Digital Economy and the Global Financial System*

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PRELIMINARY AND INCOMPLETE

Abstract

The growth of digital coins, and in particular, Stablecoins, could have contrasting consequences for the international dominance of the US dollar. On the one hand, the increased creation of Stablecoins will raise the demand for dollar reserves, enhancing the international role of the US dollar. On the other hand, Stablecoins could be a substitute for typical dollar-denominated assets, potentially reducing the demand for US dollars. We show that the first effect (higher demand for dollars) dominates initially when the size of the digital market is relatively small. However, as the size of the digital market increases, the second effect (lower demand for dollars) becomes dominant.

1 Introduction

The US government debt plays a unique role in global financial markets, acting as a reliable store of value. This is in addition to its liquidity role. Despite the liberalization of capital markets since the 1980s and the establishment

*The views expressed herein are those of the authors and do not necessarily reflect the views of the Federal Reserve Bank of Richmond.

of the European Monetary Union potentially boosting liquidity provision in other currencies, the US Dollar has maintained its privileged position. If globalization has not compromised the position of US dollar-denominated assets, what other factors could challenge it? This paper investigates whether technological advancements, particularly the introduction and growth of decentralized digital assets like cryptocurrencies, have the potential to erode the US dollar's privileged position.

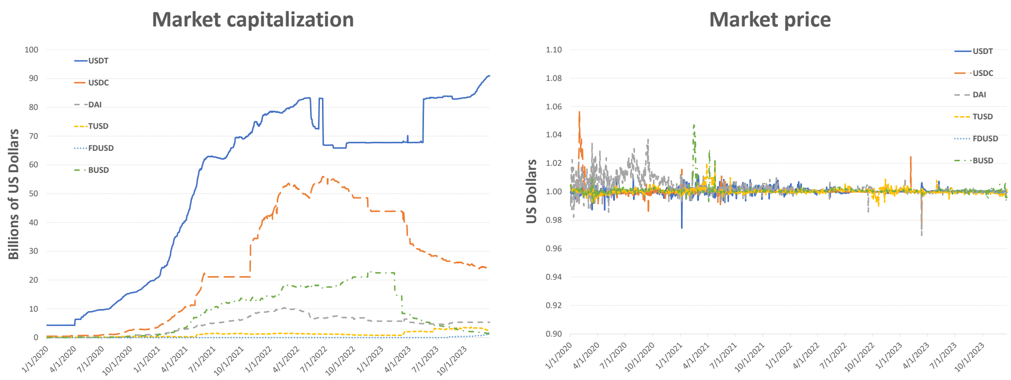
An obvious limitation in replacing US safe assets with digital assets traded in decentralized markets lies in the extreme volatility typical of these assets. Paradoxically, the growth of cryptocurrencies may actually enhance the demand for traditional dollar-denominated assets to mitigate the risk associated with digital asset investments. The extreme volatility of many digital assets, however, does not apply to Stablecoins, which are explicitly designed to reduce (or even eliminate) the volatility that characterizes conventional cryptocurrencies.

Tether (USDT) is the most important Stablecoin in terms of market capitalization. Anchored to the US dollar, Theter has consistently maintained a nearly one-to-one valuation, as shown in Figure 1. Its current market capitalization is around 90 billion dollars, a substantial figure relative to the total market capitalization of all cryptocurrencies, which is close to 2 trillion dollars. This is still relatively small when compared US treasuries worth 26 trillion dollars. However, the growth potential of the decentralized market has not fully materialized and could make Stablecoins an important component of international financial markets beyond decentralized finance.

To understand how Stablecoins might become an important component of international financial markets, consider the investment choices of savers in emerging countries, who often face barriers (such as capital controls) or other frictions (such as high transaction costs) to hold US safe assets. Anonymity might also play a role. Although anonymity can be preserved by holding dollar bills, banknotes are not an efficient long-term store of value. In contrast, the technological advantages of digital assets present a compelling alternative. These savers could, leveraging the ease of digital transactions, acquire and hold Stablecoins that are pegged to the US dollar. Provided that the peg is reliable and credible, the possession of Stablecoins could serve as a viable alternative to the direct holding of US government debt, thereby circumventing the frictions on traditional dollar-denominated assets.

But the relevance of Stablecoins for the international financial system is not limited to the convenience for private savers. Central banks around the

Figure 1: Market capitalization and price for six major Stablecoins.



Sources: coincodex.com

world hold large volumes of reserves, a large share of which with the US dollar being the most popular currency denomination. The large holdings of US assets arise despite their low return. Stablecoins, then, could provide an alternative investment vehicle with a more attractive return.

