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Macro-Financial Impacts of Foreign Digital Money

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Macro-Financial Impacts of Foreign Digital Money

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ABSTRACT: We develop a two-country New Keynesian model with endogenous currency substitution and financial frictions to examine the impact on a small developing economy of a stablecoin issued in a large foreign economy. The stablecoin provides households in the domestic economy with liquidity services and an additional hedge against domestic inflation. Its introduction amplifies currency substitution, reducing bank intermediation and weakening monetary policy transmission, worsening the impacts of recessionary shocks and increasing banking sector stress. Capital controls raise stablecoin adoption as a means of circumvention, increasing exposure to spillovers from foreign shocks. Unlike a domestic CBDC, a ban on stablecoin payments can alleviate these effects.

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1 Introduction

Developments in the international monetary system frequently raise concerns over spillovers to developing countries (Eichengreen, 2012; Rey, 2013), and the emergence of new forms of digital money is no exception. Foreign CBDC could accentuate the international transmission of shocks (Minesso et al., 2022) and global stablecoins could constrain monetary policy (Benigno et al., 2022). Where the foreign digital money is readily accessible and more attractive than the domestic currency, there is a risk of ‘digital dollarization’ (Brunnermeier et al., 2021) or ‘cryptoization’ (IMF, 2021). If households prefer to save in foreign assets, banks could be disintermediated, weakening the transmission of monetary policy (G20, 2023; IMF, 2023). And these risks are all exacerbated if digital money can also fulfill an unmet desire to circumvent capital controls (Graf von Luckner et al., 2023).

In this paper, we develop a two-country New Keynesian model to assess these risks, and possible policy responses, from the perspective of a small developing country whose currency faces competition from a foreign stablecoin. We begin with a small domestic economy with a banking sector and financial frictions following Gertler and Karadi (2011) and Aoki et al. (2018). The large foreign economy, calibrated to the US following Adrian et al. (2020), hosts a stablecoin issuer that produces a global crypto asset, backed by foreign cash and bonds following Cova et al. (2022). This asset is useful to domestic households as both a means of payment and as a non-domestic-currency store of value, generating endogenous currency substitution following Henriksen and Kydland (2010) and Özbilgin (2012). We explore the implications in the contexts of both free capital flows and capital flow management measures (CFMs), modeled as a tax on the return of foreign bonds following Davis and Presno (2017).

In our model, households initially hold domestic cash, domestic deposits, foreign cash and foreign bonds. The first three can be used as a means of payment, unlike foreign bonds which are only a store of value. Following Özbilgin (2012), the household allocates a share of its purchasing power each period to non-domestic-cash payment assets by weighing their expected return against the additional transaction cost required to use

them. Faced with negative shocks, the domestic household faces a trade-off between moving more assets out of domestic currency (reducing its exposure to, for instance, domestic inflation or depreciation, net of transactions costs) and being able to meet the liquidity demands of its desired consumption transactions. The addition of the stablecoin to the menu of payments assets loosens this trade-off, allowing the household to shift more of its purchasing power away from domestic currency assets. Currency substitution and capital outflows are thus amplified in response to negative shocks, magnifying domestic output losses. Banks face larger deposit outflows and a larger reduction in net worth, which we find are particularly severe in the case of a contractionary foreign monetary policy shock. We thus find that the presence of a global stablecoin can amplify the international transmission of shocks, similar to the results of [Minesso et al. \(2022\)](#) for a foreign CBDC.

In this environment, a central bank setting monetary policy optimally reacts more aggressively to inflation than when no stablecoin exists. Households' reallocation of assets from domestic deposits to the stablecoin disintermediates banks and reduces the share of economic activity that the central bank can influence through interest rate changes. The transmission of monetary policy to investment, output and the price level is thus weaker, forcing the central bank to change interest rates by more in response to a given deviation of inflation from target.

We next introduce CFMs on foreign bonds, noting that equivalent measures do not (at present) apply to stablecoins. A tax on the return of foreign bonds (following [Davis and Presno, 2017](#)) increases the responsiveness of stablecoin holdings to a contractionary foreign monetary policy shock—i.e., households shift more assets into the stablecoin in response to the shock than when capital is freely mobile. Intuitively, the more CFMs block the traditional diversification channel—namely, purchasing foreign bonds—the more households switch to the stablecoin. Our digital asset is thus used to circumvent capital controls, in line with empirical evidence (e.g., [Alnasaa et al., 2022](#); [Graf von Luckner et al., 2023](#)). Furthermore, and through an analogous mechanism to that in the economy without CFMs, the macrofinancial impact of the foreign shock on the

domestic economy with CFMs is more severe in the presence of the stablecoin than in its absence. Our results thus imply that crypto-asset-based circumvention could undermine attempts to use capital controls to insulate small developing economies against spillovers from foreign shocks.¹

In the final section of the paper, we explore policy options for the small economy that could counteract the stablecoin’s role in increasing spillovers to the domestic economy from foreign shocks. We first assess whether a domestic central bank digital currency (CBDC) could play a defensive role, reducing demand for the stablecoin by substituting an alternative asset. This has been a significant factor motivating central banks’ exploration of CBDCs, particularly in emerging market and developing economies (Das et al., 2023).² While we find that CBDC can partially reduce stablecoin holdings in equilibrium, it does not help mitigate the impact of the stablecoin in transmitting foreign shocks to the domestic economy. This is because the CBDC remains denominated in domestic currency, unlike the stablecoin, so cannot provide a hedge against domestic inflation or depreciation.

We then consider a comprehensive stablecoin ban that fully prevents all holding and use of the stablecoin in the domestic economy (while it remains in circulation in the foreign economy). This policy returns the economy’s response to a foreign shock almost to the baseline ‘no stablecoin’ path, so almost entirely alleviates the currency substitution, capital outflows, bank disintermediation and larger output losses described above. However, achieving such a complete ban would be far from straightforward: given the decentralized nature of the technology, policing a complete prohibition on the holding and use of the stablecoin, including in the informal sector and through peer-to-peer transfers,

¹Whether attempts to use capital controls for such purposes are appropriate and effective is an ongoing question and the subject of a rich theoretical and empirical literature (for a survey see, for instance, IMF, 2020b). For the purposes of this exercise, we assume effective capital controls that help insulate the small economy against foreign shocks. For ineffective or harmful CFMs, CFM-circumvention by crypto assets could be welfare-improving, but in such cases the primary policy response should be to remove the CFMs and the impact of crypto assets is less important.

²Central banks have shown interest in introducing CBDCs in order to guard against the potential displacement of their currencies by more appealing digital alternatives, such as stablecoins and foreign central bank digital currencies that might gain widespread usage in their economies. For example, Bank Indonesia states in a white paper that Project Garuda, its CBDC initiative, is “a contribution brought by Bank Indonesia to the nation in a struggle to safeguard Rupiah sovereignty in the digital era.”

would be difficult in practice. The credible assumption that the host economy is more able to regulate the stablecoin issuer entails that potential outcomes are weakly improved by cross-country coordination. Beyond our two-country model, if the stablecoin issuer were in a third country ('offshore') then broader multilateral coordination could be required.

Literature: Our paper relates to three overlapping literatures: (i) models of digital money in a closed economy, (ii) assessments of the international implications of digital money, and (iii) models of the financial sector and its interaction with households' asset allocation decisions. Overall, we contribute a quantitatively meaningful setting in which to assess the impact of a hypothetical widely adopted stablecoin on the macroeconomic and financial responses to various shocks of a small emerging market or developing economy.

A burgeoning literature models the impact of digital money in a closed economy, including [Andolfatto \(2021\)](#), [Agur et al. \(2022\)](#), [Asimakopoulos et al. \(2019\)](#), [Chang et al. \(2023\)](#), [Banet and Lebeau \(2022\)](#), [Chiu et al. \(2019\)](#), [Fernández-Villaverde and Sanches \(2019\)](#), [Jiang and Zhu \(2021\)](#), [Keister and Sanches \(2022\)](#), [Tan \(2023b\)](#) and [Sockin and Xiong \(2018\)](#). Our paper most closely relates to the DSGE settings of [Burlon et al. \(2022\)](#) and [Barrdear and Kumhof \(2016\)](#), though these both focus on CBDC rather than a privately issued digital asset.

[George et al. \(2021\)](#) extends [Barrdear and Kumhof \(2016\)](#) to an open economy context, using reduced-form equations to describe the foreign economy. [Ikeda et al. \(2020\)](#) focuses on foreign digital money as a unit of account, exploring the implications of agents being newly able to set prices and wages in foreign currency in as frictionless a manner as in units of the domestic currency. [Benigno et al. \(2022\)](#) in contrast model cryptocurrency as a third (global) currency, which—through triangulation, given symmetric countries and perfect markets—imposes tight restrictions on interest and exchange rates. [Uhlig and Xie \(2021\)](#) use an NK-DSGE framework to assess the macroeconomic implications of parallel currencies operating within a single country, but abstract from the sources of shocks to the exchange rate between them.

Our work is most closely related to [Minesso et al. \(2022\)](#) and [Cova et al. \(2022\)](#), who

use two-country DSGE models to study the implications of foreign CBDC and a foreign stablecoin, respectively. We contribute by focusing our model on the countries most exposed to spillovers from digital money, namely small emerging markets and developing economies (IMF, 2021). The challenge faced by these countries has a substantially different structure to that of large advanced economies, and we reflect this in our model in several ways. First, of course, size: our large economy is 67 times larger than our small economy, roughly equivalent to the difference between the USA and Malaysia, and is correspondingly far more exposed to international spillovers.³ Second, the greater relative attractiveness of foreign currency, combined with a bank-based financial system, increases the risk of banking sector disintermediation. We therefore incorporate a full banking sector with financial frictions—unlike Cova et al. (2022) and Minesso et al. (2022)—which also allows us to assess financial sector stress and monetary policy transmission. Third, we allow for rich currency substitution dynamics, drawing on Özbilgin (2012), which constitute an important extra channel for the international transmission of shocks. In our model, the choice of payment instrument when purchasing goods and services is endogenously determined by households comparing the expected opportunity cost of using domestic and foreign-currency-denominated payment instruments. When the inflation rate is at moderate levels, foreign currency can be held as a store of value, but it has a very limited use as a medium of exchange and is only used for the purchase of big-ticket items. It is only when inflation reaches high rates that foreign currency starts to be used for a wider set of goods.⁴ Finally, we allow for the imposition of capital controls, an important element for emerging markets that could be threatened by new forms of digital money (Graf von Luckner et al., 2023; He et al., 2022; IMF, 2020a).

Lastly, our paper also relates to a vast literature on financial sectors and financial frictions. Seminal works include Bernanke et al. (1999), Gertler and Kiyotaki (2010), Gertler and Karadi (2011) and Gerali et al. (2010). We use the framework of Gertler

³In comparison, the two economies in Cova et al. (2022) are symmetrically sized, while versions of Minesso et al. (2020, 2022) use calibrations to the USA versus the EU or Germany, with corresponding ratios of approximately 1.5:1 and 6:1 respectively. Similarly, Kumhof et al. (2023) assess the impact of CBDC in a two-country model where the two countries are of equal size.

⁴Minesso et al. (2022) in contrast adopt a standard cash-in-advance constraint in which only cash and the CBDC can be used to pay for consumption.

and Karadi (2011) for our banking sector and introduce a financing choice problem of domestic versus foreign deposits similar to Aoki et al. (2018), Akinci and Queralto (2018) and Akinci and Queralto (2022). We document a potential effect of stablecoins on the banking sector by allowing for stablecoin-driven bank disintermediation, which emerges from the household’s portfolio choice problem.

The rest of the paper is organized as follows. In Section 2 we outline the structure of our domestic economy—the main focus of the paper—then in Section 3, we describe the large foreign economy, including the stablecoin issuer. Section 4 simulates the effects of monetary policy and technology shocks in the presence and absence of a global stablecoin, and assesses monetary policy transmission and the impact of capital controls. Finally, Section 5 assesses possible policy responses and Section 6 concludes. Further details on the model and its calibration are provided in the Appendix.

2 The Domestic Economy

This section introduces our baseline model. The main structure is an NK-DSGE model with financial frictions in the style of Gertler and Kiyotaki (2010) and Gertler and Karadi (2011) (henceforth GK). We extend the banking sector following Aoki et al. (2016) (hereafter ABK) by allowing funding from foreigners in the financial sector. Bankers face endogenously determined balance sheet constraints.⁵ Following Gopinath et al. (2010) and Gopinath et al. (2020), only the US dollar bond—not the domestic bond—is traded internationally. We add a stablecoin issuer located in the foreign economy, and allow for currency substitution for payments. Finally, and similar to Gali and Monacelli (2005), we assume that firms set domestic goods prices in their own currency (producer currency pricing, PCP) and set export goods prices in foreign currency (dominant currency pricing, DCP). The final consumption basket is a combination of imported goods and domestically produced goods. For convenience, we denote foreign variables with an asterisk (*) and label the foreign currency the US dollar.

⁵Compared to the GK model, we do not include variable capital utilization, quantitative easing or price indexation.

2.1 Domestic Households

The representative household maximizes expected utility, which is a function of final consumption C_t and leisure L_t , subject to the constraint that expenditure equals income:

$$U_t = E_t \sum_{t=0}^{\infty} \beta^t \left[\log(C_t) - \Psi \frac{(1 - L_t)^{1+\varphi}}{1 + \varphi} \right]$$

s.t.

$$\begin{aligned} & C_t + Q_t K_t^h + \frac{D_t}{P_t} + s_t \frac{B_{F,t}}{P_t} + \frac{M_t}{P_t} + \frac{s_t M_{F,t}}{P_t} + P_t^{sc} s_t \frac{SC_t}{P_t} + \chi^h(K_t^h, K_t) + \tau(1 - j_t) \\ & = w_t H_t + (Z_t + \lambda Q_t) K_{t-1}^h + \frac{R_{t-1}^D}{P_t} D_{t-1} + \epsilon^m \frac{M_{t-1}}{P_t} + \frac{s_t M_{F,t-1}}{P_t} + P_t^{sc} s_t \frac{SC_{t-1}}{P_t} + s_t (1 - \tau_{d,t-1}) R_{z,t-1} \frac{B_{F,t-1}}{P_t} + \Pi_t \end{aligned} \quad (1)$$

where w_t denotes the real hourly wage and $H_t = 1 - L_t$ is total labor, K_t^h is physical capital, R_{t-1}^D is the risk-free nominal interest rate for deposits D_t calculated using available information at time t , P_t is the price level, and Π_t is total transfers from the government and profits distributed by firms. ϵ^m is the storage cost for holding cash, and Z_t and Q_t denote the net rental rate of capital and the equity price respectively. M_t , $M_{F,t}$ and SC_t denote holdings of domestic cash, foreign cash and stablecoins respectively, and P_t^{sc} is the price of stablecoins. s_t is the real exchange rate and $B_{F,t}$ denotes one-period foreign bonds held by domestic households denominated in US dollars paying a nominal interest rate of $R_{z,t} = R_t^* - \phi(e^{(b_{F,t} - b_F)} - 1)$, which includes the risk premium of borrowing in US dollars similar to [Gopinath et al. \(2020\)](#).⁶ $\chi^h(\cdot)$ is the intermediate cost to the household of participating the financial market. $\tau(1 - j_t)$ is the total transaction costs for accessing payment instruments. Depending on the scenario, described below, we implement a capital control tax $\tau_{d,t} \geq 0$ on the return from holding foreign bonds. We assume that the domestic bond is not traded internationally.

