Dollar Erosion: Understanding the Loss of Reserve Currency Status*

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Abstract

We develop a two-country general equilibrium model to quantify the steady-state consequences of a complete loss of reserve currency status for the U.S. dollar. This model illustrates the channels through which the dollar exchange rate and dollar interest rates adjust in response to permanent shifts in the demand for dollar safe assets, which are conceptually and quantitatively distinct from those implied by drivers of transitory exchange rate fluctuations within a stable regime. We find that a complete loss of reserve currency status would lead to a moderate 8.8% real depreciation of the dollar. On the other hand, there is a larger 90 basis point increase in U.S. real interest rates, and consequently an aggregate wealth loss of approximately $33 trillion.

Keywords: Dollar, Reserve Currency, Convenience Yield
JEL Codes: E44, F32, G15

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The U.S. dollar's status as the world's reserve currency confers an "exorbitant privilege" — the ability of the U.S. to borrow cheaply from the rest of the world by supplying the global economy with safe and liquid assets. Foreign investors, central banks, and financial institutions around the world hold Treasurys and other dollar-denominated safe assets not merely for their return, but for the convenience they provide as instruments of payment, collateral, and value storage. This global demand compresses U.S. borrowing costs and generates seigniorage revenue to U.S. entities, giving rise to an exorbitant privilege.

Recent data, however, point to a notable erosion of this privilege. The convenience yield on public dollar safe assets — the premium investors willingly forgo to hold U.S. Treasuries over comparable foreign alternatives — has declined sharply since 2022. Foreign ownership of U.S. public debt has also fallen from roughly 45% to 30% of the outstanding stock, while holdings of private dollar safe assets have remained comparatively stable. These patterns are consistent with a partial but meaningful retreat from the dollar's reserve currency role, concentrated specifically in the public debt market. We review this evidence in Section 1.

This paper asks the following question: how much would U.S. interest rates and the dollar exchange rate change if U.S. safe assets were no longer demanded as international liquidity? We distinguish this question from the well-studied case of transitory convenience yield shocks within a stable regime. In Jiang et al. (2021), we derive a valuation equation for the dollar exchange rate, x_t, with convention that a higher x_t means a stronger dollar:

$$x_t = \mathbb{E}_t \left[\sum_{j=1}^{T} \left(r^d_{t+j} - r^*_{t+j} \right) \right] - \mathbb{E}_t \left[\sum_{j=1}^{T} rp_{t+j} \right] + \mathbb{E}_t \left[\sum_{j=1}^{T} \lambda^d_{t+j} \right] + \mathbb{E}_t x_{t+T}. \tag{1}$$

This equation embeds: (1) interest rate differences $\mathbb{E}_t \left[\sum_{j=1}^{T} \left(r^d_{t+j} - r^*_{t+j} \right) \right]$; (2) currency risk premia $\mathbb{E}_t \left[\sum_{j=1}^{T} rp_{t+j} \right]$; and, (3) convenience yield on dollar safe assets $\mathbb{E}_t \left[\sum_{j=1}^{T} \lambda^d_{t+j} \right]$. The dollar appreciates when current or future U.S. interest rates increase relative to the foreign interest rates $\left(r^d_{t+j} - r^*_{t+j} \right)$ between t and $t + T$. Similarly, the dollar depreciates when current or future convenience yields λ^d_{t+j} decline between t and $t+T$, holding the term $\mathbb{E}_t x_{t+T}$ constant. Under the assumption that the long-run real exchange rate is stationary, Jiang et al. (2021) estimate that the *transitory* variation in the convenience yield component explains between 16% and 28% of the variation in the quarterly dollar exchange rate over the period from 1988 to 2017.

In this paper, we focus on *permanent* regime shifts through the term $\mathbb{E}_t x_{t+T}$. We develop a two-country general equilibrium model in which the dollar exchange rate is determined by the above components: interest rate differentials, currency risk premia, the convenience yield on dollar safe assets, and the long-run exchange rate, but the key economics of the model are in the last term where the long-run exchange rate level is governed by the steady-state demand for dollar liquidity services.

The model departs minimally from a standard international real business cycle model, but it includes a key feature to capture the role of the U.S. as the safe asset provider to the world: both home and foreign investors derive liquidity services from holding dollar safe assets. These liquidity benefits lower the yields on dollar safe assets below those on foreign safe assets, giving rise to a convenience yield. They also generate a funding advantage for U.S. safe asset issuers, who collect a seigniorage revenue in proportion to the level of convenience yield and the quantity of dollar safe assets held by foreign investors. In equilibrium, this seigniorage revenue boosts U.S. households' spending power, which bids up the price of the domestic consumption goods and the real value of the dollar.

Section 2 uses a calibrated model to compare across two steady states, one where the dollar is the reserve currency of the world and foreign investors pay a premium in line with historical data to own dollar assets, and one where the dollar is no longer the reserve currency of the world. This computation sheds light on two questions: first, it provides an endpoint for bond and currency markets in a hypothetical world where the dollar is no longer the reserve currency; second, it offers an estimate of how appreciated the dollar has been historically because of its reserve currency status.

Our headline result is that the loss of the dollar's reserve currency status leads to a steady-state depreciation of the dollar's real value of around 8.8%, and a 0.9% increase in U.S. real interest rates. These results are driven by three quantitative ingredients in the model.

First, using the flow of funds data, we calibrate the net foreign asset position in U.S. safe asset markets to be around 50% of the U.S. GDP. This number includes foreign ownership of both the U.S. Treasurys and private dollar safe assets such as bank deposits and investment-grade corporate bonds. When these assets earn a convenience yield of 2% per annum, the foreign investors are transferring $50\% \times 2\% = 1\%$ of U.S. GDP per year to the U.S. safe asset issuers in the form of a seigniorage revenue. In other words, the U.S. reserve asset status allows the U.S. to fund its liabilities at a 2% discount, lowering the U.S. interest expense by 1% of GDP per year.

Second, we calibrate the home bias and the elasticity of substitution in the goods market according to conventional estimates in the trade literature. Given that the U.S. investors are 1% richer than the foreign investors because of the seigniorage revenue, and that the U.S. investors have home bias towards domestic goods, their demand bids up the real value of the U.S. dollar. This goods market channel is the key mechanism that transmits the loss of reserve currency status in the asset market into a real depreciation of the dollar. Quantitatively, the dollar has to be 8.8% stronger in order to clear the goods and asset markets in the presence of the 1% seigniorage revenue. Conversely, if the U.S. were to lose the reserve currency status and hence the seigniorage revenue, the dollar would have to depreciate by 8.8% to restore equilibrium.

Third, we calibrate the elasticity of demand for safe dollar bonds using Krishnamurthy and Vissing-Jorgensen (2012) and Koijen and Yogo (2020). If foreign investors were to no longer have a special demand for safe dollar bonds, then about 50% of dollar bonds relative to GDP has to be reabsorbed by home investors. Given the home investors' downward-sloping demand for dollar bonds, this increase in their holdings leads to a 0.9% increase in U.S. real interest rates.

It is helpful to contrast the intuition of this mechanism with exchange rate fluctuations driven by transitory shocks in a stable regime. In the latter case, exchange rate movements are driven by a financial valuation logic: a currency is expected to depreciate when it is expected to deliver a higher interest rate, a higher convenience yield, or a lower risk premium. When the long-run exchange rate level is anchored, this expected depreciation raises the current exchange rate level. Thus, the drivers of transitory exchange rate variations only affect the deviation of the current exchange rate relative to the long-run exchange rate level. As these shocks dissipate, we expect the exchange rate to revert to its long-run level. In the case of a permanent regime shift, the exchange rate movement is driven by a different logic. The long-run exchange rate level can no longer be considered fixed and itself becomes a driver of exchange rate variation. Our model shows that both goods and asset market clearing enter: the long-run exchange rate level must adjust to clear the goods market, given the change in the relative wealth of the home and foreign investors. As the regime shift permanently lowers the U.S. households' relative wealth, the dollar must depreciate in the long run to restore the equilibrium in the goods market.

Literature. There are a number of recent papers on the dollar, tariffs, and the dollar's reserve currency status since the April 2025 shock. On the empirical side, Acharya and Laarits (2025) and Jiang, Krishnamurthy, Lustig, Richmond, and Xu (2025a) document the decrease in Treasury convenience yields after the shock, as well as the rise in U.S. interest rates and depreciation of the dollar. Ostry, Lloyd, and Corsetti (2025) and Pinter, Uslu, and Smets (2025) further trace out the impact on the dollar and other assets. The findings in these papers are consistent with our empirical results. On the modeling side, Hassan, Mertens, Wang, and Zhang (2025) and Itskhoki and Mukhin (2025) examine how models can shed light on the recent episode. Hassan et al. (2025) ties the increase in U.S. interest rates and the reduction in the dollar's safety premium directly to the tariffs and the reduction of U.S. trade flows. Itskhoki and Mukhin (2025) study optimal tariffs in a model where gross financial positions are relevant and tariffs give rise to valuation effects. Similar to the present paper and the results in Jiang et al. (2024a), they note that a convenience yield on dollar safe assets can lead to a low return on dollar assets and a steady state trade deficit, and likewise the loss of the convenience yield can depreciate the dollar. Our analysis evaluates these possibilities in a quantitative international finance model and goes further than both Jiang et al. (2024a) and Itskhoki and Mukhin (2025).

Our paper also contributes to works on equilibrium exchange rate determination. Itskhoki and Mukhin (2021); Kekre and Lenel (2024) highlight the role played by market segmentation and financial intermediation, while Jiang et al. (2021) highlight the role played by bond convenience yield. All these works focus on exchange rate fluctuations around a long-run level within a stable regime. By contrast, our paper studies and compares the equilibrium exchange rate levels in two different steady states. We show that both the economic intuition and the quantitative implications are different.

1 Dollar Erosion

1.1 Treasury and Dollar Convenience Yields

Consider a world investor who invests in Euros for one year rolling over their funds at the overnight Euro interbank rate ("€STR"). The investor does a foreign exchange swap to convert these cash flows at the end of the year into dollars. The package of the investment in the Euro safe asset and the swap is the payoff on a synthetic safe dollar security. We construct the yield spread between this package and that of an investment in the 1-year Treasury bill.

Jiang et al. (2021) construct a closely related spread—the difference between G10 1-year government bond yields, swapped from their local currencies into U.S. dollars, and the 1-year U.S. Treasury bill yield. In their sample from 1988 to 2017, this spread is almost always positive, reflecting a premium ("convenience yield") attached to the safe dollar Treasury bill. They infer, using a model, that world investors paid an average of 2% per annum to hold safe dollar assets. We use this 2% number in our calibrated model.

Figure 1 plots the €STR-Treasury spread in green in the recent sample from 2021 to 2025. The vertical black dashed line on the right is the Liberation day announcement. We can see that the Treasury convenience yield falls on that day. That is, the Treasury yield rises relative to the Euro safe asset rate. This fall in the Treasury convenience yield is also unusual, as Jiang et al. (2021) show, it typically rose during prior periods of financial turmoil.

The green line representing the 1-year Treasury convenience yield turns from positive to negative in the summer of 2024—an unusual development. Jiang et al. (2021) show that the 1-year Treasury has almost always carried a convenience yield relative to other G10 safe

FIGURE 1
TREASURY AND REPO CONVENIENCE YIELDS

Notes: This figure plots the cross-currency Euro/USD basis swap where the reference rates are €STR (Euro secured financing rate) and either the 1-year Treasury bill or SOFR (dollar secured financing rate).

assets, averaging 22 basis points. Seen in this light, the Liberation Day shock punctuates a trend predating both April 2025 and the November 2024 election (black dashed line), in which the safe-asset status of U.S. Treasurys had already been eroding.

The blue line in the figure replaces the Treasury yield with a dollar repo rate, the secured overnight financing rate ("SOFR"). This dollar rate is based on the yield expected from rolling over a dollar investment in SOFR nightly for one year. Thus, the measure is of a repo-derived dollar safe asset convenience yield rather than one from the Treasury. We see that this spread has also fallen over the past year, but has remained positive after the liberation day announcement. Indeed, it rises upon the liberation day shock perhaps reflecting a shift away from Treasury and into dollar repo.

Figure 2 plots the dollar repo convenience yield against Danish Krone LIBOR (green) and Japanese Yen interbank rate (red) as well as the against the Euro safe rate. Although the levels differ across these currencies, we see that in all cases, the convenience yields on dollar safe assets relative to that of these other currencies have been declining over the past two years.

FIGURE 2
CROSS-CURRENCY SAFE ASSET BASIS.

Notes: This figure plots the cross-currency basis swap where the reference rates are ESTR (Euro secured financing rate), DKK LIBOR, Yen unsecured rate versus SOFR (dollar secured financing rate). We plot the time series of different tenors of the swap. We also plot the cross-currency Euro/USD basis based on U.S. Treasury yield and ESTR.

1.2 Public and Private Dollar Convenience Yields

Figure 1 indicates that repo convenience yields are higher than Treasury convenience yields for short-term Treasurys and repo, and that both have fallen relative to Euro safe rates. We now turn to a within-U.S. comparison. We construct the yield spread between the package of a BBB corporate bond yield index and investment-grade CDX. The CDS hedge strips out default risk of the BBB bond yield. The maturity in this package is 10 years. We construct the spread between the yield on this package and the yield on 10 year Treasurys and the 10 year SOFR swap. The latter swap is based on overnight SOFR so it reflects the convenience on a short-term security over the next 10 years. See Mota (2023) and Chumbo and Krishnamurthy (2025) for further details. Under the assumption that the corporate bond does not contain any convenience, these spreads measure the convenience yields on both short-term repo and 10-year Treasury bonds for an investor whose investment universe is U.S. dollar bonds.

Figure 3 plots these series from 2019 to the end of 2025. We see that the short-term repo based convenience measure has fluctuated around about 90 basis points and is now at similar levels as it was in 2019 and 2023. However, the convenience yield on long-term Treasury bonds has fallen steadily since 2023, going from around 90 basis points to 20 basis points. The pattern mirrors that of the cross-currency spreads we construct in other figures.