For Stablecoins to achieve complete stability, they need to be fully backed by dollar-denominated assets. This makes the ownership of Stablecoins effectively equivalent to the ownership of dollars. However, due to its digital nature, Stablecoins are more easily accessible than traditional dollar denominated assets. Either because the transaction costs are lower or it allows to circumvent restrictions such as capital controls. Because of its greater accessibility, the diffusion of Stablecoins could boost, indirectly, the demand for dollar denominated assets (for example, US government debt), given the need to back up Stablecoins with dollar denominated assets. In reality, though, Stablecoins can also be backed by a other assets, including cryptocurrencies. In this case, Stablecoins can truly function as substitutes for US dollars, possibly diminishing its privileged position in the global economy.

To illustrate these forces we develop a two-country model representative of the US economy and the rest of the world. We then introduce a new sector that creates digital assets and provides various types of services. Importantly, the provision of these services requires the use of digital assets. We call this new sector the 'digital economy' or simply DiEco. This sector can be thought as a separate national economy with its own means of payments. However, what defines this third country are not geographical borders but the underlying technology used to produce various types of services (smart contracts recorded and executed in a blockchain) and to make payments (through the exchange of digital assets).

Stablecoins are simply a special kind of digital assets. The distinguished feature is that its value is pegged to the US dollar and, therefore, they are stable in terms of dollars. In our model their stability is in terms of consumption goods since we abstract from nominal quantities. Using the model we show that the creation of Stablecoins could further reduce the US interest rate at first, when the size of the digital economy is relatively small. However, as the size of the digital economy increases, the US interest rate rises, weakening the exorbitant privilege of the dollar.

2 Literature review

TO BE ADDED

3 A model without digital economy

We start with a model without a digital economy. After characterizing this simpler model, we extend it by adding the digital economy.

There are two countries: United States (US) and Rest of the World (RoW). In each country there is a unit measure of agents that maximize the expected lifetime utility

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \ln(c_t),$$

where c_t is consumption and $\beta \in (0,1)$ is the intertemporal discount factor.

There is a unit supply of non-reproducible land traded only domestically at price p_t. An agent that owns k_t units of land produces $z_t k_t$ units of output, where z_t is an idiosyncratic iid productivity shock with probability density $\mu(z)$. There are no aggregate shocks. The only difference between the two countries is that the volatility of the idiosyncratic shock in RoW is larger than in the US. As we will see, this implies that in the steady state the US has a negative net foreign asset position (net borrower). This could derive from higher volatility of shocks or from lower ability to insure them due, for example, to lower financial development.

There is a government in each country that issues public debt $B_{t+1} \geq 0$ at price $1/R_t$. The government balances its budget with lump-sum taxes T_t paid by domestic agents: $B_t = \frac{B_{t+1}}{R_t} + T_t$. Agents can hold bonds issued by their own government (domestic bonds) or by the other country (foreign bonds). We indicate the individual holding of 'domestic' bonds by d_t, and the individual holdings of 'foreign' bonds by f_t. Per-capita (average) holdings are indicated by capital letters D_t and F_t.

There are frictions that limit access to foreign bonds formalized by a cost $\varphi(F_{t+1})\frac{f_{t+1}}{R_t^*}$, where the star superscript on the interest rate indicates the other country. The function $\varphi(.)$ depends on the *aggregate* foreign holdings. For the moment we only impose that this function is positive and non-decreasing in $F_{t+1} > 0$. As a special case it could be a constant or an increasing and convex function.

There are different ways to justify the cost. One interpretation is that the purchase involves a transaction cost due fees charged by financial intermediaries. For certain countries it could be related to capital controls limiting access to foreign investments.

The agent's budget constraint is

$$c_t + p_t k_{t+1} + \frac{d_{t+1}}{R_t} + \frac{[1+\varphi(F_{t+1})]f_{t+1}}{R_t^*} + T_t = (z_t + p_t)k_t + d_t + f_t.$$

Define $a_t = (z_t + p_t)k_t + d_t + f_t - B_t$ the end-of-period wealth before consumption, net of the government debt B_t. The optimal agents' decision is characterized in the following lemma.

