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DIGITAL ECONOMY, STABLECOINS, AND THE GLOBAL FINANCIAL SYSTEM

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ABSTRACT

The rise of the Digital Economy has the potential to reshape international financial markets and the role of traditional reserve assets such as the US dollar. While the creation of Stablecoins may increase the demand for safe dollar-denominated instruments due to reserve backing requirements, they may also serve as substitutes, reducing the global demand for traditional reserve assets. We develop a multicountry model featuring the US, the rest of the world, and a distinct Digital Economy to quantify the impact of the potential expansion of the digital economy. Our results show that, in the long run, the reserve demand effect dominates the substitution effect, leading to lower US interest rates and greater US foreign borrowing. We also find that the expansion of the Digital Economy increases idiosyncratic consumption volatility in the US, while reducing it in the rest of the world.

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1 Introduction

The US government debt plays a unique role in global financial markets, acting as a reliable store of value, in addition to its liquidity role or more generally as a provider of convenience services. This translates into lower interest rates paid by T-bills and other dollar-denominated assets. In this paper we ask how the possible growth of the Digital Economy could affect the centrality of the US debt in global financial markets. Our goal is not to explore the role of digital assets as a *means of payment* but as *store of value*—that is, as financial instruments used for the allocation of savings.

The extreme volatility of digital assets, such as cryptocurrencies, limits their ability to substitute safe assets denominated in dollars or other popular reserve currencies. However, the extreme volatility of digital assets does not apply to Stablecoins. Stablecoins are a special type of cryptocurrencies designed to reduce (or even eliminate) fluctuations in their value relatively to other safe instruments such as dollar-denominated assets. Effectively, they are currencies pegged to the US dollar or other reserve currencies.

Figure 1 plots the market capitalization of the most popular Stablecoins, all pegged to the US dollar. Their total market value in 2025 exceeded 220 billion dollars, a substantial figure relative to the total market capitalization of all cryptocurrencies, which was around 3.7 trillion dollars. Still, the market capitalization of cryptocurrencies is relatively small compared to US treasuries, worth about 27 trillion dollars. However, the market for digital assets is still in its infancy and could grow significantly in the future. By 2028, the market for Stablecoins is projected to surge to around $2 trillion—driven largely by U.S.-dollar–backed tokens—and could eclipse other countries' (in particular China's) current holdings of U.S. Treasuries. This could result in higher holdings of Stablecoins than these countries will hold in U.S. government debt.[1]

An important feature of Stablecoins is that their prices (should) remain stable around the targeted peg. If the pegging asset is the US dollar, then the value of the Stablecoins should always be 1 dollar. Although there have been well-known cases of implosion—among them the case of Terra stablecoin that collapsed in May 2022—the second panel of Figure 1 shows that the prices of the most popular Stablecoins have remained stable.[2]

[1] See `https://www.forbes.com/sites/jonegilsson/2025/05/05/why-stablecoins-may-surpass-china-in-us-treasury-holdings-by-2028/"`

[2] The fact that the digital market has so far displayed significant turbulence with the

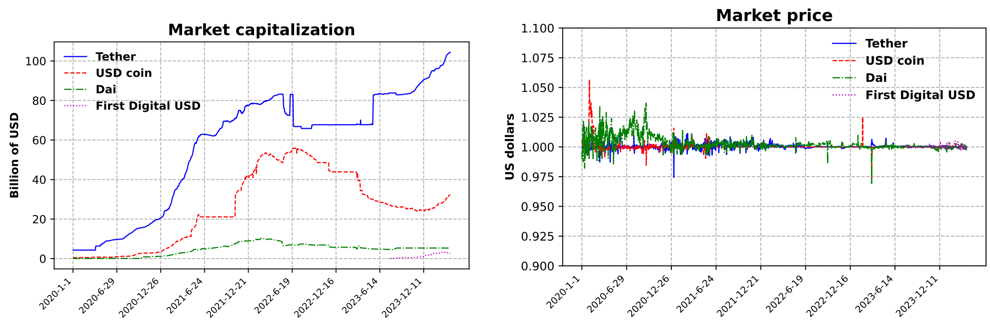

Figure 1: Market capitalization and price for major Stablecoins. *Sources*: coincodex.com

To understand the potential role of Stablecoins for international financial markets, consider the investment choices of savers in countries where the dollar plays an important role as a store of value, including developing and emerging countries. In some of these countries, savers face financial barriers to holding safe dollar assets, which translates in high transaction costs. Although some of the barriers could be related to capital controls, this is not the only reason for the high costs. Market imperfections, such as those related to the market power of financial intermediaries or limited access to standard technology, could be much more important and pervasive. The technological advances of decentralized digital markets could allow these savers to acquire and trade dollar-pegged Stablecoins with lower transaction costs and higher returns than traditional dollar-denominated assets.

There is another reason why Stablecoins could be attractive for savers. Some of the most popular dollar assets held outside the United States are US government bonds. These bonds pay lower yields because they provide convenience services. But for certain savers around the world, the convenience service provided by these bonds could be lower than for US savers. For example, foreign savers may engage less in refinancing facilities where US treasuries are used as collateral. Still, despite lower yield and convenience service, these savers choose to hold US bonds as a store of value. Arguably, this is the result of limited supply of alternative saving instruments. Sta-

creation of many competing Stablecoins, some of which have already failed and others are probably going to fail in the future, is a typical feature of a new industry. It is common for new industries to display significant turbulence initially but, eventually, they consolidate with a few dominant survivals. This is likely to be the pattern also for the new emerging Digital Economy.

blecoins could then provide an alternative saving vehicle that, as a store of value, is similar to US government bonds but could provide a higher return (net of the transaction costs) to savers.

The same consideration applies to monetary authorities around the world. Central banks hold large volumes of reserves, a large fraction of which in US dollar-denominated assets, despite their low return. Stablecoins could provide a more attractive, higher-return alternative to US dollar reserves. The incentive for some of these institutions to hold Stablecoins, rather than US treasuries, could be further enhanced by geopolitical tensions.

Of course, for Stablecoins to become an attractive alternative to traditional dollar-denominated assets, the peg must be credible. This can be achieved when Stablecoins are fully backed by safe dollar assets. In this case, the ownership of Stablecoins is effectively equivalent to the ownership of dollars. Still, due to its digital nature, Stablecoins could be more easily accessible than traditional dollar-denominated assets, either because the transaction costs are lower or they provide higher market returns. But if Stablecoins are backed by US dollars, the diffusion of Stablecoins could actually boost the demand for dollar-denominated assets as more dollar reserves are needed.

Stablecoins, however, can also be backed by other assets, including digital assets such as cryptocurrencies. In this case, Stablecoins can truly function as substitutes for US dollars, and they could possibly diminish the privileged position of the dollar in global financial markets. So, ultimately, whether the growth of Stablecoins strengthens or weakens the demand for the dollar or other reserve assets depends on the prevalence of the backing instruments: if the peg is prevalently guaranteed by dollar reserves, the demand for dollars increases; if the peg is guaranteed by other digital assets, the demand for dollars decreases. But what determines the prevalence of one type of backing assets over the other?

To understand the various forces at play, we develop a multi-country model that is representative of three countries/regions (i) the US economy, (ii) the rest of the world (RoW), and (iii) the 'Digital Economy' (DiEco). The US and RoW are traditional economies that produce physical goods and services. DiEco can be thought as a separate economy which, however, is not defined by geographical borders as traditional national economies. What defines the Digital Economy is the particular technology—the blockchain—used to produce and trade services and financial assets in a decentralized market. Conceptually, the Digital Economy functions as a standard national economy with its own currency, its own production system, and its own regulatory framework.

For the Digital Economy to have a relevant role in the world economy, it must be sizable. Although the size of DiEco is still small compared to the traditional economy, its future size could be significant. We will use the model to predict the implications of its potential growth. Although the digital growth could be driven by many factors, we focus on one specific factor: the extent to which agents in the traditional economy become familiar and comfortable transacting and doing business with the Digital Economy. We formalize this process using a learning mechanism akin to the epidemic SIR model: as more agents interact with and become accustomed to the Digital Economy, the likelihood that others do the same increases, mirroring the contagion dynamics of an infection.

As more agents become accustomed to the Digital Economy, they will consider adding digital assets in their saving portfolio. This increases the demand for digital assets—a consequence of the digital diffusion we refer to as the 'financial demand' channel. At the same time, agents might also consider purchasing certain services, such as financial intermediation services, that are produced in the Digital Economy rather than in the traditional economy. This increases the demand for digital production—a consequence of the digital diffusion we refer to as the 'real demand' channel.

Through the 'financial demand' channel, the expansion of the Digital Economy induces lower US interest rates and larger global imbalances, that is, higher US foreign borrowing. The 'real demand' channel, instead, leads to higher US interest rates and lower US foreign borrowing. In both cases, however, the supply of Stablecoins increases, but the implication for financial risk-taking differs. While the 'financial demand' channel induces riskier financial portfolios in the US and in the rest of the world (they contain a larger share of risky assets), the 'real demand' channel leads to safer portfolios (they contain a lower share of risky assets). The simulation of the model shows that the 'financial demand' channel dominates the 'real demand' channel in the long-run. As a result, the long-run US interest rate declines while global imbalances rise. The quantitative exercise also shows that the growth of the Digital Economy will be associated with greater idiosyncratic consumption volatility in the US but lower idiosyncratic consumption volatility in the Rest of the World.

1.1 Literature review

In many contributions to the literature, the fundamental value of crypto derives from its use as a medium of exchange as in Schilling and Uhlig (2018). The transactional service is also central to the model developed by Athey et al. (2016), which highlights the use of Bitcoins for remittances. Biais et al. (2023) emphasize the transactional value of cryptocurrencies that derives from facilitating cross-border transfers in regions with capital controls or unreliable banking systems compared to traditional money. Empirical evidence of the latter is provided by von Luckner et al. (2023), who document the use of crypto to move capital across borders and exchange one fiat currency for another.

In our model, the value of crypto derives from being an input of production. Crypto also acts, indirectly, as a collateral for the issuance of Stablecoins, that is, fixed income liabilities issued by the owners of non-stable cryptocurrencies. For the buyer, Stablecoins are safe assets, which emphasize their importance as store of value (as opposed to means of payment).

There is a growing scholarly interest in Stablecoins. Existing studies cover a range of topics going from the comparison of Stablecoins to traditional financial market instruments to characterizing their arbitrage role within the wider crypto market. Eichengreen (2019) describes the key properties of Stablecoins, while Makarov and Schoar (2022) and Lyons and Viswanath-Natraj (2023) analyze their arbitrage dynamics. There is also a body of theoretical contributions that analyze the possibility of speculative risks such as Cong et al. (2022) and Routledge and Zetlin-Jones (2022). Gorton et al. (2022) study how Stablecoins achieve relative price stability despite the potential for runs. See also Carapella et al. (2022) and Azar et al. (2022) for a descriptive analysis of financial stability in the broader market for digital assets. Although runs are indeed real possibilities, for simplicity we abstract from speculative attacks in our model and assume that Stablecoins are risk-free.

Another important branch of related literature studies the implications of central bank digital currency (CBDC).[3] Economically, CBDC is still fiat money regulated by a centralized institution (the central bank) and Stable-

[3]Examples include Auer et al. (2022), Andolfatto (2021), Barrdear and Kumhof (2022), Böser and Gersbach (2020), Brunnermeier and Niepelt (2019), Chiu et al. (2019), Davoodalhosseini (2022), Fernández-Villaverde et al. (2021), Garratt and Van Oordt (2021), Keister and Sanches (2023), Niepelt (2020), Paul et al. (2024), Whited et al. (2022).

coins are additional to CBDC. As a reserve asset that backs up Stablecoins, the digital currency issued by the US central bank will play the same role as more traditional dollar-denominated safe assets.

Jermann (2023) develops a macro-finance model for the supply of digital money that formalizes some of the most salient features of the Ethereum blockchain. We share the view, formalized in the model, that the Digital Economy represents a distinct ecosystem with his own currency. Our paper integrates the Digital Economy in a more general Non-digital Economy and we study the implications beyond money supply and crypto valuation.