1.3 Public and Private Dollar Debt Quantities

Next we turn to quantity data and document a shift in foreign preference for U.S. safe public and private assets. We construct public and private safe asset supply from the Federal Reserve's Z.1 Financial Accounts. Public debt consists of two components: marketable Treasury securities (FGTSL) and Agency/GSE securities, each netted of Federal Reserve holdings to capture only the supply available to the private sector.

Private debt comprises three components: commercial paper outstanding, investment-grade corporate bonds, and net short-term bank liabilities. Corporate bonds are scaled by a time-varying investment-grade share derived from the ICE BofA US Corporate Index (the sum of AAA, AA, and A market-value weights), which ranges from roughly 40% to 56% over the sample. Net bank liabilities aggregate four categories of US banking institutions (chartered depositories, foreign banking offices, banks in affiliated areas, and credit unions), computed as the sum of short-term liability items (deposits, repos, open market paper,

FIGURE 3
TREASURY AND SOFR SPREADS WITH CDS-HEDGED CORPORATE BONDS

Notes: This figure plots the convenience yields of U.S. Treasury and SOFR relative to CDS-hedged corporate bond yields. The CDS-hedged corporate bond yields are based on BBB corporate bond yield index and investment-grade CDX index.

interbank positions) minus asset offsets (repos, commercial paper, and acceptances held). Total safe asset supply is the sum of public and private components. We also note that the private safe asset supply is dominated by short-term assets while public safe assets includes all maturity of Treasurys.

Figure 4 plots the shares of public and private dollar bonds held by foreign investors. Foreign investors hold a significant share of both public and private dollar bonds, with the share of public bonds being particularly high in the 2010s. However, the share of public bonds held by foreign investors declines from nearly 45% in 2016 to 30% in 2025, while the share of private bonds has remained stable between 10% and 15% over this period. This pattern suggests that foreign investors have shifted their dollar safe asset holdings away from Treasurys, while their holdings of private dollar safe assets have remained stable as a share of the total supply. This shift in foreign demand away from Treasurys is consistent with the decline in the Treasury convenience yield and the relative stability of the repo convenience yield.

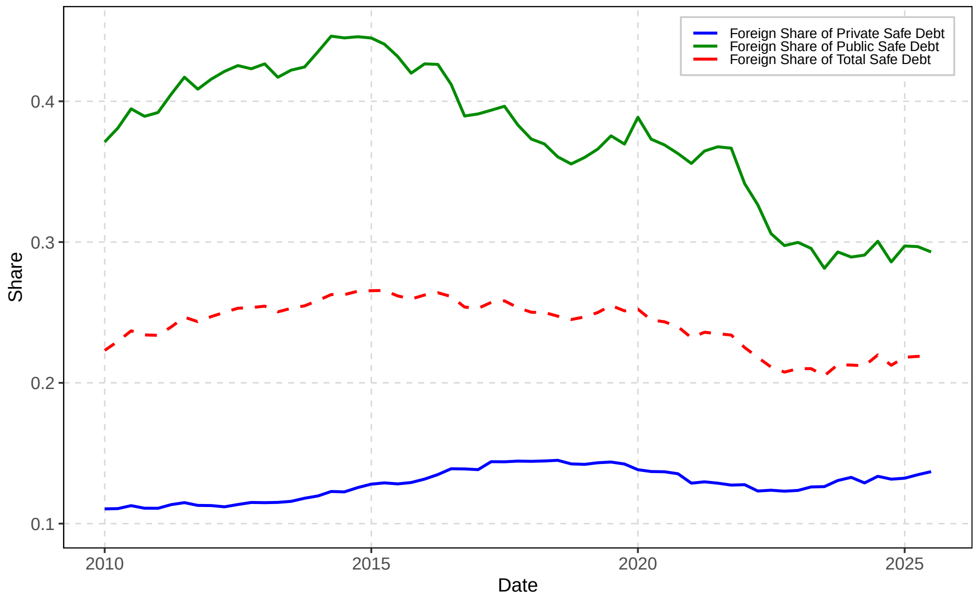

FIGURE 4
SHARE OF PUBLIC AND PRIVATE DOLLAR BONDS HELD BY FOREIGN INVESTORS

Notes: This figure shows the shares of public and private dollar bonds held by foreign investors.

2 Equilibrium with Eroding Reserve Asset Status

The reduction in the convenience yield on 1-year Treasurys starting in 2023 is consistent with investors questioning the reserve asset status of U.S. Treasurys. At longer tenors, the Treasury convenience yields have experienced a secular decline over the past 10 perhaps due to increased fiscal concerns as the Treasury has increased the supply of Treasurys (Jiang, Richmond, and Zhang 2025b), and foreign investors have shifted their dollar safe asset holdings away from Treasurys towards private dollar safe assets. If U.S. Treasurys are no longer viewed as the world's preferred safe asset[1], then the status of the dollar as the world's reserve currency may be called into question. Coppola, Krishnamurthy, and Xu (2022) argue that the reserve currency has historically been housed in the country with the largest supply of safe and liquid government assets. Shifts in the reserve currency, such as from the Dutch Florin to the British Pound Sterling and from the Pound to the Dollar, occurred when the safety of investments in these government assets was called into question and the conve-

[1] If investors around the world grow concerned that their investments in U.S. Treasury bonds may become subject to "sanctions," then they may prefer to own financial instruments that are immune to these threats. Stephen Miran, the chairman of the Council of Economic Advisors, has suggested that foreign investments in Treasurys may be subject to a user fee.

nience yield on these government assets fell (Chen et al. 2025). If this is the case, Coppola, Krishnamurthy, and Xu (2022) predict that the convenience yield on all safe dollar assets – public and private – would fall and the observed fall in the convenience yield on dollar repo is consistent with this prediction. Furthermore, if dollar assets are questioned as the world's reserve asset, then a shock such as that of liberation day, may lead to a flight away from the dollar rather than a flight to the dollar. The event-study evidence around liberation day is also consistent with this hypothesis (Jiang et al. 2025a). Thus, we conclude that the events of the last two years reflect *erosion* in the status of the dollar as the world's reserve currency.

We next turn to quantitatively assessing how the asset markets will re-equilibrate in a world where the U.S. is no longer the safe asset provider to the rest of the world. That is, where will exchange rates and interest rates equilibrate in a steady state where the reserve demand for the dollar completely disappears? The answer to this question helps benchmark where the dollar and interest rates may settle after the ups and downs of the last several months. It also sheds direct light on the Miran hypothesis: *"The root of the economic imbalances lies in persistent dollar overvaluation that prevents the balancing of international trade, and this overvaluation is driven by inelastic demand for reserve assets."*[2] How much on average had the dollar been "over-valued" and how much lower have U.S. interest rates been because of the reserve currency status of the dollar?

To answer these questions, we present a calibrated model in which investors have liquidity demand for dollar safe assets which are produced by the U.S. government and private sector. The two special economic ingredients that we include to define the role of the U.S. in the world economy are that, (1) the U.S. net foreign asset position involves a negative position in dollar safe assets and a long position in foreign assets, consistent with the characterization of the gross asset position of Gourinchas and Rey (2007); and, (2) the dollar safe assets carry a convenience yield in line with the estimates in Jiang et al. (2021).

The setup closely follows Jiang (2024) and Jiang, Krishnamurthy, and Lustig (2024a), who propose an international real business cycle model with a convenience yield on dollar safe assets to study the U.S. exorbitant privilege and the transmission mechanism for U.S. monetary policy shocks. The world consists of two countries: a home country (the U.S.) and a foreign country. Each produces a distinct consumption good. The model abstracts from nominal frictions: the dollar and the foreign currency represent the respective consumption baskets of home and foreign households, which are composed of both home and foreign goods.

[2] See Miran, A User's Guide to Restructuring the Global Trading System.

Let p_t and p_t^* denote the prices of home and foreign goods in their respective currencies. Let x_t denote the log dollar-foreign real exchange rate, which is the relative price of the home consumption basket in terms of the foreign basket. A higher x_t corresponds to a stronger dollar and a more expensive home consumption basket. For tractability, we study an endowment economy.

Households. Each country is populated by a unit mass of identical households and a government. The home households' consumption basket is a CES aggregation of home and foreign goods:

$$c_t = \left[\alpha^{1-\eta} c_{H,t}^{\eta} + (1-\alpha)^{1-\eta} c_{F,t}^{\eta}\right]^{1/\eta}.$$

Households derive utility from consumption and from holding dollar-denominated home bonds. These dollar bonds provide non-pecuniary benefits captured by a bond-in-utility specification, following Krishnamurthy and Vissing-Jorgensen (2012); Jiang et al. (2024a). The lifetime utility of home households is given by

$$\mathbb{E}_0\left[\sum_{t=0}^{\infty} \delta^t u\left(C_t\right)\right], \quad \text{with} \quad C_t \equiv c_t + \frac{1}{1-\sigma}\omega_H (\kappa b_{H,t}^{\rho} + d_{H,t}^{\rho})^{\frac{1-\sigma}{\rho}},$$

where $u(\cdot)$ satisfies the usual properties. The variable $b_{H,t}$ denotes the holdings of dollar government bonds, while $d_{H,t}$ denotes the holdings of dollar private bonds by home households. These bonds are imperfect substitutes in providing liquidity services, as captured by the CES aggregator $(\kappa b_{H,t}^{\rho} + d_{H,t}^{\rho})^{\frac{1}{\rho}}$. The parameter ρ governs the elasticity of substitution between government and private bonds, and κ measures the relative liquidity services provided by government bonds.

Home households derive utility from the liquidity services generated by dollar bonds. The parameter $1/\sigma$ determines the elasticity of demand for these liquidity services, while ω_H captures their overall importance in utility. For simplicity, we assume that foreign bonds do not provide convenience benefits.

Each home household is endowed with $D_{H,t}$ of private dollar bonds.[3] These bonds are backed by the household's resources in the next period. A key assumption is that the household must have positive holdings of the dollar bonds and cannot as a result sell more than $D_{H,t}$ of the bonds:

$$b_{H,t} \geq 0, \qquad d_{H,t} \geq 0.$$

Since the private and public dollar bonds are imperfect substitutes in providing liquidity services, their yields can be different. Let r_t^b and r_t^d denote the yields on government and private dollar bonds, respectively. Let r_t^* denote the yield on foreign bonds. The home households are subject to the following flow budget constraint, expressed in units of the home consumption basket:

$$\begin{aligned} &p_t y_t + D_{H,t} + \exp(r_{t-1}^b) b_{H,t-1} + \exp(r_{t-1}^d) d_{H,t-1} + \exp(r_{t-1}^* - x_t) b_{F,t-1} + g_t = \\ &\quad p_t c_{H,t} + p_t^* \exp(-x_t)(1+\nu_t) c_{F,t} + \exp(r_{t-1}^d) D_{H,t-1} + (b_{H,t} + d_{H,t}) + \exp(-x_t) b_{F,t} \end{aligned} \tag{2}$$

The left-hand side captures income from the endowment of home goods, proceeds from selling the bond endowment of $D_{H,t}$, returns on bond holdings from the previous period, and a government transfer g_t. The right-hand side captures consumption expenditures, repayment on the bond endowment and new bond purchases. Households pay a proportional tariff ν_t on the foreign goods in their consumption bundle, which is rebated back to them.

Foreign households are modeled in a similar way. Their lifetime utility is

$$\mathbb{E}_0 \left[\sum_{t=0}^{\infty} \delta^t u\left(C_t^*\right) \right], \quad \text{with} \quad C_t^* \equiv c_t^* + \frac{1}{1-\sigma} \omega_H^* \exp(x_t) (\kappa^* (b_{H,t}^*)^\rho + (d_{H,t}^*)^\rho)^{\frac{1-\sigma}{\rho}}.$$

Like home households, foreign households also derive utility from holding dollar bonds, which requires them to have positive holdings of the dollar bonds: $b_{H,t}^* \geq 0$, $d_{H,t}^* \geq 0$.

The foreign consumption basket is also a CES aggregation of home and foreign goods:

$$c_t^* = \left[(\alpha^*)^{1-\eta^*} (c_{F,t}^*)^{\eta^*} + (1-\alpha^*)^{1-\eta^*} (c_{H,t}^*)^{\eta^*} \right]^{1/\eta^*}.$$

[3] Another way to explain the bonds in our model setup is to say that the U.S. endowment is produced from two one-period (full depreciation) types of capital: "bond" capital and "equity" capital. The goods produced by the bond capital is $D_{H,t}$ at date $t+1$. The bond capital also generates liquidity services for the U.S. household. The household can sell some of this bond capital to the foreign investor who also generates liquidity services from the bond capital. But the U.S. household cannot sell more bond capital than it owns; that is, its holdings must be positive.

We allow the elasticity of substitution between home and foreign goods to differ, i.e., $\eta^* \neq \eta$. Doing so allows us to consider the separate impacts of reserve currency status on imports and exports.

The foreign household's flow budget constraint is,

$$p_t^* y_t^* + \exp(r_{t-1}^b + x_t) b_{H,t-1}^* + \exp(r_{t-1}^d + x_t) d_{H,t-1}^* + \exp(r_{t-1}^*) b_{F,t-1}^* + g_t^* =$$
$$p_t^* c_{F,t}^* + p_t \exp(x_t)(1 + \nu_t^*) c_{H,t}^* + \exp(x_t)(b_{H,t}^* + d_{H,t}^*) + b_{F,t}^*.$$

Foreign households face no portfolio restrictions on short selling their domestic bonds. In equilibrium, they will short-sell foreign bonds and use the proceeds to purchase dollar bonds.

Safe Asset Issuers. Safe dollar bonds consist of the private supply of dollar safe bonds, $D_{H,t}$, and one-period, risk-free bonds $B_{H,t}$ issued by the home government. For simplicity, we assume that the foreign government does not issue bonds.

The home government's net revenue consists of net bond issuance and tariff collection:

$$g_t = B_{H,t} - B_{H,t-1} \exp(r_{t-1}^b) + \nu_t p_t^* \exp(-x_t) c_{F,t}, \tag{3}$$

which are redistributed to local households via lump-sum transfers. The foreign government's net revenue consists of tariff collection only, i.e., $g_t^* = \nu_t^* p_t \exp(x_t) c_{H,t}^*$, which is also rebated to foreign households.