Lemma 3.1 *Given a_t and $\{B_{t+1}, p_t, R_t, R_t^*, \varphi(F_{t+1})\}_{t=0}^{\infty}$, the optimal policy chosen by the agent is*

$$c_t = (1-\beta)a_t,$$
$$p_t k_{t+1} = \phi_t \beta a_t,$$
$$\frac{d_{t+1} - B_{t+1}}{R_t} + \frac{[1+\varphi(F_{t+1})]f_{t+1}}{R_t^*} = (1-\phi_t)\beta a_t,$$

where ϕ_t satisfies

$$\mathbb{E}_t \left[\frac{\max\left\{R_t \, , \, \frac{R_t^*}{1+\varphi(F_{t+1})}\right\}}{\phi_t \left(\frac{z_{t+1}^i + p_{t+1}}{p_t}\right) + (1-\phi_t)\cdot \max\left\{R_t \, , \, \frac{R_t^*}{1+\varphi(F_{t+1})}\right\}} \right] = 1.$$

The lemma establishes how savings are allocated between land and bonds, but it does not specify the composition between domestic and foreign bonds. If $R_t > R_t^*/(1+\varphi_t)$, the agent invests only in domestic bonds ($f_{t+1} = 0$). If $R_t < R_t^*/(1+\varphi_t)$, the agent invests only in foreign bonds ($d_{t+1} = 0$). If $R_t = R_t^*/(1+\varphi_t)$, the agent is indifferent, so the composition of bonds is determined only in aggregate.

We focus on steady state equilibria where aggregate variables are constant. Since the US differs from the RoW only in the volatility of the idiosyncratic risk (z^{US} is less volatile than z^{RoW}), the steady state has the following properties:

- The US interest rate is lower than $1/\beta - 1$ and lower than in a closed economy.
- The RoW interest rate is lower than the US interest rate as it satisfies $R^{RoW} = R^{US}/[1+\varphi(F^{RoW})]$.
- RoW holds US bonds ($F^{RoW} > 0$), but the US does not hold RoW bonds ($F^{US} = 0$).

These results are obtained by aggregating the agents' decisions characterized in Lemma 3.1 and imposing market clearing. In the context of our model, the US dollar privilege is captured by the fact that the US pays a lower interest rate compared to the closed economy version of the model (as stated in the first bullet point). The derivation of these properties is provided in the appendix.

4 Extended model

We extend the model by adding a digital economy. We can think of the digital economy as a third country. The country, however, is not delimited by geographical borders. Instead, it is defined by the technological platform at the basis of its operation—the blockchain technology. We will refer to this third country as 'digital economy' or more simply as 'DiEco'.

The digital economy provides several services as we will describe below, and creates digital assets. From an economic standpoint, digital assets are not different from other financial assets. However, the digital form makes them more easily accessible to users. One way in which they become more easily accessible is through lower transaction fees. Also, the digital form together with the technology used to trade them, facilitate the avoidance of legal constraints such as capital controls. Something that is more challenging to do with non-digital assets. We capture the greater accessibility of digital assets by assuming that agents do not incur the financial cost $\varphi(F_{t+1})$ when holding digital assets.

Stablecoins are a particular type of digital assets. They are created via a variety of mechanisms but, inh essence, they represent liabilities issued by some entities in the digital economy. It could be a Decentralized Autonomous Organization (DAO) or a centralized institution like Coinbase. The central feature of Stablecoins is that its value is pegged to some other assets, for example the Dollar, and there is an automatic mechanism that guarantees the peg.

The easier way to think about a Stablecoin is that its creation arises when a US dollar is deposited in some issuing entity, a process known as 'minting.' The Stablecoin can be redeemed for the deposited dollar at any time, a process referred to as 'burning'. If investors have the option to redeem one Stablecoin for one dollar, the issuing entity must have sufficient reserves to honor redemption. However, the reserves do not have to be limited to dollar-denominated assets. They could include other assets such as Cryptocurrencies. As long as the dollar value of Cryptocurrencies held in reserves exceeds the value of Stablecoins, they provide sufficient value to honor redemption.

Although the creation and trade of digital assets are the most known DiEco's activities, the digital economy produces a variety of services that are traded using the same technological platform used to trade digital assets. For example, DiEco could provide rental services through the execution of smart contracts. For the provision of these services, users pay a fee similar to the fee charged by regular rental agencies. To validate these (smart) contracts, DiEco's operators need capital in the form of Cryptocurrencies to provide proof of stake (PoS). Therefore, Cryptocurrencies are not just means of payment but they are also inputs of production. Another example could be insurance contracts that compensate users for delayed air travels. Also in this case users pay a fee to compensate the service provided by the digital economy. The digital economy also produces services in the form of Games or allows for individual or social interaction through the virtual world of Metaverse. These platforms produce services which, in the case of games, are equivalent to the services provided by the entertainment industry. So it is clear that the digital economy is not just a speculative platform that create asset bubbles but it has the potential to produce a variety of useful services. Although the volume of these services are currently small compared to the size of the standard economy, they could grow significantly over time. We will take this into account in modeling the digital economy.