While most of the contributions in the literature have studied the digital market in closed economies, recent research have used two-country models. For instance, Benigno et al. (2022) explores the competition between interest-bearing bonds and money as a store of value to understand how Stablecoins impact monetary policies in individual countries. Le et al. (2023) introduces a New Keynesian model to assess how Stablecoins issued abroad influence the monetary policy of a smaller, developing economy. The findings indicate that Stablecoins not only improve liquidity and offer a hedge against inflation for local users but also encourage currency substitution, leading to 'digital dollarization' (see Brunnermeier et al. (2019)). This disrupts banking intermediation and diminishes the effectiveness of domestic monetary policy. Ferrari-Minesso et al. (2022) consider a two-country DSGE model where central bank digital currencies increase international linkages and amplify international spillovers shocks.

The aim of this paper is not to study the implications of the Digital Economy for monetary policy, but rather to examine its transitional and long-run effects as a provider of digital services and new saving instruments. In this respect, our analysis contributes to the literature on the global shortage of safe assets. We view the expansion of the Digital Economy—and Stablecoins in particular—as a potential mechanism for alleviating this shortage, with heterogeneous implications across countries.

2 Overview of Digital Economy

We provide a brief overview of how the Digital Economy operates and how Stablecoins are created. This is important to motivate some of the modeling choices made in the construction of the theoretical framework. It is useful to start with a quick description of a 'blockchain' since this is the technology underlying the operation of the Digital Economy.

2.1 Blockchains and digital production

A blockchain is a decentralized public ledger (database) that is concurrently maintained across multiple networked computers. It stores data in sequential units called 'blocks.' Any valid transaction, for example, the transfer of cryptocurrency from one user's account to another, is included in a block. A newly formed block containing a certain number of transactions will be added to previous blocks sequentially (forming a chain) in a way that is secure and immutable. It is the addition of the newly formed block to the existing chain that makes the included transactions definitive and unchangeable.

Computers actively linked to the network, called 'nodes', are in competition to validate and add a new block of transactions in return for a reward (compensation). The provision of validation services, however, is also costly. Both costs and rewards depend on the particular protocol—that is, the rules—used by the specific blockchain to select the node eligible to add a block to the chain. The most common protocols are Proof-of-Work (PoW) and Proof-of-Stake (PoS). Before a new block can be added to the chain, the network must reach a consensus that the selected node is legitimately chosen and the transactions included in the proposed block are valid.

The two largest and well known blockchains are Bitcoin and Ethereum. Bitcoin blockchain was launched in 2009 and was designed primarily as a system that governs its own cryptocurrency, BTC. The Ethereum blockchain was created in 2015 with a broader scope that goes beyond the governance of its native cryptocurrency, ETH (Ether). It has the ability to host decentralized applications (dApps) capable of providing a variety of services with the validation and execution of smart contracts.

Digital production. An important point to keep in mind is that DiEco is a production economy and often referred to as 'ecosystem'. It resembles a traditional economy in the sense of using production inputs—labor and capital—to produce services traded in the marketplace. An example is the provision matching services for the short-term lease of an apartment. This is done through decentralized applications (dApps) governed by smart contracts, and they play a similar role as traditional real estate agents. Once a match arises, the lease is executed by transferring a digital key that allows the lessee to enter the apartment, and by transferring Crypto (one of the official currencies of the ecosystem) from the account of the lessee to the account of the lessor. Production inputs are needed to execute these operations and the associated fees paid to execute these transactions provide a way to quantify the value of these services.

Differently from traditional economies, physical location is irrelevant because services are produced digitally. Hence, our reference to the 'Digital Economy'. The absence of national borders implies that there is no central government dictating the rules of the game. Governments, of course, can impose restrictions on the participation of their own citizens. However, the market cannot be fully regulated unless all countries in the world coordinate their policies.

The size of the Digital Economy is important for determining the impact on the (traditional) world economy. It would be useful, then, to have some estimates of the economic size of the Digital Economy. For this purpose, we focus on the Ethereum network because of its broader functionality: it is not limited to a pure payment system (like Bitcoin) but it provides a platform for executing a multitude of transactions. The Ethereum ecosystem has the ability to host decentralized applications (dApps) that can provide (that is, produce) a multitude of services to users with self-executing contractual agreements as in the above example of a short-term lease. Since all transactions executed in the network are recorded in the blockchain, it is possible to come up with a measure of production by aggregating the overall amount of fees paid to validate and execute transactions.

The first panel of Figure 2 plots the monthly transaction fees paid by users for the validation and execution of their transactions. It is important to point out that this is only a partial measure of production because the validation fees do not include the more direct fees that are paid for the provision of services associated with the transaction. For example, if a user exchanges Tethers for Bitcoins in a DEX (decentralized exchange), the user pays directly (or indirectly) a fee to the DEX similar to the fee that we would pay to exchange Dollars for Euros in a bank. In the traditional economy, that fee contributes to the value added of the banks and, by the same token, the fee paid to the DEX contributes to the value added created by the Digital Economy. In addition to this direct fee, the user pays the network fees for the validation of the transaction. The data plotted in Figure 2 includes only the validation fees, not the direct fees.

In 2023, total transaction fees on the Ethereum network amounted to \$2.4 billion—approximately 0.0023% of global GDP. While this suggests that

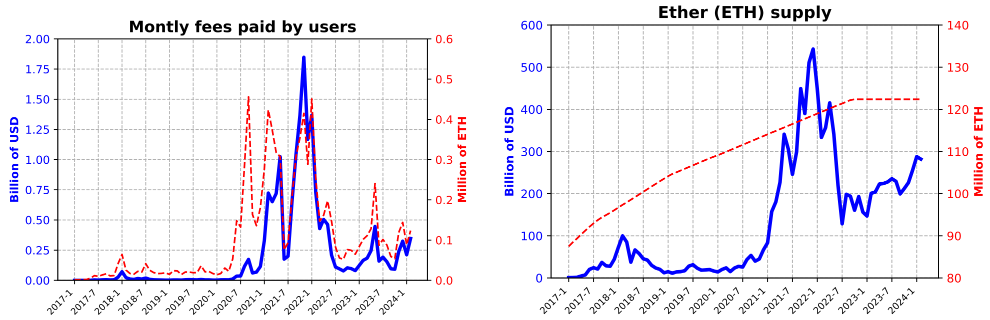

Figure 2: Ethereum monthly transaction fees paid by users (left) and Ether supply (right). *Sources*: Authors' computation using data from Etherscan.

Ethereum's measured production is still modest relative to the size of the world economy, it is important to note that Ethereum is just one of several active blockchains in the Digital Economy. Moreover, many transactions and associated fees occur off-chain and are not captured in our measure. As previously noted, our estimate also excludes the direct fees paid by users to decentralized applications.

The total market value of Ether, Ethereum's native cryptocurrency, is shown in the second panel of Figure 2. In 2023, it exceeded $400 billion, representing roughly 15% of the overall cryptocurrency market capitalization. While this figure is small relative to the outstanding stock of US Treasuries, it is not negligible. Although the Digital Economy remains modest in size today, it is still in its early stages and has the potential for significant future growth. This paper seeks to explore the global financial implications of such a digital expansion.

Crypto as a production input. In September 2022, Ethereum changed the validation protocol from Proof-of-Work (PoW) to Proof-of-Stake (PoS). With the new validation system, validators earn fees upon verification of the validity and authenticity of the transactions based on the wealth they can lock in the system (staking). Validators that lock more wealth—either because they own it directly or it was delegated to them—earn more fees paid by users. Since the wealth used to earn validation fees must be in ETH, the Etherium native currency is essentially an input of production for validation services.[4]

Figure 3 plots some variables related to staking in the Ethereum blockchain. The first panel shows the quantity of ETH locked in by validators. The series start in October 2022, after the change of the validation system from PoW to PoS. The amount of staked ETH has increased significantly since then, both in units of ETH (red dashed line) and in dollar value (solid blue line). Even though the supply of ETH grew over this period (recall Figure 2), the amount of staked ETH grew even faster, as we can see from the left panel of Figure 3. In march 2024, 33% of the total ETH supply was locked for validation purposes.

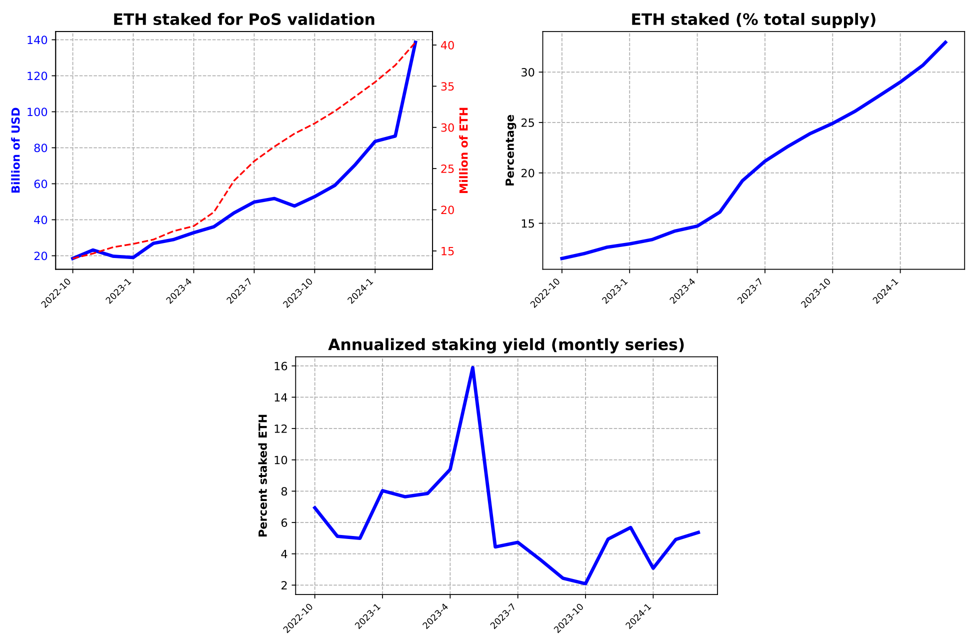

Figure 3: Ethereum staking and yield. *Sources*: Authors' computation using data from Etherscan.

The last panel shows the staking yield. This is calculated as the ratio of dollar fees paid by Ethereum users to validators and the dollar value of

[4]Validators are entrepreneurs or more generally businesses that use labor, physical capital (computers) and financial capital (staked ETH) to produce validation services. With the Proof-of-Stake, the importance of financial capital has become the most important input. In return for their services, validators earn fees paid by users and, in some cases, they receive newly created ETH.

staked ETH. The graph plots the monthly series where the fees are the sum of all fees paid during the month and the staked ETH are measured at the beginning of the month. The monthly yield, denoted by y_m, is annualized using the compounding formula $(1 + y_m)^{12} - 1$.

The yield displays a great deal of variation, but on average is close to 5% annually. There are also direct costs that validators incur such as the user cost of computers. However, after the shift to the PoS protocol, these costs have dropped dramatically. So we can interpret the yield as a proxy for the marginal product of ETH in the production of validation services.

It is important to emphasize that our measure of yield does not include capital gains which, of course, could be very important in determining the effective return of ETH. The measure of yield is close to the inverse of the price-earning ratio, commonly used to assess the valuation of a corporation.

To sum up. Based on this brief overview, it should be clear that (i) the Ethereum network is a production economy and (ii) its native cryptocurrency, Ether, is a form of financial capital that enters as an input of the production function (in addition to be a unit of account, a means of payment, and a store of value in the Ethereum ecosystem). This will be important for motivating the particular design of the theoretical model.

2.2 Creation of Stablecoins

Stablecoins are liabilities issued by some entities with their value pegged to an underlying asset. We focus on Stablecoins pegged to the US dollar. This implies that one unit of a Stablecoin should always be redeemable for one dollar. To insure redeemability, the issuer must hold reserve assets whose value is at least the value of the issued Stablecoins.

