables

Name	Description	Transformation	Source
IP	Industrial production index; total excluding construction	100*log	Eurostat
HCPI	Harmonized Consumer Price Index Overall index, EA (changing composition)	100*log	Eurostat
Stoxx 50	EURO STOXX 50 Equity Index - Historical close, average of observations through period, EA (changing composition)	100*log	Eurostat
Exchange rate	U.S. Dollars to Euro	100*log	Eurostat
1-year Bund yield	Term structure of interest rates on listed German Federal securities (method by Svensson), residual maturity of 1.0 year	None	Deutsche Bundesbank
Corporate spreads	ICE BofA Euro High Yield Index Option-Adjusted Spread	None	FRED
Commodity price index	ECB Commodity Price index Euro denominated. Non-food	None	Eurostat
Global Financial Factor	Common factor across world risky asset prices	None	Miranda-Agrippino and Hélene Rey (2020)
EA monetary policy shock	Monetary Policy shocks obtained with simple ("Poor Man's") sign restrictions.	None	Jarociński and Karadi (2020)
US monetary policy shock	Monetary Policy shocks.	None	Bauer and Swanson (2023)

Table 2: Description and sources of euro area variables used in the empirical analysis.

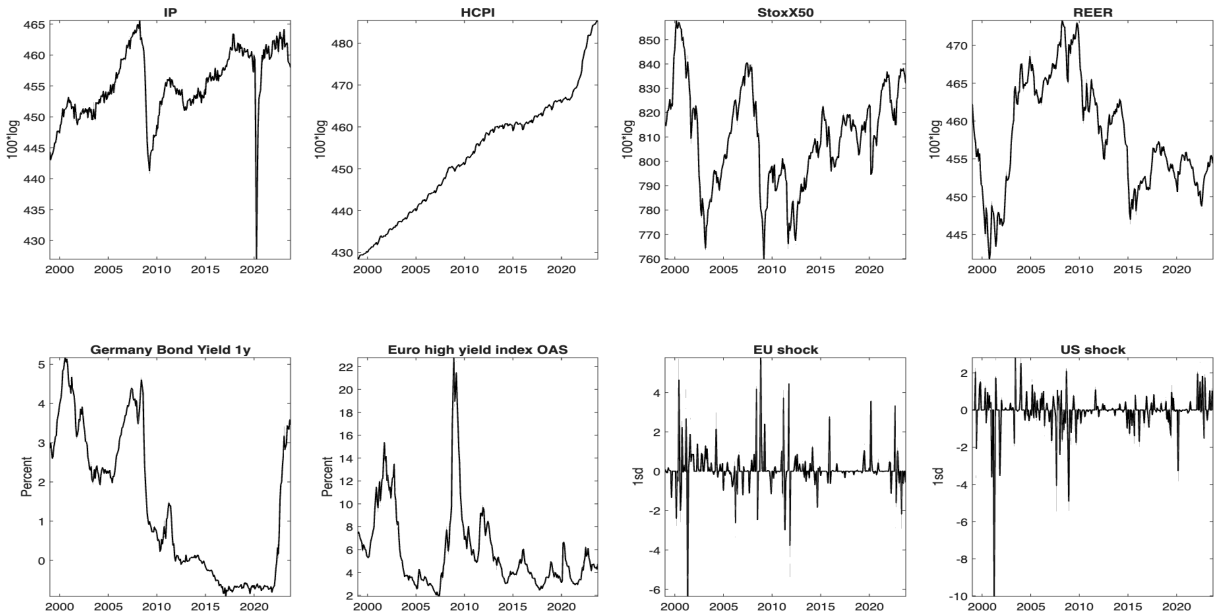

Figure 9: Euro area variables used in the baseline empirical estimation (transformed series).

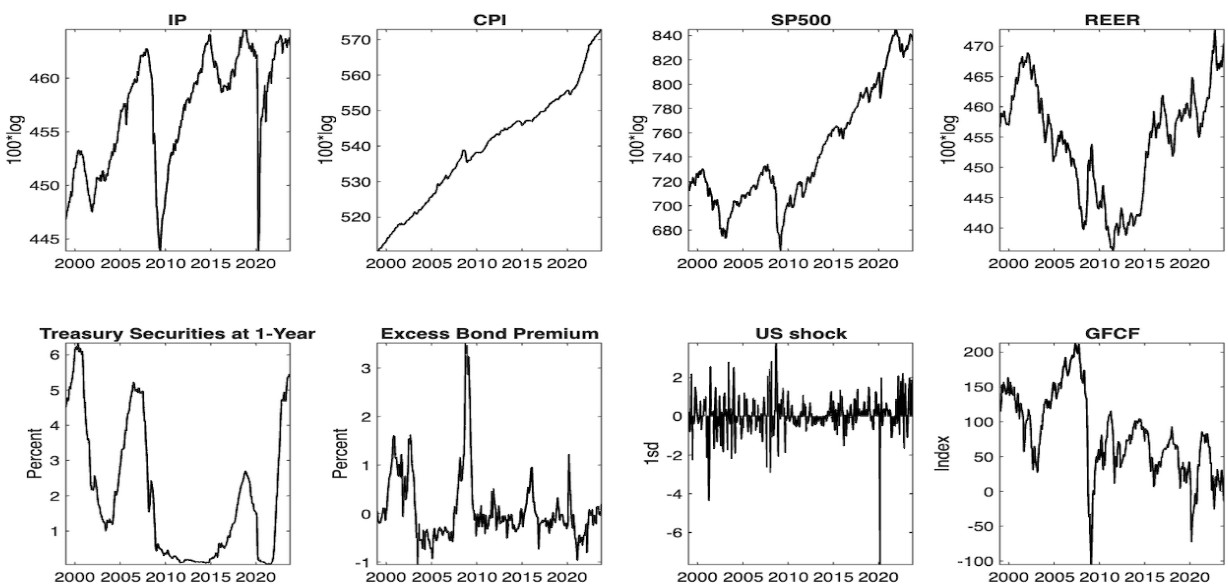

Figure 10: U.S. variables used in the baseline empirical estimation (transformed series).

Robustness Checks and Alternative Specifications

Alternative Number of Control Lags

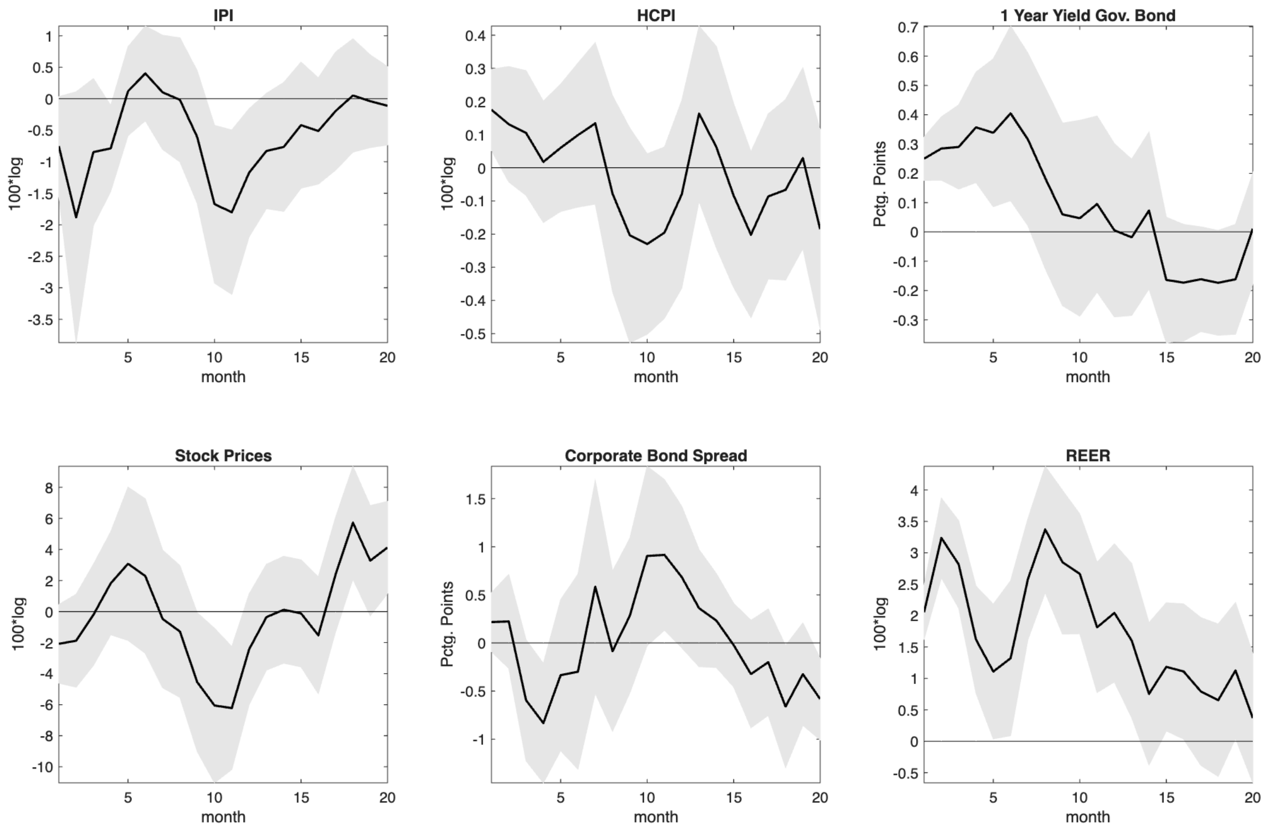

Figure 11: Impulse responses to a 25 basis points monetary policy shock using three control lags (linear model).