4.1 Digital economy in the model

In DiEco there is a continuous of agents that have the same preferences as agents living in the US and RoW. Thus, they maximize the expected lifetime utility

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \ln(c_t).$$

There is an aggregate stock of reproducible Cryptocurrencies H_t. Cryptocurrencies or in short Crypto are held only by the residents of DiEco. Residency in DiEco is not based on geographical location but whether the agent performs major operations in DiEco. It includes investors with portfolios heavily allocated to digital assets as well as miner and/or minters, that is, operators that validate blockchain transactions.

Individual holdings of Crypto, h_t, produce services $\eta_t h_t$, where η_t is an idiosyncratic shock. We think of these services as DiEco's production. As hinted above, services are produced with the validation and execution of smart contracts where Cryptocurrencies are production inputs through the proof of stake (PoS). A fraction δ of outstanding Crypto depreciates in every period. Depreciation can be related to the loss of private keys needed to access digital accounts. Even if not many private keys are lost in reality, a positive value of δ, even if small, guarantees that new Crypto is always created even in steady state equilibria.

Crypto is traded at price q_t. Thus, the value of one unit of Crypto after production is $\eta_t + (1-\delta)q_t$ and the return from holding one unit of Crypto is $[\eta_t + (1-\delta)q_t]/q_{t-1}$. Denoting by N_t the aggregate quantity of newly created Crypto, the next period stock is

$$H_{t+1} = (1-\delta)H_t + N_t.$$

The creation of new Crypto incurs the cost $\psi(N_t)n_t$, where n_t is the individual production of new Crypto while N_t is the aggregate production. The function $\psi(.)$ is strictly increasing and convex.

Competition implies that the marginal production cost of Crypto is equal to the market price of Crypto, that is, $\psi(N_t) = q_t$. In the steady state we have $\delta H = N$ which, combined with the equilibrium condition for the production of new Crypto gives $\psi(\delta H_t) = q_t$. Thus, higher is the price of Crypto, q_t, and higher is the stock of Crypto. Later we will engineer an increase in the supply of Crypto as the response to an increase in productivity η_t. The higher productivity increases the price of Crypto q_t, which in turn incentivizes the production of more Crypto.

While for early creation of Crypto—for example when Bitcoins were first launched—the expected value of η_t was close to zero, the expansion of the digital economy made Crypto instrumental for providing services in the digital economy through the validation and execution of smart contracts. These services include, but are not limited to, gaming and decentralized finance (borrowing, lending, derivatives, etc). As the digital economy becomes more popular, the value of these services increases, lifting the market price of Crypto.

A DiEco's resident can issue digital liabilities s_t that can be purchased by US and RoW agents. Their repayment is fixed in consumption units and, therefore, they are stable. We call these liabilities Stablecoins.

DiEco's residents can hold bonds issued by the US government, denoted by b_t^{US}. They could also hold bonds issued by RoW. However, we assume that they only hold US bonds. Since in equilibrium US bonds provide the same return as RoW bonds, this is without loss of generality and it is made only for notational convenience. The budget constraint is

$$c_t + q_t h_{t+1} + \frac{b_{t+1}^{US}}{R_t^S} - \frac{s_{t+1}}{R_t^S} = (\eta_t + q_t)h_t + b_t^{US} - s_t,$$

where q_t is the price of Crypto and R_t^S is the gross interest rate paid by Stablecoins (liabilities issues by DiEco). If $R_t^S > R_t^{US}$, DiEco's agents will not hold US bonds. If $R_t^S < R_t^{US}$, they will hold an infinite amount of b_t^{US} funded by an infinite amount of liabilities s_t. Clearly this cannot be an equilibrium and we limit the analysis to $R_t^S \geq R_t^{US}$.

Define $a_t = (\eta_t + q_t)h_t + b_t^{US} - s_t$ the end-of-period wealth before consumption. The following lemma characterizes the optimal decision of DiEco's residents.

Lemma 4.1 *Given a_t and $\{q_t, R_t^{US}, R_t^S\}_{t=0}^{\infty}$, the optimal policy chosen by an agent in DiEco is*

$$c_t = (1-\beta)a_t,$$
$$q_t h_{t+1} = \chi_t \beta a_t,$$
$$\frac{b_{t+1}^{US} - s_{t+1}}{R_t^S} = (1-\chi_t)\beta a_t,$$

where $b_{t+1}^{US} = 0$ if $R_t^S > R_t^{US}$ and χ_t satisfies

$$\mathbb{E}_t \left[\frac{R_t^S}{\chi_t \left(\frac{\eta_{t+1}^i + q_{t+1}}{q_t} \right) + (1-\chi_t) \cdot R_t^S} \right] = 1.$$

When $R_t^S > R_t^{US}$, the return from Stablecoins dominates the return from US bonds. In this case b_{t+1}^{US} will be zero since DiEco's agents cannot short US bonds. If they have the same return, however, US bonds and Stablecoins are economically indistinguishable and agents will be indifferent holding one or the other. In this case only $b_{t+1}^{US} - s_{t+1}$, not its components, is determined for an individual agent. The agent could buy an extra unit of US bonds and fund it with the issuance of one unit of liabilities (Stablecoins), without affecting income and wealth.