At the cost of oversimplifying, we outline two mechanisms that would guarantee redeemability. In the first mechanism, the pegged value is maintained by holding the same quantity of dollar reserves as the number of Stablecoins. In the second, Stablecoins are over-collateralized with crypto assets. Because the dollar value of Crypto is not constant, the over-collateralization guarantees that the value of reserves does not fall below the pegged value of Stablecoins. Although there are other mechanisms such as the arbitrage algorithm used for Terra, the two described here are the most common.

Backed with dollar reserves. In this case, Stablecoins are created by keeping the same or similar amount of dollars in a locked account. The balance sheet of the issuer is illustrated in Figure 4. On the left-hand-side there are dollar-denominated assets; on the right-hand-side there is the same dollar value of Stablecoins which, for the issuer, are liabilities. The issuer can transfer the Stablecoins to other users. Whoever receives the Stablecoins can redeem them for dollars at any time. Until the Stablecoins are redeemed (burned), the dollar assets remain locked and cannot be withdrawn for alternative uses.

ASSETS	**LIABILITIES**
Dollar assets	Stablecoins

Figure 4: Balance-sheet when stablecoins are backed one-to-one with dollars.

This is the mechanism underlying two of the most popular Stablecoins in terms of volume: Tether and USDC. Provided that the mechanism is enforced—that is, the dollar deposits are not withdrawn for alternative uses and the reserves are kept in safe dollar assets—the value of Stablecoins should always be 1 dollar.

Being safe, dollar-denominated assets earn low returns. Assets that pay higher returns could be more attractive, but they would endanger the stability of the peg: capital losses could deplete the value of the reserves below the pegged value of the issued Stablecoins.[5]

Backed with Crypto assets. An alternative mechanism to create Stablecoins is by holding reserves in Crypto assets. In this case, the issuer faces a balance-sheet mismatch where the denomination of assets differs from the denomination of its liabilities. Because the market value of Crypto fluctuates significantly over time, Stablecoins must be over-collateralized. Thus, for each Stablecoin, the issuer holds Crypto for a value that exceeds 1 dollar. The balance sheet of the issuer is shown in Figure 5. Since the value of assets is greater than the value of liabilities (Stablecoins), the difference represents the equity owned by the issuer.

[5] Reports in the media have questioned the safety of Tether's reserves, something that is difficult to fully verify given the limited disclosure requirements for crypto operators. Until now, however, Tether has remained stable as shown by Figure 1.

ASSETS	LIABILITIES
Crypto assets	Stablecoins
	Equity

Figure 5: Balance-sheet when Stablecoins are over-collateralized with Crypto.

The decentralized application MakerDao is an example Stablecoins backed by over-collaterilized Crypto reserves. Anyone with a digital portfolio linked to MakerDao can create units of a Stablecoin called DAI. The user deposits an amount of digital coins such as ETH and then borrows an amount of DAI up to a pre-specified fraction of the market value of deposit. For example, if the deposited value of ETHs is worth 300 dollars, the DAI debt may not exceed 100 dollars. Over time, if the market price of an ETH declines, the user needs to repay some of the debt or deposit additional ETHs. Failing to do so triggers forced liquidations.

To sum up. There are two main mechanisms that allow the creation of Stablecoins: (i) One-to-one backing with dollar-denominated assets; (ii) Over-collateralization with Crypto. Both mechanisms will be embedded in the theoretical model we will describe in the next section. Before doing so, however, we would like to emphasize that, while the mechanism based on dollar reserves does not involve a significant risk for the issuer, the mechanism based on Crypto backing carries significant risks. The Stablecoin issuer takes a risky leveraged position. Whoever acquires the newly created Stablecoins, instead, holds a safe asset. Thus, the issuer of Stablecoins provides insurance to the Stablecoins' holders by taking more risk itself. This is an important feature of our theoretical model.[6]

[6]It is worth noting that the issuance of Stablecoins is similar to bank intermediation where banks issues assets and liabilities that are not perfectly matched in terms of risk. An important difference, however, is that traditional banks are subject to extensive regulation that does not apply to the issuers of Stablecoins. This raises an important concern for the stability of the whole system.

3 Model

There are three countries/regions in the model: The United States (US), the Rest of the World (RoW), and the Digital Economy (DiEco). As discussed earlier, we think of the Digital Economy as a distinct economy with its own currency. What defines the Digital Economy, however, are not the geographical borders but the technological platform at the basis of its operations—the blockchain. In some sense, the blockchain plays the role that the geographical territory plays in defining a national economy.

3.1 Digital economy

The Digital Economy is populated by a continuum of agents that maximize the expected lifetime utility from consumption

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

The population of DiEco consists of agents whose primary economic interest is in the Digital Economy. The variable c_t is a consumption basket that aggregates two types of goods or services, $c_{D,t}$ and $c_{N,t}$ according to

$$c_t = c_{D,t}^{\alpha} c_{N,t}^{1-\alpha}.$$

Goods $c_{N,t}$ are produced only in the Non-digital economy (US and RoW), while goods $c_{D,t}$ are produced in both the Digital and Non-digital economies. The idea is that certain goods and services, such as automobiles and haircuts, can be produced only in the Non-digital economy. However, there are services that can be produced also digitally in DiEco, in alternative to those produced in the traditional economy. For example, financial intermediation services could be provided by decentralized applications in alternative to traditional banks. From now on, we will use the term 'goods' to indicate both goods and services.

Although D-goods produced in the digital economy are perfectly substitutable to D-goods produced in the traditional economy, their relative price could be different from 1. As we will describe below, this follows from a market segmentation in which agents may not have access to all markets.

Throughout the paper we will use the N-good as numeraire and denote by e_t the relative price of D-goods produced in DiEco (real exchange rate).

DiEco's agents consume both D-goods and N-goods. Since N-goods are not produced in the Digital Economy, DiEco's agents must import them from the traditional economy, while they can export part of the produced D-goods. The cost of the consumption basket in units of N-goods is $m_t = e_t c_{D,t} + c_{N,t}$.

The first order conditions for the optimal choice of the two goods return

$$\frac{c_{N,t}}{c_{D,t}} = \left(\frac{1-\alpha}{\alpha}\right) e_t.$$

Thus, DiEco's agents allocate a constant share α of consumption expenditures to D-goods, that is, $e_t c_{D,t} = \alpha m_t$.

There is a fixed stock K of Crypto, traded only by the residents of DiEco at price p_t. In reality, Cryptocurrencies are reproducible. However, this is not important for the particular question addressed in this paper. What matters is the total market value of Crypto, not its physical quantity. A higher supply would be reflected in a lower market price of Crypto, keeping its total value unchanged.

DiEco's production: DiEco produces only D-goods. Production takes place through the validation of digital transactions where Crypto is a staking input. With the PoS protocol, staking is effectively a working capital constraint: to provide x_t units of validation services, validators must satisfy the constraint

$$x_t \leq \omega p_t k_t.$$

The left-hand-side is the services produced by validators. The right-hand-side is the capacity constraint determined by the financial wealth staked by DiEco's agents (the quantity of Crypto multiplied by its price). The staked wealth is scaled by the parameter ω.[7]

The actual revenue earned by an individual agent is subject to an exogenous idiosyncratic shock z_t. The idiosyncratic shock could capture, among other things, the fact that the revenues from staking are uncertain: two validators that stake the same value of Crypto could receive different rewards. Thus, the revenue earned by an individual agent is $z_t e_t x_t$, where e_t is the market price for one unit of x_t (in units of N-goods) and z_t is the idiosyncratic

[7]Not all Cryptocurrencies are staked to produce validation services. Another use of Cryptocurrencies is for transaction purposes within the Digital Economy. For example, to pay for the digital services provided by a dApp, agents need Ether. This is similar to a cash-in-advance constraint.

shock. The aggregation over all agents, however, washes out the idiosyncratic shock which in aggregate is always equal to 1.

The model described so far features a close link between the price of services produced by the Digital Economy, e_t, and the price of Crypto, p_t. As the demand for D-goods produced in DiEco rises, the price e_t increases, which in turn raises the rewards from staking. This makes Crypto more valuable, increasing its price p_t. The demand for D-goods produced by DiEco comes in part from DiEco's residents, and in part from residents of the Non-digital economy, US and RoW, as we will describe below.

Stablecoins and financial markets: In addition to holding Crypto and using it in production, DiEco's residents can issue digital liabilities s_t. Each unit of liabilities is sold at price $1/R_t^S$ and pays back 1 unit in the next period. Price and repayment are both denominated in units of the numeraire (N-goods). Since the repayment is fixed in units of the numeraire, the value of the liabilities is stable and we refer to s_t are Stablecoins.[8] Differently from Crypto, Stablecoins can also be sold to residents of the Non-digital economy—US and RoW.

DiEco's residents can also hold foreign bonds, that is, liabilities issued by the US or RoW. However, without loss of generality, we focus on DiEco's holding of US bonds, which we denote by f_t (initial for 'foreign' bonds). These are also riskless assets: each unit purchased at price $1/R^{US}$ with promise to repay 1 in the next period, both in units of N-goods.

If $R_t^S < R_t^{US}$, DiEco's agents could arbitrage the purchase of US bonds f_t, with the issuance of liabilities s_t. This implies that in equilibrium R_t^S cannot be smaller than R_t^{US}. Thus, we limit the analysis to $R_t^S \geq R_t^{US}$, and DiEco will not hold US bonds if the inequality is strict, that is, $R_t^S > R_t^{US}$.

The budget constraint for a DiEco's agent, in units of N-goods, is

$$m_t + p_t k_{t+1} + \frac{f_{t+1}}{R_t^{US}} - \frac{s_{t+1}}{R_t^S} = p_t k_t + e_t z_t x_t + f_t - s_t,$$

where $m_t = e_t c_{D,t} + c_{T,t}$ denotes consumption expenditures and $e_t z_t x_t$ is the unit payout from Crypto staking. Since in equilibrium the working capital

[8] In reality, issuers of Stablecoins do not pay interest. However, holders of Stablecoins have various options to earn a return in the Digital Economy. For example, they could lend them through a decentralized application (DAO) such as Aave or Compound. The interest rate R_t^S in our model captures the various returns that Stablecoins holders earn by redeploying them in the ecosystem.

constraint is satisfied with equality, we have that $x_t = \omega p_t k_t$.

Define $a_t = (1+e_t z_t \omega)p_t k_t + f_t - s_t$ the end-of-period wealth in units of N-goods, before consumption. The following lemma characterizes the optimal policies chosen by DiEco's residents.

Lemma 3.1 *Given end-of-period wealth a_t and sequence of prices $\{p_t, R_t^{US}, R_t^S\}_{t=0}^{\infty}$, the optimal policies chosen by DiEco's agents are*

$$m_t = (1-\beta)a_t,$$
$$p_t k_{t+1} = \phi_t \beta a_t,$$
$$\frac{f_{t+1} - s_{t+1}}{R_t^S} = (1-\phi_t)\beta a_t,$$

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

$$\mathbb{E}_t \left[\frac{R_t^S}{\phi_t \left(\frac{(1+e_{t+1}/\omega)p_{t+1}}{p_t} \right) + (1-\phi_t) \cdot R_t^S} \right] = 1.$$

A fraction $1-\beta$ of the end-of-period wealth is spent in consumption. Then, What remains after consumption, a fraction ϕ_t is allocated to Crypto and the remaining fraction $1-\phi_t$ is allocated to fixed income assets (US bonds net of Stablecoins). When $R_t^S > R_t^{US}$, the return from Stablecoins dominates the return from US bonds. In this case f_{t+1} will be zero since DiEco's agents cannot short US bonds. If f_{t+1} and s_{t+1} pay the same returns, however, US bonds and Stablecoins are economically indistinguishable for DiEco's agents and they will be indifferent between holding one or the other. While $f_{t+1} - s_{t+1}$ is determined for an individual agent, its composition is not: purchasing an extra unit of US bonds and funding it with Stablecoins does not affect individual income, wealth and riskiness of the portfolio.

Optimal portfolio choice: To grasp some intuition about the portfolio choices made by DiEco's agents, we provide here a numerical overview of how these choices are affected by some key variables and parameters.

