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Revisiting the Asian Currency Crisis in South Korea: A Counterfactual Analysis using a Regime-Switching DSGE Model*

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ABSTRACT

The 1997 Asian financial crisis profoundly disrupted East Asian economies, with South Korea experiencing severe economic distress. This study utilizes a regime-switching dynamic stochastic general-equilibrium (DSGE) model to evaluate the macroeconomic implications of alternative monetary and exchange rate policies. Counterfactual analysis indicates that moderate monetary tightening in early 1998, combined with a strategic currency devaluation in late 1997, could have substantially alleviated the crisis's intensity and duration. These findings provide valuable insights for crisis management in emerging economies, underscoring the potential of tailored policy interventions to enhance macroeconomic stability.

Keywords: Small open emerging economy; Asian currency crisis; Regime switching; DSGE

JEL Classifications: C11; E37; E58; F41

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1 Introduction

What is the optimal monetary and exchange rate policy response to a financial crisis in an emerging market? This question remains central to macroeconomic policy debates, particularly in cases where financial distress is exacerbated by external shocks and sudden reversals in capital flows. The 1997 South Korean crisis provides a striking example: the IMF-backed policy response, which prioritized aggressive interest rate hikes to stabilize the exchange rate and restore investor confidence, deepened the recession and pushed the economy into one of its most severe downturns since the Korean War. This collapse triggered widespread unemployment, with the jobless rate soaring to 7.0% in 1998, straining households and communities (Choi et al. (2020)).[1] By contrast, other economies facing similar shocks, such as Taiwan, followed a more gradual monetary adjustment combined with currency devaluation, avoiding severe contraction.

This paper seeks to answer the following question: What would have happened if South Korea had adopted an alternative monetary and exchange rate policy during the 1997 crisis? Could alternative strategies—such as moderate monetary tightening or controlled devaluation—have mitigated the economic fallout? Employing a structural, counterfactual framework, this study provides a rigorous evaluation of alternative policy strategies, quantifying their macroeconomic impact in a way that historical comparisons alone cannot achieve.

Understanding the macroeconomic consequences of crisis policy choices remains highly relevant for today's emerging markets, which often face speculative attacks, capital flight, and financial instability. The trade-off between defending currency stability and mitigating economic contraction continues to be a major challenge, as seen in recent financial crises in Turkey (2018) and Argentina (2019-2020). Policy decisions made by central banks and governments during such episodes carry enduring implications, yet no consensus exists on the optimal strategy. By evaluating counterfactual scenarios—such as alternative responses to South Korea's 1997 crisis—this study offers actionable insights for crafting robust crisis-management frameworks in the present day.

The 1997 Asian financial crisis exposed the vulnerabilities of emerging market economies to sudden capital outflows, exchange rate depreciation, and banking sector fragility. South Korea was among the hardest-hit nations, experiencing a sharp economic contraction and requiring a $55

[1] The unemployment rate in South Korea steadily decreased from 4.5% in 1981 to 2.0% in 1996 before the crisis. However, it spiked to 7.0% in 1998 and reached a peak of 8.8% in February 1999 during and after the crisis.

billion USD bailout from the International Monetary Fund (IMF).

The crisis stemmed from deep structural vulnerabilities, including high corporate leverage (manufacturing sector leverage ratio of 396.3% in 1997) and a rising debt-to-GDP ratio (183.9% in early 1998). As capital fled the country and the Korean Won depreciated, authorities attempted to stabilize the exchange rate by dramatically increasing interest rates, reaching 25.6% in January 1998.[2] This policy, however, exacerbated the strain on heavily indebted firms, amplifying the economic downturn.

Figure 1: Korea: Real GDP growth rate (source: BOK).
Taiwan: Real GDP growth rate in 2017 U.S. dollars (source: FRED, RGDPNATWA666NRUG). This series extends only to 2019.

South Korea's real GDP growth plummeted to -4.9% in 1998, marking its lowest point since the Korean War. In contrast, Taiwan, which pursued a more flexible approach—including a controlled devaluation—managed to sustain growth at 4.2%, as illustrated in Figure 1.[3] This contrast has

[2] The policy rate had gradually declined from 19.6% in September 1991 to 9.5% in April 1996, then fluctuated between 11% and 13% until November 1997, as shown in Figure 2.

[3] Taiwan's approach combined controlled devaluation with gradual monetary adjustments, stabilizing the economy

fueled ongoing debates over whether South Korea's aggressive interest rate hikes were justified or if alternative policies could have yielded less costly outcomes.

The 1997 Asian financial crisis sparked extensive research on its macroeconomic triggers and optimal policy responses, with a central debate over defending currency pegs versus adopting flexible policies. Empirical studies like Kaminsky and Reinhart (1999) highlight how banking and currency crises intertwined, amplifying distress through financial vulnerabilities. However, such studies often rely on historical correlations, limiting their ability to test alternative policy scenarios.

Structural models offer conflicting prescriptions. Corsetti et al. (1999) and Burnside et al. (2001) advocate abandoning pegs early due to fiscal pressures, while, in contrast, Braggion et al. (2009) suggest immediate interest rate hikes as a second-best response under sudden stops. These models, however, use static assumptions, restricting their capacity to evaluate dynamic policy adjustments during crises like 1997.

Recent regime-switching DSGE models address structural shifts but fall short in crisis applications. Liu et al. (2011) and Curdia and Finocchiaro (2013) analyze macroeconomic dynamics and policy transitions, yet rarely focus on financial crises. Benigno et al. (2025) advance endogenous regime-switching for Mexico's crises but under-explore the Asian context.

These gaps—lack of dynamic counterfactuals, fixed policy assumptions, and limited quantitative cross-country comparisons—underscore the need for a model that captures abrupt policy shifts. Our regime-switching DSGE framework fills this void by simulating South Korea's 1997 crisis under alternative monetary and exchange rate policies, providing quantitative insights into their macroeconomic impacts.

To address these gaps, this paper develops a regime-switching DSGE model that explicitly accounts for monetary and exchange rate policy shifts during crises[4]. The model is estimated using

without triggering a severe recession.

[4]An alternative to regime switching involves adopting more complex shock distributions—such as those exhibiting skewness or excess kurtosis—or nonlinear policy rules that respond to economic conditions. Although these approaches may capture certain crisis-related phenomena, they present notable limitations. First, incorporating skewness or kurtosis requires moving beyond standard first-order approximation methods, necessitating fully nonlinear solution and filtering techniques. Such methods are computationally demanding and scale poorly in larger models. Second, even when feasible, isolating the effects of higher-order moments like skewness or kurtosis in a policy-relevant or empirically interpretable manner remains challenging. By contrast, a Markov-switching framework offers a tractable approach to modeling abrupt and persistent shifts in dynamics—hallmarks of real-world crises—within a first-order perturbation-based DSGE framework. Furthermore, our empirical analysis, detailed subsequently, suggests that models omitting regime switching are less effective at capturing observed crisis patterns in the data. This underscores that regime switching is not only methodologically advantageous but also critical to addressing our research question.

Bayesian techniques to ensure empirical validity and is used to conduct counterfactual simulations that quantify the macroeconomic impact of alternative policy responses.

A key innovation of this framework is its ability to model nonlinear crisis dynamics, where monetary and exchange rate policies adjust endogenously rather than remaining fixed. Unlike conventional DSGE models, which presuppose stable policy regimes, this approach captures the abrupt transitions observed in real-world crises.

Using this model, we systematically evaluate the macroeconomic effects of alternative crisis strategies, considering:

- Moderate monetary tightening in lieu of aggressive interest rate hikes.
- Controlled currency devaluation to alleviate speculative pressures.
- A hybrid strategy combining moderate tightening with devaluation.

This integrated framework—structural, empirical, and counterfactual—delivers a rigorous, policy-relevant analysis of crisis-management options, yielding insights for emerging markets facing financial instability today.

All computations are carried out efficiently using the Rationality In Switching Environments (RISE) Toolbox, available at https://github.com/jmaih/RISE_toolbox.

Our counterfactual simulations suggest that South Korea's crisis could have been less severe under alternative policy choices. A moderate monetary tightening would have reduced the contraction in output, while a controlled devaluation would have eased speculative pressures without triggering runaway inflation. The combination of both approaches outperforms the IMF-backed policy in terms of output stabilization.

The remainder of this paper is structured as follows. Section 2 presents the regime-switching small open economy DSGE model, detailing the behavior of households, firms, the financial sector, and the government. It also introduces the monetary and exchange rate policy rules and explains how policy regime shifts are incorporated into the framework. Section 3 describes the solution approach, outlining how the model is solved under regime-switching dynamics and discussing the computational challenges involved. Section 4 discusses the Bayesian estimation process for the regime-switching DSGE model and the filtering techniques used for likelihood computation.

Section 5 details the data and Bayesian estimation results, providing insights into the estimated parameters and the probability of different policy regimes over time. Section 6 conducts counterfactual policy simulations, evaluating alternative monetary and exchange rate policies, with a summary table comparing their impacts on South Korea's crisis trajectory. Section 7 performs robustness checks, assessing the sensitivity of the results to alternative model specifications and estimation techniques. Finally, Section 8 concludes by summarizing the key findings, drawing policy implications, and discussing directions for future research.

2 The Regime-Switching Small Open Economy DSGE Model

To study South Korea's 1997 financial crisis, we build a model that simulates how the economy responds to monetary and exchange rate policies under stress. The model captures key real-world features: firms and households borrow under financial constraints, policies shift abruptly (e.g., from defending the currency to letting it float), and economic shocks become more volatile during crises. By mimicking these dynamics, we can test "what-if" scenarios, like milder interest rate hikes or strategic currency devaluation, to see how they might have reduced the crisis' severity. The following subsections detail the model's components, from household behavior to central bank decisions, using a formal framework tailored to emerging markets.

This section presents a regime-switching small open economy DSGE model, designed as an analytical framework to evaluate alternative policy responses during financial crises. The model extends a standard small open economy New Keynesian DSGE framework (e.g., Galí and Monacelli (2005)), adapting it to an emerging market context, such as South Korea during the Asian financial crisis. It incorporates financial frictions, regime-switching monetary and exchange rate policies, and shock heteroskedasticity, offering a robust structure for analyzing crisis dynamics.

The economy comprises households, firms, and banks, drawing on the financial frictions framework of Gertler and Karadi (2011) and Gertler and Kiyotaki (2011). Firms are categorized into intermediate goods producers, retailers, and capital goods producers. Retailers aggregate intermediate goods into final consumption bundles, while capital goods producers create new capital stock. Households supply labor and deposit savings in banks, which obtain funding from both domestic households and foreign sources, subsequently providing loans to intermediate goods producers.

Stationarity is ensured through a risk premium mechanism (e.g., Schmitt-Grohé and Uribe (2003)), which governs capital flows and external borrowing costs.

The model features two independent Markov-switching processes:

1. Exchange Rate Regime Switching — The framework permits transitions between a managed float and a fully floating exchange rate regime, reflecting the discrete policy shifts observed in real-world crisis responses. This builds on Markov-switching DSGE approaches in the literature (e.g., Bianchi (2013), Curdia and Finocchiaro (2013), Benigno et al. (2025)) to study policy regime changes.

2. Shock Heteroskedasticity Regime Switching — The variance of macroeconomic shocks changes across regimes, allowing the model to capture the heightened volatility observed during financial crises.

By explicitly modeling regime shifts in both exchange rate policy and shock volatility, this framework provides a realistic platform for evaluating alternative crisis responses. The regime-switching structure allows for counterfactual simulations that assess how different policy strategies—such as moderate monetary tightening, controlled currency devaluation, or a combined policy approach—would have altered the crisis trajectory.

Integrating financial frictions, regime-switching in exchange rate policy, and shock heteroskedasticity, this model offers a powerful tool for assessing the macroeconomic consequences of alternative policy strategies during financial crises. A detailed formal exposition follows in Section 2, with additional technical derivations provided in Appendix B.

2.1 Households

Each household solves the following optimization problem:

$$\max \mathbb{E}_t \sum_{i=0}^{\infty} \beta^i U(C_{t+i}, N_{t+i}) \tag{1}$$

subject to

$$P_{C,t}C_t + D_t = W_t N_t + R_{t-1} D_{t-1} + P_{C,t}\Pi_t \tag{2}$$

where C_t, N_t, W_t, D_t, Π_t, $P_{C,t}$, and R_t represent consumption, hours worked, nominal wage, deposits, transfers from intermediate goods producers, the consumer price index, and the nominal deposit rate at time t, respectively. The parameter β denotes the subjective discount factor.