Note: 68% confidence bands.

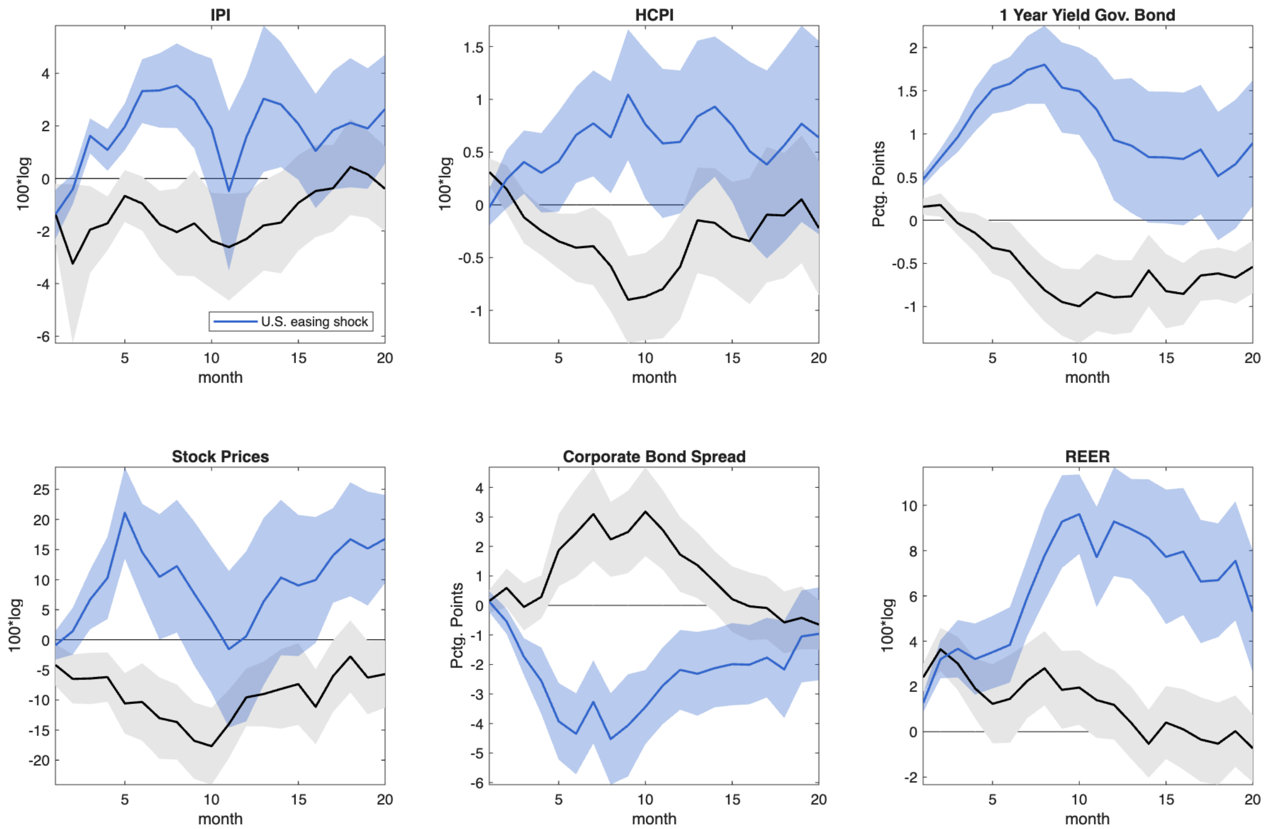

Figure 12: State-dependent impulse responses to the same monetary policy shock using three control lags.

Note: 68% confidence intervals. Blue lines indicate an easing U.S. monetary policy stance.

Alternative Samples

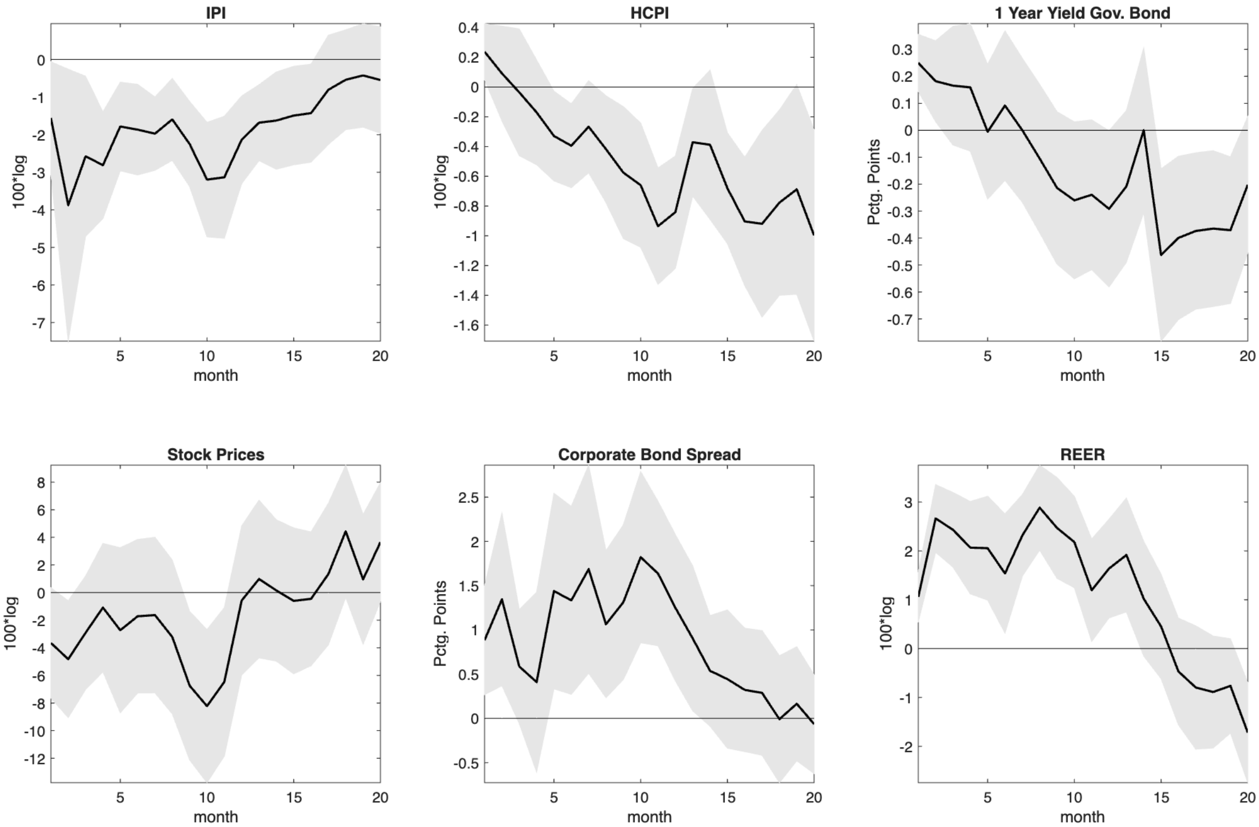

Figure 13: Impulse responses to a 25 basis points monetary policy shock (linear model). Sample from January 2002 to October 2023.

Note: 68% confidence bands.