Figure 6 shows the consolidated balance-sheet of DiEco's agents in the steady state equilibrium of the calibrated model. The aggregate balance sheet can be interpreted as the consolidation of the two balance sheets shown in Figures 4 and 5. The steady state numbers replicate the quantities observed in the data since they are used as targets for the calibration of the model (as we will describe in Section 4).

ASSETS	LIABILITIES
Crypto (2,500 billion)	Stablecoins (252 billion)
US bonds (203 billion)	Equity (2,451 billion)

Figure 6: Equilibrium balance-sheet in DiEco for calibrated parameters.

Starting from the baseline calibration, we explore how the portfolio choices made by DiEco's agents change in response to three variables: (i) the relative price of D-goods produced in DiEco (exchange rate); (ii) volatility of the idiosyncratic shock in DiEco; (iii) interest rate on Stablecoins.

The goal here is not to explore the general equilibrium impact of these changes but how individual portfolios react to these changes. Keeping this in mind, the portfolio responses are computed under the assumption that the interest rate on US bonds is equal to the interest rate on Stablecoins, and the holding of US bonds does not change. Keeping the same holding of US bonds is not sub-optimal when the interest rate on Stablecoins is equal to the interest rate on US bonds, that is, $R^S = R^{US}$. Furthermore, the responses to (i) and (ii) are computed under the assumption that the interest rate on Stablecoins remains constant. However, the price of Crypto must adjust to clear the market since Crypto is traded only locally. This is important because the price of Crypto affects the agents' wealth, which in turn affects the issuance of Stablecoins.[9]

Section (a) in Figure 7 shows how the change in the price of D-goods produced in DiEco, the variable e_t, affects three variables: Crypto price, supply of Stablecoins, and dollar reserve ratio. The dollar reserve ratio is computed by dividing the holdings of US bonds by the value of Stablecoins.

A higher price of D-goods is associated with a higher market price of Crypto. This is intuitive since the price of Crypto is the discounted value of production flows. If the value of production increases, the value of Crypto must also increase. The second panel shows that the supply of Stablecoins

[9] The experiment can be interpreted as conducted in a small open economy. Since DiEco is a small economy, the foreign demand for Stablecoins issued by DiEco and the foreign supply of US bonds are perfectly elastic. Instead, the price of Crypto must adjust to clear the market because Crypto is traded only locally. When we consider a change in the interest rate on Stablecoins, case (iii), we can interpret the impulse response as driven by a change in the US interest rate.

increases with e_t. Agents become wealthier since Crypto is worth more. Because of their higher wealth, they rescale their portfolio by holding more assets but also more liabilities (Stablecoins).

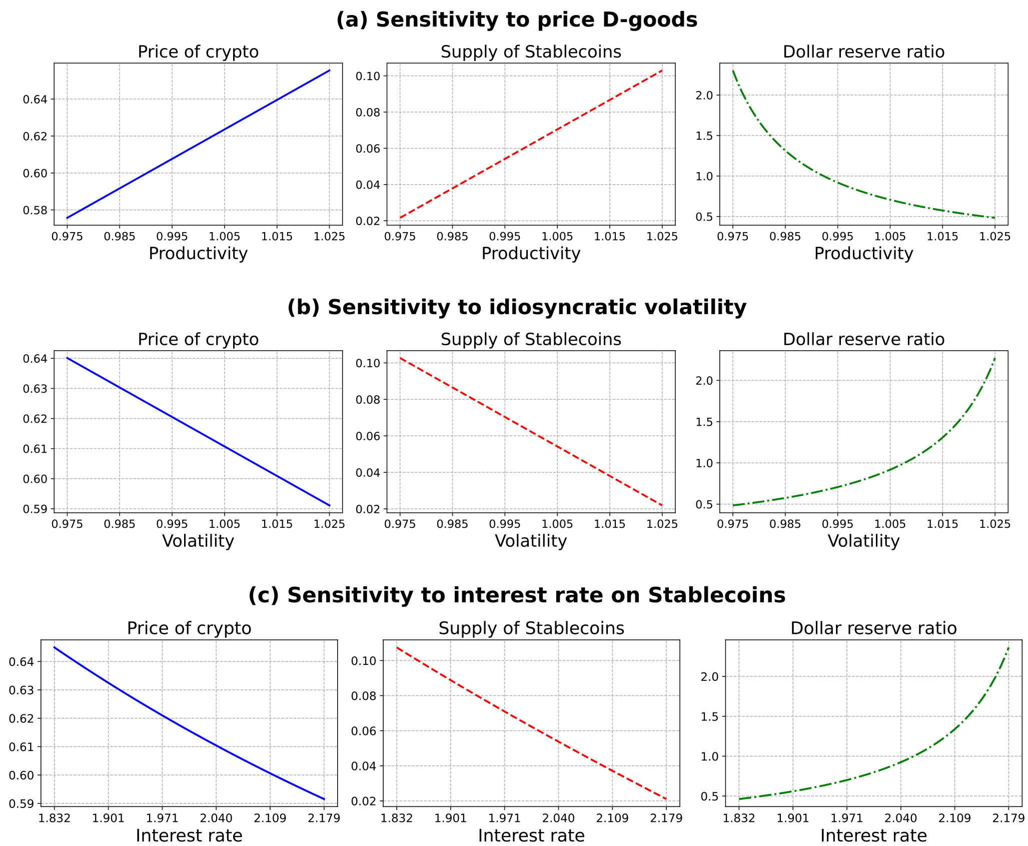

Figure 7: Portfolio sensitivity to productivity, volatility and interest rate.

We now consider changes in the idiosyncratic risk. Section (b) in Figure 7 shows the sensitivity to volatility. In the calibration we specify the distribution of the idiosyncratic shock z to be uniform. Therefore, its volatility is captured by the domain range of z. Higher volatility has a negative impact on the price of Crypto: risk aversion implies that agents now discount more heavily future cash flows generated by Crypto. The higher risk also implies that DiEco's agents issue less Stablecoins (de-leveraging), as we can see from the middle panel. As a result, a larger share of Stablecoins are now backed by US bonds.

Finally, we consider an exogenous change in the interest rate paid by Stablecoins. The interest rate on US bonds also changes so that R^{US} remains equal to R^S. As the interest rate on Stablecoins increases, DiEco's agents issue less Stablecoins. Lower leverage, then, decreases the price of Crypto since now DiEco's agents earn a lower spread between the productivity of Crypto and the cost to fund it with debt.

In summary, we have shown that a higher price of S-goods leads to greater supply of Stablecoins. Higher uncertainty or higher interest rates, instead, reduce the supply of Stablecoins. Of course, the interest rate on Stablecoins is endogenous and will be determined in general equilibrium. The analysis presented here, however, helps us understanding the general equilibrium properties we will characterize later after the description of the whole model. Before doing so, however, it will be instructive to characterize the hypothetical equilibrium in which the Digital economy is not integrated with the rest of the economy.

Financially segmented DiEco. Suppose that DiEco's agents cannot hold US bonds and cannot sell Stablecoins to neither US or RoW (financial autarky). However, they can still trade goods with the Non-digital Economy so that they can consume both goods (remember that DiEco produces only D-goods and they must import N-goods). The equilibrium with financial autarky is only hypothetical. Nevertheless, its characterization is instructive because it provides a reference point to which we can compare the environment with integrated financial markets.

With financial autarky we have that $f_{t+1} = 0$. Since Lemma 3.1 established that agents choose the same composition of portfolio, in equilibrium $s_{t+1} = 0$ for all agents. The interest rate R_t^S is then determined so that agents are indifferent between issuing or holding Stablecoins. A property of the equilibrium is that the interest rate on Stablecoins is smaller than the expected return on Crypto. This is because Crypto is risky and the expected return carries a risk premium. We state these properties formally in the next proposition.

Proposition 3.1 *In an equilibrium with financial autarky,* $s_t = 0$ *and* $R_t^S < \mathbb{E}\left\{\frac{(1+e_{t+1}z_{t+1}\omega)p_{t+1}}{p_t}\right\}$.

This is helpful for understanding whether DiEco's agents issue Stablecoins when financial markets get integrated. The sufficient condition is that agents in the US or RoW are willing to hold Stablecoins at the autarky interest rate R_t^S. If this condition is satisfied, financial integration allows foreigners to buy Stablecoins, which leads to a higher price $1/R_t^S$. Thanks to the higher price, DiEco's agents start issuing Stablecoins, that is, they will choose $s_t > 0$.

3.2 Non-digital Economy

The United States (US) and Rest of the World (RoW) are similar with one important exception we will describe below.

In both countries there is a unit mass of agents with the same preferences as DiEco's agents. They maximize the expected lifetime utility

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \ln(c_t), \qquad \text{with} \qquad c_t = c_{D,t}^{\alpha} c_{T,t}^{1-\alpha},$$

where $\beta \in (0,1)$ is the intertemporal discount factor and c_t is the aggregation of D-goods and N-goods.

Production: There is a constant supply K of non-reproducible land used in production. Land is perfectly divisible and can be traded at price p_t only domestically. An agent that owns k_t units of land produces $z_t k_t$ units of either D-goods or N-goods. The variable z_t is an idiosyncratic iid productivity shock with mean value $\bar{z}$. Since agents can produce either of the two goods with the same technology, the relative price will be 1.[10] However, the price of D-goods produced in DiEco, which we denoted by e_t, could be smaller than 1. This is possible because, as we will see, only a fraction of agents that reside in the US or RoW have access to D-goods produced in DiEco.

The only important difference between US and RoW is in the volatility of the idiosyncratic shock z_t. Agents in RoW face higher idiosyncratic volatility than US agents. This could derive from higher volatility of shocks or lower ability to insure them. In equilibrium, this assumption implies that the US has a lower net foreign asset position than RoW, consistently with the data.

Assumption 3.1 *The distribution of $z/\mathbb{E}z$ in RoW has a higher mean preserving spread than in the US.*

[10] Alternatively, we can assume that agents produce an intermediate good which is then transformed, one-to-one, in either D-goods or N-goods.

Agents' type: At any point in time, a fraction μ_t of agents in US and RoW are knowledgeable about the Digital economy and would consider purchasing D-goods from DiEco. They will do so only if D-goods are cheaper in DiEco, that is, $e_t < 1$. They also would consider the purchase of Stablecoins in the allocation of their savings. We refer to these agents as 'accustomed'.

The remaining fraction $1-\mu_t$ of agents, instead, are unfamiliar or skeptical about the Digital economy. Because of this, they do not purchase D-goods from DiEco, even if they are cheaper than in the US or RoW ($e_t < 1$). These agents are also unfamiliar or skeptical about the viability of digital assets and, therefore, they do not hold Stablecoins. We refer to these agents as 'unaccustomed'.

The status of an agent—accustomed or unaccustomed—could change over time. Agents who are unaccustomed at $t-1$ become accustomed at t with probability θ_t. Agents who are accustomed at $t-1$ become unaccustomed at t with probability δ. Based on these assumptions, the fraction of accustomed agents evolves according to

$$\mu_t = (1-\delta)\mu_{t-1} + \theta_t(1-\mu_{t-1}).$$

If the probability of becoming accustomed θ_t is constant, the fraction of accustomed agents will converge to the steady state $\mu = \theta/(\delta+\theta)$. However, borrowing from the SIR epidemic model, the probability θ_t is a function of the current stock of accustomed agents μ_t ('contagious' agents). In particular, we assume that θ_t ('contagion' or learning probability) is determined by the function

$$\theta_t = 1 - e^{-\frac{\mu_{t-1}}{1-\mu_{t-1}}}.$$

This formulation posits that the probability of becoming accustomed is low when there are few accustomed agents. However, as the fraction of accustomed agents μ_t increases, the learning probability rises.

Changes in μ_t play a very important role for the dynamics of the model: As the fraction of accustomed agents increases, the demand for D-goods produced by DiEco and the demand for Stablecoins both rise.