Market Clearing. The goods markets and the bond markets clear in the usual way:

$$c_{H,t} + c_{H,t}^* = y_t, \qquad c_{F,t} + c_{F,t}^* = y_t^*. \tag{4}$$

$$b_{H,t} + b_{H,t}^* = B_{H,t}, \qquad d_{H,t} + d_{H,t}^* = D_{H,t}. \tag{5}$$

$$b_{F,t}^* + b_{F,t} = 0. \tag{6}$$

The exogenous variables are the goods and bond endowments and tariffs: $(y_t, y_t^*, B_{H,t}, D_{H,t}, \nu_t, \nu_t^*)_{t=0}^{\infty}$. Appendix A.2 provides the full set of endogenous variables and equilibrium conditions.

2.1 Equilibrium and Steady-State Analysis

We start by substituting the government budget (3) into the home household budget (2) to clarify the impact of tariffs and reserve currency status. This yields,

$$D_{H,t} + p_t y_t + \exp(r^b_{t-1}) b_{H,t-1} + \exp(r^d_{t-1}) d_{H,t-1} + \exp(r^*_{t-1} - x_t) b_{F,t-1} + B_{H,t} - B_{H,t-1} \exp(r^b_{t-1}) = p_t c_{H,t} + \exp(-x_t) p^*_t c_{F,t} + \exp(r^d_{t-1}) D_{H,t-1} + b_{H,t} + d_{H,t} + \exp(-x_t) b_{F,t}. \tag{7}$$

Tariffs drop out in the budget constraint. We rewrite this expression dropping time subscripts in the steady state:

$$(b_H - B_H)(\exp(r^b) - 1) + (d_H - D_H)(\exp(r^d) - 1) + b_F(\exp(r^*) - 1) = pc_H + \exp(-x)p^* c_F - py.$$

External Balance. Using the home bond market clearing conditions we can further express this as,

$$\underbrace{b_F(\exp(r^*) - 1) - b^*_H(\exp(r^b) - 1) - d^*_H(\exp(r^d) - 1)}_{\text{investment income}} = \underbrace{pc_H + \exp(-x)p^* c_F - py}_{\text{trade balance}}. \tag{8}$$

Home is long b_F units of foreign bonds paying interest rate r^* and short domestic private and government bonds paying interest rate r^b and r^d, respectively. If there is a convenience yield on home bonds, then we will see that $r^b < r^*$ and $r^d < r^*$, so that the left-hand side reflects the investment income or seigniorage that the U.S. receives on its provision of dollar bonds. The right-hand side is the trade deficit, so that if investment income is positive then there is a trade deficit in steady state.

The net foreign asset position for the foreign household is,

$$NFA_t = d^*_{H,t} + b^*_{H,t} + b^*_{F,t}. \tag{9}$$

In equilibrium $b_{F,t} = -b^*_{F,t}$. Then, in steady state,

$$\underbrace{b^*_H \left(\exp(r^*) - \exp(r^b)\right) + d^*_H \left(\exp(r^*) - \exp(r^d)\right)}_{\text{seigniorage from gross portfolio}} - \underbrace{NFA(\exp(r^*) - 1)}_{\text{income from net portfolio}} = pc_H + \exp(-x)p^* c_F - py. \tag{10}$$

The second term involving the NFA is standard in models: if the home country has some steady state earnings (payments) from the NFA, then the trade balance will be in surplus (deficit). The first term involving the gross holdings is special to our modeling of the U.S. as safe asset provider to the world.

We are interested in asking how the loss of reserve currency status impacts equilibrium exchange rates and interest rates. This will work through the impact on the seigniorage revenue term $(b_H^* \left(\exp(r^*) - \exp(r^b)\right) + d_H^* \left(\exp(r^*) - \exp(r^d)\right)$, both via closing the gap in equilibrium between r^* and r^b, r^d, and on reducing in equilibrium the foreign holdings b_H^*, d_H^*.

We will impose that the $NFA = 0$ in the steady state which simplifies the exposition. Then, we can rewrite, (8) as,

$$\underbrace{b_H^* \left(\exp(r^*) - \exp(r^b)\right) + d_H^* \left(\exp(r^*) - \exp(r^d)\right)}_{\text{investment income}} = \underbrace{pc_H + \exp(-x)p^* c_F - py}_{\text{trade balance}}, \tag{11}$$

which clarifies that in the steady state, the seigniorage revenue from foreign demand for dollar bonds ("exorbitant privilege") funds the trade balance.

Bond and Dollar Pricing. Intertemporal Euler equations pin down interest rates. For the home households, they are given by

$$\begin{aligned}
1 - \omega_H(\kappa b_{H,t}^\rho + d_{H,t}^\rho)^{\frac{1-\sigma}{\rho}-1} d_{H,t}^{\rho-1} &= \mathbb{E}_t \left[\delta \frac{u'(C_{t+1})}{u'(C_t)} \exp(r_t^d)\right], \\
1 - \omega_H(\kappa b_{H,t}^\rho + d_{H,t}^\rho)^{\frac{1-\sigma}{\rho}-1} \kappa b_{H,t}^{\rho-1} &= \mathbb{E}_t \left[\delta \frac{u'(C_{t+1})}{u'(C_t)} \exp(r_t^b)\right], \\
1 &= \mathbb{E}_t \left[\delta \frac{u'(C_{t+1})}{u'(C_t)} \exp(-\Delta x_{t+1} + r_t^*)\right],
\end{aligned}$$

and for the foreign households, they are given by

$$\begin{aligned}
1 - \omega_H^*(\kappa^*(b_{H,t}^*)^\rho + (d_{H,t}^*)^\rho)^{\frac{1-\sigma}{\rho}-1} (d_{H,t}^*)^{\rho-1} &= \mathbb{E}_t \left[\delta \frac{u'(C_{t+1}^*)}{u'(C_t^*)} \exp(\Delta x_{t+1} + r_t^d)\right] \\
1 - \omega_H^*(\kappa^*(b_{H,t}^*)^\rho + (d_{H,t}^*)^\rho)^{\frac{1-\sigma}{\rho}-1} \kappa^*(b_{H,t}^*)^{\rho-1} &= \mathbb{E}_t \left[\delta \frac{u'(C_{t+1}^*)}{u'(C_t^*)} \exp(\Delta x_{t+1} + r_t^b)\right], \\
1 &= \mathbb{E}_t \left[\delta \frac{u'(C_{t+1}^*)}{u'(C_t^*)} \exp(r_t^*)\right].
\end{aligned}$$

These expressions can be used to derive the exchange rate valuation equation that is studied in Jiang et al. (2021). Define the convenience yield foreign investors assign to safe dollar debt as $\lambda_t^d = -\log\left(1 - \omega_H^*(\kappa^*(b_{H,t}^*)^\rho + (d_{H,t}^*)^\rho)^{\frac{1-\sigma}{\rho}-1}(d_{H,t}^*)^{\rho-1}\right) \approx \omega_H^*(\kappa^*(b_{H,t}^*)^\rho + (d_{H,t}^*)^\rho)^{\frac{1-\sigma}{\rho}-1}(d_{H,t}^*)^{\rho-1}$. Then, we combine the first and third Euler equations for the foreign investor to give,

$$\Delta x_{t+1} + r_t^d - r_t^* + \lambda_t^d = 0.$$

Iterating on this U.I.P. condition for T periods gives,

$$x_t - x_{t+T} = \mathbb{E}_t\left[\sum_{j=1}^{T}\left(r_{t+j}^d - r_{t+j}^*\right)\right] + \mathbb{E}_t\left[\sum_{j=1}^{T}\lambda_{t+j}^d\right]. \tag{12}$$

This equation is the certainty counterpart of the exchange rate valuation equation derived in Jiang et al. (2021). In the case of uncertainty, there is an additional risk premium term, giving,

$$x_t - x_{t+T} = \mathbb{E}_t\left[\sum_{j=1}^{T}\left(r_{t+j}^d - r_{t+j}^*\right)\right] - \mathbb{E}_t\left[\sum_{j=1}^{T} rp_{t+j}\right] + \mathbb{E}_t\left[\sum_{j=1}^{T}\lambda_{t+j}^d\right].$$

Our objective in this paper is to shed light on the terminal exchange rate, x_{t+T}, in (12). Therefore, we consider the steady state, in which the Euler equations simplify and give,

$$1 - \omega_H(\kappa b_H^\rho + d_H^\rho)^{\frac{1-\sigma}{\rho}-1} d_H^{\rho-1} = 1 - \omega_H^*(\kappa^*(b_H^*)^\rho + (d_H^*)^\rho)^{\frac{1-\sigma}{\rho}-1}(d_H^*)^{\rho-1} = \delta\exp(r^d) \tag{13}$$

$$1 - \omega_H(\kappa b_H^\rho + d_H^\rho)^{\frac{1-\sigma}{\rho}-1}\kappa b_H^{\rho-1} = 1 - \omega_H^*(\kappa^*(b_H^*)^\rho + (d_H^*)^\rho)^{\frac{1-\sigma}{\rho}-1}\kappa^*(b_H^*)^{\rho-1} = \delta\exp(r^b) \tag{14}$$

$$1 = \delta\exp(r^*) \tag{15}$$

We see that if $\omega_H, \omega_H^* > 0$, i.e., home and foreign investors derive non-pecuniary benefits from holding dollar bonds, then the yields on these bonds will be lower than the yield on foreign bonds, i.e., $r^* > r^b$ and $r^* > r^d$. We also see that if ω_H^* falls — that is, foreign demand for dollar bonds falls — then the dollar bond interest rates r^b and r^d would rise. This is an effect that has played out in the world as analyzed in Section 1.

Goods Market Clearing. Households' intra-temporal consumption choices give,

$$\frac{c_{H,t}}{c_{F,t}} = \frac{\alpha}{1-\alpha}\left(\frac{p_t}{p_t^* \exp(-x_t)(1+\nu_t)}\right)^{1/(\eta-1)}, \tag{16}$$

$$\frac{c_{F,t}^*}{c_{H,t}^*} = \frac{\alpha^*}{1-\alpha^*}\left(\frac{p_t^*}{p_t \exp(x_t)(1+\nu_t^*)}\right)^{1/(\eta^*-1)}, \tag{17}$$

with price indices satisfying

$$p_t = \alpha^{1-\eta}\left[\frac{\alpha^{1-\eta}c_{H,t}^{\eta} + (1-\alpha)^{1-\eta}c_{F,t}^{\eta}}{c_{H,t}^{\eta}}\right]^{(1-\eta)/\eta},$$

$$p_t^* = (\alpha^*)^{1-\eta^*}\left[\frac{\alpha^{1-\eta^*}(c_{F,t}^*)^{\eta^*} + (1-\alpha^*)^{1-\eta^*}(c_{H,t}^*)^{\eta^*}}{(c_{F,t}^*)^{\eta^*}}\right]^{(1-\eta^*)/\eta^*}.$$

From this equation system, we can see the economics of what will happen if we set ω_H^* to zero. From equation (11) we see that b_H^* and d_H^* will go to zero reducing the investment income/reserve currency seigniorage of the U.S. In turn, the trade balance must fall. Since the home households' purchasing power declines while the foreign households' purchasing power rises, in order to clear (16) and (17), the foreign goods which are preferred by the foreign households must rise in price relative to the home goods. Thus, to equilibrate the goods market with a lower trade balance for home, the dollar must depreciate. The extent of the depreciation depends on the elasticity of imports and exports to the exchange rate, which are parameterized by η and η^*.

2.2 Quantification

We consider a range of parameter values to quantify the impact of the loss of reserve currency status on interest rates, exchange rates, and external imbalances. Our baseline calibration assumes that the U.S. dollar bond (both private and government) enjoys a 2% convenience yield, which is consistent with the estimates in Jiang et al. (2021). Koijen and Yogo (2020) estimate a smaller convenience yield of 1.41% using an international asset demand system. Appendix A.3 presents results based on calibrating to their estimates. There is evidence that the private bond has a smaller convenience yield than the government bond (Krishnamurthy and Vissing-Jorgensen 2012). We are setting aside this difference based on the result from Jiang et al. (2021) that the bulk of the convenience yield stems from safe bonds whose payoffs are in dollars.

We choose σ to target the semi-elasticity of the bond convenience yield with respect to the log quantity of bonds based on results in Krishnamurthy and Vissing-Jorgensen (2012). More precisely, Table 1 of the paper reports that a one log point increase in debt/GDP ratio leads do a decline in the AAA-Treasury spread of 0.89 basis points. They also report that the convenience yield of Treasury bonds relative to AAA corporate bonds is 0.47% in their sample (i.e. AAA bonds also carry a convenience yield). For our computation what is important is the overall convenience yield on Treasury bonds not the relative convenience yield. Given our estimate of a 2% convenience yield on Treasurys, we scale up the semi-elasticity by 200/47, or approximately 4×0.89. To target this empirical estimate, we perturb

Variable	Notation	Value
Primitive Parameters		
Time discount factor	δ	0.975
Risk aversion	γ	2.0
Home elasticity of substitution	η	1/3
Foreign elasticity of substitution	η^*	1/3
Public-private bond substitution	ρ	0.65
Targets		
Annual convenience yield		2%
U.S. public bond/GDP ratio	$B_{H,t}$	94%
Share of public bond held by foreign investors	$b^*_{H,t}/B_{H,t}$	39%
U.S. private bond/GDP ratio	$D_{H,t}$	111%
Share of private bond held by foreign investors	$d^*_{H,t}/D_{H,t}$	14%
Net foreign assets/GDP	NFA_t	0%
Import+export/GDP		9.83%
Estimated Parameters		
Home bias	α	0.95
Bond curvature	σ	1.75
Home investor bond preference	ω_H	14.50%
Home investor public bond preference	κ	0.84
Foreign investor bond preference	ω^*_H	2.97%
Foreign investor public bond preference	κ^*	1.35

Table 1
Model Parameters

Notes: The model is simulated at the quarterly frequency. We report annualized values for the discount factor and convenience yield.

the steady state by increasing the home bond supply by 1% in log terms. When the bond curvature parameter σ is equal to 1.75, we obtain the desired semi-elasticity as found in the data.[4]

We choose ρ based on the estimates from Krishnamurthy and Li (2023), who estimate the elasticity of substitution between Treasury bonds and bank deposits and find them to be imperfect substitutes.

