

Invoicing Currency and Optimal Policies in a Global Liquidity Trap

Sangheon Ahn*

Kwang Hwan Kim[†]

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Abstract

We study how international pricing regimes shape optimal monetary-fiscal policy mix during global liquidity trap episodes. Using a two-country New Keynesian model under alternative pricing assumptions, we find that when exchange rate pass-through is high, the less affected economy optimally raises interest rates to engineer favorable exchange rate movements. However, when pass-through is limited, it maintains low rates to support global demand instead. This monetary policy divergence widens with the severity of the liquidity trap, reflecting that high pass-through makes exchange rate management a more effective tool for stabilizing relative prices between countries, though at the cost of suppressing global demand. Fiscal policy complements monetary policy by addressing its limitations: under high pass-through, it focuses on expanding government spending across both countries to boost suppressed global demand, while under low pass-through, it implements asymmetric spending increases concentrated in the more affected country to correct relative imbalances. When there is a dominant currency price-setting in trade, these policy patterns mirror either the high or low pass-through scenarios, depending on whether the shock hits the dominant or non-dominant economy.

Key Words: Zero lower bound, Nominal rigidities, Optimal monetary policy, Invoicing currency, Dominant currency pricing

JEL Classification: F41, E31, E52, E32, F31

*School of Economics, Yonsei University, heonahn@yonsei.ac.kr

[†]School of Economics, Yonsei University. Email: kimkh01@yonsei.ac.kr

1 Introduction

Should policymakers care about which currency is used in international trade in the design of the optimal monetary and fiscal policy? The invoicing pricing regime fundamentally shapes how exchange rate movements affect relative prices, trade flows, and ultimately, macroeconomic adjustment across countries, as demonstrated in the seminal work by [Gopinath et al. \(2020\)](#). Its implications for optimal policy are well established for normal times with positive nominal interest rates (e.g., [Corsetti et al. \(2011\)](#) and [Egorov and Mukhin \(2023\)](#)). Despite these insights, the role of pricing regimes in the context of a global liquidity trap remains largely unexplored, and even less is known about their roles in shaping the optimal global policy responses during a world liquidity trap. In this paper, we show that the invoicing currency regime fundamentally alters both (i) how adverse shock transmits across countries at the liquidity trap and (ii) the optimal mix of monetary and fiscal policy.

To this end, we build a two-country New Keynesian model where one economy (Home) is hit by a large negative demand shock that drives its natural interest rate below zero. The foreign economy, while not directly affected by the shock, faces spillovers through trade linkages and exchange rate movements. Within this framework, we examine three distinct pricing regimes that characterize how firms set prices in international markets: producer currency pricing (hereafter, PCP), local currency pricing (hereafter, LCP), and dominant currency pricing (hereafter, DCP). Under PCP, firms set export prices in their own currency, leading to complete exchange rate pass-through (hereafter, ERPT) as import prices fully adjust to exchange rate movements. Under LCP, firms instead price exports in the destination country's currency and the price-setting is sticky. Since export price remains sticky in local currency terms, the import prices feature incomplete ERPT. For DCP, we follow the setup of [Egorov and Mukhin \(2023\)](#), where Home firms price goods based on LCP, and the Foreign firms price goods based on PCP. The Foreign currency is dominant in this case and is the only invoicing currency for trades. Then through the model, we characterize optimal cooperative discretionary policies and demonstrate how these distinct pricing regimes fundamentally reshape both shock transmission and the optimal monetary-fiscal policy mix during liquidity traps.

Before analyzing optimal policies, we first study how pricing regimes shape the shock transmissions during liquidity traps, shaping the key trade-offs that the monetary authority faces. To transparently isolate these transmission mechanisms intrinsic to each pricing regime, we begin by examining a scenario where central banks mechanically track their natural rate paths, ensuring identical policy responses across regimes. This approach reveals that the stabilizing properties of

ERPT depend crucially on shock size, leading to markedly different adjustment patterns between mild and severe recessions.

Under small shocks that push only Home's natural rate below zero, complete pass-through under PCP serves as an effective automatic stabilizer: as Home's currency depreciates, immediate price adjustment redirects global demand toward Home goods, naturally cushioning its downturn. In contrast, sluggish pass-through under LCP impairs this stabilizing mechanism, deepening Home's recession. However, this relationship reverses dramatically under large shocks that drive both countries' natural rates negative. In this severe setting, intense deflationary pressure creates a positive real interest rate differential between Home and Foreign, triggering a perverse appreciation of Home's currency through the UIP channel (Cook and Devereux, 2013). Under PCP, rapid price adjustment now amplifies the downturn by making Home goods less competitive in global markets. Conversely, LCP's sticky export prices provide natural insulation against these destabilizing exchange rate movements.

The divergent transmission patterns we uncovered across pricing regimes directly shape the optimal monetary policy design. The key distinction emerges in Foreign's policy response: Under PCP, Foreign maintains substantially higher rates than under LCP, with this gap sharply widening with shock size. For small shocks, PCP's complete pass-through makes exchange rate management highly effective. Foreign optimally raises rates to engineer home currency depreciation through the UIP channel, trading off weaker global demand for improved relative prices. This strategy effectively stabilizes relative gaps through the strong expenditure-switching effects. In contrast, under LCP, limited pass-through constrains this exchange rate channel. This constraint leads Foreign to prioritize global demand stabilization through lower rates, even though this provides less support for relative adjustment.

This divergence in policy priorities becomes more pronounced under large shocks when exchange rates move perversely. Under PCP, Foreign must raise rates even more aggressively to counter destabilizing home currency appreciation that would otherwise amplify Home's downturn through rapid relative price adjustment. This comes at the cost of significantly suppressing global demand. Under LCP, sticky export prices act as natural insulators against adverse exchange rate movements, automatically moderating both relative output gaps and price distortions. This built-in stabilization allows Foreign to maintain zero rates for extended periods, focusing on supporting global demand rather than managing exchange rates.

Building on this monetary policy analysis, we find that fiscal policy systematically complements the constraints faced by monetary policy under each pricing regime, with its relative im-

portance varying crucially by shock size. For small shocks, fiscal intervention plays a more critical role under LCP, where low pass-through impairs natural stabilization through exchange rates. This manifests as asymmetric fiscal support concentrated in Home to address deeper relative distortions, while PCP requires more modest, synchronized expansion to offset global demand shortfall from higher Foreign rates. This relative importance reverses under large shocks: fiscal policy becomes more important under PCP, demanding substantial expansion both synchronized across countries to counter weak global demand and concentrated in Home to offset perverse exchange rate effects. Under LCP, limited pass-through from sticky export prices naturally insulates against perverse exchange rate movements, automatically moderating relative price distortions. This built-in stabilization reduces the need for fiscal intervention to modest, targeted support in Home. This pattern aligns with welfare analysis: fiscal policy yields higher gains under LCP for small shocks but generates greater welfare improvements under PCP for large shocks.

Lastly, we extend the analysis to the empirically relevant case of DCP, motivated by the prevalence of dollar invoicing in global trade. We find that the monetary-fiscal responses in such an asymmetric regime effectively mirror the patterns in the pure PCP and LCP settings, depending on which country experiences the shock. When the dominant-currency (PCP) country is hit, the other country's policy reactions resemble those in a symmetric PCP world, emphasizing relative-price stabilization through higher interest rates. Conversely, when the non-dominant (LCP) economy is shocked, policy mimics the LCP scenario, focusing on global demand support and leaving exchange-rate distortions to fiscal intervention.

These findings underscore that policymakers must pay close attention to which currency is used in international trade: the international pricing system has profound implication for cross-border shock transmission and the shape of monetary and fiscal policy in a liquidity trap. Understanding and accounting for this channel is therefore essential for designing efficient stabilization policies in our interconnected global economies.

Related Literature This paper contributes to the literature on optimal cooperative monetary policies in open economies ([Faia and Monacelli, 2008](#); [Corsetti and Pesenti, 2001](#); [Benigno and Benigno, 2003](#); [Engel, 2011](#); [Groll and Monacelli, 2020](#); [Auray et al., 2024](#)). In particular, our paper is closest to the literature when an open economy is facing significant demand shocks that lead to the ZLB. In this context, [Fujiwara et al. \(2013\)](#) shows that the optimal monetary policy in one country should respond to the macroeconomic conditions of other countries. [Cook and Devereux \(2013\)](#) analyze the optimal monetary policy under discretion as we do and argue that the less affected

country should raise the interest rate in order to ameliorate the recession in the more affected country. [Cook and Devereux \(2016\)](#) further establish that monetary unions can outperform flexible exchange rate regimes in such scenarios by preventing adverse relative price responses and reducing macroeconomic volatility. More recently, [Cho et al. \(2025\)](#) examine the optimal inflation target in an open economy with a ZLB constraint, calibrating their analysis to the Euro area. Our paper makes two distinct contributions to this literature. First, unlike previous studies that focus primarily on monetary policy at the ZLB, we provide a comprehensive analysis of how monetary and fiscal policies should optimally coordinate during liquidity traps in open economies.¹ Second, this paper provides the first systematic analysis of how different international pricing regimes (PCP, LCP, and DCP) fundamentally reshape both the transmission of ZLB episodes and the optimal policy responses.

Our paper also relates to the rich literature on international price-setting regimes and their macroeconomic implications. The importance of currency invoicing for relative price dynamics and international policy transmission has been emphasized by [Obstfeld and Rogoff \(2000\)](#) and [Engel \(2003\)](#), with recent empirical evidence provided by [Boz et al. \(2017\)](#). While the classical framework assumed producer currency pricing (PCP) following [Dornbusch \(1976\)](#), the evidence of low exchange rate pass-through led to the development of local currency pricing (LCP) models, as in [Bacchetta and van Wincoop \(2000\)](#) and [Chari et al. \(2002\)](#). More recently, [Gopinath et al. \(2020\)](#) formalized the dominant currency paradigm (DCP) based on micro-level evidence showing the prevalence of dollar invoicing in global trade. Recent studies have further enriched our understanding of how pricing regimes matters: [Egorov and Mukhin \(2023\)](#) examine its implications for optimal exchange rate policy, [Mukhin \(2022\)](#) develops a general equilibrium model with endogenously emerging dominant currencies, and [Barbiero et al. \(2018\)](#) demonstrate its importance for tax and tariff policies. The dynamic aspects of currency choice and its relationship with exchange rate pass-through have been further explored by [Gopinath et al. \(2010\)](#) and [Amiti et al. \(2022\)](#). While these different pricing regimes have been shown to matter for various aspects of international macroeconomics, their implications during global liquidity traps remain largely unexplored. Our paper addresses this gap by showing how different pricing regimes fundamentally reshape both the international transmission of shock and optimal policy responses.

¹[Cook and Devereux \(2019\)](#) examine optimal fiscal policy under liquidity trap, but in the context of a currency union. [Bhattarai and Egorov \(2016\)](#) studies optimal monetary and fiscal policy at ZLB, but under small open economy and PCP framework. In contrast, we focus on flexible exchange rate regimes and how optimal policy depends crucially on currency invoicing assumptions. Our work also connects to literature exploring fiscal policy's role when monetary policy becomes constrained. [Adao et al. \(2009\)](#), [Farhi et al. \(2014\)](#), and [Chen et al. \(2021\)](#) show how tax and tariff policies can generate exchange rate depreciation. We extend this literature by analyzing optimal fiscal policy under liquidity traps across various pricing regimes.

The rest of the paper is structured as follows. Section 2 presents our two-country New Keynesian model with PCP, LCP, and DCP pricing regimes and derives welfare functions. Section 3 analyzes how pricing regimes affect demand shock transmission at the ZLB, highlighting key differences between small and large shocks. Section 4 explores optimal monetary policy design, demonstrating how exchange rate pass-through shapes policy objectives across regimes. Section 5 examines the optimal monetary-fiscal policy mix, showing how fiscal policy complements monetary policy's regime-specific constraints. Section 6 analyzes asymmetric pricing under DCP, revealing how policy responses mirror PCP or LCP patterns depending on the shocked country, and Section 7 concludes.

2 Environment

We build on a standard two-country New Keynesian model (Corsetti et al. (2011)) with three distinct currency pricing regimes: Producer Currency Pricing (PCP), Local Currency Pricing (LCP), and Dominant Currency Pricing (DCP).

The world consists of two equal-sized countries, Home and Foreign. For brevity, we focus on describing the Home country's decision problems, with Foreign variables denoted by asterisks (*). The Foreign country's problems can be defined symmetrically.

2.1 Households

The representative household in the Home country maximizes their utility function:

$$\mathbb{E}_t \sum_{t=0}^{\infty} \{U(C_t; Z_t) + V(N_t) + J(G_t)\} = \mathbb{E}_t \sum_{t=0}^{\infty} \beta^t \left(Z_t \frac{C_t^{1-\rho}}{1-\rho} - \frac{N_t^{1+\eta}}{1+\eta} + \Psi \frac{G_t^{1-\rho}}{1-\rho} \right),$$

subject to the budget constraint:

$$P_t C_t + \sum_{h^{t+1}} q_t(h^{t+1}) \mathcal{B}_{t+1} + B_{H,t+1} \leq \mathcal{B}_t + (1 + R_t) B_{H,t} + W_t N_t + \tau_t$$

where C_t denotes the home consumption basket priced at P_t , N_t denotes the labor supply with nominal wage W_t , and G_t denotes the home government spending. β is the discount factor, ρ is the inverse of the intertemporal elasticity of substitution, η is the inverse Frisch elasticity, and Ψ is the preference parameter for government spending. $\mathcal{B}_{t+1}$ is the holdings of state-contingent securities, priced at $q_t(h^{t+1})$, paying off one unit of domestic currency when state h^{t+1} is realized at time $t + 1$. $B_{H,t}$ is the domestic nominal bond, yielding a net yield of R_t at the beginning of period t . τ_t is the lump-sum taxes. Z_t represents the demand shock that follows the lognormal

AR(1) process:

$$z_t = \rho_z z_{t-1} + \epsilon_{j,t}^z \quad \text{with} \quad \epsilon_t^z \stackrel{iid}{\sim} \mathcal{N}(0, \sigma_z^2)$$

where $z_t \equiv \log Z_t$.

The consumption basket of Home is a composite index of domestic and imported goods:

$$C_t = \left[\nu^{\frac{1}{\theta}} C_{H,t}^{\frac{\theta-1}{\theta}} + (1-\nu)^{\frac{1}{\theta}} C_{F,t}^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}},$$

where $\nu \in [\frac{1}{2}, 1]$ is weight of domestically produced goods in the consumption basket, which we refer to as the degree of home bias. $\theta > 0$ is the trade elasticity of substitution between domestic and foreign goods. $C_{H,t}$ and $C_{F,t}$ are consumption bundles of imperfectly substitutable varieties with the elasticity of substitution being θ :

$$C_{H,t} = \left[2^{\frac{1}{\theta}} \int_0^{1/2} C_{H,t}(i)^{\frac{\theta-1}{\theta}} di \right]^{\frac{\theta}{\theta-1}} \quad \text{and} \quad C_{F,t} = \left[2^{\frac{1}{\theta}} \int_{1/2}^1 C_{F,t}(i)^{\frac{\theta-1}{\theta}} di \right]^{\frac{\theta}{\theta-1}},$$

where the demand for each variety is given by:

$$C_{H,t}(i) = 2 \left(\frac{P_{H,t}(i)}{P_{H,t}} \right)^{-\theta} C_{H,t} \quad \text{and} \quad C_{F,t}(i) = 2 \left(\frac{P_{F,t}(i)}{P_{F,t}} \right)^{-\theta} C_{F,t}.$$

$P_{j,t}(i)$ is the price of good i produced in country $j \in \{H, F\}$, quoted in the Home currency.

The price index of composite consumption $C_{H,t}$ and $C_{F,t}$ is:

$$P_{H,t} = \left[2 \int_0^{1/2} P_{H,t}(i)^{1-\sigma} di \right]^{\frac{1}{1-\sigma}} \quad \text{and} \quad P_{F,t} = \left[2 \int_{1/2}^1 P_{F,t}(i)^{1-\sigma} di \right]^{\frac{1}{1-\sigma}},$$

while home's consumer price index is given by:

$$P_t = \left[\nu P_{H,t}^{1-\theta} + (1-\nu) P_{F,t}^{1-\theta} \right]^{\frac{1}{1-\theta}},$$

Household optimization yields the following consumption Euler equation:

$$\frac{U_C(C_t, \xi_t)}{P_t} = \beta(1 + R_t) \mathbb{E}_t \frac{U_C(C_{t+1}, \xi_{t+1})}{P_{t+1}}, \quad (1)$$

Complete international risk-sharing implies:

$$Q_t Z_t C_t^{-\rho} = Z_t^* (C_t^*)^{-\rho} \quad (2)$$

which links consumption patterns across countries through movements in the real exchange rate Q_t and country-specific demand shocks.

