International Sanctions and Dollar Dominance *

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Abstract

We propose a simple monetary model to investigate the implications of international financial sanctions for the reserve currency status of the US dollar. We show how the anticipation of financial sanctions can reduce the US dollar convenience yield and the holdings of US dollar reserves. We also evaluate the implications for welfare and show that they are generally detrimental for all countries.

Keywords: Reserve currency, international sanctions, foreign reserves
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1 Introduction

The rise in geopolitical tension triggered by Russia's invasion of Ukraine is altering the landscape of the international monetary system. One emerging question is whether the US dollar will maintain its status as the preeminent reserve currency as international financial sanctions threaten to push foreign countries to rethink how and where they hold their foreign assets.[1] In this paper, we offer a formal framework to evaluate this concern. In particular, we ask, will the deployment of international sanctions contribute to the demise of the dollar? If so, through what mechanism? And what are the welfare implications?

We propose a simple monetary model of a reserve currency with two key ingredients. First, we assume that dollar assets provide a special liquidity value. Second, we assume that there is a cost of issuing safe dollar assets. These two ingredients imply that dollar assets command a premium in equilibrium, in line with the observation that the US obtains an "exorbitant privilege" from its status as reserve currency (Gourinchas and Rey, 2007). In this environment, we study the implications of the anticipation of financial sanctions that reduce a foreign country's return on dollar assets holdings in the event of an international conflict.[2]

Our analysis starts from two frictionless cases, each of which abstracts from one of our key assumptions: either issuing assets is costless for US investors, or there is no special liquidity value from holding dollar assets. We demonstrate that in these two cases, sanctions have no impact on the dollar's exchange rate. We then show that in our model, in expectation of financial sanctions, a foreign country reduces its holdings of dollar reserves. Ultimately, the effects on the dollar exchange rate depend on monetary policy. To the extent that monetary policy is not tightened sufficiently, we show that sanctions weaken the value of the dollar vis-a-vis other currencies. Finally, in terms of welfare, we argue that the reduction of the premia in US dollar assets generates a welfare reduction in the US. However, the overall effect is potentially ambiguous. This is because a depreciation of the dollar also reduces the real cost of existing liabilities, which induces a positive effect on US's welfare.

Literature. We are related to the literature on reserve currencies. A theme in this literature is understanding the foundations and implications of the the hegemony of the US dollar in the global financial system (e.g., Farhi and Maggiori, 2018, Gopinath and Stein, 2021, Bianchi, Bigio and Engel, 2021, Gourinchas, Rey and Govillot, 2020, Kekre and Lenel, 2021, Choi,

[1] See, for example, Eichengreen (2022), Brunnermeier, James and Landau (2022) and 'How the Ukraine war could boost China's global finance ambitions" by Hudson Lockett, *Financial Times*, March 7, 2022. For an overview of the policy discussions, see Weiss (2022).

[2] For example, in the aftermath of the invasion of Ukraine, Russian's holdings of dollar reserves in the US were frozen.

Kirpalani and Perez, 2022, Jiang, Krishnamurthy and Lustig, 2020). A contribution of our paper is to study the role of international sanctions and how they impact the US dollar reserve status. Bahaj and Reis (2022) and Clayton, Dos Santos, Maggiori and Schreger (2022) focus instead on the emergence of a new reserve currency, motivated by the internationalization of the Renminbi.

Our paper is also related to a burgeoning literature on international sanctions, including Lorenzoni and Werning (2022), Itskhoki and Mukhin (2022), Sturm (2022), Bianchi and Sosa-Padilla (2022), and Ghironi, Kim and Ozhan (2023). Unlike these studies, we examine the impact of the anticipation of financial sanctions.

2 Model

We consider a two-period deterministic model. The world economy features two countries of equal measure. We think about one country being the United States, the sanctioning country that has a reserve currency, and the other country being China, the sanctioned country that invests in the reserve currency. There are also residents in the rest of the world, who trade real assets at a rate R^*. The baseline model features a single (tradable) good and assumes the law of one price holds.

