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Advis Budiman
University of Indonesia, Indonesia, advis.budiman@gmail.com

Solikin M. Juhro
Bank Indonesia - Indonesia, solikin@bi.go.id

Sugiharso Safuan
Faculty of Economics and Business, Universitas Indonesia, Indonesia, sugiharso@ui.ac.id

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CAPITAL FLOW AND BANK LENDING CHANNELS IN A SMALL OPEN ECONOMY: EVIDENCE FROM INDONESIA

Advis Budiman*, Solikin M. Juhro**, and Sugiharso Safuan***

*Faculty of Economics and Business, University of Indonesia. Email:advis.budiman@gmail.com
**Bank Indonesia. Email: solikin@bi.go.id
***Faculty of Economics and Business, University of Indonesia. Email: sugiharso@ui.ac.id

ABSTRACT

This paper investigates the implications of macro-financial linkages in explaining the interaction of the financial and business cycles as the primary contributor to understanding the fluctuations in the Indonesian economy. It attempts to capture the interaction of the global financial and domestic business cycles through portfolio flow by incorporating investor behavior through a preference for domestic asset classes. Furthermore, due to information asymmetries between lenders and borrowers, we include the monitoring cost to explain the transaction cost in the credit market as a factor that drives macroeconomic fluctuations. Our findings demonstrate how financial imperfections can amplify the impact of global financial cycles on domestic business cycles. The demand for riskier investment illustrates how risk-taking behavior impacts capital flow and contributes to the endogenous amplification of the economic cycle.

Keywords: Financial imperfections; Risk-taking; General equilibrium.
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I. INTRODUCTION

This study investigates how macro-financial linkages might amplify the impact of external shocks on domestic business cycles. Macro-financial linkages are the outcome of both economic agents' investment decisions and government policy actions. We saw how unconventional monetary policy boosted macro-financial linkages between developed and emerging economies during the Global Financial Crisis (GFC) 2008 (Daas, 2017; IMF, 2021). This relationship has boosted domestic liquidity into emerging economies via capital flow from advanced economies. As a result of solid investor perceptions, the domestic economy has experienced a surge in short-term portfolio investment, increasing demand for short-term deposits and exposing the banking sector to potential liquidity risk. We explored how ample liquidity from advanced economies searching for yield in emerging markets significantly amplifies economic cycles. Throughout the GFC, this ample liquidity elevates the challenges for emerging economies (Claessens and Gosh, 2013; Juhro *et al.*, 2021). Furthermore, the importance of capital regulation in influencing bank risk-taking behavior has attracted researchers' interest, particularly in how it may mitigate the consequences of risk-taking. On the other hand, risk-taking may affect not just bank behavior but also asset prices and collateral, necessitating its inclusion in business cycle studies.

Investigating how financial development may affect credit cycles is critical to understanding how policy is transmitted through banking sectors. Borio and Zhu (2012) argue that the connection between monetary policy and risk perception among bank management reshapes macroeconomic policy transmission. The influence of the credit channels on macroeconomic dynamics must also be investigated, considering contributing variables such as investor confidence, risk appetite, and perceptions of economic uncertainty. During an economic boom, investor optimism can improve confidence in a company's performance, increasing the demand for its equity. The rise in asset values during booms, such as commodity prices, enhanced a company's financial condition, making financial institutions more willing to lend to leading sectors. Meanwhile, the economy becomes more unpredictable during a recession, and financial institutions respond by raising margins to cover possible risks from intermediate activity. Increasing margins raise credit costs, limiting credit availability to the real sector and potentially amplifying the impact of a financial sector shock.

We emphasize the significance of risk-taking in monetary policy transmission, focusing on emerging economies, such as Indonesia. During considerable capital flow to emerging countries, excess liquidity provides short-term and more volatile funding for riskier investments, especially in portfolio inflows (Figures 1 and 2). Simultaneously, these capital flows strengthen the relationship between the Indonesian economic and global financial cycles, e.g., macro-financial linkages (Prabheesh *et al.*, 2021). Regardless of the benefits, growing macro-financial linkages through capital flows lead to increased financial imbalances, which must be handled appropriately to reduce the threat to Indonesian macroeconomic stability. Tight global financial conditions, on the other hand, may increase capital outflows, endangering central banks' capacity to manage volatile asset markets and reducing policy effectiveness (Juhro and Goeltom, 2015).

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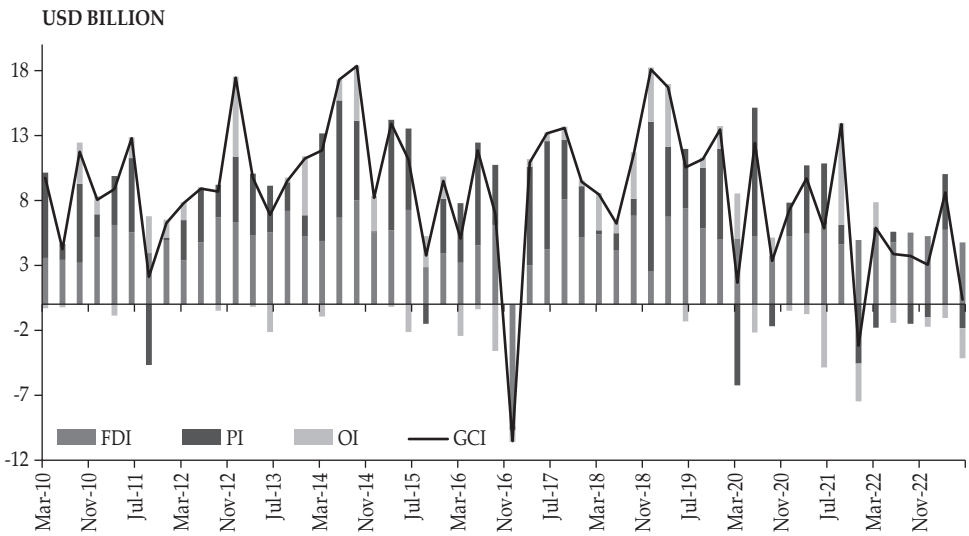
Furthermore, the behavior of the financial sector is also significant in shaping the financial cycle. For example, the effect of herding behavior drives investors to engage in massive asset sales to reduce the risk of a significant asset collapse. It demonstrates how this investment behavior exacerbates the financial sector's shock.

Figure 1. Gross Foreign Capital Flow and Gross Investment Flow

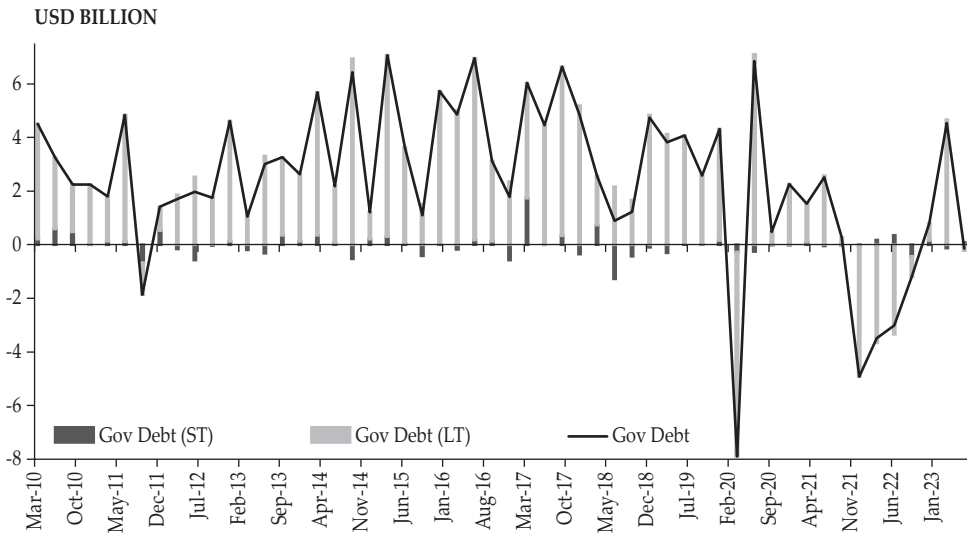
This figure provides the gross capital flow to Indonesia. The Portfolio Investment consists of Foreign Direct Investment (FDI), Portfolio Investment (PI), and Other Investment (OI). Based on International Investment Position (BPM 6), financial transactions in the balance of payments include "net acquisition of financial assets'' and "net incurrence of liabilities." Net financial asset acquisitions: net changes in financial assets with positive values imply capital outflows by domestic agents (gross outflows). Net liability incurrence: the net change in a resident's financial liabilities; a positive figure shows foreign capital inflows (gross inflows).



Source: CEIC.

Figure 2. The Portfolio Investment on Government Debt Securities – Short Term and Long Term

This figure provides the portfolio investment on Government Debt securities. We include information the amount invested on Short Term (ST) and Long Term (LT) Government Debt Securities.



Source: CEIC

Despite focusing on the financial cycle, previous studies on how financial cycles affect business cycles did not consider financial imperfections (Prabheesh *et al.*, 2021; Mara *et al.*, 2021). Previous studies argued that investors could optimally allocate asset portfolios in a frictionless economy, but financial frictions should be addressed to comprehend the implications and give better insights to policymakers. As a result, we sought to examine financial imperfection by modeling the Indonesian economy to determine how the dynamics of investors' asset class preferences drive asset portfolio allocation to deviate from its optimal conditions. Investor preferences enhance asset class substitution elasticity over time, resulting in short-term inflows that rebalance portfolios and mitigate significant risk. This circumstance raises the potential for liquidity risk by accumulating short-term and volatile funds and contributing to more serious financial imbalances in the banking sectors. We are interested in examining the risk-taking channels represented by risk appetite in the banking industry, notably through short-term liabilities such as bank deposits. This study also attempts to better understand how exogenous shocks and their links through foreign investors' risk appetite exacerbate the domestic business cycle.

The novelty of this study can be seen from several aspects. In this study, we employ a dynamic stochastic general equilibrium approach to capture imperfections and better explain the interlinkages in the economy (Blanchard, 2018). Due to asymmetric information, we incorporate the principal-agent problem and adverse selection into our framework. It generally requires lenders (financial intermediaries) to monitor their debtors to ensure their investment

return. Monitoring activities generate additional costs in every project the bank decides to participate in (Carlstrom and Fuerest, 1997). Moreover, we incorporate an international risk premium, which influences agents' decisions on asset portfolio allocations between countries, as another financial market imperfection in the economy. To capture the macro-financial linkages, we enhance the previous model of Budiman *et al*. (2022) from a closed economy to a small open economy to capture the interaction of a country's risk premium with capital flows. This model reflects the relationship between the country's risk premium and preference for domestic portfolio investment during periods of substantial capital inflow. We also use Schmitt-Grohe and Uribe's (2003) approach to capture the amount of country risk inversely proportionate to the number of debt securities and Adolfson's (2007) approach to capture the negative connection with exchange rates. We also discuss procyclicality as a cause of financial system instability and a possible source of exacerbating the domestic financial cycle, which might lead to a financial crisis (Jorda, 2010).

Some studies on capital flow divide it into push factors that can affect investor perceptions and pull factors derived from domestic economic performance. According to previous studies, capital inflows to emerging nations typically challenge macroeconomic policymaking, especially during a sudden capital reversal (Claessens and Gosh, 2013). As a result, we combine both of these aspects into a general equilibrium framework to assess the implications of capital flows. According to Hannan (2017), capital flow in Indonesia is driven only by economic growth and interest rate differentials. However, Warjiyo and Juhro (2022) indicate that assessing capital flows simply on interest rate differential is challenging and that including the country's risk premium in capital flow analysis is essential.

Finally, we incorporate financial frictions on the demand side of finance to represent how debtors' financial conditions influence the debtors' capacity to access external funding (Bernanke *et al*., 1999; Iacoviello, 2005). For example, fluctuating collateralized values might impair borrowers' creditworthiness, decreasing debtors' balance sheet position. At the same time, the collateral the borrowers offer may influence the banking sector's decision to provide credit. This relationship will enhance the financial cycle (Bernanke and Gertler, 1995). On the supply side, the balance sheet position of intermediary institutions affects their ability to channel credit (Angeloni and Faia, 2013; Rubio and Carraasco-Gallego, 2016). Regardless of the bank's financial condition, risk perception plays a role in credit allocation. Having an appetite for loans is exacerbated by optimism management, which stimulates risk-taking. These imperfections and risk-taking behavior are worsening procyclicality in the banking system (Borio and Zhu, 2012). We analyze these interactions using Adrian and Shin's (2018) approach, which allows us to quantify the risk-taking preferences of investors and financial intermediaries directly. In order to take into consideration the risk-taking channel, we endogenously incorporate the elasticity to aggregate demand of risk preferences between foreign and domestic asset classes endogenously into our model. We also adopt Schmitt-Grohe and Uribe's (2003) technique to explicitly simulate the elasticity of foreign capital flows in the Indonesian economy to reflect the dynamic of risk in the financial cycle.

Our study contributes to a growing understanding of the links between financial and business cycles, focusing on how capital flow transmission influences the economy. As Mara *et al*. (2021) and Prabheesh *et al*. (2021), who discovered a considerable influence of capital flows on domestic bank lending in Indonesia, our study adds to a better understanding of how capital flows affect a wide range of macroeconomic factors by including numerous financial imperfections in the economy. Our study focuses on the impact of financial imperfections on macroeconomic dynamics by including various financial frictions in the banking sector to better understand the financial sector's contribution to macroeconomic fluctuation. Furthermore, our study aims to assess the growing concerns caused by macro-financial linkages and the risk-taking behavior of financial institutions by relying heavily on excessive liquidity mismatch. These macro-financial linkages should be considered in the framework to measure the effectiveness of the monetary transmission mechanism in controlling inflation (Angeloni, 2015).

For these reasons, we will answer this question systematically below. Section II will provide the theoretical framework used and model development. In section III, we will look at the methodology, data, model calibration, and estimation of the DSGE model. Section IV will analyze impulse response function based on the DSGE model estimation results. Finally, in the last section, we will provide conclusions and policy recommendations.

II. THEORETICAL FRAMEWORK AND MODEL DEVELOPMENT

This paper examines the transmission of capital flows through banking sectors to see how capital inflows are transmitted to credit. This experiment is being carried out to see how the synchronization of capital flows to the Indonesian economy affects credit through the banking sector, according to Mara *et al*. (2021), who indicate that capital inflows negatively impact credit banks but have a positive impact after a year. Moreover, Prabheesh *et al*. (2021) also demonstrate that the global financial cycle directly impacts the Indonesian business cycle but indirectly impacts credit. The findings demonstrate how capital flows into the Indonesian economy via the banking sector.

We follow the models of Alpanda *et al*. (2018) using the new Keynesian framework. We develop the Small open economy DSGE model, which features Patient households (savers), Banks (intermediaries), Impatient households(borrowers), and Entrepreneurs as the four significant agents in the model (borrowers). Households, final goods firms, intermediate goods firms, and the government sector, which consists of monetary and fiscal authorities, represent our economy. The domestic economy is assumed to be small compared to the world economy, allowing world aggregates to be treated as exogenous. Firms represent consumer goods producers for households consisting of final and intermediate goods producers. The intermediate goods work in a monopolistic market and can adjust their prices using a Calvo-style approach (1983).

A. Patient Household

In this economy, there is infinitely lived patient households indexed by i, where this household chooses consumption, housing stocks, and labor. The Patient household maximizes the following utility functions:

$$E_t \sum_{\tau=t}^{\infty} \beta_P^{\tau-t} v_\tau \left\{ loglog \left[c_{P,\tau}(i) - \zeta_p c_{P,\tau-1}(i) \right] + \xi_{h,P} \tilde{\varepsilon}_{h,\tau} loglog\, h_{P,\tau}(i) - \xi_{l,P} \tilde{\varepsilon}_{l,\tau} \frac{l_{P,\tau}(i)^{1+\upsilon}}{1+\upsilon} \right\} \quad (1)$$

The budget constraint of the patient Household is

$$c_{P,t}(i) + q_{h,t}\left[h_{p,t}(i) - (1-\delta_h)\psi_{h,t} h_{p,t-1}(i)\right] + q_{k,t}\left[k_{p,t}(i) - (1-\delta_k)\psi_{k,t} k_{p,t-1}(i)\right] + \left(1+\Upsilon_{d,t}\right)\frac{D_t(i)}{P_t} + \frac{1}{\aleph_t}\left[\frac{B_t(i)}{R_t P_t} + \frac{e_t B_t^*(i)}{\Phi_t R_t^* P_t}\right] \leq \left(1-\tau_{l,t}\right)\frac{W_{P,t}(i)}{P_t} l_{p,t}(i) + \left(1-\tau_{k,t}\right) r_{kP,t} \psi_{k,t} k_{P,t-1}(i) + \tau_{k,t}\delta_k \psi_{k,t} k_{p,t-1}(i) + R_{d,t-1}\frac{D_{t-1}(i)}{P_t} + \frac{B_{t-1}(i)}{P_t} + \frac{e_t B_{t-1}^*(i)}{P_t} + \frac{TR_{P,t}}{P_t} + \frac{D_{B,t}}{P_t} + \frac{D_{E,t}}{P_t} + \frac{\Pi_{d,t}}{P_t} + \frac{\Pi_{m,t}}{P_t} - adj.cost \quad (2)$$

Where β_p represents the degree of impatient of the patient household, $c_{P,t}(i)$ is the level of consumption, $h_{p,t}(i)$ is the amount of stock, $l_{P,\tau}$ is hour worked, $k_{p,t}(i)$ is the capital stock, $W_{P,t}(i)$ is the wages received, $TR_{P,t}$ is the transfer received, $D_{B,t}$ is the dividends received from banks, $D_{E,t}$ is the dividend received from the entrepreneur, $\Pi_{d,t}$ is the profit from domestic firms and $\Pi_{m,t}$ is the profit of import firms. Patient households have financial assets in the form of deposits in banks $D_t(i)$, domestic government securities $B_t(i)$, and foreign securities $B_t^*(i)$. In this case, investors have a monitoring cost of how much savings they place in the bank. The amount of monitoring costs from the Patient Household ($\Upsilon_{d,t}$) is as follows:

$$1 + \Upsilon_{d,t} = \chi_{d1}\left(\frac{\gamma_t\left[\omega_{I,t} P_{I,t} b_{I,t} + \omega_{E,t} P_{E,t} b_{E,t}\right]}{A_t}\right)^{\chi_{d2}} \gamma_t^{\chi_{d3}} \tilde{\varepsilon}_{d,t} \quad (3)$$

the size $P_{I,t} b_{I,t}$ dan $P_{E,t} b_{E,t}$ is the market value of the credit given to the impatient household and the entrepreneur, respectively. γ_t describes the minimum capital ratio that a bank must own, A_t is the nominal capital owned by banks, χ_{d1} describes the level of parameters that determine the funding spread and χ_{d2} is the elasticity of monitoring cost to the level of leverage. χ_{d3} is the elasticity of monitoring cost to the minimum capital requirement. The portfolio preference is endogenously modeled to describe risk-taking behavior as follows:

$$\aleph_t = \left(\frac{y_t}{y}\right)^{-\varrho_\aleph} \tilde{\varepsilon}_{\aleph,t} \quad (4)$$

y_t is aggregate demand, $\varrho_{\aleph}$ is the elasticity of preference for the portfolio to aggregate demand, and $\tilde{\varepsilon}_{\aleph,t}$ is a shock to the preference for the portfolio. It also analyzes the country's risk premium when deciding on investment possibilities; this model is intended to show how pricing risk affects patient households' behavior. The equation describes the country's risk premium.

$$\Phi_t = expexp\left[-\Phi_a\left(nfa_t - \underline{nfa}\right) - \Phi_\epsilon\left(\frac{E_t e_{t+1}}{e_t}\frac{e_t}{e_{t-1}} - 1\right) + \tilde{\Phi}_t\right] \quad (5)$$

Represents the International risk premium as explained endogenously by bonds traded. In this economy, there are two types of bonds such as domestic and foreign bonds, which are traded with a discount factor R_t and $\Phi_t R_t^*$. Where R_t and R_t^* is described as the domestic and foreign policy rates respectively. Net Foreign Assets (NFAs) in this economy are described by $nfa_t = e_t B_t^* / \aleph_t \Phi_t R_t^* P_t y_{d,t}$. Parameter Φ_a describes the relationship between the country's risk premium and the NFAs owned. Next component Φ_ϵ describes the elasticity of the depreciation rate with the country's risk premium. We adopt Adolfson *et al*. (2008) approach to explain the negative relationship between the exchange rate and NFAs and Schmitt-Grohe and Uribe (2003) approach to explaining the negative relationship between NFAs and the exchange rate. Patient Household optimizes lifetime utility subject to budget constraints.

B. Impatient Household

In this economy, there is also a population that is an infinitely lived impatient household, with the Utility function of the Impatient household being the same as the Patient household, except the time discount factor is smaller than the bank $\beta_I < \beta_B$. The budget constraint of the Impatient household is:

$$c_{I,t}(i) + q_{h,t}\left[h_{I,t}(i) - (1-\delta_h)\psi_{h,t}h_{I,t-1}(i)\right] + \frac{R_{I,t}}{\pi_t}p_{I,t}b_{I,t-1}(i)$$
$$\leq \left(1-\tau_{l,t}\right)\frac{W_{I,t}(i)}{P_t}l_{I,t}(i) + p_{I,t}b_{I,t}(i) + \frac{TR_{I,t}}{P_t} - adj.cost \quad (6)$$

Where $c_{I,t}(i)$ is the level of consumption, $h_{I,t}(i)$ is the amount of housing stock, $W_{I,t}(i)$ is the wages received and $TR_{I,t}$ is a lump-sum transfer received by an impatient household from the government. In addition, impatient households also have an adjustment for wages received.

C. Entrepreneurs

In this economy, there is a unit measure of entrepreneurs denoted i. Entrepreneurs obtain financing from capital producers, which they finance via bank loans and retained earnings. In this economy, some entrepreneurs can maximize the lifetime utility described by

$$E_t \sum_{\tau=t}^{\infty} \beta_E^{\tau-t} \frac{\lambda_{E,\tau}}{\lambda_{P,t}} \left(\upsilon_{B,\tau} \frac{D_{E,\tau}(i)}{P_\tau} \right) \tag{7}$$

β_E is the discount factor of the entrepreneur. Entrepreneurs acquire physical capital from capital producers through bank loans and retained earnings, which are defined by the amount of adjustment costs. The cash flow from entrepreneurs can be described in the following equation:

$$\frac{D_{E,t}(i)}{P_t} + q_{k,t}\left[k_{E,t}(i) - (1-\delta_k)\psi_{k,t}k_{E,t-1}(i)\right] + \frac{R_{E,t}}{\pi_t} p_{E,t} b_{E,t-1}(i)$$
$$\leq \left(1-\tau_{k,t}\right) r_{kE,t}\psi_{k,t}k_{E,t-1}(i) + \tau_{k,t}\delta_k\psi_{k,t}k_{E,t-1}(i) + p_{E,t}b_{E,t}(i) - adj.cost \tag{8}$$

$k_{E,t}(i)$ is the capital owned by the entrepreneur, $D_{E,t}(i)$ is the dividend paid, and the quadratic adjustment cost for each dividend paid.