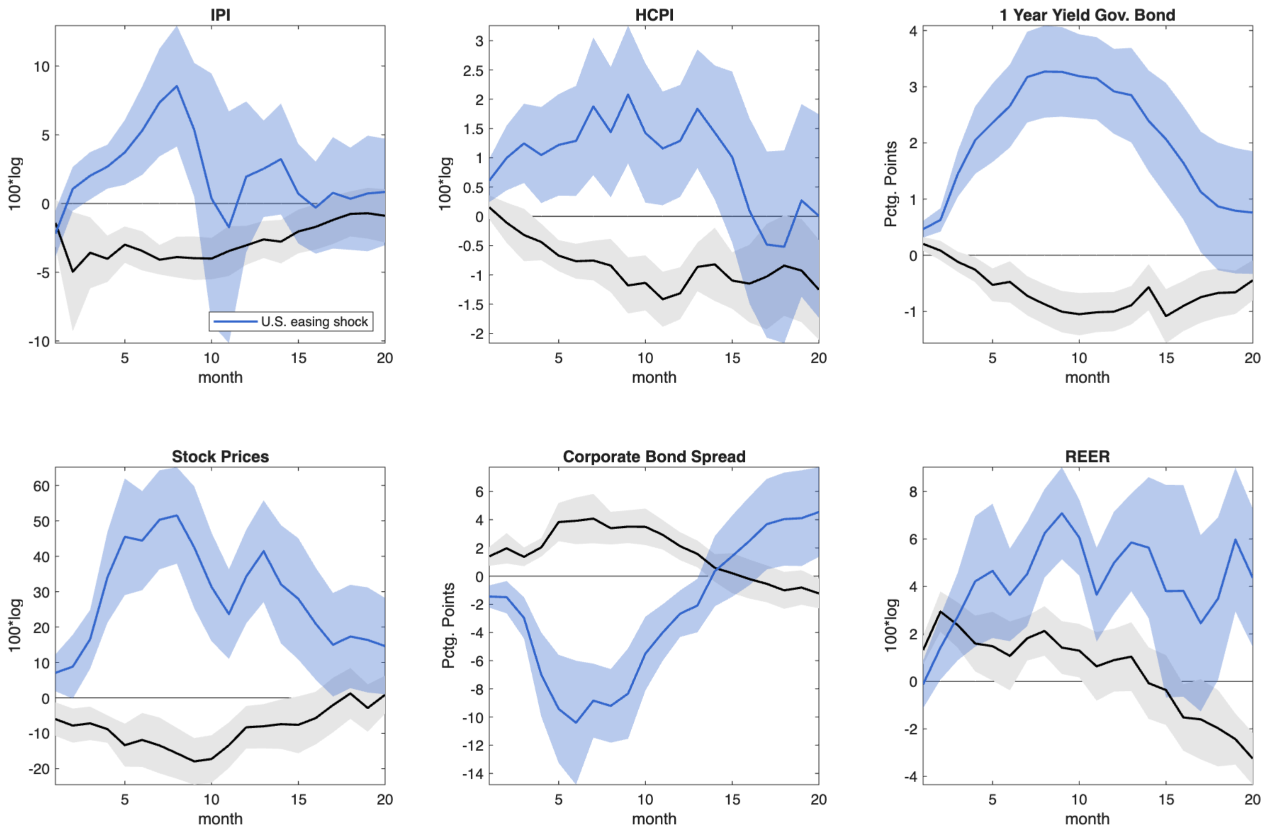

Figure 14: State-dependent impulse responses to the same monetary policy shock. Sample from January 2002 to October 2023.

Note: 68% confidence intervals. Blue lines indicate an easing U.S. monetary policy stance.

Alternative State Variable

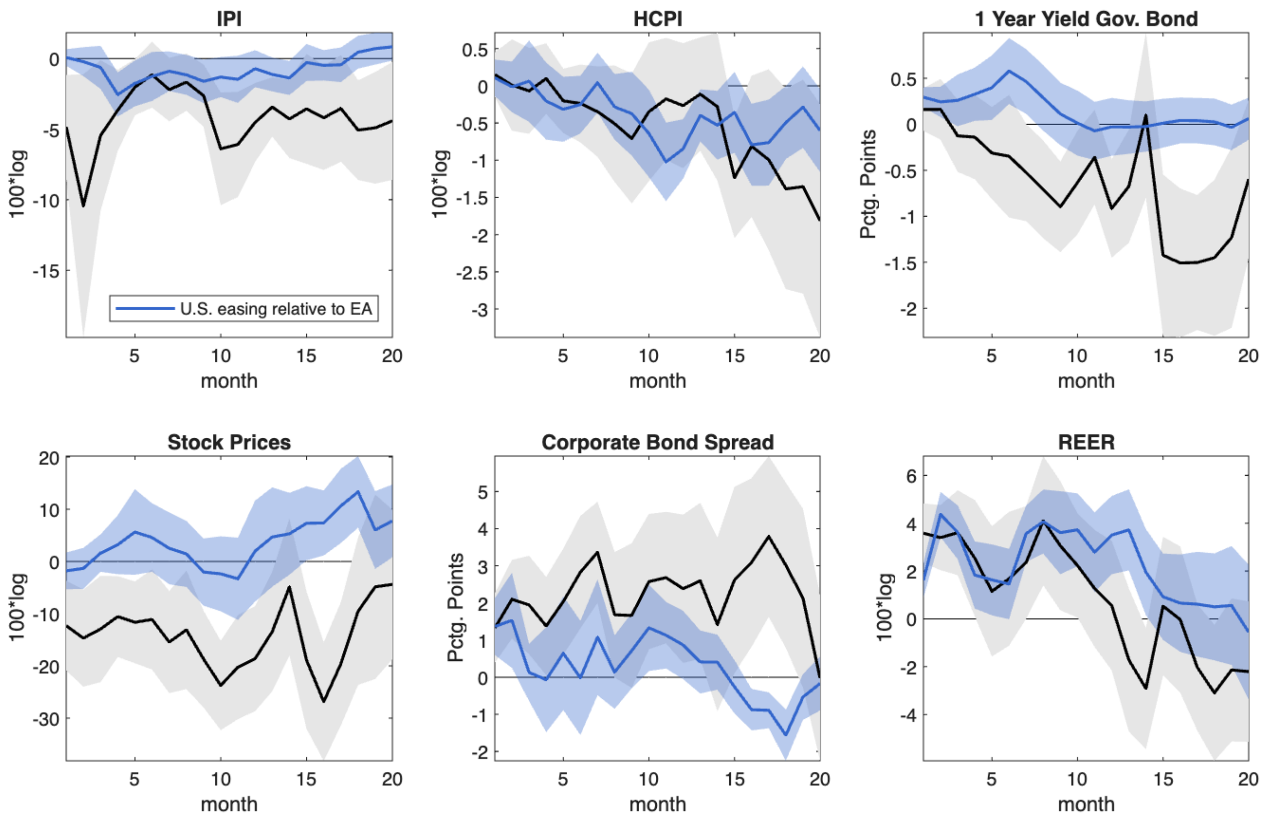

Figure 15: State-dependent impulse responses to the same monetary policy shock with alternative state definition.

Note: The figure displays impulse responses conditional on the 'U.S. easing relative stance' state. This state is defined as periods when the difference between U.S. and German 1-year government bond yields is below its median. The model is estimated using one control lag. The solid (blue) lines show the mean response to an easing U.S. monetary policy shock. 68% confidence intervals.