On the quantity side, we use data from the Federal Reserve's Flow of Funds to estimate the total supply of U.S. safe debt and the portion held by foreign investors, calibrating our model to values from Q4 2016. Section 1.3 provides a detailed discussion of the data construction. We classify Treasury securities and agency securities as public safe debt, and commercial paper, investment-grade corporate debt, and net short-term bank liabilities as private safe debt.[5] When calculating total supply, we exclude holdings by the Federal Reserve from these four categories.

To measure foreign holdings, we use the Flow of Funds data on foreign asset holdings across the relevant categories. Based on these calculations, the total supply of public safe U.S. dollar assets amounts to 94% of GDP in Q4 2016, with foreign investors holding 39% of that total. The total supply of private safe U.S. dollar assets amounts to 111% of GDP, with foreign investors holding 14% of the total.

These estimates inform ω_H, ω_H^*, κ, and κ^* in our model, which we report in Table 1. We observe that the home investor's bond preference ω_H is substantially higher than the foreign investor's bond preference ω_H^*, which is consistent with the fact that U.S. safe assets are primarily held by domestic investors. The home investor's preference for government bonds κ is lower than the foreign investor's preference κ^*, which helps explain why foreign investors hold a higher share of government bonds than private bonds.

On the trade side, we present two calibrations. We presents results for $\eta = \eta^* = 1/3$ following Itskhoki and Mukhin (2021). There is empirical evidence of a higher import elasticity in the U.S. for foreign goods relative to the export elasticity for U.S. goods (Chinn 2004). We also present a calibration with $\eta = 2/3, \eta^* = 1/3$.

[4] Alternatively, to target the Koijen and Yogo (2020) estimates we need a σ of 3.17 instead of 1.75, or a more inelastic demand curve. Appendix A.3 reports the numerical results using this parameter value. The convenience yield response in the scenario of convenience loss is greater.

[5] When we consider short-term bank liabilities to be safe U.S. dollar assets we include four types of issuers: U.S.-chartered depository institutions, foreign banking offices, banks in U.S.-affiliated areas, and credit unions. For each of these banking sectors, we compute net short-term liabilities by subtracting short-term assets from short-term liabilities.

Note that imports and exports in the data include both final goods and intermediate input goods, while consumption in our model is final goods. We use 2016 U.S. data to target the sum of U.S. imports and exports times the share of final goods in international trade, which yields 9.83% of U.S. GDP. This value implies a home bias parameter α of 0.95. We calibrate based on a 50% ratio of intermediate goods to total goods following Itskhoki and Mukhin (2021).

2.3 Full Convenience Loss

Tables 2 presents the first set of results. In both panels, we present the baseline calibration in Column (1). Both public and private U.S. dollar bonds enjoy a 2% convenience yield, which contributes to the "exorbitant privilege" of the U.S. and allows for a trade deficit of 1.05% of GDP in steady state. This seigniorage revenue increases the U.S. purchasing power and allows for a stronger dollar than parity. The model also replicates the foreign investors' holdings of U.S. dollar bonds as of Q4 2016, with foreign investors holding more public U.S. bonds than private U.S. bonds.

Then, we compute a counterfactual where we set $\omega_H^* = 0$, capturing a scenario where foreign demand for both public and private dollar safe assets disappears. Note that we maintain the U.S. (home) demand for U.S. dollar assets at ω_H as in the baseline. In panel (a), we set $\eta = 1/3$, $\eta^* = 1/3$, while in panel (b) we set $\eta = 2/3, \eta^* = 1/3$.

In both cases, the drop in foreign demand for dollar bonds increases U.S. interest rates.[6] The rate increase occurs because the U.S. investor reabsorbs the dollar bonds and, given downward sloping demand, requires a higher interest rate. The interest rate on public dollar bonds rises by 87 bps, while the interest rate on private dollar bonds rises by 72 bps.

Despite the increase in U.S. interest rates, the dollar depreciates in real terms. This occurs because of the loss of seigniorage revenue. We see that the trade balance closes from -1.05% of GDP to zero, reflecting the loss in the exorbitant privilege. In the case of panel (a), the foreign reserve demand implies a change in the dollar of 8.81%. When we increase the U.S. trade elasticity, as in panel (b), the impact on the dollar is as expected smaller at 5.12%. The higher trade elasticity means that the exchange rate has to adjust less to accommodate the change in the trade balance.

This experiment provides a theoretical grounding to understand the events of April and

[6] The foreign interest rate is not reported and remains unaffected at 2.5% (the discount factor) because we do not consider that loss of demand for dollars may result in a rise in demand for foreign currency bonds.

Panel (a): Baseline Elasticity Calibration $\eta = \eta^* = 1/3$			
	(1) Baseline	(2) Convenience Loss	(3) Difference
Log Dollar FX (%)	8.81	0.00	-8.81
Conv Yield Govt (%)	2.00	1.13	-0.87
Conv Yield Private (%)	2.00	1.28	-0.72
Seigniorage/GDP (%)	1.05	0.00	-1.05
Govt Debt Held Abroad/GDP (%)	36.64	0.00	-36.64
Private Debt Held Abroad/GDP (%)	15.42	0.00	-15.42
Foreign Debt Held by US/GDP (%)	56.85	0.00	-56.85
Govt Dollar Interest Rate (%)	0.53	1.40	0.87
Private Dollar Interest Rate (%)	0.53	1.25	0.72
Trade Balance/GDP (%)	-1.05	0.00	1.05
Import/GDP (%)	5.44	5.14	-0.30
Export/GDP (%)	4.39	5.14	0.74
H Goods Consumed by H (%)	95.61	94.86	-0.74
F Goods Consumed by F (%)	94.00	94.86	0.86
NFA/GDP (%)	0.00	0.00	0.00

Panel (b): Asymmetric Trade Elasticity Calibration $\eta = 2/3, \eta^* = 1/3$			
	Baseline	Convenience Loss	Difference
Log Dollar FX (%)	5.12	0.00	-5.12
Conv Yield Govt (%)	2.00	1.13	-0.87
Conv Yield Private (%)	2.00	1.27	-0.73
Seigniorage/GDP (%)	1.05	0.00	-1.05
Govt Debt Held Abroad/GDP (%)	36.64	0.00	-36.64
Private Debt Held Abroad/GDP (%)	15.42	0.00	-15.42
Foreign Debt Held by US/GDP (%)	54.80	0.00	-54.80
Govt Dollar Interest Rate (%)	0.53	1.40	0.87
Private Dollar Interest Rate (%)	0.53	1.26	0.73
Trade Balance/GDP (%)	-1.05	0.00	1.05
Import/GDP (%)	5.44	4.83	-0.61
Export/GDP (%)	4.39	4.83	0.44
H Goods Consumed by H (%)	95.61	95.17	-0.44
F Goods Consumed by F (%)	94.24	95.17	0.93
NFA/GDP (%)	0.00	0.00	0.00
H Log Consumption	0.01	0.00	-0.01
F Log Consumption	-0.01	0.00	0.01

Table 2
Steady-State Results with Full Convenience Loss

Notes: The model is calibrated at the quarterly frequency. The convenience yield and interest rate are annualized. In panel (a), trade elasticity is $\eta = \eta^* = 1/3$ following Itskhoki and Mukhin (2021); in panel (b), we set $\eta = 2/3, \eta^* = 1/3$ to capture the higher import elasticity for foreign goods relative to the export elasticity for U.S. goods.

May 2025. Any perceived loss of reserve currency status should be expected to both increase U.S. long-term interest rates and depreciate the dollar.

These computations come with a caveat: our model and hence our computation is for the long-run real exchange rate. Returning to the valuation equation,

$$x_t - x_{t+T} = \mathbb{E}_t \left[\sum_{j=1}^{T} \left(r^d_{t+j} - r^*_{t+j} \right) \right] - \mathbb{E}_t \left[\sum_{j=1}^{T} rp_{t+j} \right] + \mathbb{E}_t \left[\sum_{j=1}^{T} \lambda^d_{t+j} \right].$$

We compute how x_{t+T} changes for a large T. The current exchange rate x_t will price in any shifts in monetary policy (via r^d_{t+j}), changes in the path of convenience yields (via λ^d_{t+j}), as well as changes in the perceived risk premium on the dollar. If the loss of the reserve currency status triggers broader sales of U.S. assets beyond the safe asset market, the dollar could further weaken, especially when this shock also coincides with a tightening of the constraints of global financial intermediaries that tend to intermediate these asset markets. These factors will affect today's exchange rate as well as the path of exchange rates along a transition path to a new steady state. Lastly, we only consider real exchange rates, and any shifts in the price level due to inflationary concerns can also be expected to impact the trajectory of the dollar.

Our steady-state analysis abstracts from these transition dynamics, and should therefore be thought of as measuring the direct effect of the loss of the reserve currency status on the real value of the dollar.

2.4 Debt Expansion and Asymmetric Public and Private Flows

Our experiment of the last section does not identify what causes ω^*_H to fall to zero. There have been many changes over the last 3 years ranging from domestic factors, both monetary and fiscal, and international factors such as trade and foreign policy. This section zeroes in on fiscal policy.

The patterns we document are suggestive that the trends in bond and currency markets are connected to trends in the U.S. Treasury market and the fiscal health of the U.S. government. That is, as deficits and debt in the U.S. have ballooned, the demand for long-term Treasurys as a safe asset has fallen. Foreign investors have retrenched from both long-term Treasurys and overall dollar safe assets. We next investigate this chain through the lens of the model of the next section.

We emphasize at the outset, however, that our analysis is designed to only quantify the consequences of this scenario. Neither the model nor the data can identify the deteriorating U.S. fiscal position as the primary factor behind the trends we document.

We present three steps. First, we consider the pure effect of an increase in the quantity of U.S. public debt. Second, we consider the impact of a reduction in home and foreign investors' preference for U.S. public debt relative to private bonds. Last, we consider the impact of an overall reduction in foreign investors' preference for U.S. safe assets. The modeling exercise clarifies that these three factors can generate the observed trends in interest rates and exchange rates.

Step 1: Public Debt Expansion. In our baseline case, we calibrate our model based on the data in Q4 2016, when the total supply of public safe U.S. dollar assets amounts to 94% of GDP, with foreign investors holding 39% of that total, and the total supply of private safe U.S. dollar assets amounts to 111% of GDP, with foreign investors holding 14% of the total.

For the counterfactual scenario after debt expansion, we use the CBO projection made in 2026 for the U.S. public debt, which projects that the public debt will reach 120% of GDP by 2036. We assume that the agency debt/GDP ratio will remain constant. As a result, the total supply of public safe U.S. dollar assets increases to 155% of GDP, representing a 61 percentage point increase from the baseline in 2016. We also assume that the private debt/GDP ratio remains constant at 111% of GDP.

Column (2) in Table 3 reports the results. Panel (a) uses the symmetric trade elasticity calibration, while panel (b) uses the asymmetric trade elasticity calibration. In both cases, we see that the expansion of public debt alone leads to a decline in both the public and the private U.S. bond's convenience yield. The reductions in these convenience yields are large enough to dominate the impact of the increase in the quantity of public debt, leading to a decline in the U.S. seigniorage revenue (i.e. "$p \times q$" falls despite q rising). Through the mechanism we discussed in the context of Eq. (11), the decline in seigniorage revenue leads to a real depreciation of the dollar and an improvement in the trade balance. The real depreciation is $8.81 - 7.12 = 1.69\%$ in panel (a) and $5.12 - 4.19 = 0.93\%$ in panel (b). In terms of debt holdings, the expansion of U.S. public debt is absorbed by both U.S. and foreign investors. For foreigners, their holdings of U.S. public debt increase from 36.64% of GDP to 55.46% of GDP in panel (a). Driven by the overall decline in the convenience yield of U.S. safe assets, foreign investors hold slightly less private U.S. debt.

Panel (a): Baseline Elasticity Calibration $\eta = \eta^* = 1/3$				
	(1) Baseline	(2) Debt Expansion	(3) ω_H^* Reduction	(4) κ^* Reduction
Log Dollar FX (%)	8.81	7.12	2.82	3.27
Conv Yield Govt (%)	2.00	1.18	0.89	0.91
Conv Yield Private (%)	2.00	1.42	1.14	1.19
Seigniorage/GDP (%)	1.05	0.85	0.35	0.40
Govt Debt Held Abroad/GDP (%)	36.64	55.46	30.29	27.62
Private Debt Held Abroad/GDP (%)	15.42	13.69	6.42	12.30
Foreign Debt Held by US/GDP (%)	56.85	74.25	37.76	41.25
Govt Dollar Interest Rate (%)	0.53	1.35	1.64	1.62
Private Dollar Interest Rate (%)	0.53	1.11	1.40	1.34
Trade Balance/GDP (%)	-1.05	-0.85	-0.35	-0.40
Import/GDP (%)	5.44	5.38	5.23	5.25
Export/GDP (%)	4.39	4.53	4.89	4.85
H Goods Consumed by H (%)	95.61	95.47	95.11	95.15
F Goods Consumed by F (%)	94.00	94.17	94.60	94.56
NFA/GDP (%)	0.00	0.00	0.00	0.00

Panel (b): Asymmetric Trade Elasticity Calibration $\eta = 2/3, \eta^* = 1/3$				
	Baseline	Debt Expansion	ω_H^* Reduction	κ^* Reduction
Log Dollar FX (%)	5.12	4.19	1.71	1.98
Conv Yield Govt (%)	2.00	1.18	0.89	0.91
Conv Yield Private (%)	2.00	1.42	1.13	1.19
Seigniorage/GDP (%)	1.05	0.85	0.34	0.40
Govt Debt Held Abroad/GDP (%)	36.64	55.46	30.29	27.62
Private Debt Held Abroad/GDP (%)	15.42	13.69	6.42	12.30
Foreign Debt Held by US/GDP (%)	54.80	72.11	37.34	40.72
Govt Dollar Interest Rate (%)	0.53	1.35	1.64	1.62
Private Dollar Interest Rate (%)	0.53	1.11	1.40	1.34
Trade Balance/GDP (%)	-1.05	-0.85	-0.34	-0.40
Import/GDP (%)	5.44	5.32	5.03	5.06
Export/GDP (%)	4.39	4.47	4.68	4.66
H Goods Consumed by H (%)	95.61	95.53	95.32	95.34
F Goods Consumed by F (%)	94.24	94.42	94.88	94.83
NFA/GDP (%)	0.00	0.00	0.00	0.00

TABLE 3

STEADY-STATE RESULTS WITH DEBT EXPANSION AND ASYMMETRIC PUBLIC AND PRIVATE FLOWS

Notes: The model is calibrated at the quarterly frequency. The convenience yield and interest rate are annualized. In panel (a), trade elasticity is $\eta = \eta^* = 1/3$ following Itskhoki and Mukhin (2021); in panel (b), we set $\eta = 2/3, \eta^* = 1/3$ to capture the higher import elasticity for foreign goods relative to the export elasticity for U.S. goods.