D. Banks

In this economy, some banks loan to impatient households, $b_{I,t}(i)$ dan Entrepreneur, $b_{E,t}(i)$ as portfolio assets. Banks receive funding to carry out the activities from deposits from patient households, $D_t(i)$ and own capital owned by banks, $A_t(i)$. The balance sheet from banking can be written as follows:

$$\frac{p_{I,t}}{P_t} b_{I,t}(i) + \frac{p_{E,t}}{P_t} b_{E,t}(i) = \frac{D_t(i)}{P_t} + \frac{A_t(i)}{P_t} \tag{9}$$

In this model, the bank has the behavior to maximize dividends paid to investors, $D_{B,\tau}(i)$. The banking sector maximizes lifetime utility, which is illustrated in the following equation:

$$E_t \sum_{\tau=t}^{\infty} \beta_B^{\tau-t} \frac{\lambda_{P,\tau}}{\lambda_{P,t}} \left(\upsilon_{B,\tau} \frac{D_{B,\tau}(i)}{P_\tau} \right) \tag{10}$$

β_B is a discount factor for the banking sector. In addition to its implementation, banks must pay monitoring costs for their investments to impatient households and entrepreneurs. Where the magnitude of this monitoring fee will describe the spread of interest rates from liabilities and deposits, which can be described as follows:

$$1 + \Upsilon_{I,t} = \chi_{I,t} \left(\frac{(1-m_{I,t}) q_{h,t} h_{I,t}}{\eta_{I,t}} \right)^{\chi_{I2}} \tilde{\varepsilon}_{I,t} \tag{11}$$

$$1 + \Upsilon_{E,t} = \chi_{E,t} \left(\frac{(1-m_{E,t}) q_{k,t} k_{I,t}}{\eta_{E,t}} \right)^{\chi_{E2}} \tilde{\varepsilon}_{E,t} \tag{12}$$

The monitoring cost is defined by the housing and capital stock amount and can serve as a feedback loop from the real to banking sectors. Other than that, the net-worth of an impatient household and entrepreneur is described as follows:

$$\eta_{I,t} = q_{h,t} h_{I,t} - p_{I,t} b_{I,t} \tag{13}$$

$$\eta_{E,t} = q_{h,t} k_{E,t} - p_{E,t} b_{E,t} \tag{14}$$

In addition, banks also issue adjustment costs in managing dividends to be paid to shareholders so that the budget constraint for the banking sector can be described as follows:

$$\begin{aligned} &\frac{D_{B,t}(i)}{P_t} + R_{d,t-1}\frac{D_{t-1}(i)}{P_t} + \left(1+\Upsilon_{I,t}\right)p_{I,t}b_{I,t}(i) + \left(1+\Upsilon_{E,t}\right)p_{E,t}b_{E,t}(i) \\ &\leq \frac{R_{I,t}}{\pi_t}p_{I,t}b_{I,t-1}(i) + \frac{R_{E,t}}{\pi_t}p_{E,t}b_{E,t-1}(i) + \frac{D_t(i)}{P_t} - adj.cost \end{aligned} \tag{15}$$

E. Monetary, Fiscal, and Macroprudential Policy

The target of the central bank is the nominal value of the interest rate using the Taylor rule:

$$log\ R_t = \rho log\ R_{t-1} + (1-\rho)\left[log\ R + a_\pi log\ \frac{\pi_t}{\pi} + a_y log\ \frac{y_t}{y}\right] + \tilde{\varepsilon}_{r,t} \tag{16}$$

R is the steady-state value of the policy interest rate, ρ is a parameter that describes the smoothing of interest rates, fund parameters a_π and a_y each describes the magnitude of the weight for inflation and the output gap in the Taylor rule. $\tilde{\varepsilon_{r,t}}$ describes the monetary policy shock, which follows autoregressive AR(1). Then, the government has a budget constraint from the following equation:

$$\begin{aligned} &g_t + tr_{P,t} + tr_{I,t} + \frac{B_{t-1}(i)}{P_t} \\ &= \tau_{l,t}\left(\omega_{P,t}l_{P,t} + \omega_{I,t}l_{I,t}\right) + \tau_{k,t}\left(r_{kP,t}k_{P,t-1} + r_{kE,t}k_{E,t-1}\right)\psi_{k,t} + \frac{B_t(i)}{R_t P_t} \end{aligned} \tag{17}$$

$\tau_{l,t}$ and $\tau_{k,t}$ each describes the tax on wages received by households and the tax on return on investment in capital producers. The government runs an active fiscal policy where the dynamics of fiscal policy is carried out through transfers to households following the following equation:

$$tr_{i,t} = \Xi_i y_d \left(\frac{y_t}{y}\right)^{-\varrho_y} \tilde{\varepsilon}_{tr,t} - \varrho_b b_{t-1}^g, for\ i = P, I \tag{18}$$

$\Xi_i \forall i=P,I$ are level parameters, ϱ_y is the automatic stabilizer component of the transfer, and ϱ_b describes the sensitivity of the transfer to the amount of securities issued by the government. In the last part, to model the possibility of a countercyclical macroprudential policy, the capital ratio and LTV ratio can be modeled following the equation:

$$\gamma_t = \gamma + \alpha_\gamma \left(\frac{b_t}{y_t} - \frac{b}{y}\right) + \tilde{\varepsilon}_{\gamma,t} \tag{19}$$

$$m_{I,t} = m_I - \alpha_m \left(\frac{p_{I,t} b_{I,t}}{y_t} - \frac{p_I b_I}{y}\right) + \tilde{\varepsilon}_{m,t} \tag{20}$$

Where the market value of the credit is $b_t=p_{I,t}b_{I,t}+p_{E,t}b_{E,t}$. To capture the countercyclical sensitivity for each capital and LTV policy through the parameters α_γ and α_m.

F. Market Clearing

Market clearing conditions are met when the intermediate domestic good used for final good production for consumption, capital investment, housing investment, government expenditure, and export is modeled as follows:

$$c_{d,t} + i_{kd,t} + i_{hd,t} + g_{d,t} + y_{xd,t} = y_{d,t} \tag{21}$$

With the same principle, the model for imported goods used by final goods producers is modeled as follows:

$$c_{m,t} + i_{km,t} + i_{hm,t} + g_{m,t} + y_{xm,t} = y_{m,t} \tag{22}$$

Equilibrium conditions are met when the price and allocation of each agent are the maximum conditions for utility households, banks, and entrepreneurs to meet the conditions for maximum dividends, and all companies maximize profit with the constraints faced by each agent.

III. METHODOLOGY AND DATA

In performing parameter estimation, we use a Bayesian approach. After determining the prior distribution for each parameter based on previous studies related to Indonesia, we determine the posterior of each parameter. Considering that the estimated parameter number is large, we take several steps to make the estimate. First, we derive the likelihood model using random walk metropolis hasting and then calculate the model's likelihood using the harmonic mean estimator. Finally, the estimated values from metropolis hasting are used to maximize the likelihood function.

We used Dynare[1] to perform a linearization procedure by transforming each variable and computing the steady-state value of the model. After determining the steady-state value for each variable, the parameters from previous studies were taken to calibrate the model. Then, we use the Bayesian technique to estimate the parameters using the Indonesian economic indicators. We explain the observed data utilized, parameter calibration, previous and posterior, and parameter distribution to describe this approach.

A. Data

Estimates are developed utilizing 15 macroeconomics data, beginning in the fourth quarter of 2005 and ending in the second quarter of 2021. Samples started when Bank Indonesia began adopting the inflation-targeting policy framework. Domestic consumer price index, world inflation, imported price index, export price index, policy rate, deposit rate, loan rate to impatient household, loan rate to entrepreneur, consumption, total outstanding export, total domestic output, import output, foreign GDP, real effective exchange rate, and foreign interest rate are among the 15 observation data sets. In addition, there is the international economy, which is represented by statistics from the United States.

Table 1.
Observed Variables

This table lists detailed data descriptions of all variables considered in this study.

No	Variable	Source
1	Wholesale Price Index on Export	Bank Indonesia
2	Real Effective Exchange Rate	CEIC
3	Consumer Price Index	Bank Indonesia
4	Wholesale Price Index on Import	Bank Indonesia
5	US Consumer Price Index	CEIC
6	Gross Domestic Product (Constant price 2010=100)	Bank Indonesia
7	Consumption (Constant price 2010=100)	Bank Indonesia
8	Export (Constant price 2010=100)	Bank Indonesia
9	Import (Constant price 2010=100)	Bank Indonesia
10	Policy Rate (BI Rate, Policy Rate)	Bank Indonesia
11	Lending Rate on Working Capital Loan	Bank Indonesia
12	Lending Rate on Consumption Loan	Bank Indonesia
13	Three months deposit rate	Bank Indonesia
14	US Policy rate	Bank Indonesia
15	US Gross Domestic Product (YoY)	CEIC

The graph illustrates the observation data that will be used in the estimation. For estimation needs using Bayesian DSGE. Estimation must consider the DSGE model describing actual variables' dynamics. Therefore, we transformed the

[1] Dynare is a software platform for handling a wide class of economic models, in particular Dynamic Stochastic General Equilibrium (DSGE) and overlapping generations (OLG) models.

observation data into stationary data by carrying out logistic transformations for nominal variables and then using Hodric-Prescot to exclude trends from the data. This can be written as follows:

$$ln(Y_t) = ln(\hat{Y}_t) + trend \tag{23}$$

Meanwhile, in this situation, the price data are various interest rate statistics that are employed in the model. We use transformation:

$$\hat{r_t} = 1 + \frac{r_t}{4\times100} \tag{24}$$

For consumer price we use the following transformation:

$$\pi = \frac{CPI_t}{CPI_{t-1}} - 1 \tag{25}$$

B. Calibration

Because the variables utilized in the calibration do not contain information about Indonesian, we use the calibration method to acquire the initial value of the parameters. The calibrated model is then utilized to estimate the appropriate model for Indonesia.

Table 2.
Calibrated Parameters

This table lists the calibrated parameters used in the model based on DSGE literature in Indonesia.

No.	Parameters	Symbol	Value	Reference
1.	Discount Factor - Patient Households.	β_p	0.99	Chawwa (2021)
2.	Discount Factor - Impatient Households.	β_i	0.975	Chawwa (2021)
3	Discount Factor - Banks	β_b	0.99	Chawwa (2021)
4	Discount Factor - Entrepreneurs	β_e	0.975	Chawwa (2021)
5	Consumption Habit - Patient Households.	ζ_p	0.60	Chawwa (2021)
6	Consumption Habit - Impatient Households.	ζ_i	0.60	Chawwa (2021)
7	Housing Level for Patients Households.	ξ_{hp}	0.12	Setiastuti *et al*. (2021)
8	Housing Level for Impatient Households.	ξ_{hi}	0.12	Setiastuti *et al*. (2021)
9	Depreciation Rate - Capital	δ_k	0.025	Setiastuti *et al*. (2021)
10	Depreciation Rate - Housing	δ_h	0.025	Setiastuti *et al*. (2021)
11	Share of Capital	α_k	0.33	Setiastuti *et al*. (2021)
12	Import Demand Elasticity - Consumption	η_c	1.755	Setiastuti *et al*. (2021)
13	Import Demand Elasticity - Business Inv.	$\eta_{m,t}$	1.659	Setiastuti *et al*. (2021)
14	Import Demand Elasticity - Exports	$\eta_{x,t}$	1.095	Setiastuti *et al*. (2021)
15	Taylor Rule - Smoothing	ρ	0.68	
16	Taylor Rule - Inflation	ϕ_π^R	0.25	Setiastuti *et al*. (2021)
17	Taylor Rule - Output	ϕ_y^R	2	Setiastuti *et al*. (2021)
18	Capital Requirements	γ	0.14	Budiman *et al*. (2022)
19	Loan to Value	m_i	0.75	Setiastuti *et al*. (2021)

The table contains information on the calibration parameters based on a previous study on Indonesia (Chawwa,2021; Setiastuti,2021), intending to represent the Indonesian economy using this parameter. We use discount factor for patient household (β_p), the discount factor for impatient household (β_i), discount factor bankers (β_b), and discount factor for entrepreneurs (β_E) from Chawwa (2021). In our model, the household sector exhibits a rigid response to changes in consumption caused by shocks (habit formation). Then, in household utilities, we utilize weights against housing stock. The magnitude of this weight parameter from Setiastuti (2021) is used where the magnitude of ξ_{hp}=ξ_{hi}=0,12. The depreciation rate of the housing stock is taken from Setiastuti (2021), where the parameter δ_k=δ_h=0,025.

C. Maximum Likelihood Estimation

It is preferable to calibrate all parameters employed to obtain their values. Therefore, we employ two estimation methods: Random Walk Metropolis Hasting (RWMH) to obtain the posterior and maximum likelihood estimations. Because of the considerable number of parameters, we mix the two types of estimation methods to estimate the parameters, and we do not employ the Bayesian DSGE-VAR methodology (Del Negro *et al*., 2014) in this case.

We constructed 131 equations with 116 parameters in this model and used 15 observation variables to estimate all of the parameters. Given the model's size, we aim to merge the two strategies by first assessing the value of establishing the posterior distribution using the RMWH method, followed by maximum likelihood estimation. To summarize, a random walk is employed as a practical implementation of the Metropolis-Hastings algorithm. The random-walk process follows a Markov chain process that evolves according to the following definition $q(\beta^{(t)})$ or can be written in a function

$$\beta^{(t+1)} = \beta^{(t)} + \varepsilon \tag{26}$$

Where $\varepsilon \sim g(.)$ distributed through the distribution function $g(.)$. Because $g(.)$ is a symmetric distribution function, we may write as :

$$q\left(\beta^{(t)}\right) = g(-\varepsilon) = g(\varepsilon) \tag{27}$$

If the distribution of $\beta^{(t+1)}$ and $\beta^{(t)}$ are symmetrical, then we can write $q(\beta^{(t)})$=$q(\beta^{(t+1)})$, then calculate the metropolis Hastings acceptance ratio $\alpha(\beta^{(t)})$.

The RMWH estimation results are then used as initial values in the maximum likelihood estimation of the parameters. The main issue is that the DSGE model on medium and large scales frequently encounters issues with misspecification and irregular posterior distributions. The problem with DSGE parameter estimation is that the parameter's convergence value is highly dependent on the initial value. When the number of parameters and observable variables rises, the RMWH's effectiveness often diminishes (Herbst and Schorfheide, 2016). We use sequential

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estimating processes to solve this issue, with the maximum likelihood methodology preceding the RMWH results. Appendix A summarizes this information visually by plotting each estimated parameter's prior and posterior distributions from RWMH.

By employing this combination, the estimated parameter will better represent the characteristics of the Indonesian economy. The practical implementation of estimation using maximum likelihood starts with defining the likelihood function $l(\beta)$ as a likelihood function with parameters β. By using the second-order Newton approximation, we obtain an update parameter for each step as with the following equation:

$$\beta_{n+1} = \beta_n + l''(\beta_n)^{-1}[l'(\beta_n)] \tag{28}$$

The process of updating this parameter will be continued until the parameter values converge or can be written as $\beta_{n+1} \approx \beta_n$. The following table presents the estimation results using the two estimators. In addition, besides the convergence criteria, we also check the distribution of each parameter to ensure whether the estimated parameter has given the largest likelihood value. Our estimation results are presented in the tables below.

Table 3.
Parameter Distribution

This table provides Posterior Means, 90% posterior credible sets, and prior moments for the structural parameters. The letters in the column with the heading "Prior Type" indicate the prior density function.

Description	Parameters	Distribution	Prior mean	Post. Mean	Std. Dev.	5% interval	95% interval
Discount Factor for Patient Households	β_p	Beta	0.98	0.999	0.01	0.9995	0.9998
Discount Factor for Impatient Households	β_i	Beta	0.96	0.995	0.01	0.994	0.996
Discount Factor for Banks	β_b	Beta	0.98	0.991	0.01	0.983	0.998
Discount Factor for Entrepreneurs	β_e	Beta	0.96	0.923	0.01	0.886	0.954
Labor Supply Elasticity for Patient Households	ζ_p	Beta	0.6	0.601	0.02	0.575	0.628
Labor Supply Elasticity for Impatient Households	ζ_i	Beta	0.6	0.559	0.1	0.528	0.588
Housing Level of Patient Households	ξ_{hp}	Gamma	0.12	0.119	0.012	0.096	0.141
Housing Level of Impatient Households	ξ_{hi}	Gamma	0.2	0.221	0.02	0.197	0.245
Share of Capital in Productin Function	α_k	Beta	0.3	0.226	0.05	0.202	0.247
Depreciation Rate of Capital	δ_k	Beta	0.025	0	0.02	0	0
Depreciation Rate of Housing	δ_h	Beta	0.025	0.0001	0.02	0	0.0002
Import Share in Business Investment	ϕ_{ik}	Beta	0.18	0.185	0.02	0.158	0.213

Table 3.
Parameter Distribution (Continued)

Description	Parameters	Distribution	Prior mean	Post. Mean	Std. Dev.	5% interval	95% interval
Import Share in Housing Investment	ϕ_{ih}	Beta	0.1	0.090	0.02	0.063	0.125
Import Share in Gov. Expenditure	ϕ_g	Beta	0.08	0.092	0.02	0.066	0.124
Import Share in Exports Goods	ϕ_x	Beta	0.35	0.261	0.02	0.232	0.288
Import Demand Elasticity of Consumption	η_c	Gamma	1.756	1.788	0.02	1.766	1.813
Import Demand Elasticity of Business Investment	η_{ik}	Gamma	1.659	1.649	0.02	1.623	1.675
Import Demand Elasticity of Housing Investment	η_{ih}	Gamma	1.659	1.642	0.02	1.606	1.675
Import Demand Elasticity of Government Expenditure	η_g	Gamma	0.4	0.369	0.02	0.348	0.393
Import Demand Elasticity of Exports Goods	η_x	Gamma	1.095	1.081	0.02	1.054	1.105
Export Persistence (Foreign Habit)	ζ^*	Beta	0.5	0.464	0.02	0.447	0.484
Import Share of Foreign Economy	ϕ^*	Beta	0.3	0.230	0.02	0.185	0.271
Export Demand Elasticity	η^*	Gamma	1.4	1.452	0.02	1.425	1.476
Monitoring Cost Elasticity on Mortgage Loans	χ_{I2}	Gamma	1.52	1.535	0.01	1.517	1.553
Monitoring Cost Elasticity on Business Loans	χ_{E2}	Gamma	1.1	1.093	0.01	1.075	1.108
Monitoring Cost Elasticity on Deposits	χ_{d2}	Gamma	1.5	1.484	0.01	1.469	1.498
Monitoring Cost Elasticity on Capital Regulation	χ_{d3}	Gamma	0.9	0.836	0.02	0.808	0.864
Country Risk Elasticity - NFA	$\varrho_{\aleph}$	Gamma	0.95	0.956	0.02	0.006	
Taylor Rule – Smoothing Weights	ρ	Beta	0.75	0.937	0.06	0.921	0.955
Taylor Rule on Inflation	a_π	Gamma	0.25	0.265	0.06	0.207	0.316
Taylor Rule on Output	a_y	Normal	2	2.024	0.06	2	2.049
Gov. Transfers to Impatient Households	Ξ_I	Beta	0.1	0.123	0.01	0.106	0.141
Government Transfer Response to Output	ϱ_y	Beta	0.1	0.085	0.05	0.052	0.120
Government Transfer Response to Government Debt	ϱ_b	Beta	0.1	0.094	0.05	0.066	0.123
Share of Patient Households In Capital	μ_k	Beta	0.6	0.608	0.05	0.576	0.636
Share of Patient Households. In Labor	μ_l	Beta	0.3	0.245	0.05	0.195	0.289

Table 4.
Distribution of Shock

This table provides Posterior modes, medians, 90% posterior credible sets, and prior moments for the structural parameters. The letters in the column with the heading "Prior Type" indicate the prior density function.

Shocks Description	Parameters	Distribution	Prior Mean	Post. Mean	Std Dev.	5% Interval	95% Interval
Government expenditure	ϵ_g	InvGamma	0.03	0.029	Inf	0.023	0.035
Productivity	ϵ_z	InvGamma	0.06	0.049	Inf	0.033	0.066
Capital quality	ϵ_{ψ_K}	InvGamma	0.02	0.019	Inf	0.007	0.031
Housing quality	ϵ_{ψ_H}	InvGamma	0.01	0.00	Inf	0.001	0.003
Exuberance - capital	ϵ_{κ_K}	InvGamma	0.02	0.009	Inf	0.003	0.019
Exuberance - housing	ϵ_{κ_H}	InvGamma	0.02	0.01	Inf	0.005	0.016
Country risk	ϵ_{Φ_t}	InvGamma	0.01	0.036	Inf	0.001	0.078
Foreign - output	ϵ_{y^*}	InvGamma	0.01	0.006	Inf	0.005	0.007
Foreign - inflation	ϵ_{π^*}	InvGamma	0.01	0.012	Inf	0.009	0.014
Foreign - interest rate	ϵ_{r^*}	InvGamma	0.01	0.012	Inf	0.009	0.014
Taylor rule	ϵ_r	InvGamma	0.01	0.002	Inf	0.001	0.002
Shock to transfers	ϵ_{tr}	InvGamma	0.03	0.051	Inf	0.021	0.080
Capital requirement	ϵ_γ	InvGamma	0.01	0.008	Inf	0.002	0.015
Loan to Value	ϵ_m	InvGamma	0.02	0.013	Inf	0.003	0.028
Risk-taking	$\epsilon_{risk\text{-}taking}$	InvGamma	0.01	0.002	Inf	0.001	0.004

IV. RESULTS AND DISCUSSION

We examine the Impulse Response Function (IRF) to foreign shocks to assess the impact of this risk-taking behavior on macroeconomic dynamics. To better understand the external shocks, we describe the IRF of foreign output shock, foreign interest rate shock, foreign inflation, and country risk premium. The parameter values used in the study are based on the previously reported maximum likelihood results.