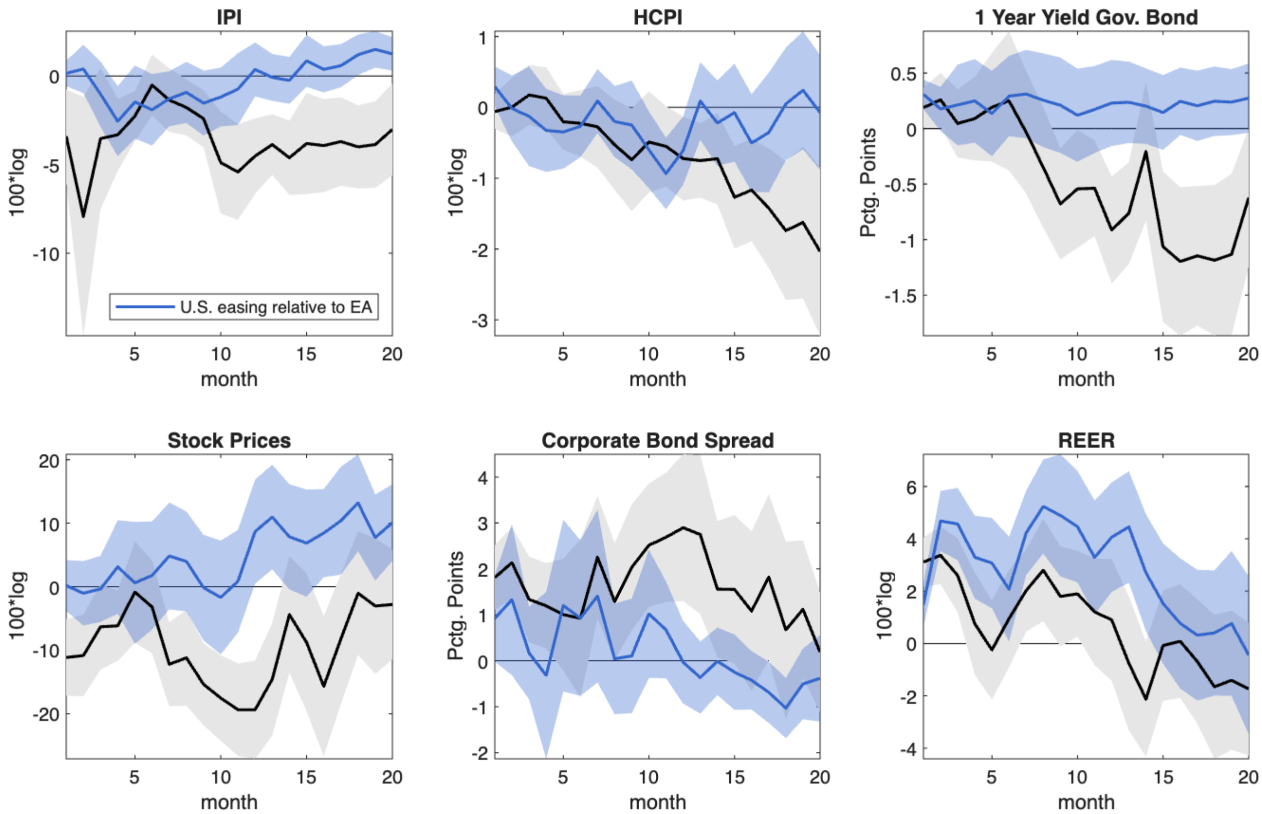

Figure 16: State-dependent impulse responses to the same monetary policy shock with alternative state definition.

Note: The figure displays impulse responses conditional on the 'U.S. easing relative stance' state. This state is defined as periods when the difference between the U.S. Federal Funds Rate and the Euro Area Deposit Facility Rate is below its median. The model is estimated using one control lag. The solid (blue) lines show the mean response to an easing U.S. monetary policy shock. 68% confidence intervals.

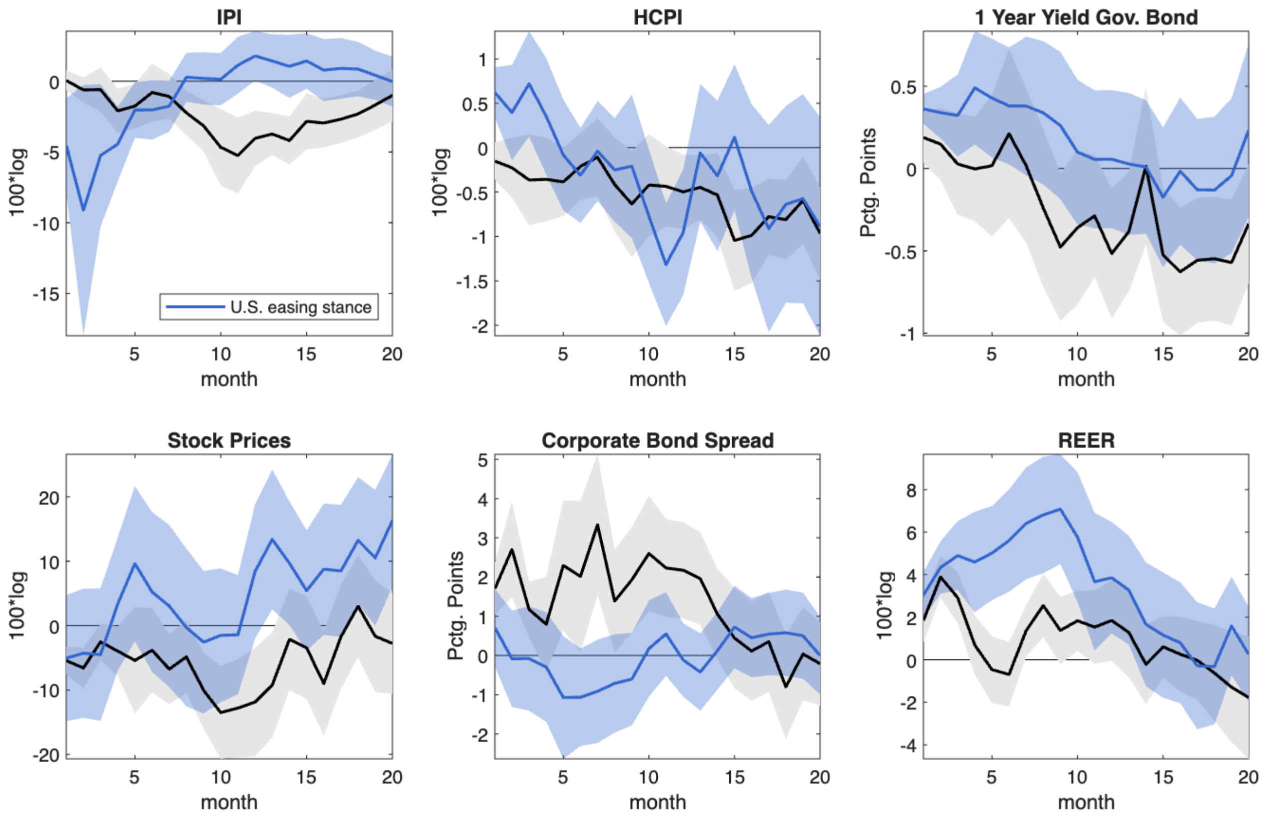

Figure 17: State-dependent impulse responses to the same monetary policy shock with alternative state definition.

Note: The figure displays impulse responses conditional on the 'U.S. easing stance' state. This state is defined as periods when the U.S. 1-year government bond yields is below its median. The model is estimated using one control lag. The solid (blue) lines show the mean response to an easing U.S. monetary policy shock. 68% confidence intervals.

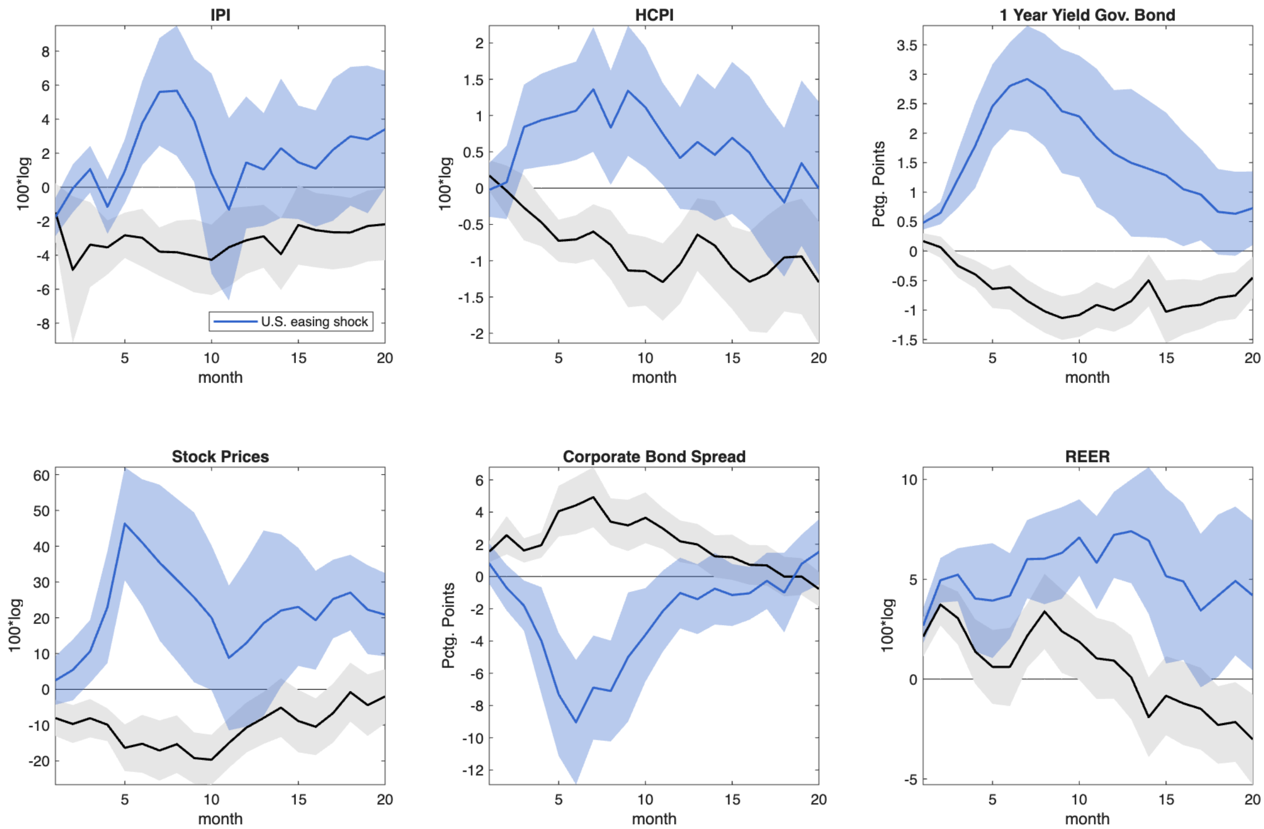

Figure 18: State-dependent impulse responses to the same monetary policy shock with alternative state definition.