2.2 Firms

In the Home country, each firm i employs domestic labor $N_t(i)$ to produce a differentiated good according to a simple linear production function:

$$Y_{H,t}(i) = N_t(i).$$

Firms follow [Calvo \(1983\)](#) pricing, with a fraction $(1 - \alpha)$ of firms choosing the optimal reset prices. We assume appropriate subsidies are in place to ensure efficient steady-state allocation. The optimal price-setting problem differs crucially across pricing regimes:

Under PCP, firm i chooses a single optimal price $P_{H,t}^o$ for both domestic and export markets²:

$$\max_{P_{H,t}^o} \mathbb{E}_t \sum_{k=0}^{\infty} (\beta\alpha)^k \Lambda_{t+k} [P_{H,t}^o \{C_{H,t+k}(i) + C_{H,t+k}^*(i)\} - W_{t+k} N_{t+k}(i)]. \quad (3)$$

Under LCP and DCP, firm i set separate prices for domestic ($P_{H,t}^o$) and export ($P_{H,t}^{*,o}$) markets:

$$\max_{P_{H,t}^o, P_{H,t}^{*,o}} \mathbb{E}_t \sum_{k=0}^{\infty} (\beta\alpha)^k \Lambda_{t+k} [P_{H,t}^o C_{H,t+k}(i) + S_{t+k} P_{H,t}^{*,o} C_{H,t+k}^*(i) - W_{t+k} N_{t+k}(i)], \quad (4)$$

where $\Lambda_{t+k} = \frac{U_C(C_{t+k}, \xi_{t+k})}{P_{t+k}} \frac{P_t}{U_C(C_t, \xi_t)}$ represents the stochastic discount factor and S_{t+k} is the nominal exchange rate defined as units of domestic currency per unit of foreign currency. These optimal prices then aggregate according to regime-specific laws of motion:

$$\begin{aligned} \text{PCP:} \quad P_{H,t} &= \left[(1 - \alpha)(P_{H,t}^o)^{1-\sigma} + \alpha P_{H,t-1}^{1-\sigma} \right]^{\frac{1}{1-\sigma}}, \\ \text{LCP \& DCP:} \quad P_{H,t} &= \left[(1 - \alpha)(P_{H,t}^o)^{1-\sigma} + \alpha P_{H,t-1}^{1-\sigma} \right]^{\frac{1}{1-\sigma}}, \\ P_{H,t}^* &= \left[(1 - \alpha)(P_{H,t}^{*,o})^{1-\sigma} + \alpha (P_{H,t-1}^*)^{1-\sigma} \right]^{\frac{1}{1-\sigma}}. \end{aligned}$$

2.3 International Relative Prices

A key element in understanding international price dynamics is the internal relative price, which measures how expensive imported goods are compared to domestic goods in each country. For the Home country, this is defined as $T_t = \frac{P_{F,t}}{P_{H,t}}$ (the price of Foreign imported goods relative to domestically produced Home goods), while for the Foreign country it is $T_t^* = \frac{P_{H,t}^*}{P_{F,t}^*}$ (the price of Home imported goods relative to domestically produced Foreign goods), playing a crucial role in determining consumption patterns and trade flows between countries.

²Given the symmetric equilibrium where all adjusting firms face identical problems, we can drop the index i from the optimal price.

Under PCP, firms set their export prices in their own currency. This creates a direct link between exchange rate movements and relative prices in both markets. When the exchange rate changes, export prices adjust immediately in the destination market's currency. This leads to a simple reciprocal relationship between Home and Foreign relative prices: $T_t = \frac{1}{T_t^*}$. A Home currency depreciation simultaneously increases T_t and decreases T_t^* , reflecting how Foreign goods become relatively more expensive in Home while Home goods become relatively cheaper in Foreign.

Under LCP, firms set their export prices in the destination market's currency. The reciprocal relationship $T_t = \frac{1}{T_t^*}$ persists, but relative prices adjust more slowly to exchange rate movements since export prices are preset in the destination currency. When exchange rates move, the prices of identical goods can diverge across countries, creating currency misalignment measured by $m_t = \left(\frac{S_t P_{H,t}^*}{P_{H,t}} \frac{S_t P_{F,t}^*}{P_{F,t}} \right)^{\frac{1}{2}}$. This misalignment captures how sticky local currency pricing temporarily prevents price equalization across borders.

Under DCP, the pricing structure becomes asymmetric: Home firms use Foreign currency for exports (following LCP), while Foreign firms use their own currency (following PCP). This asymmetry means exchange rate movements affect relative prices differently in each market. Since only Home exporters price in Foreign currency, currency misalignment $m_t = \left(\frac{S_t P_{H,t}^*}{P_{H,t}} \right)^{\frac{1}{2}}$ affects only Home exports, creating a unique pattern where one country's exports exhibit price stickiness while the other's adjust flexibly.

2.4 Market Clearing

The market clearing condition for Home goods balances total production with domestic consumption, exports, and government spending:

$$Y_{H,t} = \nu \left(\frac{P_{H,t}}{P_t} \right)^{-\theta} C_t + (1 - \nu) \left(\frac{P_{H,t}^*}{P_t^*} \right)^{-\theta} C_t^* + G_t, \quad (5)$$

where $Y_{H,t} = \left[2^{\frac{1}{\sigma}} \int_0^{1/2} Y_{H,t}(i)^{\frac{\sigma-1}{\sigma}} di \right]^{\frac{\sigma}{\sigma-1}}$ is aggregate home output.

2.5 Log-Linearized Model

To analyze the model's equilibrium dynamics, we work with a log-linear approximation around the efficient steady state. We define efficient equilibrium as the equilibrium under flexible prices, no monopolistic competition, complete financial markets, and where governments choose an optimal fiscal spending rule with a lump-sum tax, determined by $V'(N_t) = J'(G_t)$.

For any variable X_t , we define two key deviations: $\hat{X}_t \equiv \log(X_t/X)$ and $\tilde{X}_t \equiv \log(X_t/X_t^{fb})$, where X and X_t^{fb} are the efficient steady state of X_t and its efficient level, respectively. Variables are expressed as the World ($\hat{X}_t^W$) and the Relative ($\hat{X}_t^R$) terms where the World variables are the summation of the corresponding Home and Foreign variables ($\frac{\hat{X}_t + \hat{X}_t^*}{2}$ or $\frac{\hat{X}_{H,t} + \hat{X}_{F,t}}{2}$), and the Relative variables are the subtraction between them ($\frac{\hat{X}_t - \hat{X}_t^*}{2}$ or $\frac{\hat{X}_{H,t} - \hat{X}_{F,t}}{2}$). The ratio between steady-state consumption and output is $c_y = \frac{C}{Y}$.

Combining the household's consumption Euler equations (1), risk-sharing conditions (2), and the market clearing conditions (5) yields the World and Relative IS curves:

$$\textbf{World IS:} \quad \frac{1}{c_y} \left(\tilde{Y}_t^W - E_t \tilde{Y}_{t+1}^W \right) - \frac{1 - c_y}{c_y} \left(\tilde{G}_t^W - E_t \tilde{G}_{t+1}^W \right) = -\frac{1}{\rho} \left[\tilde{R}_t^W - E_t \hat{\pi}_{t+1}^W \right], \quad (6)$$

$$\begin{aligned} \textbf{Relative IS (PCP):} \quad & \frac{2v - 1}{c_y D} \left(\tilde{Y}_t^R - E_t \tilde{Y}_{t+1}^R \right) - \frac{(2v - 1)(1 - c_y)}{c_y D} \left(\tilde{G}_t^R - E_t \tilde{G}_{t+1}^R \right) \\ & = -\frac{1}{\rho} \left[\tilde{R}_{ppi,t}^R - E_t \hat{\pi}_{ppi,t+1}^R - (1 - \nu) \left(E_t \tilde{T}_{t+1} - \tilde{T}_t \right) \right], \end{aligned} \quad (7)$$

$$\begin{aligned} \textbf{Relative IS (LCP):} \quad & \frac{2v - 1}{c_y D} \left(\tilde{Y}_t^R - E_t \tilde{Y}_{t+1}^R \right) - \frac{(2v - 1)(1 - c_y)}{c_y D} \left(\tilde{G}_t^R - E_t \tilde{G}_{t+1}^R \right) \\ & + \frac{2v(1 - v)\theta}{D} (\hat{m}_t - E_t \hat{m}_{t+1}) \\ & = -\frac{1}{\rho} \left[\tilde{R}_{cpi,t}^R - E_t \hat{\pi}_{cpi,t+1}^R \right], \end{aligned} \quad (8)$$

$$D = (2\nu - 1)^2 + 4\rho\theta\nu(1 - \nu),$$

where we define $\tilde{R}_{ppi,t}^R = \hat{R}_t - \hat{R}_{ppi,t}^{fb}$ and $\tilde{R}_{cpi,t}^R = \hat{R}_t - \hat{R}_{cpi,t}^{fb}$, in which $\hat{R}_{ppi,t}^{fb}$ and $\hat{R}_{cpi,t}^{fb}$ are the Home natural rate, respectively³.

The relationship between CPI and PPI inflation differentials,

$$\hat{\pi}_{cpi,t+1}^R = E_t \hat{\pi}_{ppi,t+1}^R + (1 - \nu) \left(E_t \tilde{T}_{t+1} - \tilde{T}_t \right)$$

implies that the LCP relative IS curve converges to its PCP counterpart when currency misalignment is absent ($\hat{m}_t = 0$).

On the firm side, we can derive the World and the Relative NKPCs by solving the optimization

³We do not define $\tilde{R}_{ppi,t}^W$ and $\tilde{R}_{cpi,t}^W$ separately, because $\hat{R}_{ppi,t}^{fb} + \hat{R}_{ppi,t}^{*,fb} = \hat{R}_{cpi,t}^{fb} + \hat{R}_{cpi,t}^{*,fb}$.

problem described in the equation (3) and (4):

$$\textbf{World NKPC:} \quad \hat{\pi}_t^W = \kappa \left\{ \left(\frac{\rho}{c_y} + \eta \right) \tilde{Y}_t^W - \frac{\rho(1-c_y)}{c_y} \tilde{G}_t^W \right\} + \beta E_t \hat{\pi}_{t+1}^W, \quad (9)$$

$$\textbf{Relative NKPC (PCP):} \quad \begin{aligned} \hat{\pi}_{cpi,t}^R &= \kappa \left\{ (2\nu - 1) \left(\frac{\rho}{c_y D} + \eta \right) \tilde{Y}_t^R - (2\nu - 1) \frac{\rho(1-c_y)}{c_y D} \tilde{G}_t^R \right\} \\ &\quad + \beta E_t \hat{\pi}_{cpi,t+1}^R, \end{aligned} \quad (10)$$

$$\hat{\pi}_{ppi,t}^R = \kappa \left\{ \left(\frac{\rho}{c_y D} + \eta \right) \tilde{Y}_t^R - \frac{\rho(1-c_y)}{c_y D} \tilde{G}_t^R \right\} + \beta E_t \hat{\pi}_{ppi,t+1}^R, \quad (11)$$

$$\textbf{Relative NKPC (LCP):} \quad \begin{aligned} \hat{\pi}_{cpi,t}^R &= \kappa \left\{ (2\nu - 1) \left(\frac{\rho}{c_y D} + \eta \right) \tilde{Y}_t^R - (2\nu - 1) \frac{\rho(1-c_y)}{c_y D} \tilde{G}_t^R \right. \\ &\quad \left. + \frac{D - (2\nu - 1)^2}{2D} \hat{m}_t \right\} + \beta E_t \hat{\pi}_{cpi,t+1}^R, \end{aligned} \quad (12)$$

$$\begin{aligned} \hat{\pi}_{ppi,t}^R &= \kappa \left\{ \left(\frac{\rho}{c_y D} + \eta \right) \tilde{Y}_t^R - \frac{\rho(1-c_y)}{c_y D} \tilde{G}_t^R + \frac{D - (2\nu - 1)}{2D} \hat{m}_t \right\} \\ &\quad + \beta E_t \hat{\pi}_{ppi,t+1}^R, \end{aligned} \quad (13)$$

where κ governs the slope of the Phillips curves and is given by:

$$\kappa = \frac{(1 - \alpha\beta)(1 - \alpha)}{\alpha}.$$

$\hat{\pi}_{cpi,t}^R$ and $\hat{\pi}_{ppi,t}^R$ represent cross-country differences in CPI and PPI inflation rates, respectively. While expressing the Relative NKPCs in both CPI and PPI terms is mathematically redundant for characterizing equilibrium, we present both formulations because they play distinct roles in welfare analysis: PPI inflation is the relevant target under PCP, while CPI inflation becomes central under LCP (see Section 2.5.1 for detailed welfare analysis).

The global dimension of the model can be fully characterized by the World IS curve (6) and World NKPC (9). These equations determine the paths of world output gap ($\tilde{Y}_t^W$) and inflation ($\hat{\pi}_t^W$). Consequently, when countries implement identical policy paths ($\{\hat{R}_t^W\}_{t=0}^\infty, \{\hat{G}_t^W\}_{t=0}^\infty$), world economic outcomes remain unchanged across pricing regimes. However, differences in price transmission mechanisms create varying degrees of currency misalignment across regimes, leading to distinct patterns of relative variables even under identical policy paths.

The market clearing conditions yield the following relationships for relative prices⁴:

$$\textbf{PCP:} \quad \tilde{T}_t = \frac{1}{c_y} \frac{2\rho}{D} \tilde{Y}_t^R - \frac{1-c_y}{c_y} \frac{2\rho}{D} \tilde{G}_t^R \quad (14)$$

$$\textbf{LCP \& DCP:} \quad \tilde{T}_t^R = \frac{1}{c_y} \frac{2\rho}{D} \tilde{Y}_t^R - \frac{1-c_y}{c_y} \frac{2\rho}{D} \tilde{G}_t^R - \frac{2\nu - 1}{D} \hat{m}_t \quad (15)$$

⁴ $\tilde{T}_t^R = \tilde{T}_t$ under LCP in our setting.

The evolution of internal relative prices differs fundamentally across pricing regimes. The following linearized dynamic equations, derived from the definition of internal relative prices, characterize these differences⁵:

$$\textbf{PCP:} \quad \hat{T}_t = \hat{T}_{t-1} + \pi_{F,t}^* - \pi_{H,t} + \Delta \hat{S}_t, \quad (16)$$

$$\textbf{LCP:} \quad \Delta \hat{T}_t = \beta E_t \Delta \hat{T}_{t+1} - \kappa \left(\tilde{T}_t + 2\eta \tilde{Y}_t^R \right) \quad (17)$$

$$\textbf{DCP:} \quad \hat{T}_t^* = \hat{T}_{t-1}^* + \pi_{H,t}^* - \pi_{F,t}^*. \quad (18)$$

2.5.1 Welfare Loss Function

To derive welfare-based optimal policies, we make three key assumptions. First, firms receive subsidies that offset steady-state inefficiencies from monopolistic competition. Second, these subsidies, along with any taxes on financial returns, are funded through lump-sum transfers. Third, a benevolent global planner maximizes world welfare, defined as a weighted average of country-specific welfare measures. Under these assumptions, we derive second-order approximations to welfare losses in the world economy, with detailed derivations provided in the Online Appendix.