A. Long-run Impact of Foreign Output Shock

In the first simulation, we simulate the shock of foreign output, *y**, to understand how it impacts macroeconomic dynamics in the long term, as shown in Figure 3. This scenario is also in line with the development of the world economy after the COVID-19 pandemic. The global imbalance during the pandemic leaves structural problems that cause imbalanced global economic recovery, impacting firm productivity and disrupting cross-border trade in goods and services. Addressing this issue, we perform an IRF analysis to investigate how the global imbalance, represented by the foreign output shock, impacts the domestic business cycle of the Indonesian economy.

Figure 3.
Effect of 1 Percent Shock on the Foreign Output Gap

The following figures provide the IRF of an exogenous increase in the foreign output shock.

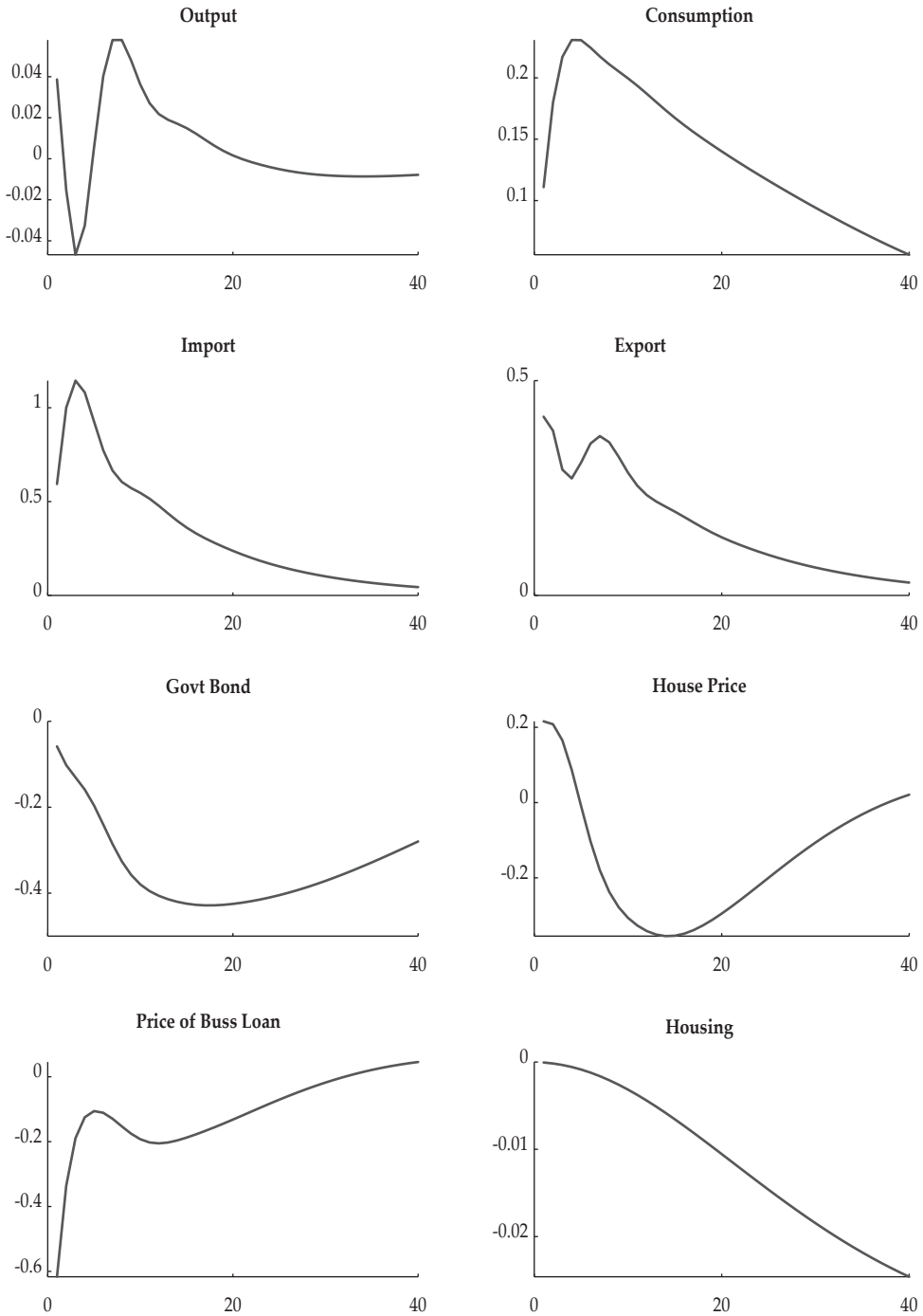

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Figure 3.
Effect of 1 Percent Shock on the Foreign Output Gap (Continued)

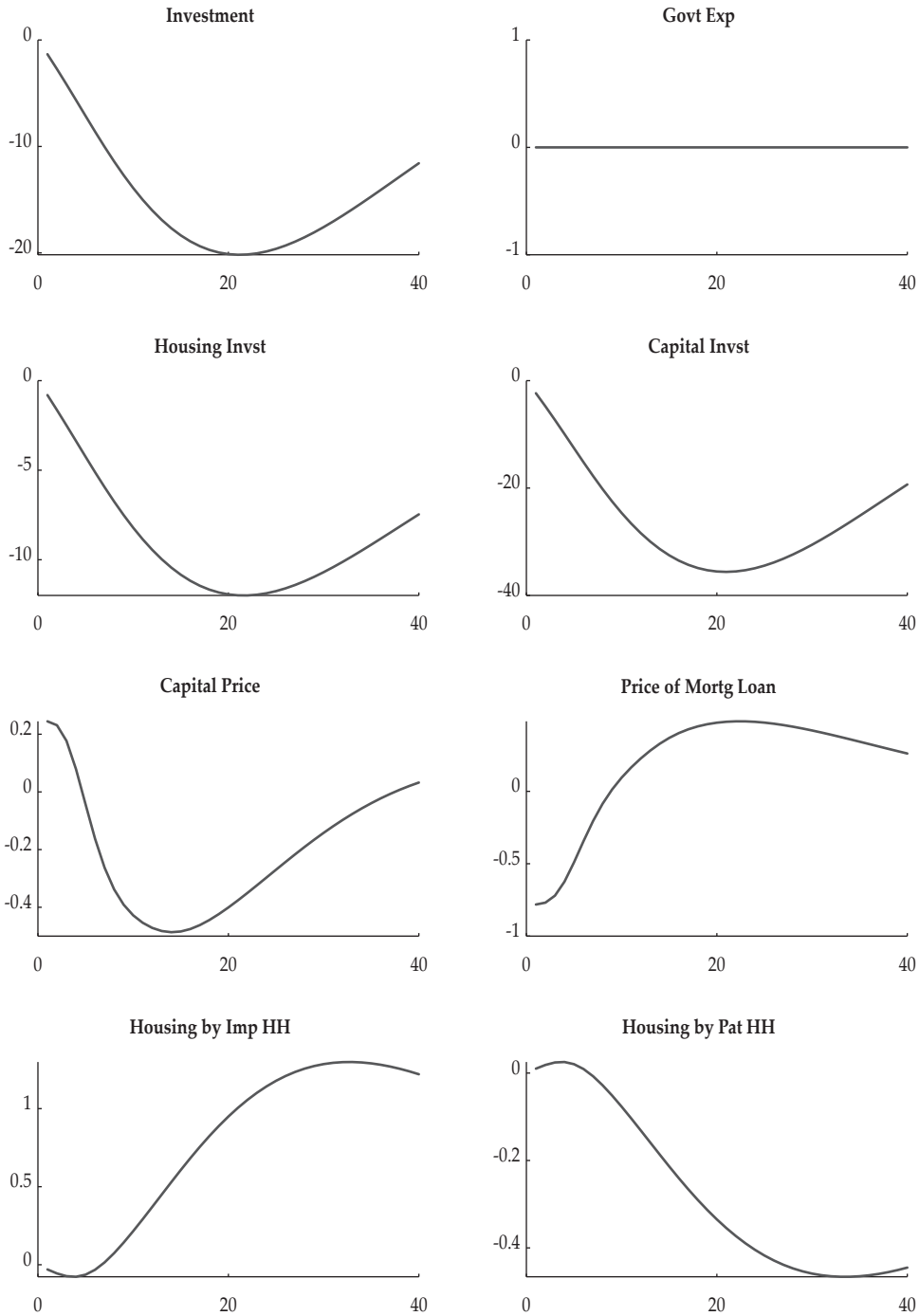


Figure 3.
Effect of 1 Percent Shock on the Foreign Output Gap (Continued)

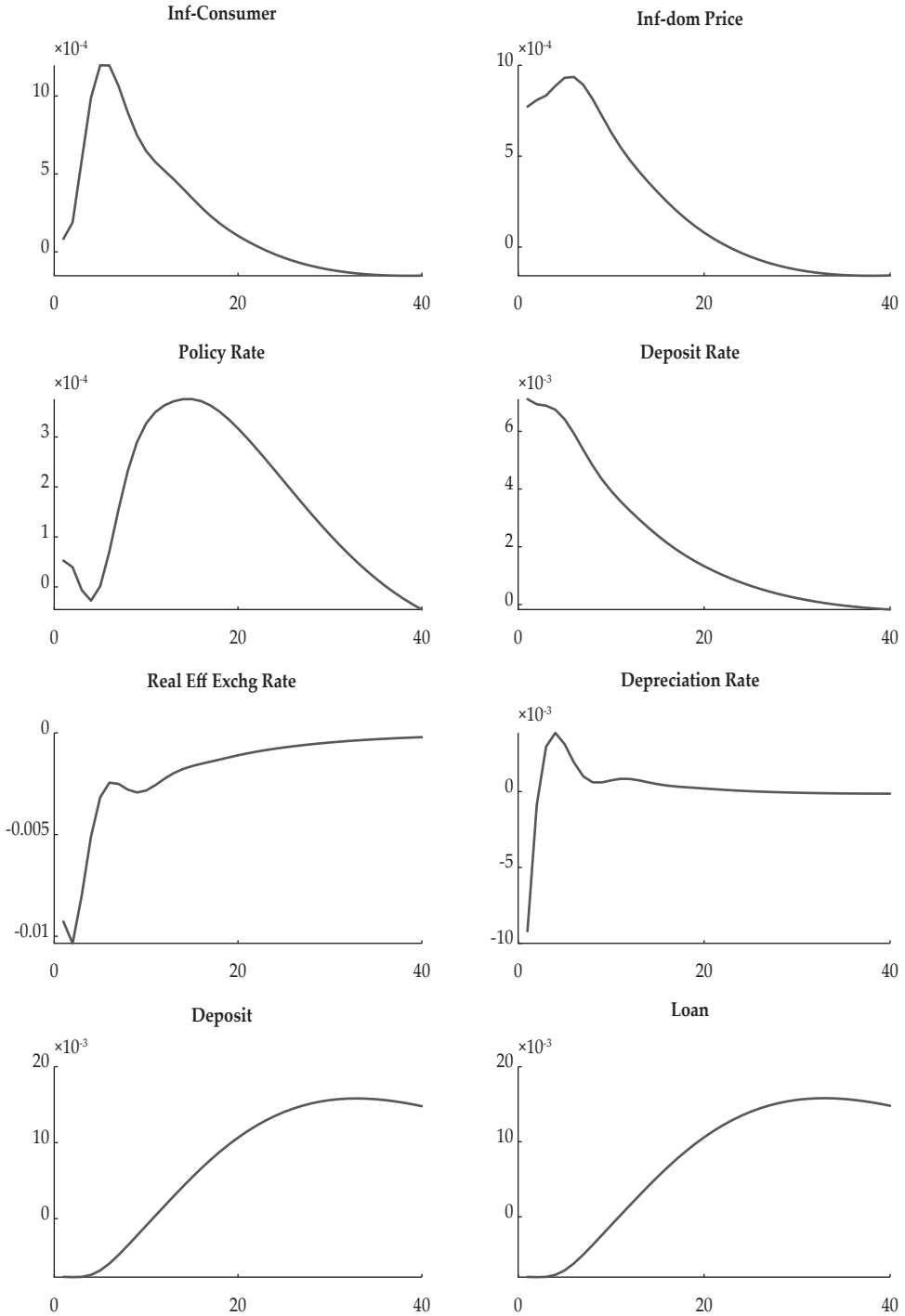
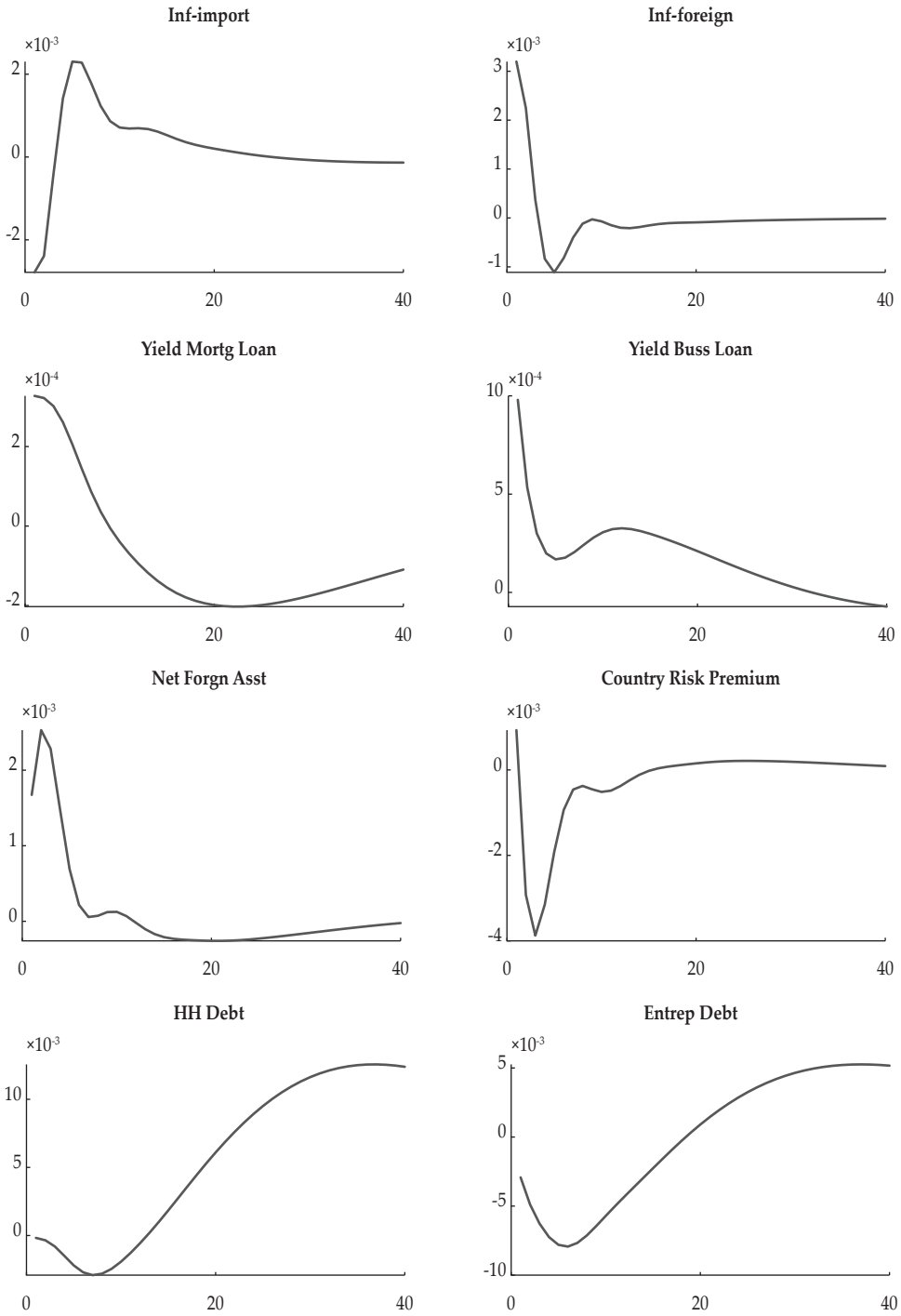


Figure 3.
Effect of 1 Percent Shock on the Foreign Output Gap (Continued)



The graph shows the impact of the shock in foreign output on the Indonesian economy. As we can see, domestic output fluctuates in the short term, but after a positive shock, the output gap will return to equilibrium. The positive shock is transmitted through the demand for domestic goods and exchange rate appreciation. According to the IRF findings, a positive shock from foreign economic growth increases demand for domestic goods and induces the exchange rate appreciation. The appreciation of the currency rate lowers the relative pricing of foreign goods, increasing demand for foreign goods. This increase had a positive impact on aggregate consumption and demand. This increase in demand for goods and services also increases consumer prices, forcing the central bank to respond by raising policy interest rates.

A positive shock to foreign output promotes the households' preference to hold foreign securities. However, it caused a negative shock to bank deposits, which caused them to fall. Banks responded by raising deposit rates to maintain liquidity, but decreasing deposits reduce financial liquidity. Therefore, banks must raise interest rates, limit their capacity to extend credit, reduce bank capacity and the bank's ability to invest in risky projects and push the overall investment. On the other hand, foreign output shock will increase capital outflow and depreciate exchange rates. As a result, it will increase the demand for foreign goods and services, thus increasing the inflation of imported goods and services.

B. Long-run Impact of Foreign Inflation Shock

We employ the IRF with a shock to international prices in our simulation to illustrate how the foreign inflation shock (ε_r^*) impacts the Indonesian economy, as shown in Figure 4, and examines its effects on the domestic business cycle. This simulation is based on the fact that inflation in Advanced Economies (AEs) and Emerging Market Economies (EMEs) has reached record highs over the last two decades. The imbalances, which create vulnerabilities, have risen alongside financial and business cycles. It is worth noting that inflation pressure challenges the central bank policy due to a significant increase in commodity prices from the end of 2020 to the beginning of 2021 and an uneven global economic recovery. Moreover, supply disruptions and intensifying global political conditions also increase producer prices and further induce inflation pressure. These facts highlight the need for a proactive macro-financial policy strategy to encourage long-term growth while preventing financial imbalances.

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Figure 4.
Effect of 1 Percent Shock to Foreign Inflation

These figures provide the IRF of an exogenous increase in the foreign inflation.

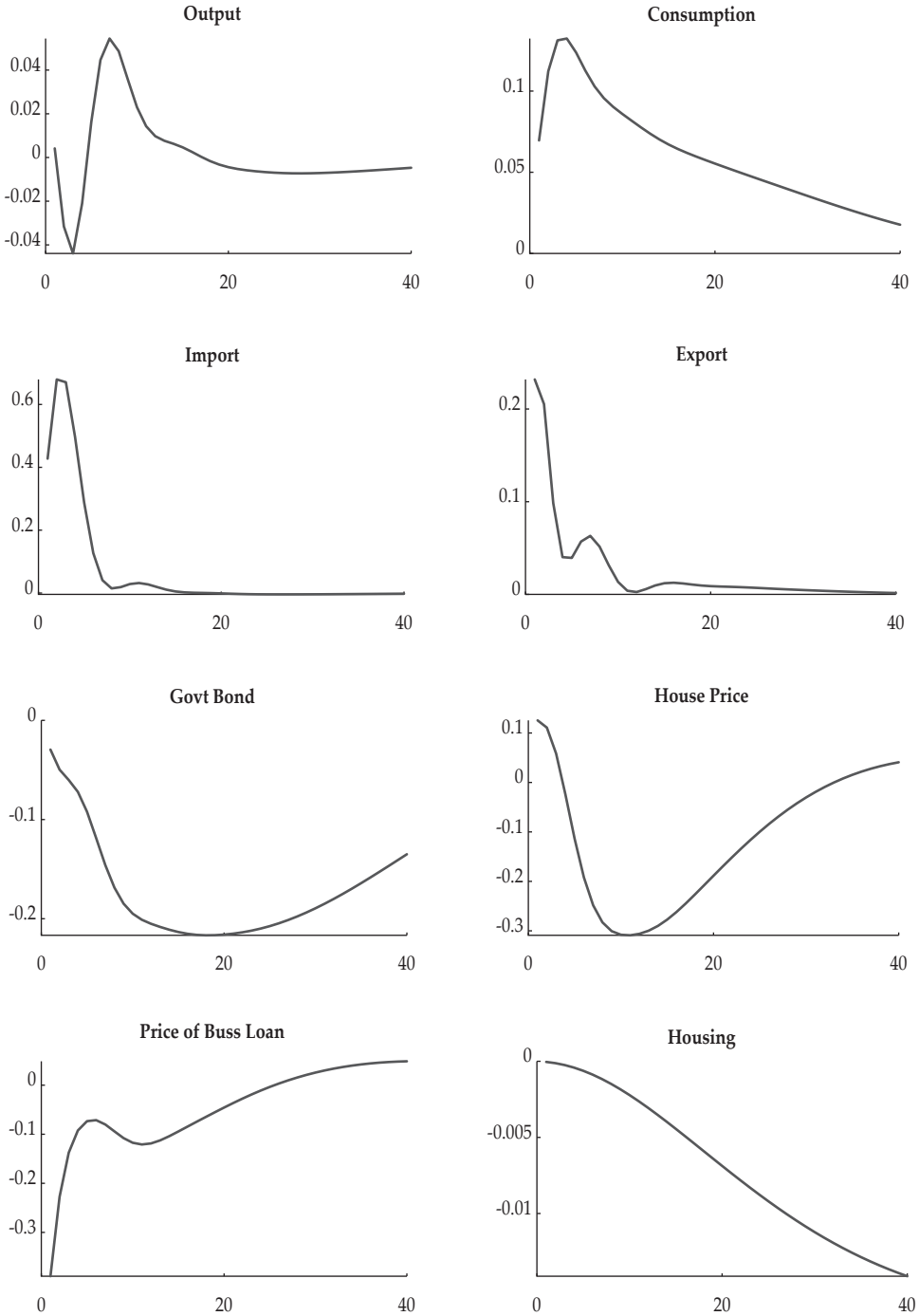


Figure 4.
Effect of 1 Percent Shock to Foreign Inflation (Continued)

