Online Appendix for:

Trade Finance and the Durability of the Dollar*

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C US bond holdings and currency use in the data

A key implication of the model is that the holdings of US assets in country j are positively correlated with the intensity of dollar use in the international trade of that country. To test this in the data, we regress the share of dollar invoicing of a country's trade on the share of US bonds in that country's aggregate portfolio.[1] In particular, we estimate the regression

$$X_j = \alpha + \beta_{B_{usd}} \frac{\text{Holdings of US bonds}_j}{\text{Total Foreign Bond Holdings}_j} + \beta_{UStrade} \frac{\text{Trade with US}_j}{\text{Total Trade}_j} + \varepsilon_j$$

where X_j is the share of dollar invoicing in country j's trade (data from Gopinath (2016)), while portfolio data is from the IMF's CPIS database. The estimates are presented in Table 1. In addition to bond holdings and US trade, we also include an euro dummy variable which takes the value of one for a country inside the Eurozone. We include these countries to maximize sample size, but the results remain qualitatively the same if we exclude them from the sample.

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[1]As documented by BIS (2014) and Friberg and Wilander (2008), the currency of invoicing is closely related to the currency in which trade is settled and financed, for the countries for which there is data for both invoicing and trade financing. However, the coverage in terms of invoicing data is much better, giving us a significantly larger sample size, thanks to the dataset built by Gopinath (2016).

Table 1: Dollar invoice share and portfolio share of dollar bond holdings

	(1)	(2)	(3)	(4)	(5)
$\frac{\text{Holdings of US bonds}_j}{\text{Total Foreign Bond Holdings}_j}$	0.73***		0.65***		
	(0.18)		(0.22)		
$\frac{\text{Trade with US}_j}{\text{Total Trade}_j}$		0.80***	0.21		1.25**
		(0.30)	(0.34)		(0.58)
$\frac{\text{Holdings of USD bonds}_j}{\text{Total Foreign Bond Holdings}_j}$				0.52***	0.36**
				(0.17)	(0.18)
Euro dummy	Yes	Yes	Yes	Yes	Yes
R^2	0.52	0.41	0.53	0.47	0.56
N	39	39	39	31	31

As predicted by the model, we find that the portfolio share of US bonds in total foreign bond holdings is highly positively correlated with the share of trade invoiced in dollars (column (1)). This is not simply a proxy for direct trade with the US – controlling for the volume of trade with the US does not change the significance or magnitude of the estimated relationship with US bond holdings (column (3)). In fact, direct US trade is not significantly associated with invoicing once we control for bond holdings (while it is by itself). Lastly, for a subset of the countries, we also have data on the currency composition of their foreign bonds holdings.[2] We find a similarly strong relationship between dollar denominated bond holdings and invoicing (columns (4) and (5)).

Thus, the data indeed strongly supports the key implication of our model that as a country saves more in US assets its firms also trade (internationally) in dollars more.

Our regressions are related, but distinct, from the ones in Gopinath and Stein (2020) who use the share of dollars in the aggregate bank liabilities of country j as the regressor, not the US bonds' share in the country's holdings of *foreign* debt assets. And in fact, our regression can help differentiate the empirical implications vis-a-vis this other mechanism.

Specifically, in Gopinath and Stein (2020) dollar usage is actually driven by a shortage of US Treasury holdings in a given country, which incentivizes local banks to create dollar deposits for local households to save in. It is a story of dollarization of the bank sector due to a relative *shortage* of US safe assets, while in our model, instead, dollar usage is motivated by the relative *abundance* of US-issued bonds in rest-of-world household portfolios.

Thus, our regressions, which use the composition of the *foreign* asset holdings of countries as the regressor not only broadly supports our model, but also helps differentiate with this different mechanism. Given our finding that countries which own a large amount of US Treasuries are indeed associated with a high usage of dollars in their trade activities,

[2] Maggiori et al. (2020) show that investors have an affinity for dollar-denominated foreign assets, even when the issuer has a different local currency, so the currency composition of portfolios is likely even more highly concentrated in dollars, than in US assets alone.