We define the nominal exchange rate, e, as yuan per dollar, so a decrease in e indicates a depreciation of the dollar. We denote by P the price of the tradable good in terms of dollars and P^* the price in terms of yuans. The central bank in China is assumed to keep the price level constant and normalized to one (i.e, $P_t^* = 1$). By the law of one price, this implies that $P_t e_t = 1$. We assume that the central bank in the US sets the nominal rate, i, in period $t = 1$ and has an objective for the exchange rate in period $t = 2$ of e_2. We take this objective as given to focus on the determination of e_1.[3]

2.1 Supply of dollar assets

The US is populated by a continuum of agents that issue safe dollar assets, B, with a nominal return i, and trade real assets, k, with a return R^*, in units of consumption. The intermediation is subject to portfolio costs discussed below. We think of agents in the US as a consolidation of households, financial intermediaries, and the government. For simplicity, we refer to them as investors. We assume that investors value consumption only in period $t = 2$. An investor that issues B units of nominal bonds today can invest in $\frac{B}{P_1}$ real assets,

[3]See Section 3.3 for a discussion on this.

and this operation delivers $B\left[\frac{P_2}{P_1}R^* - (1+i)\right]$ dollars tomorrow. In addition, issuing bonds is costly for investors. In particular, we assume that investors face $\frac{\omega}{2}\left(\frac{B}{P_1}\right)^2$ portfolio costs tomorrow, in units of consumption. The investor's problem consists of choosing a portfolio to maximize tomorrow's (real) profits. Let $R \equiv (1+i)\frac{P_1}{P_2}$ and $b \equiv \frac{B}{P_1}$. The problem can be written as

$$\max_b \; b\,(R^* - R) - \frac{\omega}{2}b^2\,.$$

Optimization yields a supply for real dollar assets that is downward-sloping in the return R (and so upward-sloping in the price):

$$b = \frac{1}{\omega}\,(R^* - R)\,. \tag{1}$$

The parameter ω determines the elasticity of the supply of US assets. When $\omega = 0$, this represents a case in which there is a perfectly elastic supply of US assets.[4]

2.2 Demand for dollar assets

Households' preferences in China are represented by

$$c_1^* + \beta u(c_2^*) + v\left(\frac{B^*}{P_1}\right),$$

where c^* denotes consumption and $u(\cdot)$ is an increasing and strictly concave utility function. The function v represents the utility from holdings dollar assets in the US financial system and captures the non-pecuniary value from holding a reserve currency asset.[5] We make the following assumption about this function:

Assumption 1. *We assume that $v(\cdot)$ satisfies $v' \geq 0, v'' < 0$, $v'(0) = \infty$, and that it features a satiation point (i.e, $v(x) = v(\bar{x})$ for $x \geq \bar{x}$).*

Chinese households receive a real endowment y^* in periods $t = 1, 2$ and trade real assets $k^* \geq 0$ and US dollar bonds $B^* \geq 0$. Their flow budget constraints are

$$\begin{aligned} c_1^* &= y^* - \frac{B^*}{P_1} - k^* \\ c_2^* &= y^* + \frac{B^*}{P_2}(1+i)(1-\lambda) + R^* k^*. \end{aligned}$$

[4]Another possible microfoundation for a supply curve that is downward-sloping (in the return) may come from the government behaving as a monopolist of the safe asset, as in Farhi and Maggiori (2018). See also Bianchi and Lorenzoni (2021) and Choi et al. (2022).

[5]See Bianchi et al. (2021) for a model where the convenience yield of dollar assets is endogenous.

We assume that as a result of international sanctions, a fraction $\lambda \in [0,1]$ of the dollar assets are confiscated in period $t = 2$. Consolidating the two flow budget constraints and defining $b^* \equiv \frac{B^*}{P_1}$, we can write the problem of households in China as

$$\max_{c_1^*, c_2^*, b^* \geq 0} c_1^* + \beta u(c_2^*) + v\left(b^*\right) \tag{2}$$

subject to

$$y^* - c_1^* + \frac{y^* - c_2^*}{R^*} - b^* \left(1 - \frac{R(1-\lambda)}{R^*}\right) \geq 0.$$

The last term on the left-hand side of the intertemporal budget constraint reflects the losses from investing in an asset that has a lower return than the real asset.