⁵We need the equation under PCP only when to characterize the first difference of the nominal exchange rate, $\Delta \hat{S}_t$.

$$\begin{aligned}
\text{PCP:} \quad 2 \left\{ \mathcal{L}_t^{W,PCP} - (\mathcal{L}_t^W)^{fb} \right\} = & - \left(\frac{\rho}{c_y} + \eta \right) \left(\tilde{Y}_t^W \right)^2 - \left(\frac{\rho}{c_y D} + \eta \right) \left(\tilde{Y}_t^R \right)^2 \\
& - \rho \frac{1-c_y}{c_y} \left(\tilde{G}_t^W \right)^2 - \rho(1-c_y) \left(\frac{1-c_y}{c_y D} + 1 \right) \left(\tilde{G}_t^R \right)^2 \\
& + 2\rho \frac{1-c_y}{c_y} \tilde{Y}_t^W \tilde{G}_t^W + 2\rho \frac{1-c_y}{c_y D} \tilde{Y}_t^R \tilde{G}_t^R \\
& - \frac{\sigma}{\kappa} \left((\hat{\pi}_t^W)^2 + (\hat{\pi}_{ppi,t}^R)^2 \right), \tag{19}
\end{aligned}$$

$$\begin{aligned}
\text{LCP:} \quad 2 \left\{ \mathcal{L}_t^{W,LCP} - (\mathcal{L}_t^W)^{fb} \right\} = & - \left(\frac{\rho}{c_y} + \eta \right) \left(\tilde{Y}_t^W \right)^2 - \left(\frac{\rho}{c_y D} + \eta \right) \left(\tilde{Y}_t^R \right)^2 \\
& - \rho \frac{1-c_y}{c_y} \left(\tilde{G}_t^W \right)^2 - \rho(1-c_y) \left(\frac{1-c_y}{c_y D} + 1 \right) \left(\tilde{G}_t^R \right)^2 \\
& + 2\rho \frac{1-c_y}{c_y} \tilde{Y}_t^W \tilde{G}_t^W + 2\rho \frac{1-c_y}{c_y D} \tilde{Y}_t^R \tilde{G}_t^R \\
& - \frac{c_y \theta \nu (1-\nu)}{D} \hat{m}_t^2 \\
& - \frac{\sigma}{\kappa} \left((\hat{\pi}_t^W)^2 + (\hat{\pi}_{cpi,t}^R)^2 - 2(1-c_y)(1-\nu) \hat{\pi}_{cpi,t}^R \Delta \hat{T}_t \right. \\
& \left. + (c_y(2\nu-1) + (1-\nu))(1-\nu) (\Delta \hat{T}_t)^2 \right), \tag{20}
\end{aligned}$$

$$\begin{aligned}
\text{DCP:} \quad 2 \left\{ \mathcal{L}_t^{W,DCP} - (\mathcal{L}_t^W)^{fb} \right\} = & - \left(\frac{\rho}{c_y} + \eta \right) \left(\tilde{Y}_t^W \right)^2 - \left(\frac{\rho}{c_y D} + \eta \right) \left(\tilde{Y}_t^R \right)^2 \\
& - \rho \frac{1-c_y}{c_y} \left(\tilde{G}_t^W \right)^2 - \rho(1-c_y) \left(\frac{1-c_y}{c_y D} + 1 \right) \left(\tilde{G}_t^R \right)^2 \\
& + 2\rho \frac{1-c_y}{c_y} \tilde{Y}_t^W \tilde{G}_t^W + 2\rho \frac{1-c_y}{c_y D} \tilde{Y}_t^R \tilde{G}_t^R \\
& - \frac{c_y \theta \nu (1-\nu)(D+1)}{D} \hat{m}_t^2 \\
& - \frac{c_y \sigma}{2} \left(\frac{1-(1-\nu)c_y}{c_y \kappa_H} \hat{\pi}_{H,t}^2 + \frac{1-\nu}{\kappa_H} (\hat{\pi}_{H,t}^*)^2 + \frac{1}{c_y \kappa_F} (\hat{\pi}_{F,t}^*)^2 \right). \tag{21}
\end{aligned}$$

The welfare loss functions reveal three key insights about optimal policy across pricing regimes. First, the planner's objective consistently encompasses both global economic stabilization and cross-country distributional concerns, regardless of the pricing framework. Second, the optimal approach to inflation stabilization varies systematically with the pricing regime: under PCP, where exchange rate changes pass through directly, stabilizing PPI inflation takes precedence, while under LCP, with its incomplete passthrough, CPI inflation becomes the primary target. Third, LCP introduces two distinct welfare considerations absent in PCP: currency misalignment ($\hat{m}_t$), reflecting inefficiencies from deviations from the law of one price, and relative price dynamics ($\Delta \hat{T}_t$), which govern international trade flows. These additional terms underscore how incomplete passthrough fundamentally alters the central bank's stabilization problem.

Parameter	Value	Description
ρ	1	Inverse of the elasticity of intertemporal substitution
β	0.9963	Discount factor
η	1	Inverse of Frisch elasticity of labor supply
ν	0.8	Home bias (degree of trade openness)
σ	5	Elasticity of substitution between differentiated goods
θ	2	Elasticity of substitution between goods across countries
Ψ	0.25	Preference parameter for government spending
α	0.85	Calvo parameter
μ	0.9	Shock persistence

Table 1: Baseline Calibration

2.6 Calibration

We set $\beta = 0.9963$, corresponding to a 1.5% annual real interest rate. Following [Cook and Devreux \(2013\)](#), we set the inverse Frisch elasticity η to be 1, Calvo parameter α to be 0.85, and the within-country elasticity of substitution σ to be 5, which corresponds to 25% markup at the steady state. Following [Cho et al. \(2023a\)](#), we set the inverse elasticity of intertemporal substitution ρ to 1 and the trade elasticity θ to 2, which implies that international goods are Edgeworth substitutes. We set the government spending preference parameter Ψ to 0.25, which yields a steady-state consumption-to-output ratio of 0.8. The demand shock persistence μ is 0.9, and the trade openness ν is 0.8. Table 1 summarizes these parameter values. With this calibration, we proceed to analyze shock propagation through numerical simulation. In Section 5.4, we demonstrate that our key findings regarding optimal monetary and fiscal policy mix remain robust across alternative parameter specifications, including variations in ρ , ν , θ , α , and different Edgeworth relationships.

2.7 Solution Methods

Under LCP, the discretionary optimization problem becomes substantially more complex due to the presence of endogenous state variables. The interaction between relative price across countries and deviations from the law of one price introduce additional dynamic constraints that govern the evolution of future macroeconomic variables. This fundamentally transforms the policy problem into a non-trivial dynamic game between current and future policymakers, departing significantly from the static nature of the PCP case.

To address this dynamic complexity, we employ a Markov-perfect Stackelberg-Nash equilibrium framework where the policymaker acts as a Stackelberg leader and private agents and future policymakers serve as followers. While such problems can traditionally be solved using the

algorithm proposed by [Dennis \(2007\)](#), we adopt [Harrison and Waldron \(2021\)](#)’s piecewise linear method to accomodate the occasionally binding zero lower bound (ZLB) constraint.⁶ This approach yields a discretionary policy solution under perfect foresight, which serves as the foundation for our baseline analysis throughout the paper.

3 ERPT and Demand Shock Transmission

In this section, we explore how varying degrees of exchange rate pass-through yield different macroeconomic outcomes during demand-driven ZLB episodes. To obtain sharp economic intuition, we compare two canonical pricing regimes: producer currency pricing (PCP), where exchange rate pass-through is complete, and local currency pricing (LCP), where pass-through is incomplete due to sticky export prices. Our analysis reveals that the stabilizing properties of ERPT depend crucially on shock size and the binding of the ZLB constraint.

3.1 Characterizing Demand Shocks: Small versus Large

A key finding of our analysis is that the transmission of demand shocks through exchange rates operates differently depending on shock size. When the zero lower bound (ZLB) is not binding, a negative demand shock in the home economy leads to a depreciation of the home currency, regardless of its magnitude. This occurs because the home real interest rate falls below the foreign rate, and the uncovered interest parity (UIP) condition implies currency depreciation. This standard mechanism continues to operate even when the ZLB binds, provided the deflationary pressures are modest. However, the exchange rate dynamics fundamentally change when a large shock drives the economy to bind at the ZLB. Intense deflationary pressures ($E_t \pi_{t+1} < 0$) may cause the home currency to appreciate, as the home real interest rate rises above the foreign rate ([Cook and Devereux \(2013\)](#)). As the direction of exchange rate movements under the ZLB is influenced by the magnitude of the shock, we categorize demand shocks into two types to examine the role of ERPT in each scenario separately.

The separating criterion determining the severity of ZLB is an impact response of the natural interest rate, the real interest rates that prevail in a flexible price economy. A ‘small shock’ pushes only the home country’s natural rate below zero in a fully open economy ($\nu = 0.5$), while keeping the foreign rate positive under baseline home bias ($\nu = 0.8$). Under such shocks, only the Home

⁶The algorithm proceeds by solving the finite horizon dynamic problem backward from the terminal steady state, beginning with an initial guess for the periods of binding ZLB constraint. If the resulting solution satisfies both the original constraints and the non-negativity conditions on the Lagrange multipliers for the inequality constraints, the algorithm terminates. Otherwise, it updates the guess for the binding ZLB periods and iterates.

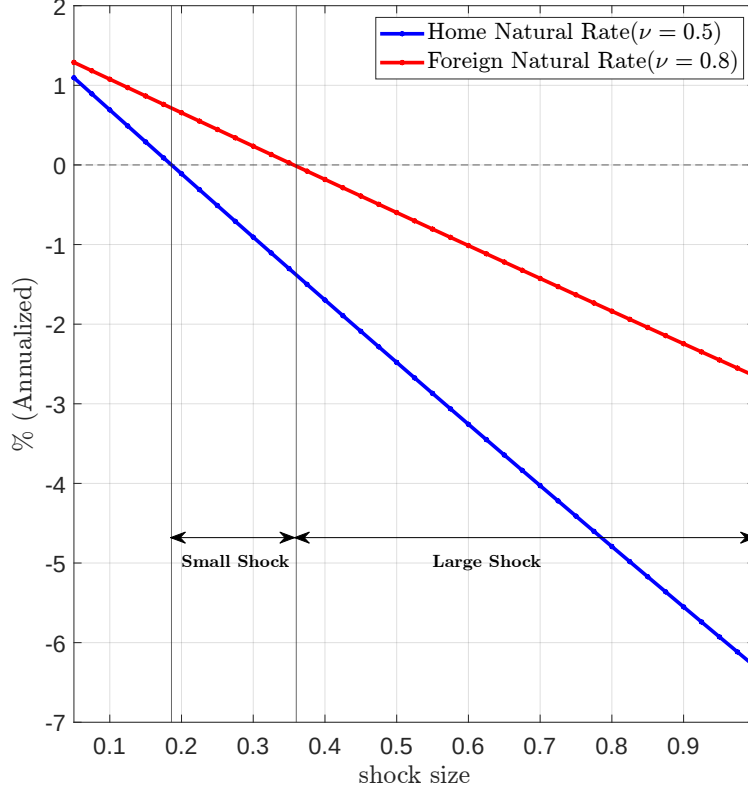


Figure 1: Small Shock vs Large Shock

country faces a binding ZLB when monetary policy follows the natural rate.

A ‘large shock’, in contrast, drives both countries’ natural rates negative under baseline home bias, creating a global liquidity trap when monetary policy follows the natural rate. Figure 1 illustrates this classification under our baseline parameters (Table 1), showing that small shocks fall between 0.18 and 0.36 in magnitude. For our analysis, we use representative values of 0.3 and 0.6 for small and large shocks, respectively.

3.2 Demand Shock Transmission: PCP vs LCP

Using the definition of shocks in the previous section, we investigate how varying degrees of ERPT changes the dynamics of macroeconomic variables at ZLB. As the main purpose of this experiment is to reveal the intrinsic difference between two pricing regimes, we aim to have monetary authorities in each country follow their respective natural interest rate paths. However, directly setting policy rates equal to natural rates can lead to multiple equilibria, as noted in Section 4.3.1.1 of Galí (2015). To address this issue, we adopt a policy rule where interest rates respond to both the natural rate and deviations in inflation and output. Following the IRF matching approach of Christiano et al. (2005), we choose the coefficients ϕ_π and ϕ_c to minimize the distance between the

natural rate path and the actual nominal rate path:

$$\begin{aligned}\hat{R}_t &= \max \left\{ -\log \left(\frac{1}{\beta} \right), \hat{R}_t^{fb} + \phi_\pi \pi_{H,t} + \phi_c \tilde{C}_t \right\}, \\ \hat{R}_t^* &= \max \left\{ -\log \left(\frac{1}{\beta} \right), \hat{R}_t^{*,fb} + \phi_\pi \pi_{F,t}^* + \phi_c \tilde{C}_t^* \right\}.\end{aligned}$$

Additionally, to isolate the effects of pricing regimes on monetary policy transmission, we set government spending in each country to follow their flexible-price counterparts:

$$\hat{G}_t = \hat{G}_t^{fb} \qquad \hat{G}_t^* = \hat{G}_t^{*,fb}$$

This framework aims to ensure identical policy paths across pricing regimes. As discussed in Section 2.5, for identical policy paths, the global variables should theoretically remain unchanged across PCP and LCP regimes. While our IRF matching approach does not achieve exactly identical paths due to small numerical optimization errors, the resulting world variables remain very close across pricing regimes. Therefore, any meaningful differences in the relative variables can be attributed primarily to the underlying transmission mechanisms (ERPT) affecting the distribution of adjustment between countries.

Small Shocks Figure 2 illustrates the dynamics of world and relative variables when a small shock hits the Home country. By design, both economies' nominal interest rates track their natural rate paths closely through IRF matching, leading to nearly identical trajectories in world output gap and inflation (panels 1 and 2). However, significant differences emerge in relative variables, most notably in the output gap (panel 3).

Panel 3 reveals that the relative output gap falls more sharply under LCP than PCP, indicating that incomplete pass-through amplifies the Home country's share of the recession. This asymmetry stems from the sluggish adjustment of internal relative prices, which hampers Home's ability to benefit from exchange rate movements.

During mild ZLB episodes, home currency depreciation serves as an automatic stabilizer by making home exports cheaper and imports more expensive. This relative price adjustment redirects global demand toward home-produced goods, cushioning Home's recession. However, the effectiveness of this stabilization channel depends crucially on the degree of exchange rate pass-through. Under PCP, rapid price adjustment allows this channel to work efficiently, protecting Home from a severe downturn. In contrast, under LCP, relative prices adjust more sluggishly (panel 5), weakening this natural stabilizing mechanism and deepening the recession despite identical policy rates.

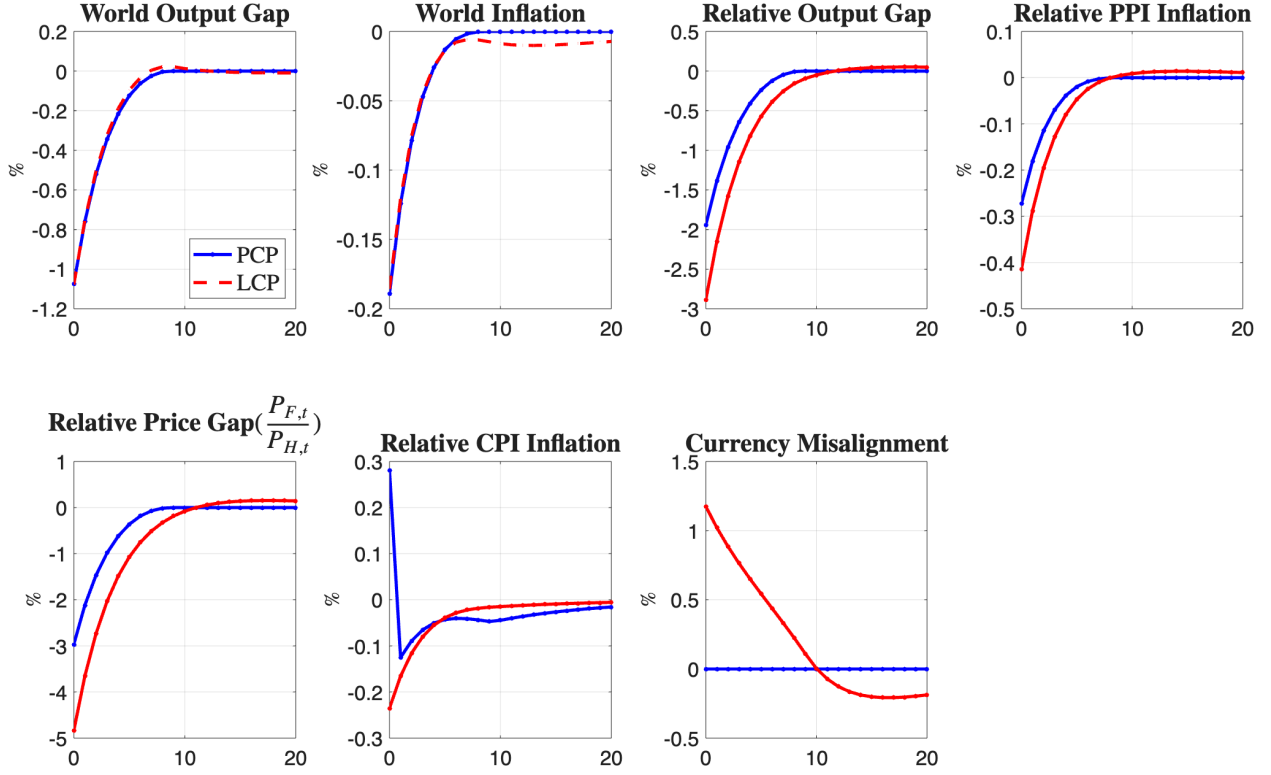


Figure 2: Impulse Response (Small Shock)

Currency misalignment represents another key difference between PCP and LCP dynamics (Figure 2 panel 7). This misalignment, reflecting deviations from the law of one price, arises because sticky export prices under LCP prevent full adjustment to exchange rate changes. When Home's currency depreciates, export and import prices adjust less than under PCP due to sticky export price-setting, leading to lower relative CPI inflation and distorted consumption patterns: Home consumes more while Foreign consumes less compared to PCP. This higher Home consumption exacerbates the relative output decline by reducing labor supply through wealth effect. Moreover, sticky export prices distort markups in export markets, affecting firms' labor demand. Consequently, minimizing currency misalignment becomes an additional policy objective under LCP, unlike under PCP where such misalignment does not occur.