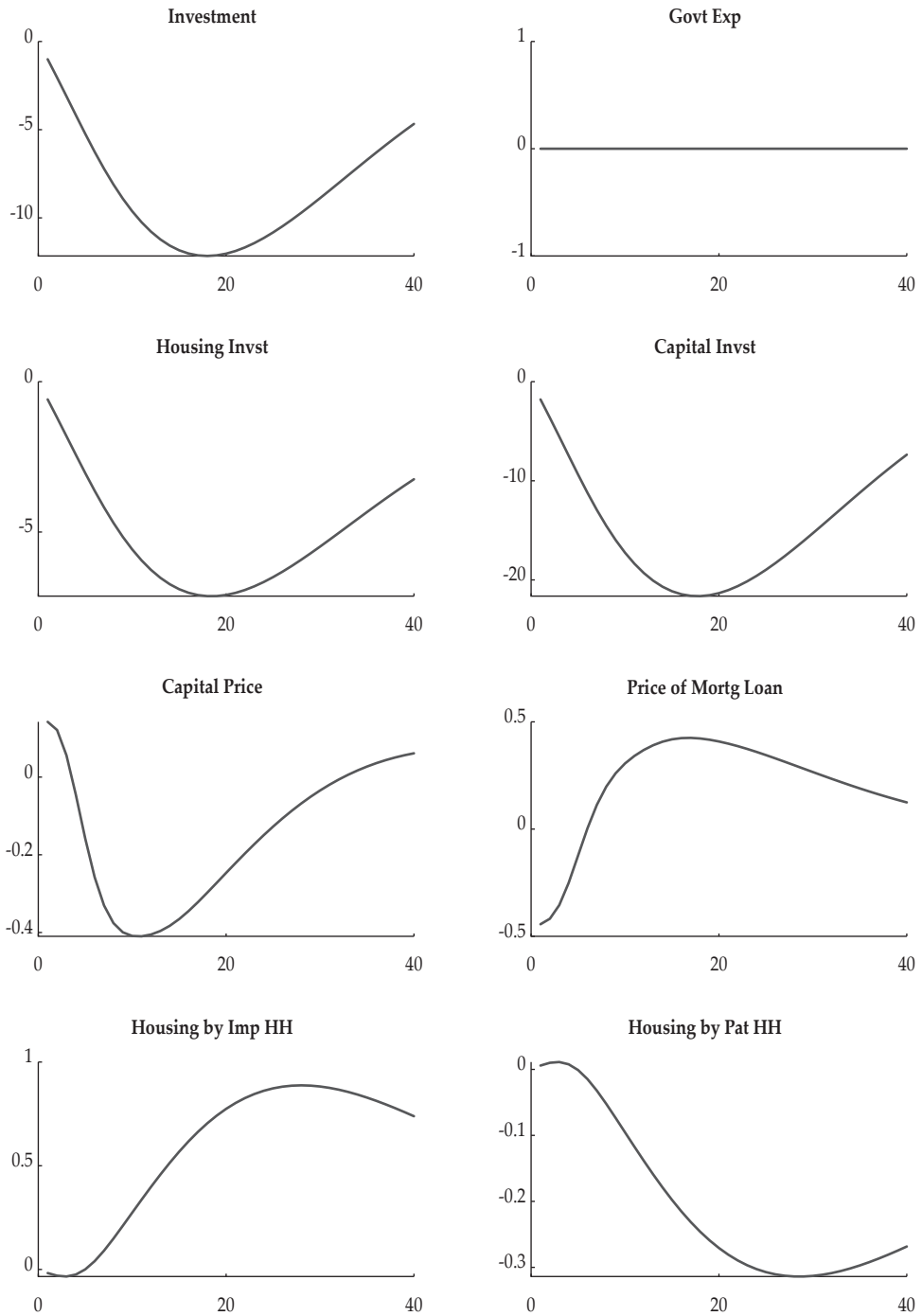


Figure 4.
Effect of 1 Percent Shock to Foreign Inflation (Continued)

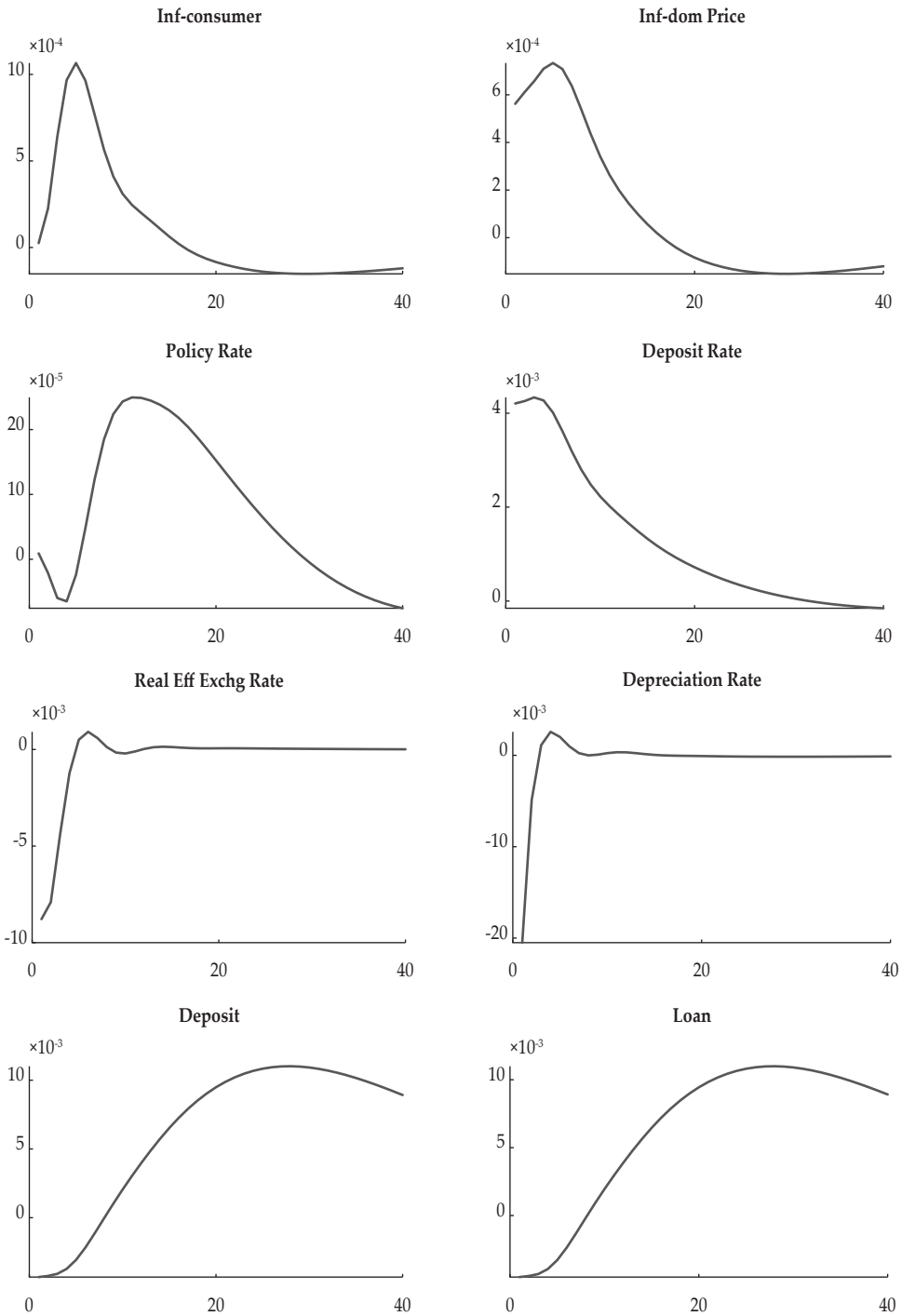
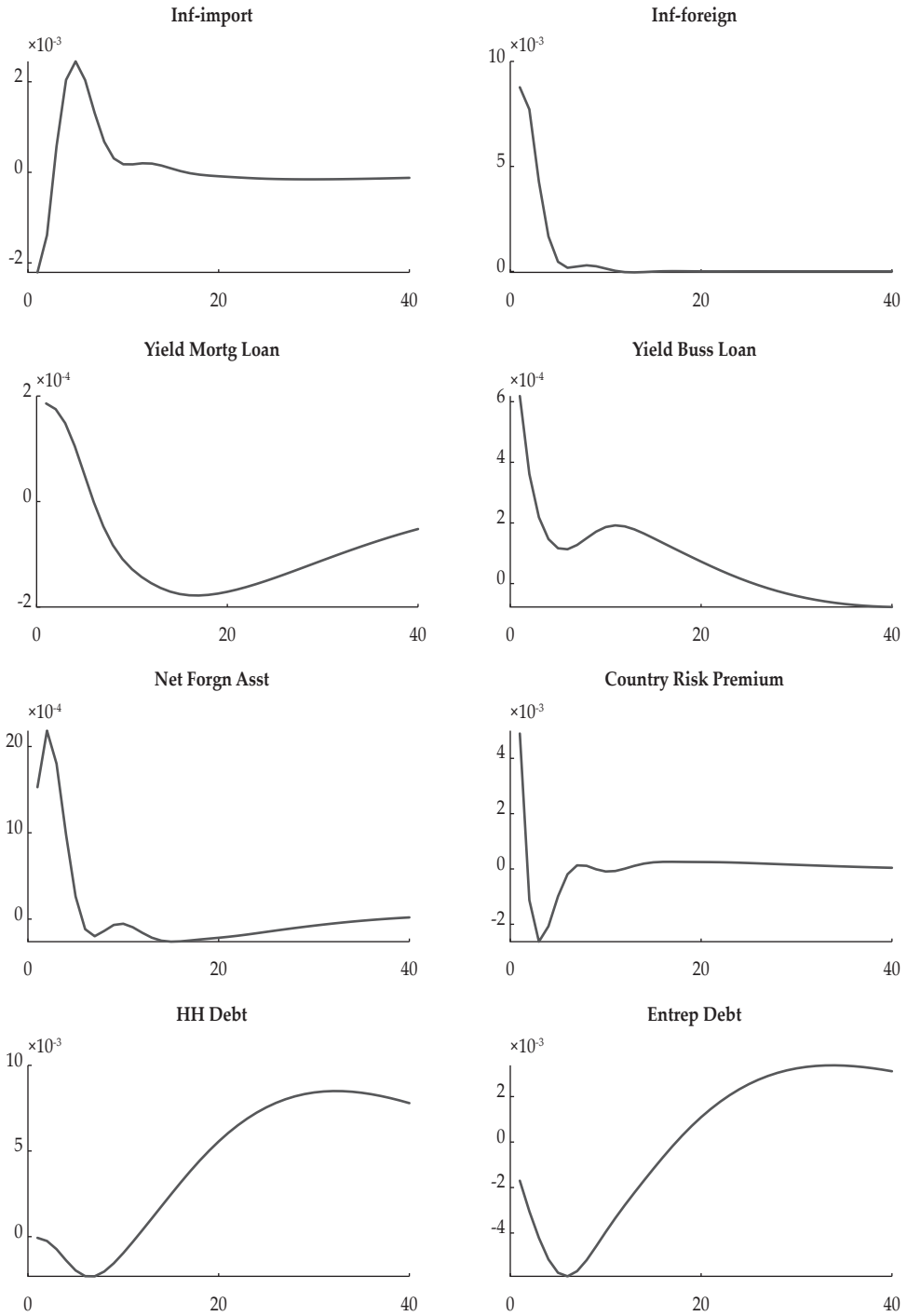


Figure 4.
Effect of 1 Percent Shock to Foreign Inflation (Continued)



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According to the IRF, the foreign inflation shock affects exchange rate movements. The exchange rate will further transmit the shock of foreign inflation to the Indonesian economy. Increasing the currency's value will enhance the demand for domestic goods. At the same time, the high demand for imported goods will increase the pressure on domestic prices and lead to aggregate price inflation.

On the other hand, rising foreign inflation has increased household preference for foreign securities portfolios, resulting in capital outflows from the Indonesian economy. This capital flight reduces banking liquidity and influences banks' capacity to channel credit to the real sector. In addition, foreign inflation shock also resulted in a rise in local consumer price levels. As a result, the central bank is forced to increase its policy rate.

C. Long-run Impact of Foreign Interest Rate Shock

Next, we conduct simulations to see how the impact of the foreign interest rate shock will be (ε_{r^*}) to the Indonesian economy. We investigate the IRF form in anticipation of a policy shock, as shown in Figure 5, that is consistent with the current situation. Following the pandemic, central banks have been urged to increase policy rates to keep inflation under control. We conduct an IRF of foreign policy shock and examine how it affects the domestic business cycle to analyze the effect of increased foreign policy. This increase in international interest rates can trigger a capital flow reversal and generate financial market volatility. This analysis is carried out to anticipate the influence on the domestic business cycle by understanding the transmission via financial channels.

Our result shows that rising foreign interest rates will induce fluctuations in domestic output. A positive shock to foreign interest rates causes currency depreciation, which leads to an increase in exports. In general, an increase in international interest rates will result in lower foreign and domestic inflation if the depreciation and increase in exports improve the competitiveness of the domestic economy. In such a case, the central bank will lower its interest rate in response to this reduction while encouraging domestic demand.

The rise in foreign interest rates has resulted in currency depreciation, risk premium increases, and capital flow volatility through financial channels. It also causes exchange rate volatility and motivates people to shift their portfolios from bank deposits to lower-risk assets, such as government securities.

Figure 5.
Effect of 1 Percent Shock to Foreign Interest Rate

These figures provide the IRF of an exogenous increase in the foreign interest rate.

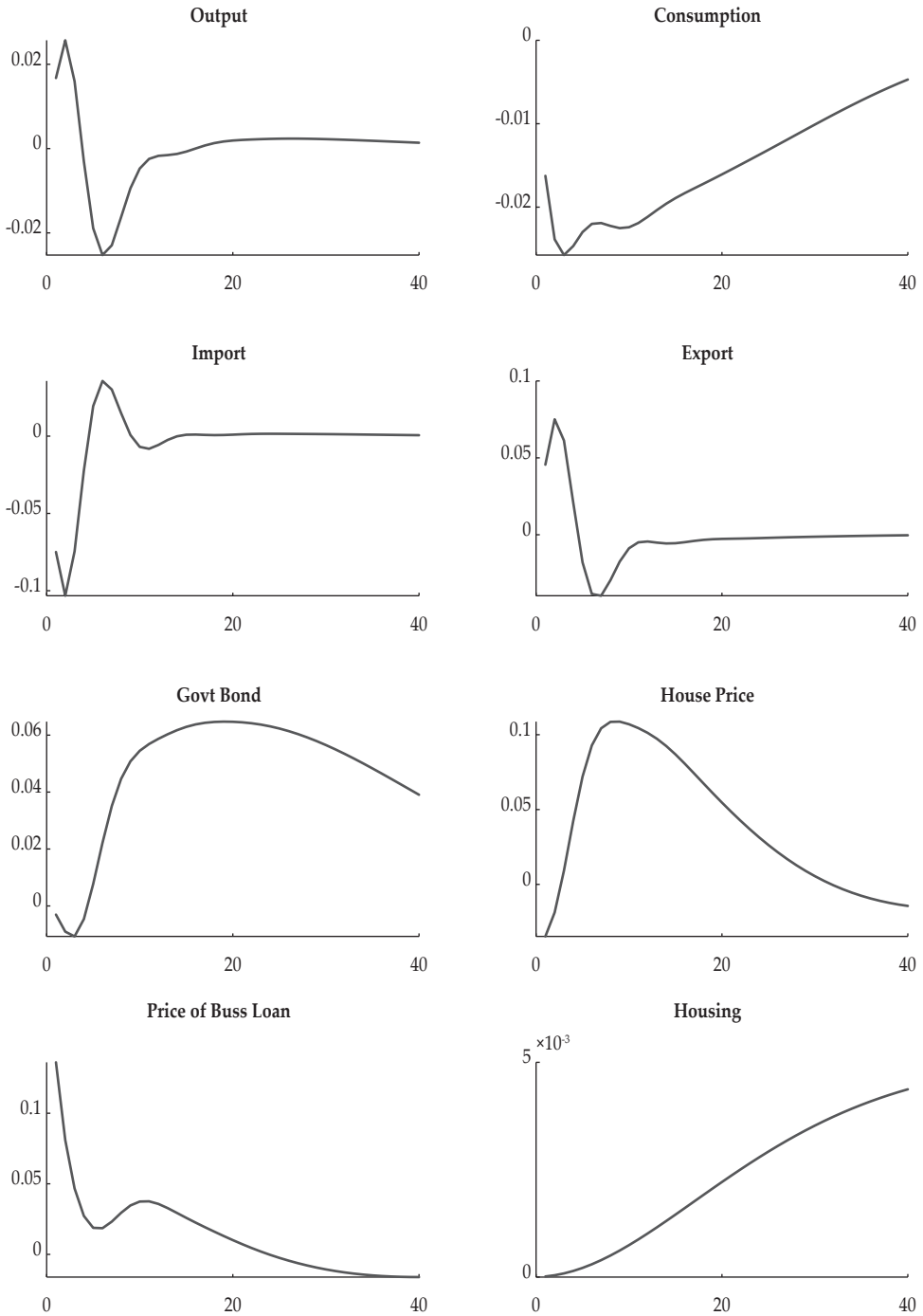


Figure 5.
Effect of 1 Percent Shock to Foreign Interest Rate (Continued)

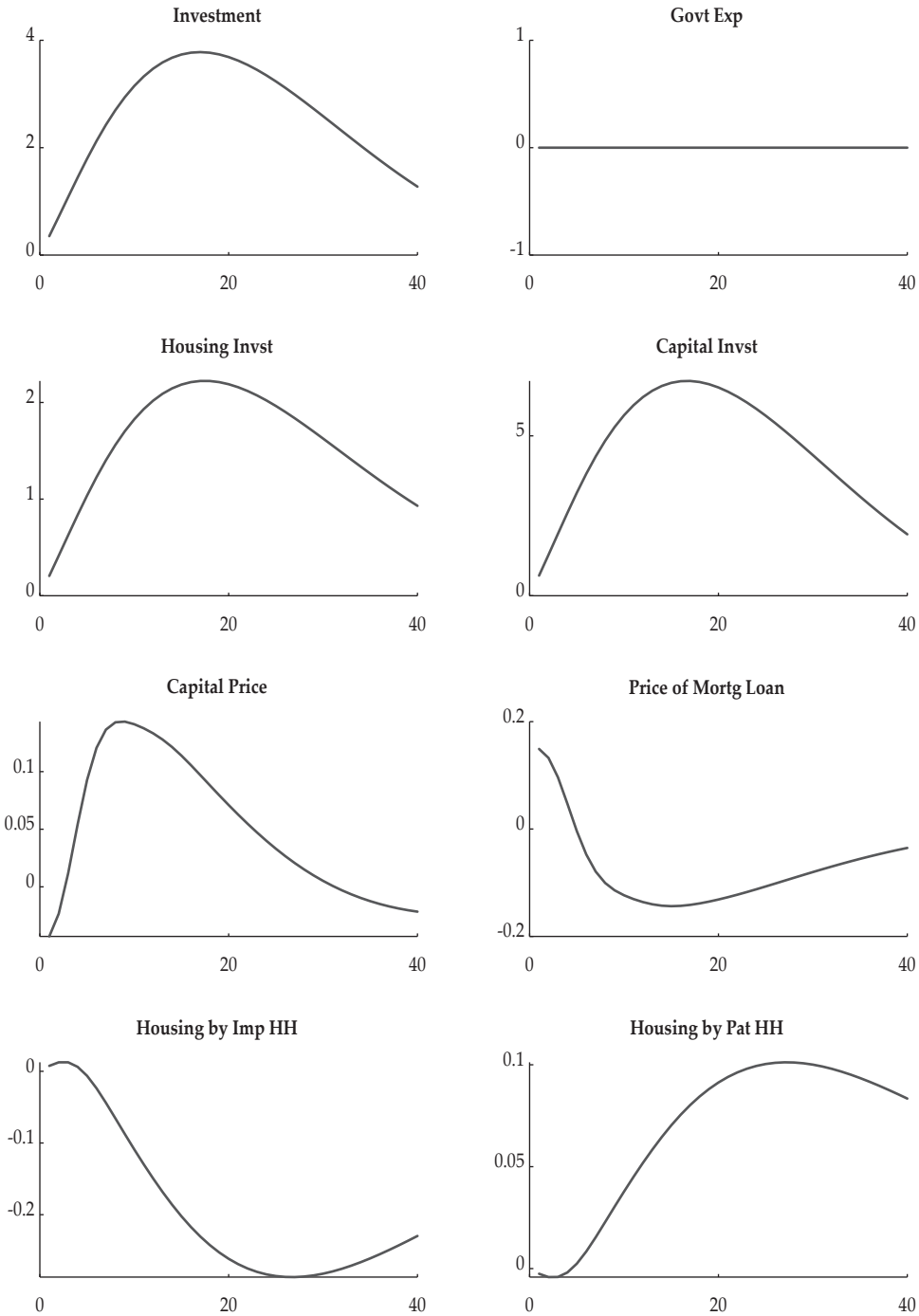


Figure 5.
Effect of 1 Percent Shock to Foreign Interest Rate (Continued)