4.2 Fully segmented DiEco

We start characterizing the digital economy under the assumption that it is not integrated neither with the US nor with RoW. Obviously, this is an abstraction but will help us understand the functioning of the model. In this case $b_{t+1}^{US} = 0$, that is, agents in DiEco do not hold US bonds. By Lemma 4.1 we know that agents choose the same composition of portfolio. Therefore, if some agents choose $s_{t+1} > 0$, other agents also choose $s_{t+1} > 0$. But this cannot be an equilibrium because nobody will purchase the issued liabilities. This implies that in equilibrium we must have $s_{t+1} = 0$. The interest rate R_t^S is then determined so that agents are indifferent between issuing one Stablecoin or holding one Stablecoin issued by other agents. Since a Stablecoin is a safe asset while Crypto is risky, the interest rate on Stablecoins will be smaller than the expected return on Crypto.

When DiEco is not integrated with the other two countries, the equilibrium in the US and RoW remains the same as the one characterized in the simpler version of the model with only two countries: US and RoW. The next step is to study how the integration of the digital economy affects the equilibrium, with special attention to the US interest rate.

4.3 Fully integrated DiEco

We now consider the environment in which agents in the US and RoW can hold Stablecoins issued by DiEco. The US and RoW can hold Stablecoins without incurring any cost. Similarly, DiEco can hold US bonds costlessly.

In this environment the three interest rates must equalize in equilibrium, that is, $R_t^S = R_t^{US} = R_t^{RoW}$. To see why, suppose that $R_t^S > R_t^{US}$. US agents will sell US bonds and buy only Stablecoins. The same will be true for agents in RoW. Because of this, R_t^S declines while R_t^{US} increases. By the same token, if $R_t^S < R_t^{US}$, nobody will hold Stablecoins. However, agents in DiEco will find optimal to issue a large quantity of Stablecoins and buy US bonds. This increases R_t^S and decreases R_t^{US}. A similar argument can be made to show that $R_t^{US} = R_t^{RoW}$. If $R_t^{US} > R_t^{RoW}$, nobody will hold RoW bonds. If $R_t^{US} < R_t^{RoW}$, nobody will hold US bonds.

To understand how the integration of DiEco with the already integrated US and RoW affects the US interest rate, we will consider three cases:

1. In the pre-liberalization regime $R^S > R^{US}$.
2. In the pre-liberalization regime $R^{US} > R^S > R^{RoW}$.
3. In the pre-liberalization regime $R^{US} > R^{RoW} > R^S$.

The analysis will be based on steady state comparisons. As a reminder, in the steady state before DiEco integrates with US and RoW, we have that $R^{US} = R^{RoW}(1 + \psi(F^{RoW}))$, where $F^{RoW} > 0$. Thus, RoW holds US bonds and the US interest rate is higher than the interest rate in RoW.

Case 1: We start with the case in which $R^S > R^{US}$ in the pre-liberalization regime. Whether liberalization leads to higher or lower R^{US} depends on the magnitude of the supply response of Stablecoins. If the response is small, relatively to the economic size of US and RoW, the post-liberalization R^{US} will be lower. If the response is large, the post-liberalization value of R^{US} increases. Following is an intuitive explanation for this finding.

Suppose that R^{US} does not change in the steady state after liberalization. This means that R^S and R^{RoW} will converge to the pre-liberalization value of R^{US}. Because US agents hold only US bonds prior to liberalization, there is no reason for them to change their holdings of US bonds or switch to Stablecoins (since they earn the same return). Agents in RoW, instead, will no longer hold US bonds, that is, $F^{RoW} = 0$, and replace them with Stablecoins S^{RoW}. This is because there is no cost for holding Stablecoins but holding US bonds is costly. This also implies that RoW agents get a higher return on S^{RoW} compared to the net return on F^{RoW} (on Stablecoins they get the return $R^S = R^{US} = R^{RoW}$ while on the previous holding of US bonds the return was $(1 + R^{US})/(1 + \varphi(F^{RoW}))$. Because of the higher return, RoW agents will buy more safe assets, that is, $S^{RoW} - F^{RoW} > 0$. This implies that the demand for Stablecoins net of the supply of US bonds is positive.