The period utility function is given by:

$$U(C_t, N_t) = \frac{\varepsilon_{C,t}(C_t - hC_{t-1})^{1-\sigma_C} - 1}{1-\sigma_C} - \kappa_N \frac{{N_t}^{1+\sigma_N}}{1+\sigma_N} \tag{3}$$

where the parameter h denotes the degree of habit formation, σ_C and σ_N denote the degree of risk aversion (or the inverse of the intertemporal elasticity of substitution) and the inverse of Frisch elasticity, respectively, and κ_N captures the degree of disutility from labor. The variable ε_t represents a preference shock in period t.

The consumption bundle is given by:

$$C_t = \left[a_C^{\frac{1}{\eta}} C_{H,t}^{\frac{\eta-1}{\eta}} + (1-a_C)^{\frac{1}{\eta}} C_{F,t}^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}, \quad \eta > 0 \tag{4}$$

where $C_{H,t}$ and $C_{F,t}$ the consumption of domestic and foreign goods, respectively. The parameter $1 - a_C$ captures the degree of openness, while η denotes the elasticity of substitution between domestic and foreign goods.

The corresponding consumer price index ($P_{C,t}$, CPI) is given by:

$$P_{C,t} = \left[a_C P_{H,t}^{1-\eta} + (1-a_C) P_{F,t}^{1-\eta} \right]^{\frac{1}{1-\eta}}, \ \eta > 0 \tag{5}$$

where $P_{H,t}$ and $P_{F,t}$ denote the prices of domestic and foreign goods, respectively.

The consumption demand for domestic and foreign goods is given by:

$$C_{H,t} = a_C \left[\frac{P_{H,t}}{P_{C,t}} \right]^{-\eta} C_t, \tag{6}$$

$$C_{F,t} = (1-a_C) \left[\frac{P_{F,t}}{P_{C,t}} \right]^{-\eta} C_t. \tag{7}$$

We assume that the foreign demand for home goods is given by:

$$C_{H,t}^* = a_C^* \left(\frac{P_{H,t}^*}{P_t^*} \right)^{-\eta^*} Y_t^* \tag{8}$$

where Y_t^*, P_t^*, and $P_{H,t}^*$ represent foreign output, the foreign price level, and the price of exportable home goods in foreign currency, respectively.

We assume that the law of one price holds.

$$P_{F,t} = S_t P_t^* \tag{9}$$

$$S_t P_{H,t}^* = P_{H,t} \tag{10}$$

where S_t denotes the nominal exchange rate (defined as Won/$).

The balance of payments is given by:

$$S_t B_{t+1}^F + P_{F,t} C_{F,t} = S_t P_{H,t}^* C_{H,t}^* + S_t R_{t-1}^F \Psi_{t-1} B_t^F \tag{11}$$

where B_t^F and R_t^F represent foreign borrowing and the foreign risk-free interest rate, respectively. The variable Ψ_t denotes the risk premium at time t. Following Schmitt-Grohé and Uribe (2003), the risk premium is specified as:

$$\Psi_t = \left(exp(\psi_R \frac{B_t^F - \bar{B}^F}{P_{H,t} Y_{H,t}}) \right) \psi_t \tag{12}$$

where ψ_t represents an exogenous risk premium shock.

The CPI inflation rate ($\pi_{C,t}$) and the domestic price inflation rate ($\pi_{H,t}$) are defined as follows:

$$\pi_{C,t} = \frac{P_{C,t}}{P_{C,t-1}}, \quad \pi_{H,t} = \frac{P_{H,t}}{P_{H,t-1}}. \tag{13}$$

2.2 BANKS Banks borrow D_t from domestic households at the risk-free gross rate R_t and obtain additional funds from abroad by issuing B_t^F at the gross rate R_t^F. They then lend B_t to domestic intermediate goods producers at the gross rate R_t^B. The bank's balance sheet is given by:

$$b_t = d_t + b_t^F + nw_t \tag{14}$$

where each lowercase letter represents the real counterpart of its corresponding uppercase variable. For example,

$$b_t^F \equiv \frac{S_t B_{t+1}^F}{P_{C,t}}, \quad d_t \equiv \frac{D_t}{P_{C,t}}$$

denote the real values of foreign borrowing and domestic deposits, respectively. The variable nw_t represents the real net worth at time t. The evolution of net worth is given by:

$$nw_t = \frac{R_t^B b_{t-1}}{\pi_{C,t}} - \frac{R_{t-1} d_{t-1}}{\pi_{C,t}} - \frac{R_{t-1}^F b_{t-1}^F}{\pi_{C,t}}. \tag{15}$$

The various gross real interest rates are given by:

$$r_t^B \equiv \frac{R_t^B}{\pi_{C,t}}, \quad r_t^F \equiv \Psi_{t-1}(R_{t-1}^F)\frac{S_t}{S_{t-1}}\frac{P_{C,t-1}}{P_{C,t}}, \quad r_t \equiv \frac{R_{t-1}}{\pi_{C,t}} \tag{16}$$

Bank j maximizes its expected terminal wealth, which is given by:

$$V_{jt}(nw_t(j)) \;\; = \;\; max \;\; \mathbb{E}_t \left[\sum_{i=0}^{\infty} (1-\xi)\xi^i \beta^{i+1} \Lambda_{t,t+1+i} \, nw_{t+1+i}(j) \right] \tag{17}$$

subject to

$$nw_{t+1}(j) = \left(r_{t+1}^B - \frac{R_t}{\pi_{C,t+1}} \right) b_t + \left(\frac{R_t}{\pi_{C,t+1}} - r_{t+1}^F \right) b_t^F + \frac{R_t}{\pi_{C,t+1}} nw_t \tag{18}$$

where $(1-\xi)$ represents the probability that a bank exits in each period, while ξ denotes the probability of continuation. The assumption of a finite bank lifespan prevents banks from accumulating an infinite amount of net worth over time, ensuring a well-behaved equilibrium in the model.

Drawing on the frameworks of Gertler and Kiyotaki (2011) and Mimir and Sunel (2019), we incorporate an incentive constraint parameter, denoted τ, to model financial frictions stemming from asymmetric information between domestic depositors and banks. Furthermore, we posit that domestic depositors possess a comparative advantage over foreign lenders in asset recovery following a bank bankruptcy.

This asymmetry in frictions between domestic and foreign lenders generates a differential, or spread, between domestic and foreign borrowing rates. The magnitude of this friction is captured by the parameter $0 \leq \omega_l \leq 1$, which quantifies the relative disadvantage faced by foreign lenders in recovering assets compared to domestic depositors.

$$V_{jt} \geq \tau(b_t - \omega_l d_t). \tag{19}$$

It should be noted that when $\omega_l = 0$, the spread between domestic and foreign risk-free borrowing rates vanishes, resulting in the satisfaction of the uncovered interest rate parity (UIP) condition. This outcome arises because $\omega_l = 0$ indicates that the bank's capacity to divert funds is equivalent irrespective of whether the funds are sourced from domestic depositors or foreign lenders.

Under these circumstances, the borrowing constraint confronting the bank exhibits symmetry across the domestic and foreign credit markets. Consequently, domestic and foreign funds become perfectly substitutable as financing sources, eliminating the risk premium associated with foreign borrowing and ensuring adherence to the UIP condition.

Consistent with the established literature, we address the bank's optimization problem by employing the guess-and-verify method. We assume that the value function is linear in the marginal returns to loans (ν_{bt}), foreign borrowings ($\nu_{b_t^F}$), and net worth (ν_{nt}). Specifically, we hypothesize that the bank's value function adopts the following form:

$$V_t(nw_t) = \nu_{bt} b_t + \nu_{b_t^F} b_t^F + \nu_{nt} nw_t$$

Substituting this into the bank's objective, the problem can be rewritten as:

$$max_{b_t, b_t^F} \quad \nu_{bt} b_t + \nu_{b_t^F} b_t^F + \nu_{nt} nw_t + \mu_t \left\{ \nu_{bt} b_t + \nu_{b_t^F} b_t^F + \nu_{nt} nw_t - \tau \left[b_t - \omega_l \left(b_t - nw_t - b_t^F \right) \right] \right\} \tag{20}$$

The leverage ratio (κ_t) is defined as:

$$b_t - \omega_l d_t \equiv \kappa_t nw_t. \tag{21}$$

Each period, total net worths is divided between new entrants (nw_{yt}) and continuing (old) bankers (nw_{ot}). This can be expressed as:

$$nw_{ot} = \xi \left[\left(r_t^B - \frac{R_{t-1}}{\pi_{C,t}} \right) b_{t-1} + \left(\frac{R_{t-1}}{\pi_{C,t}} - r_t^F \right) b_{t-1}^F + \frac{R_{t-1}}{\pi_{C,t}} nw_{t-1} \right] \tag{22}$$

$$nw_{yt} = \iota b^B_{t-1}. \tag{23}$$

The share of net worth allocated to new entrants is typically assumed to be a fraction of total assets, ensuring a stationary distribution of net worth in the economy.

2.3 Capital goods producers

Capital goods producers operate within a perfectly competitive market. They acquire final goods and the residual non-depreciated capital from intermediate goods producers to generate new capital goods, a process characterized by convex adjustment costs. The newly produced capital is subsequently sold to intermediate goods producers at the real market price, denoted q_t.

The capital goods producers solve the following optimization problem:

$$\max\ E_t \sum_{i=0}^{\infty} \Lambda_{t,t+i} \left[q_{t+i} k_{t+i} - (1-\delta) q_{t+i} k_{t-1+i} - i_{t+i} \right] \tag{24}$$

subject to the capital accumulation equation:

$$k_t = (1-\delta) k_{t-1} + \left[1 - \frac{\kappa_I}{2} \left(\frac{i_t}{i_{t-1}} - 1 \right)^2 \right] i_t. \tag{25}$$

2.4 Intermediate goods producers

The intermediate goods producers operate in a monopolisticly competitive market. Their production function follows a Cobb-Douglas form:

$$y_{H,t+k}(i) = A_{t+k} K^{\alpha}_{t-1+k} N^{1-\alpha}_{t+k} \tag{26}$$

where A_t represents a technology shock at time t.

The demand for the intermediate goods producer's output comes from final goods producers, who aggregate differentiated intermediate goods into a final consumption good. The demand function is given by:

$$y_{H,t+k}(i) = \left(\frac{P_{H,t+k}(i)}{P_{H,t+k}} \right)^{-\epsilon} y_{H,t+k}. \tag{27}$$

Each intermediate goods producer faces Rotemberg-type price adjustment costs, as introduced by Rotemberg (1982). The cost of adjusting prices is given by:

$$\frac{\kappa_P}{2}\left(\frac{P_{H,t}(i)}{P_{H,t-1}(i)}-\bar{\pi}\right)^2 P_{H,t}y_{H,t}$$

where the parameter κ_P denotes the degree of price adjustment costs.

Each intermediate goods producer solves the following profit-maximization problem:

$$\mathcal{L}^I = \mathbb{E}_0\sum_{t=0}^{\infty}\beta^t\frac{\lambda_t}{\lambda_0}\Bigg\{\frac{P_{H,t}(i)}{P_{C,t}}\left(\frac{P_{H,t}(i)}{P_{H,t}}\right)^{-\epsilon}y_{H,t}-w_t h_t(i)-r_t^K k_{t-1}(i)$$
$$-\frac{\kappa_P}{2}\left(\frac{P_{H,t}(i)}{P_{H,t-1}(i)}-\bar{\pi}\right)^2\frac{P_{H,t}y_{H,t}}{P_{C,t}}-mc_t(i)\left[y_{H,t}\left(\frac{P_{H,t}(i)}{P_{H,t}}\right)^{-\epsilon}-a_t(k_{t-1}(i))^{\alpha}h_t(i)^{1-\alpha}\right]\Bigg\} \tag{28}$$

where w_t denotes the real wage at time t, and $r_t^K \equiv r_t^B q_{t-1}-(1-\delta)q_t$ represents the real rental price of capital.

2.5 Final goods producers

The final goods producers operate in a perfectly competitive market and combine differentiated intermediate goods to produce the final consumption good bundle using a CES aggregator:

$$y_{H,t}=\left[\int_0^1 y_{H,t}(i)^{\frac{\epsilon-1}{\epsilon}}di\right]^{\frac{\epsilon}{\epsilon-1}},\quad \epsilon>1. \tag{29}$$

The cost minimization problem of final goods producers leads to (27).