We introduce currency substitution in payment instruments, extending the framework of [Özbilgin \(2012\)](#) to incorporate stablecoins. The household values the consumption of

⁶The subscript F normally denotes the foreign assets held by domestic agents.

a continuum of goods $c_t(j)$ indexed by $j \in [0, 1]$, with Leontief-type instantaneous utility from each equal to:

$$u_t = u \left(\min \left\{ \frac{c_t(j)}{(\omega - 1)j^{-\omega}} \right\} \right), \quad \omega \in \mathbb{R}_- \quad (2)$$

This implies that the consumption of each good satisfies:

$$\frac{c_t(j)}{(\omega - 1)j^{-\omega}} = C_t, \quad j \in [0, 1] \quad (3)$$

A share \bar{j}_t of these goods is purchased using domestic cash, and the remainder is purchased using other liquid assets—specifically deposits, foreign cash, and stablecoins, if available.⁷

The composite liquidity provided by these other liquid assets is:

$$\Omega(D_t, s_t M_{F,t}, s_t SC_t) = \mu^{M^*} \left(\frac{s_t M_{F,t}^{\sigma^{M^*} - 1}}{\sigma^{M^*} - 1} \right) + \mu^{SC} \left(\frac{s_t SC_t^{\sigma^{SC} - 1}}{\sigma^{SC} - 1} \right) + \mu^D \left(\frac{D_t^{\sigma^D - 1}}{\sigma^D - 1} \right) \quad (4)$$

Following [Freeman and Kydland \(2000\)](#), the household chooses their distribution of asset holdings at the beginning of each period and maintains it until the beginning of the next. Keeping the proportions constant requires visiting the asset market n_t times at a small cost of κ units of time in each case. Households therefore base their payment decisions on a forward-looking consideration of inflation, exchange rates, interest rates, the price of stablecoins, and the cost of visiting the asset market. They will choose to use liquid assets if, as in [Özbilgin \(2012\)](#):

$$v_t^d R_{t+1}^D + v_t^{sc} \frac{P_t^{sc}}{P_{t-1}^{sc}} s_t + v_t^{m^*} De_{t+1} - \frac{n_t \tau (\bar{r}_{t+1}^k)}{c_t(j)} - \Delta_t \geq \frac{1}{\pi_{t+1}} \quad (5)$$

where v_t^i is the weight of each asset in the portfolio, De_t is the depreciation of the nominal exchange rate, \bar{r}_{t+1}^k is the net return of capital adjusted for adjustment cost and Δ_t corrects for transformation between assets in the non-cash bundle and is independent of the amount of consumption goods purchased using it. Intuitively, a higher rate of domestic

⁷Following [Henriksen and Kydland \(2010\)](#) and [Özbilgin \(2012\)](#), we assume the foreign bond and capital are illiquid and cannot be used for purchases.

inflation—holding constant the return on deposits, the price of the stablecoin, depreciation and transactions costs—encourages the household to shift away from domestic cash and toward other liquid assets that provide a better store of value.⁸ Defining \bar{j}_t as the threshold good, for which Equation 5 holds with equality and the household is indifferent between payment options, we can finally express the household’s total demands for cash and liquid assets in period t as:

$$\int_0^{\bar{j}_t} c_t(j) dj = n_t \frac{M_t}{P_t} \quad (6)$$

$$\int_{\bar{j}_t}^1 c_t(j) dj = n_t \frac{\Omega(D_t, e_t M_{H,t}^*, e_t SC_t)}{P_t} \quad (7)$$

We normalize the time endowment of the household to one unit, which they spend on labor, leisure and trips to the asset market:

$$L_t + H_t + \kappa n_t = 1 \quad (8)$$

In addition to their choice of payment method, the household faces an orthogonal decision over whether to purchase each unit of consumption from domestic or foreign producers. They consume a CES bundle of both, where subscript F denotes Foreign-produced goods:⁹

$$C_t = \left[(1 - \gamma)^{\frac{1}{\eta}} C_{Ht}^{\frac{\eta-1}{\eta}} + \gamma^{\frac{1}{\eta}} C_{Ft}^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}} \quad (9)$$

The consumption price index therefore takes the following form, where P_{Ft} is the price of imported goods:

$$P_t = [(1 - \gamma)(P_{Ht})^{1-\eta} + \gamma(P_{Ft})^{1-\eta}]^{\frac{1}{1-\eta}} \quad (10)$$

Exports—with price p_{Ht}^* , denominated in the foreign currency—follow similarly, where *

⁸Note that foreign inflation is only relevant to the extent that it impacts the exchange rate since the household is concerned with the domestic purchasing power of the foreign currency.

⁹The problem is similar for the foreign economy, with different home bias parameters.

denotes goods consumed in Foreign:

$$C_{Ht}^* = \gamma^* (p_{Ht}^*)^{-\eta} C_t^* \quad (11)$$

Full derivations can be found in the Appendix. Usage and exports of the investment good has a symmetric structure to consumption goods:

$$I_t = [(1 - \gamma)^{\frac{1}{\eta}} I_{Ht}^{\frac{\eta-1}{\eta}} + \gamma^{\frac{1}{\eta}} I_{Ft}^{\frac{\eta-1}{\eta}}]^{\frac{\eta}{\eta-1}} \quad (12)$$

$$I_{Ht}^* = \gamma^* (p_{Ht}^*)^{-\eta} I_t^* \quad (13)$$

2.2 Production Sectors

Total output Y_t is a CES aggregate of differentiated intermediate inputs indexed by $i \in [0, 1]$:

$$Y_t = \left[\int_0^1 Y_t(i)^{\frac{\epsilon-1}{\epsilon}} di \right]^{\frac{\epsilon}{\epsilon-1}} \quad (14)$$

Each intermediate-good producer therefore faces final demand

$$Y_t(i) = \left(\frac{P_t(i)}{P_t} \right)^{-\epsilon} Y_t \quad (15)$$

with the retail price index a composite of intermediate-good prices:

$$P_t = \left[\int_0^1 P_t(i)^{1-\epsilon} di \right]^{\frac{1}{1-\epsilon}} \quad (16)$$

Since all domestic producers are symmetric, aggregate output, Y_t can be written as:

$$Y_t = A_t \left(\frac{K_{t-1}}{\alpha_K} \right)^{\alpha_K} \left(\frac{H_t}{1 - \alpha_K} \right)^{1-\alpha_K} \quad (17)$$

where K_{t-1} and H_t are capital and labor from households.¹⁰ A_t is the total factor productivity which follows an autoregressive process with technology shock parameter $v_t^a \sim N(0, \sigma_a^2)$:

$$\log(A_t) = (1 - \rho_a)\log(A) + \rho_a\log(A) + v_t^a$$

Firms operate in monopolistic competition and set the price of their own good accordingly. Following [Adrian et al. \(2021\)](#), [Akinci and Queralto \(2018\)](#) and [Ahmed et al. \(2021\)](#), we incorporate dominant currency pricing: we assume the domestic price is set in Home currency and the export price is set in US dollars. When setting domestic prices, retailer i chooses $p_{Ht}(i)$ for domestic goods, expressed in terms of the domestic CPI, to maximize her future discounted profit:

$$E_t \sum_{t=0}^{\infty} \beta^t \frac{\lambda_t}{\lambda_0} \left[\frac{P_{Ht}(i) - MC_t}{P_t} (C_{Ht}(i) + I_{Ht}(i)) - \frac{AC_t(i)}{P_t} \right] \quad (18)$$

where MC_t is the marginal cost of the retailer, $C_{Ht} + I_{Ht}$ is the total domestic production of domestic consumption and investment, and adjustment costs for setting prices $AC_t(i)$ are defined by:

$$AC_t(i) = \frac{\Omega_P}{2} \left(\frac{P_{Ht}(i)}{P_{Ht}(i)} - \bar{\pi} \right)^2 P_{Ht}(C_{Ht} + I_{Ht}) \quad (19)$$

A change in retail prices requires quadratic adjustment costs $AC_t(i)$ in nominal terms following [Rotemberg \(1982\)](#), giving the New Keynesian Philips Curve:¹¹

$$mc_t = p_{Ht} \left(\frac{\epsilon - 1}{\epsilon} \right) + \frac{\Omega_P}{\epsilon} (\pi_{Ht} - \bar{\pi}) \pi_{Ht} - \left(\beta \frac{\lambda_{t+1}}{\lambda_t} \pi_{H,t+1} (\pi_{H,t+1} - \bar{\pi}) \frac{p_{H,t+1} (C_{H,t+1} + I_{H,t+1})}{p_{H,t} (C_{Ht} + I_{Ht})} \right) \quad (20)$$

where π_{Ht} is the domestic price inflation, ϵ is the elasticity of substitution between retail products, and Ω_P is the price adjustment cost parameter.

¹⁰To ensure a solution to the model, we define K_{t-1} as cumulative capital predetermined by the end of period $t - 1$, used for production at time t .

¹¹Lower case letters denote values relative to the price level.

Turning to export prices, exporter i chooses $p_{Ht}^*(i)$ for exported goods to maximize her future discounted profit, but since $p_{Ht}^*(i)$ is denoted in US dollars they must also take exchange rate movements into consideration:

$$E_t \sum_{t=0}^{\infty} \beta^t \frac{\lambda_t}{\lambda_0} \left[\frac{P_{Ht}^*(i) s_t - MC_t}{P_t} (C_{Ht}^*(i) + I_{Ht}^*(i)) - \frac{AC_t(i)}{P_t} \right] \quad (21)$$

where adjustment costs and the Philips Curve are defined analogously to Equation 19 and Equation 20 respectively.

In line with Gertler and Karadi (2011), capital producers purchase final goods and non-depreciated capital to produce capital goods which are bought later by intermediate firms. They maximize expected profits

$$\max E_t \sum_{t=0}^{\infty} \beta^t \frac{\lambda_t}{\lambda_0} [Q_t K_t - (1 - \delta) Q_t K_{t-1} - I_t] \quad (22)$$

subject to depreciation and an investment adjustment cost

$$K_t = (1 - \delta) K_{t-1} + \left[1 - \frac{\kappa_I}{2} \left(\frac{I_t}{I_{t-1}} - 1 \right)^2 \right] I_t \quad (23)$$

2.3 Financial Intermediaries

Domestic bankers have three sources of funding that they use to make their capital loans to producers: their own net worth N_t , domestic deposits D_t and foreign deposits D_t^* . x_t is the fraction of assets financed by foreign borrowing. Foreign deposits are converted into domestic currency at the prevailing exchange rate s_t and are more expensive—we assume that domestic banks in the emerging market must pay a risk premium $(1 + \frac{\alpha_b}{2})^2$ to accumulate foreign debt. The flow of funds constraint for a representative bank is therefore:

$$\left(1 + \frac{\alpha_b}{2} x_t^2 \right)^2 Q_t K_t^b = N_t + D_t + s_t D_t^* \quad (24)$$

Businesses in turn can receive two sources of capital: directly from households, and from the financial sector. As mentioned briefly above, businesses may receive two sources of capital. The first is from the household directly¹². The second is from the financial sector, K_t^b . Then the net worth is as follows:

$$N_t = (Z_t + Q_t \lambda) K_{t-1}^b - \frac{D_{t-1} R_{t-1}}{\pi_t} - \frac{s_t D_{t-1}^* R_{t-1}^*}{\pi_t^*} \quad (25)$$

At the beginning of each period t , bankers raise funds and purchase assets from non-financial firms. During this period, the banker decides whether to keep working as a banker (operating honestly) or to divert assets. Deciding to keep being a banker means carrying capital until the returns are given and the banker fulfils the responsibilities to depositors. Otherwise, bankers can choose to exit and keep a fraction θ of total assets for themselves.

We define V_t as the bank's value function, which can be considered the 'market value' of bankers. Depositors will only trust the bank with their funds if bankers are incentivized not to divert assets, i.e. if

$$V_t(N_t) \geq \Theta(x_t, x_t^c) Q_t K_t^b \quad (26)$$

Under a perfect financial market, the incentive constraint always holds with equality to prevent limitless asset expansion. However, in our model, banks are also subject to a terminal wealth maximization problem. Banks maximize expected terminal wealth, which can be expressed recursively as:

$$V_t(N_t) = \max E_t \Lambda_{t,t+1} [(1 - \sigma) N_{t+1} + \sigma V_{t+1}(N_{t+1})] \quad (27)$$

We can also express this in terms of Tobin's Q maximization, where $\psi_t = \frac{V_t}{N_t}$ is Tobin's Q, and $lev_t = \frac{Q_t K_t^b}{N_t}$ is the leverage ratio.¹³

¹²This reflects that the household can participate in the financial market.

¹³A detailed derivation of banks' problem can be found in the Appendix.

$$\psi_t = \max_{lev_t, x_t} \left(\mu_t lev_t + \left(1 - \frac{\alpha_b}{2} lev_t^2 x_t \right) v_t + \mu_t^* lev_t x_t \right) \quad (28)$$

s.t.

$$\psi_t \geq \Theta(x_t, x_t^c) lev_t \quad (29)$$

$$\mu_t = E_t \left[\Lambda_{t;t+1} \left(\frac{Z_{t+1} + \lambda Q_{t+1}}{Q_t} - R_{t,t+1} \right) \right] \quad (30)$$

$$\mu_t^* = E_t \left[\Lambda_{t;t+1} \left(R_{t+1} - \frac{s_{t+1}}{s_t} R_{t,t+1}^* \right) \right] \quad (31)$$

$$v_t = E_t [\Lambda_{t;t+1} R_{t+1}] \quad (32)$$

$$\Omega_{t+1} = \Lambda_{t;t+1} (1 - \sigma + \sigma \psi_{t+1}) \quad (33)$$

where $\Omega_{t;t+1}$ is the stochastic discount factor of the banker, μ_t is the excess return on capital over home deposits, μ_t^* is the cost advantage of foreign currency debt over home deposits or the deviation from real uncovered interest parity (UIP), and v_t is the marginal cost of deposits.

2.4 Home Central Bank and Market Clearing

The domestic central bank follows a Taylor rule in setting its policy rate:¹⁴

$$\ln \left(\frac{R_t}{R_{ss}} \right) = \rho_r \ln \left(\frac{R_{t-1}}{R_{ss}} \right) + (1 - \rho_r) \left(\rho_\pi \ln \left(\frac{\pi_t}{\pi_{ss}} \right) + \rho_y \ln \left(\frac{Y_t}{Y_{t-1}} \right) \right) \quad (34)$$

¹⁴We impose this for tractability; future extensions could allow more nuanced responses, such as distinguishing between supply- and demand-driven inflation.

Goods market clearing requires:

$$\begin{aligned}
Y_t &= (1 - \gamma)(p_{Ht})^{-\eta}(C_t + I_t) + G_t \\
&\quad + \frac{1 - n}{n}\gamma^*(p_{Ht}^*)^{-\eta}(C_t^* + I_t^*) \\
&\quad + \frac{\Omega_P}{2}(\pi_{Ht} - \bar{\pi})^2(C_{Ht} + I_{Ht}) \\
&\quad + \frac{\Omega_{P^*}}{2}(\pi_{Ht}^* - \bar{\pi})^2(C_{Ht}^* + I_{Ht}^*) + \chi^h + \chi^b
\end{aligned} \tag{35}$$

i.e., that total output is equal to total domestic expenditure on domestic and foreign consumption and investment goods, as well as transaction and adjustment costs from bankers and households, χ^b and χ^h . Similarly, trade balance requires that:

$$\begin{aligned}
TB_t &= s_t b F_t - s_t R_{z,t-1} \frac{b F_{t-1}}{\pi_t^*} + \frac{R_{t-1}^*}{\pi_t^*} D_{t-1}^* s_t \\
&\quad - D_t^* s_t + s_t (M_{H,t}^* - M_{H,t-1}^*) + (n P_t^{SC} SC_t - n P_t^{SC} SC_{t-1}) s_t
\end{aligned} \tag{36}$$

3 The Foreign Economy

The foreign economy is calibrated to the US and has a relatively standard NK-DSGE structure, with the addition of the stablecoin issuer. To maintain tractability, we do not include a foreign banking sector, but we do allow foreign households to save in the domestic banking sector. The foreign household can hold foreign cash and stablecoin, which also provides utility directly, and save by investing in bonds. The foreign currency is dominant, so do not allow for currency substitution and firms only price in dollars. Most importantly, the stablecoin issuer is based in the Foreign economy and owned by an entrepreneur, building on [Cova et al. \(2022\)](#), [Carlstrom and Fuerst \(1997\)](#), [Bernanke et al. \(1999\)](#) and [Gerali et al. \(2010\)](#).

3.1 Foreign Households

The representative foreign household maximizes utility from consumption, leisure, and holding dollars and stablecoin.

$$U_t^* = E_t \sum_{t=0}^{\infty} \beta^t \left[\frac{(C_t^*)^{1-\sigma^*}}{1-\sigma^*} - \kappa_L \frac{H_t^{*1+\varphi^*}}{1+\varphi^*} + \mu^{*M^*} \left(\frac{M_t^{*1-\sigma^{M^*}}}{1-\sigma^{M^*}} \right) + \mu^{*SC^*} \left(\frac{SC_t^{*1-\sigma^{SC^*}}}{1-\sigma^{SC^*}} \right) \right] \quad (37)$$

subject to the income-expenditure constraint

$$C_t^* + I_t^* + \frac{B_{Ft}^*}{P_t^*} + \frac{D_t^*}{P_t^*} + \frac{M_t^*}{P_t^*} + P_t^{sc} \frac{SC_t^*}{P_t^*} = w_t^* H_t^* + r_t^{k^*} K_{t-1}^* + \frac{r_{t-1}^*}{P_t^*} D_{t-1}^* + \frac{R_{t-1}^*}{P_t^*} B_{F,t-1}^* + P_t^{sc} \frac{SC_{t-1}^*}{P_t^*} + \frac{R_{t-1}^*}{P_t^*} b_{F,t-1}^* + \Gamma_t^* \quad (38)$$

$$K_t^* = (1 - \delta^*) K_{t-1}^* + \left[1 - \frac{\Omega_k^*}{2} \left(\frac{I_{t+1}^*}{I_t^*} - 1 \right)^2 \right] I_t^* \quad (39)$$

where C_t^* and I_t^* are foreign consumption and investment, respectively. B_{Ft}^* and D_t^* are foreign bonds and deposits in the domestic economy, which are perfect substitutes from the household's perspective. R_t^* is the foreign risk-free rate. M_t^* and SC_t^* are foreign holdings of foreign cash and the stablecoin respectively. The household receives utility from holding liquid assets, following [Woodford \(2003\)](#), and we assume that cash is the most liquid asset such that $\mu^{*M^*} > \mu^{*SC^*}$. Lastly, P_t^* is the foreign price level. Different from the domestic household, we let the foreign household be the capital producer.