Financial markets: In the US and RoW there is a government that issues public debt $B_{t+1} \geq 0$ at price $1/R_t$. The government also raises lump-sum taxes T_t paid by domestic residents. Their budget constraint is $B_t = \frac{B_{t+1}}{R_t} + T_t$. Bonds can be sold to domestic and/or foreign agents, including DiEco's residents. 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. Agents in both countries can also hold Stablecoins s_t, that is, liabilities issued by DiEco's agents (as described earlier).

An important assumption is that the holdings of foreign government bonds is costly.

Assumption 3.2 *US and RoW incur the cost $\varphi(F_{t+1})\frac{f_{t+1}}{R_t^*}$ to hold foreign bonds, but there is no cost to hold Stablecoins.*

The assumption that the function $\varphi(.)$ depends on *aggregate* foreign holdings, as opposed to individual holdings, simplifies the analysis but it is not essential for the key properties of the model. For the moment we only impose that $\varphi(.)$ is positive, non-decreasing in $F_{t+1} > 0$, and satisfies $\varphi(0) = 0$. As a special case, the function could be constant or strictly increasing and convex. The star superscript on the interest rate indicates the foreign country.

There are different ways to justify the financial cost. One interpretation is that bond holdings require the service of financial intermediaries that charges management or transaction fees. For certain countries it could be related to capital controls that limit access to foreign investments. However, capital controls are not the only factor determining this cost. Fees charged by financial intermediaries could be much more important.

In contrast to foreign bond holdings, there is no such cost associated with holding stablecoins. The premise is that the digital economy can streamline or bypass the costly infrastructure and market power of traditional intermediaries, thereby reducing transaction costs (see Harvey et al. (2021) for further discussion). Nevertheless, it takes time for agents to become familiar with and develop trust in the new system before they are willing to substitute traditional financial assets (bonds, in the model) with digital alternatives. As noted earlier, this learning and adoption process is captured by the gradual evolution of μ_t.

Optimal policies: The agents' budget constraint differs for accustomed and unaccustomed agents. For accustomed agents we have

$$m_t + p_t k_{t+1} + \frac{d_{t+1}}{R_t} + \frac{[1+\varphi(F_{t+1})]f_{t+1}}{R_t^*} + \frac{s_{t+1}}{R_t^S} + T_t \; = \\ (z_t + p_t)k_t + d_t + f_t + s_t,$$

where $m_t = e_t c_{D,t} + c_{T,t}$ denotes consumption expenditures, R_t is the domestic interest rate, R_t^S the interest rate paid by Stablecoins, and R_t^* the interest rate on foreign bonds. For a US agent, R_t^* is the interest rate paid by government bonds issued by RoW. For an agent in RoW, R_t^* is the interest rate paid by government bonds issued by the US.

For non-accustomed agents, the budget constraint is similar but with consumption expenditures given by $m_t = c_{D,t} + c_{T,t}$ (since D-goods are purchased locally at price 1) and $s_{t+1} = 0$ (since they do not hold Stablecoins).

Define $a_t = (z_t + p_t)k_t + d_t + f_t + s_t - B_t$ the end-of-period wealth before consumption, but net of government debt B_t. Agents' decisions are characterized by the following lemma.

Lemma 3.2 *Given a_t and the sequence $\{p_t, R_t, R_t^*, R_t^S, B_{t+1}, F_{t+1}\}_{t=0}^{\infty}$, the optimal portfolio choice of accustomed agents' satisfy*

$$\begin{gathered} m_t = (1-\beta)a_t, \\ p_t k_{t+1} = \phi_t \beta a_t, \\ \tfrac{d_{t+1} - B_{t+1}}{R_t} + \tfrac{[1+\varphi(F_{t+1})]f_{t+1}}{R_t^*} + \tfrac{s_{t+1}}{R_t^S} = (1-\phi_t)\beta a_t, \end{gathered}$$

where ϕ_t solves

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

Unaccustomed agents' policies satisfy the same conditions, but with $s_{t+1} = 0$.

The lemma establishes the precise allocation of savings between land and bonds. However, for accustomed agents, it does not specify how the investment in bonds is allocated among domestic bonds, foreign bonds, and Stablecoins. If one of the returns—R_t, $R_t^*/(1+\varphi_t(F_{t+1}))$ or R_t^S—is strictly greater than the others, the agent invests only in the asset with the highest return—d_{t+1}, f_{t+1} or s_{t+1}. If the returns are equal, the agent is indifferent. In this case the individual composition of portfolio is undetermined. Only the aggregate portfolio composition will be determined.

Equilibrium w/o Digital Economy. Before characterizing the equilibrium with full integration, it will be useful to derive some properties of the equilibrium without the Digital Economy. In this section we focus on steady state equilibria. Since the US differs from the RoW only in the volatility of the idiosyncratic shock ($z^{US}/\mathbb{E}z^{US}$ is less volatile than $z^{RoW}/\mathbb{E}z^{RoW}$), the steady state of the integrated economy has the following properties:

- RoW holds US bonds ($F^{RoW} > 0$), but the US does not hold RoW bonds ($F^{US} = 0$).
- The US interest rate is greater than in RoW, that is, $R^{US} > R^{RoW}$.
- The US interest rate is lower than in autarky (US privilege).

These results are obtained by aggregating the agents' decisions characterized in Lemma 3.2, and imposing market clearing. The detailed derivation will be provided in the appendix.

The first property derives from the fact that higher idiosyncratic uncertainty (higher risk) induces more saving. The country that saves more (the RoW in the model) lends on net to the other country (the US in the model).

For the second property we have to consider that, if RoW holds both domestic and US bonds, their net returns must be equalized. But since the holding of US bonds implies a cost, agents in RoW will hold them only if US bonds pay a higher interest rate than the interest rate paid by RoW bonds (so that, net of the financial cost, the returns on US and RoW bonds are equalized).

This feature may appear inconsistent with the data, as the prevailing view is that the US pays a lower interest rate. However, a meaningful comparison requires using instruments that are perfect substitutes—an extremely difficult task, particularly for emerging and developing economies. As a result, the available data often involve comparisons between instruments that are not fully equivalent, leading to the mistaken conclusion that US real interest rates are systematically lower than those abroad. The correct interpretation of the exorbitant privilege is that financial integration enables the US to borrow at a lower interest rate than it would in a closed economy where the rest of the world cannot purchase US debt. This is precisely what the third property captures. Our model reflects the exorbitant privilege by showing that the US pays a lower interest rate than it would in the absence of global financial integration.

3.3 Fully integrated world economy

We now consider the fully integrated economy in which accustomed agents in the US and RoW can hold Stablecoins issued by DiEco, and DiEco's agents can hold bonds issued by the US and RoW. The following proposition characterizes some of the steady state properties.

Proposition 3.2 *In a steady state equilibrium:*

(i) RoW holds US bonds ($F^{RoW} > 0$), but not viceversa ($F^{US} = 0$).

(ii) The interest rates on US and RoW bonds satisfy

$$\frac{R^{US}}{1 + \varphi(F^{RoW})} = R^{RoW}.$$

(iii) The interest rates on Stablecoins and US bonds satisfy

$$R^S \geq R^{US}, \qquad (= \text{ if } F^{DiEco} > 0).$$

(iv) Accustomed agents in RoW hold Stablecoins but not RoW bonds.

(v) Accustomed agents in US are indifferent between Stablecoins and US bonds if $R^S = R^{US}$. They hold only Stablecoins if $R^S > R^{US}$.

Proof 3.1 *The first property derives from the assumption that RoW agents face higher idiosyncratic uncertainty than US agents. The second property derives from the arbitrage of ROW. The left-hand-side is the return from holding US bonds and the right-hand-side is the return from holding domestic bonds. Since $F^{RoW} > 0$, agents in RoW hold both domestic and foreign bonds and, therefore, their returns must be equal. The relation between R^S and R^{US} derives from the arbitrage of DiEco's agents. They could issue liabilities (Stablecoins) that pay R^S and invest in US bonds. They will choose to do so only if $R^S = R^{US}$. In this case accustomed agents in US are indifferent between holding US bonds and Stablecoins. However, if $R^S > R^{US}$, DiEco's agents do not hold US bonds since the return is lower than the cost of liabilities issued to fund them, and accustomed agents in the US hold only Stablecoins.*

These properties will be helpful for understanding the quantitative properties of the model we are going to study next.

4 Quantitative analysis

In this section we quantify how the growth of the Digital economy impacts both local and global financial markets. The expansion of the Digital Economy is driven by the extent to which agents in the traditional (Non-digital) economy become informed about and comfortable with engaging in digital activity. In the model, this process is captured by the variable μ_t, which represents the share of agents accustomed to the Digital Economy.

An increase in μ_t influences the economy through two distinct channels. The first operates through the demand for Stablecoins: as more agents become willing to incorporate digital assets into their savings portfolios, the demand for Stablecoins rises. We refer to this as the 'financial demand' channel.

The second channel operates through the demand for services produced within the Digital Economy—the D-goods. As agents become more accustomed to digital platforms, they begin to substitute traditional services with their digital counterparts. For instance, short-term real estate rentals might be facilitated through decentralized applications (dApps) rather than traditional agencies, and financial intermediation (e.g., borrowing and lending) could shift from banks to dApps. This increased demand for digital services raises their production and enhances the value of Crypto, which serves as a productive input. We refer to this as the 'real demand' channel.

While the two channels are driven by the same force—the increase in the fraction of accustomed agents μ_t—we will be able to separate them through counterfactual simulations. Let's first describe the parametrization of the model.

4.1 Calibration

The main quantitative exercise consists in the simulation of the model to construct the transition dynamics induced by changes in μ_t (fraction of accustomed agents in the traditional economy). The starting year for the simulation is 2023 and some of the parameter values are chosen to replicate empirical targets observed in 2023.

Let's first specify the functional forms for the financial cost and the distribution of the idiosyncratic shock. The financial cost takes the form $\varphi(F) = \kappa F$ and the distribution of the idiosyncratic shock is uniform. Thus, the distribution is fully characterized by two parameters: the mean ($\bar{z}^{DiEco}$,

$\bar{z}^{US}$, $\bar{z}^{RoW}$) and the domain of the uniform distribution (σ^{DiEco}, σ^{US}, σ^{RoW}).

Parameter values. The discount factor is calibrated to match the average return from Crypto with the observed average staking return shown in the third panel of Figure 3. Based on the data, the average annual staking return is approximately 5%, leading us to set $\beta = 0.95$.

We think of D-goods as mostly composing of services, a large share of which related to finance. In the US, the finance industry (FIRE) accounts, currently, for about 8% of GDP. However, the Digital economy could also contribute to other industries besides finance. To account for that we set the share of expenditures in D-goods to $\alpha = 0.1$, which is slightly higher than the share of FIRE. Note that this does not mean that agents in the Non-digital economy allocate 10% of their consumption expenditures to purchase services produced by the Digital economy. Only accustomed agents, who remain a minority, purchase D-goods from DiEco.

Let's focus now on the parameters that determine the dynamics of μ_t. The fraction of accustomed agents evolves over time according to

$$\mu_t = (1-\delta)\mu_{t-1} + \theta_t(1 - \mu_{t-1} - \gamma), \text{ with } \theta_t = 1 - e^{-\frac{\mu_{t-1}}{1-\mu_{t-1}}}.$$

The formulation used here extends the earlier specification by introducing an additional parameter, γ. While γ does not alter the model's qualitative behavior, it provides greater flexibility in calibration. Specifically, we target the steady-state share of accustomed agents, $\bar{\mu}$. Since higher values of δ reduce $\bar{\mu}$, we can target any desired steady-state level by appropriately choosing δ. However, achieving a relatively small $\bar{\mu}$ requires setting δ close to 1, which is not realistic[11]. To address this, we introduce an additional parameter, γ, which allows us to match a low steady-state value of $\bar{\mu}$ while maintaining a more plausible value of δ. In practice, we set $\delta = 0.2$ and target $\bar{\mu} = 0.1$ (i.e., 10% in the long run), which allows us to determine the implied value of γ. Given these parameter choices, the evolution of μ_t is fully characterized once its initial value is specified.

To set the initial value of μ_t in 2023, we target the market value of Crypto in the same year.[12] The estimated value is around 2.5 trillion dollars. As-

[11] A value of δ near 1 implies that nearly all accustomed agents are replaced each period.