2.6 Markov-Switching Heteroskedasticity in Shocks

The model incorporates Markov-switching heteroskedasticity, meaning that the volatility of structural shocks varies over time depending on the prevailing state. Specifically, the variance of shocks is governed by a discrete Markov process, denoted s_t^V, which evolves as a first-order Markov chain:

$$P\left(s_{t+1}^V=j|s_t^V=k\right)=\pi_{jk}^V,\qquad s_t^V\in\{1,2\}$$

This setup allows for two distinct volatility states:

- Low-volatility state ($s_t^V = 1$): Macroeconomic fluctuations remain relatively stable.
- High-volatility state ($s_t^V = 2$): Periods of heightened financial instability, where shocks exert amplified effects.

Each structural shock follows a standard normal distribution, but with a state-dependent scaling σ_{x,s_t^V} that determines the magnitude of shocks in each state. Formally, we assume:

$$e_{x,t} \sim \mathcal{N}(0,1)$$

$$\sigma_{x,s_t^V} > 0, \qquad \text{where} \quad x \in \{R^F, Y^\star, \pi^\star, e_m, \varepsilon_C, A, \psi\}$$

2.7 Foreign sector we assume that the foreign sector is exogenously given and follows a log AR(1) process:

$$\log(R_t^F) - \log(\bar{R}^F) = \rho_{R^F}(\log(R_{t-1}^F) - \log(\bar{R}^F)) + \sigma_{R^F,s_t^V} \cdot e_{R^F,t} \tag{30}$$

$$\log(Y_t^*) - \log(\bar{Y}^*) = \rho_{Y^*}(\log(Y_{t-1}^*) - \log(\bar{Y}^*)) + \sigma_{Y^*,s_t^V} \cdot e_{Y^*,t} \tag{31}$$

$$\log(\pi_t^*) - \log(\bar{\pi}^*) = \rho_{\pi^*}(log\pi_{t-1}^*) - \log(\bar{\pi}^*)) + \sigma_{\pi^*,s_t^V} \cdot e_{\pi^*,t} \tag{32}$$

2.8 Market clearing conditions and Shocks The goods and bond market clearing conditions are given by:

$$Y_{H,t} = C_{H,t} + I_t + C_{H,t}^* + \frac{\kappa_P}{2}(\pi_{H,t} - \bar{\pi})^2 Y_{H,t} \tag{33}$$

and

$$q_t k_t = b_t \tag{34}$$

In addition to the monetary policy shock and the three foreign shocks— $e_{m,t}$, $e_{R^F,t}$, $e_{\pi^*,t}$, and

$e_{Y^*,t}$ — we consider a preference shock, a technology shock, and a risk premium shock. Each of these follows a log AR(1) process:

$$\log(\varepsilon_{C,t}) = \rho_\varepsilon \log(\varepsilon_{C,t-1}) + \sigma_{\varepsilon_C, s_t^V} \cdot e_{\varepsilon_C t} \tag{35}$$

$$\log(A_t) - \log(\bar{A}) = \rho_A(\log(A_{t-1}) - \log(\bar{A})) + \sigma_{A,s_t^V} e_{A,t} \tag{36}$$

$$\log(\psi_t) - \log(\bar{\psi}) = \rho_\psi(\log(\psi_{t-1}) - \log(\bar{\psi})) + \sigma_{\psi,s_t^V} \cdot e_{\psi,t} \tag{37}$$

2.9 Monetary and Exchange Rate Policy

Monetary and exchange rate policies played a critical role during the 1997 Asian Financial Crisis, particularly in South Korea, where policymakers implemented interest rate hikes in response to sharp exchange rate depreciation. To capture these dynamics, we incorporate a regime-switching Taylor rule that governs the central bank's interest rate policy.

Our specification follows the standard Taylor rule framework for open economies, where the policy rate responds to inflation, output deviations, and exchange rate fluctuations. Formally, the monetary policy follows:

$$\begin{aligned}\log(R_t) - \log(\bar{R}) = \rho_R \left(\log(R_{t-1}) - \log(\bar{R})\right) + (1-\rho_R)\Bigg[&\rho_\pi \left(\log(\pi_{H,t}) - \log(\bar{\pi}_H)\right) \\ &+ \rho_Y \left(\log(Y_{H,t}) - \log(\bar{Y}_H)\right) + \rho_S \left(\log\left(\frac{S_t}{S_{t-1}}\right) - 1\right)\Bigg] + \sigma_{e_m} \cdot e_{m,t}\end{aligned} \tag{38}$$

where R_t, $\pi_{H,t}$, $Y_{H,t}$, and S_t denotes the policy rate, domestic inflation rate, output, and the nominal exchange rate (Won/\$), respectively. The parameter ρ_R measures the persistence of the policy rate, and ρ_π, ρ_Y, and ρ_S represents the response of the policy rate to the domestic inflation rate, output, and the log depreciation rate of the Korean Won, respectively.

Following the literature, we assume that under a managed floating regime, the central bank stabilizes the exchange rate by adjusting interest rates in response to exchange rate fluctuations ($\rho_S > 0$; e.g., Gertler et al. (2007), Batini et al. (2010), Curdia and Finocchiaro (2013), Balma (2014)). However, after South Korea transitioned to a flexible exchange rate system in December

1997 (Bank of Korea (2016)), we assume that the central bank ceased targeting exchange rate fluctuations, implying that $\rho_S = 0$ under a floating exchange rate state.

2.9.1 Exchange Rate Regime Switching

To capture the shift from a managed float to a floating exchange rate system, we introduce exchange rate regime switching. This approach aligns with Markov-switching DSGE models that account for discrete changes in monetary policy rules (e.g., Bianchi (2013), Curdia and Finocchiaro (2013)).

We define the exchange rate state as s_t^P, which evolves according to a first-order Markov process:

$$P\left(s_{t+1}^P = j | s_t^P = k\right) = \pi_{jk}^P, \qquad s_t^P \in \{\text{Managed Float, Floating Exchange Rate}\}$$

This process determines the policy response to exchange rate fluctuations:

$$\rho_{S,t} = \begin{cases} \rho_S > 0, & \text{if } s_t^P = \text{Managed Float} \\ 0, & \text{if } s_t^P = \text{Floating Exchange Rate} \end{cases}$$

Thus, the central bank's reaction function changes endogenously depending on the prevailing exchange rate state.

This formulation is supported by historical evidence (Bank of Korea (2016)), which documents the Korean government's adoption of a flexible exchange rate regime in mid-December 1997. Our model allows us to quantify the effects of this regime change on monetary policy dynamics.

3 The Generic Framework and the Solution Approach

To simulate South Korea's economy during the 1997 crisis, our model must account for sudden policy changes, like shifts from defending the currency to letting it float. Solving this complex system requires a method that predicts how economic variables evolve under such transitions. We use a technique called perturbation, which approximates the model's behavior by starting from a known baseline and adjusting for shocks and policy shifts. This section explains this approach, detailing how we compute the model's predictions to test alternative crisis policies.

To that end, we outline the general formulation of the regime-switching DSGE model and the solution method employed to approximate the equilibrium dynamics. We consider an economy where economic dynamics depend on an evolving policy and economic environment, governed by a Markov-switching structure. This setup poses significant challenges for model solution, as agents' expectations must incorporate uncertainty about future regimes.

3.1 The General Model Formulation

Following the conventions of RISE, we define a "regime" as a composite of states from independent Markov processes—for instance, a combination of high volatility and a managed float exchange rate system. In contrast, a "state" refers to the condition of a single Markov process, capturing transitions within one economic dimension, such as monetary policy stance or volatility dynamics.

This distinction explains why, in this section, we use $r_t \equiv \{s_t^V, s_t^P\}$ rather than just s_t, as the regime r_t encapsulates the joint behavior of the volatility (s_t^V) and policy (s_t^P) processes.

The central challenge is to solve a system of expectational equations that define the equilibrium of the regime-switching DSGE model. Formally, the model is specified as follows:

$$E_t \sum_{r_{t+1}=1}^{h} p_{r_t,r_{t+1}}\left(\mathcal{I}_t\right) f_{r_t}\left(x_{t+1}\left(r_{t+1}\right), x_t\left(r_t\right), x_{t-1}, \theta_{r_t}, \theta_{r_{t+1}}, \varepsilon_t\right) = 0$$

where:

- $p_{r_t,r_{t+1}}\left(I_t\right)$: the transition probability from regime r_t at time t to regime r_{t+1} at time $t+1$, conditional on the information set $\mathcal{I}_t$.
- f_{r_t} : a potentially nonlinear function that describes the model's equilibrium conditions under regime r_t.
- $x_t\left(r_t\right)$: the vector of endogenous variables, which depends on the current regime r_t.
- θ_{r_t} : the set of structural parameters that vary across regimes.
- $\varepsilon_t \sim N\left(0, I\right)$: the vector of stochastic shocks.

This formulation reveals a fundamental characteristic of decision-making in regime-switching DSGE models: when agents make choices in the current regime r_t, their behavior is not solely determined by the conditions of the present regime. Instead, their actions are shaped by the entire distribution of possible future regimes r_{t+1} and the likelihood of transitioning into each one, as governed by the transition probabilities $p_{r_t,r_{t+1}}(I_t)$.

This formulation also highlights two key forward-looking mechanisms that are absent in standard DSGE models with fixed policy regimes: Regime-Contingent Expectations[5] as well as Precautionary and Preemptive Adjustments[6].

3.2 Solution via perturbation

We assume that the model admits a minimum state variable (MSV) solution of the form:

$$x_t = \mathcal{T}_{r_t}(x_{t-1}, \varepsilon_t)$$

where:

- $\mathcal{T}_{r_t}(.)$ is a regime-dependent function that maps state variables and shocks into the endogenous variables.
- The solution explicitly depends on the current regime r_t, meaning that policy rules and economic relationships differ across regimes.

This MSV solution ensures that the model remains tractable, even in the presence of Markov-switching structures.

Since an exact analytical solution is generally intractable for regime-switching DSGE models, we use perturbation methods to approximate the function $\mathcal{T}_{r_t}(.)$. In particular, we apply a p-th order perturbation expansion around potentially shifting steady states:

$$\mathcal{T}^{r_t}(z_t) \simeq \mathcal{T}^{r_t}(\bar{z}_{r_t}) + \mathcal{T}_z^{r_t}(z_t - \bar{z}_{r_t}) + \frac{1}{2!}\mathcal{T}_{zz}^{r_t}(z_t - \bar{z}_{r_t})^{\otimes 2} + ... + \frac{1}{p!}\mathcal{T}_{z^{(p)}}^{r_t}(z_t - \bar{z}_{r_t})^{\otimes p}$$

where:

[5] This means that even in a stable period (e.g., normal economic conditions with accommodative policy), expectations about a possible future crisis regime (e.g., high interest rates, financial tightening) will affect current-period decisions.

[6] For example, in a regime with low interest rates and expansionary policy, agents may still be reluctant to engage in excessive borrowing if there is a non-trivial probability of switching to a tight monetary regime with sharply higher rates

- z_t is the vector of state variables, including lagged endogenous variables and exogenous shocks.
- The function $\mathcal{T}^{r_t}$ is expanded around the steady state $\bar{z}_{r_t}$ for each regime r_t
- The higher-order terms capture nonlinear effects, which are particularly important in the presence of regime switching.

The system state variables are defined as:

$$z_t \equiv \begin{bmatrix} x'_{t-1} & \chi & \varepsilon'_t \end{bmatrix}'$$

where:

- x_{t-1} represents lagged endogenous variables.
- ε_t denotes stochastic shocks.
- χ: is a perturbation parameter used to control the expansion order

Several perturbation-based methodologies have been developed to address the challenges of solving regime-switching DSGE models. The approach employed in this study adheres to the framework delineated by Maih and Waggoner (2018). This perturbation technique, as exemplified in Chang et al. (2021), facilitates the derivation of regime-specific steady states (or approximation points) under conditions where switching parameters influence the steady state.[7]

4 Econometric Strategy: Bayesian Estimation and Filtering Techniques

To understand how South Korea's economy behaved during the 1997 crisis, we need to fit our model to real-world data, like GDP and interest rates. We use Bayesian estimation for that purpose. Since policies shifted rapidly during the crisis, we also apply special techniques to track these

[7] Alternative methods, such as those in Foerster et al. (2016) and Barthélemy and Marx (2017), also address these challenges. While differing in their perturbation strategies, they share the goal of approximating solutions that accommodate Markov-switching dynamics.

changes. This section explains these methods, showing how we ensure the model reflects the crisis accurately.