3.2 Production Sectors

As in the domestic economy, foreign production is a CES aggregate of differentiated intermediate inputs i

$$Y_t^* = \left[\int_0^1 Y_t^*(i)^{\frac{\epsilon^*-1}{\epsilon^*}} di \right]^{\frac{\epsilon^*}{\epsilon^*-1}}$$

which again implies that demand from the representative final-good firm for each input is

$$Y_t^*(i) = \left(\frac{P_t^*(i)}{P_t^*} \right)^{-\epsilon^*} Y_t^* \quad (40)$$

The production function of each foreign intermediate goods producer is

$$Y_t^*(i) = A_t^* (K_{t-1}^*)^{\alpha^*} H_t^{*1-\alpha^*} \quad (41)$$

where A_t^* is firm productivity which follows an AR(1) process with technology shock parameter $\epsilon_t^a \sim N(0, \sigma_a^2)$:

$$\log(A_t^*) = (1 - \rho_a) \log(\bar{A}^*) + \rho_a \log(A_{t-1}^*) + \epsilon_t^a$$

Firms then maximize profits in line with [Rotemberg \(1982\)](#)

$$E_t \sum_{i=0}^{\infty} \beta^i \frac{\lambda_t^*}{\lambda_0^*} \left[\frac{P_{Ft}^*(i)}{P_t^*} Y_{Ft}^*(i) - w_t^* H_t(i)^* - r_t^{k^*} K_{t-1}^*(i) - \frac{AC_t(i)}{P_t^*} \right] \quad (42)$$

where the adjustment cost, AC_t , is defined by

$$AC_t^*(i) = \frac{\kappa_P}{2} \left(\frac{P_{Ft}^*(i)}{P_{F,t-1}^*(i)} - \pi^* \right)^2 P_{Ft}^* Y_t^* \quad (43)$$

Only foreign prices need to be considered, since all sales by foreign firms—including exports—are priced in dollars.

3.3 Stablecoin Issuers

Following [Cova et al. \(2022\)](#), the stablecoin issuer sells stablecoins that it produces from foreign cash and foreign bonds according to the technology constraint

$$SC_t^s = \left[b^{\frac{1}{e}} M_{SC,t}^* \frac{e-1}{e} + (1-b)^{\frac{1}{e}} B_{SC,t}^* \frac{e-1}{e} \right]^{\frac{e}{e-1}} \quad (44)$$

where $M_{SC,t}^*$ and $B_{SC,t}^*$ are its holdings of cash and bonds respectively.¹⁵ The issuer is owned by an entrepreneur, who maximizes discounted profit in the form:

$$\max E_t \left(\sum_{j=0}^{\infty} \beta_e^j \frac{\Lambda_{t+j}^e}{\Lambda_t^e} \Omega_{t+j}^{SC} \right) \quad (45)$$

where

$$\Omega_t^{SC^s} = (P_t^{SC} SC_t^s - P_t^{SC} SC_{t-1}^s) - (M_{SC,t}^* - M_{SC,t-1}^*) - (B_{SC,t}^* - \frac{R_{t-1}^*}{\pi_t^*} B_{SC,t-1}^*) \quad (46)$$

This generates the following first-order conditions, where all variables are expressed relative to price level for convenience and λ_t^{sc} is the Lagrangian multiplier.

F.O.C. wrt SC_t^s :

$$P_t^{SC} = \lambda_t^{sc} - \beta_e \frac{\Lambda_{t+1}^e}{\Lambda_t^e} P_{t+1}^{SC}; \quad (47)$$

F.O.C. wrt $M_{SC,t}^*$:

$$\lambda_t^{sc} b^{\frac{1}{e}} \left(\frac{SC_t^s}{M_{SC,t}^*} \right)^{\frac{1}{e}} = 1 - \beta_e \frac{\Lambda_{t+1}^e}{\Lambda_t^e}; \quad (48)$$

F.O.C. wrt $B_{SC,t}^*$:

$$\lambda_t^{sc} (1-b)^{\frac{1}{e}} \left(\frac{SC_t^s}{B_{SC,t}^*} \right)^{\frac{1}{e}} = 1 - \beta_e \frac{\Lambda_{t+1}^e}{\Lambda_t^e} \frac{R_{t+1}^*}{\pi_{t+1}^*}; \quad (49)$$

The market clears when total global stablecoin supply SC_t^s is equal to total demand from the domestic and foreign economies

$$SC_t^s = \frac{n}{1-n} SC_t + SC_t^* \quad (50)$$

¹⁵Unlike [Cova et al. \(2022\)](#), we do not include domestic bonds among the backing assets, reflecting that the domestic economy is a small developing country whose assets are not widely included in global reserves.

where n and $1 - n$ are the sizes of the domestic and foreign economies respectively.

3.4 Foreign Central Bank and Market Clearing

Market clearing requires that the total supply of dollars M_t^{s*} is equal to the total holdings of dollars by the stablecoin issuer, foreign households and domestic households:

$$M_t^{s*} = M_{SC,t}^* + M_t^* + \frac{n}{1-n} M_{F,t} \quad (51)$$

Likewise, for the US bond market, we require:

$$B_t^{s*} = B_{SC,t}^* + B_{F,t}^* + \frac{n}{1-n} B_{F,t} \quad (52)$$

The foreign government constraint follows [Lindé and Trabandt \(2018\)](#):

$$B_t^{s*} - \frac{R_t^*}{\pi_{t+1}^*} B_{t-1}^{s*} + M_t^{s*} - M_{t-1}^{s*} = G_t^* - TR_t \quad (53)$$

$$\frac{TR_t}{TR} = \left(\frac{B_{t-1}^{s*}}{B^{s*}} \right)^\phi \quad (54)$$

The foreign central bank is also assumed to follow a Taylor-type rule:

$$\ln \left(\frac{R_t^*}{R^*} \right) = \rho_r^* \ln \left(\frac{R_{t-1}^*}{R^*} \right) + (1 - \rho_r^*) \left(\rho_\pi^* \ln \left(\frac{\pi_t^*}{\pi_{ss}^*} \right) + \rho_y^* \ln \left(\frac{Y_t^*}{Y_{t-1}^*} \right) \right) \quad (55)$$

Lastly, foreign goods market clearing requires:

$$Y_t^* = (1 - \gamma^*) (p_{Ft}^*)^{-\eta} (C_t^* + I_t^*) + G_t^* + C_t^e + \frac{n}{1-n} \gamma^* (p_{Ft})^{-\eta} (C_t + I_t) + \frac{\kappa_P}{2} (\pi_{Ft}^* - \bar{\pi}^*)^2 Y_t^* \quad (56)$$

4 Simulations

This section first describes our baseline calibration of the model, then illustrates the quantitative implications. We focus on the dynamic responses to three common shocks: a productivity shock, a domestic monetary policy shock, and a foreign monetary policy

shock. For each, we compare the responses in scenarios with and without the presence of stablecoins.

4.1 Calibration

We draw most of our parameter values from the literature, particularly [Aoki et al. \(2016\)](#) and [Adrian et al. \(2021\)](#), and their values are relatively standard. Table 3 in the Appendix shows the main parameters and steady-state ratios. For the banking sector, we set the ex-ante steady-state leverage ratio to 4 and the credit spread to 2% annually. This results in the proportional transfer to new bankers being 0.002, with foreign borrowing accounting for 25% of bank assets. In addition, the survival rate of the bankers is set at 0.94. Most of the key steady-state ratios that result are in line with the literature.

For the stablecoin, the hypothetical nature of our exercise—exploring the potential macrofinancial implications of the as-yet-nonexistent broad adoption of a new asset—precludes estimating the key parameters empirically. Instead, we set the main parameters such that approximately 2% of payment assets are held in the stablecoin (see Table 4 in the Appendix), which we consider substantial but not infeasible.¹⁶ Given an elasticity of the stablecoin equal to that of deposits, i.e., $\sigma_{SC} = \sigma_D$, this 2% assumption implies that the usefulness of the stablecoin in providing liquidity is roughly halfway between that of foreign currency and deposits, i.e., $\mu^{M^*} < \mu^{SC} < \mu^D$. We again consider this reasonable and in line with other work modelling a liquidity premium for digital money over cash based on convenience, potential programmability ([Lee, 2021](#)), or other opportunities for improvement as adoption and innovation reinforce each other ([Cong and Mayer, 2022](#); [Tan, 2023a](#)).

For the structure of the stablecoin issuer, we use a similar technology to [Cova et al. \(2022\)](#) with slightly different parameters. We set the share of foreign cash (versus foreign bonds) in the issuer’s technology at 95%, in line with the evidence in [IMF \(2021\)](#) that the largest, safest stablecoins are almost entirely backed by liquid assets with maturity

¹⁶In our baseline, stablecoin holdings are less than 4% the size of deposits. Less conservative assumptions—i.e., a larger share of stablecoin holdings in equilibrium—would increase the macrofinancial impacts of stablecoin availability.

of one year or less.

4.2 Domestic TFP Shock

First, we assess the impact on the domestic economy of a 1% negative shock to domestic total factor productivity (TFP). The black line in Figure 1 shows the results in our baseline without the stablecoin, which are relatively conventional and in line with existing models in the literature. Output falls as a result of the standard negative supply shock, as do both consumption and investment. Inflation rises due to the lower productivity of goods-producing firms. The central bank responds to inflation by raising the policy rate, reducing domestic holdings of the foreign bond and leading to a decrease in the real exchange rate, signifying currency appreciation. The rise in the policy rate causes a recession in the real economy which reduces investment and the asset price.¹⁷ In the banking sector, the negative TFP shock diminishes the net worth (a measure of current and future profits by pushing down the asset price) of the banks and increases the credit spread. As the cost of capital increases due to risk premium, it decreases capital demand by the production sector and enhances the reaction in investment and asset price. Additionally, there's a decrease in demand for both domestic and foreign deposits, resulting in reduced domestic and foreign financing channels for the banking sector.

The red line indicates the outcomes when the stablecoin is available. As highlighted by [Cova et al. \(2022\)](#), households look forward, taking into account the expected stablecoin price for the next period. As a result, households tend to reallocate toward the stablecoin when they expect the price to rise and reallocate away from it when they expect the price to fall (relative to other sources of liquidity). While the price of the stablecoin in US dollars deviates very little, its price in domestic currency deviates substantially as the exchange rate changes, and the anticipation of this in turn drives households' decisions. Figure 1 and subsequent figures depict the price of the stablecoin from the perspective of domestic households—i.e., in domestic currency.

¹⁷Lower output and income also reduces imports, improving the trade balance.

The availability of stablecoins worsens the impact of the negative TFP shock. Alongside a somewhat larger slump in output, consumption and investment, we see a more pronounced reduction in usage of domestic cash and an increase in holdings of the stablecoin. This marginal currency substitution is also accompanied by a slightly larger fall in domestic deposits, indicating potential bank disintermediation.

In Figure 10 in the Appendix, we show that the results for a cost-push shock are similar to those from a negative TFP shock. Intuitively, both shocks drive inflation higher, which increases the relative attractiveness of non-domestic-currency assets, including the stablecoin. This aligns with the concerns expressed in [IMF \(2021\)](#) and elsewhere that countries with weak monetary policy regimes and volatile prices may be particularly exposed to the adoption of crypto assets as a means of hedging against domestic inflation and depreciation.

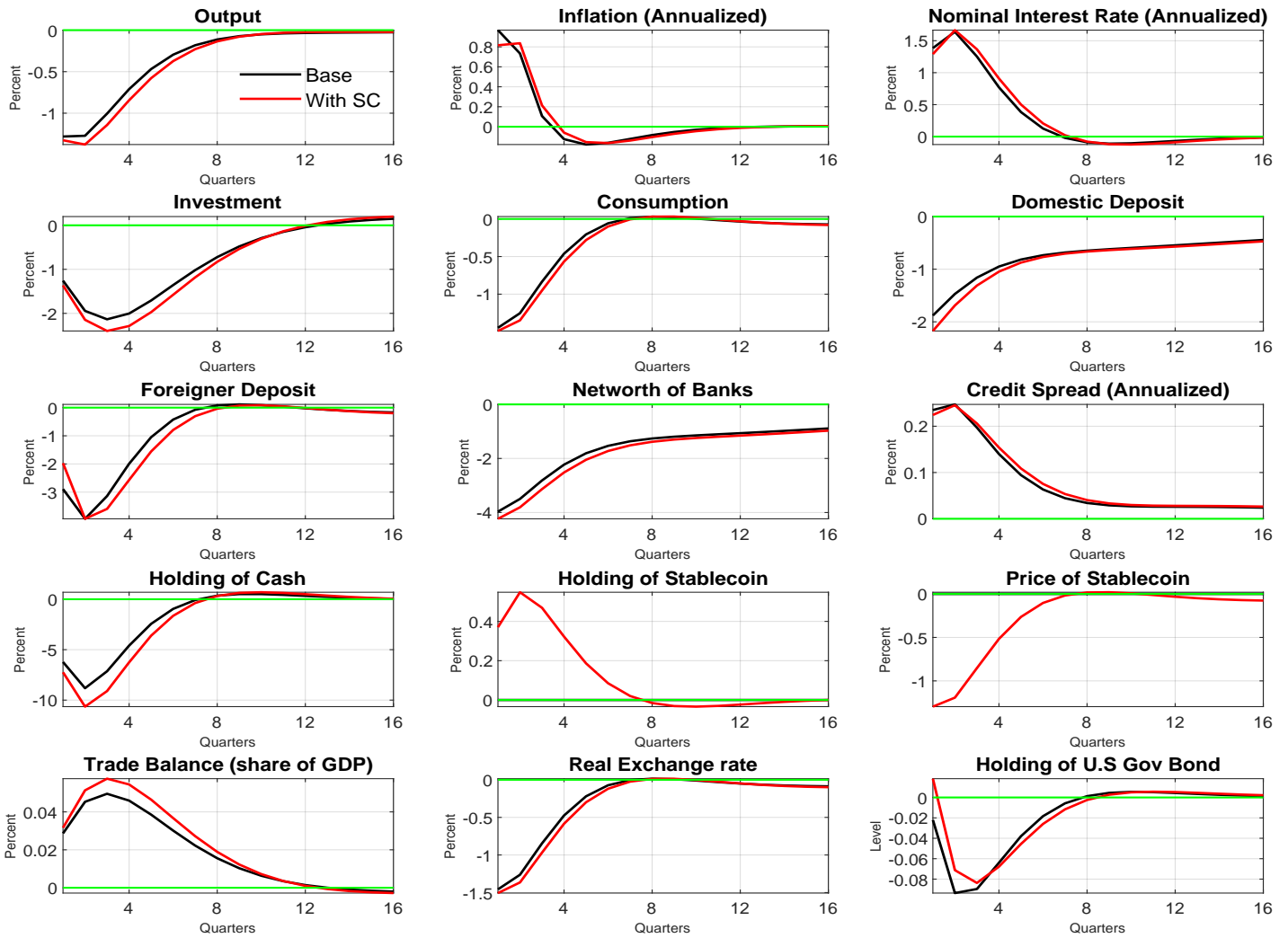


Figure 1: Responses of selected variables in the domestic economy to a negative 1% TFP shock. Time is in quarters. The black line depicts the model without the stablecoin, and the red line depicts the model with the stablecoin. Impulse responses are in % deviation from steady state, while inflation, the credit spread and the interest rate are annualized. The stablecoin price refers to the price in domestic currency.

4.3 Domestic Monetary Rate Shock

We next assess the impact of a contractionary shock in the domestic monetary rate, as illustrated in Figure 2. As with the TFP shock, the outcomes here are consistent with our expectations based on other models. The increase in the domestic interest rate results in an immediate decline in consumption, investment and output and a reduction in inflation. To smooth consumption, households also reduce their holdings of foreign bonds. Ultimately, the rise in the policy rate contributes to an appreciation of the

domestic currency.

Once again, the contractionary shock increases banking sector stress. The asset price, Tobin's Q , drops significantly. Initially, banks receive deposits from households, and in conjunction with their existing net worth, they profit by lending to intermediate firms. However, a higher monetary rate leads to a decrease in the value of capital goods and investment, as the elevated nominal rate heavily discounts the rental income of capital. Furthermore, banks themselves bear the impact of fluctuations in the asset price, resulting in an immediate decrease in their net worth. To counterbalance the escalating cost of financing, banks raise lending rates for firms, causing an increase in the credit spread. Nonetheless, due to the declining trajectory of banks' leverage, the spread initially rises and subsequently decreases over time.