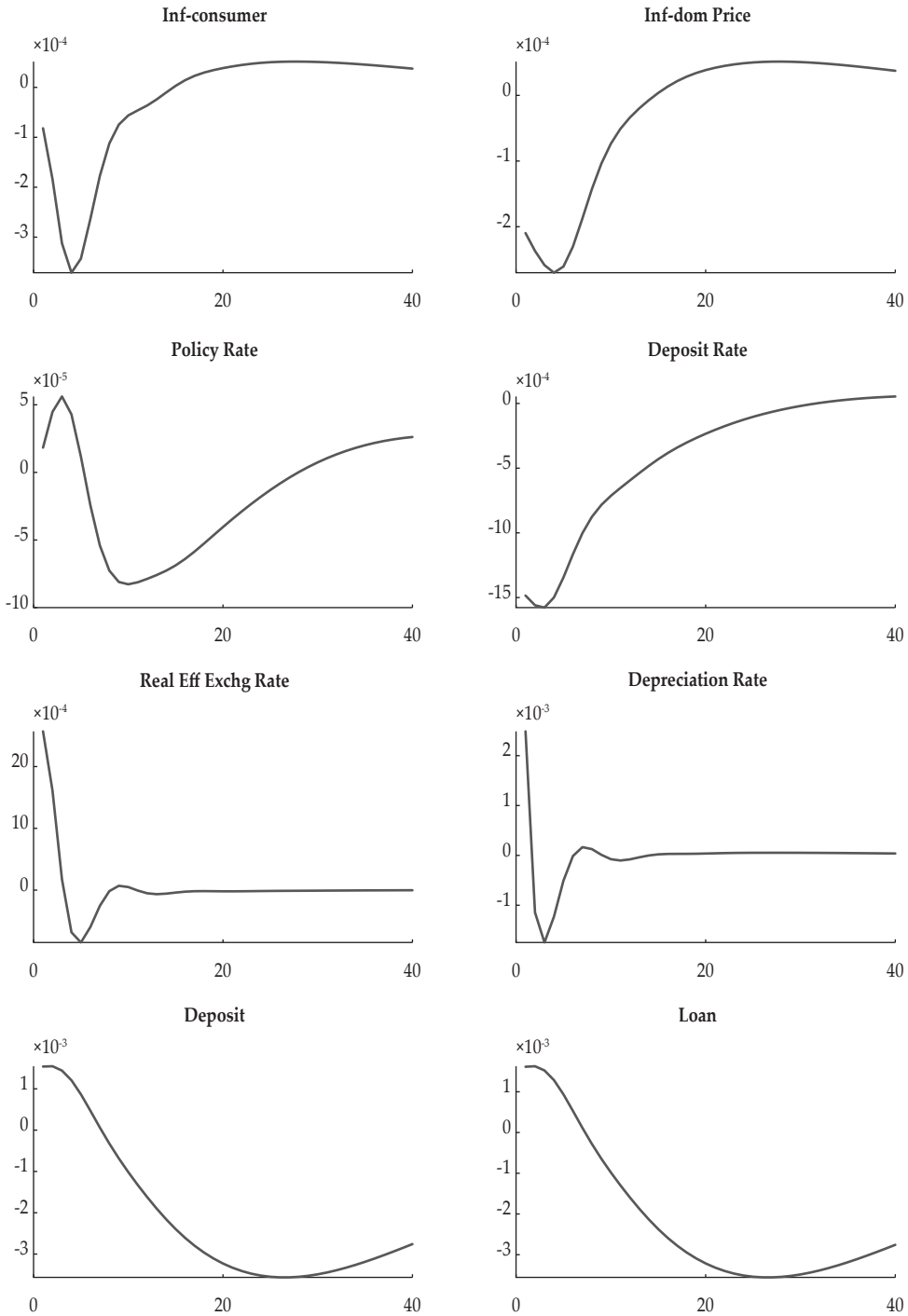
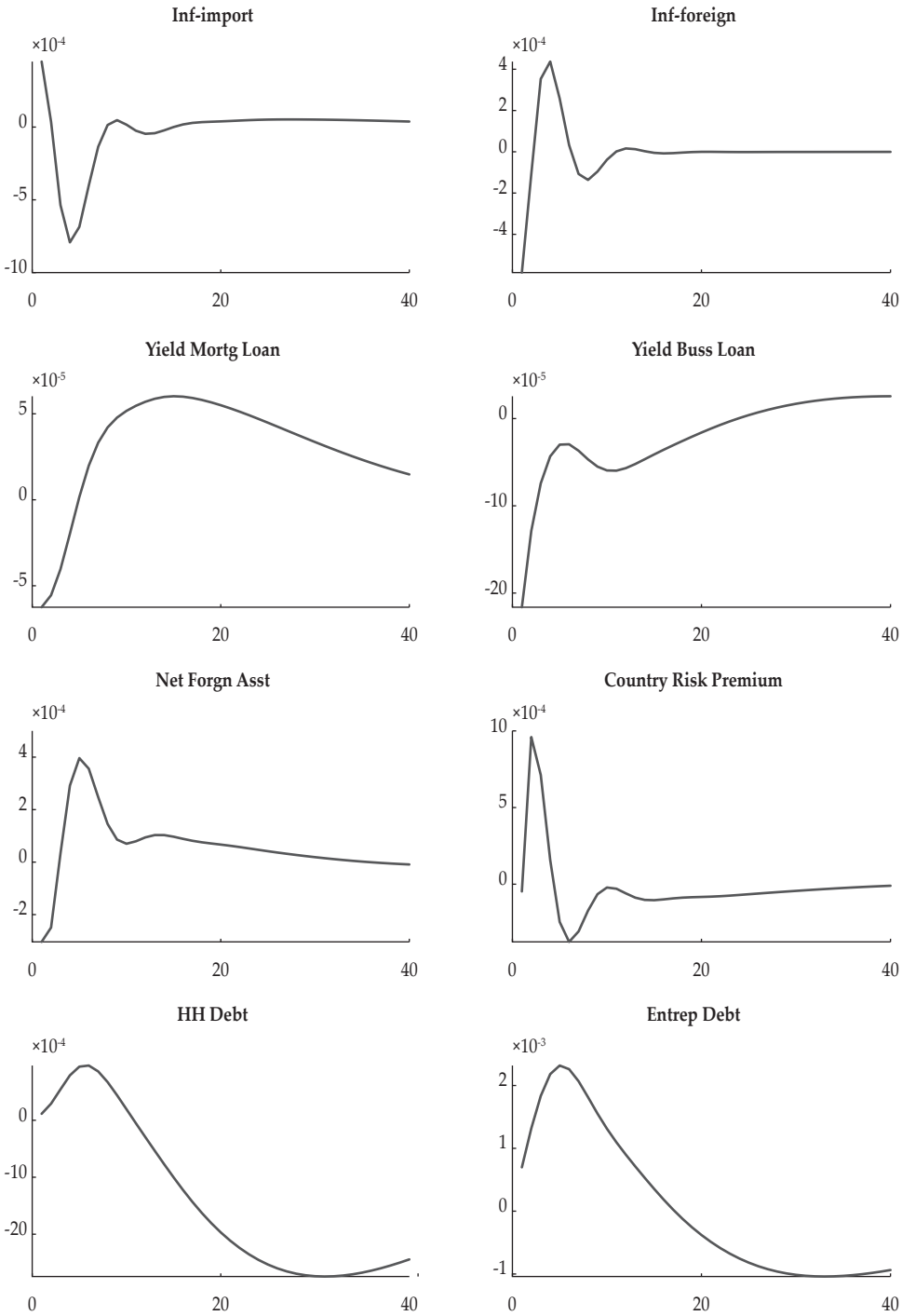


Figure 5.
Effect of 1 Percent Shock to Foreign Interest Rate (Continued)



D. Long-run Impact of Capital Exuberance Shock

We continue the simulation by shocking investors' expectations. A positive shock to investor perceptions indicates that investors depart from their optimal portfolio selection and opt for higher investment yield. Therefore, irrational exuberance can be attributed to a shock of positive and huge investor perceptions. Exuberance shocks, as shown in Figure 6, mostly happen because agents have higher expectations than investment gains on each invested capital. In this section, we consider the impact of the capital exuberance shock ($\varkappa_k$) and how it impacts the domestic economy.

Figure 6.
Effect of 1 Percent Shock to Capital Exuberance

The following figures provide the IRF of an exogenous increase in investor perception.

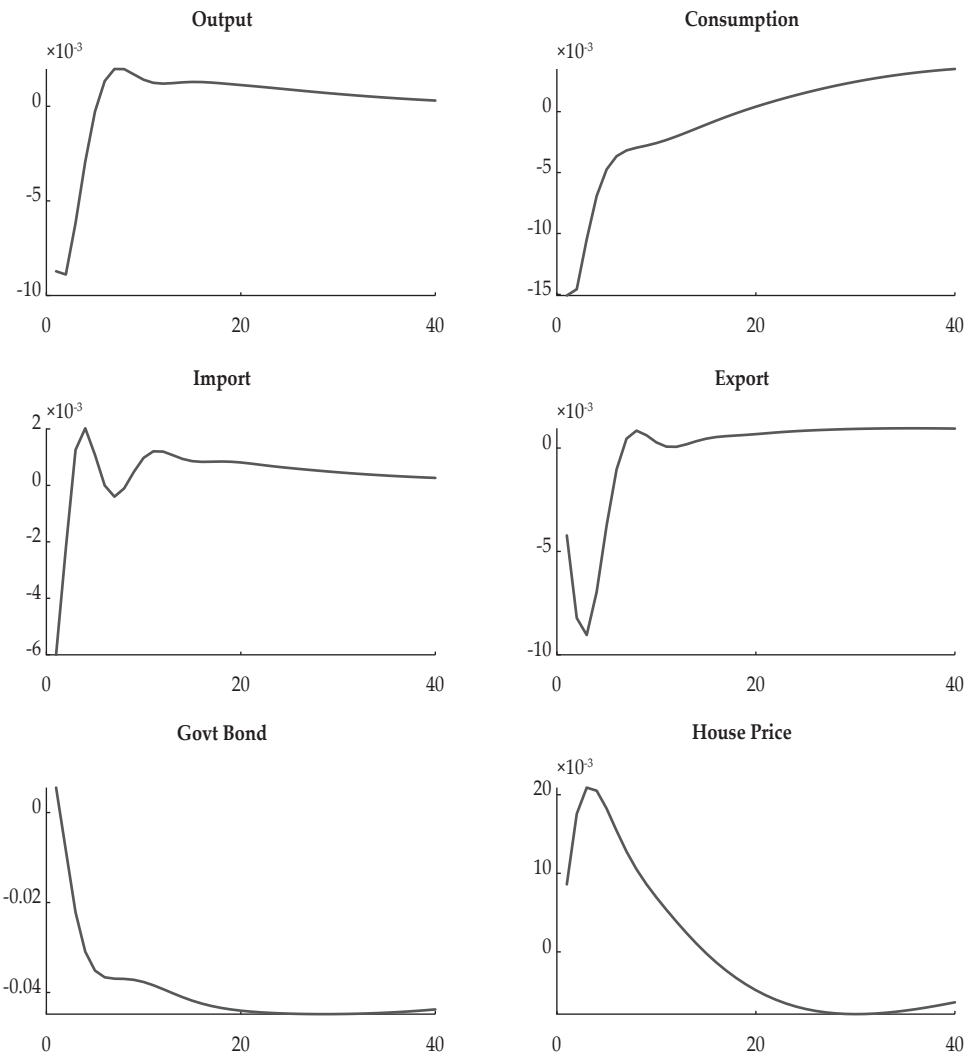


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Figure 6.
Effect of 1 Percent Shock to Capital Exuberance (Continued)

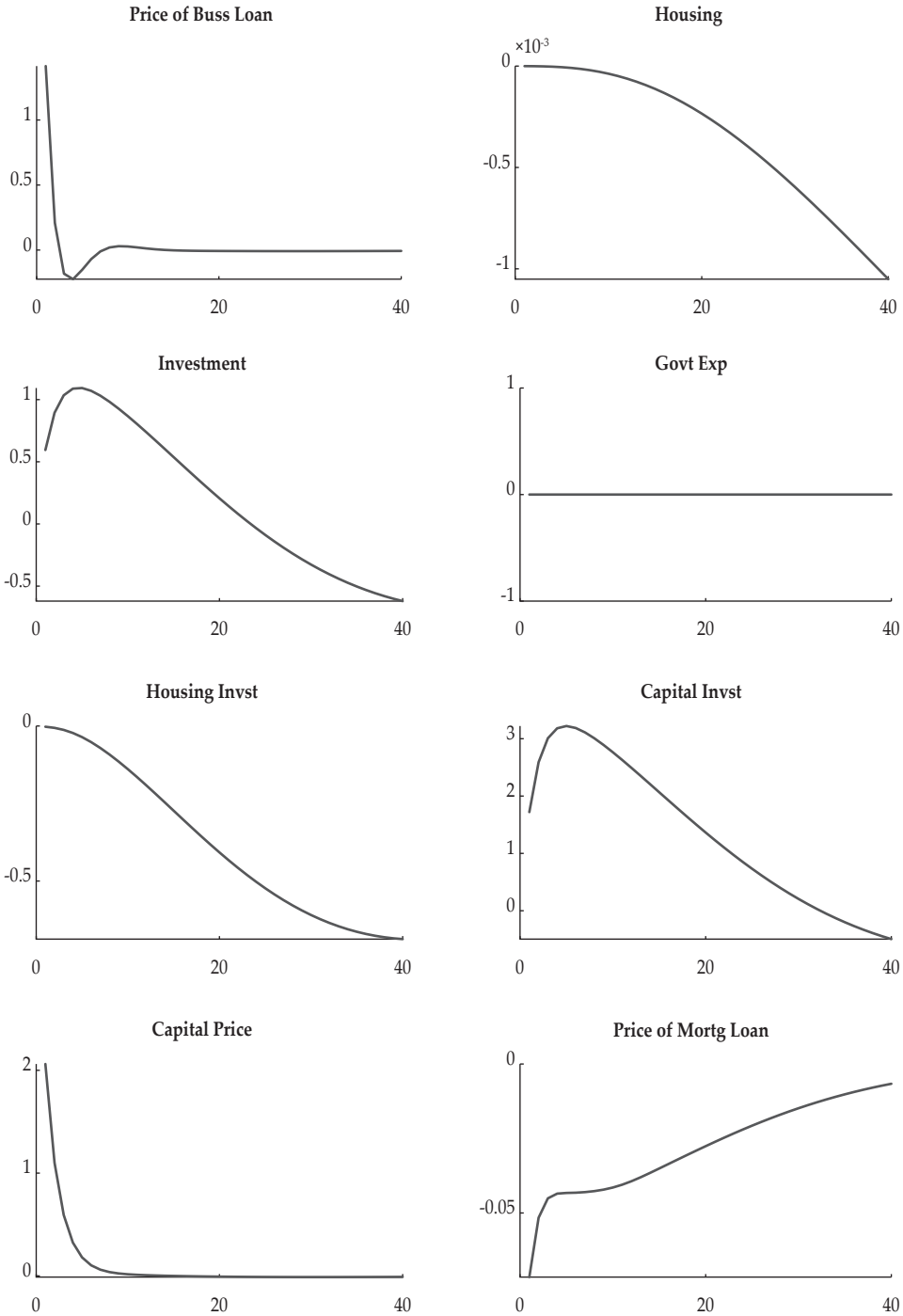

Figure 6.
Effect of 1 Percent Shock to Capital Exuberance (Continued)

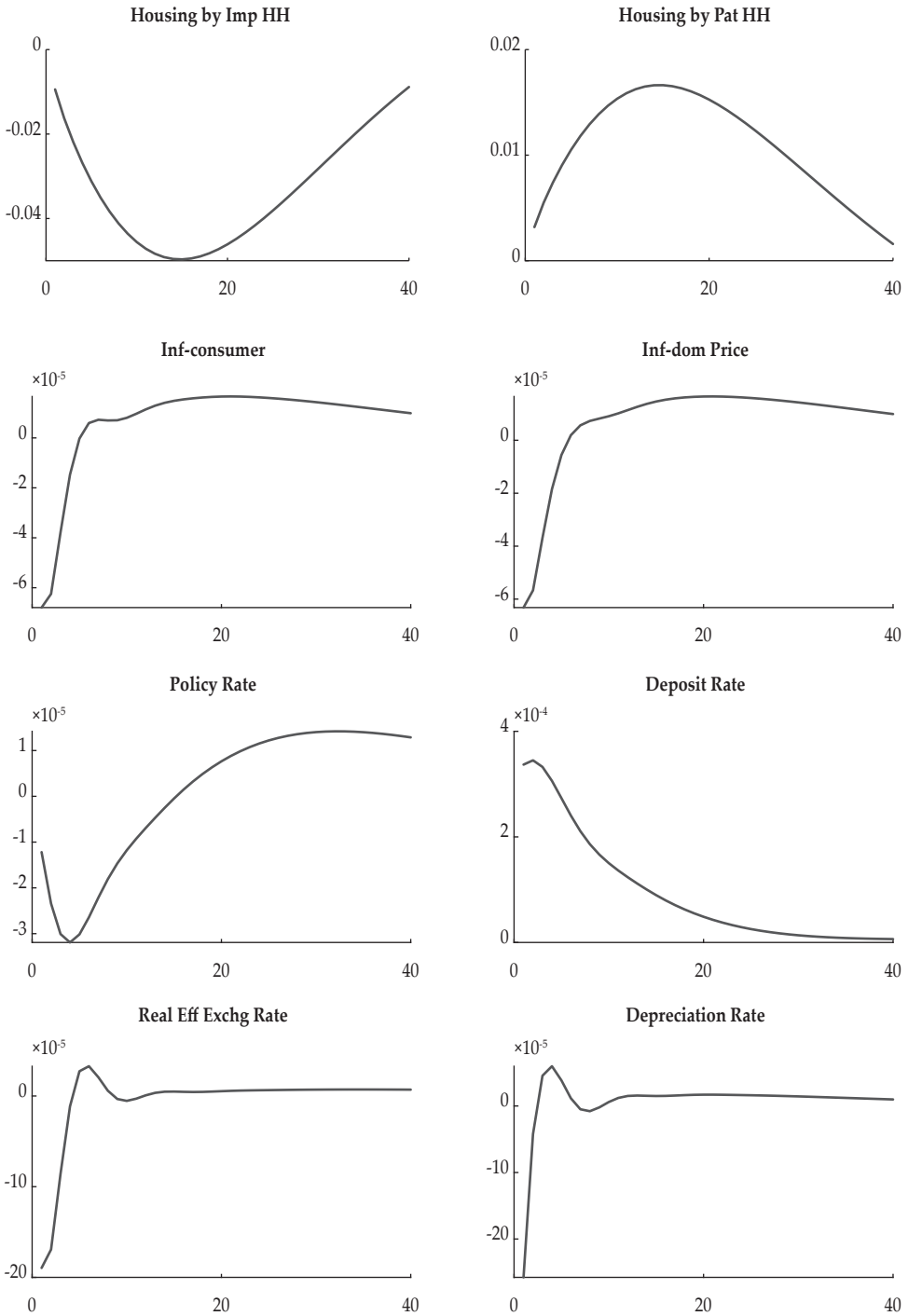

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Figure 6.
Effect of 1 Percent Shock to Capital Exuberance (Continued)

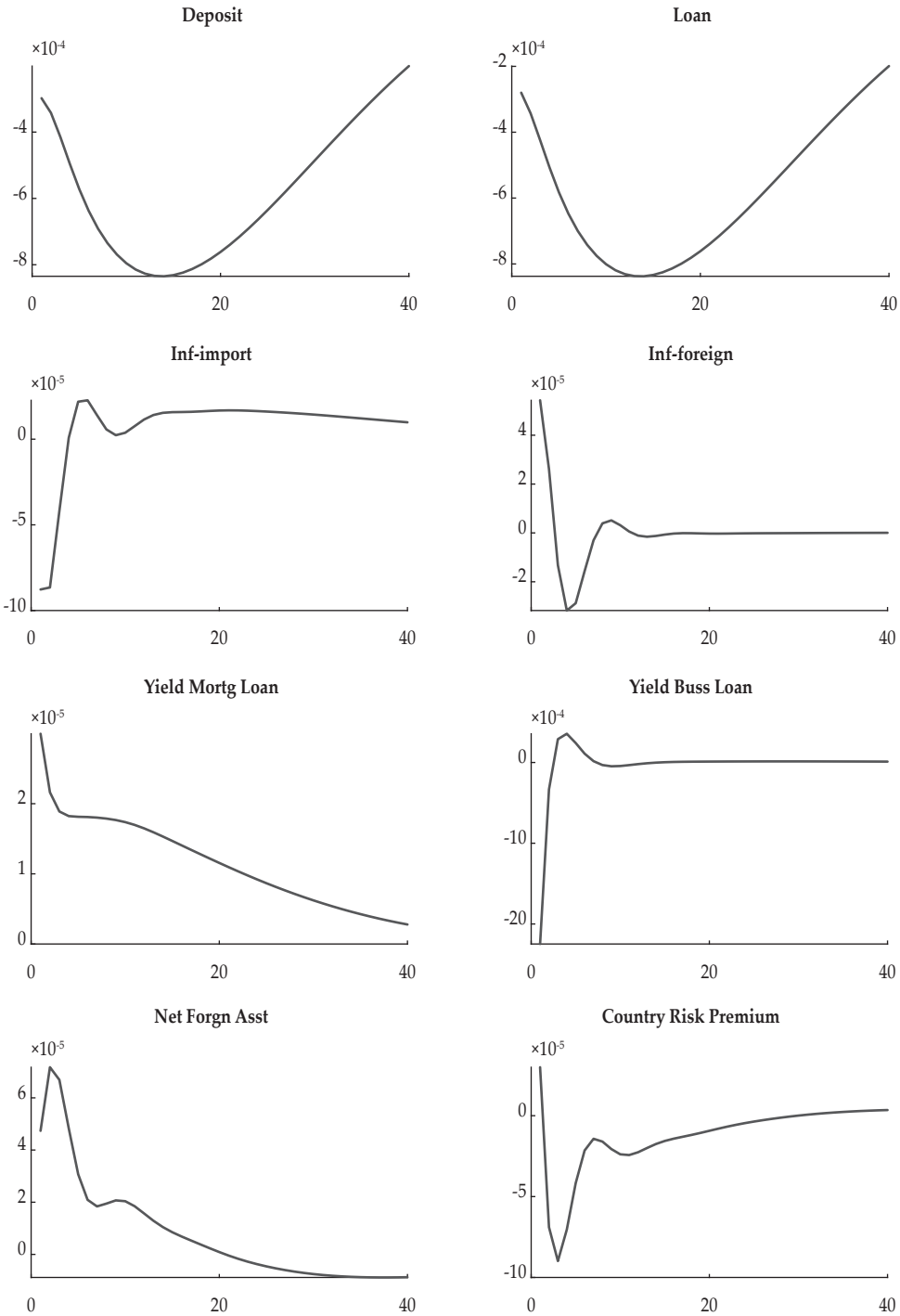
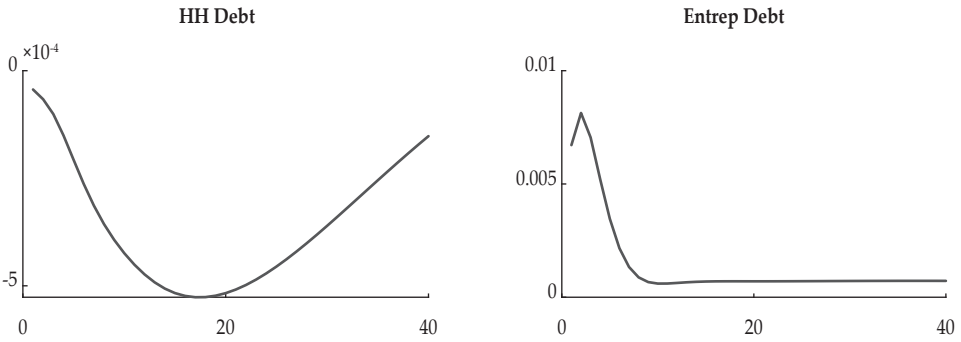


Figure 6.
Effect of 1 Percent Shock to Capital Exuberance (Continued)



The change in investor perception causes a shock to the capital price and investment in capital producers. This shift in perception will cause a short-term decline in aggregate demand but may support economic growth in the medium term. It demonstrates how economic agents' perceptions can impact macroeconomic dynamics.