Step 2: Reduction in Foreign Investors' Preference for U.S. Safe Assets. The expansion of public debt alone leads to an increase in foreign holdings of public dollar debt, which also crowds out foreign holdings of private dollar debt. This does not capture patterns in the data. Foreign investors must reduce their overall preference for U.S. safe assets. To capture this effect, we start from step 1, and reduce the foreign investor's preference parameter ω_H^* by 75% from its baseline value, while holding the home investor's preference parameter ω_H fixed at its baseline value.

Column (3) in Table 3 reports the results. The reduction in the foreign investors' preference for U.S. safe assets reduces the convenience yields of both public and private U.S. bonds relative to step 2. The U.S. seigniorage revenue declines sharply, leading to a real depreciation of the dollar and an improvement in the trade balance.

What this exercise misses is the difference between public and private dollar assets. A uniform reduction in the foreign investors' preference for U.S. safe assets leads to reduction in their holdings of both public and private U.S. bonds, whereas the data show that the decline in foreign holdings is more pronounced for public U.S. bonds than private U.S. bonds.

Step 3: Reduction in Foreign Investors' Public Bond Preference. The uniform reduction in holdings of U.S. safe assets leads to a significant fall in holdings of private safe assets. The data suggest that those holdings are stable and moreover that the convenience yield on public assets fall more than that of private assets. To capture this differential preference we next reduce κ^* by 25% from its baseline value, while holding the bond preference parameter κ fixed at its baseline value. This experiment is consistent with the theory we cited earlier (Coppola et al. 2022), where a reduction in perceived safety of public assets is coupled with a withdrawal from all dollar assets.

We also maintain the expanded public debt quantity from step 1 and the reduction in ω_H and ω_H^* from step 2. In other words, while step 2 emphasizes the asymmetry between home and foreign investors, this step emphasizes the asymmetry between public and private U.S. bonds.

Column (4) in Table 3 reports the results. Compared to step 2 reported in Column (3), we see a moderate increase in the convenience yield of public U.S. bonds, and a larger increase in the convenience yield of private U.S. bonds. This is because a reduction in κ^* has two effects. First, it increases the relative desirability of private U.S. bonds relative to public U.S. bonds to foreign investors. Second, it reduces the effective aggregate supply of safe assets, because the public U.S. debt produces less liquidity services.

The second effect is important, because it effectively reverses the effect of debt expansion in step 1. The private U.S. debt disproportionately benefits from the reduction of aggregate liquidity, leading to a greater increase in its convenience yield. Since the U.S. enjoys the monopoly of issuing both public and private safe assets, its seigniorage revenue actually increases relative to step 2, despite the reduction in the desirability of its public debt. As a result, the dollar's real exchange rate appreciates and recovers from the depreciation in step 2.

On the quantity side, the reduction in κ^* leads to a significant decline in foreign holdings of public U.S. bonds, while their holdings of private U.S. bonds increase. This pattern helps us understand the data, which show a more pronounced decline in foreign holdings of public U.S. bonds than private U.S. bonds.

Taking stock, our analysis highlights that the impact of the U.S. fiscal deterioration is through a nuanced channel: the loss of confidence in U.S. public debt is coupled with a broader foreign sale of all U.S. safe assets. The latter is necessary to generate a large enough decline in the U.S. seigniorage revenue to cause a significant depreciation of the dollar.

2.5 Present Value of Exorbitant Privilege

The fall in the value of the dollar and rise in U.S. interest rates imply an effective loss of "wealth" of the U.S. household. We can size the impact of the scenario on wealth by computing the lost present value of exorbitant privilege when $\omega_H^* = 0$. Given that the U.S. bond enjoys a convenience yield of 2%, and that the foreign investors hold 52% of U.S. GDP in public and private dollar bonds, the U.S. earns a seigniorage revenue of $52\% \times 2\% = 1.04\%$ of GDP per year. We can compute the present value of this claim to translate it into a "wealth" equivalent. In our model, the discount rate is 2.5% and we could use this rate to compute the present value. However, we step outside our model for this computation and take the more relevant case where the stream is risky and the discount rate reflects GDP risk. We take two approaches.

In our first approach, we note that the exercise is identical to that done in Jiang et al. (2024b) where the computation is of the present value of the stream of fiscal surpluses, where the fiscal surplus is cointegrated with GDP (and hence as risky as GDP). Following that paper, we use a risk-adjusted discount rate of 4.68% (which includes a 3% risk premium on GDP claims) and a growth rate of 2.95% per year, which leads to a discount rate of

$4.68\% - 2.95\% = 1.73\%$. Then, the present value of the exorbitant privilege is

$$\frac{seigniorage}{r-g} = \frac{1.04\%}{1.73\%} = 60\%$$

of U.S. GDP or roughly \$18 trillion in today's dollars. The U.S. has an "asset" worth \$18 trillion and the dividend on this asset finances part of the trade balance. If reserve demand for the dollar was to disappear, then the U.S. would effectively lose \$18 trillion of wealth.

The previous computation is based on Jiang et al. (2024b) estimates of r and g from historical data (sample from 1947–2020). In our second approach, we are interested in computing the current present value, so the appropriate strategy is to estimate discount and growth rates prospectively. To do so, we follow 2025 AQR's capital market assumptions for major asset classes. We use AQR's current estimates from `www.aqr.com`. For U.S. large cap equities, they assume a dividend yield of $3.3\% - 1.8\% = 1.5\%$, based on a discount rate of 3.3% and a growth rate of 1.8%. Using their prevailing U.S. risk-free rate (U.S. cash return) of 1.7%, this corresponds to an equity risk premium of 1.6%. Assuming that the GDP claim is 2/3 as risky as the equity claim, the GDP risk premium is $1.6\% \times 2/3 = 1.07\%$. So, the $r-g$ for the GDP claim is $1.7\% + 1.07\% - 1.8\% = 0.97\%$. The present value of the exorbitant privilege is

$$\frac{seigniorage}{r-g} = \frac{1.04\%}{0.97\%} = 107\%$$

or roughly \$33 trillion.

2.6 Tariff and Convenience Loss

We next consider a case where the U.S. and the foreign country impose a 15% tariff on each other's goods and the U.S. loses its convenience status. The results are reported in Table 4. We report four cases. In Column (1), we report the baseline case as above, with no tariff and U.S. dollar bonds enjoying a convenience yield. In Column (2), we report the case where both countries impose a 15% tariff on each other's goods, but the U.S. dollar bonds still enjoy a convenience yield. In Column (3), we report the case where both countries impose tariff, and the U.S. dollar bonds lose their convenience yield. In Column (4), we report the difference between Column (3) and Column (2) to isolate the effect of losing the convenience yield from the effect of imposing tariffs.

Panel (a): Baseline Elasticity Calibration $\eta = \eta^* = 1/3$				
	(1) Baseline	(2) Tariff	(3) Convenience Loss	(4) Diff (3) − (2)
Log Dollar FX (%)	8.81	11.26	0.00	-11.26
Conv Yield Govt (%)	2.00	2.02	1.15	-0.87
Conv Yield Private (%)	2.00	2.02	1.29	-0.73
Seigniorage/GDP (%)	1.05	1.06	0.00	-1.06
Govt Debt Held Abroad/GDP (%)	36.64	36.64	0.00	-36.64
Private Debt Held Abroad/GDP (%)	15.42	15.42	0.00	-15.42
Foreign Debt Held by US/GDP (%)	56.85	58.27	0.00	-56.85
Govt Dollar Interest Rate (%)	0.53	0.51	1.38	0.87
Private Dollar Interest Rate (%)	0.53	0.51	1.24	0.73
Trade Balance/GDP (%)	-1.05	-1.06	0.00	1.06
Import/GDP (%)	5.44	4.51	4.21	-0.31
Export/GDP (%)	4.39	3.46	4.21	0.75
H Goods Consumed by H (%)	95.61	96.54	95.79	-0.75
F Goods Consumed by F (%)	94.00	94.89	95.79	0.90
NFA/GDP (%)	0.00	0.00	0.00	0.00
Panel (b): Asymmetric Trade Elasticity Calibration $\eta = 2/3, \eta^* = 1/3$				
	Baseline	Tariff	Convenience Loss	Diff (3) − (2)
Log Dollar FX (%)	5.12	12.39	5.37	-7.02
Conv Yield Govt (%)	2.00	2.01	1.14	-0.87
Conv Yield Private (%)	2.00	2.01	1.28	-0.73
Seigniorage/GDP (%)	1.05	1.05	0.00	-1.05
Govt Debt Held Abroad/GDP (%)	36.64	36.64	0.00	-36.64
Private Debt Held Abroad/GDP (%)	15.42	15.42	0.00	-15.42
Foreign Debt Held by US/GDP (%)	54.80	58.92	0.00	-54.80
Govt Dollar Interest Rate (%)	0.53	0.52	1.40	0.87
Private Dollar Interest Rate (%)	0.53	0.52	1.25	0.73
Trade Balance/GDP (%)	-1.05	-1.05	0.00	1.05
Import/GDP (%)	5.44	4.24	3.62	-0.62
Export/GDP (%)	4.39	3.19	3.62	0.43
H Goods Consumed by H (%)	95.61	96.81	96.38	-0.43
F Goods Consumed by F (%)	94.24	95.14	96.16	1.02
NFA/GDP (%)	0.00	0.00	0.00	0.00

Table 4
Steady-State Results with Tariff

Notes: The model is calibrated at the quarterly frequency. The convenience yield and interest rate are annualized. In panel (a), trade elasticity is $\eta = \eta^* = 1/3$ following Itskhoki and Mukhin (2021); in panel (b), we set $\eta = 2/3, \eta^* = 1/3$ to capture the higher import elasticity for foreign goods relative to the export elasticity for U.S. goods.

Panel (a) reports the results with symmetric elasticities, which reflect the same depreciation in the dollar and rise in interest rates as in our baseline case with no tariffs. In the presence of tariffs (Column (2)), while the U.S. bonds enjoy similar magnitudes of convenience yields as in the baseline case, and hence similar seigniorage revenues, the dollar is even stronger. This is because, as tariff makes both countries effectively more closed, more exchange rate adjustment is needed to equilibrate with the same level of trade balance as driven by the U.S. seigniorage revenue.

When we additionally impose the loss of convenience yield on U.S. dollar bonds (Column (3)), the dollar exchange rate reverts to parity. In other words, in the presence of tariffs, the loss of reserve currency status leads to even stronger dollar depreciation in our steady-state calculation. The tariff magnifies the exchange rate response to the loss of reserve currency status, while the effect on interest rates remains similar to the baseline case.

Panel (b) reports the results with asymmetric elasticities. Somewhat surprisingly, the dollar appreciates in this scenario even with the loss of reserve currency status (Column (3)). Interest rates still rise as the U.S. has to absorb the bond sales of foreign investors. The dollar appreciation can be understood as follows. With $\eta > \eta^*$, the model needs a stronger level of the dollar in order to make imports equal to exports in the high-tariff steady state. In particular, when reserve asset demand disappears, the U.S. no longer earns seigniorage from foreigners, so in steady state the trade balance must be zero. With $\eta > \eta^*$, U.S. import demand is more price-sensitive than foreign demand for U.S. goods. Under the tariff scenario, U.S. households must reduce their imports of foreign goods even more. To produce the zero trade balance, the model needs a relative-price tilt: a stronger dollar that (i) makes foreign goods cheaper for U.S. households (raising U.S. imports despite tariffs) and (ii) makes U.S. goods more expensive for foreigners (reducing exports).

This comparison underlines that the asset price movements in April and May of 2025 were unlikely due to the direct impact of the tariffs and more likely due to the impact that the liberation day announcements have had on the erosion of safe asset status of dollar assets.

2.7 Endogenous Output

Last, in Appendix B, we consider a variant of the model with production and household labor supply decision. These ingredients are modeled in a standard fashion. We calibrate the model also using conventional parameters. The extension asks which of our results are sensitive to the fixed output model we have considered. We find that with endogenous output, the loss of reserve currency status delivers a similar magnitude loss in seigniorage revenue and a rise in U.S. interest rates. However, the dollar depreciation is smaller — 3.54% vs. 8.81% — in the model with production.

To understand this difference, note that the loss in the seigniorage revenue in the U.S. leads to a permanent wealth effect: as the U.S. household's wealth declines, the U.S. allocates less resources to not only consumption but also investment and productive capital. As a result, output in the U.S. also declines when we explicitly model the production process, whereas output is held constant in the baseline model without production. Then, the loss of reserve currency status drives a combination of a demand shock (U.S. having lower wealth) and a supply shock (U.S. producing fewer home goods). The latter effect reduces the supply of home goods, which partially mitigates the depreciation of the dollar real exchange rate needed to clear the goods market.