Once again, the availability of stablecoins magnifies the severity of the shock. A more substantial decrease in investment is observed, alongside more pronounced reduction in cash, similar to the impact of the TFP shock. Banks' net worth falls by more and the credit spread widens by more. Overall, the model with a stablecoin predicts a slightly more severe recession, characterized by heightened currency substitution with a larger decrease in domestic cash.

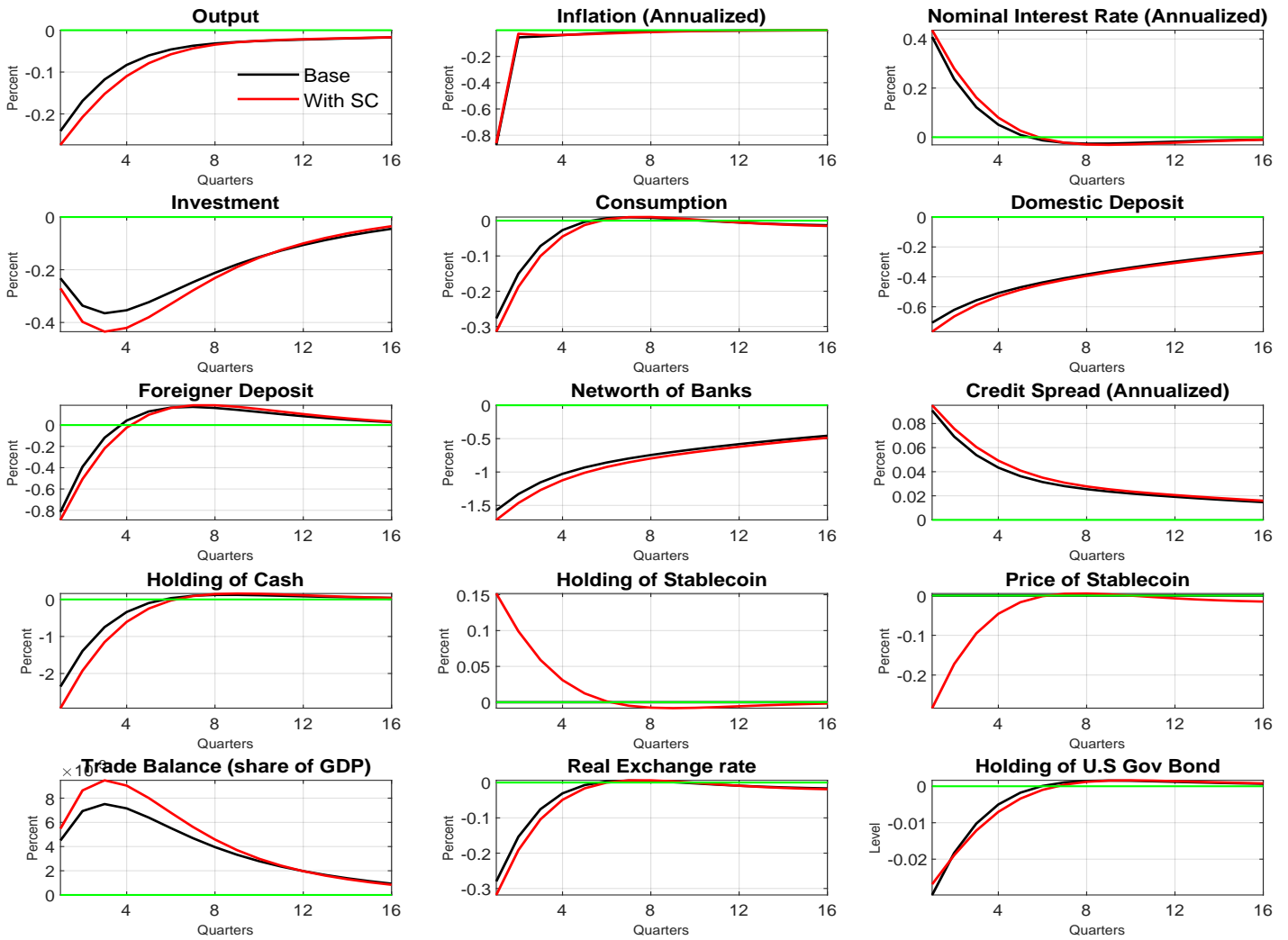


Figure 2: Responses of selected variables in the domestic economy to a contractionary domestic monetary policy shock. Time is in quarters. The black line depicts the model without the stablecoin, and the red line depicts the model with the stablecoin. Impulse responses are in % deviation from steady state, while inflation, the credit spread and the interest rate are annualized. The stablecoin price refers to the price in domestic currency.

4.4 Foreign Monetary Rate Shock

We now turn to a shock emanating from outside the domestic economy. Given the small size of our domestic economy and the trade and financial linkages between countries, fluctuations in the large economy have particular significance, in line with the literature on the ‘Global Financial Cycle’ (Miranda-Agrippino and Rey, 2020; Miranda-Agrippino et al., 2020; Rey, 2013).

Figure 3 shows the responses to a contractionary shock in the foreign interest rate.

The shock triggers a contraction in domestic output. As the appeal of the domestic currency wanes, the real exchange rate depreciates, which bolsters exports through an expenditure-switching effect and supports aggregate demand. However, the depreciation in the exchange rate also prompts an increase in the inflation rate by elevating the prices of imported goods. The central bank responds to these inflationary pressures by raising interest rates, which raises savings rates and reduces consumption. Although the high inflation environment helps alleviate the real burden of debt denominated in the home currency, the relationship between deteriorating bank balance sheets and the decline in investment and asset prices (Tobin's Q), echoes the findings of [Kiyotaki and Moore \(1997\)](#) and [Gertler and Karadi \(2015\)](#).

As the stablecoin can be traded between three agents—domestic households, foreign households and issuers—its availability increases the connection between the two economies. Importantly, the FOC for stablecoin holdings also involves the exchange rate, which creates an additional cross-border transmission channel. We observe a substantially larger spillover effect in the presence of the stablecoin. The responses of output, consumption, and investment are more pronounced than in the scenario without stablecoins. As highlighted by [Minesso et al. \(2022\)](#) for foreign central bank digital currencies (CBDCs), the existence of the new digital asset introduces a new novel arbitrage condition that intertwines the domestic interest rate, the exchange rate, and the trajectory of stablecoin prices. This mostly reflects through the first-order conditions on the household side. Cash and deposits decrease more in response to the foreign shock, and the domestic banking sector undergoes a period of stress, evident in both bank net worth and the credit spread.¹⁸ Holdings of the stablecoin and foreign bonds increase as domestic households reallocate away from domestic cash and deposits and the exchange rate depreciates substantially.

¹⁸The credit spread measures the risk in the credit market as a higher spread usually reflects a higher lending rate to firms in compensation for the risk premium.

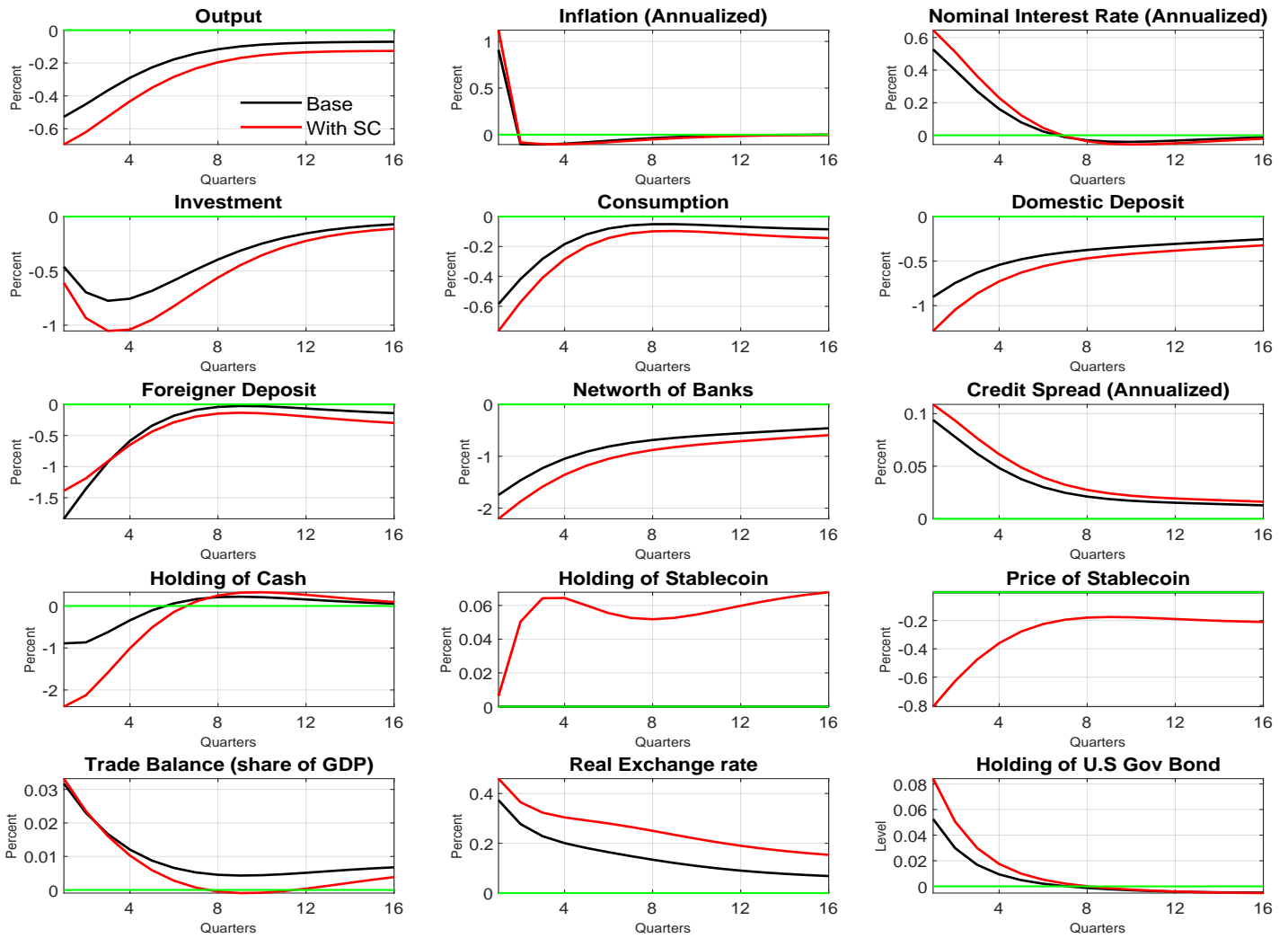


Figure 3: Responses of selected variables in the domestic economy to a contractionary foreign monetary policy shock. Time is in quarters. The black line depicts the model without the stablecoin, the red line depicts the model with the stablecoin. Impulse responses are in % deviation from steady state, while inflation, the credit spread and the interest rate are annualized. The stablecoin price refers to the price in domestic currency.

Overall, in this section we find that stablecoins can magnify both the extent of currency substitution and the severity of the macroeconomic environment's response to contractionary shocks. Stablecoins contribute to a minor form of bank disintermediation, characterized by a more pronounced decrease in domestic deposits. The largest impacts result from the foreign monetary policy shock. The presence of the stablecoin introduces an additional channel of international linkage, similar to the findings of [Minesso et al. \(2022\)](#) for CBDC, which intensifies the already large spillover effects on our small domestic economy.

4.5 Monetary Policy Transmission

By incentivizing households to hold more assets offshore, disintermediating banks, the existence of the stablecoin can weaken the transmission of monetary policy. In this section, we explore this mechanism underlying our results by conducting an optimal monetary policy exercise. By examining how the optimal Taylor rule parameters change in the presence of the stablecoin, we can assess its impact on the central bank's ability to influence inflation over the business cycle.

We follow common practice (see [Levin and Williams, 2003](#)) and define the loss function of the central bank as a weighted sum of the unconditional variances of inflation, the change in interest rate, and output growth, consistent with the Taylor rule described in Equation 55. Given the importance of the exchange rate in many small, open emerging market economies, we also allow the variance of the real exchange rate to enter the central bank loss function:

$$L_{CB} = Var(\pi_t) + \lambda_y Var(\Delta Y_t) + \lambda_e Var(s_t) + \lambda_R Var(R_t) \quad (57)$$

A unique and stable equilibrium exists for this model. The optimal policy exercise consists of selecting the Taylor-type rule parameters that minimize the central bank's loss function over the distribution of shocks included in the model (except for the monetary policy shock), and over the full business cycle—i.e., over the full transition path back to

equilibrium.¹⁹ The central bank thus maximizes:

$$\begin{aligned} \min \quad & L_{CB} & (58) \\ \text{s.t.} \quad & \ln \left(\frac{R_t}{R_{ss}} \right) = \rho_r \ln \left(\frac{R_{t-1}}{R_{ss}} \right) + (1 - \rho_r) \left(\rho_\pi \ln \left(\frac{\pi_t}{\pi_{ss}} \right) + \rho_y \ln \left(\frac{Y_t}{Y_{t-1}} \right) \right) \end{aligned}$$

$$\mathbf{E}_t [f(x_t, x_{t+1}, x_{t-1}, \Theta)] = 0$$

where f denotes the set of equations (apart from the policy rule) and x and Θ represent the endogenous variables and parameters, respectively. The last equation ensures the solution of the model with optimized parameters.²⁰

The results are shown in Table 1, for a variety of weights (relative to inflation) on the parameters of the central bank's loss function. In the model incorporating the stablecoin, the central bank responds notably more assertively to inflation, with ρ_π frequently reaching its upper limit. Despite varying the relative emphasis on output and the exchange rate within the loss function, the outcomes remain consistent. This suggests that the presence of the stablecoin attenuates the effectiveness of monetary policy transmission, compelling the central bank to adopt a more forceful stance to fulfill its mandate. These results are aligned with the previous analysis: in the impulse responses above, we observe that domestic deposits decline more with the presence of the stablecoin and the macroeconomic response to each contractionary shock is more severe. In our model, monetary policy transmission is primarily conducted through saving and investment decisions. Since we assume that deposits are the only domestic asset with a policy rate, lower holdings of deposits could potentially weaken monetary policy.²¹ These findings are consistent with the concerns highlighted in IMF (2021), IMF-FSB (2023), Das et al.

¹⁹These shocks are the foreign interest rate and domestic TFP shock. We follow the literature in excluding the domestic interest rate shock. We scale the variance of the important variables—namely inflation, output growth, the real exchange rate and the interest rate—to ensure that all variances are approximately the same size.

²⁰We follow the literature in imposing an upper limit of 5 on the inflation reaction to ensure no corner solution.

²¹Since we do not incorporate fiscal authority, domestic deposits and government bonds are perfect substitutes.

(2023) and MacDonald and Zhao (2023).

Table 1: Optimal Taylor Rule Parameters

Relative weights			Without Stablecoin		With Stablecoin	
λ_y	λ_e	λ_R	ρ_π	ρ_y	ρ_π	ρ_y
1	1	0.5	2.2840	0.1281	4.8857	0.0198
1	0.5	0.5	2.2867	0.1273	5	0.0134
1	0.3	0.5	2.2841	0.1281	5	0.0148
0.5	0	0.5	2.2170	0.1356	5	0.0167

Notes: This table shows the optimal parameters for the Taylor rule in response to foreign interest rate and domestic TFP shocks, for each set of relative weights in the central bank's loss function, in the cases with and without the stablecoin.

4.6 Capital Controls

Finally, we investigate the implications of stablecoin availability for governments imposing capital flow management measures (CFMs). We follow Davis and Presno (2017) in imposing a tax on the return of the foreign bonds, giving the central bank the ability to influence capital outflows through the traditional bond channel.²² Specifically, the tax rate $\tau_{d,t}$ is set as a constant fraction ϕ_{bf} of the difference between domestic and foreign interest rates

$$\tau_{d,t} = \phi_{bf}(R_{z,t} - R_t) \quad (59)$$

where we impose that $\phi_{bf} \geq 0$ and $\tau_{d,t} \geq 0$. With capital controls in place—i.e., when $\phi_{bf} > 0$ —then, for any rise in the nominal interest rate on foreign bonds above that on domestic bonds, the central bank responds by imposing a positive tax to discourage capital outflows.²³ The first-order condition for the household with respect to holdings of foreign bonds becomes:

$$\lambda_t = \beta E_t \left(\lambda_{t+1} (1 - \tau_{d,t}) \frac{R_{z,t} s_{t+1}}{\pi_{t+1}^* s_t} \right) \quad (60)$$

²²A rich empirical literature assesses the effectiveness of capital flow management measures (for a survey see, for instance, IMF, 2020b). For the purposes of this exercise, we assume that the CFMs imposed do indeed influence non-stablecoin capital flows as intended by the policymaker.