[12] To see why the valuation of Crypto is related to μ_t, let's consider the value added generated by the Digital economy. In the model this is equal to $e_t X_{D,t}$, where $X_{D,t}$ is

suming a world capital-output ratio of 3, this corresponds to about 0.8% the value of world capital.[13] Thus, we choose 0.8% as calibration target for μ_t.

The value of Crypto in the model is determined by the price p_t^{DiEco}. The relationship between μ_t and p_t^{DiEco} is complex due to the forward-looking nature of asset prices. While p_t^{DiEco} can be solved numerically, its value depends on μ_t as well as on other model parameters. As a result, μ_t must be jointly calibrated with additional parameters described below.

To calibrate the average productivities $\bar{z}^{US}$ and $\bar{z}^{RoW}$, we first normalize the fixed input endowments K^{US} and K^{RoW} to 1. This normalization is without loss of generality, as the linearity of the production function implies that higher productivity is equivalent to a larger capital stock. We also normalize $\bar{z}^{US} = 1$, as only the relative productivity levels matter. Given these normalizations, we choose $\bar{z}^{RoW} = 3$ so that the model matches the empirical observation that US GDP accounted for approximately 25% of global output in 2023.

We now turn to production in DiEco. In the model, the market value of Crypto is proportional to the output of digital services, captured by the equation: $p_t^{DiEco} K^{DiEco} = \omega X_{D,t}$, where p_t^{DiEco} is the price of Crypto, K^{DiEco} is the stock of Crypto, $X_{D,t}$ is the production of D-goods in DiEco, and ω is a parameter. Recall that digital production requires staked Crypto: the greater the value staked, the higher the output of digital services. The parameter ω is calibrated so that the price of D-goods produced in DiEco, e_t, is close to

the demand for services produced by DiEco and e_t is its price. The demand $X_{D,t}$ comes from agents in DiEco and from accustomed agents in US and RoW. As the fraction of accustomed agents μ_t increases, $X_{D,t}$ also increases. The higher demand generates an increase in the price e_t, which in turn increases the market value of Crypto p_t^{DiEco}, thanks to higher profits. Thus, there is a positive relation between μ_t and p_t^{DiEco}.

[13] The US GDP in 2013 was about 27 trillion dollars, while the world GDP was about 108 trillion dollars (four times the US GDP). With a capital-GDP ratio of 3, we estimate that total capital in the world was 324 trillion dollars (108×3). Thus, 2.5 trillion dollars worth of cryptocurrencies correspond to 0.8% the value of world capital.

1 in the long-run equilibrium.[14] The precise value of ω will be chosen jointly with other parameters due to their interdependence.

We still have four additional parameters: κ, σ^{DiEco}, σ^{US}, σ^{RoW}. We calibrate these parameters together with ω and μ_t to target six moments:

1. The interest rate on US bonds in 2023, equal to 2%.
2. The US net foreign asset position in 2023, corresponding to -30% the value of output.
3. The value of Stablecoins in 2023, equivalent to 10% the value of Crypto.
4. The fraction of Stablecoins backed by US bonds in 2023 of 80%.
5. The value of Crypto in 2023, which was 0.8% the value of global capital.
6. The price of $D-$goods, close to 1 in the long-run (final steady state).

To calculate the US net foreign asset position (second targeted moment), we have to take into account that in our economy production is only earned by land (capital). In the real economy, however, capital income is only a fraction of GDP. Output in the model corresponds to net capital income in the data, which is about 20 percent the value of GDP. This implies that the net foreign asset position of the US in the model should be -150%, that is, the NFA-to-GDP ratio of -30% multiplied by 5.

[14] To understand how ω relates to the long-run value of e_t, consider that the price of Crypto p_t^{DiEco} reflects the expected discounted value of services generated by each unit of Crypto. In steady state, this price approximately equals

$$p^{DiEco} = \frac{\beta}{1-\beta}\left(\frac{eX_D}{K^{DiEco}}\right).$$

The term in parentheses represents the value of services produced per unit of Crypto—that is, the total value of production divided by the stock of Crypto—which is constant in the steady state. By discounting the stream of production flows at rate β, we obtain the expression above. Note that this provides only an approximation to the actual long-run price of Crypto, since agents do not discount future payoffs using β alone. In practice, they also account for the stochastic nature of individual revenues (risk) and for financial leverage (as they receive leveraged cash flows). Nonetheless, the actual price of Crypto in the model is not expected to deviate significantly from the value implied by this approximation. We can now substitute p^{DiEco} in the equation $p_t^{DiEco}K^{DiEco} = \omega X_{D,t}$, evaluated at the steady state, from which we obtain $e = (1-\beta)\omega/\beta$. This (approximate) equation shows that the steady state price e increases with the parameter ω.

Although the five parameters and the initial μ_t all contribute to determine the six moments, we can outline the primary impact of each parameter on the targeted moments. An increase in the idiosyncratic volatility (both US and RoW) raises the insurance benefit of holding riskless bonds and reduces their interest rate. Thus, in order to have a US interest rate of 2% when the inter-temporal discount rate is 5%, we need significant idiosyncratic volatility.

Given the level of idiosyncratic volatility in the US, denoted by σ^{US}, the volatility in the RoW, σ^{RoW}, plays a key role in determining the US net foreign asset (NFA) position. Specifically, a higher idiosyncratic volatility in RoW relative to the US leads to a greater demand for US bonds by RoW agents, resulting in a larger external imbalance. For the US to hold a negative NFA position—i.e., for the rest of the world to be a net holder of US bonds—it must be the case that $\sigma_z^{RoW}/\bar{z}^{RoW} > \sigma_z^{US}/\bar{z}^{US}$, consistent with Assumption 3.1. Moreover, the larger the disparity in idiosyncratic volatility across countries, the greater the resulting imbalance.

The parameter κ plays a central role in determining the demand for Stablecoins. A higher value of κ lowers the net return from holding US bonds, which in turn increases the incentive for agents in the RoW to hold Stablecoins. In equilibrium, this determines the stock of Stablecoins. The relative idiosyncratic volatility of DiEco, denoted by σ^{DiEco}, is key to determining the share of Stablecoins backed by US bonds. Stablecoin issuance backed by US bonds does not introduce risk to DiEco agents' balance sheets, as both the asset and liability sides increase equally. In contrast, issuing Stablecoins not backed by US bonds increases leverage and raises portfolio risk. When DiEco's assets are riskier (i.e., higher σ^{DiEco}), agents in DiEco reduce leverage to manage this risk. Conversely, if DiEco's assets are relatively safe, agents are willing to increase leverage by issuing more unbacked Stablecoins. Finally, the parameter ω and the initial share of accustomed agents, μ_t, are important for determining both the long-run price of DiEco's output and the initial value of Crypto, as discussed above. Table 1 provides the full set of calibrated parameters and their values.

4.2 Transition equilibrium

Figure 8 illustrates the transition dynamics of four key variables. Panel (a) displays the evolution of the fraction of accustomed agents in the Non-digital economy (US and RoW), denoted by μ_t. This variable evolves exogenously and serves as the primary driver of the model's transitional dynamics. Ini-

Table 1: Model parameters and calibration values

Description	*Parameter*	*Value*
Discount factor	β	0.9500
Consumption share of D-goods	α	0.1000
Dynamics accustomed agents (parameter 1)	δ	0.2000
Dynamics accustomed agents (parameter 2)	γ	0.7098
Production technology in DiEco	ω	20.9000
Mean productivity US	$\bar{z}^{US}$	1.0000
Mean productivity RoW	$\bar{z}^{RoW}$	3.0000
Domain range shocks in DiEco	σ^{DiEco}	11.0356
Domain range shocks in US	σ^{US}	11.7400
Domain range shocks in RoW	σ^{RoW}	41.1176
Holding cost foreign bonds	κ	0.0197
Initial fraction of accustomed agents	μ_0	0.0040

tially, μ_t is set at 0.4%, but it increases gradually over time, ultimately converging to 10% in the long run.

Panel (b) shows the price of D-goods produced in the Digital Economy, which can be interpreted as an exchange rate. Initially, this price is substantially lower than that of comparable goods in the Non-digital economy (approximately 0.2 versus 1). This discrepancy reflects the limited demand for D-goods at the early stages, when only a small fraction of agents in the Non-digital economy are accustomed to interacting with DiEco. As μ_t rises over time, the demand for D-goods increases, driving up their price. Consequently, as shown in Panel (c), the value added generated by DiEco grows from 0.2 percent to approximately 1.1 percent of total world output.

Panel (d) displays the ratio of the market price of Crypto to the market value of DiEco's production—a measure analogous to a price-earnings (P/E) ratio. This ratio is initially very high (exceeding 100) but gradually declines to its long-run value of approximately 20. The high initial ratio reflects the high market valuation of Crypto in the base year, 2023. Although Crypto generates limited earnings early on, its valuation is driven by expectations of future growth in digital production. This pattern mirrors the behavior observed in emerging industries, where firms are often traded at high valuations despite not yet being profitable. As the sector matures and earnings materialize, valuations normalize—an outcome consistent with the model's prediction for DiEco.

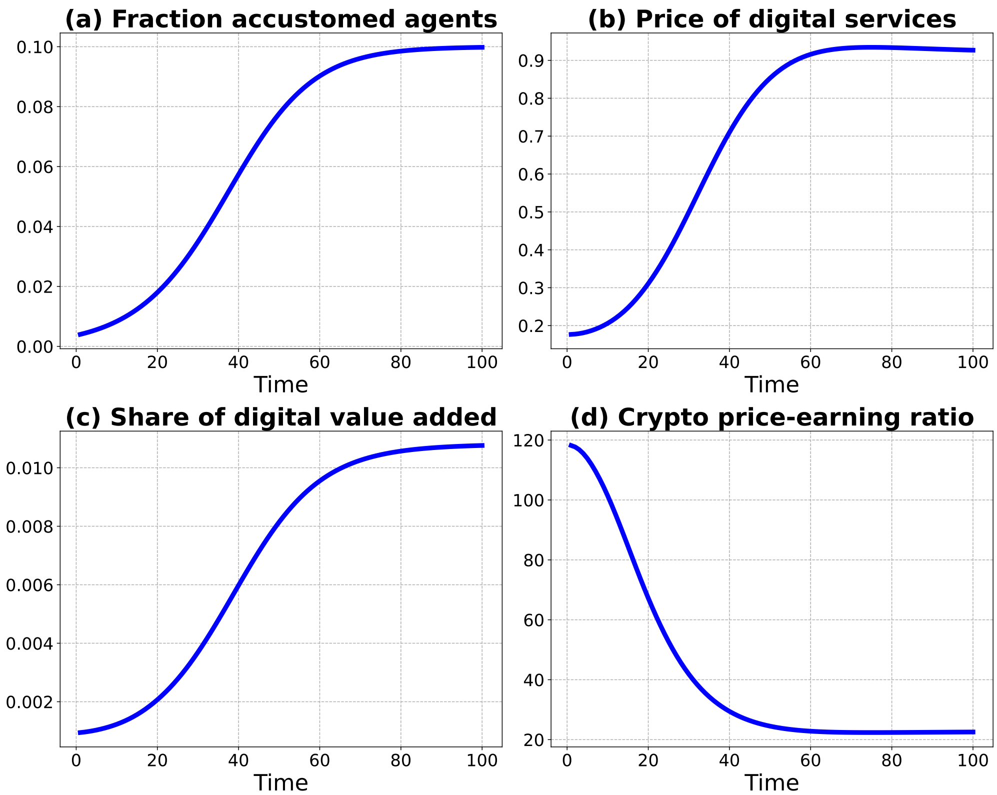

Figure 8: Dynamics of fractions of accustomed agents, price of D-goods, world share of DiEco's production, and Crypto price-earning ratio.