Large Shock Figure 3 displays the impulse response of world and relative macro variables when a large shock strikes the Home economy. In this extreme ZLB episode, the Home economy faces significant deflationary pressures, leading to a positive interest rate differential ($r_t - r_t^* > 0$). Combined with UIP condition, the home currency appreciates, in contrast to what occurs under a small shock.

This reversal in exchange rate movement reshapes the relative performance of PCP and LCP economies. The relative output gap (Figure 3 panel 3) contracts less severely under LCP than PCP. The economic intuition behind this phenomenon is that the deviation from complete pass-through under LCP provides a natural insulation against the “perverse” effects of exchange rate movements.

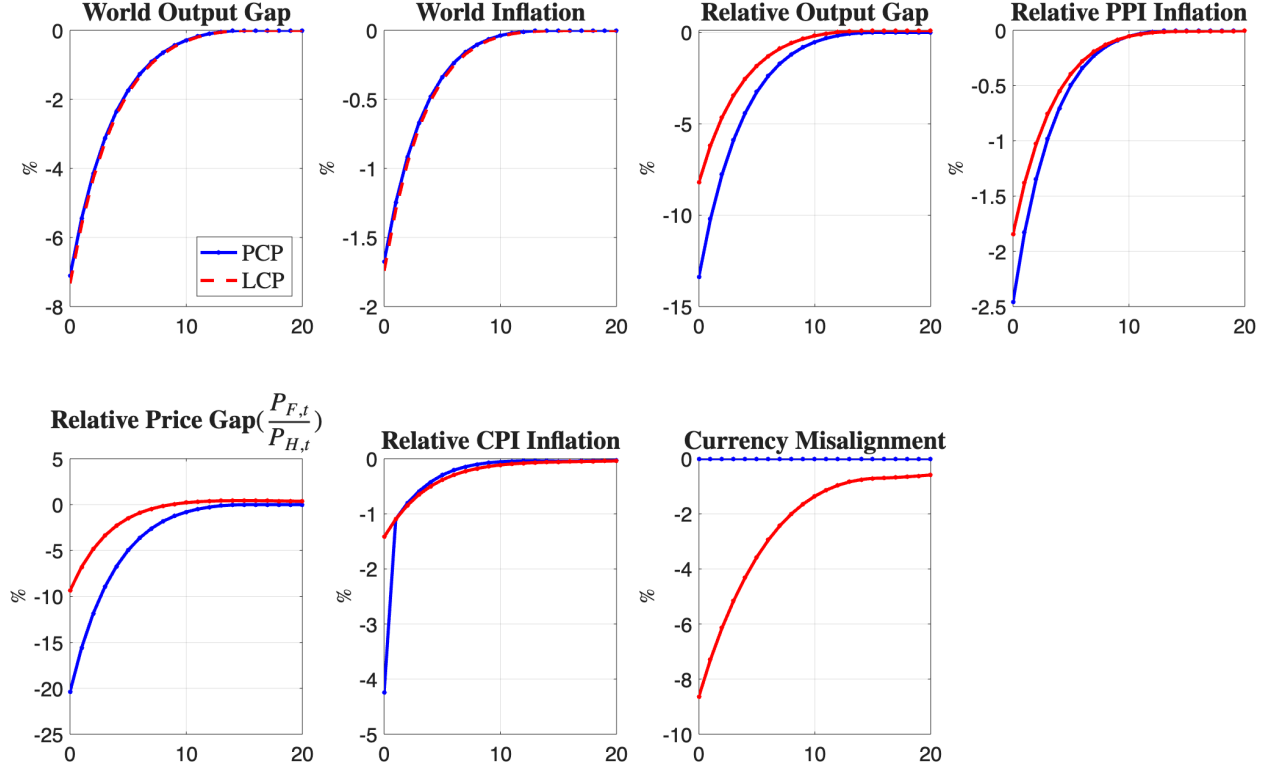


Figure 3: Impulse Response (Large Shock)

Unlike small shock scenarios where currency depreciation helps stabilize Home’s economy, appreciation under large shocks has destabilizing effects: it makes home exports more expensive and foreign imports cheaper. Hence, this expenditure-switching away from home-produced goods deepens Home’s recession. Again, the severity of this destabilizing mechanism depends critically on the degree of ERPT. With complete pass-through under PCP, Home experiences the maximal adverse effect from currency appreciation since internal relative prices in both countries instantly reflect the exchange rate movements. However, when ERPT is incomplete under LCP, internal relative prices are only partially influenced by currency appreciation due to inertia generated by sticky export prices. Hence, expenditure switching toward foreign goods is limited, and recession in the home country becomes less severe than under PCP.

This analysis reveals a fundamental state dependence in how pricing regimes affect macroe-

economic stability. Under small shocks, PCP's rapid price adjustment helps stabilize the economy through beneficial expenditure-switching. However, this same price flexibility becomes a cost under large shocks by amplifying the adverse effect of perverse exchange rate movements. Conversely, while LCP's price stickiness impairs adjustment to small shocks, it provides valuable insulation against large ones. These findings carry important implications for optimal policy design: policy effectiveness depends crucially on both the pricing regime and shock size—themes we explore in detail in the next section.

4 Pricing Regimes and Optimal Monetary Policy

This section analyzes the design of the optimal cooperative policy under discretion for both PCP and LCP pricing regimes. The policy instruments include the nominal interest rates (R_t, R_t^*) and government spending (G_t, G_t^*) in each country. Our analysis proceeds in two steps. First, we examine optimal monetary policy alone, keeping fiscal policy passive at its flexible price level. Then, in the next section, we characterize the optimal mix of monetary and fiscal policies when all instruments are deployed to maximize world welfare.

4.1 Small Shocks

Figure 4 compares optimal monetary policy responses and welfare-relevant variables under PCP and LCP when a small shock hits the Home country. While Home's policy rates follow similar paths under both regimes (panel 1), a striking difference emerges in Foreign's behavior: Foreign pursues substantially tighter policy under PCP than LCP (panel 2).

The divergence in monetary policy design can be attributed to two key factors: (1) differing stabilization objectives and (2) the extent of exchange rate pass-through on internal relative prices. As observed in the equation (22), under PCP with passive fiscal policy, the stabilizing objectives of the social planner are average and relative output gap and PPI inflation between the two countries.

$$2 \left\{ \mathcal{L}_t^{W,PCP} - \mathcal{L}_t^{fb} \right\} = - \left(\frac{\rho}{c_y} + \eta \right) \left(\tilde{Y}_t^W \right)^2 - \left(\frac{\rho}{c_y D} + \eta \right) \left(\tilde{Y}_t^R \right)^2 - \frac{\sigma}{\kappa} \left((\hat{\pi}_t^{P,W})^2 + (\hat{\pi}_t^{P,R})^2 \right) \quad (22)$$

Under PCP, the social planner achieves maximal welfare by engineering the more favorable relative prices (terms-of-trade) for the home economy. Complete exchange rate pass-through makes this relative-focused strategy effective. When Foreign raises rates, the resulting home currency depreciation immediately affects relative prices, generating strong expenditure switching toward home-produced goods. This mechanism helps stabilize both the relative output gap (Figure 4 panel 5) and inflation (panel 8). While higher Foreign rates do suppress global demand through

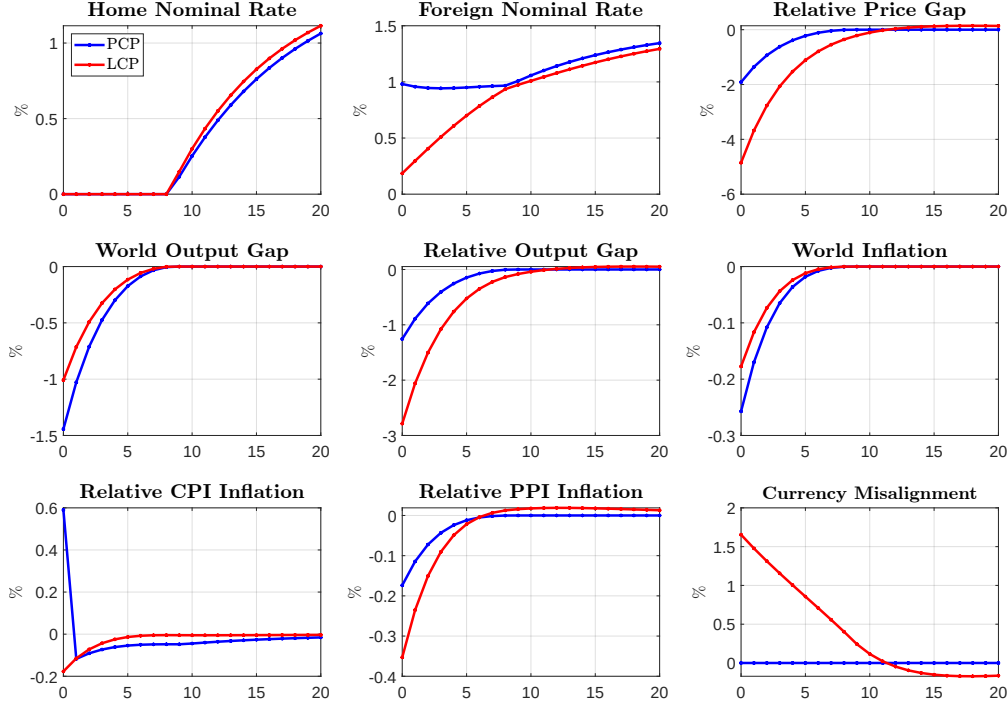


Figure 4: Optimal Monetary Policy (Small Shock)

intertemporal substitution (panels 4 and 6), the benefits of correcting relative imbalances outweigh these costs when pass-through is complete.

Under LCP, the welfare objective of the social planner becomes more complex compared to the PCP. Since sticky export prices incur misallocation of labor in export markets and distort the relative consumption between two countries, social planner tries to stabilize CPI inflation and currency misalignment instead of PPI inflation as observed in equation 23.

$$\begin{aligned}
 2 \left\{ \mathcal{L}_t^{W,LCP} - \mathcal{L}_t^{fb} \right\} = & - \left(\frac{\rho}{c_y} + \eta \right) \left(\tilde{Y}_t^W \right)^2 - \left(\frac{\rho}{c_y D} + \eta \right) \left(\tilde{Y}_t^R \right)^2 - \frac{c_y \nu (1 - \nu) \theta}{D} \hat{m}_t^2 \\
 & - \frac{\sigma}{\kappa} \left(\left(\hat{\pi}_t^W \right)^2 + \left(\hat{\pi}_t^R \right)^2 + \left(c_y (2\nu - 1) - 2(1 - \nu)(1 - c_y) \hat{\pi}_t^R \Delta \hat{T}_t + (1 - \nu) \right) (1 - \nu) \left(\Delta \hat{T}_t \right)^2 \right)
 \end{aligned} \tag{23}$$

Sticky export prices introduce another channel through which the optimal monetary policy design under LCP diverges from PCP: the social planner's reduced ability to influence the relative output gap. As can be observed by comparing two equations (16) and (17), relative prices exhibit inertia under LCP, in contrast to the forward-looking behavior seen under PCP. This sluggishness limits policy's ability to influence relative variables through exchange rate movements, forcing greater emphasis on managing global variables.

Moreover, the currency misalignment channel plays a key role in shaping LCP's optimal pol-

icy response. Unlike PCP where misalignment does not occur, any policy action that alters the exchange rate under LCP will affect the degree of misalignment. In the case of small shocks, raising Foreign interest rates would further depreciate the Home currency, exacerbating misalignment and its associated welfare costs.

As a result, the social planner under LCP pursues a very different strategy compared to PCP: maintaining lower Foreign interest rates to simultaneously support global demand and limit currency misalignment, even though this provides less help for relative adjustment. This trade-off is evident in Figure 4: Foreign's more accommodative stance (panel 2) helps limit the decline in world output gap (panel 4) compared to PCP. This reflects a fundamental shift in policy priorities - when ERPT is weak, attempting to correct relative gaps through aggressive rate hikes becomes less effective, making global demand stabilization through lower world interest rates the more efficient policy choice.

4.2 Large Shocks

Figure 5 presents the outcomes of optimal monetary policy in response to a large negative demand shock in the Home country. The most dramatic difference appears in Foreign's interest rate policy (Figure 5 panel 2): under PCP, Foreign raises rates above steady state, while under LCP, it maintains zero rates for eight periods.

When a large demand shock meets ZLB, strong deflationary pressures create a positive real interest rate gap, leading to an appreciation of the home currency. As outlined in Section 3, under PCP, this counterintuitive exchange rate movement intensifies the recession by redirecting expenditure away from home goods, further worsening the distortion in the relative output gap (Panel 5). Hence, the objective of optimal monetary policy is to mitigate the home currency appreciation by lowering the relative interest rate gap between the two economies. This is achieved by substantially increasing the foreign nominal interest rate, albeit at the expense of suppressing global demand (Figure 5 panels 4 and 6). Again, this optimal policy design leverages the strong expenditure-switching mechanism driven by the tight connection between exchange rates and internal relative prices.

Under LCP, limited ERPT shifts optimal policy toward global stabilization. While Foreign's aggressive rate hikes effectively manage relative variables under PCP, they become counterproductive under LCP - significantly depressing global demand while achieving minimal improvement in relative imbalances. The need for active relative stabilization is further reduced by sticky export prices, which act as natural insulators against adverse exchange rate movements, automatically

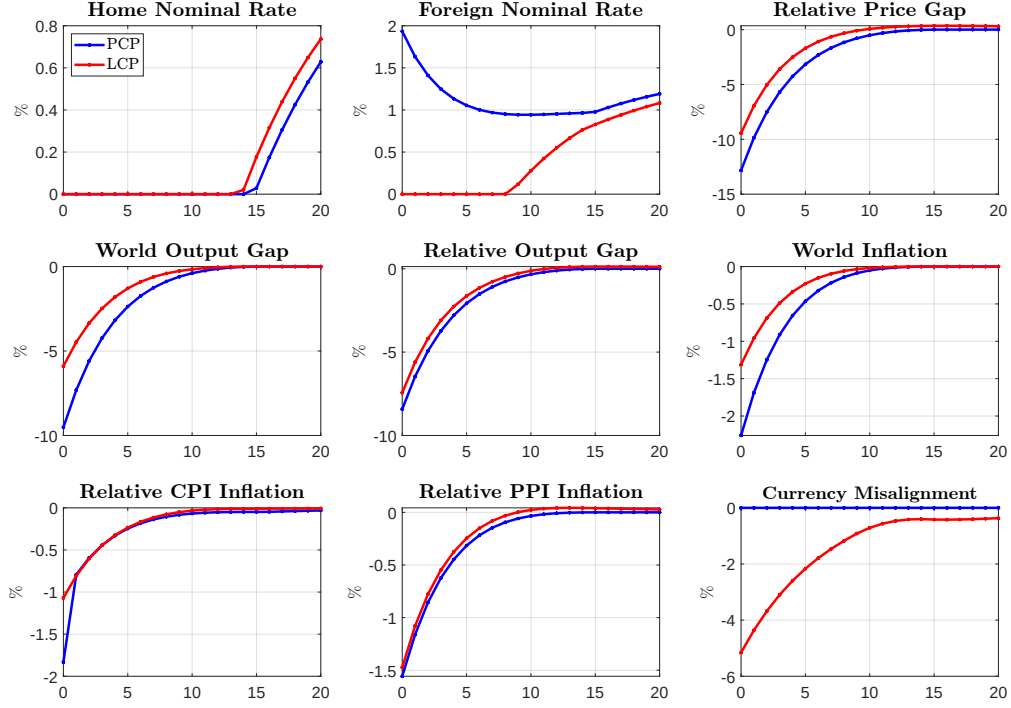


Figure 5: Optimal Monetary Policy (Large Shock)

moderating both relative output gaps and price distortions (Figure 5 panels 3, 5, and 8).