²³We set ϕ_{bf} to 0.25 in our baseline calibration, in line with Davis and Presno (2017).

Crucially, these CFMs do not apply to the stablecoin, in line with, among others, [IMF \(2020a\)](#), [He et al. \(2022\)](#) and [Graf von Luckner et al. \(2023\)](#). The stablecoin can thus be used to circumvent capital controls, increasing its utility to the household.

In [Figure 4](#), we show the impact of CFMs on the model’s response to a foreign interest rate shock.²⁴ The red line repeats the stablecoin-inclusive model from [Figure 3](#) for comparison, then the blue dashed line includes active CFMs. These CFMs somewhat mitigate the spillovers from the foreign shock by redirecting resources toward domestic assets. The tax dampens the increase in the attractiveness of foreign bonds relative to domestic deposits, reducing capital outflows and ameliorating the depreciation of the exchange rate. With a smaller decline in domestic deposits, the negative impact on investment is reduced and the paths of output and consumption improve, along with banks’ net worth and the credit spread.²⁵

Importantly, the representative household does not reallocate from foreign bonds entirely into domestic bonds, since these are exposed to depreciation—instead, they also reallocate into the stablecoin. One non-domestic-currency asset (the foreign bond) is now less attractive, so the household increases its relative holdings of another (the stablecoin). The imposition of CFMs thus accelerates the adoption of the stablecoin.

Does this increased adoption of the stablecoin make outcomes worse, in an economy with CFMs? To address this question, in [Figure 5](#) we again show the responses to the foreign monetary shock, but now imposing CFMs in both cases and comparing responses with and without the stablecoin. In the world with the stablecoin (the blue dashed line), macroeconomic outcomes are generally worse. The ability of the domestic household to circumvent the CFMs leads them to reallocate away from domestic currency assets (cash and deposits) and toward the stablecoin. This shift is substantial, worsening the depreciation of the exchange rate and forcing the central bank to hike rates even more. Investment, output and consumption worsen, and banks exhibit greater stress with lower

²⁴We focus on the response to a foreign interest rate shock because the tax is imposed to reduce capital outflows, so its impact is limited for the other shocks where no capital outflow is observed.

²⁵Banks do see large outflows of foreigners’ deposits, however, since the CFMs do not apply to foreigners’ holdings of the foreign bond—but in our baseline calibration, the overall impact of CFMs remains positive for banks.

net worth and wider credit spreads. Thus our results imply that crypto-asset-based circumvention of capital controls could undermine their effectiveness in insulating small developing economies against spillovers from foreign shocks. Recent empirical work (e.g., Graf von Luckner et al., 2023) confirms that such circumvention is indeed taking place, albeit at a small scale; our model suggests that—if adoption continues to grow—such flows could potentially have harmful macroeconomic effects.

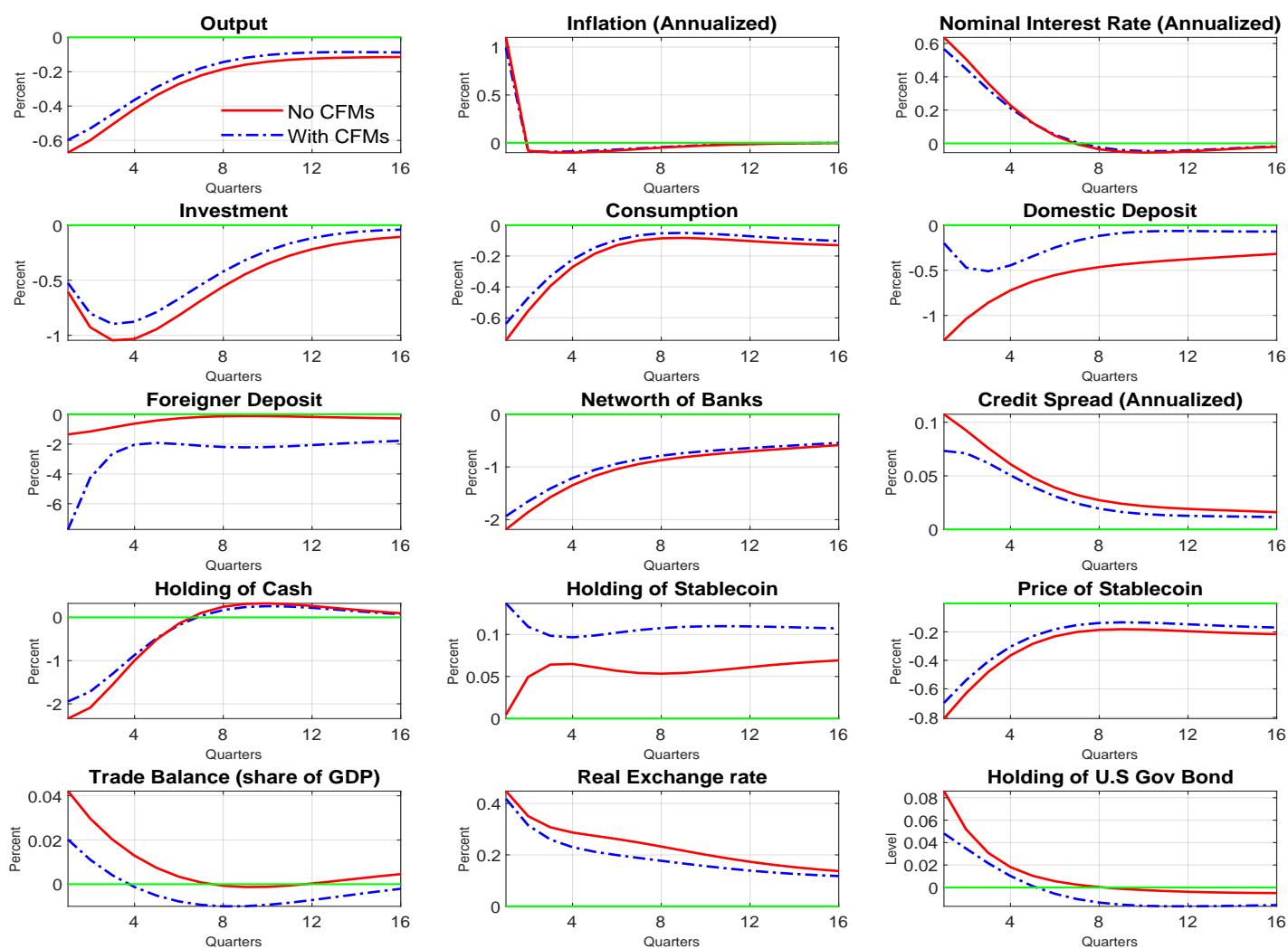


Figure 4: Responses of selected variables in the domestic economy to a contractionary foreign monetary policy shock. Time is in quarters. The stablecoin is available in both cases. The red line depicts the model without CFMs, and the dashed blue line depicts the model with CFMs. Impulse responses are in % deviation from steady state, while inflation, the credit spread and the interest rate are annualized. The stablecoin price refers to the price in domestic currency.

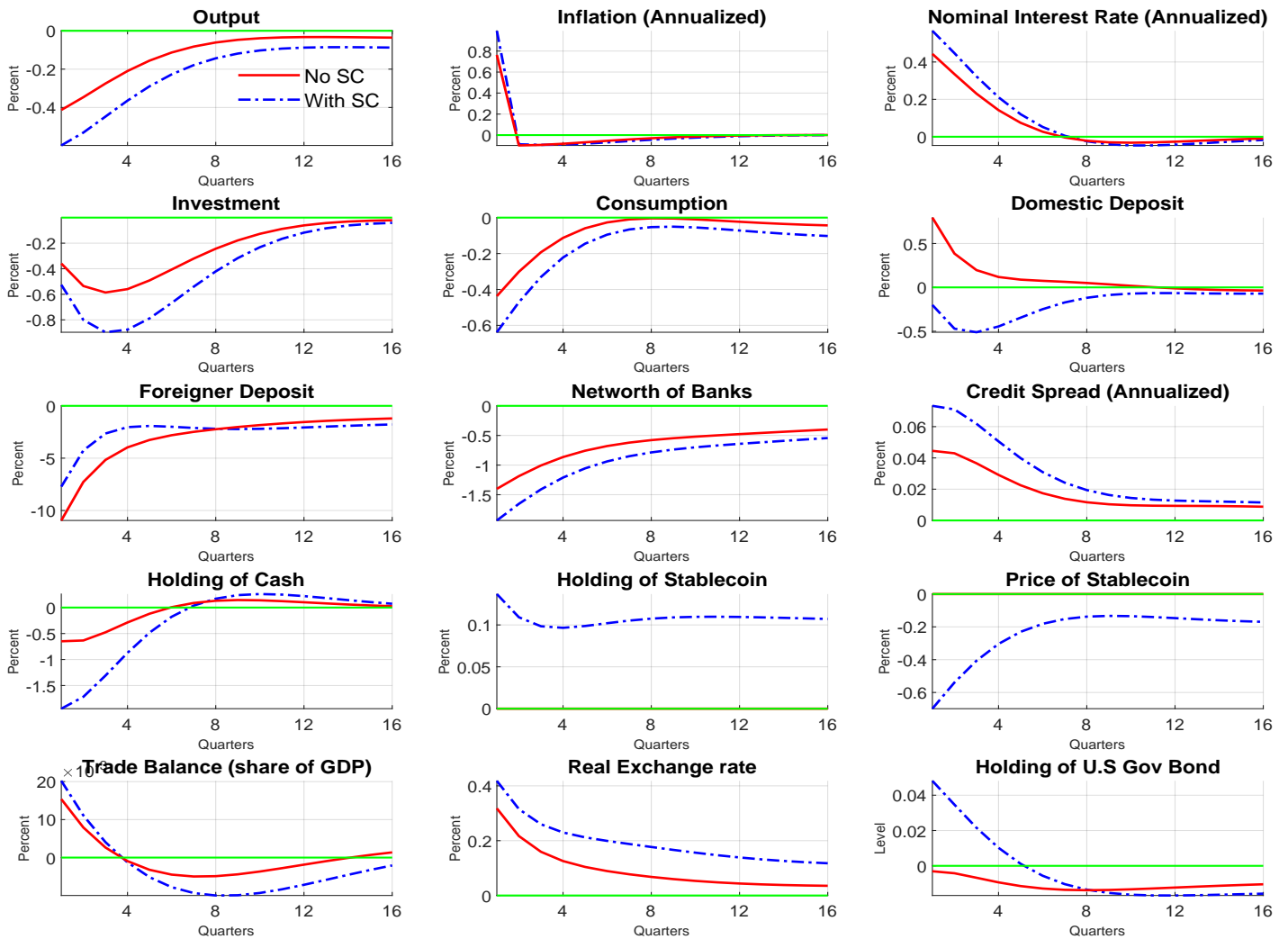


Figure 5: Responses of selected variables in the domestic economy to a contractionary foreign monetary policy shock. Time is in quarters. CFMs are active in both cases. The red line depicts the model without the stablecoin and the blue line depicts the model with the stablecoin. Impulse responses are in % deviation from steady state, while inflation, the credit spread and the interest rate are annualized. The stablecoin price refers to the price in domestic currency.

5 Potential Policy Responses

We now turn to policy options that could mitigate these potential challenges posed by the widespread adoption of a foreign stablecoin. We first consider the potential for a domestic central bank digital currency (CBDC) to displace the stablecoin by offering an alternative form of digital liquidity. We then consider a hypothetical ban that removes the usefulness of stablecoins as a means of payment in the domestic economy.²⁶

5.1 Central Bank Digital Currency

We first consider whether a domestic Central Bank Digital Currency (CBDC) could ameliorate the impacts of the stablecoin by providing a substitute denominated in domestic currency.²⁷ We model a simple form of CBDC in this context as a risk-free means of payment and store of value, such that the liquidity bundle becomes

$$\Omega(D_t, s_t M_{F,t}, s_t SC_t, DC_t) = \mu^{M^*} \left(\frac{s_t M_{F,t}^{\sigma^{M^*}-1}}{\sigma^{M^*}-1} \right) + \mu^{SC} \left(\frac{s_t SC_t^{\sigma^{SC}-1}}{\sigma^{SC}-1} \right) + \mu^D \left(\frac{D_t^{\sigma^D-1}}{\sigma^D-1} \right) + \mu^{DC} \left(\frac{DC_t^{\sigma^{DC}-1}}{\sigma^{DC}-1} \right) \quad (61)$$

where DC_t are CBDC holdings, which we also include in the household budget constraint.

We consider three alternative characterizations of the CBDC, which we describe in Table 2. In the first two cases, we assume that the CBDC has the same usefulness for payments as cash—i.e., we set $\mu_{I,A}^{DC} = \mu_{I,B}^{DC} = 1$. In equilibrium, the household primarily reduces their holdings of cash and deposits to hold more stablecoin (see rows 4 and 5 of Table 4). Could such a stablecoin mitigate spillovers from a foreign monetary policy shock? Figure 6 shows the results when σ_I^{DC} is set to achieve either high or low CBDC adoption in response to the contractionary foreign monetary policy shock. These increases in CBDC holdings slightly reduce uptake of the stablecoin and mitigate the downturn in investment and output. However, the effect is quantitatively only marginal yet reliant on

²⁶Other policy options are possible and this assessment is not exhaustive. IMF (2020a) considers a broader range of risks from foreign digital money and discusses other potential measures in response, as do He et al. (2022) for the case of CFMs.

²⁷Of course, responding to foreign digital money is not the only motivation for CBDCs, so a CBDC need not be justified on that criterion alone.

extreme assumptions for σ_I^{DC} .²⁸ Thus our model provides little support for the hypothesis that a cash-like CBDC could mitigate spillovers from a foreign stablecoin.

A cash-like CBDC could underestimate the benefits, however, if the CBDC design provides improvements on cash. Case *II* in Table 2 sets $\mu_{II}^{DC} = \mu^{SC} = 1.65$ and $\sigma_{II}^{DC} = \sigma^{SC} = 2.85$ —i.e., it assumes that any improvements on cash embodied by the stablecoin (e.g., digital format, programmability) are shared by the CBDC. The final row of Table 4 shows that this more attractive CBDC reduces equilibrium stablecoin holdings further, as well as partially substituting for deposits and foreign cash. Could this more attractive CBDC mitigate spillovers amplified by the stablecoin? Figure 7 shows that the opposite occurs: faced with a contractionary foreign monetary policy shock, the household reduces its holdings of CBDC and increases its reallocation into the stablecoin; macro outcomes are marginally worse.²⁹ The greater usefulness of the upgraded CBDC (i.e., $\mu_{II}^{DC} > \mu_I^{DC}$) is insufficient to compensate for the fact that CBDC remains a domestic-currency asset. In the face of depreciation, the domestic household sells it to purchase more of the stablecoin.

Alternative CBDC design choices could potentially make the CBDC more attractive. A CBDC that has legal tender status and is universally accepted for payments could be more useful than the stablecoin. A CBDC could also offer offline functionality and have lower transaction fees than stablecoins.³⁰ This higher μ^{DC} would further crowd out holdings of the stablecoin in equilibrium. However, in all cases CBDC remains a domestic-currency asset, so can never entirely negate the use of the stablecoin to hedge against domestic inflation or depreciation. An economy with volatile inflation and exchange rates would continue to see significant stablecoin usage even in the presence of a very attractive CBDC. The presence of CFMs that the stablecoin can evade (again, unlike the CBDC) would further strengthen this result.

²⁸Specifically, CBDC cases *I.A* and *I.B* set σ_I^{DC} equal to -1.85 and -5.85 respectively, in contrast to 1.35 for cash or 2.85 for deposits and the stablecoin. We also find similarly small mitigation effects in the analogous model with CFMs, shown in Appendix Figure 11.

²⁹This is also the case in the model with CFMs, shown in Appendix Figure 12.

³⁰As a public-sector offering, CBDC does not need to generate profit for the issuer (the central bank) and could thus potentially be cheaper than other digital payment offerings.

Table 2: CBDC Scenarios

Scenario		μ^{DC}	σ^{DC}	CBDC Holdings Steady State	Response to $\uparrow R^*$
<i>I.A</i>	Cash-like	1	-1.85	8.12%	Large increase
<i>I.B</i>	Cash-like	1	-5.85	10.69%	Small increase
<i>II</i>	Stablecoin-like	1.65	2.85	16.49%	Decrease

Notes: This table shows each of the three CBDC scenarios we consider and the implications for CBDC holdings both in the steady state and in response to a contractionary foreign monetary policy shock. CBDC holdings in the steady state are shown as a share of total payment assets, in line with Table 4.