Taking first-order conditions, and assuming an interior solution, we obtain

$$v'\left(b^*\right) = 1 - \frac{R(1-\lambda)}{R^*}. \tag{3}$$

Using that $v'' < 0$, (3) gives us a demand for dollar assets that is upward-sloping in the return R (and so downward-sloping in the price).[6] Moreover, an increase in λ reduces the demand for dollar assets, for given returns.

Discussion on sanctions. We modeled the financial sanctions as a confiscation of dollar assets. Notice that implicit in (1) is that US investors do not take control of the seized assets. We think this is the realistic case, as assets seized are more likely to be taken over by governments and used to finance war reparations. Sanctions could alternatively involve a freeze of assets as opposed to a reduction in the pecuniary return, as in Bianchi and Sosa-Padilla (2022).[7] What is crucial for our main analysis is that sanctions open a wedge between the return on dollar assets perceived by China and the cost of issuing debt by the US. Moreover, we also note that while here we study a deterministic model, we expect our results to also hold in a more general stochastic environment where with some probability, the country faces sanctions in the event of an international conflict.

2.3 Equilibrium

Given government policies $\{i, e_2\}$, a competitive equilibrium is a set of allocations $\{c_1^*, c_2^*, k, k^*, B, B^*\}$, an exchange rate e_1, and price levels $\{P_1, P_2\}$ such that

[6] Notice that a bounded solution of (2) requires $R(1-\lambda) < R^*$.

[7] See also Bianchi and Lorenzoni (2021) and Clayton et al. (2022) for an analysis of ex-post capital controls on real assets.

1. agents in the US and China maximize their utility;

2. the market for US dollar assets clears:

$$b = b^*, \text{ and}$$

3. prices satisfy the law of one price: $P_t e_t = 1$ for $t = 1, 2$.

We now argue that in equilibrium, there is a convenience yield on dollar bonds $R < R^*$ and that China holds positive US dollar bonds (i.e. issued by US investors) in equilibrium.

Lemma 1 (Convenience yield)**.** *Suppose Assumption 1 holds. In equilibrium $R < R^*$ and $b^* > 0$ for any λ.*

Proof. Suppose, by contradiction, that $R \geq R^*$. Then, using (1), this implies $b < 0$. But using (3) and $v' \geq 0$, this implies that $b^* \geq 0$. Thus, market clearing cannot hold, implying that $R < R^*$. In addition, this result and (3) imply that in equilibrium $b^* > 0$. □

Intuitively, in this economy, households in China place a special value on dollar assets. The Inada condition on $v(\cdot)$ and the fact that the marginal cost of producing assets is zero at $b = 0$ for US investors, imply that the equilibrium must feature positive trade of dollar assets. The fact that the dollar asset features a lower equilibrium return than the real asset reflects its non-pecuniary value.

Figure 1 illustrates the equilibrium by presenting the supply and demand of dollar assets, as represented respectively by (1) and (3).