Figure 9 presents the transition dynamics of additional variables.The continuous line in Panel (a) is for the US interest rate. Initially, the US rate increases but then it declines monotonically to a lower long-run level. This non-monotonic results from two contrasting forces. On one hand, as μ_t increases, more agents in the RoW shift from holding US bonds to holding Stablecoins. This higher demand for Stablecoins puts downward pressure on their interest rate. Because a portion of Stablecoins are backed by US bonds, this also contributes to a decline in the US interest rate. On the other hand, the rise in μ_t also boosts the demand for D-goods produced in the Digital Economy (DiEco), raising their relative price, e_t. A higher e_t increases the value of Crypto, which functions as an input in DiEco's production process. This appreciation in Crypto increases the wealth of DiEco agents, who respond by supplying more Stablecoins. The resulting increase in the supply of Stablecoins places upward pressure on both the Stablecoin and US interest rates.

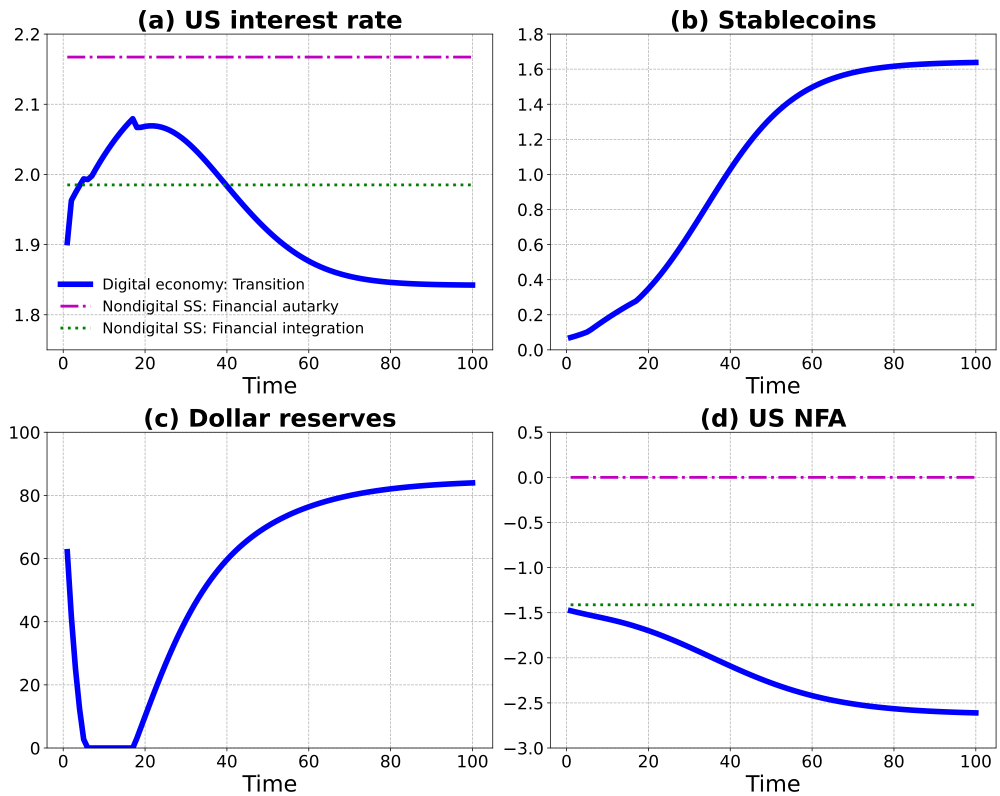

Figure 9: Dynamics of interest rate, Stablecoins, dollar reserves, and US net foreign asset position.

The net effect of these two opposing forces—a demand-driven decline and a wealth-induced rise in interest rates—gives rise to the non-monotonic trajectory of the US interest rate: an initial increase followed by a gradual decline. Both forces increase the issuance of Stablecoins, as shown in Panel (b). However, their relative influence evolves over the course of the transition. In the early phase, the US interest rate increases, suggesting that the supply-side effect—driven by rising wealth and greater willingness of DiEco agents to issue Stablecoins—dominates the demand-side pressure. This interpretation is further supported by Panel (c), which plots the share of US bonds (i.e., dollar reserves) held by DiEco relative to the total stock of Stablecoins. During the initial phase of the transition, this reserve ratio is low, implying that a larger portion of Stablecoins are not backed by US bonds. This weakens the demand for US bonds and leads to a higher US interest rate. In the second phase, however, the reserve ratio increases, reinforcing the demand for US bonds.

Panel (a) also displays the steady-state interest rate in the absence of the Digital Economy under two alternative regimes. In the first regime, the US and the rest of the world (RoW) are not financially integrated (autarky), while in the second, their capital markets are fully integrated. We observe that the steady-state US interest rate is higher under autarky than under financial integration. This illustrates that financial integration enables the US to borrow at a lower interest rate compared to a regime without integration—an expression of the so-called *exorbitant privilege*. Notably, the interest rate with the Digital Economy is even lower, as indicated by the solid line lying below the dotted line for most periods. This suggests that the expansion of the Digital Economy reinforces, rather than erodes, the US's exorbitant privilege.

The expansion of the Digital Economy also affects the cross-country ownership of financial assets. The model is calibrated such that the US initially holds a negative net foreign asset (NFA) position equivalent to 30% of its GDP. As the Digital Economy expands, the US NFA position deteriorates further, as shown in Panel (d). Thus, a key implication of the model is that the rise of the Digital Economy amplifies the US external imbalance.

4.3 Consumption insurance

The growth of the Digital economy impacts global financial markets through the issuance of a new financial instrument, Stablecoins. The supply of this new financial instrument allows agents to change the composition of their portfolios, which in turn affects the volatility of individual consumption and wealth.

Appendix A derives the analytical formula for the standard deviation of individual consumption growth, which takes the form

$$
\begin{aligned}
\mathrm{Var}_t(g_{t+1}) \quad = \quad & \beta \tilde{e}_t^{\alpha} \left\{ \left(\frac{\phi_t}{p_t}\right)^2 \left[\left(\frac{1}{e_{t+1}}\right)^{2\alpha} \lambda_t + 1 - \lambda_t \right] \frac{\sigma^2}{12} + \lambda_t (1-\lambda_t) \times \right. \\
& \left. \left[\phi_t \left(\frac{\mathbb{E} z_{t+1} + p_{t+1}}{p_t} \right) + (1-\phi_t) R_t \right]^2 \left[\left(\frac{1}{e_{t+1}} \right)^{\alpha} - 1 \right]^2 \right\}^{\frac{1}{2}}
\end{aligned} \tag{1}
$$

The variable λ_t is the probability of being accustomed at $t+1$ and $1-\lambda_t$ the probability of being unaccustomed. These probabilities depend on the current agent's type. For an agent that is accustomed at time t, the probability of being accustomed at $t+1$ is $\lambda_t = 1-\delta$. For an agent that is unaccustomed at time t, the probability of being accustomed at $t+1$ is $\lambda_t = \theta_t$. For DiEco's agents $\lambda_t = 1$ since they do not switch type.

The price of D-goods, $\tilde{e}_t$, also depends on the agent's type. For an accustomed agent $\tilde{e}_t = e_t$ while for an unaccustomed agent $\tilde{e}_t = 1$. Finally, the variable R_t denotes the gross return earned on fixed-income investments. For accustomed agents this is the interest rate on Stablecoins, that is, $R_t = R_t^S$. For unaccustomed agents is the interest rate on local bonds, that is, $R_t = R_t^{US}$ for the US and $R_t = R_t^{RoW}$ for RoW. For DiEco's agents is also equal to the interest rate on Stablecoins since this is what they pay on their borrowing. However, since $\lambda_t = 1$ for DiEco's agents, R_t does not affect the standard deviation of consumption growth.

Looking at equation (1), we can see that consumption volatility increases with the volatility of the idiosyncratic shock, σ. It also depends on the portfolio allocation ϕ_t since agents that hold a larger share of wealth in risky assets experience higher consumption volatility. This differs not only across countries but also among agents' types.

Quantitative properties. Figure 10 plots the standard deviation of consumption growth over the transition for each country and for different types of agents. Panel (a) is for the US (continuous line for accustomed agents and dashed line for unaccustomed agents). Consumption volatility for accustomed agents increases over time. This is a direct consequence of the fact that the US experiences a decline in NFA: the US borrows more from abroad (higher levered position), which implies more net worth volatility. Higher volatility of net worth then implies higher consumption volatility. For unaccustomed agents, however, volatility is high also initially. This captures the fact that accustomed agents could switch to unaccustomed in the next period, in which case they will experience a large increase in the price paid for D-goods (and, thus, high consumption uncertainty). Over time, the price difference declines and the effect described here becomes less important.

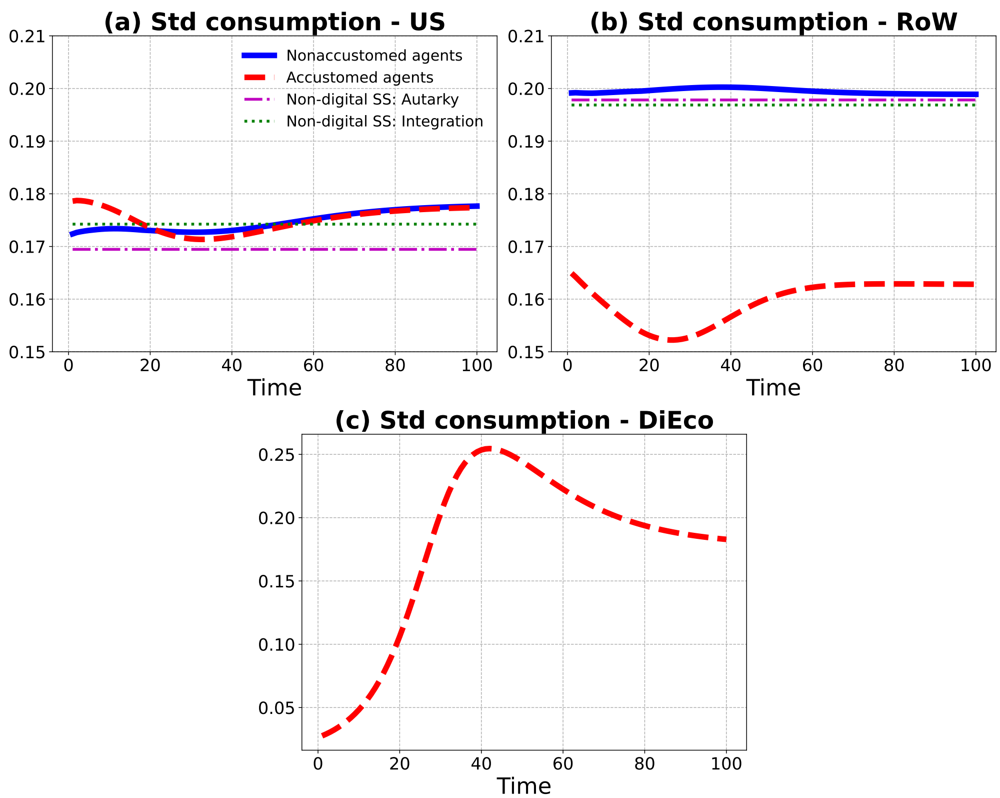

Figure 10: Standard deviation of consumption growth.

Panel (a) also plots consumption volatility in the steady state equilibrium without a Digital economy when the US is not financially integrated with RoW (dotted line), and when the US is financially integrated with RoW (dotted-dashed line). Without the Digital economy, all agents are unaccustomed. In the long-run, consumption volatility experienced by US residents (both accustomed and unaccustomed) will be higher when they are integrated with the Digital economy. In the short-run, however, accustomed agents experience smaller volatility, which is caused by the lower price paid for D-goods purchased from DiEco (see equation (1)). As we saw in Figure

8, the initial price of D-goods produced in DiEco is significantly lower than the price of D-goods produced in US and RoW.

Panel (b) plots the standard deviation of consumption growth for agents in RoW. Accustomed agents experience lower consumption volatility compared to unaccustomed agents. This is because, thanks to their access to the Digital economy, they can purchase higher return bonds (Stablecoins). As a result, they change their portfolio composition toward more fixed income assets (they reduce the holding of risky land). Because of this, their net worth becomes less volatile, which in turn implies lower volatility of consumption.