Let's consider now the response of DiEco's agents. Since R^{US} is assumed to remain the same after liberalization but the pre-liberalization value of R^S was bigger than R^{US}, then liberalization lowers the value of R^S. The equality between R^S and R^{US} implies that DiEco's agents are indifferent between holding US bonds, denoted by B^{US}, and funding them with Stablecoins, denoted by S. What DiEco's agents care is the net value, that is, $B^{US} - S$. Since R^S is smaller, DiEco will reduce $B^{US} - S$. Being zero in the pre-liberalization steady state, $B^{US} - S$ becomes negative and, therefore, DiEco will supply Stablecoins to the US and RoW in excess of its purchase of US bonds. On the one hand we have that *RoW* demands more Stablecoins than its sale of US bonds. On the other we have the DiEco sells Stablecoins in excess of its purchase of US bonds. The question, then, is whether the net supply of Stablecoins from DiEco is sufficient to cover net demand from RoW, that is, whether $S - B^{US}$ is at least as big as $S^{RoW} - F^{RoW}$.

If the increase in supply is small, then there is too much net demand of Stablecoins and the interest rate R^S must drop. Since in equilibrium $R^S = R^{US}$, this will also imply a drop in R^US. In this case the introduction of Stablecoins reinforces the privileged position of the US. If, instead, the increase in the supply of Stablecoins is large, there will be too much net supply of Stablecoins, and the interest rate R^S must increase. Since in equilibrium $R^S = R^{US}$, this implies an increase in

$R^U S$. In this case the introduction of Stablecoins weakens the privileged position of the US.

Case 2: When the pre-liberalization regime is characterized by $R^{US} > R^S > R^{RoW}$, integration causes a reduction in the US interest rate R^{US}.

> Suppose that R^{US} does not change after liberalization. Since $R^S = R^{US}$, RoW will no longer hold US bonds, F^{RoW}, and instead will hold Stablecoins, S. At the same time R^{RoW} rises to R^S. Because the return from safe assets increases, the demand for Stablecoins increases more than the drop in the RoW demand for US bonds, that is, $S^{RoW} > F^{RoW}$.
>
> Let's see how DiEco responds. Since the interest rate on Stablecoins must converge to R^{US}, R^S will be higher post-liberalization. This implies that DiEco will decrease the net supply of Stablecoins $S - B^{US}$. Because the increase in the net demand of Stablecoins from RoW will not be filled by DiEco, the interest rate on Stablecoins R^S must be lower than R^{US}. This implies that R^{US} must decline. We can also show that R^{RoW} will be higher post liberalization.
>
> Whether the new value of R^S is lower or higher than in the pre-liberalization equilibrium depends on the magnitude of the supply response of Stablecoins. If the response is small then R^S declines. If the response is large, R^S increases.

Case 3: We now consider the case in which $R^{RoW} > R^S$ in the pre-liberalization equilibrium. In this case R^{US} also drops. Differently from the previous case, however, R^{RoW} may increase or decrease. Let's see why.

> Let's start by assuming that R^{RoW} does not change after liberalization. Since R^{US} must converge to R^S, the US interest rate will be lower in the post-liberalization steady state. But now that US bonds have the same interest rate as bonds issued by RoW, agents in RoW will no longer hold US bonds. Therefore, they no longer hold F^{RoW} in US bonds. Instead, they purchase Stablecoins S^{RoW} by the same quantity, that is, $S^{RoW} = F^{RoW}$.
>
> Let's see how US agents will respond. Since US bonds earn a lower interest rate (R^{US} must drop to R^{RoW}), US agents will hold less US

bonds. Therefore, even if RoW purchases Stablecoins, the supply of US bonds coming from US and RoW agents exceeds the demand of Stablecoins.

As far as DiEco is concerned, R^S must increase to R^{RoW}. This implies that $B^{US} - S$ increases, meaning that the net supply of Stablecoins falls or, equivalently, the net demand of US bonds increases. The question is whether this is sufficient to cover the drop in the demand for US bonds coming from US agents. If the increase in US bond demand from DiEco is small, the interest rate R^{US} must rise, which implies a rise in R^{RoW}. If the response from DiEco is large and exceeds the decline in the US bond demand from US agents, R^{US} must decline which in turn implies a decline in R^{RoW}.

4.4 Magnitude of DiEco Response

The analysis of the previous section emphasized that the impact of integrating the digital economy on the US interest rate depends on the magnitude of the supply/demand response from DiEco. What determines the magnitude of the response? In the context of the model we can emphasize three factors:

1. Optimal portfolio decision of DiEco's agents.
2. Cost of creating new Crypto.
3. The size of DiEco.

In what follows we discuss the importance of the last two factors, Crypto production cost and size of DiEco.