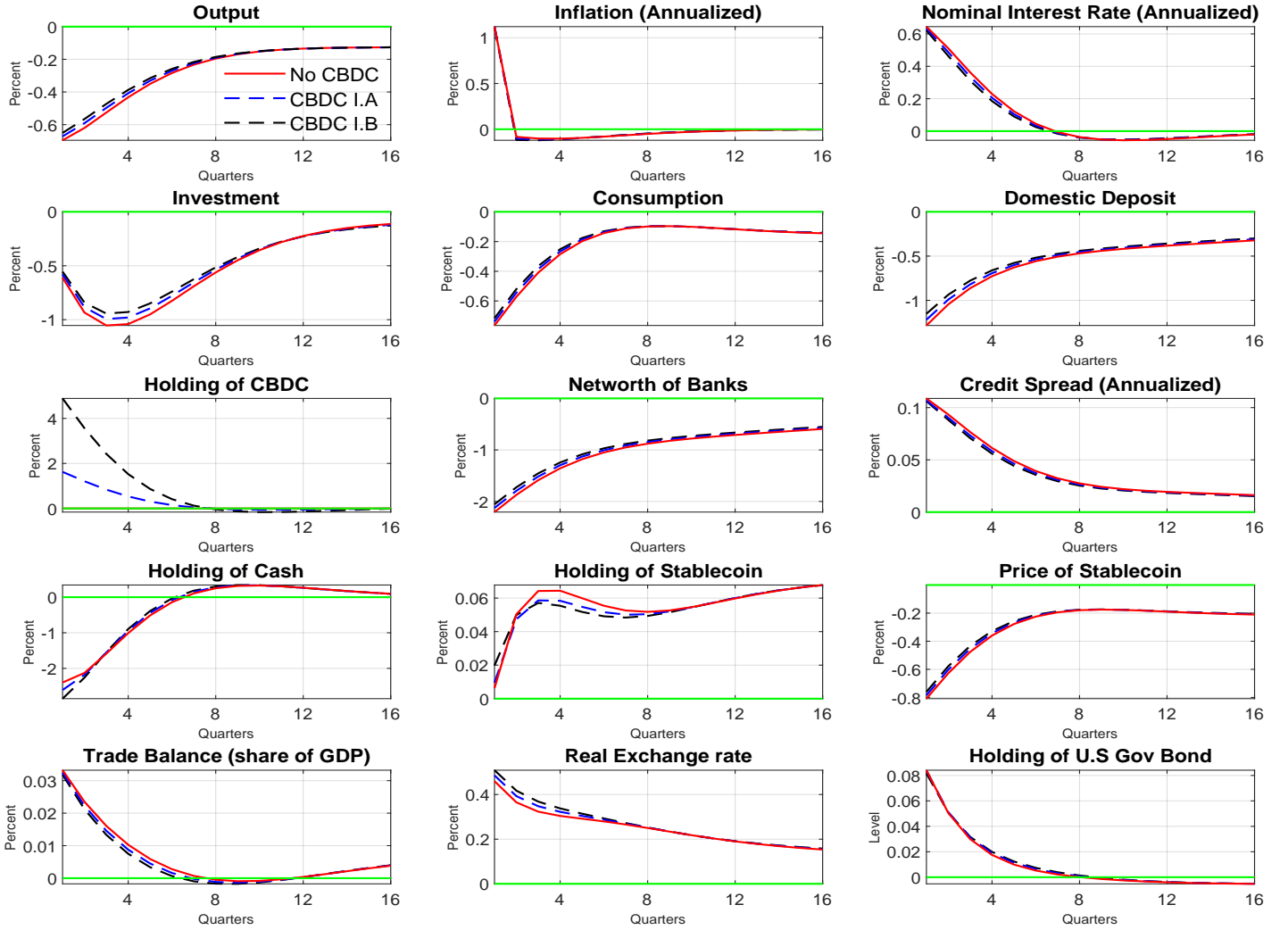


Figure 6: Responses of selected variables in the domestic economy without CFMs to a contractionary foreign monetary policy shock. Time is in quarters. The red line depicts the model without CBDC, the black dashed line depicts the model with CBDC of type *I.A* in Table 2, and the dashed blue line depicts the model with CBDC of type *I.B* in Table 2. Impulse responses are in % deviation from steady state, while inflation, the credit spread and the interest rate are annualized. The stablecoin price refers to the price in domestic currency.

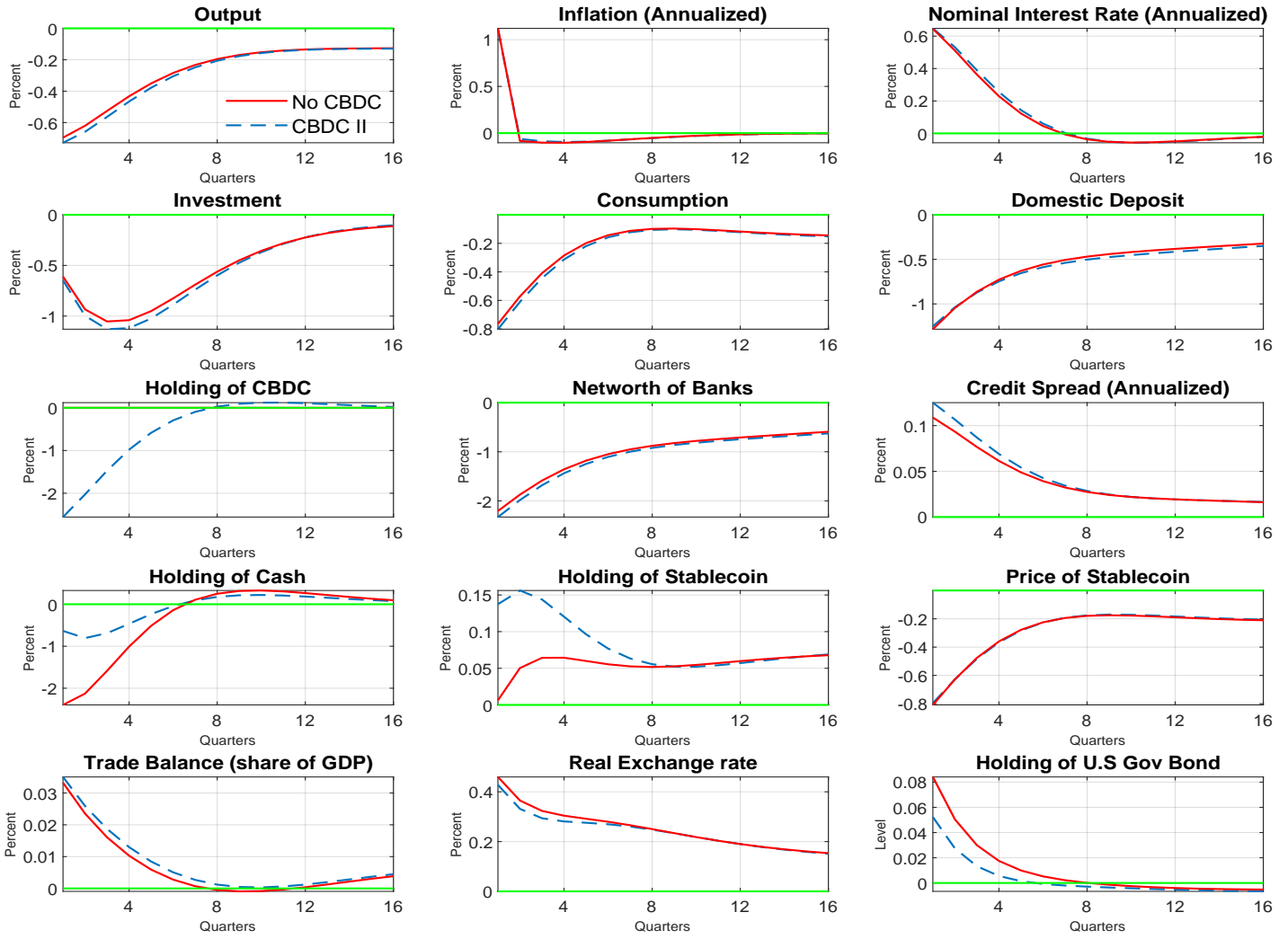


Figure 7: Responses of selected variables in the domestic economy without CFMs to a contractionary foreign monetary policy shock. Time is in quarters. The red line depicts the model without CBDC and the dashed blue line depicts the model with CBDC of type *II* in Table 2. Impulse responses are in % deviation from steady state, while inflation, the credit spread and the interest rate are annualized. The stablecoin price refers to the price in domestic currency.

5.2 Banning the Stablecoin

We next consider the case of a comprehensive unilateral ban on holding the stablecoin in the domestic economy. By ‘comprehensive’, we mean that the ban is 100% effective at preventing domestic households from accessing the stablecoin, equivalent to setting $SC_t = 0$ in the non-cash liquidity bundle (Equation 4).³¹

³¹The third row of Table 4 in the Appendix reflects that domestic holdings of the stablecoin are zero in steady state when the ban is in place. The allocation across other payment assets is not the same as that in the first row (when there is no stablecoin anywhere) due to the continued circulation of the stablecoin

Figure 8 shows the response of the economy to a foreign monetary policy shock in this case, alongside the responses with no ban and no stablecoin previously shown in Section 4.4. The outcome with the ban is close to the outcome with no stablecoin, but not identical since the stablecoin still circulates in the foreign economy. In general, the ban tempers the amplification effect of the stablecoin, reducing the negative effects on consumption, investment and output and reducing the stress in the banking sector.

We observe a similar effect in the case where CFMs are present, shown in Figure 9. Again, the ban largely returns the economy to the ‘no stablecoin’ path, with some differences due to the fact that the stablecoin is still used in the foreign economy. In our model the comprehensive unilateral ban on holding the stablecoin thus also helps to preserve the effectiveness of the pre-stablecoin CFM regime.

The feasibility of such a ban in practice is an open question and the answer is likely to vary across countries. A fully comprehensive ban would be difficult to enforce: for instance, households and merchants in the informal sector could still have an incentive to evade a legal prohibition by using the stablecoin, if it had other advantages such as anonymity coupled with low transaction costs.³² Here, cross-country coordination could play a role: since the stablecoin issuer is headquartered in the foreign economy, the foreign government may have greater ability to enforce compliance with regulation. The foreign stablecoin issuer may be more likely to impose restrictions on the use of its product by the domestic household if the instruction to do so comes from the legal authority within whose jurisdiction the firm and its workers are located. Lastly, and moving beyond our two-country model, if the stablecoin issuer were instead footloose, basing itself ‘offshore’ in third countries, then broader multilateral coordination could be required.

in the foreign economy.

³²While cash also offers anonymity, for large transactions the cost of security in delivery is high, unlike anonymous or pseudonymous digital payment options.

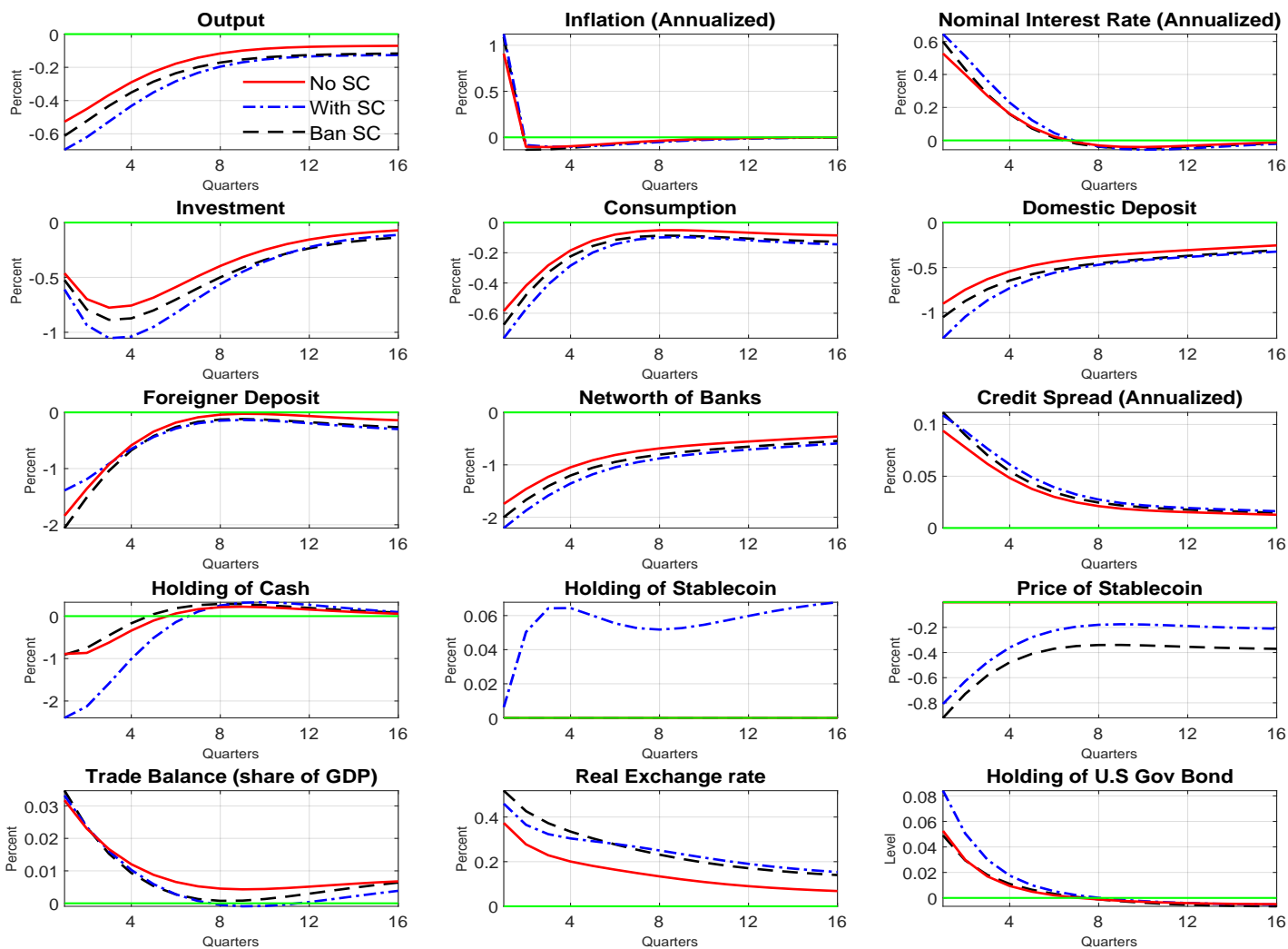


Figure 8: Responses of selected variables in the domestic economy to a contractionary foreign monetary policy shock. Time is in quarters. The red line depicts the model with no stablecoin, the dot-dashed blue line depicts the model with the stablecoin, and the dashed black line depicts the model after the ban is imposed. Impulse responses are in % deviation from steady state, while inflation, the credit spread and the interest rate are annualized. The stablecoin price refers to the price in domestic currency.