3 Conclusion

The dollar depreciated in April 2025 while interest rates in the U.S. rose relative to Euro, and the convenience yield on 1-year Treasurys fell relative to foreign currency safe assets. The decline in the dollar convenience yield predates the April 2025 shock by two years and is accompanied by a shift away from foreign holdings of public dollar safe assets. Our theoretical analysis clarifies that these moves are consistent with shifts in demand for U.S. dollar safe assets and the perception that the U.S. may lose its reserve currency status. Our calibrated model offers guidance on how much a loss of reserve demand for dollar assets will impact interest rates and the real value of the dollar.

Our analysis also sheds light on the magnitude of the exorbitant privilege the U.S. has enjoyed over the past several decades. We find that the real exchange rate has been appreciated by only about 8.8% due to the position of the U.S. On the other hand, steady-state interest rates have been lower by about 90 basis points. The loss of reserve currency status would reverse these effects and lead to a wealth loss to the U.S. of $33 trillion.

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Appendix

A Model Derivations

A.1 Decisions

Within-period Consumption Choice. Given the amount of final consumption goods, home households choose intermediate good composition to minimize the cost, i.e.,

$$\min_{c_{H,t},c_{F,t}} p_t c_{H,t} + p_t^* \exp(-x_t)(1+\nu_t)c_{F,t},$$

s.t.

$$c_t = \left[\alpha^{1-\eta} c_{H,t}^{\eta} + (1-\alpha)^{1-\eta} c_{F,t}^{\eta}\right]^{1/\eta} \tag{A.1.1}$$

The Lagrangian is

$$\mathcal{L} = -p_t c_{H,t} - p_t^* \exp(-x_t)(1+\nu_t)c_{F,t} + \zeta[\left[\alpha^{1-\eta} c_{H,t}^{\eta} + (1-\alpha)^{1-\eta} c_{F,t}^{\eta}\right]^{1/\eta} - c_t],$$

which implies the first order condition

$$\begin{aligned} -p_t + \zeta c_t^{1-\eta} \alpha^{1-\eta} c_{H,t}^{\eta-1} &= 0, \\ -p_t^* \exp(-x_t)(1+\nu_t) + \zeta c_t^{1-\eta} (1-\alpha)^{1-\eta} c_{F,t}^{\eta-1} &= 0. \end{aligned}$$

To pin down the lagrangian multiplier, note that the FOCs can be restated as

$$c_{H,t} = p_t^{1/(\eta-1)} \zeta^{1/(1-\eta)} \alpha c_t \tag{A.1.2}$$

$$c_{F,t} = (p_t^* \exp(-x_t)(1+\nu_t))^{1/(\eta-1)} \zeta^{1/(1-\eta)} (1-\alpha) c_t \tag{A.1.3}$$

i.e.,

$$\frac{c_{H,t}}{c_{F,t}} = \frac{\alpha}{1-\alpha}\left(\frac{p_t}{p_t^* \exp(-x_t)(1+\nu_t)}\right)^{1/(\eta-1)}.$$

Hence,

$$\begin{aligned}\frac{p_t c_{H,t}}{p_t^* \exp(-x_t)(1+\nu_t) c_{F,t}} &= \frac{\alpha}{1-\alpha}\left(\frac{p_t}{p_t^* \exp(-x_t)(1+\nu_t)}\right)^{\eta/(\eta-1)} \\ &= \frac{\alpha^{1-\eta}}{(1-\alpha)^{1-\eta}}\left(\frac{c_{H,t}}{c_{F,t}}\right)^{\eta} \qquad \text{(A.1.4)}\end{aligned}$$

Substituting equation (A.1.2),(A.1.3) into (A.1.1) yield

$$c_t = \left[\alpha^{1-\eta}(p_t^{1/(\eta-1)}\zeta^{1/(1-\eta)}\alpha c_t)^{\eta} + (1-\alpha)^{1-\eta}\left((p_t^* \exp(-x_t)(1+\nu_t))^{1/(\eta-1)}\zeta^{1/(1-\eta)}(1-\alpha)c_t\right)^{\eta}\right]^{1/\eta}$$

Further simplification gives

$$\zeta^{1/(1-\eta)} = \left[\alpha p_t^{\eta/(\eta-1)} + (1-\alpha)\left(p_t^* \exp(-x_t)(1+\nu_t)\right)^{\eta/(\eta-1)}\right]^{-1/\eta}$$

Substituting back into equation (A.1.2), (A.1.3)

$$\begin{aligned}c_{H,t} &= \frac{\alpha p_t^{1/(\eta-1)}}{\left[\alpha p_t^{\eta/(\eta-1)} + (1-\alpha)\left(p_t^* \exp(-x_t)(1+\nu_t)\right)^{\eta/(\eta-1)}\right]^{1/\eta}} c_t, \\ c_{F,t} &= \frac{(1-\alpha)\left(p_t^* \exp(-x_t)(1+\nu_t)\right)^{1/(\eta-1)}}{\left[\alpha p_t^{\eta/(\eta-1)} + (1-\alpha)\left(p_t^* \exp(-x_t)(1+\nu_t)\right)^{\eta/(\eta-1)}\right]^{1/\eta}} c_t\end{aligned}$$

Then we have

$$p_t c_{H,t} + p_t^* \exp(-x_t)(1+\nu_t) c_{F,t} = c_t,$$

which implies

$$\begin{aligned} p_t &= \alpha^{1-\eta} c_{H,t}^{\eta-1} \left[\alpha^{1-\eta} c_{H,t}^{\eta} + (1-\alpha)^{1-\eta} c_{F,t}^{\eta}\right]^{(1-\eta)/\eta}, \\ p_t^* \exp(-x_t)(1+\nu_t) &= (1-\alpha)^{1-\eta} c_{F,t}^{\eta-1} \left[\alpha^{1-\eta} c_{H,t}^{\eta} + (1-\alpha)^{1-\eta} c_{F,t}^{\eta}\right]^{(1-\eta)/\eta} \end{aligned}$$

Simplifying this expression yields

$$\begin{aligned} p_t &= \alpha^{1-\eta} \left[\frac{\alpha^{1-\eta} c_{H,t}^{\eta} + (1-\alpha)^{1-\eta} c_{F,t}^{\eta}}{c_{H,t}^{\eta}}\right]^{(1-\eta)/\eta} \\ p_t^* \exp(-x_t)(1+\nu_t) &= (1-\alpha)^{1-\eta} \left[\frac{\alpha^{1-\eta} c_{H,t}^{\eta} + (1-\alpha)^{1-\eta} c_{F,t}^{\eta}}{c_{F,t}^{\eta}}\right]^{(1-\eta)/\eta} \end{aligned}$$

Likewise, we can derive similar expressions for the foreign ones:

$$\begin{aligned} p_t^* &= (\alpha^*)^{1-\eta^*} \left[\frac{(\alpha^*)^{1-\eta^*} {c_{F,t}^*}^{\eta^*} + (1-\alpha^*)^{1-\eta^*} {c_{H,t}^*}^{\eta^*}}{{c_{F,t}^*}^{\eta^*}}\right]^{(1-\eta^*)/\eta^*} \\ p_t \exp(x_t)(1+\nu_t^*) &= (1-\alpha^*)^{1-\eta^*} \left[\frac{(\alpha^*)^{1-\eta^*} {c_{F,t}^*}^{\eta^*} + (1-\alpha^*)^{1-\eta^*} {c_{H,t}^*}^{\eta^*}}{{c_{H,t}^*}^{\eta^*}}\right]^{(1-\eta^*)/\eta^*} \end{aligned}$$

Intertemporal Solution Households' intertemporal budget constraint is

$$p_t y_t + D_{H,t} + \exp(r^b_{t-1}) b_{H,t-1} + \exp(r^d_{t-1}) d_{H,t-1} + \exp(r^*_{t-1} - x_t) b_{F,t-1} + g_t =$$
$$p_t c_{H,t} + p^*_t \exp(-x_t)(1+\nu_t) c_{F,t} + \exp(r^d_{t-1}) D_{H,t-1} + (b_{H,t} + d_{H,t}) + \exp(-x_t) b_{F,t}.$$

The Lagrangian is

$$\mathbb{E}_0 \Bigg[\sum_{t=0}^{\infty} \delta^t u \left(c_t + \frac{1}{1-\sigma} \omega_H (\kappa b^\rho_{H,t} + d^\rho_{H,t})^{\frac{1-\sigma}{\rho}} \right)$$
$$+ \sum_{t=1}^{\infty} \zeta_t (p_t y_t + D_{H,t} + \exp(r^b_{t-1}) b_{H,t-1} + \exp(r^d_{t-1}) d_{H,t-1} + \exp(r^*_{t-1} - x_t) b_{F,t-1} + g_t$$
$$- p_t c_{H,t} - p^*_t \exp(-x_t)(1+\nu_t) c_{F,t} - \exp(r^d_{t-1}) D_{H,t-1} - (b_{H,t} + d_{H,t}) - \exp(-x_t) b_{F,t}) \Bigg].$$

Let $C_t \equiv c_t + \frac{1}{1-\sigma} \omega_H (\kappa b^\rho_{H,t} + d^\rho_{H,t})^{\frac{1-\sigma}{\rho}}$.
The first-order conditions w.r.t. c_t, $b_{H,t}$, $d_{H,t}$ and $b_{F,t}$ are:

$$\delta^t u'(C_t) - \zeta_t = 0,$$
$$\mathbb{E}_t \left[\delta^t u'(C_t) \omega_H (\kappa b^\rho_{H,t} + d^\rho_{H,t})^{\frac{1-\sigma}{\rho} - 1} \kappa b^{\rho-1}_{H,t} - \zeta_t + \exp(r^b_t) \zeta_{t+1} \right] = 0,$$
$$\mathbb{E}_t \left[\delta^t u'(C_t) \omega_H (\kappa b^\rho_{H,t} + d^\rho_{H,t})^{\frac{1-\sigma}{\rho} - 1} d^{\rho-1}_{H,t} - \zeta_t + \exp(r^d_t) \zeta_{t+1} \right] = 0,$$
$$\mathbb{E}_t \left[- \exp(-x_t) \zeta_t + \exp(r^*_t - x_{t+1}) \zeta_{t+1} \right] = 0,$$

which give the implied Euler Equation:

$$1 - \omega_H (\kappa b^\rho_{H,t} + d^\rho_{H,t})^{\frac{1-\sigma}{\rho} - 1} d^{\rho-1}_{H,t} = \mathbb{E}_t \left[\delta \frac{u'(C_{t+1})}{u'(C_t)} \exp(r^d_t) \right],$$
$$1 - \omega_H (\kappa b^\rho_{H,t} + d^\rho_{H,t})^{\frac{1-\sigma}{\rho} - 1} \kappa b^{\rho-1}_{H,t} = \mathbb{E}_t \left[\delta \frac{u'(C_{t+1})}{u'(C_t)} \exp(r^b_t) \right],$$
$$1 = \mathbb{E}_t \left[\delta \frac{u'(C_{t+1})}{u'(C_t)} \exp(-\Delta x_{t+1} + r^*_t) \right],$$

Similarly, the foreign household's Lagrangian is defined as

$$\mathbb{E}_0\left[\sum_{t=0}^{\infty}\delta^t u\left(c_t^* + \frac{1}{1-\sigma}\omega_H^* \exp(x_t)(\kappa^*(b_{H,t}^*)^\rho + (d_{H,t}^*)^\rho)^{\frac{1-\sigma}{\rho}}\right)\right.$$
$$+\sum_{t=1}^{\infty}\zeta_t^*(p_t^* y_t^* + \exp(r_{t-1}^b + x_t)b_{H,t-1}^* + \exp(r_{t-1}^d + x_t)d_{H,t-1}^* + \exp(r_{t-1}^*)b_{F,t-1}^* + g_t^*$$
$$\left. - p_t^* c_{F,t}^* - p_t \exp(x_t)(1+\nu_t^*)c_{H,t}^* - \exp(x_t)(b_{H,t}^* + d_{H,t}^*) - b_{F,t}^*)\right].$$

Define $C_t^* \equiv c_t^* + \frac{1}{1-\sigma}\omega_H^* \exp(x_t)(\kappa^*(b_{H,t}^*)^\rho + (d_{H,t}^*)^\rho)^{\frac{1-\sigma}{\rho}}$. Then, we have

$$1 - \omega_H^*(\kappa^*(b_{H,t}^*)^\rho + (d_{H,t}^*)^\rho)^{\frac{1-\sigma}{\rho}-1}(d_{H,t}^*)^{\rho-1} = \mathbb{E}_t\left[\delta\frac{u'(C_{t+1}^*)}{u'(C_t^*)}\exp(\Delta x_{t+1} + r_t^d)\right]$$
$$1 - \omega_H^*(\kappa^*(b_{H,t}^*)^\rho + (d_{H,t}^*)^\rho)^{\frac{1-\sigma}{\rho}-1}\kappa^*(b_{H,t}^*)^{\rho-1} = \mathbb{E}_t\left[\delta\frac{u'(C_{t+1}^*)}{u'(C_t^*)}\exp(\Delta x_{t+1} + r_t^b)\right],$$
$$1 = \mathbb{E}_t\left[\delta\frac{u'(C_{t+1}^*)}{u'(C_t^*)}\exp(r_t^*)\right].$$

A.2 Macro Synthesis

There are 18 endogenous variables in each period t:

$$(c_t, c_{H,t}, c_{F,t}, b_{H,t}, d_{H,t}, b_{F,t}, p_t, c_t^*, c_{H,t}^*, c_{F,t}^*, b_{H,t}^*, d_{H,t}^*, b_{F,t}^*, p_t^*, r_t^b, r_t^d, r_t^*, x_t)_{t=0}^{\infty}.$$

The model implies the following 19 equations in each period, one of which is redundant. These 19 equations include 2 consumption aggregation equations,

$$c_t = \left[\alpha^{1-\eta}c_{H,t}^\eta + (1-\alpha)^{1-\eta}c_{F,t}^\eta\right]^{1/\eta},$$
$$c_t^* = \left[(\alpha^*)^{1-\eta^*}(c_{F,t}^*)^{\eta^*} + (1-\alpha^*)^{1-\eta^*}(c_{H,t}^*)^{\eta^*}\right]^{1/\eta^*},$$