Optimism that this high rate of return on investment will increase credit demand. On the other hand, this high level of optimism pushed consumers to move their portfolios from deposits to investments, resulting in a negative shock to bank deposits. This deposit drop diminishes banks' liquidity, limiting credit availability and increasing loan interest rates.

E. Long-run Impact of Country Risk Premium

Following that, as shown in Figure 7, we will simulate a positive shock of risk premium to capture the additional return or premium requested by investors to compensate them for the increased risk associated with investing in a foreign country rather than the domestic market. This simulation may also demonstrate how capital flows from developed countries shift due to increased risk. In this economy, we also endogenously model the negative relationship between NFAs and the country's risk premium. Finally, we apply the NFA's elasticity parameter to the country risk premium to represent the dynamic NFA's influence on domestic economic cycles.

Figure 7.
Effect of 1 Percent Shock to Country Risk Premium

These figures provide the IRF of an exogenous increase in country risk premium.

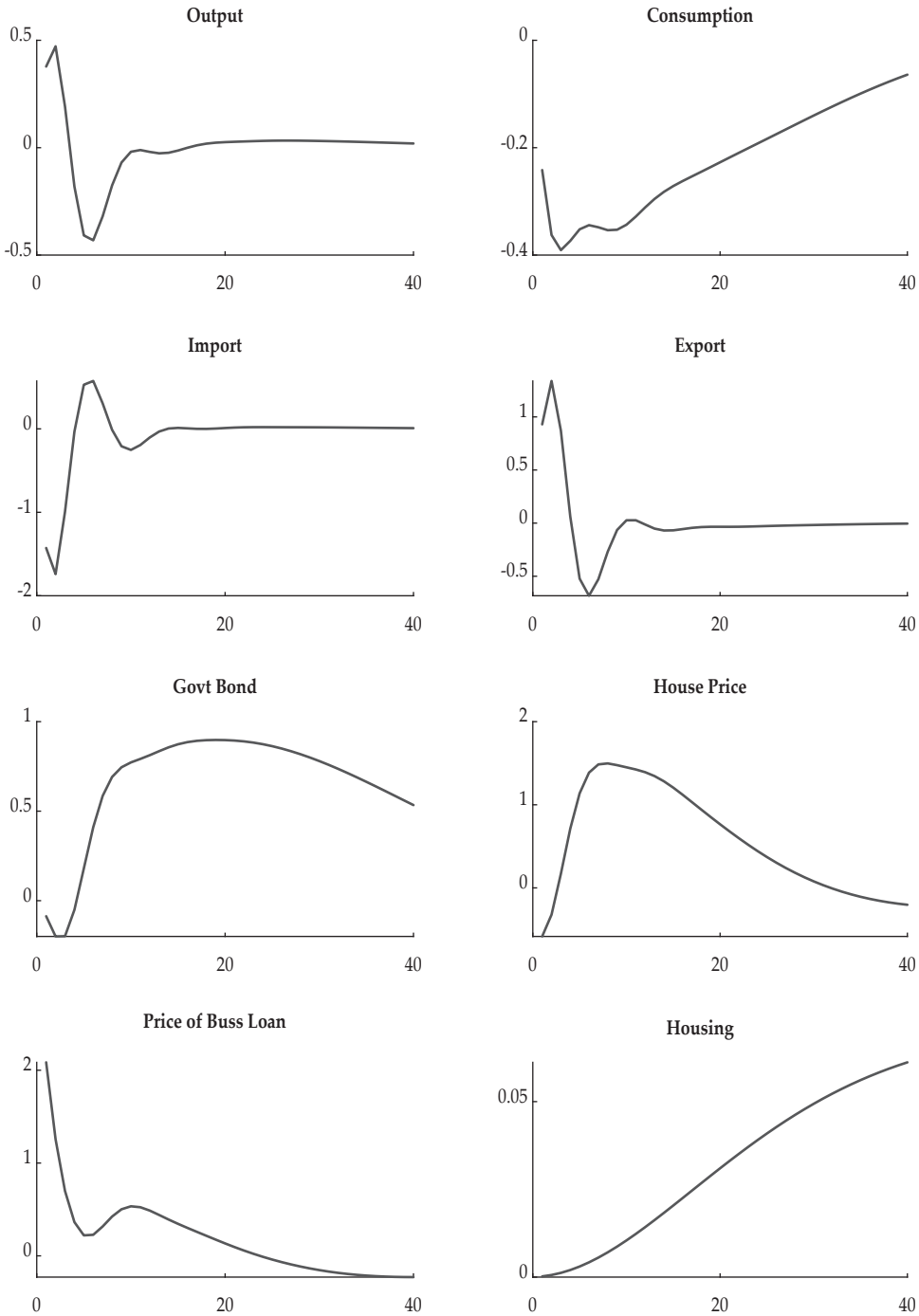


Figure 7.
Effect of 1 Percent Shock to Country Risk Premium (Continued)

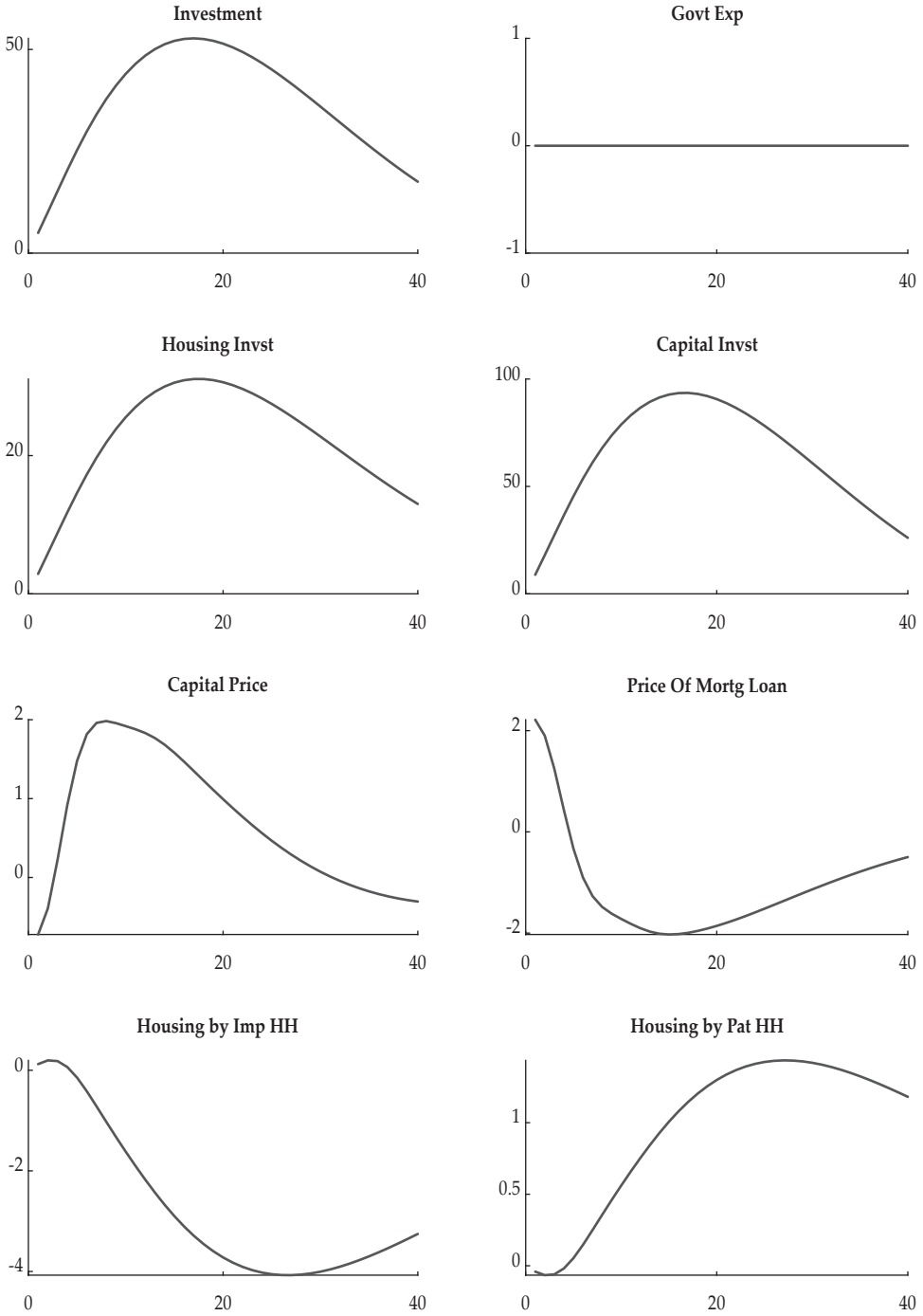


Figure 7.
Effect of 1 Percent Shock to Country Risk Premium (Continued)

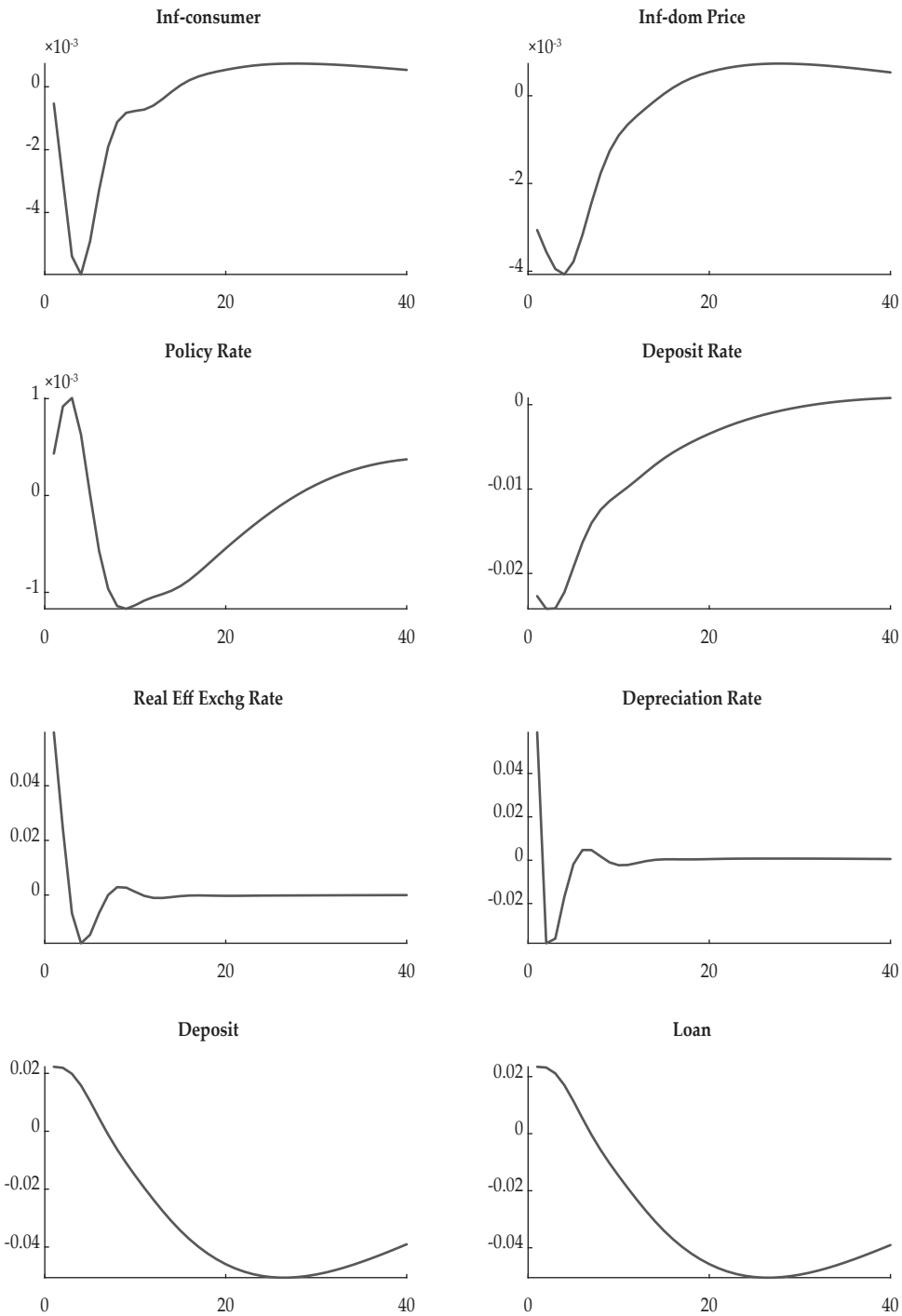
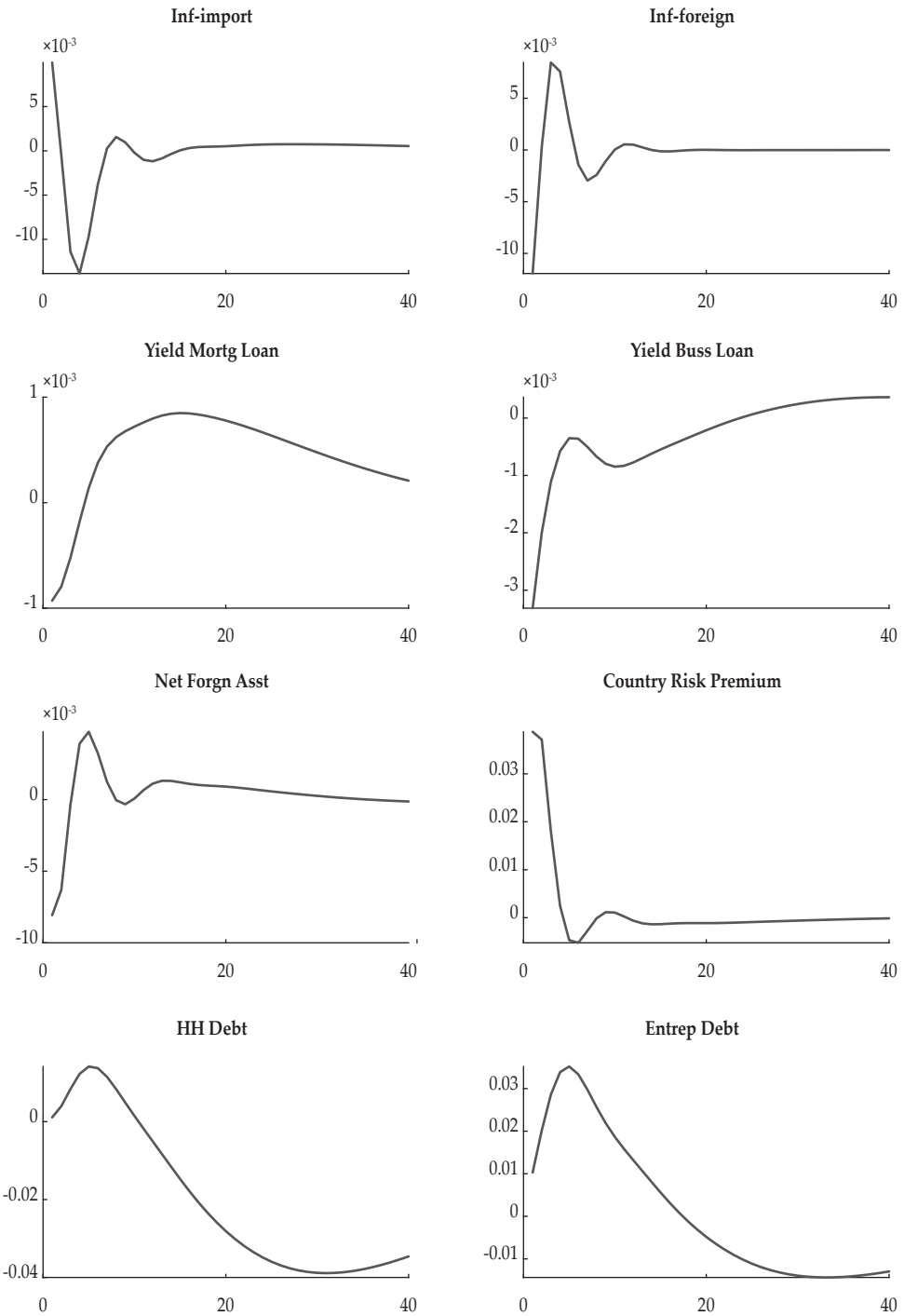


Figure 7.
Effect of 1 Percent Shock to Country Risk Premium (Continued)



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According to our findings, an increase in the international risk premium increases capital flows into the domestic portfolio. The positive shock to the international risk premium indicates that the foreign securities portfolio is riskier than the domestic portfolios, driving households to choose the domestic portfolios of government bonds and bank deposits. Our findings indicate that international risk premiums will boost bank deposits in the run and government securities in the long run. A positive shock to bank deposits increases the availability of banking liquidity, which might result in a positive response to bank loans. Furthermore, capital inflows can induce a drop in domestic interest rates, both deposit and lending rates.

Our results demonstrate how capital flows can affect the dynamics of other macroeconomic variables. Due to capital flows, domestic asset values and the price of capital will rise in the short run. As a result, it may be able to boost domestic investment in the medium run. The shock on internal risk premium drives a positive response for entrepreneurs' debt, pushing investment in the medium and the long term.

F. Long-run Impact of Risk-taking

Finally, we investigate the influence of risk-taking channels in the financial sector, as shown in Figure 8. This path becomes the main focus as we examine how risk-taking behavior in the banking sector might magnify the impact of macroeconomic variables. As previously stated, risk-taking behavior in the economy is defined by economic agents' preferences to deviate from optimal asset allocations to seek greater returns, endogenously driven by overall aggregate demand. As a result, we can see how the risk-taking method influences the domestic business cycles.

Figure 8.
Effect of 1 Percent Shock to Risk-taking

These figures provide the IRF of an exogenous increase in risk appetite for riskier investment.

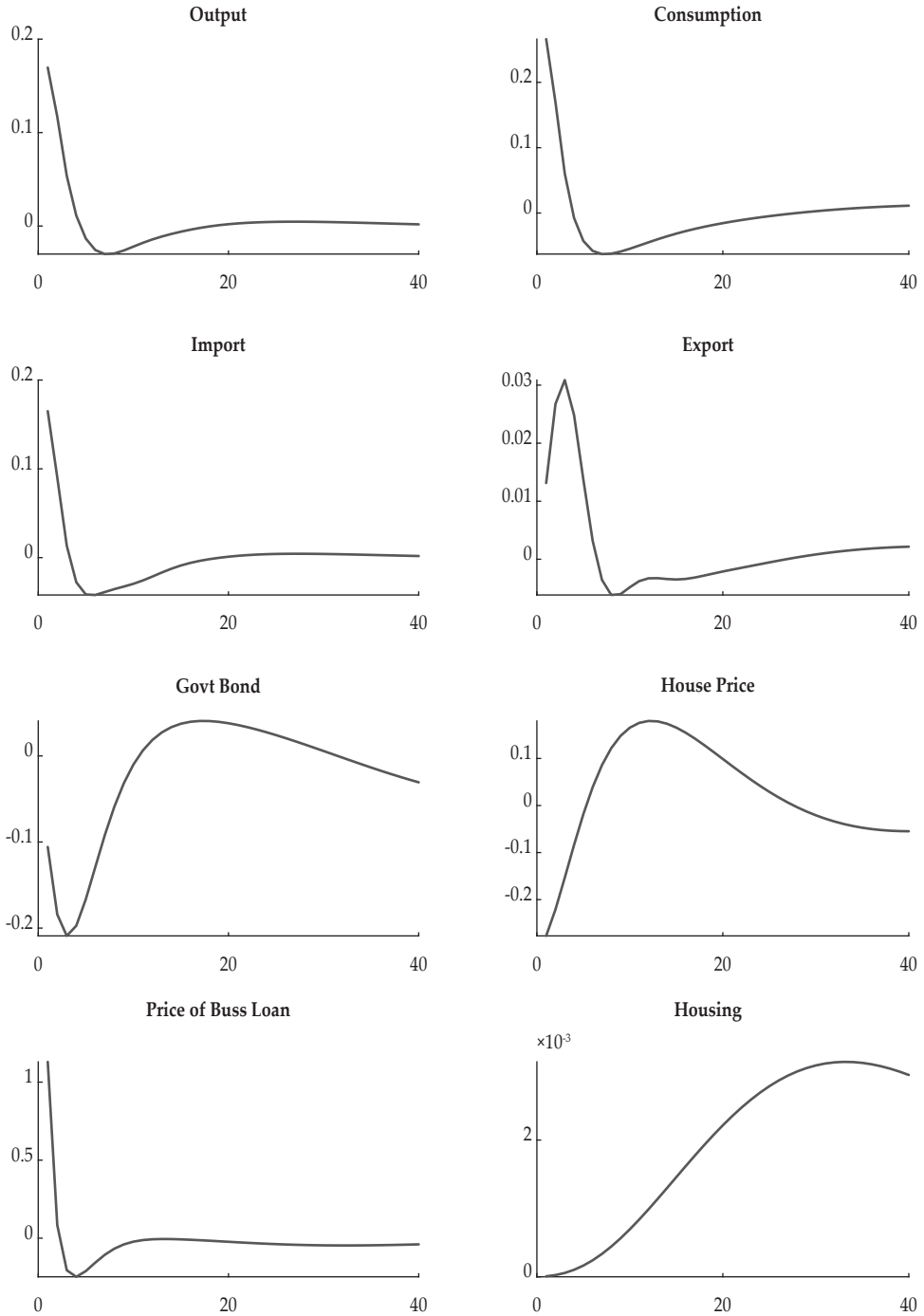

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Figure 8.
Effect of 1 Percent Shock to Risk-taking (Continued)