Production cost of Crypto: Liberalization has an impact on R^S which in equilibrium affects the price of Crypto. More specifically a lower R^S increases the price of Crypto q. As we have seen, when the price of Crypto rises, more Crypto is created. This, in turn, increases the supply of Stablecoins and further reduces R^S. Ultimately, whether the increase in supply is big or small depends on the cost elasticity of Crypto, that is, the function $\psi(.)$. If the cost rises very quickly, the increase in the supply of Crypto will be small and, as a result, the impact on R^S will also be small. The opposite arises if the function $\psi(.)$ is flat. In this case the increase in the supply of Crypto is large, leading to a sizable drop in R^S.

Size of DiEco: When the economic size of the digital economy is large relatively to the size of the US and RoW, the supply response of Stablecoins is also large. The economic size of DiEco is captured in the model by the market capitalization of Crypto, that is, qH. As the market value of Crypto rises over time, the supply of Stablecoins also rises. The increase in the supply of Stablecoins will have a positive impact on the US interest rate.

This raises the question of whether the price of Crypto and its size will continue to grow. At this stage we can only speculate, of course. However, if the digital economy continues to expand and becomes truly mainstream, there is no reason why the US dollar should maintain its privileged position in the global economy. Stablecoins should become a viable substitute.

5 Numerical exercise

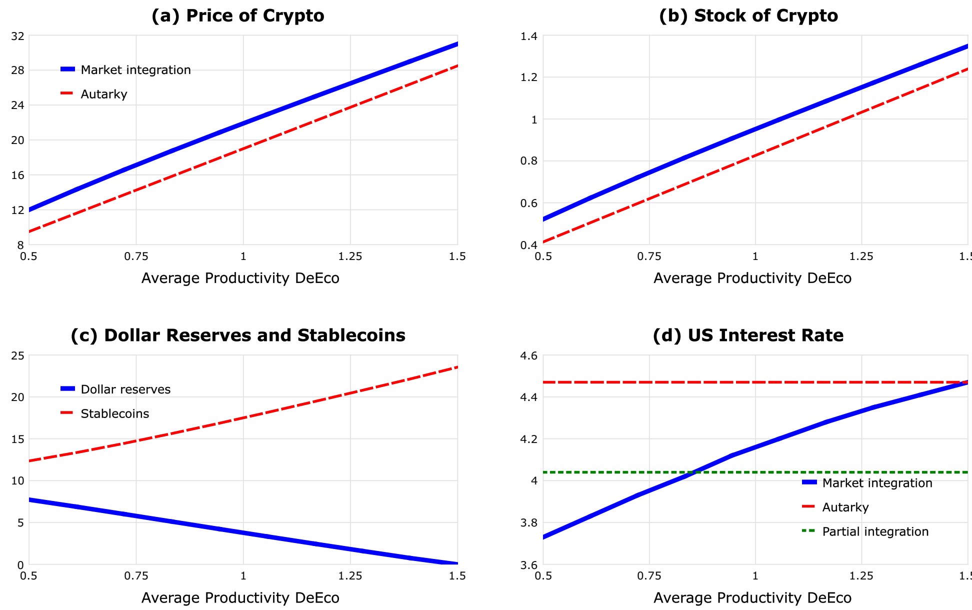
We conduct a numerical exercise to show how the growth of the digital economy affects the US interest rate. The exercise is for illustrative purpose and uses the following parameters. The discount factor is $\beta = 0.95$. The idiosyncratic shocks in the US and RoW are drawn from the uniform distributions $z^{US} \sim 1 + U[-3, 3]$ and $z^{RoW} \sim 1 + U[-6, 6]$. The cost of holding foreign bonds is $\varphi(F) = 0.0005 \times F^2$. The values of B^{US} and B^{RoW} do not need to be specified since they do not affect the results.

The idiosyncratic shock in DiEco is $\eta = \bar{\eta}\varepsilon$, where $\varepsilon \sim 1 + U[-1.5, 1.5]$. The variable $\bar{\eta}$ is the mean value of the shock. It also affects the volatility of the shock. A higher $\bar{\eta}$ implies higher average productivity in DiEco and, therefore, a larger economy. The main numerical exercise conducted in the paper performs a comparative static analysis by changing this parameter. The cost to produce new Crypo is $\psi(N) = 2,300 \times N$ and the depreciation rate is $\delta = 0.01$.

Figure 2 plots the steady state values of several variables associated with different values of $\bar{\eta}$. For each value of $\bar{\eta}$, indicated on the horizontal axis, we compute the steady state equilibrium and plot the value of the variable of interest in the vertical axis. For some variables we distinguish the regime in which the US, RoW and DiEco are not integrated (Autarky), and the regime in which they are integrated.