With this built-in stabilization of relative variables, the social planner focuses on boosting global demand through lower foreign (and thus lower world) interest rates. This strategy involves a key trade-off: maintaining low rates helps support global demand but allows home currency appreciation to persist, worsening currency misalignment (panel 9). The social planner must therefore carefully calibrate the duration of Foreign's zero-rate policy, balancing global demand support against the costs of prolonged exchange rate distortions and cross-country consumption imbalances.

This pattern reveals how ERPT fundamentally shapes Foreign's optimal monetary policy. Under complete pass-through (PCP), Foreign prioritizes exchange rate management through higher rates to facilitate expenditure switching, accepting weaker global demand as the cost. When pass-through is limited (LCP), these priorities reverse - Foreign focuses on supporting global variables through lower rates, even at the expense of larger cross-country imbalances. This relationship intensifies further under large shock, where exchange rate moves perversely. This shift in objectives from relative adjustment (PCP) to global stabilization (LCP) demonstrates how firms' pricing decisions reshape both monetary policy transmission and optimal responses during liquidity trap episodes.

5 Optimal Monetary and Fiscal Policy Mix

In the previous section, we explored how and why optimal monetary policy varies across different pricing regimes while keeping fiscal policy to a passive rule. Now, we explore the optimal coordination of monetary and fiscal policies, considering government spending as an additional instrument to counteract the effects of a negative demand shock. The prominent channel through which government spending combats the recession is the New-Keynesian demand effect. An increase in government spending beyond the flexible price level ($\tilde{G}_t > 0$) reduces markups by boosting labor demand. When the policy rate in one country is constrained by the ZLB, the New Keynesian demand effect of government spending can complement the limitations of monetary policy, helping to mitigate declines in output and inflation. However, active fiscal intervention also incurs a cost by distorting the marginal rate of substitution between leisure and government spending from its optimal level. Balancing this trade-off, the optimal fiscal response will be designed to address the most severe distortions that monetary policy alone cannot fully take care of.

Our analysis reveals that fiscal policy systematically addresses the distortions that monetary policy cannot effectively manage due to its regime-specific constraints. Under PCP, monetary policy primarily targets relative variables through high ERPT, but this focus comes at the cost of suppressing global demand, particularly when counteracting perverse exchange rate movements. Consequently, fiscal policy's main role is to support aggregate demand while providing additional help with relative adjustment when monetary policy's effectiveness is limited by the ZLB. Under LCP, the roles reverse: monetary policy concentrates on supporting global demand through low interest rates, as weak pass-through constrains its ability to manage relative distortions. This creates space for fiscal policy to focus primarily on addressing cross-country imbalances that monetary policy cannot effectively target. These distinct complementary relationships between monetary and fiscal policy become more pronounced as shock size increases and vary systematically with the degree of trade integration.

5.1 Small Shock

Figure 6 illustrates the optimal fiscal policy responses for both types of shocks, revealing how fiscal policy complements monetary policy's focus under each pricing regime. Under PCP, monetary policy prioritizes correcting relative imbalances through higher Foreign interest rates. While this monetary strategy effectively addresses cross-country imbalances, it inevitably puts downward pressure on global demand and triggers a recession in the Foreign economy. To compensate for these contractionary effects, fiscal policy focuses on supporting global demand through synchro-

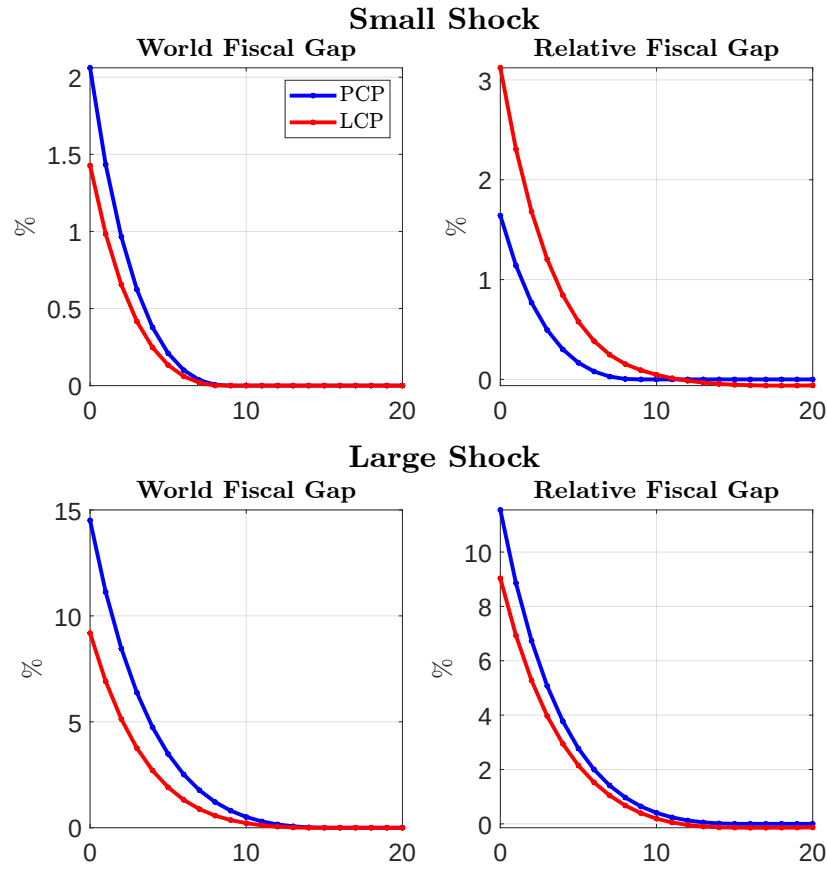


Figure 6: Optimal Fiscal Policy

nized increases in government spending across both countries (Figure 6, panels 1 and 2). Although this fiscal intervention improves welfare through both global and relative channels, its primary contribution comes from boosting aggregate demand. Figure 7 quantifies these improvements by showing the difference between scenarios with and without fiscal intervention. As panels 1 and 3 demonstrate, the expansionary fiscal policy successfully raises the world output gap and inflation by approximately 0.5% and 0.04% respectively, directly addressing the global demand shortfall created by monetary policy's focus on relative stability.

Under LCP, the complementary relationship reverses, as can be seen from the red line in Panel 1 and 2 of Figure 6. With monetary policy focused on supporting global demand through low world interest rates (due to limited ERPT), fiscal policy primarily addresses the resulting relative imbalances. This manifests in an asymmetric fiscal response: Less worldwide expansion in government spending (Panel 1) but more relative expansion in Home than PCP (Panel 2). Figure 7 confirms this complementary role - the largest improvements appear in relative variables, with fiscal policy reducing the relative output gap and CPI inflation by 0.6% and 0.03% respectively

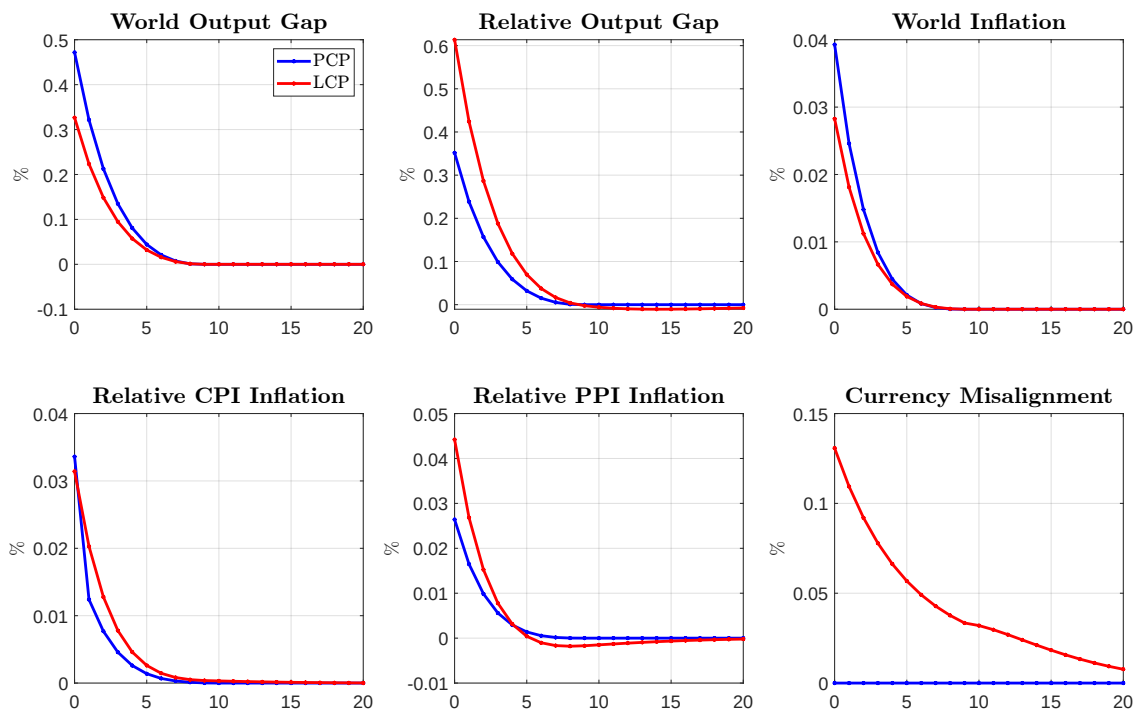


Figure 7: Gains from Optimal Fiscal Policy (Small Shock)

Note: Each panel shows the difference in impulse responses between scenarios with optimal fiscal policy and those with passive fiscal policy

(panels 2 and 4). This asymmetric fiscal intervention directly targets the distortions that arise when monetary policy's accommodative stance, while successful in boosting global demand, creates inefficient cross-country imbalances.

Table 2 quantifies these complementary relationships through welfare decomposition. Under PCP, welfare gains (0.0964) come primarily from improvements in world variables, reflecting fiscal policy's focus on supporting global demand while monetary policy handles relative adjustment. Under LCP, higher total welfare gains (0.1271) are achieved mainly through improvements in relative variables, though this requires larger welfare losses from relative government spending (-0.0475 under LCP vs -0.0114 under PCP) to compensate for monetary policy's limited effectiveness in managing cross-country imbalances. This welfare analysis confirms how fiscal policy systematically addresses the areas where monetary policy's regime-specific focus creates gaps in stabilization.

Terms	Small Shock		Large Shock	
	PCP	LCP	PCP	LCP
$\tilde{Y}_t^W$	0.0476	0.0230	3.0480	1.0224
$\tilde{Y}_t^R$	0.0246	0.1060	1.6681	0.9061
$\tilde{G}_t^W$	-0.0195	-0.0092	-1.2266	-0.4642
$\tilde{G}_t^R$	-0.0114	-0.0475	-0.7168	-0.4378
$\tilde{Y}_t^W \tilde{G}_t^W$	-0.0191	-0.0091	-0.9796	-0.3893
$\tilde{Y}_t^R \tilde{G}_t^R$	-0.0086	-0.0447	-0.4559	-0.3568
$\hat{m}_t$	N/A	-0.0025	N/A	0.0417
$\hat{\pi}_t^W$	0.0569	0.0284	7.4739	1.9236
$\hat{\pi}_t^R$	0.0257	0.0314	3.5095	1.0356
$\Delta \hat{T}_t$	N/A	0.0424	N/A	0.3290
$\hat{\pi}_t^R \Delta \hat{T}_t$	N/A	0.0088	N/A	0.1120
Total	0.0964	0.1271	12.321	3.7224

Table 2: Welfare Gain Accounting

Note: Each component measures the welfare gain attributable to using optimal fiscal policy. Specifically, each is derived as the difference between welfare components under the fully optimal monetary and fiscal policy mix (R, R^*, G, G^*) and those under a regime where only optimal monetary policy (R, R^*) is implemented. The relative inflation term corresponds to relative PPI inflation under PCP and CPI inflation LCP. To enhance interpretability, all values are scaled by a factor of 100.

5.2 Large Shock

Under large shocks, the complementary relationship between monetary and fiscal policy intensifies significantly, especially when perverse exchange rate movements emerge at the ZLB. The optimal fiscal policy responses for large shocks under both pricing regimes are presented in the lower panels of Figure 6.

Figure 8 shows the difference in impulse responses between scenarios with optimal fiscal policy and those with passive fiscal policy. Under PCP, monetary policy prioritizes managing relative distortions by raising Foreign rates to counter perverse appreciation. However, this focus on relative stability through high rates significantly contracts global demand - which is much larger than in the small shock case. As a result, fiscal policy must expand beyond its small-shock role of primarily supporting global demand to address both objectives: it must boost the severely weakened aggregate demand while also helping correct relative distortions that monetary policy cannot fully manage due to the ZLB. This is clearly visible in the optimal policy responses shown in Figure 6: substantial fiscal expansions are required in both world and relative terms. Furthermore, the effectiveness of this dual-objective fiscal intervention is evident in Figure 8: under PCP, the fiscal policy achieves roughly twice the improvement in global variables (panels 1 and 3) and 50% larger gains in relative variables (panels 2, 4, and 5) compared to LCP.

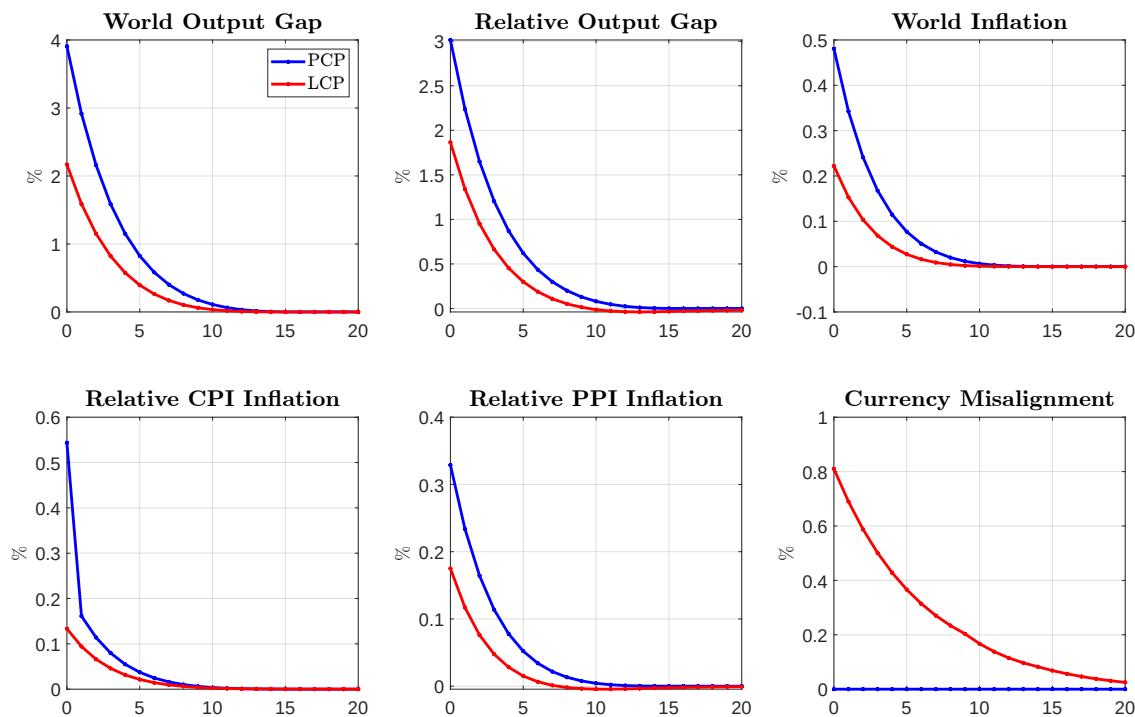


Figure 8: Gains from Optimal Fiscal Policy (Large Shock)

Note: Each panel shows the difference in impulse responses between scenarios with optimal fiscal policy and those with passive fiscal policy

Under LCP, this complementary dynamic shifts fundamentally. Since sticky export prices naturally moderate exchange rate effects, monetary policy can maintain its focus on supporting global demand through low rates without creating severe relative distortions. This built-in insulation against perverse exchange rate movements reduces the need for both monetary and fiscal intervention, resulting in substantially reduced fiscal stimulus requirements relative to PCP, as evidenced by smaller gaps in both global and relative fiscal spending (Figure 6 lower panels). The magnitude of fiscal expansions in the world and relative terms are approximately 25% smaller than the level required under PCP. Since monetary policy can effectively support global demand without creating severe relative distortions, fiscal policy can focus more narrowly on providing targeted support primarily in the Home economy.