4.1 Why Bayesian Estimation? Estimating regime-switching DSGE models presents unique challenges, particularly in identifying structural parameters and accounting for nonlinearities introduced by regime transitions. A Bayesian estimation approach is particularly well-suited for these models due to the following advantages:

- Incorporation of prior information: Bayesian methods allow researchers to incorporate theoretical and empirical knowledge into the estimation process. This is particularly useful when data alone are insufficient to precisely identify parameters, especially in models with multiple regimes.
- Handling parameter uncertainty: Unlike classical maximum likelihood estimation (MLE), which produces point estimates, Bayesian methods provide full posterior distributions of parameters, allowing for a richer inference.
- Flexible treatment of nonlinearities: Bayesian estimation can efficiently handle highly nonlinear models where structural relationships change over time due to policy regime shifts.

A key requirement of Bayesian estimation is the computation of the likelihood function, which in a regime-switching DSGE model requires an appropriate filtering technique to estimate the unobserved state variables. In single-regime models, this is typically done using the Kalman filter, but as we discuss next, the Kalman filter is inapplicable in regime-switching settings.

4.2 The Filtering Challenge in Regime-Switching Models In a standard linear Gaussian DSGE model, likelihood computation is straightforward with the Kalman filter, which recursively updates estimates of the unobserved state variables. However, in regime-switching models, the Kalman filter is not applicable due to the discrete regime transitions governed by a Markov process.

The key challenge arises from the fact that at each time t, the economy can be in one of h regimes, leading to an exponential increase in possible regime histories. Formally, the set of possible regime sequences up to time t is:

$$\mathcal{J}_t = \{r_1, r_2, ..., r_{t-1}, r_t\} \in \mathbb{H}_{t,t}$$

where $\mathbb{H}_{t,t}$ represents the set of all possible regime paths. Because agents form expectations over multiple potential future regimes, the number of possible paths grows exponentially over time, making direct likelihood evaluation computationally infeasible.

As a result, standard filtering methods break down, requiring alternative filtering approaches specifically designed for regime-switching environments.

4.3 Alternative Filtering Techniques for Likelihood Computation

To compute the likelihood function efficiently in a regime-switching framework, we rely on non-standard filtering techniques that can track both continuous state variables and discrete regime transitions. Two prominent methods are:

The Kim-Nelson Filter (GPB2): Known as the Generalized Pseudo-Bayesian (GPB2) filter in engineering (Kim and Nelson (1999)), this method is widely adopted in econometrics for Markov-switching state-space models. It operates by:

- Tracking multiple possible regime paths while keeping computational complexity manageable.
- Collapsing regime sequences at each time step to prevent exponential growth in state histories.
- Computing an approximate posterior distribution for unobserved state variables under each regime.

While effective, this approach is still computationally demanding, particularly for high-dimensional models with many regimes. In this study we use the filtering procedure described next.

The Interacting Multiple Model (IMM) Filter: A more efficient alternative is the Interacting Multiple Model (IMM) filter, which is frequently used in engineering applications where regime uncertainty is critical. The IMM filter improves computational efficiency by:

- Dynamically updating regime probabilities, rather than tracking all regime histories explicitly.

- Blending multiple state estimates at each step, reducing computational complexity.
- Providing near-optimal filtering performance while keeping regime tracking feasible in large models.

4.4 Bayesian Estimation Procedure

Once we obtain the filtered state estimates, we use them to compute the likelihood function, which is then combined with prior distributions to estimate the posterior distribution of parameters.

Bayesian estimation follows Bayes' theorem: $p(\theta|Y) \propto p(Y|\theta)p(\theta)$, where $p(\theta)$ is the prior distribution over the structural parameters θ; $p(Y|\theta)$ is the likelihood function, herein computed using the IMM filter; $p(\theta|Y)$ is the posterior distribution, which we estimate using Markov Chain Monte Carlo (MCMC) methods.

5 Data and Estimation Results

5.1 Data and Observables

This study employs quarterly, seasonally adjusted data for South Korea, encompassing real per capita private consumption, output, total fixed capital investment, and the policy interest rate. To proxy the global economy, we utilize U.S. real per capita GDP, CPI inflation rates, and the federal funds rate. A comprehensive description of the dataset is provided in Appendix A. The model, delineated in Section 2, incorporates seven exogenous shocks: a preference shock, a technology shock, a risk premium shock, an interest rate shock, and three foreign shocks—namely, output, inflation, and interest rate shocks. The analysis leverages four Korean observables—real per capita private consumption, output, total fixed capital investment, and the policy interest rate—alongside three U.S. observables (real per capita GDP, CPI inflation rate, and the federal funds rate). The dataset spans the period from 1991Q1 to 2023Q4.

5.2 Model Estimation Challenges and Alternative Approaches

Estimating a regime-switching Dynamic Stochastic General Equilibrium (DSGE) model for the Korean economy poses a substantial technical challenge. Figure 2 depicts the trajectories of the policy rate and depreciation rates. During the crisis period, the Korean Won underwent significant depreciation, prompting the Korean government to elevate interest rates in early 1998, consistent with recommendations from

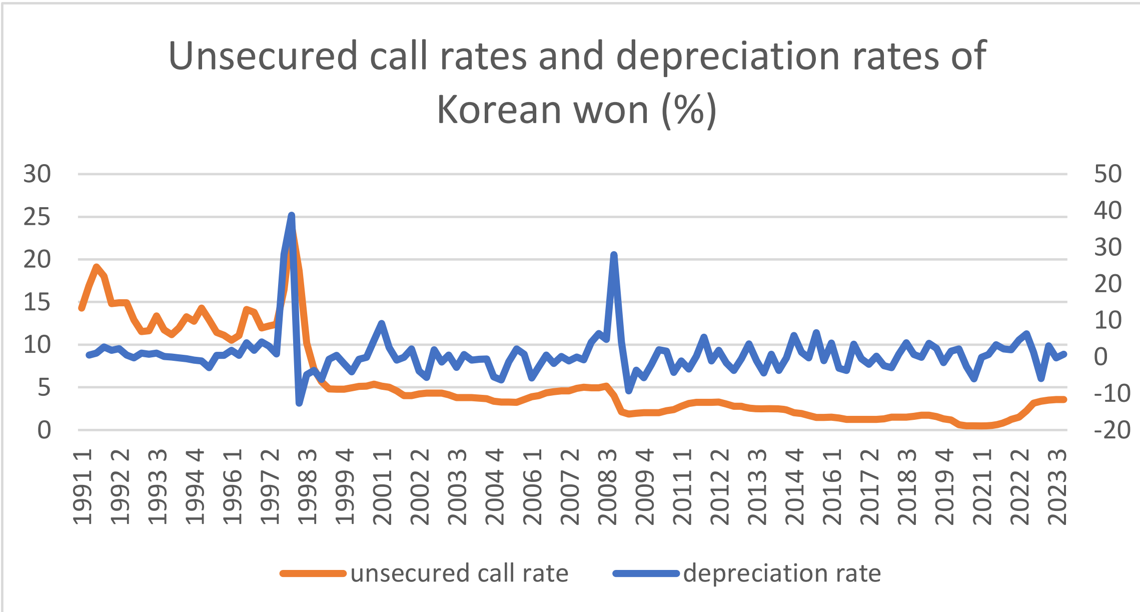

Figure 2: interest rates and depreciation rates

the International Monetary Fund (IMF). As a result, the data from this period reveal a marked positive correlation between interest rates and exchange rates. Theoretical predictions under a flexible exchange rate system, however, suggest that the interest rate response to exchange rate fluctuations should be minimal, implying a negligible correlation between these variables.

A rudimentary regime-switching model with two regimes frequently misclassifies the crisis period as part of the managed floating system and the pre-crisis period as part of the flexible exchange rate system. For example, the constant-parameter model's lower log-likelihood (Table 4) indicates higher misclassification errors, underscoring the stochastic-switch model's superior fit. This misclassification arises from the elevated correlation between interest rates and exchange rates observed during the crisis. To address this estimation challenge without explicitly modeling the crisis episode, we propose two alternative regime-switching frameworks.

The first, the known-switch model, as outlined earlier, assumes that the regime shift transpired in the first quarter of 1998. The second framework introduces a dual structure comprising two monetary policy regimes and two volatility regimes. This approach, termed the stochastic-switch model, hypothesizes that periods of heightened volatility in key variables are likely to align with, or overlap, the crisis period. Furthermore, the stochastic-switch model accounts for the possibility that economic agents may not have fully trusted the transition to a flexible exchange rate system during and immediately following the crisis. We posit that the stochastic-switch model will more effectively capture the dynamics of regime shifts compared to both the constant-parameter and known-switch models.

Table 1: Calibration of parameters

Parameter	Value	Description	Reference
β	0.99	discount factor	
α	0.4	output elast. to capital	Korean data
ϵ	6	subst. elast. (diff. goods)	
δ	0.025	depreciation	
σ_C	2	risk aversion (cons.)	
σ_N	1	inv. Frisch elast.	
h	0.75	habit formation	
Y/Y^*	1/50	Korea/world output share	OECD data
η	1.5	subst. elast. (home vs. foreign)	Faia and Monacelli (2008)
η^*	1.5	subst. elast. (foreign vs. home)	
$1 - a_C$	0.4	trade openness	Korean data
ξ	0.9	bank survival rate	
ω_l	0.4	incentive constraint (bankers)	
κ	4	bank leverage ratio	Korean data
$R^B - R$	0.0035	lend-deposit spread	Korean data
$R - R^F$	0.0023	dom.-foreign rate spread	formula-based
τ	0.314	derived from ω_l, spreads, κ	
b^F/Y_H	0.3	debt-to-GDP ratio	
Y_H	1	normalized dom. output	
N	1/3	ss labor supply	
$\pi_H = \pi_C$	1.01	ss inflation (dom. & CPI)	
κ_N	–	labor disutility (N = 1/3)	HH FOC
κ_P	–	Calvo stickiness (0.66)	Rotemberg equivalence

5.3 Calibration of Key Parameters

For the estimation process, selected parameters are calibrated to align with both theoretical underpinnings and empirical evidence. Table 1 reports the calibrated parameter values. The subjective discount factor, β, is set to 0.99, yielding a steady-state quarterly real gross interest rate of approximately 1.01 percent. The capital share in production is calibrated at 0.4, consistent with a labor income share of approximately 0.6 over the sample period in South Korea. The quarterly capital depreciation rate, δ, is fixed at 0.025. The coefficient of relative risk aversion and the inverse of the Frisch elasticity are assigned values of 2 and 1, respectively. For normalization, steady-state output, Y_H, is set to 1.

The labor disutility parameter κ_N and price adjustment cost parameter κ_P are not fixed but determined endogenously during posterior maximization and sampling. Specifically, κ_N is set to maintain a steady-state labor supply, N, of 1/3, by solving the household's labor supply condition. Similarly, κ_P is adjusted to achieve a Calvo-equivalent price stickiness of 0.66, implying an average price duration of three quarters, based on the Rotemberg price adjustment framework. These parameters vary with each parameter vector to ensure model consistency. Additionally, the steady-state gross domestic and consumer price index (CPI) inflation rates are both established at 1.01 percent.

The elasticity of substitution between differentiated goods, ϵ, is calibrated to 6, implying a steady-state markup of 20 percent. The degree of habit formation, h, is set to 0.75. The Korean economy's share in the global economy is assumed to be approximately 2 percent, aligning with empirical data. The openness parameter, $1 - a_C$, is calibrated to 0.4, reflecting the share of imports and exports relative to GDP in South Korea over the sample period. The elasticity of substitution between domestic and foreign goods in consumption is set to 1.5, a value close to that proposed by Faia and Monacelli (2008). These calibration choices are broadly consistent with standard practices in the literature.

For the banking sector, parameter values are selected to reflect conditions observed during crisis periods, thereby capturing the dynamics of volatile capital inflows and outflows. The leverage ratio κ is calibrated at 4, reflecting high indebtedness in South Korea during the 1997 crisis. The Bank of Korea's 1998 "Financial Statement Analysis" (p. 14) reports manufacturing sector leverage ratios of 361.2% (1980-1989) and 302.4% (1990-1999), with similar figures in the 2000 report (p. 13, Table 1). We choose κ = 4 (400%) to account for potentially higher leverage in non-manufacturing sectors like construction and real estate, which faced speculative bubbles during the crisis. This also considers "window-dressing", where firms temporarily reduced reported debt at year-end, understating proper leverage. While manufacturing data may not fully represent the broader economy, future work could explore sensitivity to alternative leverage ratios.