Table 2: Dollar bank deposits and US bond holdings

	(1)	(2)	(3)	(4)
$\frac{\text{Holdings of US bonds}_j}{\text{GDP}_j}$	0.68***		0.71***	
	(0.16)		(0.16)	
$\frac{\text{Trade with US}_j}{\text{GDP}_j}$	0.14	0.43		
	(0.11)	(0.30)		
$\frac{\text{Holdings of USD bonds}_j}{\text{GDP}_j}$		0.44***		0.50***
		(0.07)		(0.03)
$\frac{\text{USD invoiced Trade}_j}{\text{GDP}_j}$			0.12**	0.28***
			(0.06)	(0.04)
Euro dummy	Yes	Yes	Yes	Yes
R^2	0.60	0.85	0.67	0.96
N	22	15	21	15

we conclude that the usage of dollars in trade is more likely driven by the fact that US Treasuries are abundantly available in global markets, as our model suggests, rather than being relatively scarce.

To further this analysis, we can directly test whether the dollarization of the local banking industry is a associated with a relative lack of US Treasuries at the country level, or rather by a relative (local) abundance of Treasuries. Specifically, we estimate the regression

$$\frac{\text{Bank Liab. to non-banks}_j}{GDP_j} = \alpha + \gamma_{B_{us}} \frac{\text{Holdings of US bonds}_j}{GDP_j} + \gamma_{UStrade} \frac{\text{US Trade}_j}{GDP_j} + \varepsilon_j$$

The left-hand-side variable is from the BIS database on local bank statistics, and effectively captures the size of bank deposits owned by non-bank entities. The model of Gopinath and Stein (2020) implies that $\gamma_{B_{us}} < 0$ – i.e. holding the volume of trade with the US constant (which generates a demand for dollar savings), the more US Treasuries country j owns, the lower is the need and incentive for locally creating additional, synthetic dollar safe assets via dollar deposits with local banks.

To the contrary, in the data we find a strong positive association between the holdings of US bonds at the country level, and the bank dollarization. The results are presented in Table 2. We consider several variation of the basic regression, alternatively using the holdings of dollar denominated foreign bonds (instead of holdings of US-issued bonds only), and also proxying for the demand for dollar savings with the total volume of trade invoices in dollars in country j, rather than just using its trade directly with the US.

In all cases, we find a highly positive $\gamma_{B_{us}}$, which combined with the results in Table 1, suggests that the dollarization of both trade and banking is associated with a relative *abundance* of US bond holdings in a given country, consistent with our liquidity-based mechanism.

D Additional Quantitative Model Details

D.1 Households

For $j \in \{us, ez\}$, foreign imports consist of the good of the other big country and an aggregate of rest-of-the world goods. Hence, the big country consumption aggregator is

$$C_{jt} = (C_{jt}^{j})^{a_h} \left((C_{jt}^{j'})^{\frac{\mu_{j'}}{\mu_{j'}+\mu_{rw}}} (C_{jt}^{rw})^{(\frac{\mu_{rw}}{\mu_{j'}+\mu_{rw}})} \right)^{1-a_h}, \tag{1}$$

where j' is the complement of j and $C_{jt}^{j'}$ is the consumption in country j of the good of country j', and a_h controls the degree of home bias in consumption. Rest-of-world consumption goods are aggregated according to $C_{jt}^{rw} = (\int (C_{jt}^{i})^{\frac{\eta-1}{\eta}} di)^{\frac{\eta}{\eta-1}}$. The corresponding aggregate consumption price index is

$$P_{jt} = \frac{1}{K}(P_{jt}^{j})^{a_h} \left((P_{jt}^{j'})^{\frac{\mu_{j'}}{\mu_{j'}+\mu_{rw}}} (P_{jt}^{rw})^{\frac{\mu_{rw}}{\mu_{j'}+\mu_{rw}}} \right)^{1-a_h}. \tag{2}$$

where $K \equiv a_h^{a_h}(1-a_h)^{1-a_h} \left(\frac{\mu_{j'}}{\mu_{j'}+\mu_{rw}}\right)^{(1-a_h)\frac{\mu_{j'}}{\mu_{j'}+\mu_{rw}}} \left(\frac{\mu_{rw}}{\mu_{j'}+\mu_{rw}}\right)^{(1-a_h)\frac{\mu_{rw}}{\mu_{j'}+\mu_{rw}}}$.