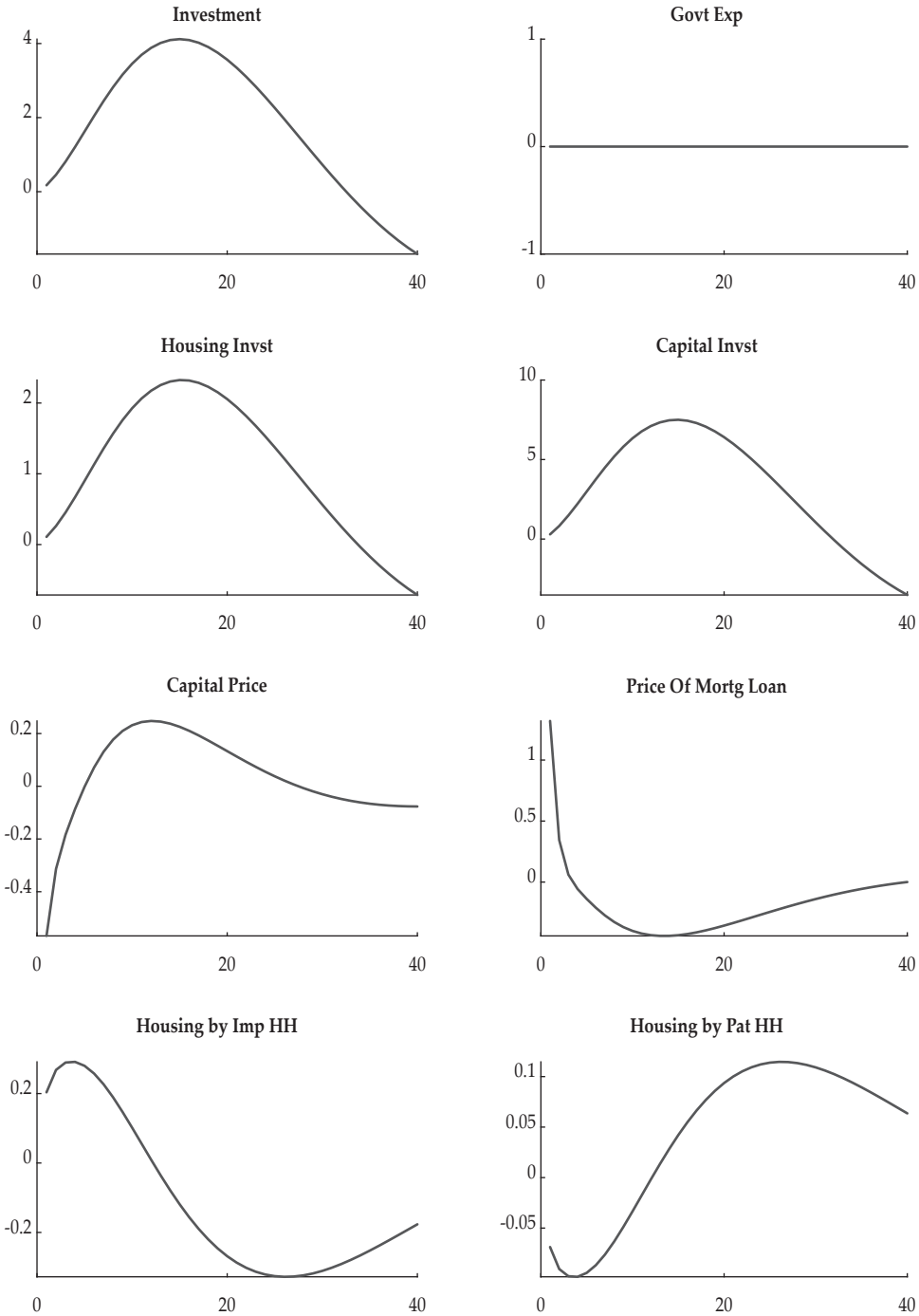

Figure 8.
Effect of 1 Percent Shock to Risk-taking (Continued)

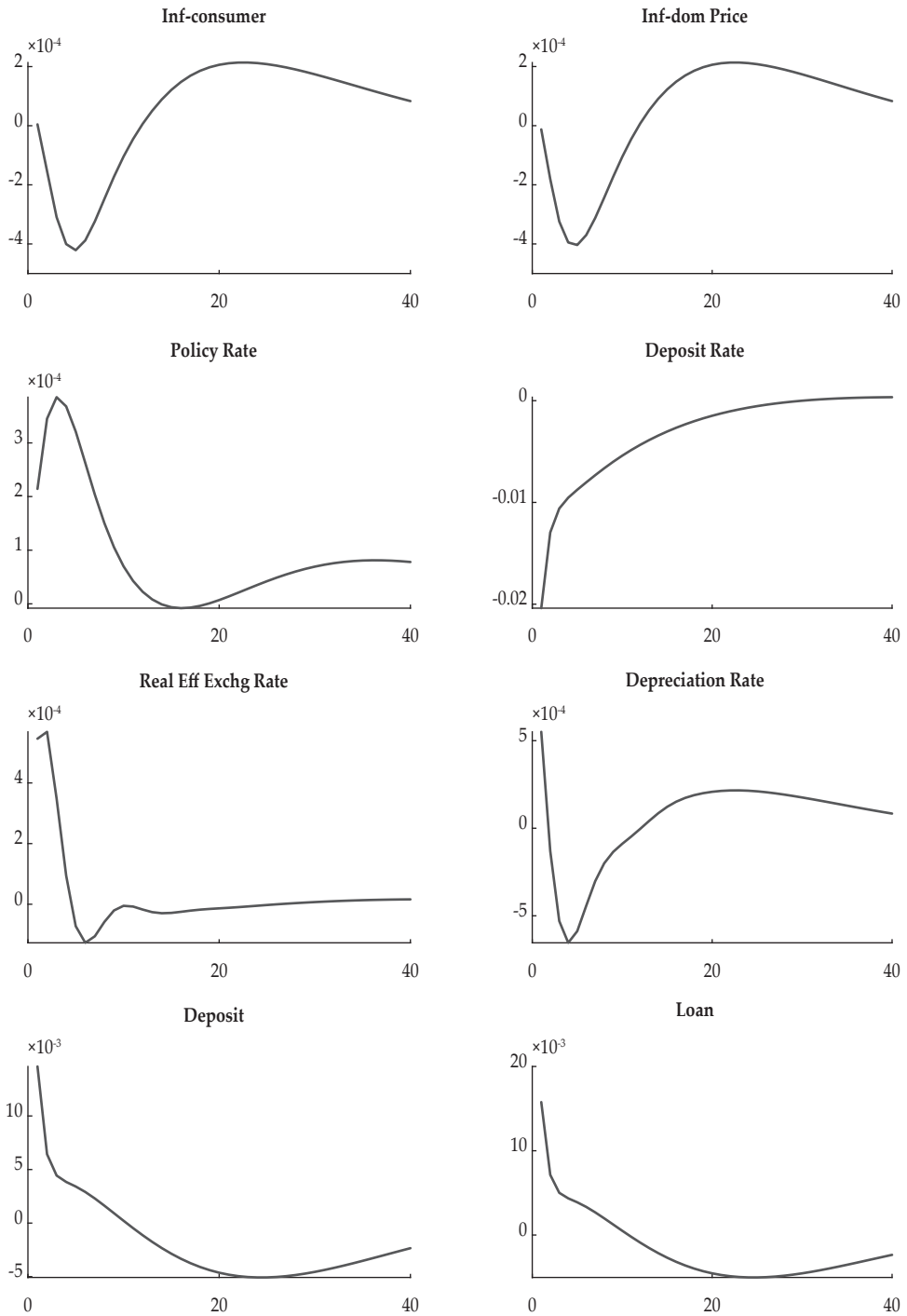

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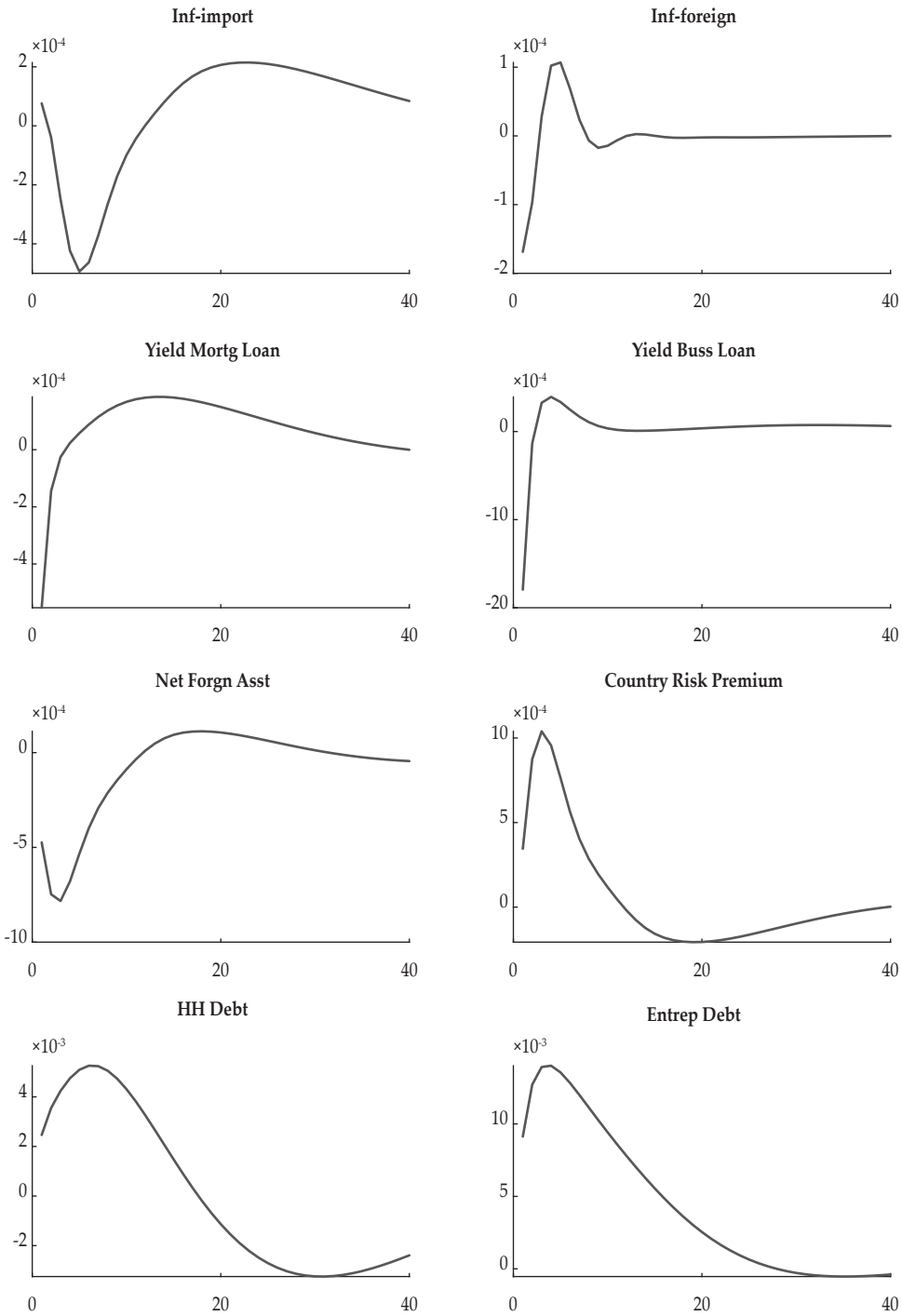
Figure 8.
Effect of 1 Percent Shock to Risk-taking (Continued)



Our findings indicate that higher risk-taking changes household preferences and increases aggregate spending. Increasing consumption gives firms more confidence in their businesses, which drives aggregate investment, including capital and housing investment. Deposits in the banking industry are rising in the short run, while deposits are decreasing in the long run. Increasing banking liquidity improves the capacity of banks to offer loans. Increased liquidity may encourage banks to lend more to impatient households and enterprises. Furthermore, capital spending increases productivity, which leads to an improvement in the trade balance. Overall, it shows how risk-taking behavior may influence macroeconomic dynamics.

V. CONCLUSIONS

During the last four decades, domestic boom-bust cycles have been characterized mainly by growing macro-financial linkages. Fluctuations in global and domestic financial conditions usually drive a small open economy's macroeconomic and financial stability. The problem is more severe in the EMEs than in the advanced economies because the EMEs have less securely established institutional settings and less developed financial markets. These conditions, among others, cause the impact of global shocks to be amplified and trigger macroeconomic and financial imbalances.

Our findings for the Indonesian case show that financial imperfections can amplify the impact of global financial cycles on domestic business cycles. The preference for riskier investment explains how risk-taking behavior affects capital flow and contributes to endogenously amplifying the dynamic of economic cycles. Furthermore, the risk perception that may be described endogenously by monitoring cost contributes to a better understanding of the relationship between the financial and economic cycles. Our findings show how external shocks influence economic savings and investment decisions through risk-taking channels. The vulnerability arises when central banks decide to increase interest rates amplifies global financial cycles. Unexpected global financial spillovers impair monetary policy transmission, limiting the central bank's ability to manage the economy. The stronger the financial channel, the stronger the link between the global and domestic business cycles.

This study helps us understand the current integrated framework employed by the monetary policy framework to solve policy challenges arising from various types of financial imperfections and macro-financial linkages in the economy. Our modeling frameworks seek to quantify the impact of foreign shocks on the domestic economy by considering recent advances in mix-policies with complementary features between macroprudential policy, exchange rate policy, capital flow management, and fiscal policy. This framework attempts to accommodate central banks' shifting frameworks, which are moving toward a more integrated framework for maintaining domestic economic growth, particularly in the face of global economic shocks. Finally, our framework also emphasizes the significance of enhancing coordination among monetary, fiscal, and prudential authority to implement a credible strategy for attaining growth and stability.

Finally, our study explores how financial imperfections in the credit market, such as a preference for riskier investments, influence macroeconomic dynamics and policies. This feature would address prior criticisms of the macroeconomic model by assisting us in understanding how the vulnerabilities of the banking sector affect aggregate demand. Furthermore, our conclusion applies to non-neoclassical channels (Boivin *et al*., 2011), implying that financial intermediaries are inefficient in allocating capital. In this study, we argued for risk-taking channels to be endogenously represented in the DSGE model to comprehend the complexities of real and financial linkages amid various types of financial imperfection and assess better macroeconomic policy's effectiveness in unexpected shocks.

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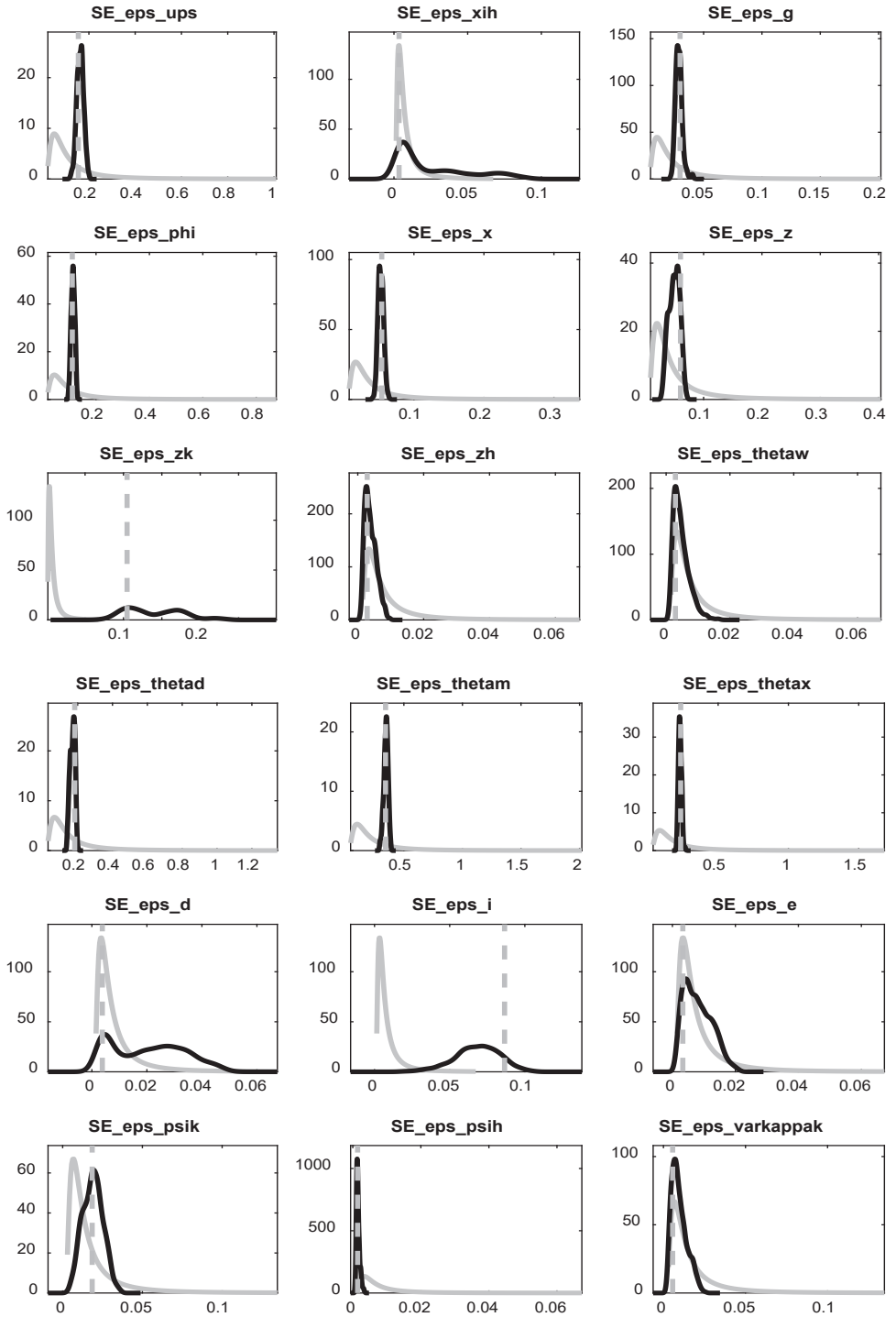
Appendix A.
Prior and Posterior Distributions



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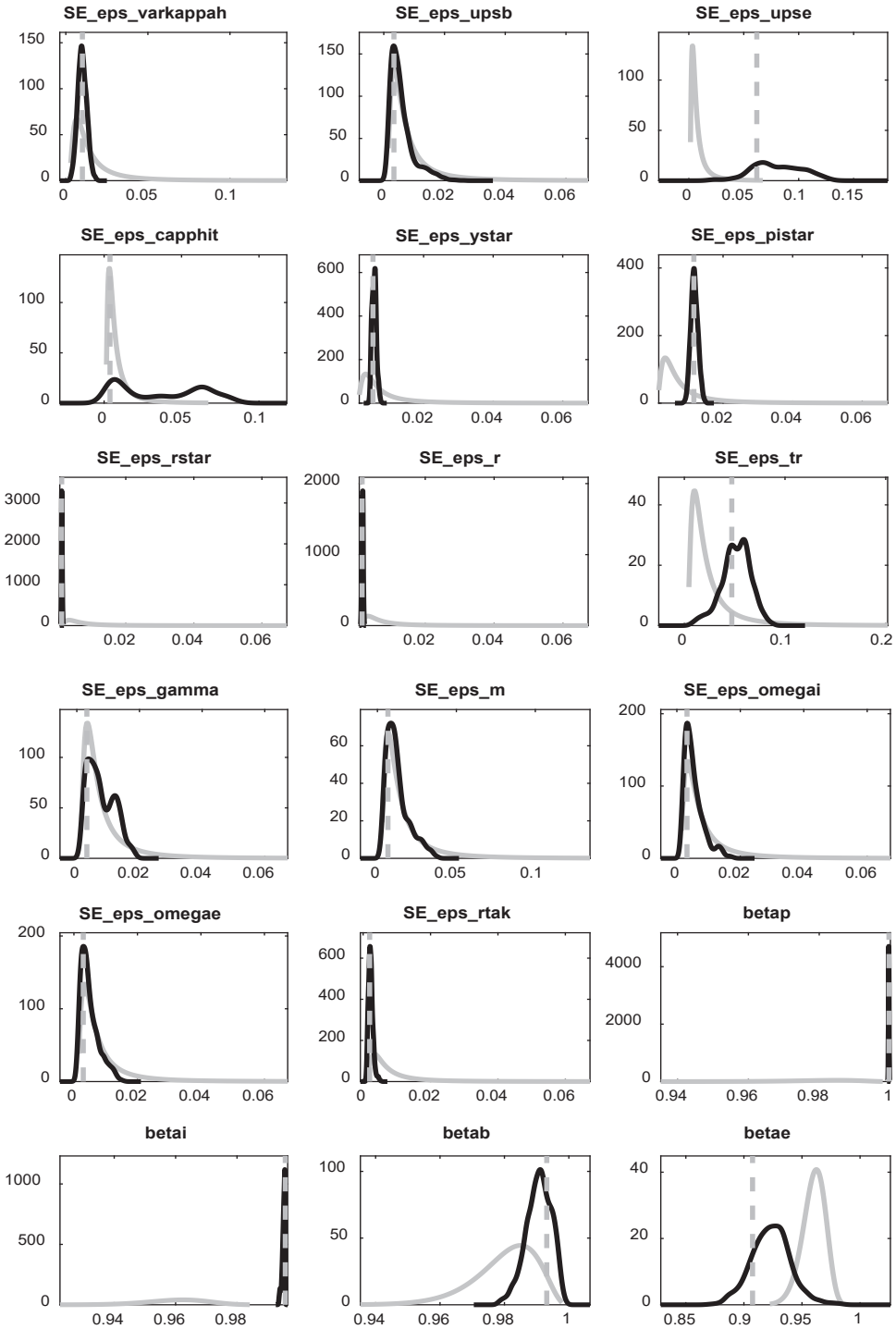