Panel (c) shows consumption volatility for DiEco's agents. Residents of DiEco experience a significant increase in consumption volatility. To understand why, let's go back to Figure 8. Panel (d) shows that the price-earning ratio for Crypto declines over time. This is a consequence of the increase in the price of D-goods, e_t. As the price-earning ratio declines, a larger share of wealth held by DiEco's agents—the variable a_t—derives from current earnings (which are subject to the idiosyncratic risk) and a smaller share from the market value of Crypto (which is not subject to the idiosyncratic risk). As a result, the end-of-period wealth becomes more volatile for an individual agent. This implies that individual consumption becomes more volatile.

To summarize, the growth of the Digital economy could have non-negligible consequences for risk-sharing across the globe. In the long-run, the US extends its provision of insurance to agents in other parts of the world. Part of the insurance is also provided by the (virtual) residents of the new Digital economy. Since individual consumption volatility is related to the volatility of individual wealth, wealth concentration will rise in the US but could decline in the rest of the world (set aside the residents of the Digital economy).

5 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 how the potential growth of the Digital economy and Stablecoins in particular, could impact the global financial system. We have shown that this depends on the relative importance of two channels associated with the growth of the Digital economy. The first channel increases the demand for Stablecoins. Since Stablecoins are in part backed by dollar-denominated assets, this causes a decline in the US interest rate and an increase in global imbalances. The second channel increases the supply of Stablecoins backed by non-dollar assets. This increases the US interest rate and reduces global imbalances. The simulation of the model shows that, in the long-run, the first channel dominates the second, and the US interest rate declines. This also implies that US net foreign borrowing will continue to rise.

We have also explored the implications of the Digital economy for consumption volatility at the micro level. In general, the expansion of the Digital economy will be associated with an increased supply of Stablecoins that allows certain agents to enjoy greater consumption smothing. In particular, this benefit is more likely to arise for agents in the Rest of the World who become accustomed to the Digital economy. Their lower consumption volatility, however, will be at the cost of higher consumption volatility for US and DiEco's agents.

Is the expansion of the Digital economy welfare improving? On a global level the answer should be positive. This is because the Digital economy provides cheaper services (services produced in the Digital economy) as well as insurance by creating more accessible safe assets. However, the benefits are not symmetric among countries and across agents within a country. Exploring the welfare implications of the emerging Digital economy will be the next research step.

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A Derivation of equation (1)

Expenditures m_t are allocated to D-goods and N-goods according to

$$\begin{aligned} c_{D,t} &= \left(\frac{\alpha}{\tilde{e}_t}\right) m_t, \\ c_{N,t} &= (1-\alpha) m_t, \end{aligned}$$

where $\tilde{e}_t$ is the relative price of D-goods. The relative price is equal to 1 for non-accustomed agents in US and RoW, but it is equal to $e_t < 1$ for DiEco's agents and accustomed agents in US and RoW. The consumption bundle is then

$$c_t = \left[\left(\frac{\alpha}{\tilde{e}_t}\right)^{\alpha} (1-\alpha)^{1-\alpha} \right] m_t \tag{A.1}$$

Given logarithmic utility, consumption expenditures at time t and $t+1$ are

$$m_t = (1-\beta) a_t, \tag{A.2}$$
$$m_{t+1} = (1-\beta) a_{t+1}, \tag{A.3}$$

with a_t the end-of-period wealth before consumption at time t, and a_{t+1} is the end-of-period wealth before consumption at $t+1$.

Let's consider first accustomed agents in US and RoW. The end of period wealth at $t+1$ is

$$a_{t+1} = (z_{t+1} + p_{t+1}) k_{t+1} + s_{t+1}. \tag{A.4}$$

Remember that accustomed agents hold land, k_{t+1}, and Stablecoins, s_{t+1}.

The optimal portfolio decision of accustomed agents gives rise to the following investment policies,

$$p_t k_{t+1} = \phi_t \beta a_t, \tag{A.5}$$
$$\left(\frac{1}{R_t^S}\right) s_{t+1} = (1-\phi_t) \beta a_t, \tag{A.6}$$

where R_t^S is the interest rate on Stablecoins and $1/R_t^S$ its price.

Using equations (A.5) and (A.6) to eliminate k_{t+1} and s_{t+1} in (A.18), we obtain

$$\frac{a_{t+1}}{a_t} = \beta \left[\phi_t \left(\frac{z_{t+1} + p_{t+1}}{p_t} \right) + (1-\phi_t) R_t^S \right]. \tag{A.7}$$

Equations (A.2) and (A.3) imply $m_{t+1}/m_t = a_{t+1}/a_t$. Substituting and using the expression for c_t (and c_{t+1}) from (A.1), we obtain

$$\frac{c_{t+1}}{c_t} = \beta \left[\phi_t \left(\frac{z_{t+1} + p_{t+1}}{p_t} \right) + (1 - \phi_t) R_t^S \right] \left(\frac{e_t}{\tilde{e}_{t+1}} \right)^{\alpha}. \tag{A.8}$$

Since we are considering an accustomed agent, the price paid for D-goods at time t is e_t, which we take into account when we use (A.1). The next period price, however, is unknown at time t since an accustomed agent could become unaccustomed. Thus, in the formula, the next period price is indicated by $\tilde{e}_{t+1}$.

Equation (A.8) defines the gross growth rate of consumption as a linear function of the next period realization of the idiosyncratic shock, z_{t+1}. The function depends on two stochastic variables. The first is the next period idiosyncratic productivity z_{t+1} and the second is the next period price of D-goods $\tilde{e}_{t+1}$. The standard deviation of consumption growth then depends on the probability distribution of these two stochastic variables.

It will be useful to rewrite consumption growth more compactly as

$$g_{t+1} = \frac{c_{t+1}}{c_t} = f(z_{t+1}) h(\tilde{e}_{t+1}), \tag{A.9}$$

where the two functions are

$$\begin{aligned} f(z_{t+1}) &= \beta \left[\phi_t \left(\frac{z_{t+1} + p_{t+1}}{p_t} \right) + (1 - \phi_t) R_t^S \right] && \text{(A.10)} \\ h(\tilde{e}_{t+1}) &= \left(\frac{e_t}{\tilde{e}_{t+1}} \right)^{\alpha}. && \text{(A.11)} \end{aligned}$$

The first function depends on z_{t+1} but not on $\tilde{e}_{t+1}$. The second function depends on $\tilde{e}_{t+1}$ but not on z_{t+1}.

Deriving the standard deviation. We first derive the variance of consumption growth and then we derive the standard deviation by taking the sqare root. Using the law of total variance, the variance can be written as

$$\text{Var}(g_{t+1}) = \mathbb{E}\Big\{ \text{Var}\Big(g_{t+1} | \tilde{e}_{t+1} \Big) \Big\} + \text{Var}\Big\{ \mathbb{E}\Big(g_{t+1} | \tilde{e}_{t+1} \Big) \Big\} \tag{A.12}$$

Using (A.9) this can be rewritten as

$$\text{Var}(g_{t+1}) = \mathbb{E}\Big\{ h(\tilde{e}_{t+1})^2 \Big\} \text{Var}\Big\{ f(z_{t+1}) \Big\} + \Big\{ \mathbb{E} f(\tilde{z}_{t+1}) \Big\}^2 \text{Var}\Big\{ h(\tilde{e}_{t+1}) \Big\} \tag{A.13}$$

The right-hand-side has four components. Using the definition of $f(z_{t+1}$ and $h(\tilde{e}_{t+1}$ provided in equations (A.10) and (A.11) and taking into account that an accustomed agent beccomes unaccustomed with probability δ, we can show that the four components are equal to

$$\mathbb{E}\Big\{h(\tilde{e}_{t+1})^2\Big\} = e_t^{2\alpha}\left[\left(\frac{1}{e_{t+1}}\right)^{2\alpha}(1-\delta)+\delta\right] \tag{A.14}$$

$$\mathrm{Var}\Big\{f(z_{t+1})\Big\} = \left(\frac{\beta\phi_t}{p_t}\right)^2 \mathrm{Var}(z_{t+1}) \tag{A.15}$$

$$\Big\{\mathbb{E}f(\tilde{z}_{t+1})\Big\}^2 = \beta^2\left[\phi_t\left(\frac{\mathbb{E}z_{t+1}+p_{t+1}}{p_t}\right)+(1-\phi_t)R_t^S\right]^2 \tag{A.16}$$

$$\mathrm{Var}\Big\{h(\tilde{e}_{t+1})\Big\} = e_t^{2\alpha}\left[\left(\frac{1}{e_{t+1}}\right)^{\alpha}-1\right]^2\delta(1-\delta) \tag{A.17}$$

Since the distribution of the idiosyncratic shock z_{t+1} is uniform, the variance $\mathrm{Var}(z_{t+1})$ can be computed analytically. Given the domain σ, that is, the difference between the highest and lowest values of z, we have $\mathrm{Var}(z_{t+1}) = \sigma^2/12$.

Substituting in equation (A.9) we obtain

$$\begin{aligned}\mathrm{Var}(g_{t+1}) = \beta^2 e_t^{2\alpha}\Bigg\{ &\left(\frac{\phi_t}{p_t}\right)^2\left[\left(\frac{1}{e_{t+1}}\right)^{2\alpha}(1-\delta)+\delta\right]\frac{\sigma^2}{12} + \\ &\delta(1-\delta)\left[\phi_t\left(\frac{\mathbb{E}z_{t+1}+p_{t+1}}{p_t}\right)+(1-\phi_t)R_t^S\right]^2\left[\left(\frac{1}{e_{t+1}}\right)^{\alpha}-1\right]^2\Bigg\}\end{aligned}$$

For unaccustomed agents we obtain a similar expression once we take into account that unaccustomed agents do not hold Stablecoins. Thus the return on fixed-income investments is the return on local bonds, R^{US} or R^{RoW}. Also, unaccustomed agents become accustomed with some probability $\tilde{\theta}_t$. Finally, in period t the price of D-goods is 1 for unaccustomed agents. With these changes the variance of consumption growth is

$$\begin{aligned}\mathrm{Var}(g_{t+1}) = \beta^2\Bigg\{ &\left(\frac{\phi_t}{p_t}\right)^2\left[\left(\frac{1}{e_{t+1}}\right)^{2\alpha}\tilde{\theta}_t+1-\tilde{\theta}_t\right]\frac{\sigma^2}{12} + \\ &\tilde{\theta}_t(1-\tilde{\theta}_t)\left[\phi_t\left(\frac{\mathbb{E}z_{t+1}+p_{t+1}}{p_t}\right)+(1-\phi_t)R_t\right]^2\left[\left(\frac{1}{e_{t+1}}\right)^{\alpha}-1\right]^2\Bigg\}.\end{aligned}$$

For US unaccustomed agents R_t is the interest rate in the US. For RoW agents R_t is the interest rate in RoW.

Finally, for DiEco's agents, we can derive the variance using the same procedure but with the end of period wealth at $t+1$ given by

$$a_{t+1} = \left(1+\frac{z_{t+1}e_{t+1}}{\omega}\right)p_{t+1}k_{t+1}+f_{t+1}-s_{t+1}, \tag{A.18}$$

and with the investment policies,

$$p_t k_{t+1} = \phi_t \beta a_t, \tag{A.19}$$

$$\left(\frac{1}{R_t^S}\right)\left(f_{t+1} - s_{t+1}\right) = (1-\phi_t)\beta a_t. \tag{A.20}$$

The resulting expression for the variance of consumption growth is

$$\mathrm{Var}(g_{t+1}) = \left(\frac{\beta \phi_t e_{t+1} p_{t+1}}{\omega p_t}\right)^2 \left(\frac{e_t}{e_{t+1}}\right)^{2\alpha} \frac{\sigma^2}{12}.$$

The expression for DiEco's agents is much simpler because they do not switch type and they always pay the price e_t at time t and e_{t+1} at time $t+1$ for D-goods. The next period price e_{t+1} shows twice in the formula because for DiEco's agents the price of D-goods affects also their income, in addition to the cost of their consumption.