For small countries $j \in [0, \mu_{rw}]$, the consumption basket includes imports from both big countries and all other rest-of-world small countries:

$$C_{jt} = C_{jt}^{j\ a_h} \left((C_{jt}^{us})^{\frac{\mu_{us}}{\mu_{us}+\mu_{ez}+\mu_{rw}}} (C_{jt}^{ez})^{\frac{\mu_{ez}}{\mu_{us}+\mu_{ez}+\mu_{rw}}} (C_{jt}^{rw})^{\frac{\mu_{rw}}{\mu_{us}+\mu_{ez}+\mu_{rw}}} \right)^{1-a_h}. \tag{3}$$

The associated price index is

$$P_{jt} = \frac{1}{K_{rw}}(P_{jt}^{j})^{a_h} \left((P_{jt}^{us})^{\frac{\mu_{us}}{\mu_{us}+\mu_{ez}+\mu_{rw}}} (P_{jt}^{ez})^{\frac{\mu_{ez}}{\mu_{us}+\mu_{ez}+\mu_{rw}}} (P_{jt}^{rw})^{\frac{\mu_{rw}}{\mu_{us}+\mu_{ez}+\mu_{rw}}} \right)^{1-a_h}. \tag{4}$$

where $K_{rw}$is defined analogously to K above.

D.2 The Import-Export Sector

The following subsection provide additional details on the trading structure of the general equilibrium model.

Trading Round and Profits

Let $\tilde{m}_{jit}^{im}$ be the mass of *funded* importing firms in country j seeking trade with funded exporting firms in country i at time t. Then the probability of a country j importer matching with a country i exporter is

$$p_{jit}^{ie} = \frac{\tilde{m}_{ijt}^{ex}}{\left[(\tilde{m}_{ijt}^{ex})^{1/\varepsilon_T} + (\tilde{m}_{jit}^{im})^{1/\varepsilon_T}\right]^{\varepsilon_T}},$$

Using analogous definitions, the probability of a country j exporter matching with a country i importer is

$$p_{jit}^{ei} = \frac{\tilde{m}_{ijt}^{im}}{\left[(\tilde{m}_{ijt}^{im})^{1/\varepsilon_T} + (\tilde{m}_{jit}^{ex})^{1/\varepsilon_T}\right]^{\varepsilon_T}}.$$

Let $\tilde{X}_{jt}$ be the fraction of funded country j firms who hold dollar collateral, as defined in the main text. Then the expected profits of a country-j importer importing from i who holds dollars is given by

$$\pi_{jit}^{\$,im} = p_{jit}^{ie} \frac{(1-\alpha)}{P_{ijt}^{whol}} \left[P_{jt}^{i} - P_{it}^{i} - \kappa P_{ijt}^{whol}(1-\tilde{X}_{it})\right],$$

while if it hold euros, expected profits are

$$\pi_{jit}^{€,im} = p_{jit}^{ie} \frac{(1-\alpha)}{P_{ijt}^{whol}} \left[P_{jt}^{i} - P_{it}^{i} - \kappa P_{ijt}^{whol}\tilde{X}_{it}\right].$$

Similar expressions hold for exporters:

$$\pi_{jit}^{\$,ex} = p_{jit}^{ei} \frac{(1-\alpha)}{P_{jit}^{whol}} \left[P_{it}^{j} - P_{jt}^{j} - \kappa P_{jit}^{whol}(1-\tilde{X}_{it})\right]$$
$$\pi_{jit}^{€,ex} = p_{jit}^{ei} \frac{(1-\alpha)}{P_{jit}^{whol}} \left[P_{it}^{j} - P_{jt}^{j} - \kappa P_{jit}^{whol}\tilde{X}_{it}\right].$$

Firm Formation

Equilibrium with interior p_{jit}^{im} and p_{jit}^{ex} requires that, prior to learning their idiosyncratic currency preference shock, firms are in expectation indifferent between importing and exporting to the various countries. Hence, for example in the US, we must have

$$X_{us}\pi_{us,j,t}^{\$,im} + (1-X_{us})\pi_{us,j,t}^{€,im} = X_{us}\pi_{us,i,t}^{\$,im} + (1-X_{us})\pi_{us,i,t}^{€,im}$$

for all US potential trading partners j and i (where the firm realizes that, ex-ante, X_{us} is the probability it will choose to fund its trades with dollars). The same indifference must hold for exporting to any two trading partners j and i.