Gertler et al. (2007) sets the survival rate of bankers in Korea, denoted ξ, to 0.97. However, we adopt a value of 0.9—comparable to the 0.925 used by Mimir and Sunel (2019)—to better reflect the impact of bank failures during the Korean financial crisis. The steady-state spread between the domestic lending rate and the deposit rate is calibrated to 0.035 percent quarterly, corresponding to an annualized spread of approximately 1.4 percent, which closely approximates the observed market lending-deposit rate differential of 1.65 percent over the sample period. The parameter ω_l is set to 0.4, resulting in a spread of 0.93 percent between domestic and foreign risk-free rates. This spread is determined by the expression $\frac{\omega_l}{1-\omega_l}$ multiplied by the steady-state difference between the domestic lending rate and the deposit rate ($R^B - R$). Notably, if $\omega_l \geq 1/2$, the spread between domestic and foreign borrowing rates would exceed that between domestic lending and deposit rates, a result inconsistent with prior expectations. Thus, we fix ω_l at 0.4, despite the absence of official data. During 1997-1998, the net external debt of non-financial firms relative to GDP in South Korea fluctuated between 23 percent and 43 percent, with a sample average of 13 percent. Accordingly, we calibrate the steady-state ratio of foreign borrowing to output, $\frac{B^F}{P_H Y_H}$, to 0.3.

In Section 7, robustness checks are conducted by varying selected parameter values. The results remain robust and do not alter the qualitative conclusions.

5.4 Prior Distributions and Bayesian Estimation

The model is estimated using Bayesian techniques. Following standard Bayesian estimation conventions, prior distributions for the AR(1) parameters of the shock processes are specified as beta distributions, parameters constrained to positive values as gamma distributions, and standard deviations of the shock processes as inverse-gamma distributions. Table 2 reports the prior distributions, alongside the estimated posterior modes and corresponding 90% credible intervals from the stochastic-switch model. To conserve space, estimation results from the constant-parameter and known-switch models are omitted here but are discussed in Section 7 as part of the robustness analysis.

The risk premium's response to foreign borrowing is parameterized with a prior of $\psi_R = 1.1$. Estimation results indicate a posterior mode of 1.1, same as the prior. For the monetary policy rule, priors are set as follows: $\rho_\pi = 1.5$, $\rho_y = 0.5$, with the response of the policy rate to the log depreciation rate specified as $\rho_s = 0.5$ under the managed floating exchange rate system and $\rho_s = 0.01$ under the flexible exchange rate system. The estimated parameters for the monetary policy response to inflation and output are 1.31 and 0.43, respectively, aligning closely with prior findings in the literature. The estimated response to depreciation rates is 1.06 under the managed floating system and zero under the flexible system.

The monetary policy rate exhibits substantial persistence, with an estimated AR(1) coefficient of 0.97. Estimates of the monetary policy transition parameter closely align with the priors, reflecting the known timing of the regime shift and the use of endogenous priors in estimation. Transition probabilities for the volatility regime suggest a 0.07 probability of shifting from low to high volatility and a zero probability of transitioning from high to low volatility regime.

Table 2: Posterior Estimates of Model Parameters from Bayesian Estimation: Stochastic-Switch Model

Parameter	PriorDistr	PriorMean	PriorStd	PosteriorMode	LowCI	HighCI
κ_I	GAMMA	3.0000	0.3000	2.0981	1.7657	2.4972
Ψ_R	GAMMA	1.1000	0.1000	1.1318	1.0520	1.3075
ρ_π	GAMMA	1.5000	0.1000	1.3136	1.1602	1.4462
ρ_Y	BETA	0.5000	0.0500	0.4301	0.3674	0.5196
ρ_A	BETA	0.7000	0.1000	0.6478	0.5768	0.7063
ρ_m	BETA	0.7000	0.1000	0.9726	0.9682	0.9767
ρ_ψ	BETA	0.7000	0.1000	0.8655	0.8228	0.8990
ρ_{ε_C}	BETA	0.7000	0.1000	0.3923	0.3140	0.4959
ρ_{Y^*}	BETA	0.7000	0.1000	0.8046	0.7310	0.8597
ρ_{π^*}	BETA	0.7000	0.1000	0.7777	0.6969	0.8434
ρ_{R^F}	BETA	0.7000	0.1000	0.9426	0.9059	0.9683
$\rho_{S,\text{monPol},1}$	GAMMA	0.5000	0.1000	1.0606	0.8979	1.2565
$\rho_{S,\text{monPol},2}$	GAMMA	0.0100	0.0100	0.0000	0.0000	0.0000
$\text{monPol}_{tp,1,2}$	BETA	0.1500	0.1000	0.0006	0.0003	0.0015
$\text{monPol}_{tp,2,1}$	BETA	0.0150	0.0100	0.0088	0.0058	0.0192
$\text{vol}_{tp,1,2}$	BETA	0.1500	0.1000	0.0725	0.0388	0.1432
$\text{vol}_{tp,2,1}$	BETA	0.1500	0.1000	0.0016	0.0007	0.0040
$\sigma_{A,\text{vol},1}$	IGAMMA1	0.0100	Inf	0.0174	0.0142	0.0231
$\sigma_{A,\text{vol},2}$	IGAMMA1	0.0300	Inf	0.0823	0.0678	0.1012
$\sigma_{m,\text{vol},1}$	IGAMMA1	0.0025	Inf	0.0005	0.0004	0.0006
$\sigma_{m,\text{vol},2}$	IGAMMA1	0.0075	Inf	0.0019	0.0016	0.0023
$\sigma_{\psi,\text{vol},1}$	IGAMMA1	0.0100	Inf	0.0107	0.0100	0.0123
$\sigma_{\psi,\text{vol},2}$	IGAMMA1	0.0300	Inf	0.0524	0.0471	0.0647
$\sigma_{\varepsilon_C,\text{vol},1}$	IGAMMA1	0.0100	Inf	0.0457	0.0410	0.0541
$\sigma_{\varepsilon_C,\text{vol},2}$	IGAMMA1	0.0300	Inf	0.1818	0.1636	0.2119
$\sigma_{Y^*,\text{vol},1}$	IGAMMA1	0.0100	Inf	0.0044	0.0038	0.0055
$\sigma_{Y^*,\text{vol},2}$	IGAMMA1	0.0300	Inf	0.0131	0.0115	0.0149
$\sigma_{\pi^*,\text{vol},1}$	IGAMMA1	0.0100	Inf	0.0065	0.0057	0.0077
$\sigma_{\pi^*,\text{vol},2}$	IGAMMA1	0.0300	Inf	0.0078	0.0069	0.0087
$\sigma_{R^F,\text{vol},1}$	IGAMMA1	0.0025	Inf	0.0006	0.0005	0.0007
$\sigma_{R^F,\text{vol},2}$	IGAMMA1	0.0075	Inf	0.0014	0.0012	0.0016

LowCI and HighCI represent the 5% and 95% credible intervals. IGAMMA1 denotes an inverse gamma distribution with shape parameter 1.

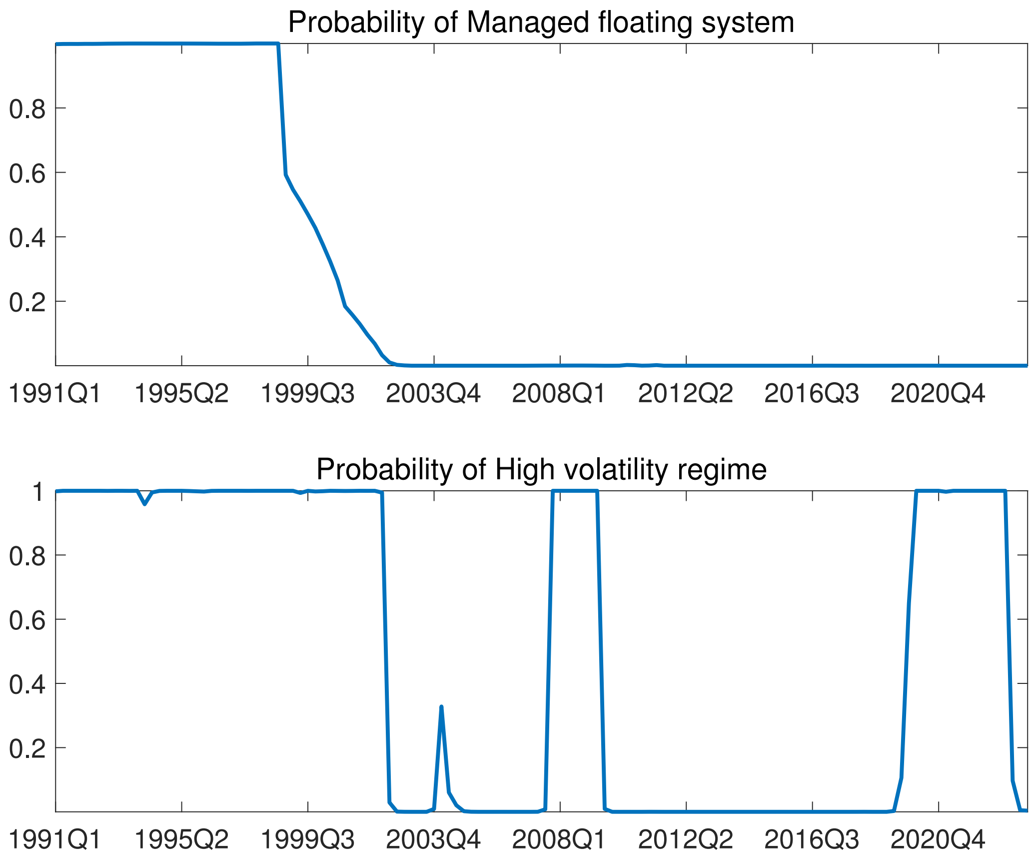

Figure 3: Estimated probabilities of managed floating (upper) and high volatility (lower) regimes, 1991Q1–2023Q4, with key transitions at the IMF bailout (1997Q4) and crisis peak (1998Q1).

5.5 Estimated Regime Probabilities and Model Fit

Figure 3 illustrates the estimated state probabilities for four states: The upper panel depicts the probabilities associated with the managed floating system, while the lower panel illustrates the probabilities of the high volatility state. The data designate the period up to 1999Q2 as corresponding to the managed floating system and from 1999Q3 onward as the flexible exchange rate system. High-volatility periods include those up to 2002Q1, the global financial crisis (2007Q4-2009Q2), and the COVID-19 pandemic (2019Q4-2023Q1).

5.6 Monetary Policy Effects and Impulse Response Functions (IRFs)

The analysis focuses on the effects of monetary policy during the crisis period. Impulse response functions (IRFs) of key variables to domestic monetary policy shocks are presented in Figure 4. $Regime_1$,

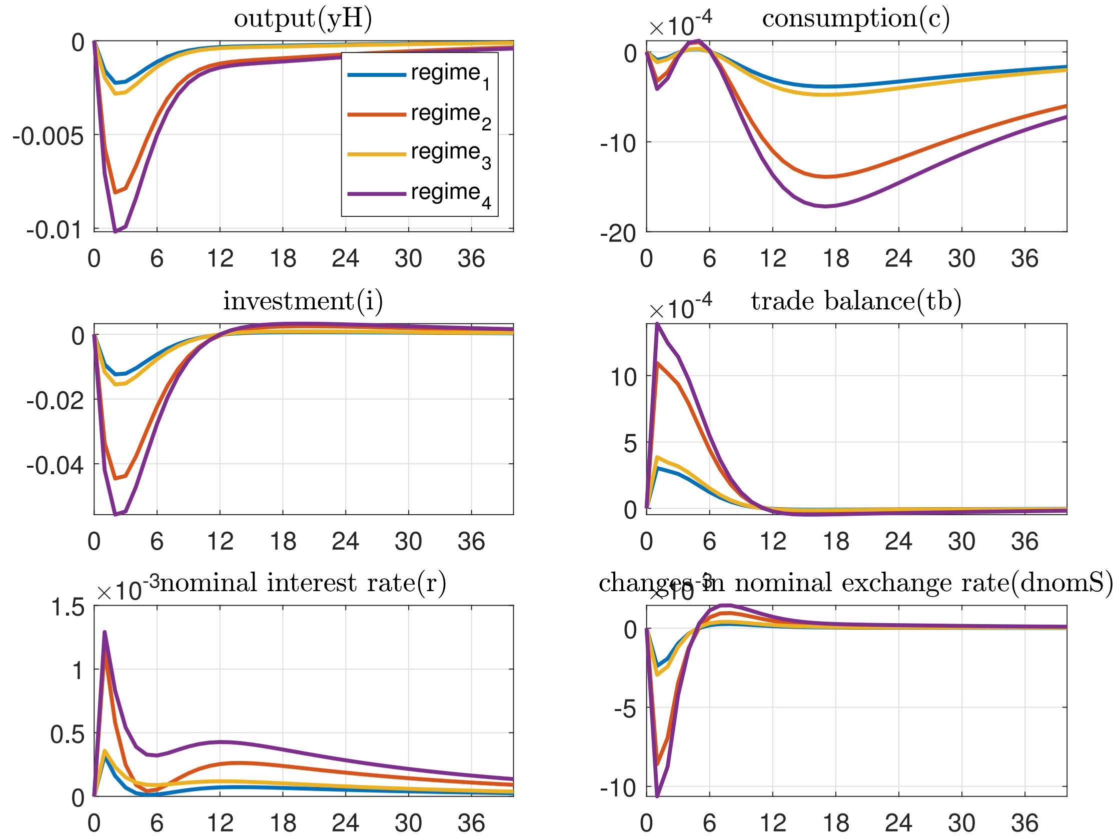

Figure 4: $Regime_1$, $Regime_2$, $Regime_3$, and $Regime_4$ correspond respectively to the following exchange rate frameworks: the managed floating regime with low volatility, the managed floating regime with high volatility, the flexible exchange rate regime with low volatility, and the flexible exchange rate regime with high volatility.