2 household budget conditions are

$$p_t y_t + D_{H,t} + \exp(r_{t-1}^b)b_{H,t-1} + \exp(r_{t-1}^d)d_{H,t-1} + \exp(r_{t-1}^* - x_t)b_{F,t-1} + g_t =$$
$$p_t c_{H,t} + p_t^* \exp(-x_t)(1+\nu_t)c_{F,t} + \exp(r_{t-1}^d)D_{H,t-1} + (b_{H,t} + d_{H,t}) + \exp(-x_t)b_{F,t},$$

$$p_t^* y_t^* + \exp(r_{t-1}^b + x_t) b_{H,t-1}^* + \exp(r_{t-1}^d + x_t) d_{H,t-1}^* + \exp(r_{t-1}^*) b_{F,t-1}^* + g_t^* =$$
$$p_t^* c_{F,t}^* + p_t \exp(x_t)(1+\nu_t^*) c_{H,t}^* + \exp(x_t)(b_{H,t}^* + d_{H,t}^*) + b_{F,t}^*,$$

2 goods market clearing conditions

$$c_{H,t} + c_{H,t}^* = y_t,$$
$$c_{F,t} + c_{F,t}^* = y_t^*,$$

3 bond market clearing conditions

$$B_{H,t} = b_{H,t} + b_{H,t}^*,$$
$$D_{H,t} = d_{H,t} + d_{H,t}^*,$$
$$0 = b_{F,t} + b_{F,t}^*,$$

4 within-period consumption choices

$$\left[\alpha^{1-\eta} c_{H,t}^{\eta} + (1-\alpha)^{1-\eta} c_{F,t}^{\eta}\right]^{1/\eta - 1} \alpha^{1-\eta} c_{H,t}^{\eta-1} = p_t,$$
$$\left[\alpha^{1-\eta} c_{H,t}^{\eta} + (1-\alpha)^{1-\eta} c_{F,t}^{\eta}\right]^{1/\eta - 1} (1-\alpha)^{1-\eta} c_{F,t}^{\eta-1} = p_t^* \exp(-x_t)(1+\nu_t),$$
$$\left[(\alpha^*)^{1-\eta^*} (c_{F,t}^*)^{\eta} + (1-\alpha^*)^{1-\eta^*} (c_{H,t}^*)^{\eta^*}\right]^{1/\eta^* - 1} (\alpha^*)^{1-\eta^*} (c_{F,t}^*)^{\eta^*-1} = p_t^*,$$
$$\left[(\alpha^*)^{1-\eta^*} (c_{F,t}^*)^{\eta^*} + (1-\alpha^*)^{1-\eta^*} (c_{H,t}^*)^{\eta^*}\right]^{1/\eta^* - 1} (1-\alpha^*)^{1-\eta^*} (c_{H,t}^*)^{\eta^*-1} = p_t \exp(x_t)(1+\nu_t^*),$$

and 6 Euler equations

$$\begin{aligned}
1 - \omega_H(\kappa b_{H,t}^{\rho} + d_{H,t}^{\rho})^{\frac{1-\sigma}{\rho}-1} d_{H,t}^{\rho-1} &= \mathbb{E}_t\left[\delta \frac{u'(C_{t+1})}{u'(C_t)} \exp(r_t^d)\right], \\
1 - \omega_H(\kappa b_{H,t}^{\rho} + d_{H,t}^{\rho})^{\frac{1-\sigma}{\rho}-1} \kappa b_{H,t}^{\rho-1} &= \mathbb{E}_t\left[\delta \frac{u'(C_{t+1})}{u'(C_t)} \exp(r_t^b)\right], \\
1 &= \mathbb{E}_t\left[\delta \frac{u'(C_{t+1})}{u'(C_t)} \exp(-\Delta x_{t+1} + r_t^*)\right], \\
1 - \omega_H^*(\kappa^*(b_{H,t}^*)^{\rho} + (d_{H,t}^*)^{\rho})^{\frac{1-\sigma}{\rho}-1} (d_{H,t}^*)^{\rho-1} &= \mathbb{E}_t\left[\delta \frac{u'(C_{t+1}^*)}{u'(C_t^*)} \exp(\Delta x_{t+1} + r_t^d)\right], \\
1 - \omega_H^*(\kappa^*(b_{H,t}^*)^{\rho} + (d_{H,t}^*)^{\rho})^{\frac{1-\sigma}{\rho}-1} \kappa^*(b_{H,t}^*)^{\rho-1} &= \mathbb{E}_t\left[\delta \frac{u'(C_{t+1}^*)}{u'(C_t^*)} \exp(\Delta x_{t+1} + r_t^b)\right], \\
1 &= \mathbb{E}_t\left[\delta \frac{u'(C_{t+1}^*)}{u'(C_t^*)} \exp(r_t^*)\right].
\end{aligned}$$

The households' optimal consumption choices also imply

$$p_t c_{H,t} + p_t^* \exp(-x_t)(1 + \nu_t) c_{F,t} = c_t,$$

a useful identity that will be used in the analysis.

A.3 Additional Results: Koijen and Yogo (2020) Calibration

In this section, we calibrate the bond demand elasticity based on Koijen and Yogo (2020)'s empirical estimate, which requires a higher curvature parameter σ. Specifically, Koijen and Yogo (2020) report a mean demand elasticity of 3.2 for long-term bonds. Assuming an average duration of 5 years, this implies that a 1% log change in debt quantity is associated with $100/(5 \times 3.2) = 6.25$ basis point change in bond convenience yield. Moreover, Koijen and Yogo (2020) report a convenience yield estimate of 1.47% for the U.S. dollar. To match these moments, the bond curvature parameter is set to $\sigma = 4.38$, reflecting a more inelastic demand curve.

The results are in Tables A.1, A.2 and A.3. The calibration with the Koijen and Yogo (2020) estimates looks broadly similar. Because we adopt a lower steady-state value of the convenience yield in the steady-state, the effects of losing reserve currency status on the seigniorage revenue and the dollar exchange rate are smaller. However, because the bond curvature parameter is higher, the interest rate effects are significantly larger.

Panel (a): Baseline Elasticity Calibration $\eta = \eta^* = 1/3$			
	(1) Baseline	(2) Convenience Loss	(3) Difference
Log Dollar FX (%)	6.48	0.00	-6.48
Conv Yield Govt (%)	1.47	0.39	-1.08
Conv Yield Private (%)	1.47	0.44	-1.03
Seigniorage/GDP (%)	0.77	0.00	-0.77
Govt Debt Held Abroad/GDP (%)	36.64	0.00	-36.64
Private Debt Held Abroad/GDP (%)	15.42	0.00	-15.42
Foreign Debt Held by US/GDP (%)	55.55	0.00	-55.55
Govt Dollar Interest Rate (%)	1.06	2.14	1.08
Private Dollar Interest Rate (%)	1.06	2.09	1.03
Trade Balance/GDP (%)	-0.77	0.00	0.77
Import/GDP (%)	5.30	5.08	-0.22
Export/GDP (%)	4.53	5.08	0.55
H Goods Consumed by H (%)	95.47	94.92	-0.55
F Goods Consumed by F (%)	94.30	94.92	0.61
NFA/GDP (%)	0.00	0.00	0.00

Panel (b): Asymmetric Trade Elasticity Calibration $\eta = 2/3, \eta^* = 1/3$			
	Baseline	Convenience Loss	Difference
Log Dollar FX (%)	3.76	0.00	-3.76
Conv Yield Govt (%)	1.47	0.39	-1.08
Conv Yield Private (%)	1.47	0.44	-1.03
Seigniorage/GDP (%)	0.77	0.00	-0.77
Govt Debt Held Abroad/GDP (%)	36.64	0.00	-36.64
Private Debt Held Abroad/GDP (%)	15.42	0.00	-15.42
Foreign Debt Held by US/GDP (%)	54.06	0.00	-54.06
Govt Dollar Interest Rate (%)	1.06	2.14	1.08
Private Dollar Interest Rate (%)	1.06	2.09	1.03
Trade Balance/GDP (%)	-0.77	0.00	0.77
Import/GDP (%)	5.30	4.86	-0.44
Export/GDP (%)	4.53	4.86	0.33
H Goods Consumed by H (%)	95.47	95.14	-0.33
F Goods Consumed by F (%)	94.47	95.14	0.67
NFA/GDP (%)	0.00	0.00	0.00

TABLE A.1
STEADY-STATE RESULTS WITH FULL CONVENIENCE LOSS

Notes: The model is calibrated at the quarterly frequency. The convenience yield and interest rate are annualized. In panel (a), trade elasticity is $\eta = \eta^* = 1/3$ following Itskhoki and Mukhin (2021); in panel (b), we set $\eta = 2/3, \eta^* = 1/3$ to capture the higher import elasticity for foreign goods relative to the export elasticity for U.S. goods.

Panel (a): Baseline Elasticity Calibration $\eta = \eta^* = 1/3$				
	(1) Baseline	(2) Debt Expansion	(3) ω_H^* Reduction	(4) κ^* Reduction
Log Dollar FX (%)	6.48	2.67	1.53	2.30
Conv Yield Govt (%)	1.47	0.45	0.33	0.41
Conv Yield Private (%)	1.47	0.55	0.41	0.52
Seigniorage/GDP (%)	0.77	0.32	0.19	0.28
Govt Debt Held Abroad/GDP (%)	36.64	54.68	43.42	42.70
Private Debt Held Abroad/GDP (%)	15.42	13.43	9.93	19.90
Foreign Debt Held by US/GDP (%)	55.55	69.95	54.18	64.06
Govt Dollar Interest Rate (%)	1.06	2.08	2.20	2.13
Private Dollar Interest Rate (%)	1.06	1.98	2.12	2.01
Trade Balance/GDP (%)	-0.77	-0.32	-0.19	-0.28
Import/GDP (%)	5.30	5.17	5.14	5.16
Export/GDP (%)	4.53	4.85	4.95	4.88
H Goods Consumed by H (%)	95.47	95.15	95.05	95.12
F Goods Consumed by F (%)	94.30	94.67	94.78	94.71
NFA/GDP (%)	0.00	0.00	0.00	0.00
Panel (b): Asymmetric Trade Elasticity Calibration $\eta = 2/3, \eta^* = 1/3$				
	Baseline	Debt Expansion	ω_H^* Reduction	κ^* Reduction
Log Dollar FX (%)	3.76	1.59	0.92	1.37
Conv Yield Govt (%)	1.47	0.45	0.33	0.40
Conv Yield Private (%)	1.47	0.54	0.41	0.52
Seigniorage/GDP (%)	0.77	0.32	0.19	0.28
Govt Debt Held Abroad/GDP (%)	36.64	54.68	43.42	42.70
Private Debt Held Abroad/GDP (%)	15.42	13.43	9.93	19.90
Foreign Debt Held by US/GDP (%)	54.06	69.20	53.84	63.46
Govt Dollar Interest Rate (%)	1.06	2.08	2.20	2.13
Private Dollar Interest Rate (%)	1.06	1.99	2.12	2.01
Trade Balance/GDP (%)	-0.77	-0.32	-0.19	-0.28
Import/GDP (%)	5.30	5.04	4.96	5.02
Export/GDP (%)	4.53	4.72	4.78	4.74
H Goods Consumed by H (%)	95.47	95.28	95.22	95.26
F Goods Consumed by F (%)	94.47	94.87	94.99	94.91
NFA/GDP (%)	0.00	0.00	0.00	0.00

Table A.2
Steady-State Results with Debt Expansion and Asymmetric Public and Private Flows

Notes: The model is calibrated at the quarterly frequency. The convenience yield and interest rate are annualized. In panel (a), trade elasticity is $\eta = \eta^* = 1/3$ following Itskhoki and Mukhin (2021); in panel (b), we set $\eta = 2/3, \eta^* = 1/3$ to capture the higher import elasticity for foreign goods relative to the export elasticity for U.S. goods.

Panel (a): Baseline Elasticity Calibration $\eta = \eta^* = 1/3$				
	(1) Baseline	(2) Tariff	(3) Convenience Loss	(4) Diff (3) − (2)
Log Dollar FX (%)	6.48	8.40	0.00	-8.40
Conv Yield Govt (%)	1.47	1.51	0.41	-1.10
Conv Yield Private (%)	1.47	1.51	0.46	-1.05
Seigniorage/GDP (%)	0.77	0.79	0.00	-0.79
Govt Debt Held Abroad/GDP (%)	36.64	36.64	0.00	-36.64
Private Debt Held Abroad/GDP (%)	15.42	15.42	0.00	-15.42
Foreign Debt Held by US/GDP (%)	55.55	56.62	0.00	-55.55
Govt Dollar Interest Rate (%)	1.06	1.02	2.13	1.10
Private Dollar Interest Rate (%)	1.06	1.02	2.07	1.05
Trade Balance/GDP (%)	-0.77	-0.79	0.00	0.79
Import/GDP (%)	5.30	4.39	4.16	-0.22
Export/GDP (%)	4.53	3.60	4.16	0.57
H Goods Consumed by H (%)	95.47	96.40	95.84	-0.57
F Goods Consumed by F (%)	94.30	95.19	95.84	0.65
NFA/GDP (%)	0.00	0.00	0.00	0.00

Panel (b): Asymmetric Trade Elasticity Calibration $\eta = 2/3, \eta^* = 1/3$				
	Baseline	Tariff	Convenience Loss	Diff (3) − (2)
Log Dollar FX (%)	3.76	10.58	5.36	-5.21
Conv Yield Govt (%)	1.47	1.49	0.40	-1.09
Conv Yield Private (%)	1.47	1.49	0.45	-1.04
Seigniorage/GDP (%)	0.77	0.78	0.00	-0.78
Govt Debt Held Abroad/GDP (%)	36.64	36.64	0.00	-36.64
Private Debt Held Abroad/GDP (%)	15.42	15.42	0.00	-15.42
Foreign Debt Held by US/GDP (%)	54.06	57.87	0.00	-54.06
Govt Dollar Interest Rate (%)	1.06	1.04	2.13	1.09
Private Dollar Interest Rate (%)	1.06	1.04	2.08	1.04
Trade Balance/GDP (%)	-0.77	-0.78	0.00	0.78
Import/GDP (%)	5.30	4.10	3.64	-0.45
Export/GDP (%)	4.53	3.32	3.64	0.32
H Goods Consumed by H (%)	95.47	96.68	96.36	-0.32
F Goods Consumed by F (%)	94.47	95.40	96.13	0.74
NFA/GDP (%)	0.00	0.00	0.00	0.00

TABLE A.3
STEADY-STATE RESULTS WITH TARIFF

Notes: The model is calibrated at the quarterly frequency. The convenience yield and interest rate are annualized. In panel (a), trade elasticity is $\eta = \eta^* = 1/3$ following Itskhoki and Mukhin (2021); in panel (b), we set $\eta = 2/3, \eta^* = 1/3$ to capture the higher import elasticity for foreign goods relative to the export elasticity for U.S. goods.