The column labeled large shock in Table 1 reveals how these different complementary patterns translate into gains. PCP achieves substantially higher total welfare gains (12.321 vs 3.7224), but requires roughly triple the fiscal intervention costs. This reflects PCP's expanded fiscal role: larger interventions are needed to compensate for monetary policy's acute trade-off between relative stability and global demand when high pass-through amplifies exchange rate distortions. Under

LCP, both welfare gains and fiscal costs remain modest since sticky prices naturally help monetary policy avoid this difficult trade-off, reducing the need for compensatory fiscal action.

In summary, the optimal design of fiscal policy fundamentally differs across pricing regimes based on its complementary role to monetary policy. Under small shocks, PCP monetary policy's focus on relative stability through exchange rates leaves gaps in global demand that fiscal policy must fill through coordinated expansion. Under LCP, monetary policy's focus shifts to supporting global demand, requiring fiscal policy to instead address resulting relative imbalances through asymmetric interventions. This complementary relationship intensifies dramatically under large shocks: PCP requires aggressive fiscal stimulus in both countries to address the severe trade-offs created by monetary policy's fight against perverse exchange rate effects, while LCP's natural insulation against these exchange rate distortions allows for more moderate, targeted fiscal support. These patterns demonstrate how firms' pricing decisions fundamentally shape not just the transmission of shocks but the entire optimal policy mix between monetary and fiscal authorities.

5.3 Trade Openness and Optimal Policy

The effectiveness of monetary and fiscal policy coordination depends crucially on trade integration between countries (Cook and Devereux, 2013). Our analysis thus far has demonstrated how pricing regimes fundamentally shape optimal policy responses under baseline trade integration. We now examine how these relationships evolve across different levels of economic integration between countries. While the core mechanisms identified earlier - monetary policy's regime-specific focus and fiscal policy's complementary role - remain operational, their relative strength varies systematically with trade openness, leading to distinct optimal policy mixes.

Optimal Monetary Policy Figure 9 maps the optimal monetary policy choices of Foreign across trade openness levels (ν) and shock magnitudes (σ_z). Given that Home's interest rate remains at zero across all parameter combinations, we focus on analyzing Foreign's policy responses.

Figure 9 plots the optimal interest rate chosen by Foreign under PCP (left panel) and under LCP (right panel). Comparing these two panels, our key finding about pricing regimes' impact on optimal policy remains robust across a wide range of parameters: Foreign adopts a more accommodative stance under LCP compared to PCP. While Foreign's policy rate under PCP takes positive values across most parameter configurations (except at perfect trade integration, $\nu = 0.5$), under LCP it remains at zero for much of the parameter space. Moreover, the interest rate differential between PCP and LCP increases with shock size and displays an inverse U-shaped pattern

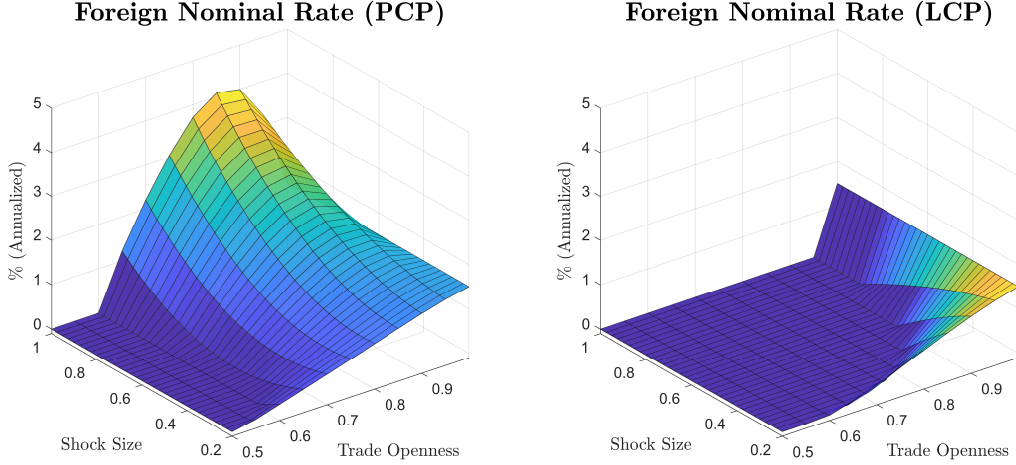


Figure 9: Trade Openness and Optimal Monetary Policy

with respect to trade openness.

This systematic difference in policy stances reflects the distinct transmission channels operating under each regime, as established in Sections 3 and 4. Under PCP, monetary policy primarily aims to manage relative price distortions through exchange rate channels, necessitating higher Foreign rates. Under LCP, with dampened ERPT, policy instead prioritizes stimulating global demand through lower rates. These divergent objectives become more pronounced with shock size, particularly when large shocks trigger home currency appreciation. In these cases, PCP requires aggressive rate hikes to counter severe relative distortions, while LCP's natural insulation from exchange rate movements allows Foreign to maintain accommodative policy.

The relationship between trade openness and optimal policy rates reveals distinct patterns across pricing regimes. Under PCP, Foreign's rate decisions reflect two competing forces. As home bias increases (lower trade openness), the adverse home demand shock becomes more concentrated in the Home economy, widening real interest rate differentials between countries. This triggers stronger home currency appreciation and more intense expenditure-switching effects, which Foreign counteracts by raising rates. However, this policy mechanism loses potency as economies approach complete closure ($\nu \rightarrow 1$), since countries predominantly consume domestic goods. These opposing forces create a "sweet spot" at intermediate levels of trade openness - near our baseline calibration of $\nu \approx 0.8$ - where Foreign's rate adjustments have maximum impact on relative variables.⁷

⁷For a more detailed explanation of this logic, see the discussion on pages 386-387 in [Cho et al. \(2023b\)](#).

Under LCP, the relationship between optimal Foreign policy and trade openness follows a more straightforward pattern driven by two complementary mechanisms. In highly integrated economies, Foreign maintains zero rates because: (1) higher trade integration means imports comprise a larger share of consumption baskets, making Foreign's monetary expansion more effective at stimulating global demand, and (2) sticky export prices naturally moderate relative price distortions under large shock, allowing Foreign to focus on supporting aggregate demand. As economies become more closed, this calculus shifts - monetary policy loses its effectiveness at boosting global demand through trade channels while relative distortions persist, leading Foreign to implement positive rates.

These patterns explain why policy divergence between PCP and LCP peaks at intermediate openness ($\nu \approx 0.8$) and large shock sizes. This environment maximizes each regime's distinctive features: under PCP, the economy maintains sufficient integration for exchange rates to matter while having enough home bias for relative distortions to be severe, requiring aggressive rate hikes. Under LCP, this intermediate openness is sufficiently open to allow monetary stimulus to effectively support global demand through trade channels, while sticky prices provide natural insulation against relative distortions.

This state-dependent relationship between trade openness and optimal monetary policy carries important implications for policymakers. It suggests that the choice of exchange rate pass-through regime becomes most consequential for monetary policy design at intermediate levels of trade integration - precisely the environment that characterizes many advanced economies today. Moreover, it highlights how the effectiveness of monetary policy tools varies systematically with both the pricing regime and the degree of trade openness, requiring careful calibration of policy responses to country-specific circumstances.

Optimal Fiscal Policy Building on our analysis of how fiscal policy complements monetary policy's regime-specific focus, we now examine how this complementary relationship evolves with trade openness. Figure 10 illustrates these patterns by plotting differences in world and relative government spending between PCP and LCP across varying levels of trade integration and shock sizes. Positive values indicate larger fiscal expansion under PCP, while red dotted points mark where LCP requires greater fiscal intervention.

The left panel of Figure 10 displays the difference in the world fiscal gap response between the two pricing regimes during the impact period. A notable observation is that PCP generally requires larger global fiscal expansion across most parameter combinations. This pattern directly re-

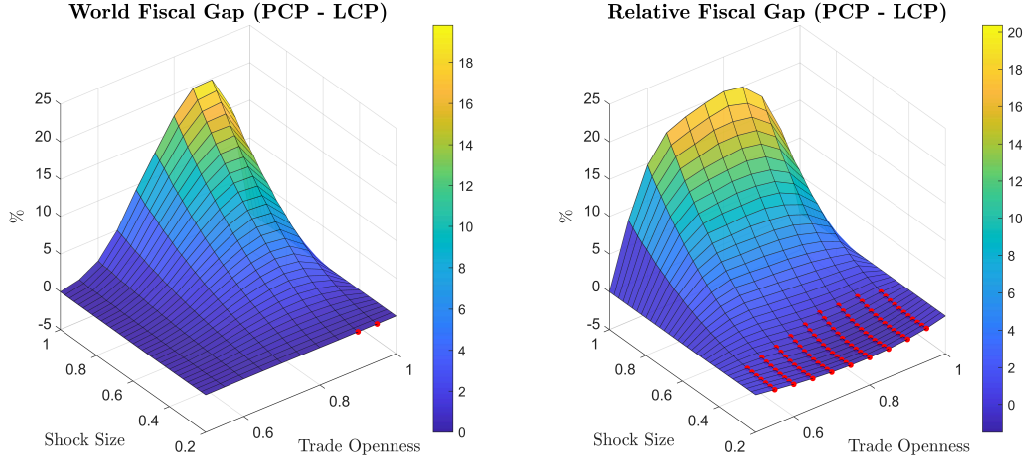


Figure 10: Trade Openness and Optimal Fiscal Policy

Note: Figure shows the period-0 difference in world and relative government spending gap between the two pricing regimes. Positive values correspond to more government spending under PCP. Red dotted points denote the parameter combinations where government spending increases less under PCP compared to LCP.

flects our earlier finding about monetary policy's regime-specific focus: under PCP, monetary policy's emphasis on managing relative prices through higher Foreign rates creates a global demand shortfall that fiscal policy must address. This fiscal compensation becomes more pronounced both with shock size and at intermediate levels of trade openness.

The economic mechanism behind this pattern connects directly to monetary policy's divergent objectives across regimes. Under PCP, Foreign's focus on counteracting relative distortions leads to higher world interest rates ($\frac{R_t + R_t^*}{2}$), particularly when large shocks and complete pass-through amplify these distortions. Fiscal policy must then expand more aggressively to offset this contractionary monetary stance. This difference peaks at intermediate trade openness for two reasons. First, monetary policy's regime-specific trade-offs are most severe at this level as previously explained - there is sufficient integration for exchange rates to matter significantly, yet enough home bias for their movements to create meaningful distortions. Second, by the same force, fiscal policy's effectiveness at addressing both domestic and international variables is maximized, making it particularly important for compensating for PCP's higher interest rates. These differences naturally diminish at extreme levels of openness as exchange rates become either less relevant (in closed economies) or less distortionary (in fully integrated economies).

The right panel of Figure 10 depicts the difference in the relative fiscal gap ($\frac{\tilde{G}_t - \tilde{G}_t^*}{2}$) between the two pricing regimes, where a more positive value signifies a greater concentration of government spending at Home under PCP. For small shocks, LCP requires larger relative fiscal intervention

(shown by red dotted points) because slower ERPT leads to sharper declines in the relative output gap and inflation. This aligns with our earlier findings about LCP's limited price adjustment hampering natural stabilization through exchange rates. However, as shock size increases, this pattern dramatically reverses. Under large shocks, PCP demands increasingly asymmetric fiscal expansion concentrated in Home because complete pass-through amplifies the destabilizing effects of perverse exchange rate movements, while under LCP, the natural insulation from sticky prices moderates these distortions.

Regarding trade openness, the difference in the relative fiscal gap exhibits a U-shaped pattern for small shocks and an inverted U-shaped pattern for large shocks. These patterns emerge because varying degrees of ERPT have their strongest impact on relative variables at moderate trade openness. Under small shocks, PCP's complete pass-through of currency depreciation provides natural stabilization while reducing the need for fiscal intervention. This relative fiscal need under LCP is strongest at moderate trade openness but diminishes as economies become either very open or very closed, creating the U-shaped pattern. For large shocks this relationship inverts - PCP's complete pass-through amplifies relative distortions most severely at intermediate openness and necessitates substantial home-concentrated fiscal expansion. This larger gap in relative fiscal needs between PCP and LCP generates the inverse-U shape. In sum, during ZLB episodes with large deflation, PCP requires more expansionary fiscal policy in both global and relative terms.

Figure 11 quantifies how these different fiscal policy responses translate into welfare gains. In the figure, positive values indicate larger welfare gains under PCP relative to LCP, while red dotted points mark regions where LCP generates higher welfare gains. Under small shocks, LCP generates marginally higher gains as fiscal policy must actively compensate for monetary policy's limited effectiveness in using exchange rate channels. Under large shocks, this pattern dramatically reverses - PCP achieves substantially larger welfare gains, peaking at intermediate openness ($\nu \approx 0.8$). This reflects the expanded role of fiscal policy under PCP: it must address both severe relative distortions from perverse exchange rate movements and weak global demand from monetary tightening, with these challenges most acute at intermediate openness. The substantial fiscal intervention needed to manage these dual problems generates larger welfare gains compared to LCP, where sticky prices naturally help monetary policy avoid such sharp trade-offs.

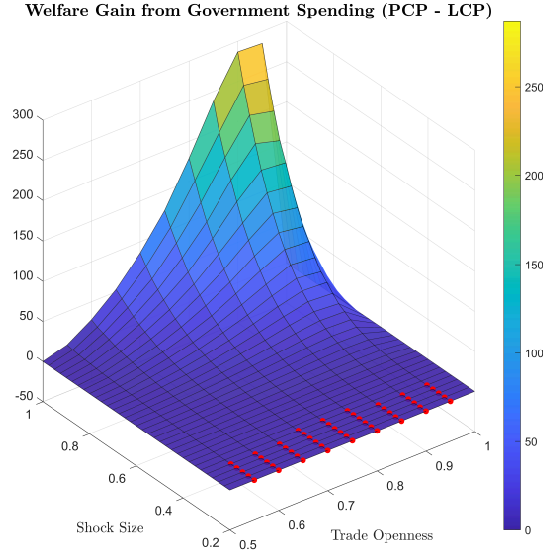


Figure 11: Trade Openness and Welfare Gain from Optimal Fiscal Policy

Note: Figure displays the gap of the additional welfare gain from using fiscal policy between PCP and LCP. A higher positive value means additional welfare gain from using fiscal policy is larger under PCP. Red dotted points denote the parameter combinations where welfare from using fiscal policy is smaller under PCP compared to LCP.

5.4 Robustness Check

In this section, we demonstrate that our key findings about the relationship between pricing regimes and optimal policy responses remain robust across different parameter specifications. We examine variations in three additional critical parameters from our baseline calibration: trade elasticity θ , inverse elasticity of intertemporal substitution ρ , and Calvo price stickiness α . These parameters have been identified as fundamental determinants of international shock transmission and policy effectiveness in the open economy literature ([Benigno and Benigno, 2006](#); [Corsetti et al., 2011](#)). For each alternative parameter configuration, we analyze how optimal policy varies across both trade openness (ν) and shock magnitudes (σ_z), maintaining the same parameter space explored in [Section 5.3](#). This approach allows us to systematically verify that our core findings about the interaction between pricing regimes, trade integration, and shock size remain qualitatively robust to different parameter choices.

A particularly important composite parameter in open economy models is $\rho\theta$, which governs the substitutability between home and foreign goods. We systematically explore how optimal policy varies under three scenarios: when goods are Edgeworth substitutes ($\rho\theta > 1$), complements ($\rho\theta < 1$), and independent ($\rho\theta = 1$). We achieve these different scenarios through targeted

adjustments to either ρ or θ while holding other parameters constant.

Figures A1 and A2 examine the case where $\rho = 0.5$, corresponding to higher intertemporal elasticity of substitution. Under this parameterization, home and foreign goods become Edgeworth independent ($\rho\theta = 1$). This independence weakens the efficacy of Foreign’s monetary policy in facilitating expenditure switching or counteracting perverse exchange rate movements under large shocks. Consequently, Foreign maintains rates near zero even under PCP across a broader range of parameters (Figure A1). The higher intertemporal elasticity of substitution also makes consumption more responsive to real interest rate deviations, leading to more severe recessions. This necessitates substantially larger fiscal interventions in both world and relative terms (Figure A2), though the qualitative patterns of optimal policy remain consistent with our baseline findings.

Figures A3 and A4 consider the case with $\rho = 2$, featuring stronger Edgeworth substitutability between goods. While Foreign still raises rates under PCP to manage relative prices (Figures A3), these increases are less pronounced than in our baseline calibration. This moderated monetary response reflects the lower intertemporal elasticity of substitution, which dampens the severity of recessions and reduces the need for aggressive policy intervention. The world and relative fiscal gaps demonstrate similar qualitative patterns but smaller magnitudes, consistent with this reduced severity (Figure A4).