Note: The figure displays impulse responses conditional on an alternative state definition. This 'easing' state is defined as periods where the high-frequency monetary policy surprise (instrument) from Jarociński and Karadi (2020) is negative. The model is estimated using one control lag. The solid (blue) lines show the mean response to an easing U.S. monetary policy shock. 68% confidence intervals.

Alternative Real Variable

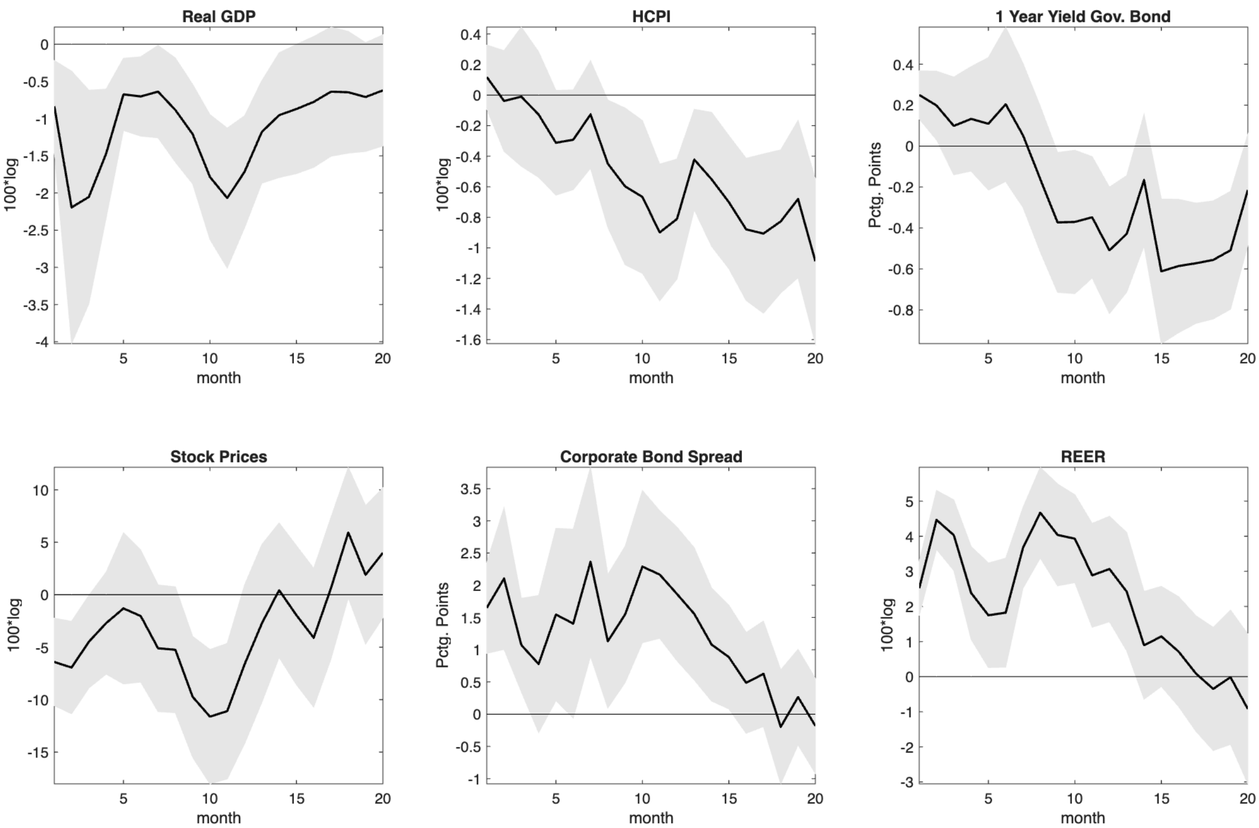

Figure 19: Impulse responses to a 25 basis points monetary policy shock (linear model).

Note: The figure displays the impulse response of real Gross Domestic Product (GDP), used here as the alternative real variable. 68% confidence intervals.

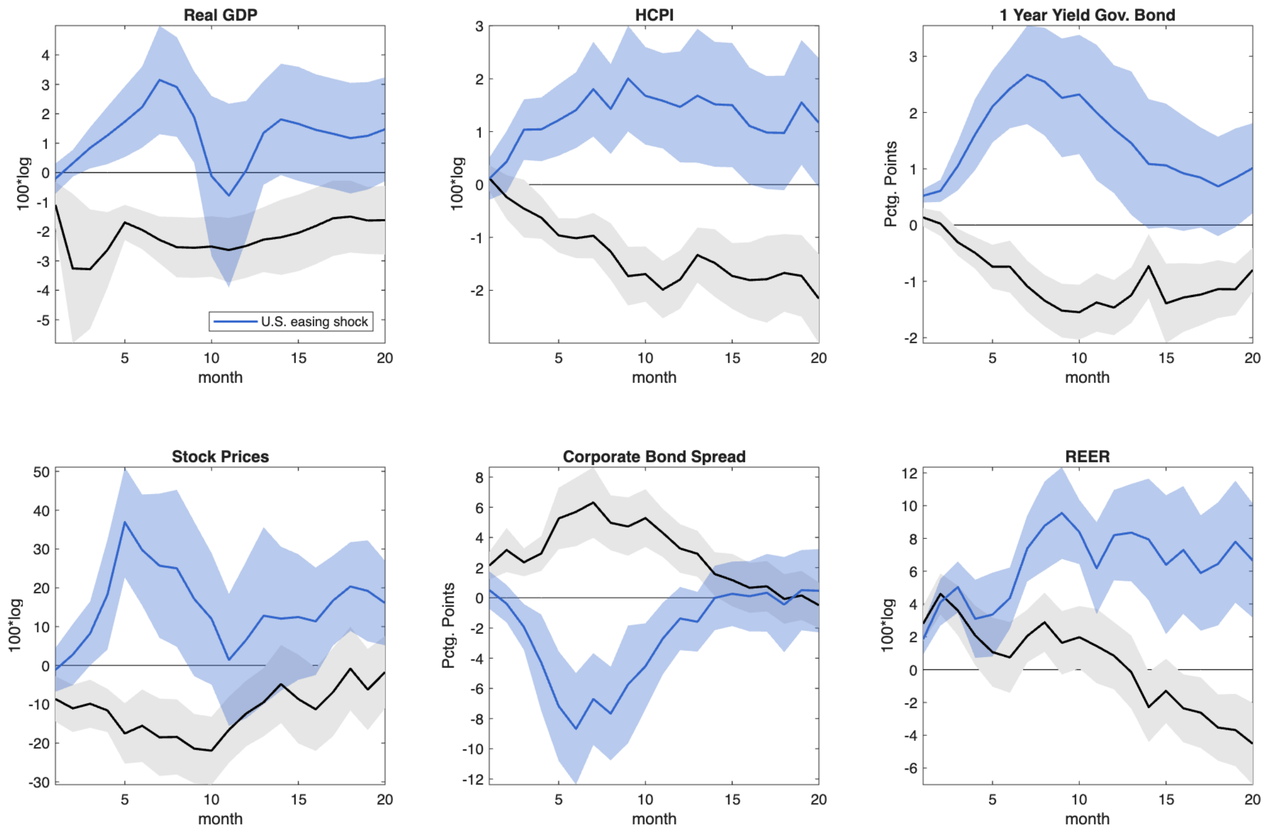

Figure 20: State-dependent impulse responses to the same monetary policy shock under different U.S. monetary policy states.