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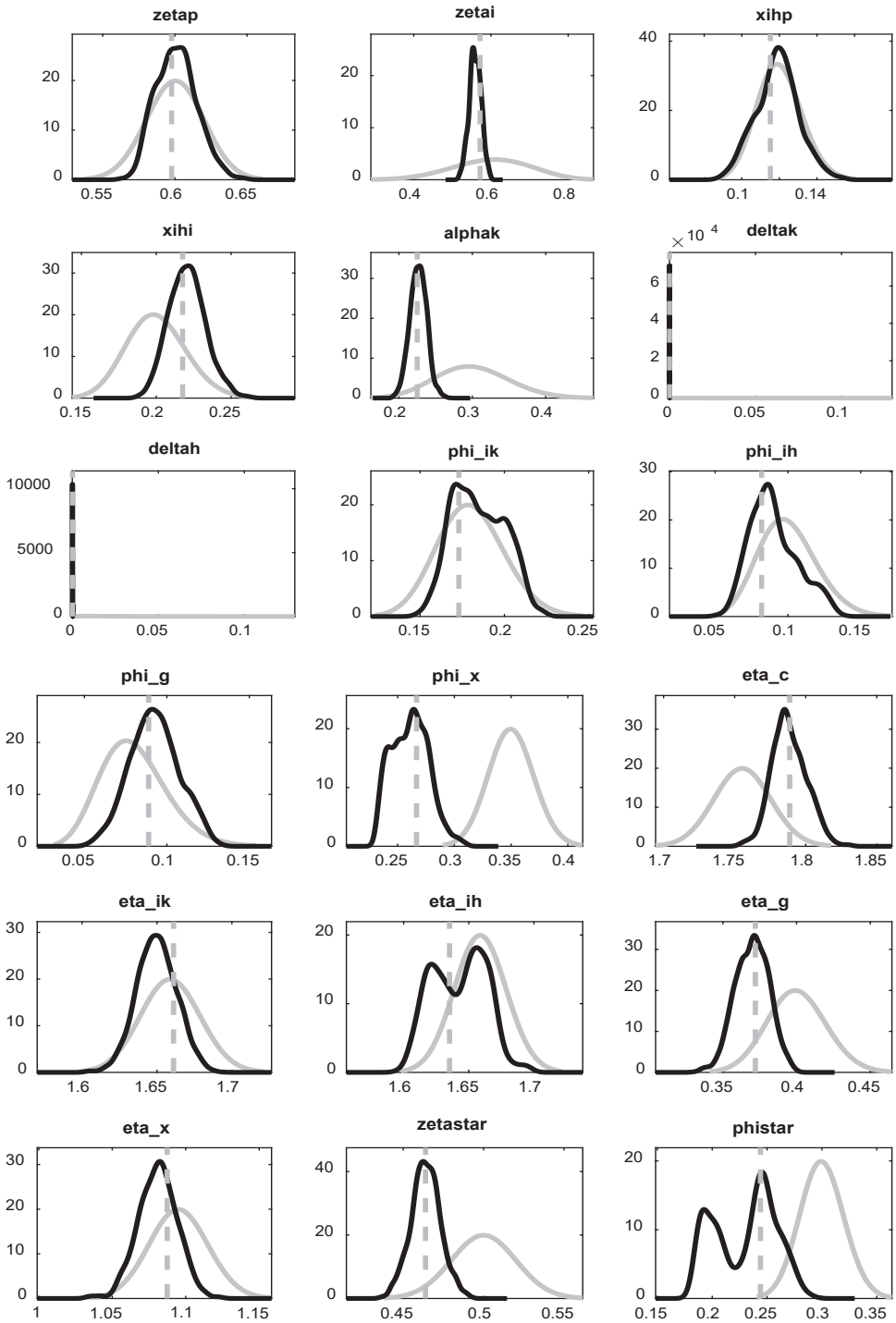

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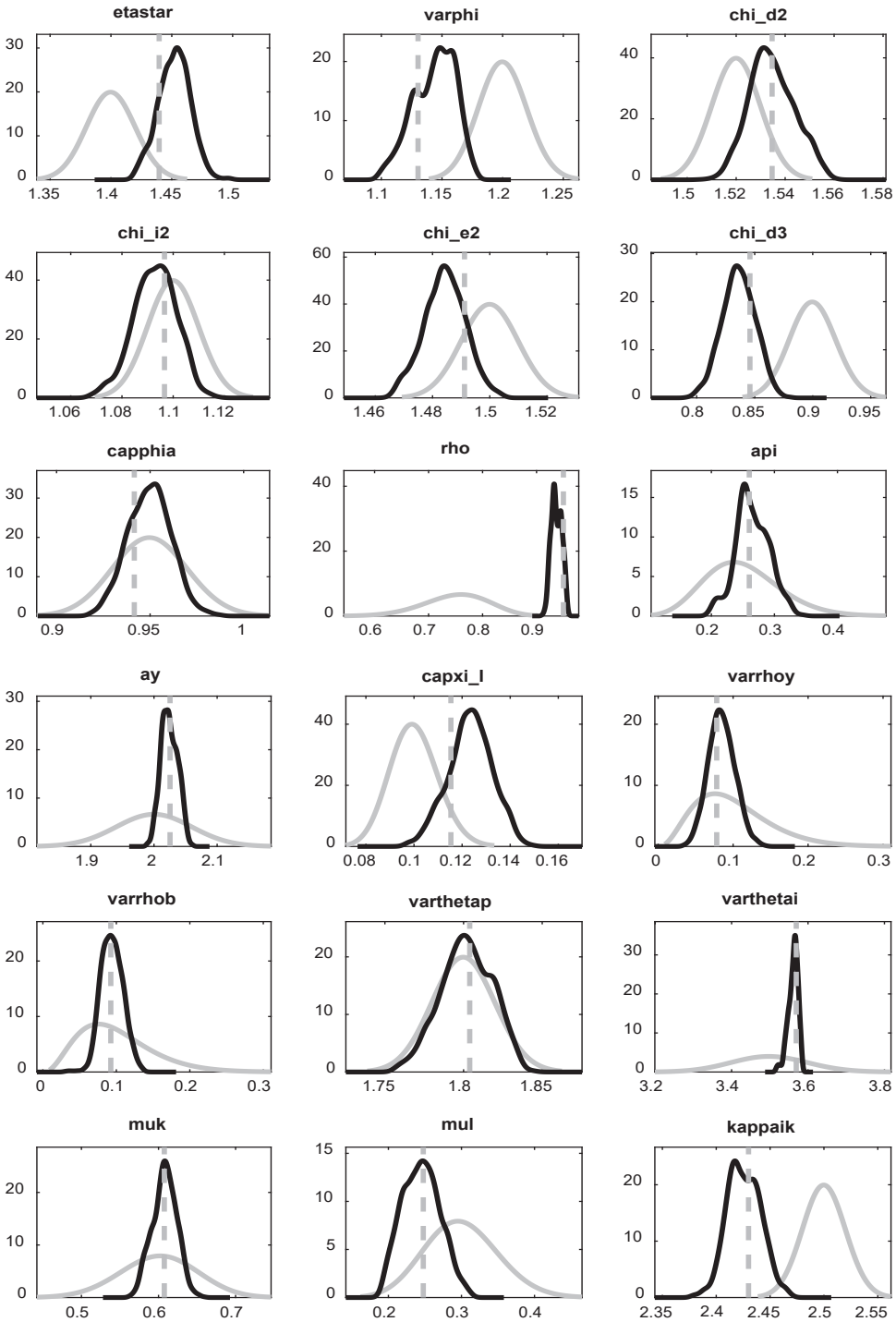

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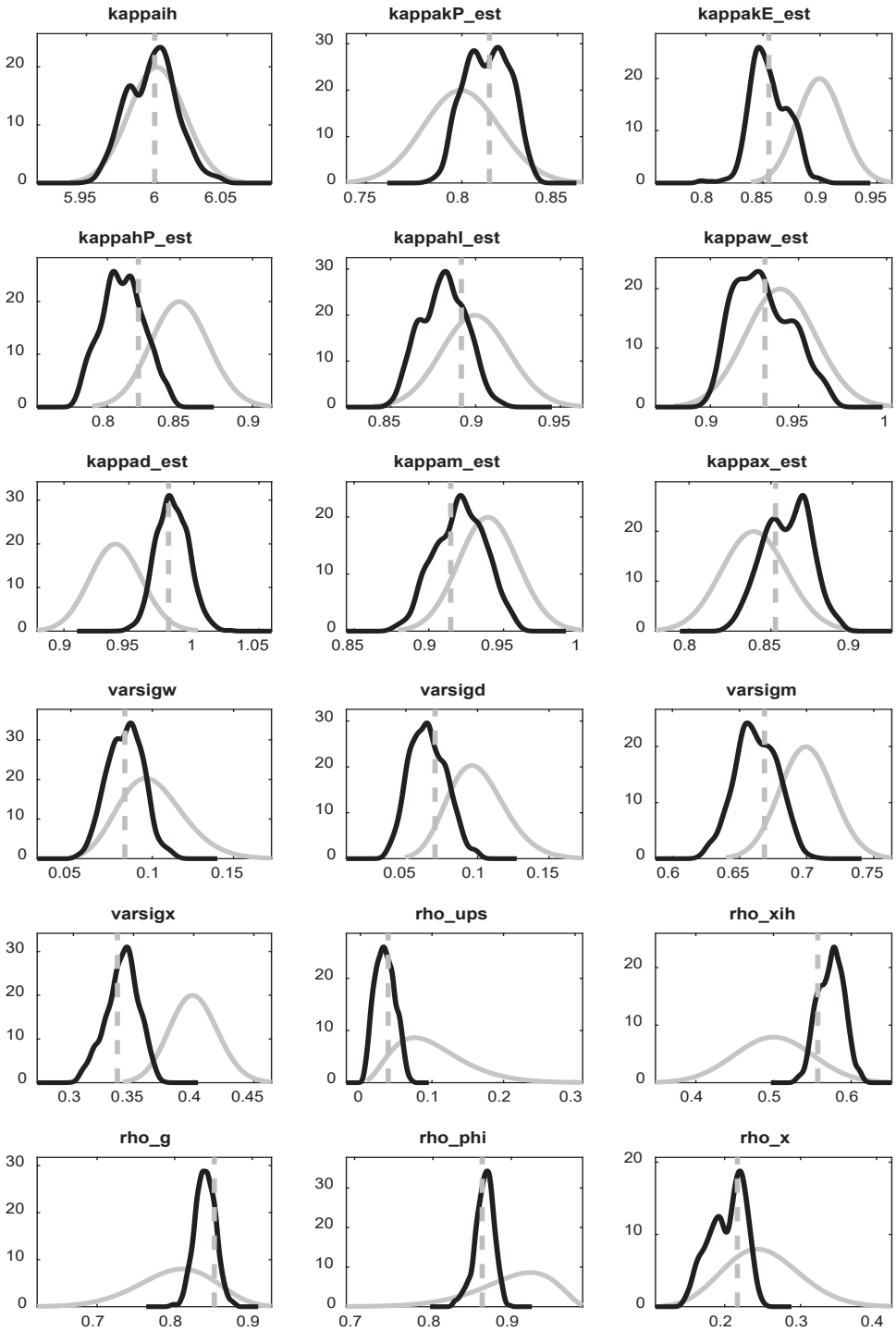

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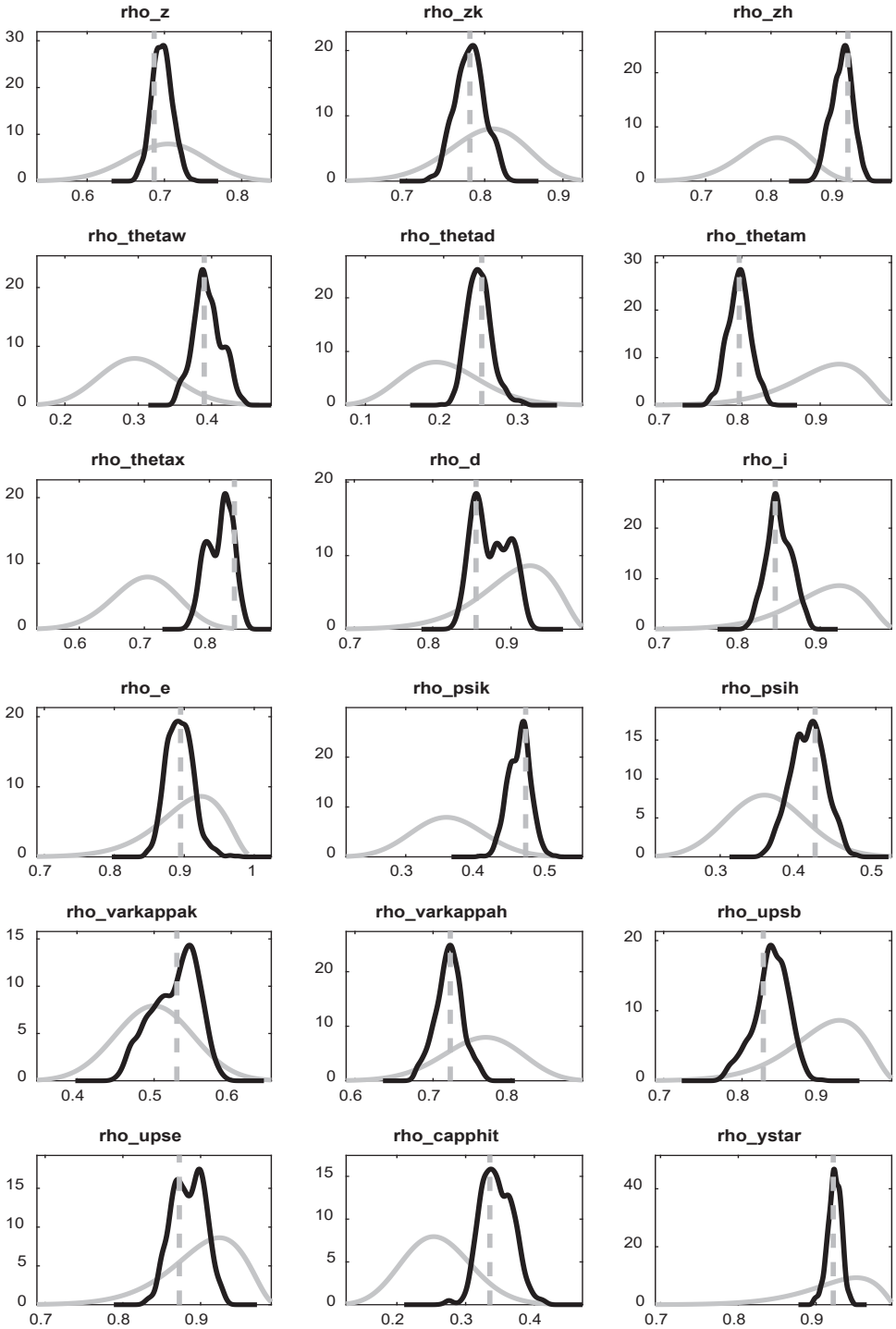

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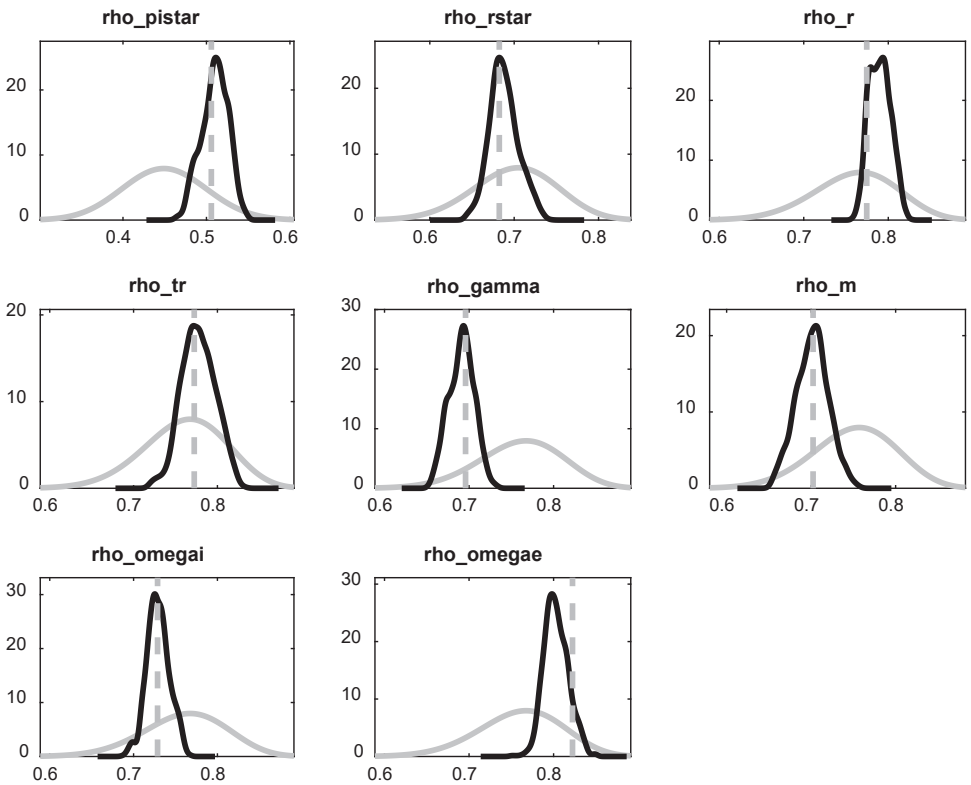

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% INNOVATIONS OF SHOCKS

%_____

NO	SYMBOLS	PARAMETERS
1	eps_ups	time preference
2	eps_xih	housing demand
3	eps_g	government expenditure
4	eps_phi	import demand (of home country)
5	eps_x	export demand (of foreigners)
6	eps_z	productivity
7	eps_zk	investment-spec. - capital
8	eps_zh	investment-spec. - housing
9	eps_thetaw	mark up - wage
10	eps_thetad	mark up - domestic goods price
11	eps_thetam	mark up - imported goods price
12	eps_thetax	mark up - exported goods price
13	eps_d	funding spread
14	eps_i	lending spread on mortgage loans
15	eps_e	lending spread on entrep. loans
16	eps_psik	capital quality
17	eps_psih	housing quality
18	eps_varkappak	exuberance - capital
19	eps_varkappah	exuberance - housing
20	eps_upsb	time preference for bank dividends
21	eps_upse	time preference for entrep. dividends
22	eps_capphit	country risk
23	eps_ystar	foreign - output
24	eps_pistar	foreign - inflation
25	eps_rstar	foreign - interest rate
26	eps_r	Taylor rule
27	eps_tr	shock to transfers
28	eps_gamma	capital requirement
29	eps_m	LTV
30	eps_omegai	risk-weight on mortgage loans
31	eps_omegae	risk-weight on entrep. loans
32	eps_rtak	risk taking

%_____

% DECLARING PARAMETERS

%_____

NO	SYMBOLS	PARAMETERS
		% UTILITY FUNCTION
1	betap	discount factor - patient hh.
2	betai	discount factor - impatient hh.
3	betab	discount factor - banks
4	betae	discount factor - entrepreneurs
5	varthetap	labor supply elasticity - patient hh.
6	varthetai	labor supply elasticity - impatient hh.
7	zetap	consumption habit - patient hh.
8	zetai	consumption habit - impatient hh.
9	xihp	housing level ? patient hh.
10	xihi	housing level ? impatient hh.
		% DOMESTIC PRODUCTION
11	alphak	share of capital
12	muk	share of patient hh. in capital
13	mul	share of patient hh. in labor
14	deltak	depreciation rate - capital
15	deltah	depreciation rate - housing
		% FINAL GOODS AGGREGATORS
16	phi_c	import share - consumption
17	phi_ik	import share - business inv.
18	phi_ih	import share - housing inv.
19	phi_g	import share - gov. exp.
20	phi_x	import share - exports
21	eta_c	import demand elasticity - consumption
22	eta_ik	import demand elasticity - business inv.
23	eta_ih	import demand elasticity - housing inv.
24	eta_g	import demand elasticity - gov. exp.
25	eta_x	import demand elasticity - exports
		%EXPORT DEMAND
26	zetastar	export persistence (foreign habit)
27	phistar	import share of foreign economy
28	etastar	export demand elasticity
29	varphi	elasticity w.r.t. to foreign output gap
		%REAL RIGIDITIES
30	kappaik	adj. cost - investment in capital
31	kappaih	adj. cost - investment in housing
32	kappakP_est	adj. cost - capital level - patient HH
33	kappakE_est	adj. cost - capital level - entrep.
34	kappahP_est	adj. cost - housing level - patient HH
35	kappahI_est	adj. cost - housing level - impatient HH
36	varpi	elasticity - utilization cost
37	varpi_est	elasticity - utilization cost

NO	SYMBOLS	PARAMETERS
		% DECLARING PARAMETERS
		% NOMINAL RIGIDITIES
38	kappaw_est	Calvo - wage
39	kappad_est	Calvo - domestic goods price
40	kappam_est	Calvo - imported goods price
41	kappax_est	Calvo - exported goods price
42	varsigw	indexation - wage
43	varsigd	indexation - domestic goods price
44	varsigm	indexation - imported goods price
45	varsigx	indexation - exported goods price
46	thetaw_bar	mark-up - wage
47	thetad_bar	mark-up - domestic goods price
48	thetam_bar	mark-up - imported goods price
49	thetax_bar	mark-up - exported goods price
		% FINANCIAL RIGIDITIES
50	chi_d1	monitoring cost level ? deposits
51	chi_i1	monitoring cost level ? mortgage loans
52	chi_e1	monitoring cost level ? business loans
53	chi_d2	monitoring cost elast. ? deposits
54	chi_i2	monitoring cost elast. ? mortgage loans
55	chi_e2	monitoring cost elast. ? business loans
56	chi_d3	monitoring cost elast. ? cap. reg.
57	kappa_divB_est	adj. cost for dividends - banks
58	kappa_divE_est	adj. cost for dividends - entrepreneurs
59	deltabi	coupon rate - mortgage loans
60	deltabe	coupon rate - business loans
61	capphia	country risk elasticity - NFA
62	capphie	country risk elasticity - expected depreciation
		% MONETARYPOLICY
63	pi_bar	steady-state inflation
64	rho	Taylor rule - smoothing
65	api	Taylor rule - inflation
66	ay	Taylor rule - output
		% FISCAL POLICY
67	capxi_I	transfers to impatient hh/output
68	varrhoy	transfer response to output
69	varrhob	transfer response to gov. debt
		% SHOCK PERSISTENCE
70	rho_ups	time preference
71	rho_xih	housing demand
72	rho_g	government expenditure
73	rho_phi	import demand (of home country)
74	rho_x	export demand (of foreigners)
75	rho_z	productivity

%

% DECLARING PARAMETERS

%

NO	SYMBOLS	PARAMETERS
76	rho_zk	investment-spec. - capital
77	rho_zh	investment-spec. - housing
78	rho_thetaw	mark up - wage
79	rho_thetad	mark up - domestic goods price
80	rho_thetam	mark up - imported goods price
81	rho_thetax	mark up - exported goods price
82	rho_d	funding spread
83	rho_i	lending spread on mortgage loans
84	rho_e	lending spread on entrep. loans
85	rho_psik	capital quality
86	rho_psih	housing quality
87	rho_varkappak	exuberance - capital
88	rho_varkappah	exuberance - housing
89	rho_upsb	time preference for bank dividends
90	rho_upse	time preference for entrep. dividends
91	rho_capphit	country risk
92	rho_ystar	foreign - output
93	rho_pistar	foreign - inflation
94	rho_rstar	foreign - interest rate
95	rho_r	Taylor rule
96	rho_tr	shock to transfers
97	rho_gamma	capital requirement
98	rho_m	LTV
99	rho_omegai	risk-weight on mortgage loans
100	rho_omegae	risk-weight on entrep. loans