Panel (a) shows that, as the size of DiEco increases, the price of Crypto rises. This is obvious since each unit of Crypto produces more on average when $\bar{\eta}$ is higher. Our interest, however, is to understand how the higher price

Figure 2: US interest rate in steady state for different values of κ.



of Crypto affects the creation of Crypto, Stablecoins and the world interest rate. We also notice that the price of Crypto is lower in autarky (dashed line) compared to the price with market integration (continuous line). We will come back to this point below.

Panel (b) plots the steady state stock of Crypto, which increases with $\bar{\eta}$. This is a direct consequence of the increase in the price of Crypto: it is optimal to produce more Crypto even if this raises the marginal cost of Crypto production if the market value is higher.

What are the implications for the creation of Stablecoins? This is illustrated in Panel (c). We can see that higher values of $\bar{\eta}$ are associated with more creation of Stablecoins (dashed line). At the same time, DiEco purchases less US bonds (continuous line labelled dollar reserves). The difference between Stablecoins and Dollar reserves represents the net liabilities of DiEco. Thus, the graph shows that, as DiEco becomes bigger, it issues more net liabilities. These liabilities provide insurance to the rest of the economy because they are safe assets acquired by US and RoW.

The last Panel (d) shows that the US interest rate increases as $\bar{\eta}$ rises. This is because the increased creation of Stablecoins raises the supply of safe assets in the US and RoW. What matters is the net supply of safe assets, that is, the difference between Stablecoins and US bonds purchased by DiEco. The net supply increases because the creation of Stablecoins increases and DiEco's purchase of US bonds declines. When DiEco is small (low $\bar{\eta}$), there is significant creation of Stablecoins. However, DiEco also purchases a large quantity of US bonds. Therefore, the net supply of safe assets is not large. As a result, the US interest rate is low. As DiEco becomes larger (higher $\bar{\eta}$), more Stablecoins are created backed by Crypto, rather than US bonds. As a result, the net supply of safe assets increases, raising the interest rate.

Panel (d) also plots the case of autarky (indicated by the dashed line with all three economies isolated from each others) and the case of partial integration (indicated by the dotted line where only the US and RoW are integrated). Comparing the autarky regime with the regime of partial integration, we can see that the US interest rate is lower with partial integration. This captures the exorbitant privilege enjoyed by the US: thanks to its capital integration with the RoW, the US can borrow at a lower interest rate.

We now compare the dotted line (partial integration) with the continuous line (market integration). They illustrate how the introduction of Stablecoins impacts the interest rate. When the size of DiEco is small, the introduction of Stablecoins further increases the US exorbitant privilege. This is shown by the fact that the interest rate becomes even smaller than in the regime with partial integration, that is, when the US is integrated with RoW but not with DiEco. The reason is that, when DiEco is small, the production of Stablecoins is mostly backed by US bonds. Agents in DiEco creates Stablecoins but they also purchase US bonds. The increase in the demand for US bonds from DiEco then causes a reduction in the interest rate. However, as DiEco becomes bigger, the demand for US bonds from DiEco declines and this raises the interest rate. At some point, the US interest rate in the environment with market integration (continuous line) becomes higher than the interest rate without Stablecoins (dashed line).

The key message provided by the numerical example is that, as long as the digital economy remains small, Stablecoins may reinforce the exorbitant privilege of the US dollar. However, as the digital economy grows in size, the privilege starts to erode. Of course, there is no assurance that the digital economy will keep growing. However, it is not an unplausible outcome.

6 Conclusion

Thanks to its proven stability, the US dollar is at the center of the international financial system, serving both as a means of payment and as a store of value. We explored whether the growth of a digital economy and Stablecoins in particular, could impact the international role of the US dollar. We have shown that this depends on the size of the digital economy. When the digital economy is small, the introduction of Stablecoins could reinforce the privileged role of the Dollar. However, as the digital economy expands, the privileged position of the Dollar may start to weaken.

Is the expansion of the digital economy welfare improving? On a global prospective the answer could be positive. This is because the expansion of the digital economy creates more safe assets which provide insurance. This can be seen as a step that moves the economy a bit closer to an ideal economy with complete markets. However, the benefits are not symmetric. The US loses the ability to borrow cheaply and, as a result, the welfare consequences could be negative. The RoW, instead, gains the ability to diversify its portfolio with safe assets that earn a higher return. Decentralized operators would also benefit because they are able to issue liabilities that pay a lower interest rate. To fully explore the welfare consequences, however, we cannot simply compare steady states. This requires the consideration of the transitional dynamics we will explore in follow up work.

References

TO BE ADDED