Figures A5 and A6 analyze the complementarity case by setting $\theta = 0.5$. Under Edgeworth complementarity, both PCP and LCP frameworks exhibit similar monetary policy responses, with Foreign maintaining zero rates across most parameter combinations (Figure A5). This convergence occurs because complementarity weakens the expenditure-switching channel: households consume home and foreign goods together rather than substituting between them. This both reduces the need to manage relative distortions and dampens global recession severity, explaining the smaller world and relative fiscal gaps compared to our baseline (Figure A6).

Figures A7 and A8 examine another case of Edgeworth independence by setting $\theta = 1$. While independence again reduces Foreign’s incentive to raise rates under PCP (Figure A7), baseline intertemporal elasticity results in milder recessions than the $\rho = 0.5$ case, requiring smaller fiscal interventions (Figure A8).

Finally, Figures A9 and A10 examine the impact of reduced price stickiness ($\alpha = 0.75$). While the qualitative patterns of optimal monetary and fiscal policy remain unchanged, the magnitude of required interventions increases substantially. This amplification reflects the “Paradox of Flexibility” identified by Eggertsson and Woodford (2003) and Werning (2011), where greater price

flexibility can exacerbate economic distortions at the zero lower bound by intensifying deflationary pressures. As can be seen from these robustness exercises, we found that the relationship between pricing regimes and optimal policy responses remains robust across different parameter specifications.

6 Dominant Currency Pricing

The analysis thus far has focused on symmetric pricing regimes where both countries follow either PCP or LCP. However, empirical evidence suggests that many countries price their exports in a dominant currency—typically the U.S. dollar—while the dominant-currency country prices in its own currency. This dominant currency pricing (DCP) creates distinct transmission channels that operate differently under small versus large shocks, fundamentally altering the monetary-fiscal policy mix.

In our analysis of DCP, we consider a specific but empirically relevant case: the Home country follows LCP, while the Foreign country, representing the dominant currency issuer, follows PCP. A key insight emerges from this setup: the optimal policy responses under DCP effectively mirror those from our earlier symmetric pricing analysis, depending on which country experiences the shock. When a shock hits the Foreign (PCP) economy, we find that the Home country's optimal policy choices closely resemble those of the counterpart country in the pure PCP regime. Conversely, when the shock hits the Home (LCP) economy, the Foreign country's optimal policies align with those of the counterpart country in the pure LCP regime. While this mirroring pattern provides a useful framework for understanding policy choices under DCP, the asymmetric nature of price-setting creates distinct transmission channels that shape the magnitude and timing of optimal policy responses.

6.1 Demand Shock Transmission Under Asymmetric Pricing Regime

Before proceeding to the optimal policy analysis, we first examine the characteristics of demand shock transmission under DCP, which turn out to be important in understanding the optimal policy responses. The most notable distinction in demand shock transmission under DCP, compared to symmetric pricing regimes (PCP and LCP), is the presence of a channel where currency misalignment directly impacts global demand.

As demonstrated in Section 3, under symmetric pricing regimes, deviations from the law of one price influence only relative distortions, while the extent of the decline in global demand remains identical between PCP and LCP. This knife-edge result stems from the fact that internal

relative price dynamics in each country exhibit symmetry regardless of the degree of ERPT. Under symmetric preference, technology, and degree of price stickiness, the relative prices in each country move in different directions but in the same magnitudes (i.e., $\hat{T}_t + \hat{T}_t^* = 0$). Introducing the local currency pricing behavior only affects the absolute size of relative price fluctuation ($|\hat{T}_t|, |\hat{T}_t^*|$) but preserves the symmetry. Heuristically, consumption distortion in the Home is exactly canceled off from the consumption distortion in Foreign since the two relative prices exhibit equally sluggish dynamics under LCP. Consequently, allocative differences between PCP and LCP occur only in the dimension of relative side ($\tilde{Y}_{H,t} - \tilde{Y}_{F,t}$) under identical policy paths.

$$\begin{aligned} \text{World IS (PCP, LCP)} : & \frac{1}{c_y} \left(\tilde{Y}_t^W - E_t \tilde{Y}_{t+1}^W \right) - \frac{1 - c_y}{c_y} \left(\tilde{G}_t^W - E_t \tilde{G}_{t+1}^W \right) \\ & = -\frac{1}{\rho} \left(\frac{1}{2} \left(\hat{R}_t + \hat{R}_t^* \right) - E_t \hat{\pi}_{t+1}^{P,W} - \frac{1}{2} \left(\hat{r}_t^e + \hat{r}_t^{*,e} \right) \right) \end{aligned} \quad (24)$$

$$\begin{aligned} \text{World IS (DCP)} : & \frac{1}{c_y} \left(\tilde{Y}_t^W - E_t \tilde{Y}_{t+1}^W \right) - \frac{1 - c_y}{c_y} \left(\tilde{G}_t^W - E_t \tilde{G}_{t+1}^W \right) \\ & = -\frac{1}{\rho} \left(\frac{1}{2} \left(\hat{R}_t + \hat{R}_t^* \right) - E_t \hat{\pi}_{t+1}^{P,W} - (1 - \nu) E_t \Delta \hat{m}_{t+1} - \frac{1}{2} \left(\hat{r}_t^e + \hat{r}_t^{*,e} \right) \right) \end{aligned} \quad (25)$$

Under DCP, however, this sharp symmetry no longer exists. Since relative prices in each country exhibit an asymmetric degree of sluggishness, one country's consumption distortion is not counteracted by consumption distortion in the other country. Hence, depending on the sign of exchange rate movement, currency misalignment in Home-produced goods induces over(under) production of world output compared to the two symmetric pricing regimes. This economic intuition is clearly evidenced in the comparison of equations (24) and (25). Under symmetric pricing regimes, the currency misalignment term ($\hat{m}_t$) does not appear in the world IS curve. In contrast, under DCP, an increase (decrease) in currency misalignment reduces (raises) global demand. Specifically, when the Home currency depreciates (an increase in currency misalignment), sticky export prices in the Foreign market limit expenditure switching toward Home goods ($C_{H,t}^*$), while flexible relative prices in the Home market amplify expenditure switching away from Foreign goods ($C_{F,t}$). As a result, global demand declines more significantly under DCP than under PCP or LCP. Conversely, when the Home currency appreciates (a decrease in currency misalignment), sticky export prices in the Foreign market constrain expenditure switching away from Home goods, while flexible relative prices in the Home market induce stronger expenditure switching toward Foreign goods. Consequently, global demand decreases less under DCP compared to symmetric pricing regimes. In summary, during episodes of Home currency depreciation, the social

planner has a stronger incentive to address distortions in the world channel. Conversely, during episodes of Foreign currency depreciation, the focus shifts to addressing distortions in the relative channels (since world output intrinsically falls less).

6.2 Optimal Monetary and Fiscal Policy under Asymmetric Pricing Regime

Optimal Monetary Policy Building on the economics explained above, we investigate the optimal monetary and fiscal policy mix under DCP. Firstly, we will focus on the difference in optimal monetary policy design and move on to the fiscal policy. Figure 12 illustrates the impact period optimal policy responses conditional on the shock sizes. Blue and red lines correspond to the policy response under symmetric PCP and LCP, respectively. For two green lines, the solid line corresponds to the policy response when Foreign (PCP country) is shocked, and the dashed line corresponds to the policy response when Home (PCP country) is shocked. Hence, the solid line in panel 2 denotes the policy rate of Home, and the dashed line in panel 2 denotes the policy rate of Foreign.

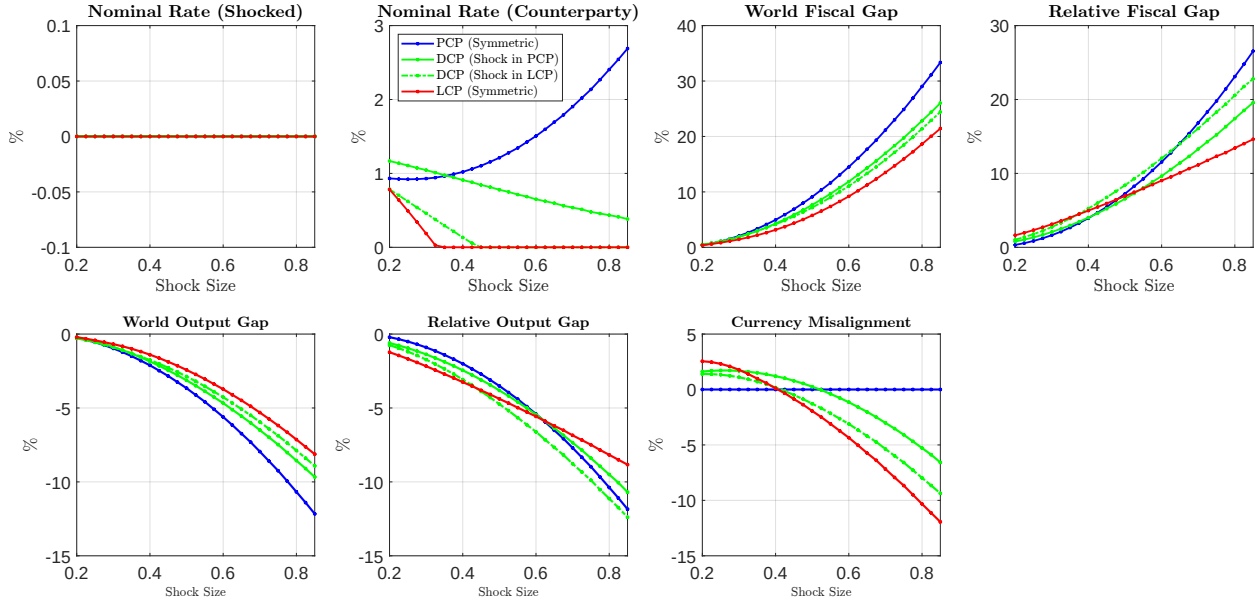


Figure 12: Optimal Monetary and Fiscal Policy Mix in DCP

Note: Relative variables are defined as $\frac{X_t^{\text{shocked}} - X_t^{\text{counterparty}}}{2}$. The currency misalignment term is represented such that positive value indicates the depreciation of shocked country's currency.

The key characteristics of optimal monetary policy can be summarized as follows: (1) The counterparty country adopts a significantly lower policy rate when a shock occurs in an LCP country (e.g., the EU) compared to when a shock affects a PCP country (e.g., the US). Specifically, for small shocks, the counterparty policy rate is even higher than that of symmetric PCP when

the dominant country is shocked. (2) As the magnitude of the shock increases, the counterparty's policy rate at the impact period decreases monotonically. However, the rate of decline is notably faster when the shock originates in a non-dominant country.

We first examine the optimal monetary policy when a negative demand shock hits a dominant country (PCP country). In this case, the asymmetric degree of pass-through acts as a buffering mechanism in world demand for small shocks. Foreign currency depreciation boosts import demand in the Home market through strong expenditure switching, while the decline in import demand in the Foreign market is limited by incomplete pass-through. Hence, under an identical policy path, the fall in world demand is less pronounced compared to PCP, but the relative output gap falls more than PCP. Hence, the social planner's focus becomes more tilted toward managing the relative output gap, which is employed by a higher counterparty policy rate compared to the PCP. Unlike the symmetric LCP, this strategy is feasible since Home's relative price rapidly reflects the movement in the exchange rate.

However, as the shock size grows, exactly opposite economics starts to operate. In the scenario of foreign currency appreciation, non-uniform pass-through exerts an inherent downward pressure on world output since the flexible relative price at Home induces strong expenditure switching away from foreign goods. Hence, the world output gap falls more than PCP, and the relative output gap falls less since limited pass-through restrains the surge in import demand in the Foreign market. In this circumstance, the social planner's focus is more oriented toward combating the fall in the world output gap, which is implemented by lower policy rates in counterparty country. The remaining question is why the speed of decrease in counterparty policy rate is slow, and why interest rates remain positive even under the extreme value of shock sizes. The answer also lies in understanding the mechanism of asymmetric pass-through. Suppose social planner employed zero policy rate in counterparty economy as is the case of symmetric LCP. This more expansionary approach can improve world demand through direct intertemporal substitution, but its effectiveness is limited than under LCP. More foreign currency appreciation suppresses the import demand in the Home market keeping the increase in import demand in Foreign mostly unaffected. Consequently, the increase in world demand from a maximally low policy rate is not as significant as LCP, but the cost of exacerbating the relative distortions is more significant. Hence, confronting this limitation in expansionary monetary policy, the social planner maintains a positive policy rate even in the region of large shocks.

Next, we explore the economics of optimal monetary policy when shock hits the non-dominant economy (LCP country). Firstly, for small shocks, home currency depreciation leads to a lower

world output gap than symmetric pricing regimes under the same policy path. Furthermore, the decline in the relative output gap is also more pronounced because the asymmetric pass-through constrains the natural stabilizing mechanism. In this context, the social planner sets the counterparty policy rate lower than when the shock occurs in the Foreign economy, aiming to mitigate the decline in global demand.

The remaining part to be explained is that for the increase in the shock size, the convergence of the policy rate toward zero lower bound is much faster than the previous analysis. The intuition comes from the fact that more home currency appreciation through lower interest rates does not counteract direct intertemporal substitution. More expansionary policy rates naturally generate a more positive interest rate differential between shocked and counterparty countries, which leads to a stronger home currency. While more severe relative side distortion is a cost, a combination of strong expenditure switching at Home and weak expenditure switching at Foreign act as a stimulus in world demand compared to symmetric pricing regimes. Hence, contrary to the shock in PCP country, the social planner has more incentive to employ a lower world interest rate at the purpose of boosting global demand at the cost of aggravating relative distortions. In sum, the positive feedback effect of currency misalignment in world demand induces rapid convergence of policy rates toward zero lower bound.

Optimal Fiscal Policy The optimal fiscal policy also exhibits asymmetry depending on the origination of shocks. First, relative fiscal gap ($\frac{\tilde{G}_t^{\text{shocked}} - \tilde{G}_t^{\text{counterparty}}}{2}$) is larger for all shock sizes in the case that shock originates in non-dominant country compared to the other case. The rationale for this more concentrated government spending in the shocked economy is to offset the cost of implementing a more expansionary monetary policy to stabilize global demand. As explained in the monetary policy analysis, when non-dominant economy faces shock, the social planner has more incentive to lower policy rates to mitigate a fall in global demand intrinsically (small shocks) and deliberately (large shocks). Since a lower world interest rate amplifies distortion in the relative side, fiscal expansion should also be more concentrated toward the shocked economy (more relative fiscal gap).

The world fiscal gap exhibits a little bit more intricate pattern. In the region of small shocks, more global fiscal expansion is required when the shock originates in a non-dominant country. However, as shock size grows, more fiscal expansion is required when the shock originates in the dominant country. The economic rationale behind the contrasting patterns of the global fiscal gap lies in understanding the fundamental mechanisms of demand shock transmission and the monetary policy responses. In the case of small shocks, world demand falls less (more) than symmetric

pricing regimes when the shock originates in the PCP (LCP) country. Although the world interest rate is lower when the non-dominant country suffers negative shocks, the inherently more severe decline in world demand requires more aggressive fiscal expansions. In the case of large shocks, however, opposite economics applies. The world demand intrinsically falls more (less) than symmetric pricing regimes when shock originates in the PCP (LCP) country. Furthermore, the world interest rate is higher when the PCP country faces a negative demand shock. As a result, greater global fiscal expansion is needed when the shock originates in the PCP country, with the gap in required fiscal expansion between the two cases widening as the magnitude of the shock increases.

7 Conclusion

This paper demonstrates that international pricing regimes (PCP, LCP, DCP) fundamentally shape how monetary and fiscal policies should optimally respond during liquidity trap episodes. Our analysis reveals three key findings. First, the effectiveness of ERPT as a stabilization mechanism depends critically on shock size. While complete pass-through under PCP helps stabilize economies during mild recessions, it amplifies distortions when large shocks trigger perverse exchange rate movements at the ZLB. In contrast, LCP's sluggish price adjustment, while detrimental under small shocks, provides valuable insulation against large shocks.

Second, these transmission patterns directly influence optimal policy design. Under PCP, less affected countries should raise interest rates to engineer favorable exchange rate movements, though this requires aggressive synchronized fiscal expansion to offset suppressed global demand. Under LCP, monetary policy should focus on boosting aggregate demand since exchange rate channels are less effective, while fiscal policy addresses cross-country imbalances. For large shocks, these differences intensify - PCP requires substantial monetary-fiscal coordination to counter perverse exchange rate effects, while LCP's natural insulation reduces intervention needs.