$Regime_2$, $Regime_3$, and $Regime_4$ correspond respectively to the following exchange rate frameworks: the managed floating regime with low volatility, the managed floating regime with high volatility, the flexible exchange rate regime with low volatility, and the flexible exchange rate regime with high volatility. Following an interest rate increase, output, consumption, and investment decline, while the exchange rate appreciates. Typically, exchange rate appreciation would deteriorate the trade balance, ceteris paribus. However, the IRFs indicate an improvement in the trade balance, potentially attributable to the “depression surplus” phenomenon. During the crisis, the Korean economy experienced a sharp output contraction, with consumption and investment declining even more severely, possibly contributing to this trade balance improvement.

6 Counterfactuals

6.1 Medium-High Interest Rate Policy in 1998Q1 What if South Korea had chosen different policies during the 1997 financial crisis? This section explores alternative approaches, like milder interest rate hikes or devaluing the currency, to see how they might have reduced the economic downturn. Using our model, we test these "what-if" scenarios to understand their impact on growth and stability, with detailed results explained below.

We present counterfactual experiments designed to evaluate alternative monetary policy scenarios during the Asian financial crisis. Specifically, we examine the potential economic outcomes had the Korean government, in collaboration with the International Monetary Fund (IMF), implemented a medium-high interest rate policy in the first quarter of 1998 (Q1 1998), rather than the exceptionally high interest rate policy that was historically enacted.

The high interest rate policy adopted during the crisis aimed primarily to stabilize the Korean Won amid severe currency depreciation. However, as outlined in Section 5, the Korean economy in early 1998 was characterized by significant indebtedness, rendering it highly vulnerable to the contractionary effects of elevated interest rates. The policy rate, proxied by the unsecured overnight call rate, peaked at 24% in Q1 1998 and remained elevated at 19% in Q2 1998. This aggressive monetary tightening precipitated substantial economic costs, evidenced by a sharp contraction in real GDP, which declined by 6.7% quarter-on-quarter in Q1 1998 and by an additional 0.8% in Q2 1998.

Figure 5 illustrates the pronounced economic downturn triggered by this stringent monetary policy stance. In response to these adverse developments, the Korean government sought IMF assistance to mitigate the effects of the high interest rate regime and promote recovery. This collaboration culminated in a mutual agreement to lower interest rates, which subsequently fell to approximately 10% in Q3 1998 and 7% in Q4 1998.

In the first counterfactual scenario, we hypothesize that the magnitude of the policy interest rate shock in Q1 1998 was reduced by half. Figure 6 juxtaposes the simulated economic output under this counterfactual policy with the observed historical output. The results suggest that a medium-high interest rate policy would have moderated the severity of the economic downturn, though the improvement in economic performance would have been modest rather than substantial.

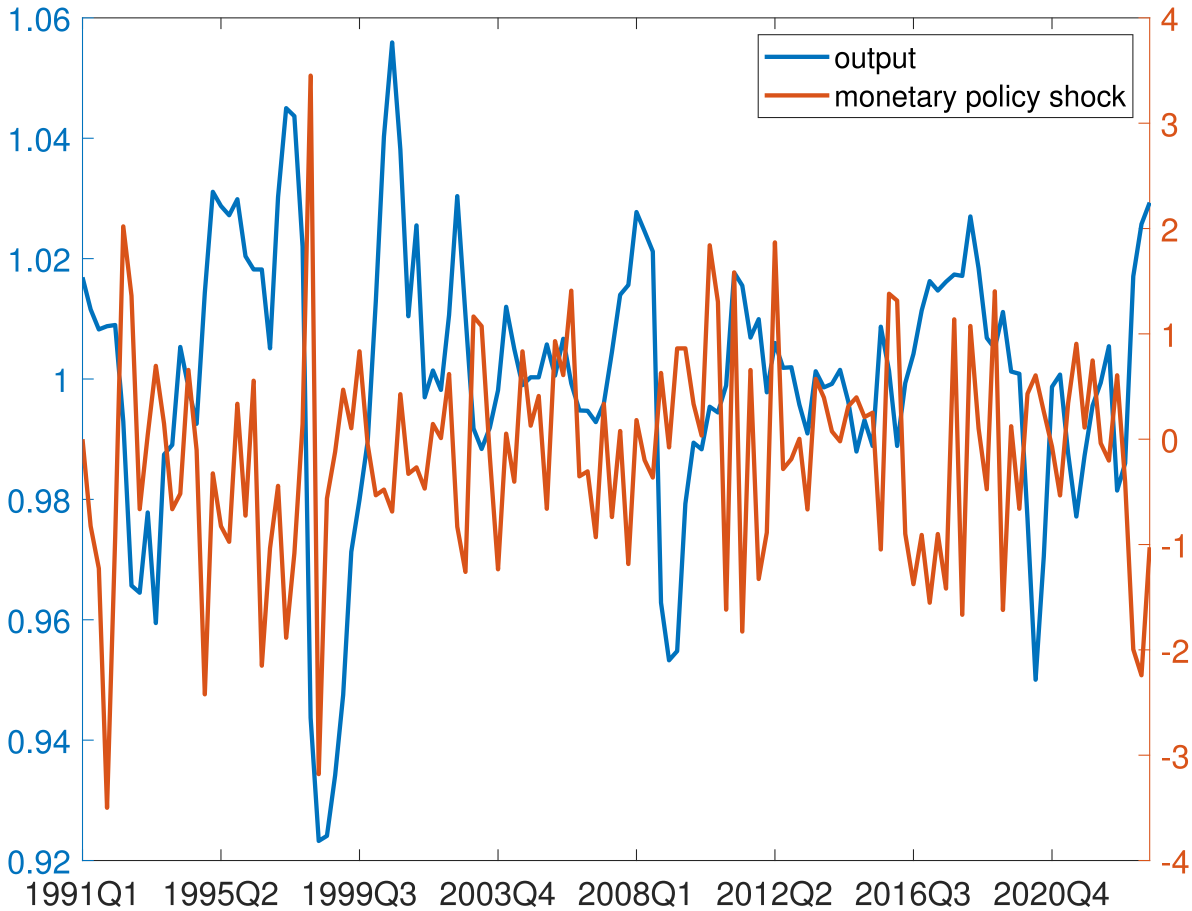

Figure 5: Output and monetary policy shock: Stochastic Switch

These findings indicate that adopting a medium-high interest rate policy in Q1 1998, as opposed to the historically implemented very high interest rate policy, could have marginally alleviated the depth of the Korean economic contraction in 1998. While the counterfactual scenario does not eliminate the downturn entirely, it underscores the sensitivity of the heavily indebted Korean economy to the intensity of monetary tightening during this period.

6.2 Devaluation in 1997Q3 combined with Medium-High Interest Rate Policy in 1998Q1

This counterfactual scenario investigates the potential economic outcomes of a dual policy intervention: a controlled 10% devaluation of the Korean Won in the third quarter of 1997, followed by a medium-high interest rate policy in the first quarter of 1998. During the Asian financial crisis, the Korean Won faced severe speculative pressure, particularly in Q4 1997. In an effort to defend the currency, the Korean government widened the managed floating exchange rate

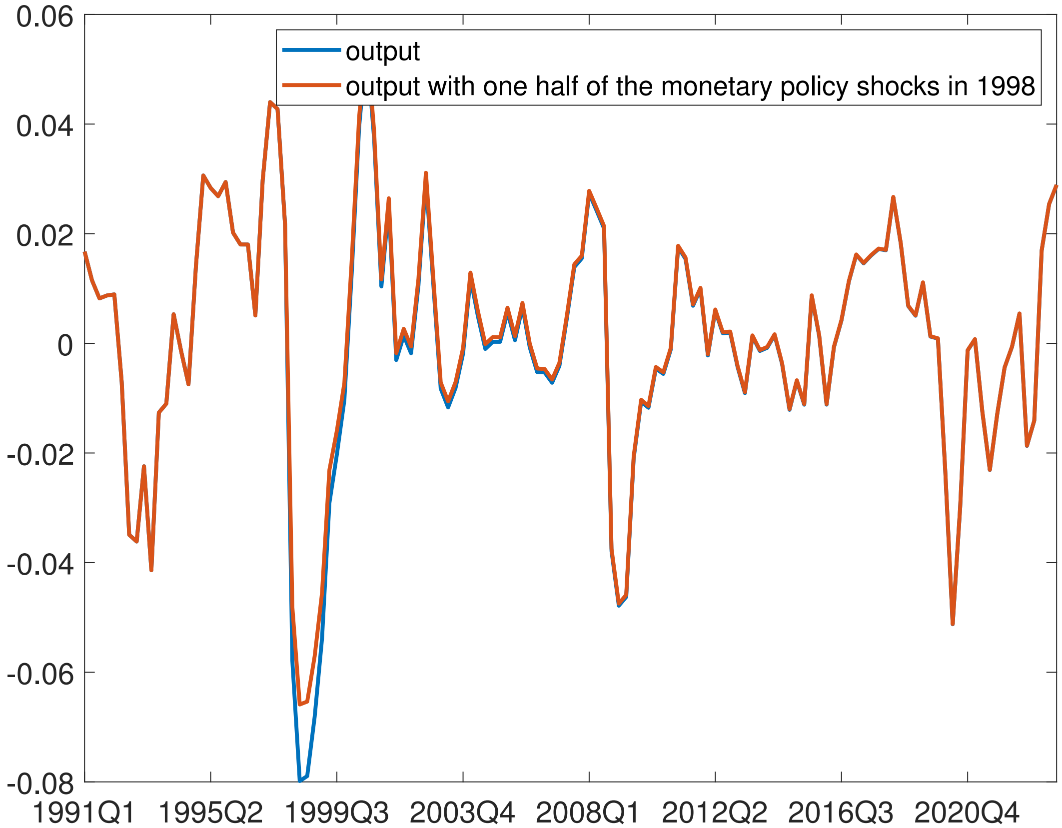

Figure 6: Actual output (blue lines) and simulated counterfactual output (red lines): Stochastic switch model, Medium-High Interest Rate Policy in 1998Q1

band to ±10% on November 20, 1997. However, as foreign exchange reserves dwindled, Korea sought an IMF rescue package on November 21, 1997, securing a $55 billion USD bailout on December 1, 1997. Amid these speculative attacks, the Won depreciated by 28.1% in Q4 1997 and by an additional 38.7% in Q1 1998.

The rationale for this counterfactual draws on historical examples where strategic devaluation mitigated economic crises. For example, Taiwan devalued the New Taiwan Dollar by approximately 6.7% (from NT$28.6:US$1 to NT$30.5:US$1) in mid-October 1997, successfully averting a deeper crisis (see Chen (1998)). Similarly, during the 1992 European Exchange Rate Mechanism (ERM) turmoil, countries such as Finland and Italy employed controlled devaluations to stabilize their economies and mitigate disruptions.