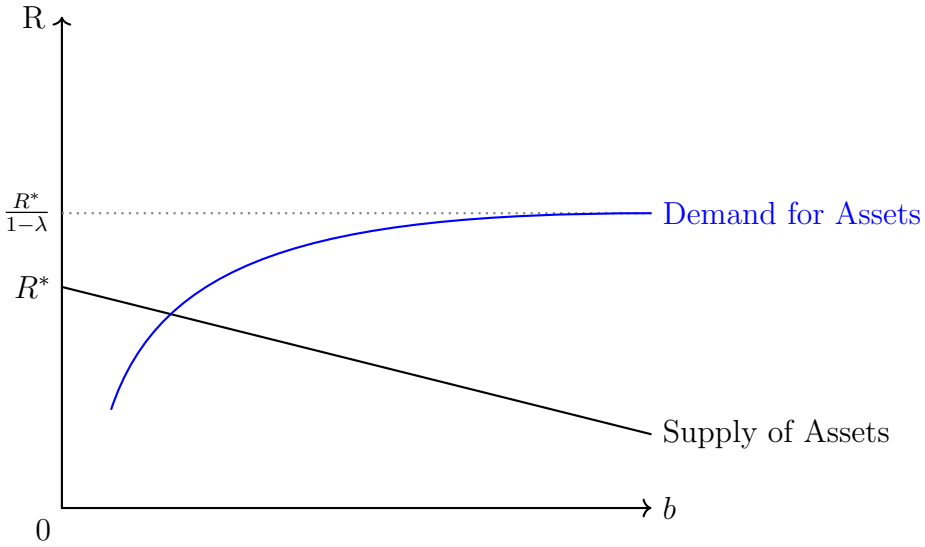

Figure 1: Illustration of the equilibirum

3 An Increase in International Sanctions

The goal is now to explore the effects of international sanctions by performing a comparative static with respect to λ. We first consider two frictionless versions where international sanctions play no role in the determination of the nominal exchange rate. After that, we turn to our baseline model in which the expectation of sanctions will depreciate the dollar and reduce the issuance of dollar assets.

3.1 Frictionless versions

We start the analysis by considering two "frictionless cases," one in wich the dollar assets do not feature a non-pecuniary value for China, and another one in which there is a zero cost of issuing dollar assets for US investors.

Non-special dollar assets. Suppose that dollar assets do not provide a non-pecuniary return (i.e., $v(x) = 0$). One way to think about this case is that there are no deeper frictions that justify why dollar assets may be special.

Lemma 2. *Suppose that $v(x) = 0$ for all x. Then, an increase in the sanction λ has no effects on the exchange rate or the quantity of assets traded.*

Proof. We first show that if $v(x) = 0$ for all x, we have that $R = R^*$. Suppose that $R < R^*$. Then, from (1), we know that US investors would be willing to issue assets, $b > 0$. However, from the problem in (2), it follows that if $v(x) = 0$, then $b^* = 0$. Thus, market clearing cannot hold. We can also rule out $R > R^*$. If $R > R^*$, (1) implies that US investors would like to save in dollar assets. Since China cannot issue dollar assets, we reach a contradiction.

Having argued that $R = R^*$, we then note that this implies from (1) that $b = 0$ for any λ. Finally, to see that there are no effects on the exchange rate, we use the definition of R and the law of one price to see that $R = \frac{(1+i)e_2}{e_1}$. Since R is invariant to λ and the central bank is assumed to keep i and e_2 constant, then e_1 remains constant. □

Intuitively, if dollar assets have no special value, households in China are not willing to hold dollar assets unless the return is the same as the real assets. At the same time, the US is not willing to produce dollar assets unless there is a spread. This case is illustrated in Figure 2. We can see that the demand for US assets follows an inverted L shape that intersects at zero with the supply of assets. An increase in λ shifts the demand for assets but has no consequences for the equilibrium.