Note: The figure displays the impulse response of real Gross Domestic Product (GDP), used here as the alternative real variable. 68% confidence intervals. Blue lines indicate an easing U.S. monetary policy stance.

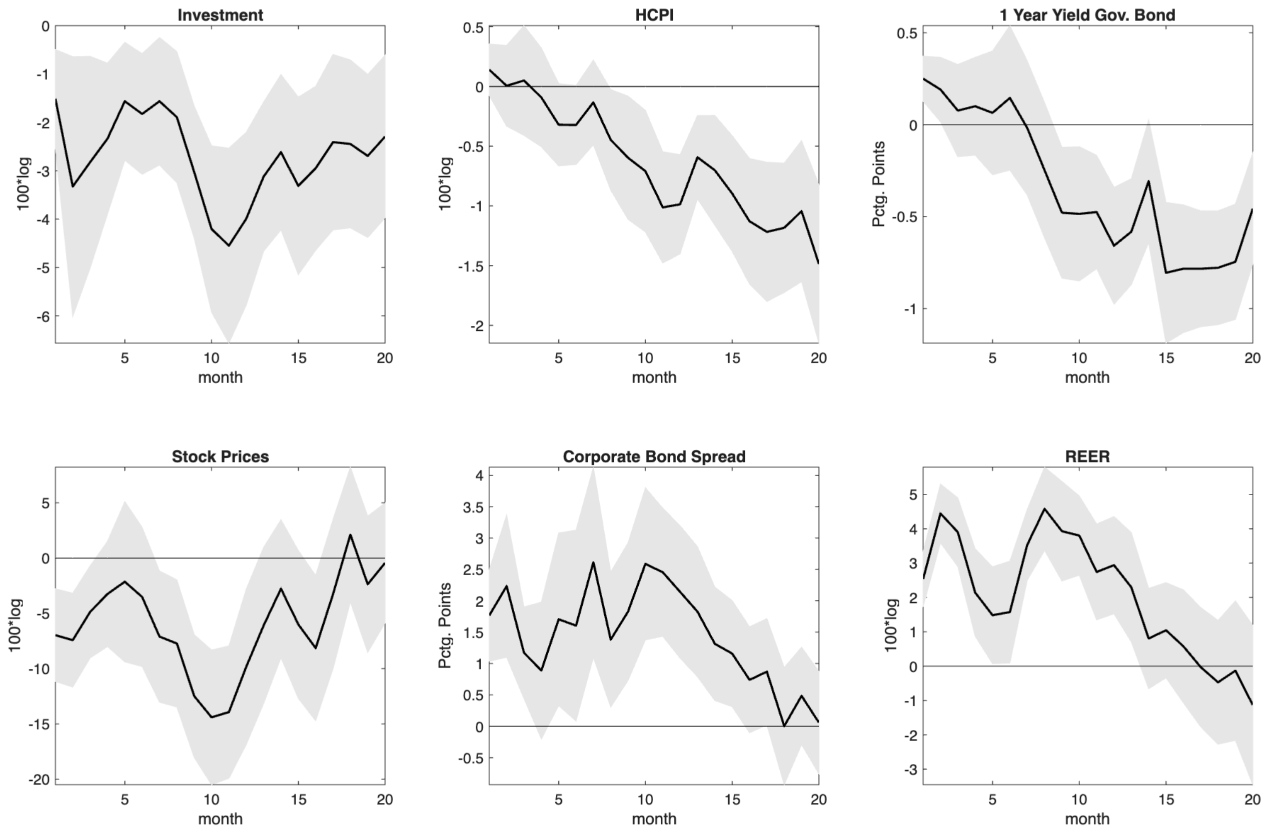

Figure 21: Impulse responses to a 25 basis points monetary policy shock (linear model).

Note: The figure displays the impulse response of (real) investment, used here as the alternative real variable. 68% confidence intervals.

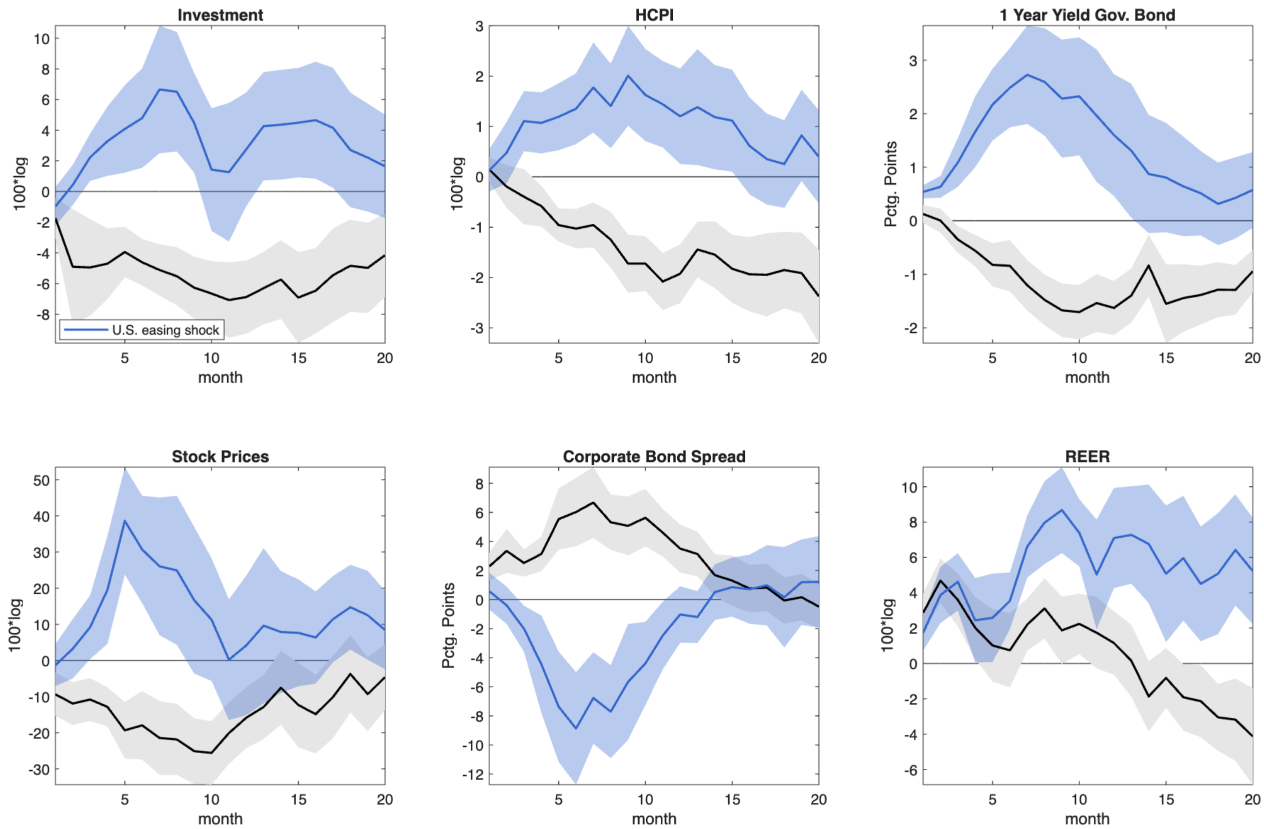

Figure 22: State-dependent impulse responses to the same monetary policy shock under different U.S. monetary policy states.

Note: The figure displays the impulse response of investment, used here as the alternative real variable. 68% confidence intervals. Blue lines indicate an easing U.S. monetary policy stance.