In this scenario, we assume that monetary policy in Q3 1997 was calibrated to achieve a 10%

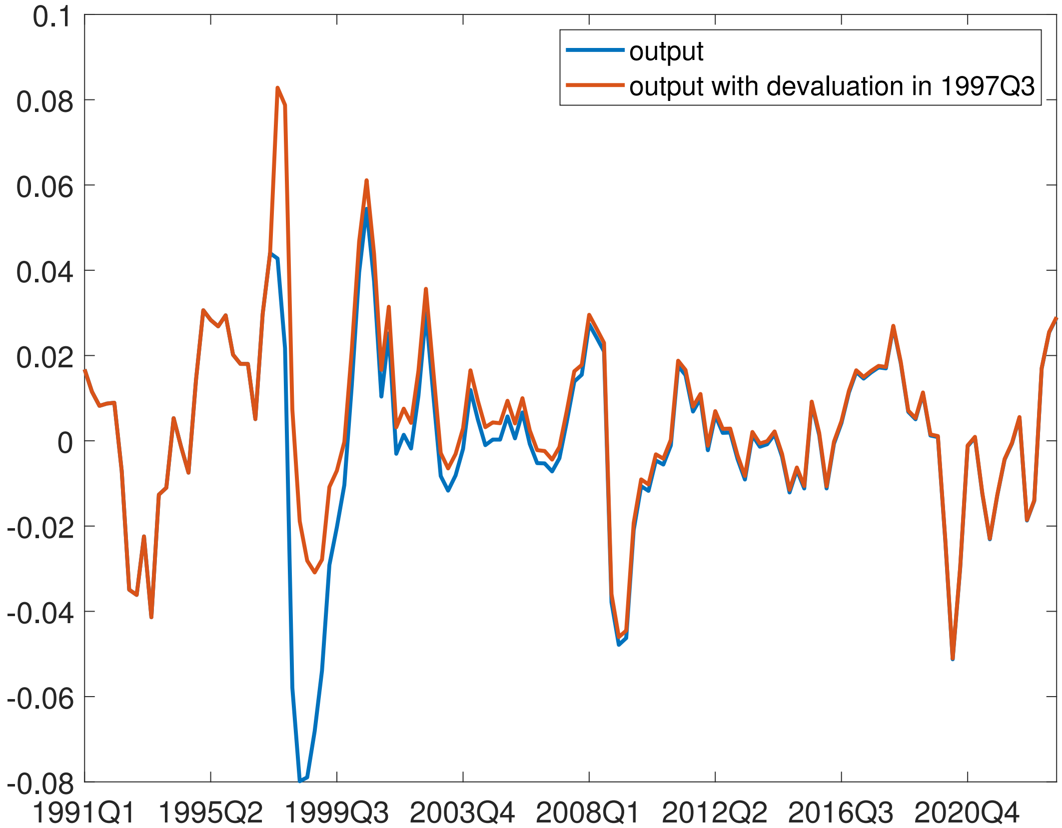

Figure 7: Actual output (blue lines) and simulated counterfactual output (red lines): Stochastic switch model, Devaluation in 1997Q3 combined with Medium-High Interest Rate Policy in 1998Q1

devaluation of the Won, followed by a reduction of the policy interest rate shock in Q1 1998 to half its historical magnitude. Figure 7 depicts the simulated output trajectory under this counterfactual policy mix. The results indicate that output would have reached approximately 8.3% above the long-term trend in Q3 1997, before declining to 3.1% below the trend in Q4 1998. By comparison, historical data reveal output at 4.3% above the long-term trend in Q3 1997, followed by a steeper fall to 8.0% below the trend by Q2 1998. Notably, the counterfactual output trajectory remains consistently higher than the actual output throughout the period preceding the global financial crisis. (The analysis employs HP-filtered log per capita real GDP, with values representing percentage deviations from the long-term trend, either positive or negative.)

These findings underscore the potential benefits of a proactive 10% devaluation in Q3 1997. Such a policy, paired with a moderated interest rate stance in Q1 1998, could have significantly

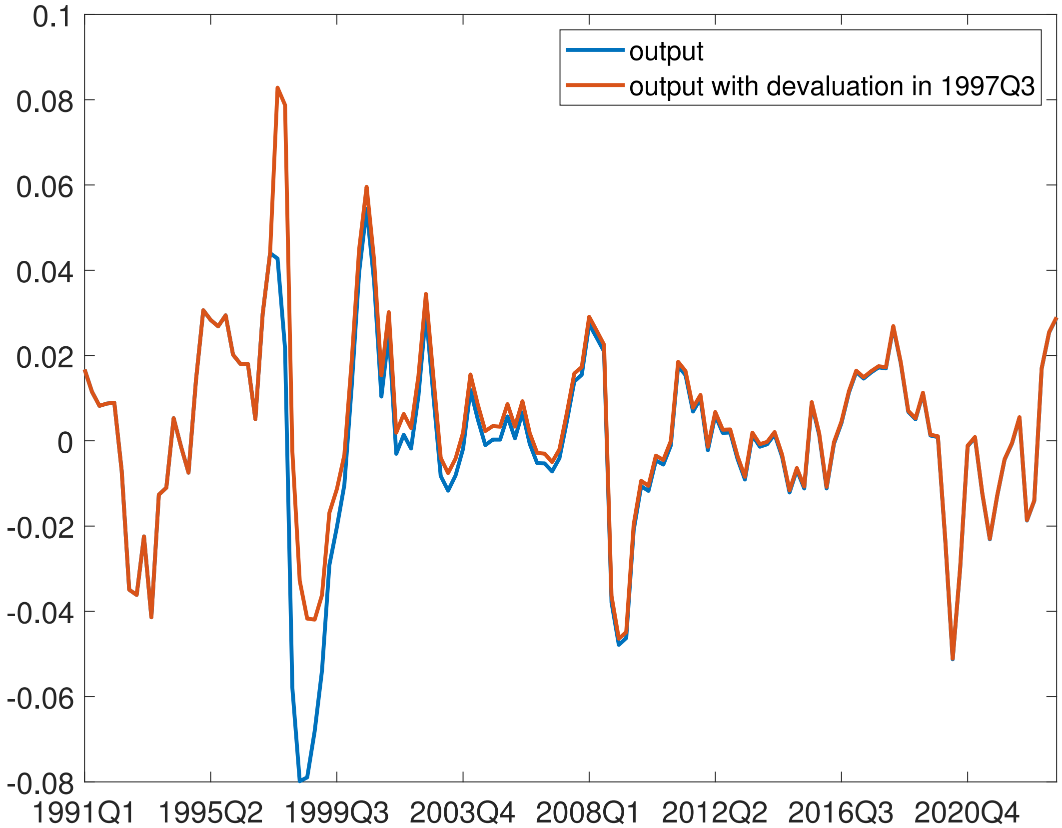

Figure 8: Actual output (blue lines) and simulated counterfactual output (red lines): Stochastic switch model, Devaluation in 1997Q3 with very high Interest Rate Policy in 1998Q1

reduced the depth of Korea's economic downturn, offering a more resilient output path during the crisis.

6.3 Devaluation in 1997Q3 only

The previous scenario examined the combined effects of a 10% devaluation in Q3 1997 and a medium-high interest rate policy in Q1 1998, suggesting it may have been a better response to the speculative attacks on the Korean Won. This subsection isolates the impact of a 10% devaluation in Q3 1997 while retaining the historically implemented very high interest rate policy in early 1998.

Figure 8 illustrates that a 10% currency devaluation in Q3 1997 would have boosted output growth in that quarter and softened the subsequent downturn in 1998. Specifically, output would have reached approximately 8.3% above the long-term trend in Q3 1997, falling to 4.2% below the trend by Q3 1998. By comparison, actual historical data show output at 4.3% above the long-term trend in Q3 1997, dropping to 7.9% below it by Q3 1998. The benefits of this devaluation align closely with those of the prior scenario. However, its effects in 1998 may be understated, as the Korean Won faced sharp depreciation in Q4 1997 and Q1 1998 amid intensifying speculative pressures.

Had the Korean government enacted a 10% devaluation—or one sufficient to forestall the crisis—speculative attacks might have been substantially mitigated, potentially averting the severe downturn of 1998. To test this, we introduce a modified risk premium model with exogenous and endogenous components:

$$\log(\psi_t) - \log(\bar{\psi}) = \rho_\psi(\log(\psi_{t-1}) - \log(\bar{\psi})) - \rho_{\psi dS}(\log(dS_{t-1}) - \log(d\bar{S})) + \sigma_{\psi,s_t^V} \cdot e_{\psi,t} \quad (37')$$

This contrasts with the baseline specification:

$$\log(\psi_t) - \log(\bar{\psi}) = \rho_\psi(\log(\psi_{t-1}) - \log(\bar{\psi})) + \sigma_{\psi,s_t^V} \cdot e_{\psi,t} \quad (37)$$

Here, $\rho_{\psi dS}$[8] represents the sensitivity of the risk premium to currency depreciation. The term $e_{\psi,t}$ denotes the exogenous risk premium shock, and $-\rho_{\psi dS}\left(\log(dS_{t-1}) - \log(d\bar{S})\right)$ captures the endogenous component. A depreciation reduces the endogenous risk premium, potentially stabilizing the economy under speculative pressure.

Figure 9 compares simulated and actual outputs under this revised framework. The results indicate that a 10% devaluation in Q3 1997 would have yielded output growth of approximately 8.4% above the long-term trend in Q3 1997, with a decline to 2.9% below the trend by Q3 1998. While the initial positive effects mirror those of the previous scenario, the modified risk premium model suggests a slightly more mitigated early 1998 downturn.

In summary, these counterfactual analyses demonstrate that a moderated interest rate policy could have reduced the severity of Korea's economic contraction during the crisis. Furthermore, in the absence of sufficient reserves to defend the currency, a strategic devaluation in Q3 1997

[8] The prior for $\rho_{\psi dS}$ is specified consistently with other shock persistence parameters, including ρ_ψ, with an estimated mode of 0.48.

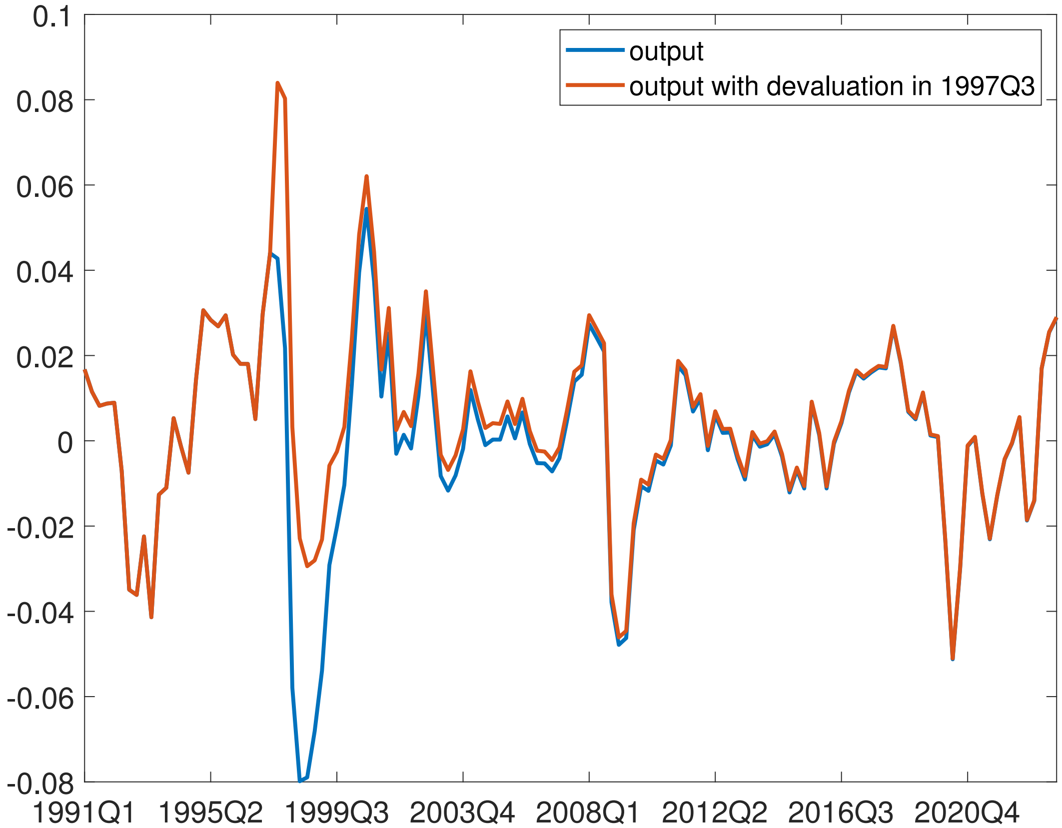

Figure 9: Actual output (blue lines) and simulated counterfactual output (red lines): Stochastic switch model, Devaluation in 1997Q3 with very high Interest Rate Policy in 1998. Risk premium shock follows: $\log(\psi_t) - \log(\bar{\psi}) = \rho_\psi(\log(\psi_{t-1}) - \log(\bar{\psi})) - \rho_{\psi dS}(\log(dS_{t-1}) - \log(\bar{dS})) + \sigma_{\psi,s_t^V} \cdot e_{\psi,t}$

emerges as a potentially more effective countermeasure against speculative attacks. These findings highlight the critical role of tailored monetary and exchange rate policies in cushioning emerging economies against the destabilizing effects of financial crises.