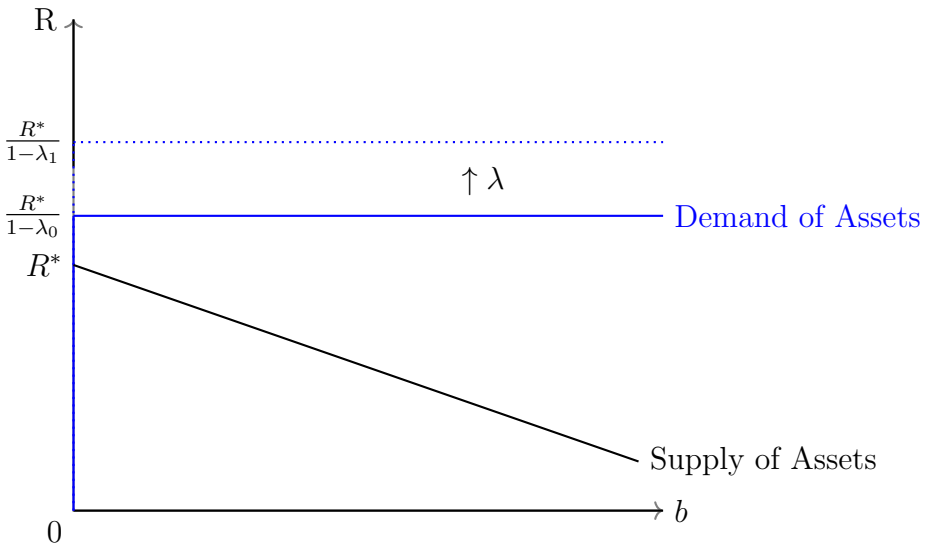

Figure 2: The effects of an increase in λ when $v = 0$

No costs from issuing safe assets. The second frictionless case is when $\omega = 0$. This corresponds to the case in which US investors provide an infinitely elastic supply of dollar assets. The following lemma establishes that in this case, sanctions have no effects on the exchange rate.

Lemma 3. *Suppose $\omega = 0$. Then, an increase in λ has no effect on the exchange rate.*

Proof. We show that if $\omega = 0$, then $R = R^*$ for any λ. From the arguments above, we can rule out $R > R^*$. Suppose $R < R^*$. Then, from (1), it follows that asset issuances are infinite in the US. From (3), it follows that b^* is finite, thus, the contradiction. Finally, the argument that the exchange rate is unaffected follows the same logic as the one in the proof of Lemma 2. □

The intuition for this result is that if there is no cost of producing dollar assets, their return must be pinned down by the return of real assets. As a result, sanctions can have no impact on the exchange rate. See Figure 3 for an illustration.

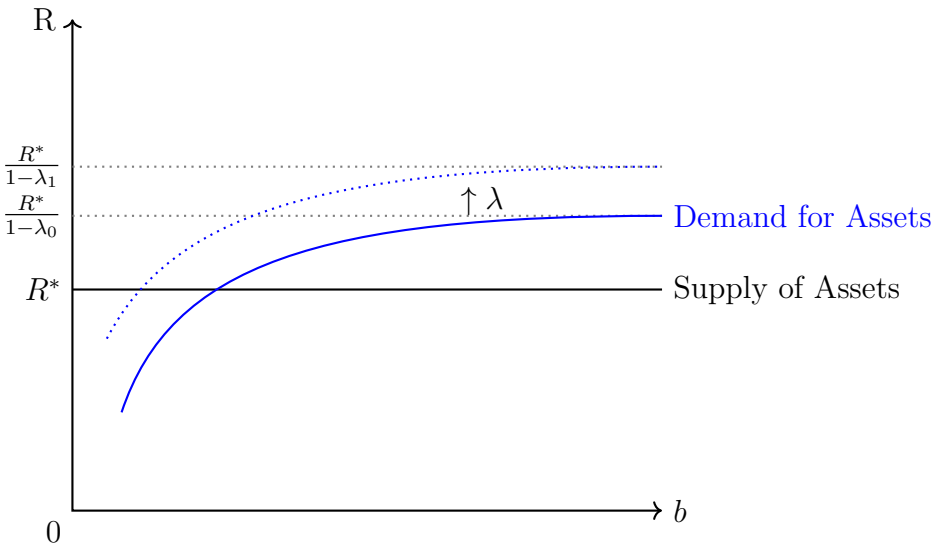

Figure 3: The effects of an increase in λ when there are no costs from issuing assets

3.2 The Weakening of the Dollar

Consider now the general case in which dollar assets have a special value, $v > 0$, and there is a decreasing supply of assets by the US, $\omega > 0$. We now show that R increases in response to an increase in expected sanctions and that there is a fall in the amount of dollar reserves. We formalize this result below.

Proposition 1. *Suppose Assumption 1 holds and $\omega > 0$. An increase in λ increases R, decreases $R(1-\lambda)$, depreciates the dollar, and lowers b^*.*

Proof. Replacing (3) in (1), we obtain that

$$v'\left(\frac{1}{\omega}(R^* - R)\right) = \frac{R^* - R(1-\lambda)}{R^*}$$

Totally differentiating, we obtain

$$\frac{\partial R}{\partial \lambda} = \frac{R}{-v''(b^*)\frac{R^*}{\omega} + (1-\lambda)} > 0 \tag{4}$$