Appendix B: Equilibrium Conditions

Households

$$\lambda_t = (c_t - hc_{t-1})^{-\sigma} - \beta h\,(c_{t+1} - hc_t)^{-\sigma}, \tag{23}$$

$$\psi\,\ell_t^{\varphi} = \lambda_t\,w_t, \tag{24}$$

$$1 = \beta\,\mathbb{E}_t\left[\frac{\lambda_{t+1}}{\lambda_t}\,\frac{R_t}{\pi_{t+1}}\right], \tag{25}$$

$$1 = \beta\,\mathbb{E}_t\left[\frac{\lambda_{t+1}}{\lambda_t}\,\frac{R_t^*}{\pi_{t+1}^*}\,\frac{e_{t+1}}{e_t}\right] \;-\; \Phi^D\,(d_t - d^{ss}), \tag{26}$$

$$\lambda_t^* = (c_t^* - hc_{t-1}^*)^{-\sigma} - \beta h\,(c_{t+1}^* - hc_t^*)^{-\sigma}, \tag{27}$$

$$\psi\,(\ell_t^*)^{\varphi} = \lambda_t^*\,w_t^*, \tag{28}$$

$$1 = \beta\,\mathbb{E}_t\left[\frac{\lambda_{t+1}^*}{\lambda_t^*}\,\frac{R_t^*}{\pi_{t+1}^*}\right]. \tag{29}$$

Production and pricing

$$w_t = (1-\alpha)\,mc_t\,\frac{\bar{y}_t}{l_t}, \tag{30}$$

$$z_t = \alpha\,mc_t\,\frac{\bar{y}_t}{k_{t-1}}, \tag{31}$$

$$1 - \varepsilon + \varepsilon\,\frac{mc_t}{p_{Ht}} \;=\; \Phi_P(\pi_{Ht} - \bar{\pi})\,\pi_{Ht} \;-\; \Phi_P\,\beta\,\mathbb{E}_t\left[\frac{\lambda_{t+1}}{\lambda_t}\;(\pi_{H,t+1} - \bar{\pi})\;\pi_{H,t+1}^2\,\frac{\overline{y}_{t+1}}{\overline{y}_t}\right], \tag{32}$$

$$w_t^* \;=\; (1-\alpha)\,mc_t^*\frac{\overline{y}_t^*}{l_t^*}, \tag{33}$$

$$z_t^* = \alpha mc_t^*\,\frac{\overline{y}_t^*}{k_{t-1}^*}, \tag{34}$$

$$1 - \varepsilon + \varepsilon\,\frac{mc_t^*}{p_{Ft}^*} \;=\; \Phi_P(\pi_{Ft}^* - \bar{\pi}^*)\,\pi_{Ft}^* \;-\; \Phi_P\,\beta\,\mathbb{E}_t\left[\frac{\lambda_{t+1}^*}{\lambda_t^*}\;\left(\pi_{F,t+1}^* - \bar{\pi}^*\right)\;(\pi_{F,t+1}^*)^2\,\frac{\overline{y}_{t+1}^*}{\overline{y}_t^*}\right]. \tag{35}$$

Capital producers

$$k_t = (1-\delta)\,k_{t-1} + I_t\left(1 - \frac{\kappa_I}{2}\left(\frac{I_t}{I_{t-1}} - 1\right)^2\right), \tag{36}$$

$$k_t^* = (1-\delta)\,k_{t-1}^* + I_t^*\left(1 - \frac{\kappa_I}{2}\left(\frac{I_t^*}{I_{t-1}^*} - 1\right)^2\right), \tag{37}$$

$$q_t = 1 + \frac{\kappa_I}{2}\left(\frac{I_t}{I_{t-1}} - 1\right)^2 + \kappa_I\left(\frac{I_t}{I_{t-1}} - 1\right)\frac{I_t}{I_{t-1}} - \beta\,\mathbb{E}_t\left[\frac{\lambda_{t+1}}{\lambda_t}\,\kappa_I\left(\frac{I_{t+1}}{I_t} - 1\right)\left(\frac{I_{t+1}}{I_t}\right)^2\right], \tag{38}$$

$$q_t^* = 1 + \frac{\kappa_I}{2}\left(\frac{I_t^*}{I_{t-1}^*} - 1\right)^2 + \kappa_I\left(\frac{I_t^*}{I_{t-1}^*} - 1\right)\frac{I_t^*}{I_{t-1}^*} - \beta^*\,\mathbb{E}_t\left[\frac{\lambda_{t+1}^*}{\lambda_t^*}\,\kappa_I\left(\frac{I_{t+1}^*}{I_t^*} - 1\right)\left(\frac{I_{t+1}^*}{I_t^*}\right)^2\right]. \tag{39}$$

Global investor

$$\mathrm{rk}_t^* = \frac{z_t^* + q_t^*(1-\delta)}{q_{t-1}^*}, \tag{40}$$

$$\mathrm{rk}_t = \frac{z_t + q_t(1-\delta)}{q_{t-1}}, \tag{41}$$

$$0 = \beta^*\,\frac{\lambda_{t+1}^*}{\lambda_t^*}\left(\mathrm{rk}_{t+1}^* - \frac{r_t^d}{\pi_{t+1}^*}\right), \tag{42}$$

$$0 = \beta^*\,\frac{\lambda_{t+1}^*}{\lambda_t^*}\left(\mathrm{rk}_{t+1}\,\frac{e_t}{e_{t+1}} - \frac{r_t^d}{\pi_{t+1}^*}\right), \tag{43}$$

$$r_t^d = \chi_t\,r_t^*, \tag{44}$$

$$\chi_t \;=\; \bar{\chi} + \left(\frac{d_t^e}{n_t^e}\right)^{\chi_E} - (DN)^{\chi_E} + \exp(f_t^s) - 1, \tag{45}$$

$$q_t^* k_t^* + \frac{q_t}{e_t} k_t = n_t^e + d_t^e, \tag{46}$$

$$n_t^e = \Gamma^e\left(\mathrm{rk}_t^* k_{t-1}^* q_{t-1}^* + \mathrm{rk}_t\,\frac{e_{t-1}}{e_t}\,\frac{k_{t-1} q_{t-1}}{e_{t-1}} - \frac{r_{t-1}^d}{\pi_t^*}\,d_{t-1}^e\right) + (1-\Gamma^e)\,W^e. \tag{47}$$

Prices and inflation

$$
\begin{aligned}
1 &= \omega\, p_{H,t}^{1-\theta} + (1-\omega)\, p_{F,t}^{1-\theta}, && (48)\\
1 &= \omega^*\, (p_{F,t}^*)^{\,1-\theta} + (1-\omega^*)\, (p_{H,t}^*)^{\,1-\theta}, && (49)\\
p_{F,t} &= e_t\, p_{F,t}^*, && (50)\\
p_{H,t} &= e_t\, p_{H,t}^*, && (51)\\
\pi_{H,t} &= \frac{p_{H,t}}{p_{H,t-1}}\, \pi_t, && (52)\\
\pi_{F,t}^* &= \frac{p_{F,t}^*}{p_{F,t-1}^*}\, \pi_t^*. && (53)
\end{aligned}
$$

Monetary policy

$$
\begin{aligned}
\frac{r_t}{\bar{R}} &= \left(\frac{r_{t-1}}{\bar{R}}\right)^{\rho_r} \left(\frac{\pi_{H,t}}{\bar{\Pi}}\right)^{(1-\rho_r)\phi_\pi} \exp(v_t^m), && (54)\\
\frac{r_t^*}{\bar{R}^*} &= \left(\frac{r_{t-1}^*}{\bar{R}^*}\right)^{\rho_r} \left(\frac{\pi_{F,t}^*}{\bar{\Pi}^*}\right)^{(1-\rho_r)\phi_\pi}. && (55)
\end{aligned}
$$

Goods market clearing and demands

$$
\begin{aligned}
\bar{y}_t &= y_{H,t} + \frac{\kappa_P}{2}\, (\pi_{H,t} - \bar{\pi})^2\, \bar{y}_t + \frac{N_f}{N_h}\, y_{H,t}^*, && (56)\\
\bar{y}_t^* &= y_{F,t}^* + \frac{\kappa_P}{2}\, (\pi_{F,t}^* - \bar{\pi}^*)^2\, \bar{y}_t^* + \frac{N_h}{N_f}\, y_{F,t} && (57)\\
y_t &= c_t + I_t, && (58)\\
y_t^* &= c_t^* + I_t^*, && (59)\\
y_{H,t} &= \omega\, p_{H,t}^{-\theta}\, y_t, && (60)\\
y_{H,t}^* &= (1-\omega^*)\, (p_{H,t}^*)^{-\theta}\, y_t^*, && (61)\\
y_{F,t} &= (1-\omega)\, p_{F,t}^{-\theta}\, y_t, && (62)\\
y_{F,t}^* &= \omega^*\, (p_{F,t}^*)^{-\theta}\, y_t^*, && (63)\\
d_t^e &= \frac{N_h}{N_f}\, d_t + d_t^*. && (64)
\end{aligned}
$$

Balance of payments (Foreign):

$$y_t^* = p_{F,t}^*\, \bar{y}_t^* \Big(1 - \frac{\kappa_P}{2}\, (\pi_{F,t}^* - \bar{\pi}^*)^2\Big) - \frac{q_t}{e_t}\, k_t + \frac{k_{t-1}}{e_t}(z_t + q_t(1-\delta)) + d_t - \frac{R_{t-1}^*}{\pi_t^*}\, d_{t-1}. \tag{65}$$