Third, examining the empirically relevant case of DCP, we find that optimal policy responses effectively mirror either PCP or LCP patterns depending on whether the shock hits the dominant or non-dominant currency country. As the global economy becomes increasingly integrated, understanding how international pricing regimes shape policy transmission and effectiveness is crucial for maintaining macroeconomic stability during liquidity trap episodes.

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Appendices

A.1 Robustness Checks

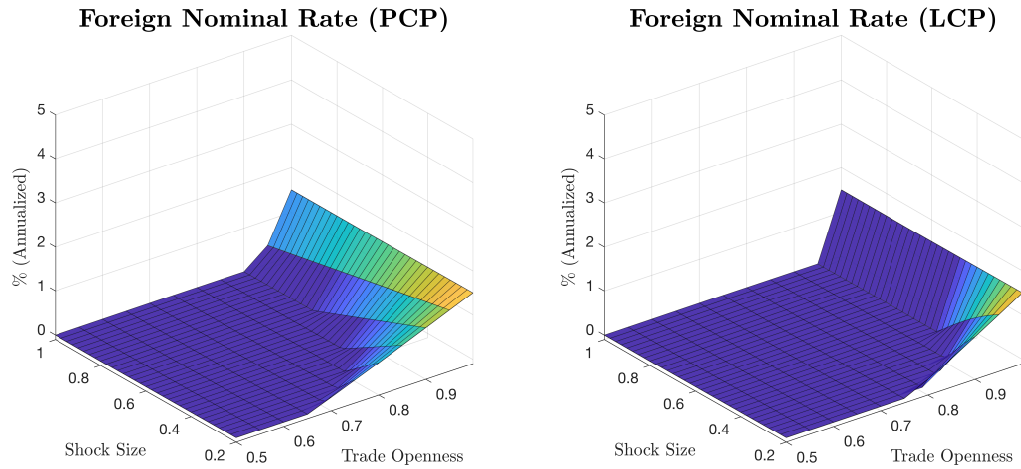


Figure A1: Trade Openness and Optimal Monetary Policy ($\rho = 0.5$)

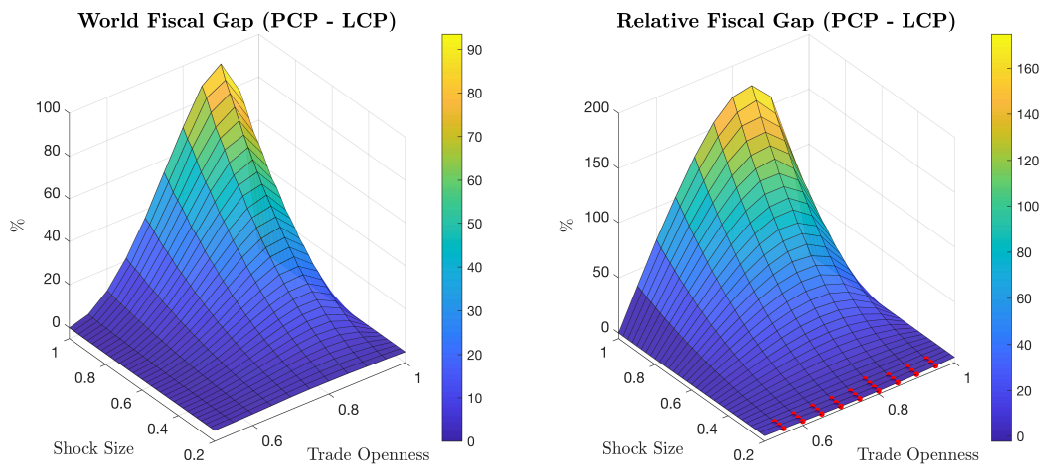


Figure A2: Trade Openness and Optimal Fiscal Policy ($\rho = 0.5$)

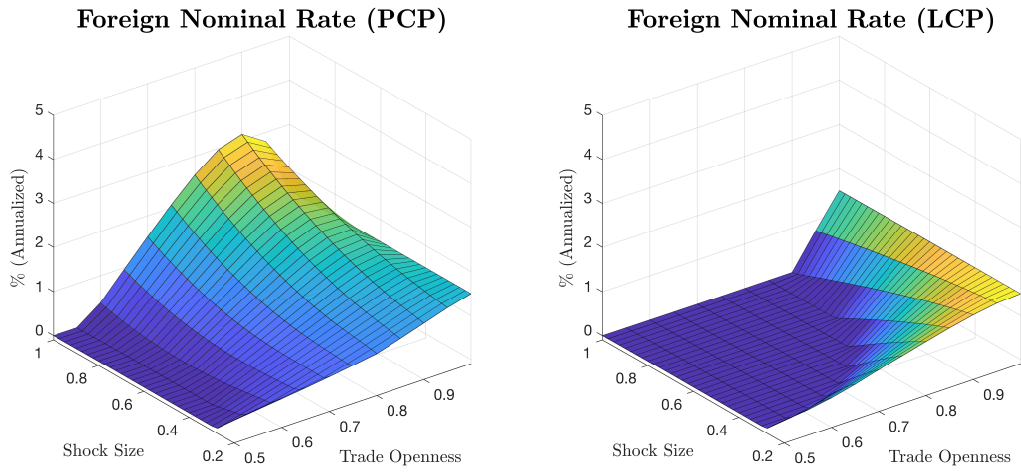


Figure A3: Trade Openness and Optimal Monetary Policy ($\rho = 2$)

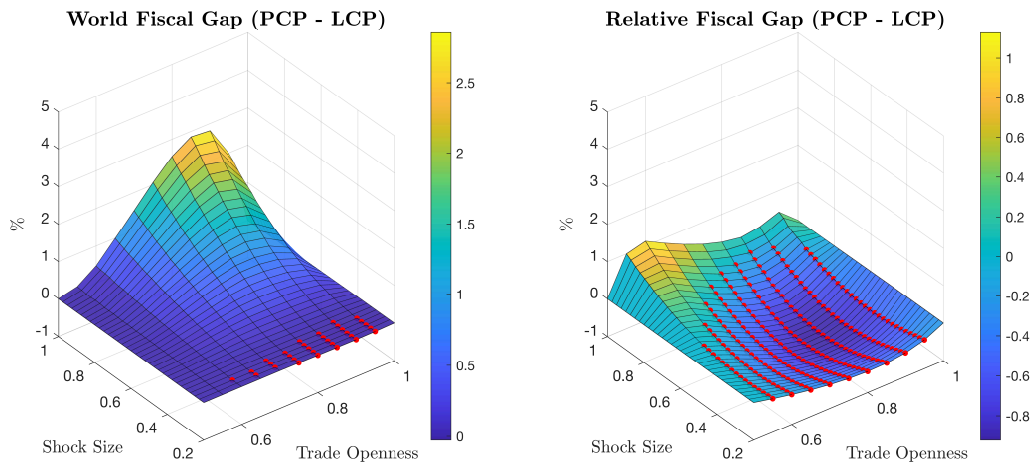


Figure A4: Trade Openness and Optimal Fiscal Policy ($\rho = 2$)

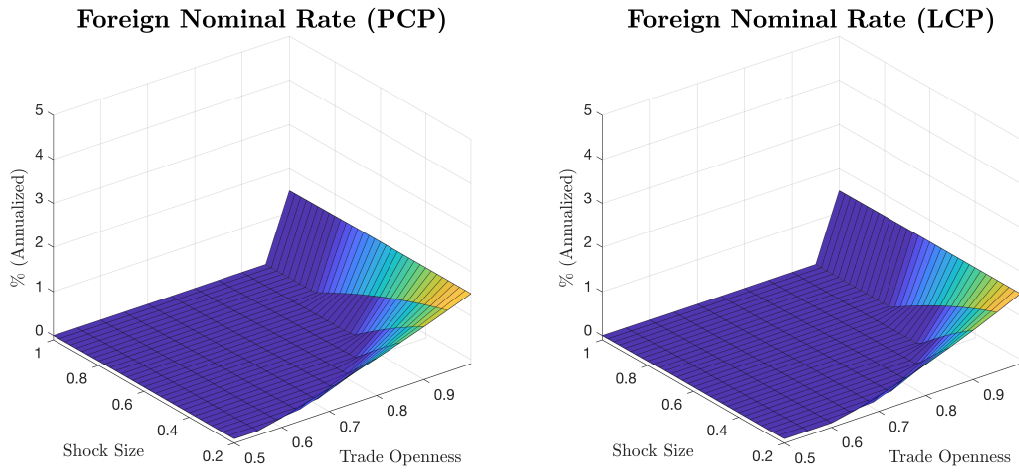


Figure A5: Trade Openness and Optimal Monetary Policy ($\theta = 0.5$)

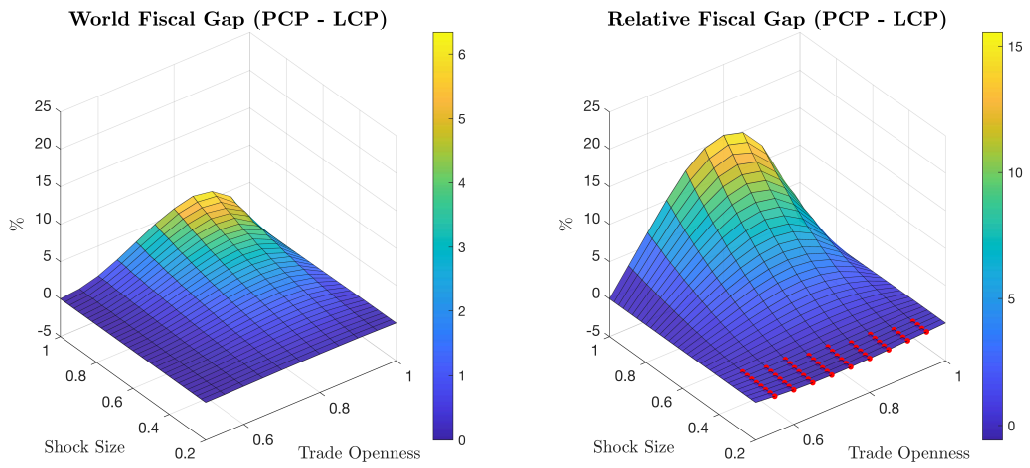


Figure A6: Trade Openness and Optimal Fiscal Policy ($\theta = 0.5$)

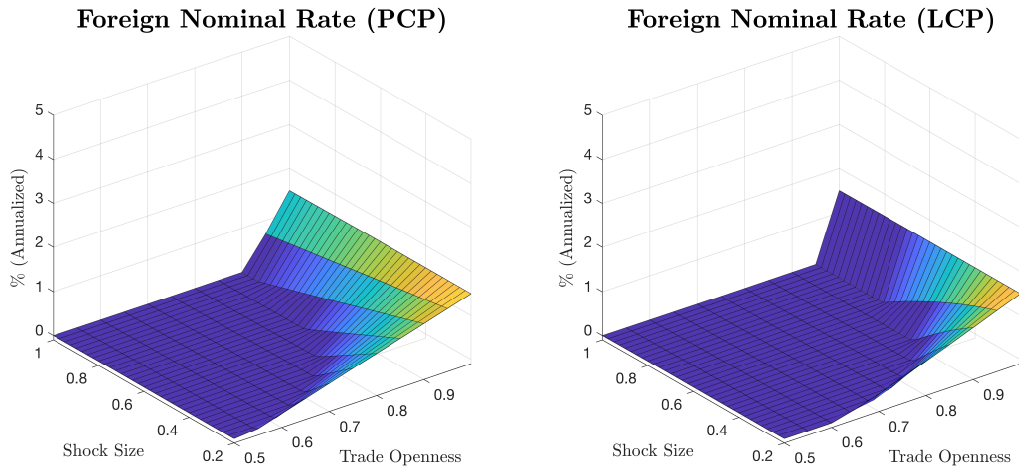


Figure A7: Trade Openness and Optimal Monetary Policy ($\theta = 1$)

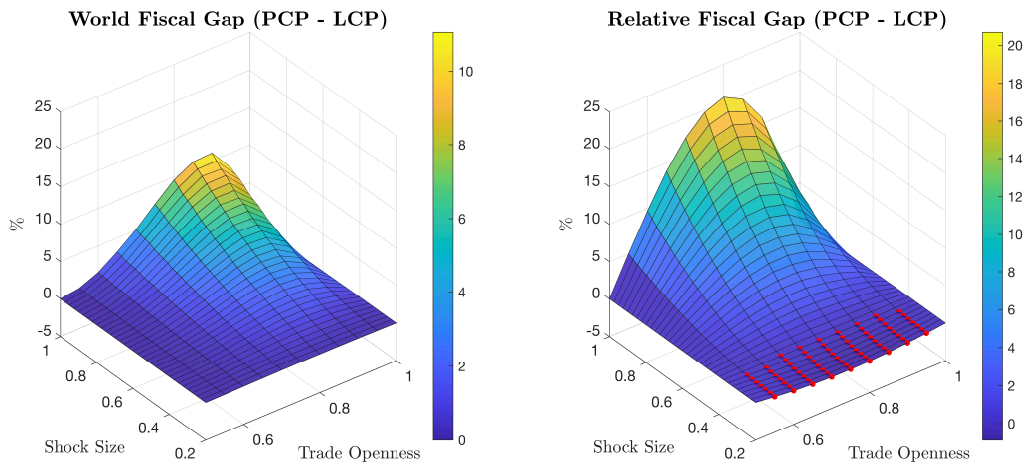


Figure A8: Trade Openness and Optimal Fiscal Policy ($\theta = 1$)

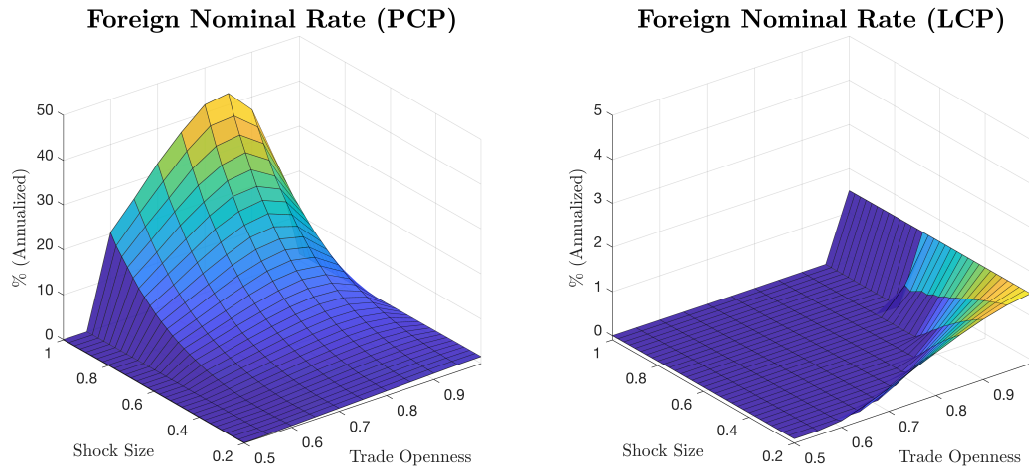


Figure A9: Trade Openness and Optimal Monetary Policy ($\alpha = 0.75$)

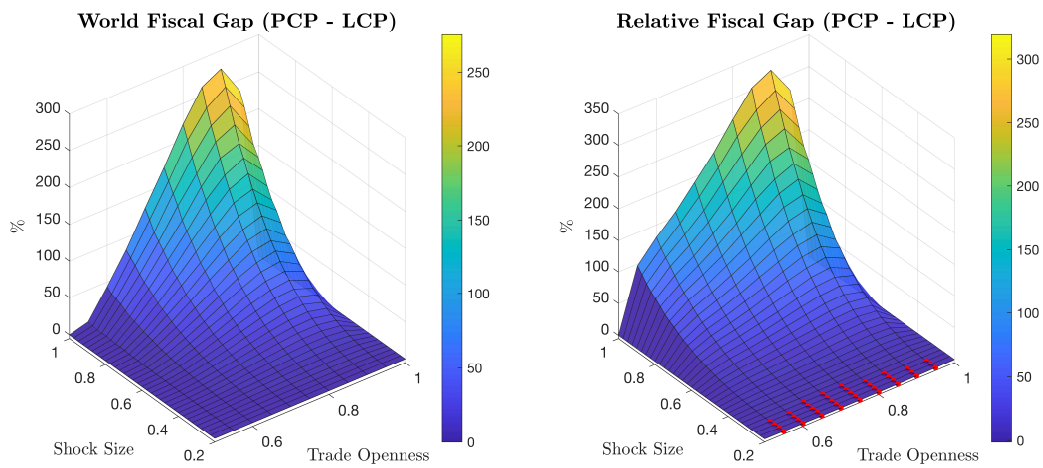


Figure A10: Trade Openness and Optimal Fiscal Policy ($\alpha = 0.75$)