Using that $R = (1+i)\frac{e_2}{e_1}$, and recalling that the US central bank is assumed to keep i and e_2 constant, it then follows that e_1 falls. Using (4) in addition to (1) and market clearing, we

obtain that b^* falls. Finally, to show that $R(1-\lambda)$ must fall, we note that:

$$\begin{aligned}\frac{\partial R(1-\lambda)}{\partial \lambda} =& \frac{\partial R}{\partial \lambda}(1-\lambda) - R \\ =& R\left[\frac{1}{1-v''(b^*)\frac{R^*}{\omega(1-\lambda)}} - 1\right] < 0\end{aligned}$$

□

These results can best be appreciated graphically, as in Figure 4. We can see that as λ goes up, the demand for dollar assets is reduced for any R. In equilibrium, we end up with a higher return R, a weaker dollar, and a lower amount of dollar assets.

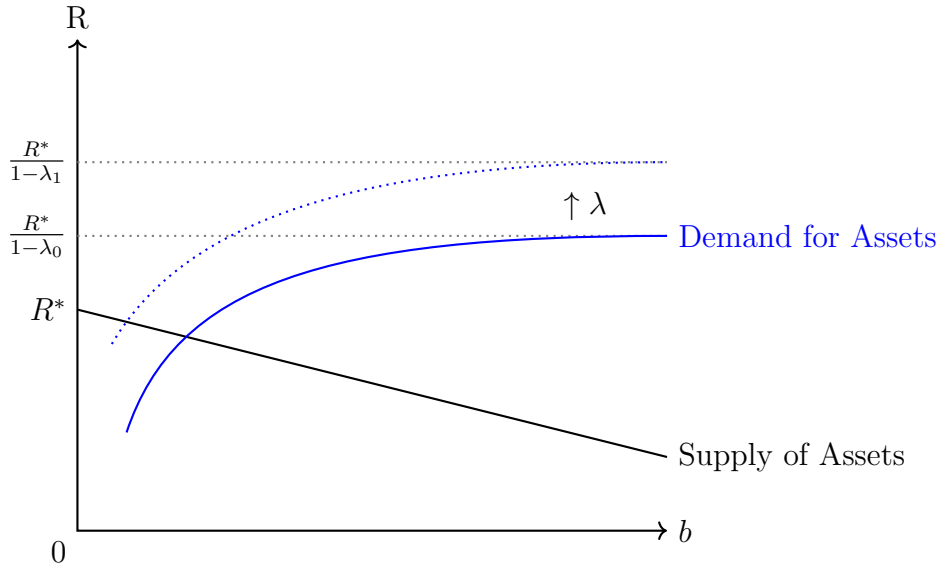

Figure 4: General case: the weakening of US dollar

3.3 Discussion

Monetary policy. The depreciation of the US dollar was obtained under the assumption that the nominal interest rate i is kept constant by the central bank in the US. This raises the question of whether a response by the central bank in the US would undo the dollar depreciation. In particular, if the central bank were to raise i, this would offset the dollar depreciation. However, we argue that the assumption that the US does not raise the nominal interest rate and offset the depreciation pressure is a natural one. In particular, consider an extension of the model with non-tradable goods and an inflation target by the central bank. In this context, the increase in the real interest rate at which the US borrows generates a negative wealth effect which necessarily leads to a reduction in demand for domestic goods

and a *real* exchange rate depreciation in the US. Therefore, it follows that for the central bank to avoid deflation, it must let the nominal exchange rate depreciate.

Welfare implications. The final question we tackle is about the implications of sanctions for welfare. Regarding China's welfare, it is clear that an increase in λ reduces the return obtained by Chinese investors on their dollar assets. Even though R goes up in equilibrium, the overall return $R(1-\lambda)$ decreases, and so the net effect is a reduction in welfare.