6.4 Comparing Counterfactual Outcomes

Table 3 quantifies the counterfactual scenarios' impact on output (% deviation from long-term trend) relative to the historical outcome. A 10% devaluation in Q3 1997, alone (Section 6.3) or with a medium-high interest rate policy in Q1 1998 (Section 6.2), raises output to 8.3% above trend in Q3 1997 (vs. 4.3% historically) and reduces the 1998 downturn (-3.1% to -4.2% vs. -7.9% in Q3 1998). The combined policy yields the strongest stabilization (-3.1%), while devaluation alone improves further with an endogenous risk premium (-2.9%). A medium-high interest rate policy alone offers modest gains (-6.0%, estimated). These comparisons highlight the relative effectiveness of each policy mix.

Table 3: Summary of Counterfactual Output Outcomes

Scenario	Q3 1997 Output (% Dev.)	Q3 1998 Output (% Dev.)	Policy Summary
Historical	4.3	-7.9	Severe downturn, high rates
Med.-High Rate (6.1)	4.3	-6.0*	Some downturn relief
Deval. + Med.-High (6.2)	8.3	-3.1	Strong stabilization
Devaluation Only (6.3)	8.3	-4.2**	Notable stabilization

*Estimated. **-2.9 with endog. risk premium.

7 Robustness of the Results

To evaluate the robustness of our findings, we estimated a constant parameter model, which assumes invariant parameter values across the sample period, implicitly excluding regime shifts in the economy. Table 4 reports the log-likelihood measures for this model. Compared to the stochastic-switch model, the constant parameter model yields lower log-likelihood values, indicating a less favorable fit. However, the counterfactual simulation results closely align with those from the stochastic-switch model and are thus omitted here for brevity.

As noted in Section 4, the Korean government adopted a flexible exchange rate system in 1998 following International Monetary Fund (IMF) recommendations. To account for this structural break, we estimated a known-switch model, which assumes a transition from a managed floating regime to a flexible exchange rate regime in Q1 1998. Table 4 shows that the log-likelihood values for the known-switch model are marginally lower than those of the constant parameter model. This outcome is anticipated, as the known-switch model imposes an exogenous regime shift at a fixed point without capturing whether economic agents fully anticipated or internalized the transition. Nonetheless, the counterfactual simulation results remain qualitatively consistent with the baseline findings.

Given the model's lack of an explicit growth trend specification, we employed second-order detrending alongside HP-filtering to ensure data stationarity. As reported in Table 4, log-likelihood values from the detrended data are slightly lower than those from HP-filtered data. Despite this, the counterfactual simulation results exhibit qualitative consistency, reinforcing the following insights:

Table 4: Robustness of results: Various models and parameters

Model	Log-post	Log-lik	Log-MDD (Laplace)
	HP filtering		
Stochastic-switch	3522.3	3371.2	3234.9
Constant parameter	3218.7	3202.5	3156.4
Known-switch	3194.5	3196.0	3118.0
	2nd order detrening		
Stochastic-switch	3437.8	3263.4	3284.6
Constant parameter	3107.5	3101.2	3066.5
Known-switch	3091.9	3098.2	3013.3
HP Filtering, Stochastic-switch Model, Different parameters			
h=0 (no habit)	3374.5	3385.9	3251.2
$\omega_l = 0$ (UIP)	3502.0	3370.5	3345.5
$\eta = 0.5, \eta^* = 1, B^F = 0, \pi_C = \pi_H = 1$	3336.4	3370.8	3098.0

UIP stands for uncovered interest rate parity.

1. A medium-high interest rate policy in Q1 1998 could have moderated the severe economic downturn of that year.

2. A 10% currency devaluation in Q3 1997, paired with a medium-high interest rate policy in Q1 1998, could have significantly alleviated the crisis's adverse economic effects.

3. A standalone 10% devaluation in Q3 1997 could have substantially mitigated the downturn, though the inclusion of a risk premium with both exogenous and endogenous components (as opposed to an exogenous-only specification) offers relatively limited additional relief.

To further test robustness, we modified key model parameters and re-evaluated the counterfactual scenarios. These variations include:

1. No habit formation, i.e., $h = 0$.

2. Setting $\omega_l = 0$, corresponding to the case where uncovered interest rate parity (UIP) holds, as detailed in Section 5.

3. Adjusting parameters to $\eta = 0.5$, $\eta^* = 1$, steady-state values $\pi_C = 1$ and $\pi_H = 1$, and $b^F = 0$. Here, $\eta = 0.5$ and $\eta^* = 1$ align with values in the literature (e.g., Mimir and Sunel (2019)), $\pi_C = 1$ and $\pi_H = 1$ denote price stability, and $b^F = 0$ implies a zero steady-state trade balance.

When $\omega_l = 0$, the log-likelihood values closely match those of the baseline scenario in the first panel of Table 4. In other cases, log-likelihood values are slightly lower than the baseline, yet the qualitative conclusions from the counterfactual analyses remain consistent with the primary findings. Detailed results are omitted for conciseness.

8 Concluding remarks

This study uses a regime-switching DSGE model to analyze South Korea's 1997 financial crisis, revealing how alternative monetary and exchange rate policies could have lessened its economic toll. By incorporating financial frictions and policy shifts, we show that a medium-high interest rate policy in Q1 1998, a 10% currency devaluation in Q3 1997, or both could have significantly reduced the 1998 downturn's severity. An endogenous risk premium further moderates crisis effects, though marginally. Robustness checks across model specifications, detrending methods, and parameter variations confirm these findings' stability.

Our empirical findings yield two key policy implications for central banks in emerging markets. First, in the face of speculative currency attacks, a controlled devaluation, typically on the order of 10% but adjusted to the unique economic and financial circumstances of the country, implemented early in a crisis, can effectively stabilize financial markets and preserve economic output. This approach is supported by our counterfactual analyses and exemplified by Taiwan's successful management of the 1997 Asian financial crisis. Second, moderate interest rate hikes, rather than aggressive increases such as South Korea's 24% peak, can balance currency defense with economic growth, minimizing harm to indebted firms. These lessons find resonance in recent episodes of currency volatility, such as Turkey's 2018 lira collapse, where high rates deepened economic distress, and Argentina's 2019-2020 currency fluctuations, where earlier devaluation might have eased mounting pressures.

Despite these insights, our generalized DSGE framework may not fully capture crisis-specific nuances. Future research could develop tailored models with detailed speculative pressures and reserve constraints, offering even more precise guidance. These findings underscore the value of flexible, proactive policies to shield emerging economies from financial shocks.

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Appendix

A Data

Korean data from 1990:Q1 to 2023:Q4 were utilized for model estimation. Additionally, the U.S. quarterly GDP, CPI inflation rate, and federal funds rate were employed as proxies for the global economy. Detailed descriptions of the data are provided below:

$$
\begin{aligned}
\text{GDP} &= \log(\text{Domestic Real Per Capita GDP}),\\
\text{Consumption} &= \log(\text{Domestic Real Per Capita Private Consumption}),\\
\text{Investment} &= \log(\text{Domestic Real Per Capita Investment}),\\
\text{Export} &= \log(\text{Domestic Real Per Capita Export}),\\
\text{Import} &= \log(\text{Domestic Real Per Capita Import}),\\
\text{Nominal Depreciation Rate} &= \log(\text{Nominal Exchange Rate/Nominal Exchange Rate(-1)}),\\
\text{Inflation Rate} &= \log(\text{Domestic CPI/Domestic CPI}(-4)),\\
\text{Nominal Interest Rate} &= \text{1+Overnight Call Rate (per annum)}/400,\\
\text{World GDP} &= \log(\text{U.S. Real Per Capita GDP}),\\
\text{World Inflation} &= \log(\text{U.S. CPI/U.S. CPI}(-4)),\\
\text{World Nominal Interest Rate} &= \text{1+U.S. Federal Funds Rate (per annum)}/400,
\end{aligned}
$$

where all domestic real data (adjusted to 2020 prices) were divided by the population to construct per capita variables.

To ensure data stationarity, we applied the HP filter to all variables except for domestic and world interest rates, standard in DSGE models, though endpoint issues may affect crisis dynamics; Table 4 confirms qualitative consistency with second-order detrending. The sources of the original data are as follows:

- Domestic Real GDP: Real gross domestic product, seasonally adjusted, the Bank of Korea's Economic Statistics System database (BOK-ECOS)
- Domestic Real Consumption: Real gross consumption expenditure by households, seasonally adjusted, BOK-ECOS
- Domestic Real Investment: Real gross fixed capital formation, seasonally adjusted, BOK-ECOS

- Domestic Real Export: Real Export of Goods and Services, seasonally adjusted, BOK-ECOS
- Domestic Real Import: Real Import of Goods and Services, seasonally adjusted, BOK-ECOS
- Nominal Exchange Rate: Won/Dollar exchange rate, averages of daily figures, BOK-ECOS
- Domestic CPI: Consumer price indexes, 2020=100, seasonally adjusted, BOK-ECOS
- Domestic Nominal Interest Rate: Overnight call rate, uncollateralized, percent per annum, averages of daily figures, BOK-ECOS
- Domestic Population: Total population, annual, KOSIS
- U.S. Real GDP: Real gross domestic product per capita, Chained 2017 Dollars, Quarterly, Seasonally Adjusted Annual Rate (A939RX0Q048SBEA), FRED(Link: https://fred.stlouisfed.org)
- U.S. CPI: Consumer Price Index for All Urban Consumers: All Items in U.S. City Average, Index 1982-1984=100, Quarterly, Seasonally Adjusted (CPIAUCSL), FRED(Link: https://fred.stlouisfed.org)
- U.S. Federal Funds Rate: Federal Funds Effective Rate, Percent, Quarterly, Not Seasonally Adjusted (FEDFUNDS), FRED(Link: https://fred.stlouisfed.org)

B Model Solution

- Households

  FOC's:

$$U_C(C_t) = \varepsilon_{C,t}(C_t - hC_{t-1})^{-\sigma_C} - \beta h \mathbb{E}_t \left[\varepsilon_{C,t+1}(C_{t+1} - hC_t)^{-\sigma_C}\right] \tag{B1}$$

$$\kappa_N N_t^{\sigma_N} / U_C(C_t) = \frac{W_t}{P_{C,t}} \tag{B2}$$

$$U_C(C_t) = \beta \mathbb{E}_t \left[U_C(C_{t+1}) \frac{(1+R_t)}{\pi_{C,t+1}}\right] \tag{B3}$$

- Banks

  FOC's:

$$\nu_{bt}(1+\mu_t) = \tau\mu_t(1-\omega_l) \tag{B4}$$

$$\nu_{b_t^F}(1+\mu_t) = \tau\mu_t\omega_l \tag{B5}$$

$$\nu_{bt} b_t + \nu_{b_t^F}(b_t - d_t - nw_t) + \nu_{nt} nw_t - \tau(b_t - \omega_l d_t) \geq 0 \tag{B6}$$

- Capital good producers

  FOC:

$$\begin{aligned} q_t &\left\{1 - \frac{\kappa_I}{2}\left(\frac{i_t}{i_{t-1}} - 1\right)^2 - \kappa_I \frac{i_t}{i_{t-1}}\left(\frac{i_t}{i_{t-1}} - 1\right)\right\} \\ &+ \beta \mathbb{E}_t \left[\Lambda_{t,t+1} q_{t+1} \left(\frac{i_{t+1}}{i_t}\right)^2 \kappa_I \left(\frac{i_{t+1}}{i_t} - 1\right)\right] = 1 \end{aligned} \tag{B7}$$

- Intermediate goods producers FOC's:

$$r_t^K = mc_t \alpha \frac{y_{H,t}}{k_{t-1}} \tag{B8}$$

$$w_t = mc_t(1-\alpha)\frac{y_{H,t}}{h_t} \tag{B9}$$

$$\pi_{H,t}\left(\pi_{H,t} - \bar{\pi}\right) = \beta \mathbb{E}_t \left[\frac{\lambda_{t+1}}{\lambda_t} \pi_{H,t+1}\left(\pi_{H,t+1} - \bar{\pi}\right) \frac{p_{H,t+1} y_{H,t+1}}{p_{H,t} y_{H,t}}\right] + \frac{\epsilon}{\kappa_P}\left(\frac{mc_t}{p_{H,t}} - \frac{\epsilon - 1}{\epsilon}\right) \tag{B10}$$