B Model with Production

We follow the production specification in Itskhoki and Mukhin (2021), in which both countries accumulate capital and use capital, labor, and intermediate input to produce final goods. These final goods are then allocated to consumption, investment, and intermediate use. The model abstracts from price stickiness, as it is not central to its exchange rate determination mechanism, and from tariffs used in our baseline specification to simplify the analysis. We assume that households have preferences over consumption and leisure according to Greenwood et al. (1988), which mutes the labor supply response to declines in seigniorage revenue and consumption.

We continue to assume that both home and foreign households can invest in domestic and foreign bonds, while deriving additional non-pecuniary benefits from holding the home bonds. This assumption implies that bond investment is characterized by the same set of Euler equations as in our baseline model without production.

Specifically, home households' expected lifetime utility is

$$\mathbb{E}_0 \left[\sum_{t=0}^{\infty} \delta^t \frac{1}{1-\gamma} \left(C_t \right)^{1-\gamma} \right],$$

where

$$C_t = c_t - \frac{1}{1+1/\xi} \ell_t^{1+1/\xi} + \frac{1}{1-\sigma} \omega_H \left(\kappa b_{H,t}^{\rho} + d_{H,t}^{\rho} \right)^{\frac{1-\sigma}{\rho}},$$

and

$$c_t = \left[\alpha^{1-\eta} c_{H,t}^{\eta} + (1-\alpha)^{1-\eta} c_{F,t}^{\eta} \right]^{1/\eta}.$$

B.1 Equilibrium Conditions

The exogenous variables are the productivity shocks and bond endowments:

$$(a_t, a_t^*, B_{H,t}, D_{H,t})_{t=0}^{\infty}.$$

The model contains 32 endogenous variables in each period t:

$$
\begin{aligned}
&(y_t, y_{H,t}, y_{F,t}, c_t, k_t, z_t, v_t, \ell_t, b_{H,t}, d_{H,t}, b_{F,t}, q_t, w_t, p_t,\\
&y_t^*, y_{H,t}^*, y_{F,t}^*, c_t^*, k_t^*, z_t^*, v_t^*, \ell_t^*, b_{H,t}^*, d_{H,t}^*, b_{F,t}^*, q_t^*, w_t^*, p_t^*,\\
&r_t^b, r_t^d, r_t^*, x_t)_{t=0}^{\infty},
\end{aligned}
$$

where v denotes the intermediate input used for final goods production.

The model implies the following system of equations in each period, one of which is redundant because the market clearing adds up to the sum of households' budget constraints. These 33 equations include two consumption aggregation equations,

$$
\begin{aligned}
c_t + z_t + v_t &= \left[\alpha^{1-\eta} y_{H,t}^{\eta} + (1-\alpha)^{1-\eta} y_{F,t}^{\eta}\right]^{1/\eta},\\
c_t^* + z_t^* + v_t^* &= \left[\alpha^{1-\eta} (y_{F,t}^*)^{\eta} + (1-\alpha)^{1-\eta} (y_{H,t}^*)^{\eta}\right]^{1/\eta},
\end{aligned}
$$

two goods market clearing conditions,

$$
\begin{aligned}
y_t &= y_{H,t} + y_{H,t}^*,\\
y_t^* &= y_{F,t} + y_{F,t}^*,
\end{aligned}
$$

six optimality conditions for within-period consumption and labor choices,

$$
\begin{aligned}
\left[\alpha^{1-\eta} y_{H,t}^{\eta} + (1-\alpha)^{1-\eta} y_{F,t}^{\eta}\right]^{1/\eta-1} \alpha^{1-\eta} y_{H,t}^{\eta-1} &= p_t,\\
\left[\alpha^{1-\eta} y_{H,t}^{\eta} + (1-\alpha)^{1-\eta} y_{F,t}^{\eta}\right]^{1/\eta-1} (1-\alpha)^{1-\eta} y_{F,t}^{\eta-1} &= p_t^* \exp(-x_t),\\
\ell_t^{1/\xi} &= w_t,\\
\left[\alpha^{1-\eta} (y_{F,t}^*)^{\eta} + (1-\alpha)^{1-\eta} (y_{H,t}^*)^{\eta}\right]^{1/\eta-1} \alpha^{1-\eta} (y_{F,t}^*)^{\eta-1} &= p_t^*,\\
\left[\alpha^{1-\eta} (y_{F,t}^*)^{\eta} + (1-\alpha)^{1-\eta} (y_{H,t}^*)^{\eta}\right]^{1/\eta-1} (1-\alpha)^{1-\eta} (y_{H,t}^*)^{\eta-1} &= p_t \exp(x_t),\\
(\ell_t^*)^{1/\xi} &= w_t^*,
\end{aligned}
$$

eight equations that govern firm production and factor prices,

$$
\begin{aligned}
y_t &= (\exp(a_t) k_t^{\vartheta} \ell_t^{(1-\vartheta)})^{1-\phi} v_t^{\phi}, \\
\ell_t w_t &= p_t (1-\vartheta)(1-\phi) y_t, \\
k_t q_t &= p_t \vartheta (1-\phi) y_t, \\
v_t &= p_t \phi y_t, \\
y_t^* &= (\exp(a_t^*)(k_t^*)^{\vartheta} (\ell_t^*)^{(1-\vartheta)})^{1-\phi} (v_t^*)^{\phi}, \\
\ell_t^* w_t^* &= p_t^* (1-\vartheta)(1-\phi) y_t^*, \\
k_t^* q_t^* &= p_t^* \vartheta (1-\phi) y_t^*, \\
v_t^* &= p_t^* \phi y_t^*,
\end{aligned}
$$

for equations that govern capital accumulation,

$$
\begin{aligned}
z_t &= k_{t+1} - (1-d) k_t + \frac{\kappa}{2} \frac{(\Delta k_{t+1})^2}{k_t}, \\
1 + \kappa \frac{\Delta k_{t+1}}{k_t} &= \mathbb{E}_t \left[\delta \left(\frac{C_{t+1}}{C_t} \right)^{-\gamma} \left(q_{t+1} + 1 - d + \kappa \frac{\Delta k_{t+2}}{k_{t+1}} + \frac{\kappa}{2} \left(\frac{\Delta k_{t+2}}{k_{t+1}} \right)^2 \right) \right], \\
z_t^* &= k_{t+1}^* - (1-d)^* k_t + \frac{\kappa}{2} \frac{(\Delta k_{t+1}^*)^2}{k_t^*}, \\
1 + \kappa \frac{\Delta k_{t+1}^*}{k_t^*} &= \mathbb{E}_t \left[\delta \left(\frac{C_{t+1}^*}{C_t^*} \right)^{-\gamma} \left(q_{t+1}^* + 1 - d + \kappa \frac{\Delta k_{t+2}^*}{k_{t+1}^*} + \frac{\kappa}{2} \left(\frac{\Delta k_{t+2}^*}{k_{t+1}^*} \right)^2 \right) \right],
\end{aligned}
$$

six Euler equations for households and the intermediary,

$$1-\omega_H(\kappa b_{H,t}^{\rho}+d_{H,t}^{\rho})^{\frac{1-\sigma}{\rho}-1}d_{H,t}^{\rho-1}=\mathbb{E}_t\left[\delta\left(\frac{C_{t+1}}{C_t}\right)^{-\gamma}\exp(r_t^d)\right],$$

$$1-\omega_H(\kappa b_{H,t}^{\rho}+d_{H,t}^{\rho})^{\frac{1-\sigma}{\rho}-1}\kappa b_{H,t}^{\rho-1}=\mathbb{E}_t\left[\delta\left(\frac{C_{t+1}}{C_t}\right)^{-\gamma}\exp(r_t^b)\right],$$

$$1=\mathbb{E}_t\left[\delta\left(\frac{C_{t+1}}{C_t}\right)^{-\gamma}\exp(-\Delta x_{t+1}+r_t^*)\right],$$

$$1-\omega_H^*(\kappa^*(b_{H,t}^*)^{\rho}+(d_{H,t}^*)^{\rho})^{\frac{1-\sigma}{\rho}-1}(d_{H,t}^*)^{\rho-1}=\mathbb{E}_t\left[\delta\left(\frac{C_{t+1}^*}{C_t^*}\right)^{-\gamma}\exp(\Delta x_{t+1}+r_t^d)\right],$$

$$1-\omega_H^*(\kappa^*(b_{H,t}^*)^{\rho}+(d_{H,t}^*)^{\rho})^{\frac{1-\sigma}{\rho}-1}\kappa^*(b_{H,t}^*)^{\rho-1}=\mathbb{E}_t\left[\delta\left(\frac{C_{t+1}^*}{C_t^*}\right)^{-\gamma}\exp(\Delta x_{t+1}+r_t^b)\right],$$

$$1=\mathbb{E}_t\left[\delta\left(\frac{C_{t+1}^*}{C_t^*}\right)^{-\gamma}\exp(r_t^*)\right],$$

two budget constraints for households,

$$\begin{aligned}
&(w_t\ell_t+q_tk_t)+\exp(r_{t-1}^b)b_{H,t-1}+\exp(r_{t-1}^d)d_{H,t-1}+\exp(r_{t-1}^*-x_t)b_{F,t-1}\\
&+B_{H,t}-B_{H,t-1}\exp(r_{t-1}^b)+D_{H,t}-D_{H,t-1}\exp(r_{t-1}^d)\\
&=c_t+z_t+b_{H,t}+d_{H,t}+\exp(-x_t)b_{F,t},\\
&(w_t^*\ell_t^*+q_t^*k_t^*)+\exp(r_{t-1}^b+x_t)b_{H,t-1}^*+\exp(r_{t-1}^d+x_t)d_{H,t-1}^*+\exp(r_{t-1}^*)b_{F,t-1}^*\\
&=c_t^*+z_t^*+\exp(x_t)(b_{H,t}^*+d_{H,t}^*)+b_{F,t}^*,
\end{aligned}$$

and three bond market clearing condition,

$$\begin{aligned}
B_{H,t}&=b_{H,t}+b_{H,t}^*,\\
D_{H,t}&=d_{H,t}+d_{H,t}^*,\\
0&=b_{F,t}+b_{F,t}^*.
\end{aligned}$$

B.2 Calibration

We maintain the parameter values in our baseline calibration. The new parameters are calibrated following Itskhoki and Mukhin (2021): the curvature in labor disutility $\xi = 1$, the share of intermediate input in production function $\phi = 0.5$, the share of capital input in production function $\vartheta = 0.3$, capital depreciation rate $d = 0.02$ on quarterly basis.

B.3 Results

We report the results in Table A.4. The results are qualitatively similar to the model without production. The reduction in the convenience yield and the corresponding increase in the interest rate are comparable to the magnitudes in the model without production. The implied dollar depreciation is smaller (3.54% vs. 8.81%) in the model with production.

To understand this difference, note that the loss in the seigniorage revenue in the U.S. leads to a permanent wealth effect: as the U.S. household's wealth declines, the U.S. allocates less resources to not only consumption but also investment and productive capital. As a result, output in the U.S. also declines when we explicitly model the production process, whereas output is held constant in the baseline model without production.

Tthe loss of reserve currency status drives a combination of a demand shock (U.S. having lower wealth) and a supply shock (U.S. producing fewer home goods). The latter effect creates scarcity in the home goods market, which partially mitigates the depreciation of the dollar real exchange rate needed to restore the equilibrium in the goods market. As a result, when the U.S. loses seigniorage revenue to a similar magnitude as in the fixed output case, but the dollar depreciates by 3.54% in the model with production rather than the 8.81% depreciation in the model without production.

Panel (a): Model with Production			
	(1) Baseline	(2) Convenience Loss	(3) Difference
Log Dollar FX (%)	3.54	0.00	-3.54
Conv Yield Govt (%)	2.00	1.15	-0.85
Conv Yield Private (%)	2.00	1.29	-0.71
Seigniorage/GDP (%)	1.05	0.00	-1.05
Govt Debt Held Abroad/GDP (%)	36.64	0.00	-36.64
Private Debt Held Abroad/GDP (%)	15.42	0.00	-15.42
Foreign Debt Held by US/GDP (%)	53.94	0.00	-53.94
Govt Dollar Interest Rate (%)	0.53	1.39	0.85
Private Dollar Interest Rate (%)	0.53	1.24	0.71
Trade Balance/GDP (%)	-1.05	0.00	1.05
Import/GDP (%)	5.18	5.06	-0.12
Export/GDP (%)	4.66	5.06	0.40
H Goods Consumed by H (%)	95.34	94.94	-0.40
F Goods Consumed by F (%)	94.51	94.94	0.43
NFA/GDP (%)	0.00	0.00	0.00
H Output (%)	100.00	99.06	-0.94
F Output (%)	100.00	100.93	0.93
H Consumption (%)	100.00	97.54	-2.46
F Consumption (%)	100.00	102.61	2.61

Panel (b): Baseline Model without Production			
	Baseline	Convenience Loss	Difference
H Output (%)	100.00	100.00	0.00
F Output (%)	100.00	100.00	0.00
H Consumption (%)	100.00	98.46	-1.54
F Consumption (%)	100.00	101.67	1.67

Table A.4
Steady-State Results with Full Convenience Loss, Production Model

Notes: The model is calibrated at the quarterly frequency. The convenience yield and interest rate are annualized. Trade elasticity is $\eta = \eta^* = 1/3$ following Itskhoki and Mukhin (2021).