For the US, the increase in R implies a reduction in the convenience yield, causing lower rents from intermediation. Because US investors have a negative position in dollar assets, the increase of the interest rate on these assets causes a reduction in US investors' welfare. At the same time, it is worth highlighting that we assume that US investors are starting from zero debt positions. In the more realistic case where US investors start with positive dollar liabilities, the depreciation of the dollar would dilute the real value of their liabilities. This translates into a positive welfare effect, leading to a potentially ambiguous net welfare efffect.[8]

4 Conclusions

In this paper, we articulate a channel by which international financial sanctions could weaken the dollar as a reserve currency. To conclude, let us highlight that while our analysis isolates a mechanism by which financial sanctions can weaken the dollar as a reserve currency, it does not rule out other mechanisms by which sanctions may contribute to strengthening the dollar. One could argue, for example, that the imposition of sanctions may deter belligerence in the future and strengthen the dollar. Further analysis and quantification of these channels warrant future research.

[8] A more thorough investigation of this issue requires an explicit analysis of optimal monetary policy. One can show that if the US were constrained in its ability to depreciate the currency (e.g., because of a zero lower bound), the effect of sanctions would relax that constraint and, indeed have a positive welfare effect. On the other hand, absent this constraint, one can show using an envelope argument that this implies that the overall effect on welfare is negative for the US.

References

Bahaj, Saleem and Ricardo Reis, "Jumpstarting an International Currency," 2022. CEPR Discussion Paper 14793.

Bianchi, Javier and César Sosa-Padilla, "On Wars, Sanctions and Sovereign Default," 2022. NBER Working Paper 29989.

Bianchi, Javier and Guido Lorenzoni, "The Prudential Use of Capital Controls and Foreign Currency Reserves," 2021. Forthcoming, Handbook of International Economics, Volume V, edited by Gita Gopinath, Elhanan Helpman and Kenneth Rogoff, North Holland.

Bianchi, Javier, Saki Bigio, and Charles Engel, "Scrambling for Dollars: International Liquidity, Banks and Exchange Rates," 2021. NBER Working Paper No. 29457.

Brunnermeier, Markus K, Harold James, and Jean-Pierre Landau, "Sanctions and the international monetary system," *VoxEU. org*, 2022, *5*.

Choi, Jason, Rishabh Kirpalani, and Diego J Perez, "The macroeconomic implications of US market power in safe assets," Technical Report 2022. NBER Working Paper No. 30720.

Clayton, Christopher, Amanda Dos Santos, Matteo Maggiori, and Jesse Schreger, "Internationalizing Like China," 2022. NBER Working Paper No. 30336.

Eichengreen, Barry, "The Monetary Consequences of Vladimir Putin," 2022. Column, Project Syndicate.

Farhi, Emmanuel and Matteo Maggiori, "A model of the international monetary system," *The Quarterly Journal of Economics*, 2018, *133* (1), 295–355.

Ghironi, Fabio, Daisoon Kim, and Galip Kemal Ozhan, "International Economic Sanctions and Third-Country Effects," 2023. Mimeo NC State.

Gopinath, Gita and Jeremy C Stein, "Banking, trade, and the making of a dominant currency," *The Quarterly Journal of Economics*, 2021, *136* (2), 783–830.

Gourinchas, Pierre-Olivier and Helene Rey, "From world banker to world venture capitalist: US external adjustment and the exorbitant privilege," in "G7 current account imbalances: sustainability and adjustment," University of Chicago Press, 2007, pp. 11–66.

Gourinchas, Pierre-Olivier, Hélène Rey, and Nicolas Govillot, "Exorbitant Privilege and Exorbitant Duty," 2020. CEPR, Discussion Paper.

Itskhoki, Oleg and Dmitry Mukhin, "Sanctions and the Exchange Rate," 2022. Mimeo, UCLA.

Jiang, Zhengyang, Arvind Krishnamurthy, and Hanno Lustig, "Dollar safety and the global financial cycle," 2020. NBER Working Paper No. 27682.

Kekre, Rohan and Moritz Lenel, "The flight to safety and international risk sharing," 2021.

Lorenzoni, Guido and Ivan Werning, "A minimalist model for the ruble during the russian invasion of Ukraine," 2022. NBER Working Paper No. 29929.

Sturm, John, "A Note on Designing Economic Sanctions," 2022. Mimeo, MIT.

Weiss, Colin, "Geopolitics and the US Dollar's Future as a Reserve Currency," *International Finance Discussion Paper*, 2022, (1359).