Exogenous processes

$$\log a_t = (1-\rho_a)\log \bar{A} + \rho_a \log a_{t-1} + \varepsilon_t^a, \tag{66}$$

$$\log a_t^* = (1-\rho_a)\log \bar{A}^* + \rho_a \log a_{t-1}^* + \varepsilon_t^{a^*}, \tag{67}$$

$$f_t^s = \rho_f\, f_{t-1}^s + \varepsilon_t^f. \tag{68}$$

Model monetary policy spillovers

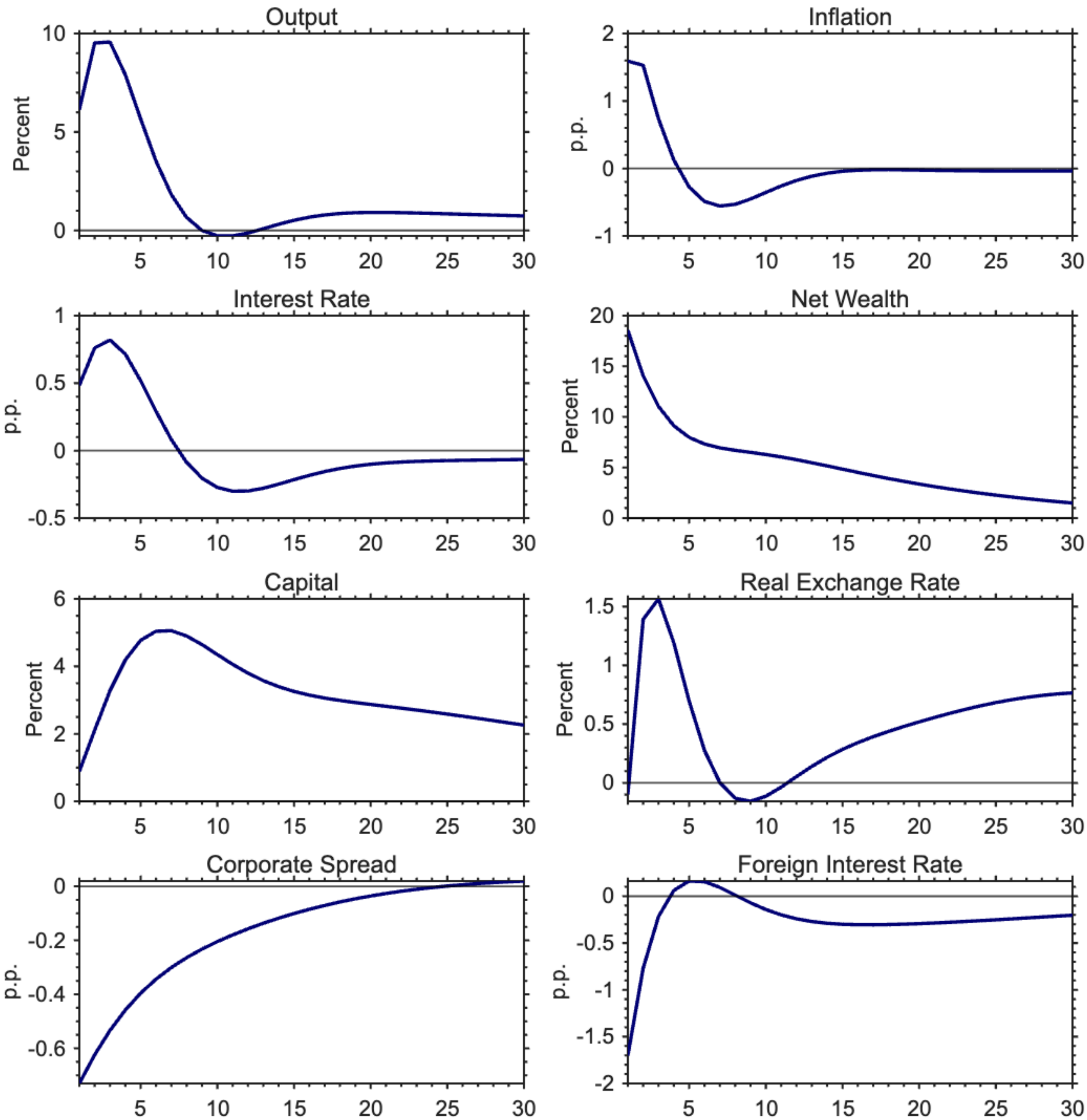

Figure 23: Model Home variables impulse responses to a Foreign monetary easing.

Note. The panels report the impulse responses of selected model variables. Interest-rate and spread responses are in percentage points. Real quantities and the real exchange rate are in percent deviations from the steady state. Each period is one quarter.

Model monetary policy spillovers

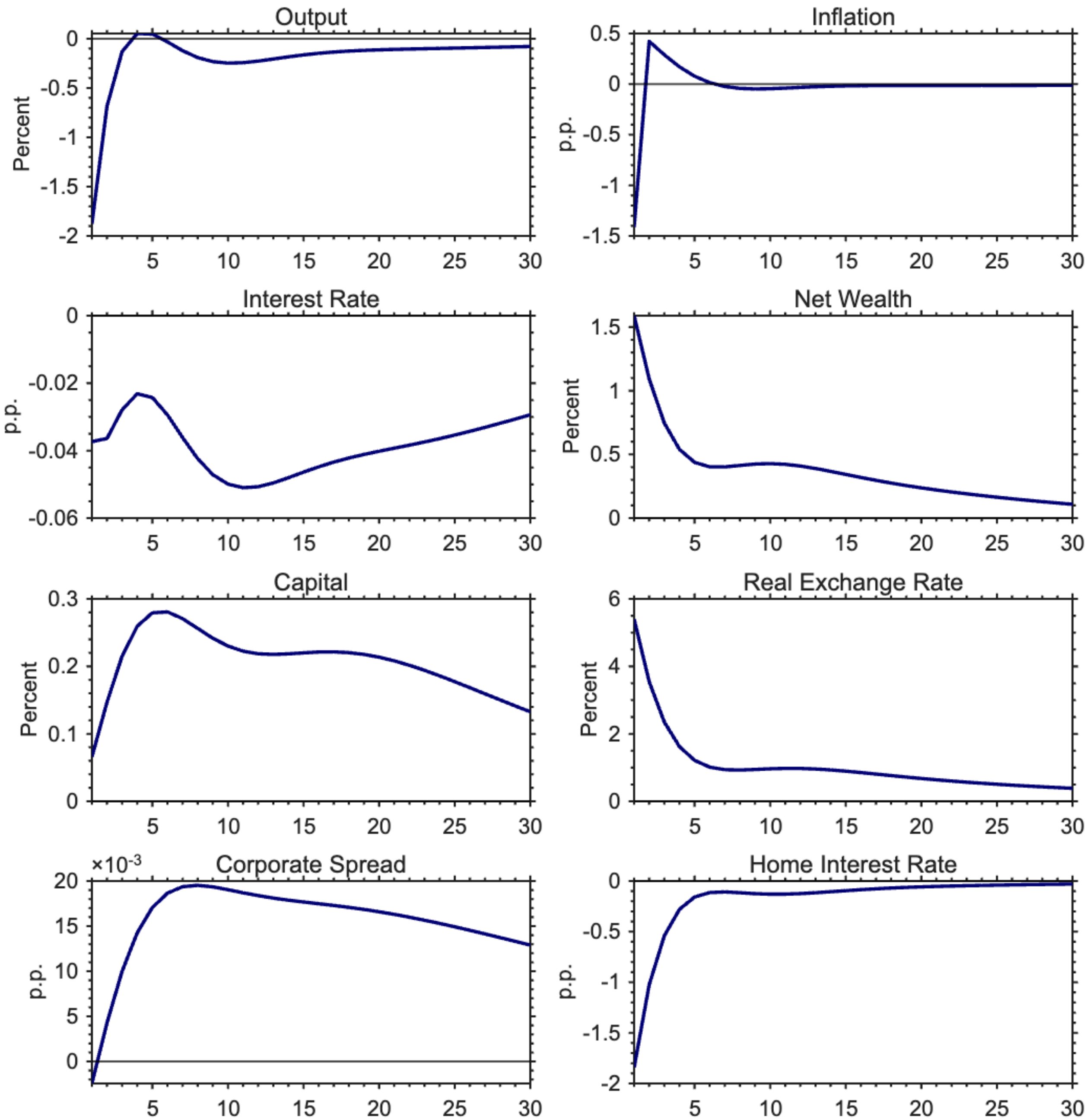

Figure 24: Model Foreign variables impulse responses to a Home monetary easing.

Note. The panels report the impulse responses of selected model variables. Interest-rate and spread responses are in percentage points. Real quantities and the real exchange rate are in percent deviations from the steady state. Each period is one quarter.