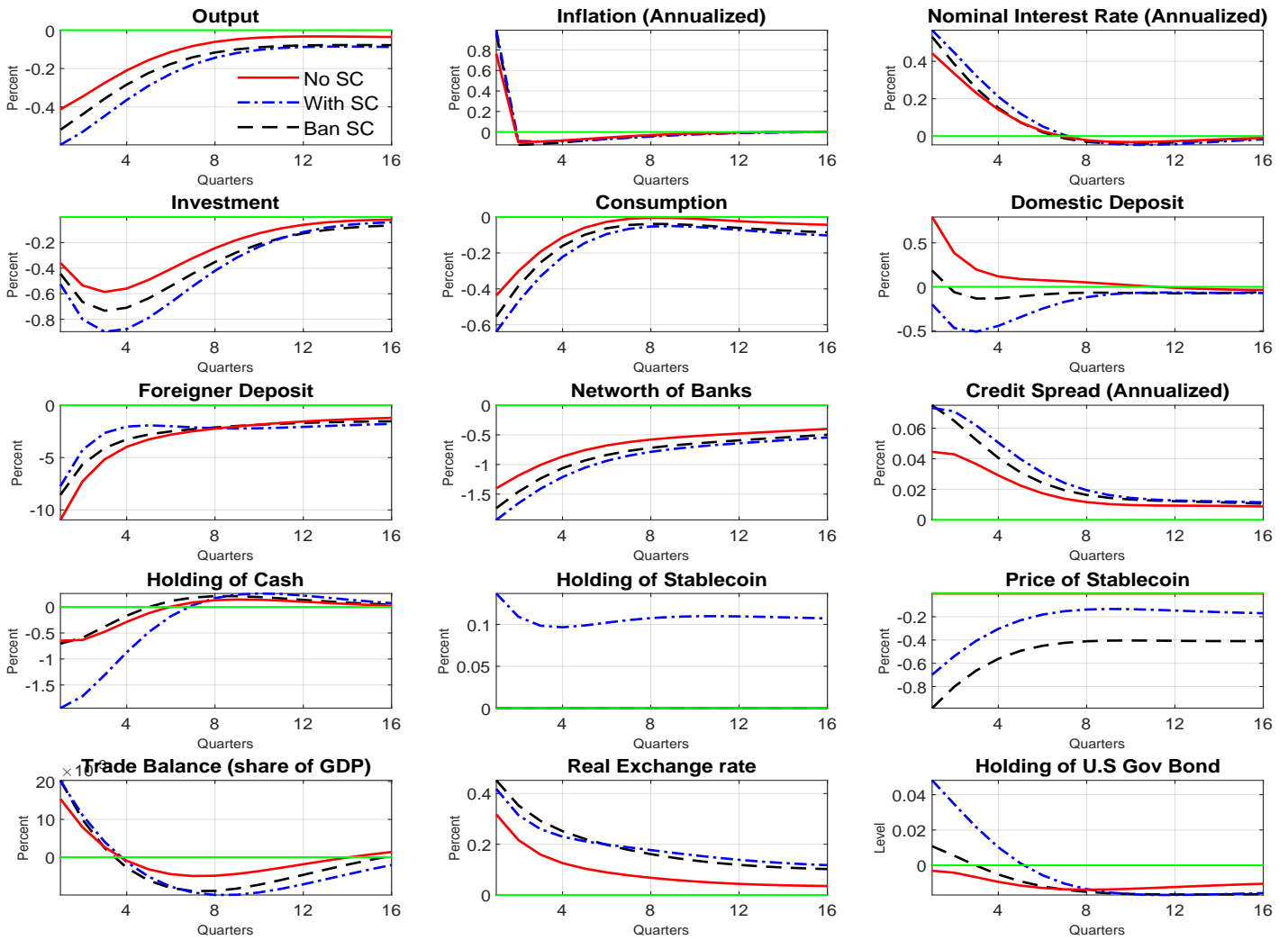


Figure 9: Responses of selected variables in the domestic economy to a contractionary foreign monetary policy shock. Time is in quarters. CFMs are active in all cases. The red line depicts the model with no stablecoin, the dot-dashed blue line depicts the model with the stablecoin, and the dashed black line depicts the model after the ban is imposed. Impulse responses are in % deviation from steady state, while inflation, the credit spread and the interest rate are annualized. The stablecoin price refers to the price in domestic currency.

6 Conclusion

In this paper, we use a large two-country dynamic stochastic general equilibrium model to investigate the macrofinancial implications of foreign digital money for a small developing economy. Our model includes endogenous currency substitution and a rich banking sector featuring financial frictions and foreign deposits, as well as a stablecoin issuer that produces a stablecoin backed by foreign cash and foreign bonds. We find that availabil-

ity of the stablecoin can amplify currency substitution by providing an additional asset through which the domestic household can diversify away from the domestic currency. Bank intermediation falls and monetary policy transmission weakens, worsening the impacts of recessionary shocks and increasing stress in the banking sector. For a shock originating abroad, we find that the availability of the stablecoin can magnify spillover effects from the foreign economy onto the domestic economy by introducing an additional transmission channel, in line with the findings of [Minesso et al. \(2022\)](#) for a foreign central bank digital currency.

We next introduce capital flow management measures (CFMs) on domestic holdings of foreign bonds, noting that equivalent measures do not (currently) apply to stablecoins. This increases the responsiveness of stablecoin holdings to a contractionary foreign monetary policy shock, reflecting that with one diversification channel obstructed the domestic household reallocates toward the stablecoin. Spillovers from the shock to an economy with CFMs are larger in the presence of the stablecoin than in its absence, highlighting that by enabling the circumvention of capital controls it can undermine their effectiveness in reducing the exposure of the small developing economy to the global business cycle.

Finally, we investigate policy options for the small economy that could mitigate the potential challenges posed by the widespread adoption of foreign stablecoin. We find that while a domestic CBDC can reduce stablecoin holdings in equilibrium, it does not help counteract the role of the stablecoin in transmitting foreign shocks to the domestic economy. The CBDC remains denominated in domestic currency, so does not substitute for the stablecoin in protecting purchasing power from domestic inflation or depreciation. In contrast, we find that a comprehensive unilateral ban on holding and using the stablecoin domestically could help, while cross-country cooperation may allow it to be implemented more effectively in practice. Further policy options, and any differences in the case of a foreign CBDC rather than a foreign stablecoin, could be explored in future research.

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A Appendix

A.1 Intratemporal Allocation Decisions

In this part, we describe how the consumption bundle is formed as well as the demand for foreign and home goods. For this part, the problem is the same for both economies. Thus, only detailed derivations for the home economy are presented. For the foreign economy, all variables are defined with an asterisk (*). We largely follow the setup of [Adrian et al. \(2021\)](#).

First, we build up the consumption bundle which combines home and foreign goods:

$$C_t = [(1 - \gamma)^{\frac{1}{\eta}} C_{Ht}^{\frac{\eta-1}{\eta}} + \gamma^{\frac{1}{\eta}} C_{Ft}^{\frac{\eta-1}{\eta}}]^{\frac{\eta}{\eta-1}} \quad (62)$$

in which C_{Ht} and C_{Ft} stand for home and foreign consumption goods respectively.

The representative agent has to decide the allocation of their consumption between two kinds of goods, home and foreign goods. The between-good optimization problem can be solved separately from the inter-temporal problem.

$$\max_{C_{Ht}, C_{Ft}} [(1 - \gamma)^{\frac{1}{\eta}} C_{Ht}^{\frac{\eta-1}{\eta}} + \gamma^{\frac{1}{\eta}} C_{Ft}^{\frac{\eta-1}{\eta}}]^{\frac{\eta}{\eta-1}} \quad (63)$$

$$\text{s.t. } P_{Ht} C_{Ht} + P_{Ft} C_{Ft} = Z_t \quad (64)$$

where P_{Ht} and P_{Ft} are home goods and foreign goods prices in home currency, respectively. Z_t can be expressed as a given level of expenditure. The first-order condition with regard to C_{Ht} is

$$C_{Ht} = (1 - \gamma)(\zeta P_{Ht})^{-\eta} C_t \quad (65)$$

and that with regard to C_{Ft} is

$$C_{Ft} = \gamma(\zeta P_{Ft})^{-\eta} C_t \quad (66)$$

where ζ is the Lagrangian multiplier. Combining with the consumption bundle, we obtain the demand function for C_{Ht} and C_{Ft} :

$$C_{Ht} = (1 - \gamma) \left(\frac{P_{Ht}}{P_t} \right)^{-\eta} C_t \quad (67)$$

$$C_{Ft} = \gamma \left(\frac{P_{Ft}}{P_t} \right)^{-\eta} C_t \quad (68)$$

where $P_t = [(1 - \gamma)(P_{Ht})^{1-\eta} + \gamma(P_{Ft})^{1-\eta}]^{\frac{1}{1-\eta}}$ is defined as the domestic CPI. Moreover, the price can be expressed in terms of the domestic CPI, $p_{Ht} = \frac{P_{Ht}}{P_t}$ and $p_{Ft} = \frac{P_{Ft}}{P_t}$. Then, we can rewrite (6) and (7) as:

$$C_{Ht} = (1 - \gamma)(p_{Ht})^{-\eta} C_t \quad (69)$$

$$C_{Ft} = \gamma(p_{Ft})^{-\eta} C_t \quad (70)$$

$$1 = [(1 - \gamma)p_{Ht}^{1-\eta} + \gamma p_{Ft}^{1-\eta}]^{\frac{1}{1-\eta}} \quad (71)$$

In contrast to [Benigno \(2009\)](#) and [Gali and Monacelli \(2005\)](#), we also include physical

capital in both countries to incorporate the financial frictions that are a focus of this paper. Hence, home investment goods are subject to a similar intratemporal problem which yields the same equilibrium conditions.

$$I_t = [(1 - \gamma)^{\frac{1}{\eta}} I_{Ht}^{\frac{\eta-1}{\eta}} + \gamma^{\frac{1}{\eta}} I_{Ft}^{\frac{\eta-1}{\eta}}]^{\frac{\eta}{\eta-1}} \quad (72)$$

$$I_{Ht} = (1 - \gamma)(p_{Ht})^{-\eta} I_t \quad (73)$$

$$I_{Ft} = \gamma(p_{Ft})^{-\eta} I_t \quad (74)$$

In the foreign economy, similar equilibrium conditions hold in which p_{Ht}^* and p_{Ft}^* are respectively the relative prices of home goods and foreign goods in the foreign country. For a foreign consumption bundle, C_t^* , I denote C_{Ht}^* and C_{Ft}^* as the home and foreign consumption goods in the foreign economy, respectively.

$$C_t^* = [(\gamma^*)^{\frac{1}{\eta}} (C_{Ht}^*)^{\frac{\eta-1}{\eta}} + (1 - \gamma^*)^{\frac{1}{\eta}} (C_{Ft}^*)^{\frac{\eta-1}{\eta}}]^{\frac{\eta}{\eta-1}} \quad (75)$$

$$C_{Ht}^* = \gamma^*(p_{Ht}^*)^{-\eta} C_t^* \quad (76)$$

$$C_{Ft}^* = (1 - \gamma^*)(p_{Ft}^*)^{-\eta} C_t^* \quad (77)$$

$$1 = [\gamma^*(p_{Ht}^*)^{-1/\eta} + (1 - \gamma^*)(p_{Ft}^*)^{-1/\eta}]^{-\eta} \quad (78)$$

For investment goods in the foreign economy, the problem is the same and yields

similar equilibrium conditions as in the home economy:

$$I_t^* = [(\gamma^*)^{\frac{1}{\eta}}(I_{Ht}^*)^{\frac{\eta-1}{\eta}} + (1 - \gamma^*)^{\frac{1}{\eta}}(I_{Ft}^*)^{\frac{\eta-1}{\eta}}]^{\frac{\eta}{\eta-1}} \quad (79)$$

$$I_{Ht}^* = \gamma^*(p_{Ht}^*)^{-\eta} I_t^* \quad (80)$$

$$I_{Ft}^* = (1 - \gamma^*)(p_{Ft}^*)^{-\eta} I_t^* \quad (81)$$

Linking the two economies, we also define the real exchange rate below:

$$s_t = e_t \frac{P_t^*}{P_t} \quad (82)$$

where P_t^* is the foreign consumer price index (in foreign currency), P_t is the home consumer price index and the nominal exchange rate e_t is the value of one unit of foreign currency in terms of the domestic currency. Furthermore, because the price level P_t is not stationary, the nominal exchange rate can only be included if we rewrite Equation (82) as:

$$\frac{s_t}{s_{t-1}} = \frac{\Delta e_t \pi_t^*}{\pi_t} \quad (83)$$

where $\Delta e_t = \frac{e_t}{e_{t-1}}$ is the gross rate of nominal depreciation of the home currency.

A.2 Domestic Household

$$U_t = E_t \sum_{t=0}^{\infty} \beta^t \left[\log(C_t) - \Psi \frac{(1 - L_t)^{1+\varphi}}{1 + \varphi} \right]$$

s.t.

$$\begin{aligned}
& C_t + Q_t K_t^h + \frac{D_t}{P_t} + s_t \frac{b_{Ft}}{P_t} + \frac{M_t}{P_t} + \frac{s_t M_{H,t}^*}{P_t} + P_t^{sc} s_t \frac{SC_t}{P_t} + \chi^h(K_t^h, K_t) + \tau(1 - j_t) \\
& = w_t H_t + (Z_t + \lambda Q_t) K_{t-1}^h + \frac{R_{t-1}^D}{P_t} D_{t-1} + \epsilon^m \frac{M_{t-1}}{P_t} + \frac{s_t M_{H,t-1}^*}{P_t} + P_t^{sc} s_t \frac{SC_{t-1}}{P_t} + s_t(1 - \tau_{d,t-1}) R_{z,t-1} \frac{b_{F,t-1}}{P_t} + \Pi_t
\end{aligned} \tag{84}$$

$$\int_0^{\bar{j}_t} c_t(j) dj = n_t \frac{M_t}{P_t} \tag{85}$$

$$\int_{\bar{j}_t}^1 c_t(j) dj = n_t \frac{\Omega(D_t, e_t M_{H,t}^*, e_t SC_t)}{P_t} \tag{86}$$

$$L_t + H_t + \kappa n_t = 1 \tag{87}$$

F.O.C. wrt consumption:

$$\lambda_t = \frac{1}{C_t} \tag{88}$$

F.O.C. wrt deposits:

$$\lambda_t = \beta E_t \left(\lambda_{t+1} \frac{R_t^D}{\pi_{t+1}} \right) + \lambda_t^\Omega n_t \mu^D D_t^{-\sigma_D} \tag{89}$$

F.O.C. wrt stablecoins:

$$\lambda_t P_t^{SC} s_t = E_t s_{t+1} \beta \lambda_{t+1} \frac{P_{t+1}^{SC}}{\pi_{t+1}} + \lambda_t^\Omega n_t \mu^{SC} SC_t^{-\sigma_{SC}} \tag{90}$$

F.O.C. wrt foreign cash:

$$\lambda_t s_t = E_t s_{t+1} \beta \frac{\lambda_{t+1}}{\pi_{t+1}} + \lambda_t^\Omega n_t \mu^{M^*} M_{F,t}^{-\sigma_{M^*}} \tag{91}$$

F.O.C. wrt domestic cash:

$$\lambda_t = E_t \beta \frac{\lambda_{t+1}}{\pi_{t+1}} + \lambda_t^m n_t \quad (92)$$

F.O.C. wrt household supply of capital:

$$\lambda_t = \beta E_t \left(\lambda_{t+1} \frac{(Z_t + \lambda Q_t)}{Q_t + \chi^h(K_t^h, K_t)} \right) \quad (93)$$

F.O.C. wrt labor:

$$w_t = \Psi \frac{(1 - L_t)^\varphi}{\lambda_t} \quad (94)$$

F.O.C. wrt foreign bonds with capital outflow control:

$$\lambda_t = \beta E_t \left(\lambda_{t+1} (1 - \tau_{d,t}) \frac{R_{z,t} s_{t+1}}{\pi_{t+1}^* s_t} \right) \quad (95)$$

FOC with regard to investment from capital producer:

$$1 = Q_t \left[1 - \frac{\Omega_k}{2} \left(\frac{I_t}{I_{t-1}} - 1 \right)^2 - \Omega_k \frac{I_t}{I_{t-1}} \left(\frac{I_t}{I_{t-1}} - 1 \right) \right] + \beta E_t \left[Q_{t+1} \frac{\lambda_{t+1}}{\lambda_t} \Omega_k \left(\frac{I_{t+1}}{I_t} \right)^2 \left(\frac{I_{t+1}}{I_t} - 1 \right) \right] \quad (96)$$

A.3 Foreign Household

$$U_t^* = E_t \sum_{t=0}^{\infty} \beta^t \left[\frac{(C_t^*)^{1-\sigma^*}}{1-\sigma^*} - \kappa_L \frac{H_t^{*1+\varphi^*}}{1+\varphi^*} + \mu^{\$M^*} \left(\frac{M_t^{*1-\sigma^{\$}}}{1-\sigma^{\$}} \right) + \mu^{SC^*} \left(\frac{SC_t^{*1-\sigma^{SC^*}}}{1-\sigma^{SC^*}} \right) \right] \quad (97)$$

s.t.

$$C_t^* + I_t^* + \frac{B_{Ft}^*}{P_t^*} + \frac{D_t^*}{P_t^*} + \frac{M_t^*}{P_t^*} + P_t^{sc} \frac{SC_t^*}{P_t^*} = w_t^* H_t^* + r_t^{k*} K_{t-1}^* + \frac{r_{t-1}^*}{P_t^*} D_{t-1}^* + \frac{R_{t-1}^*}{P_t^*} B_{F,t-1}^* + P_t^{sc} \frac{SC_{t-1}^*}{P_t^*} + \frac{R_{t-1}^*}{P_t^*} b F_{t-1}^* + \Gamma_t^* \quad (98)$$

$$K_t^* = (1 - \delta^*) K_{t-1}^* + \left[1 - \frac{\Omega_k^*}{2} \left(\frac{I_{t+1}^*}{I_t^*} - 1 \right)^2 \right] I_t^* \quad (99)$$

F.O.C. wrt consumption:

$$\lambda_t^* = (C_t^*)^{-\sigma^*} \quad (100)$$

F.O.C. wrt deposits and internationally traded bonds:

$$\lambda_t^* = \beta E_t (\lambda_{t+1}^* \frac{r_t^*}{\pi_{t+1}^*}) \quad (101)$$

F.O.C. wrt cash

$$\mu^{\$} M_t^{*- \sigma^{\$}} = \lambda_t^* - \beta E_t \lambda_{t+1}^* \quad (102)$$

F.O.C. wrt stablecoins

$$\mu^{SC^*} M_t^{*- \sigma^{SC^*}} = \lambda_t^* P_t^{sc} - \beta E_t \lambda_{t+1}^* P_{t+1}^{sc} \quad (103)$$

F.O.C. wrt labor:

$$w_t^* = \kappa_L \frac{H_t^{*\varphi^*}}{\lambda_t^*} \quad (104)$$

F.O.C. wrt capital

$$1 = \beta E_t \left\{ \frac{\lambda_{t+1}^* R_{t+1}^{k*} + (1 - \delta^*) q_{t+1}^*}{\lambda_t^* q_t^*} \right\} \quad (105)$$

F.O.C. wrt investment:

$$1 = q_t^* \left[1 - \frac{\Omega_k^*}{2} \left(\frac{I_t^*}{I_{t-1}^*} - 1 \right)^2 - \Omega_k^* \frac{I_t^*}{I_{t-1}^*} \left(\frac{I_t^*}{I_{t-1}^*} - 1 \right) \right] + \beta E_t \left[q_{t+1}^* \frac{\lambda_{t+1}^*}{\lambda_t^*} \Omega_k^* \left(\frac{I_{t+1}^*}{I_t^*} \right)^2 \left(\frac{I_{t+1}^*}{I_t^*} - 1 \right) \right]$$

(106)

A.4 Additional Figures and Tables

Table 3: Calibrated Parameter Values

Parameter	Value	Description
β	0.995	Discount rate of household (IPF)
β_E	0.975	Discount rate of entrepreneur (Gerali et al. (2010))
θ	0.501	Elasticity of leverage wrt foreign borrowing
σ	0.94	Survival probability
ξ	0.0045	Fraction of total assets brought by new banks
\varkappa^b	0.0219	Management cost for foreign borrowing
ζ	1	Inverse of Frisch elasticity of labor supply
ζ_0	7.1463	Labor disutility (labor in steady state around 1/3)
\varkappa_h	0.0197	Cost parameter of direct finance (ABK)
α_K	0.30	Cost-share of capital (IPF)
δ	0.025	Depreciation rate
η_d	8	Elasticity of demand
ω_c	0.4	Calvo parameter of price stickiness
κ_I	2.48	Investment adjustment cost (Christiano et al. (2005))
ϵ^m	1	Storage cost
μ^{M*}	0.35	Weight of USD
μ^D	2.65	Weight of deposit
μ^{SC}	1.65	Weight of SC
μ^{DC}	1	Weight of CBDC
σ_{M*}	1.35	Elasticity of cash
σ_D	2.85	Elasticity of deposit
σ_{SC}	2.85	Elasticity of SC
\bar{A}	1.000	Steady state productivity
ρ_i	0.82	Taylor rule persistence (IPF)
ϕ_π	3	Taylor rule response to CPI inflation (IPF)
ϕ_{π_D}	1.5	Taylor rule response to domestic inflation (IPF)
ϕ_Y	0.09	Taylor rule response to output (IPF)
ϕ_{bf}	0.25	CFMs rule response
γ	0.297	Home bias
n	0.25	Relative size of the population of the home economy
ς	67	Relative size of the foreign economy to domestic economy
η	0.8	Elasticity of substitution (IPF)
b	0.95	Share of foreign cash in SC issuer tech
ω	-1.5	Leontief utility parameter
TB/Y	0.0037	Steady state of the trade balance to GDP (IPF)
C/Y	0.65	Steady state of consumption to GDP
K/Y	7.	Steady state of consumption to GDP
I/Y	0.18	Steady state of investment to GDP
J	0.23	Share of cash payment
Π	4%	Steady state of annualized inflation

Notes: This table shows the main parameters used in the model and their sources. ABK refers to Aoki et al. (2016); IPF refers to Adrian et al. (2021).

Table 4: Holdings by Payment Asset

Scenario	Domestic Cash	Deposit	Stablecoins	Foreign Cash	Domestic CBDC
No SC	35.01%	54.31%	0%	10.68%	0%
With SC	35.68%	50.85%	1.97%	11.49%	0%
Ban SC	34.56%	54.86%	0%	10.57%	0%
CBDC <i>I.A</i>	31.68%	47.28%	1.85%	11.05%	8.12%
CBDC <i>I.B</i>	31.08%	45.47%	1.77%	10.97%	10.69%
CBDC <i>II</i>	33.04%	41.06%	1.51%	7.89%	16.49%

Notes: This table shows the representative domestic household's distribution of holdings by payment asset in the steady state, measured in % by domestic currency value.

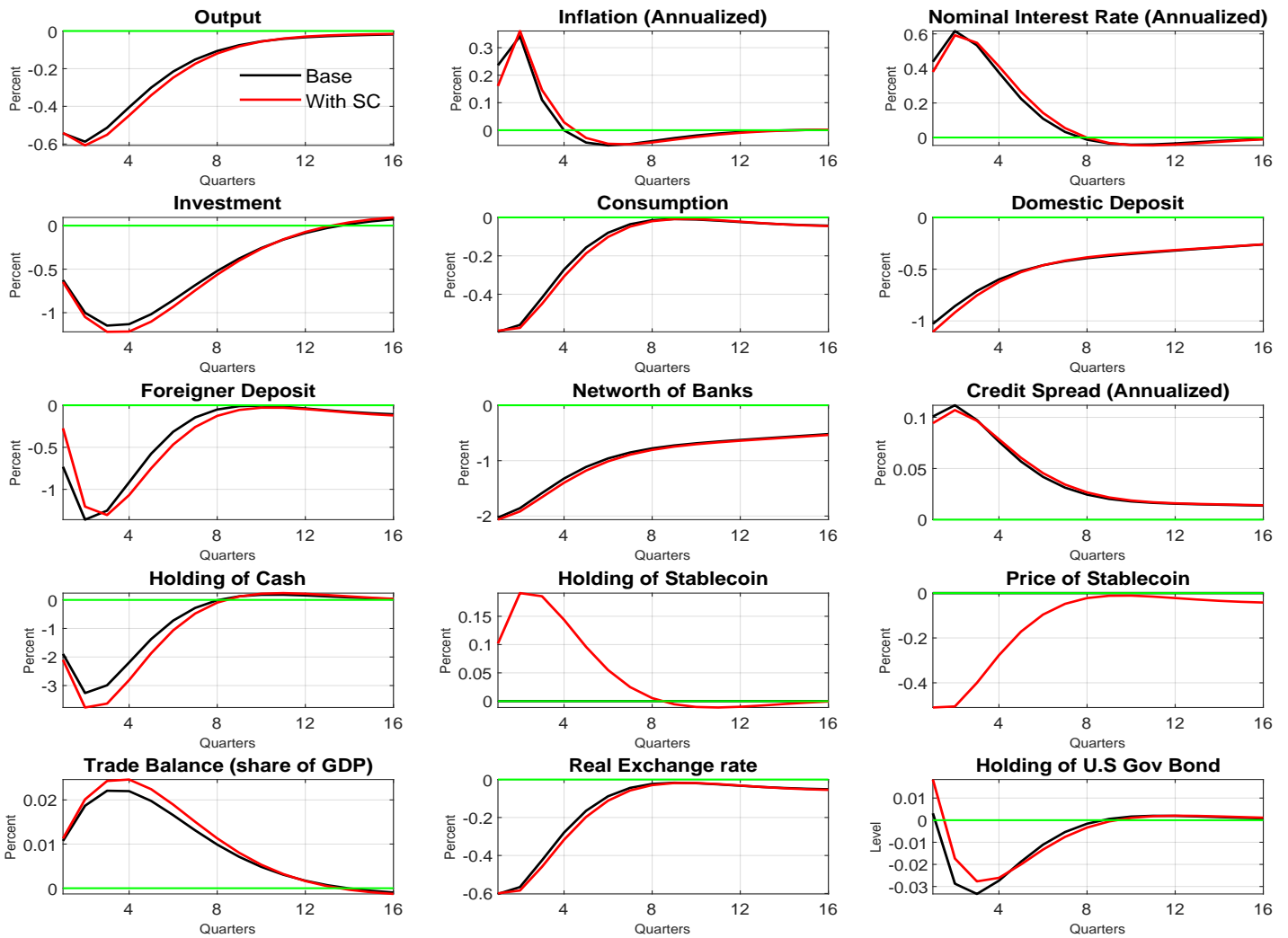


Figure 10: Responses of selected variables in the domestic economy to a positive cost-push shock. Time is in quarters. The black line depicts the model without the stablecoin, the red line depicts the model with the stablecoin. Impulse responses are in % deviation from steady state, while inflation, the credit spread and the interest rate are annualized. The stablecoin price refers to the price in domestic currency.

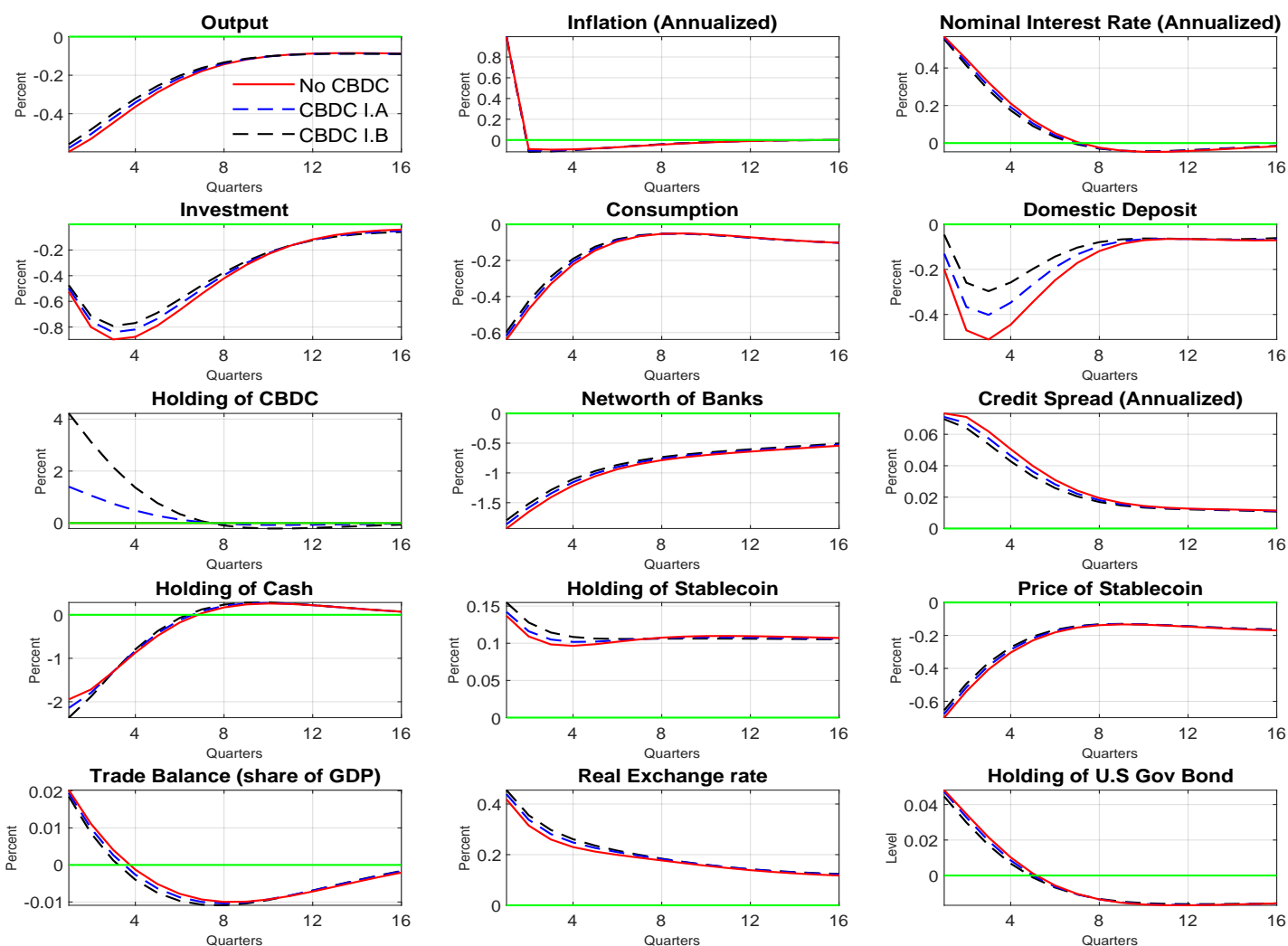


Figure 11: Responses of selected variables in the domestic economy with CFMs to a contractionary foreign monetary policy shock. Time is in quarters. The red line depicts the model without CBDC, the black dashed line depicts the model with CBDC of type *I.A* in Table 2, and the dashed blue line depicts the model with CBDC of type *I.B* in Table 2. Impulse responses are in % deviation from steady state, while inflation, the credit spread and the interest rate are annualized. The stablecoin price refers to the price in domestic currency.

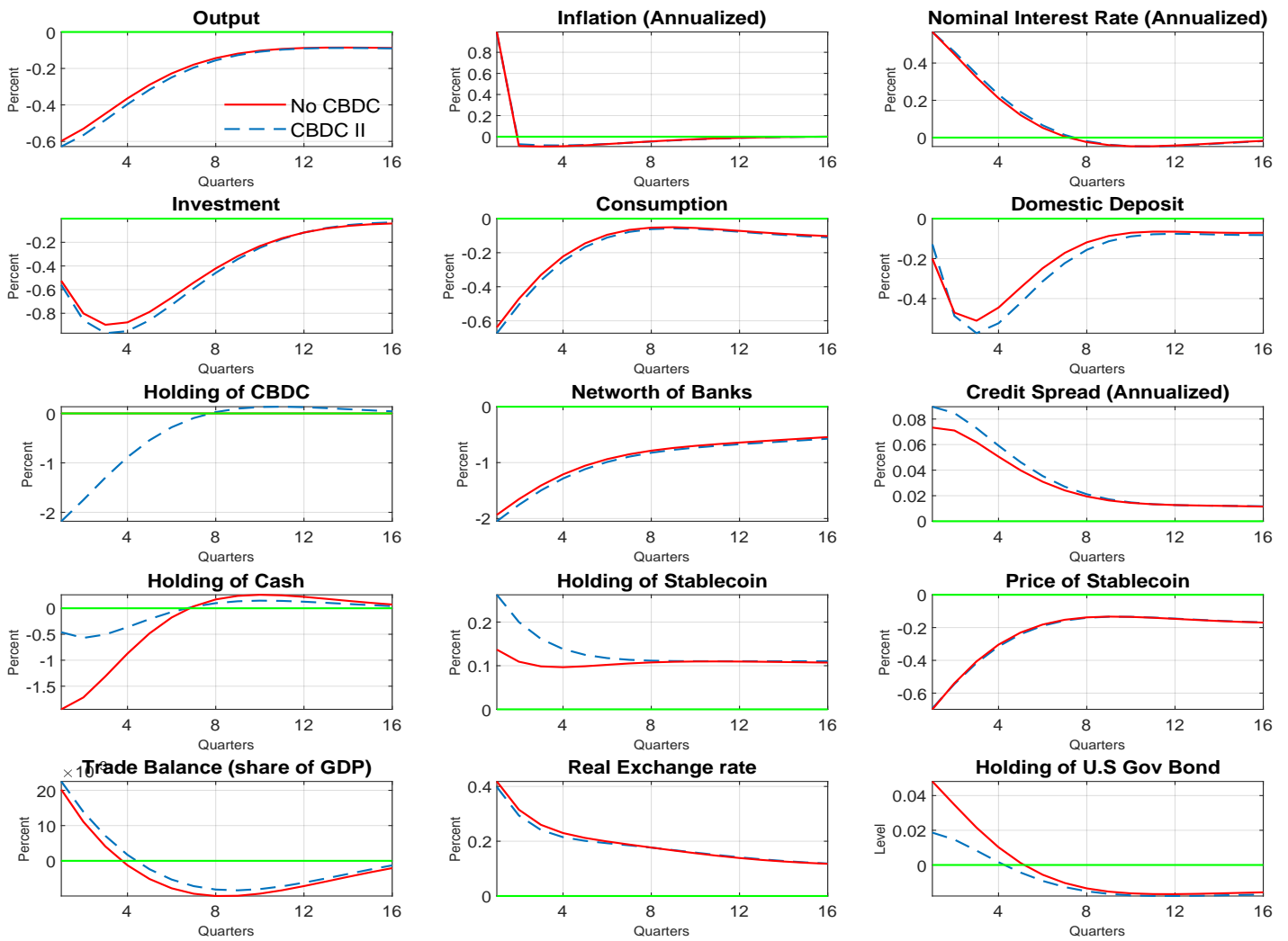


Figure 12: Responses of selected variables in the domestic economy with CFMs to a contractionary foreign monetary policy shock. Time is in quarters. The red line depicts the model without CBDC and the dashed blue line depicts the model with CBDC of type *II* in Table 2. Impulse responses are in % deviation from steady state, while inflation, the credit spread and the interest rate are annualized. The stablecoin price refers to the price in domestic currency.



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