Similarly, there is also indifference between exporting and importing to a given country j:

$$X_{us}\pi_{us,j,t}^{\$,im} + (1-X_{us})\pi_{us,j,t}^{€,im} = X_{us}\pi_{us,j,t}^{\$,ex} + (1-X_{us})\pi_{us,j,t}^{€,ex}.$$

The above equations are sufficient to pin down the equilibrium probabilities for importing and exporting to and from each country pair.

Given this and all of the above choices, prospective firms then decide whether or not to pay the fixed cost $\phi > 0$ in order to become operational this period. Firms enter the import-export sector until the zero-profit condition

$$W_{jt} = \max_{\{p^{im}_{jit}, p^{ex}_{jit}\}} X_{jt}\Pi^{\$}_{jt} + (1 - X_{jt})\Pi^{€}_{jt} - \phi P_{jt} = 0 \quad \text{s.t.} \quad \sum_{i \neq j} p^{im}_{jit} + \sum_{i \neq j} p^{ex}_{jit} = 1.$$

is satisfied. Thus, the equilibrium mass of active firms in country j, which we label m_{jt}, is determined by the condition $W_{jt} = 0$, and the optimal trade pattern is such that firms are indifferent between operating as an importer or exporter in any direction.

Equilibrium Definition

Definition 1 (**Equilibrium**). *A symmetric equilibrium is a pair of bond prices* $\{Q^{\$}_t, Q^{€}_t\}$, *and a set of country specific allocations* $\{C^{us}_{jt}, C^{ez}_{jt}, C^{rw}_{jt}, B^{\$}_{jt}, B^{€}_{j}, X_{jt}, m_{jt}, p^{im}_{jit}, p^{ex}_{jit}\}$, *prices* $\{P^{us}_{jt}, P^{ez}_{jt}, P^{rw}_{jt}\}$, *and liquidity premia* $\{\Delta^{\$}_{jt}, \Delta^{€}_{jt}\}$ *for* $j \in \{us, ez, rw\}$ *such that*

1. *The household optimality conditions are satisfied.*
2. *The trading firms optimality conditions are satisfied.*
3. *Liquidity premia earned by households are given by* (16)-(17).
4. *The mass of successful cross-border trading matches is consistent with consumption of foreign goods* $C^{j'}_{jt}$ *for all* $j \neq j'$.

E Rest-of-World Asset Supply

Our baseline economy abstracts from the presence of any savings vehicle issued by the rest of the world. This is in part because, absent a liquidity premium term, adding such an asset would create an indeterminacy in long-run wealth levels. The same sort of indeterminacy is pervasive in open economy models with incomplete asset markets.

A simple way to include a rest-of-world asset market is to assume there exists an exogenous liquidity demand z_j for the assets of each country $j \in [0, \mu_{rw}]$. Though we do not model this role explicitly, we assume it is proportional to the measure of firms in the country j economy, so that the liquidity wedge a the rest-of-world asset is given by

$$\Delta^{RW}_{jt} = \frac{M^f\left(m_{jt}z_j, \nu P^{rw}_{rw,t} B^j_{jt} Q^j_t\right)}{\nu P^{rw}_{rw,t} B^j_{jt} Q^j_t} r.$$

In the numerical implementation of this model, we make z_j negligible ($z_j = 0.01$), so that it plays no substantive role except for making asset positions determinate.

Since the small open economies j are identical, the price and liquidity premia of all of these assets are the same, e.g. $Q^j_t = Q^{rw}_t$, hence it is sufficient to treat it as a basket of rest-of-world assets denoted by RW. The household Euler equation for the rest-of-world basket of bonds is

$$1 = \beta E_t \left[\left(\frac{C_{jt+1}}{C_{jt}} \right)^{-\sigma} \frac{P_{jt}}{P_{jt+1}} \frac{P^{rw}_{rw,t+1}}{P^{rw}_{rw,t}} \frac{1}{Q^{rw}_t (1 - \Delta^{rw}_{jt} + \tau'(B^{rw}_{j,t}, B^{rw}_{j,t-1})} \right].$$

A desirable feature of this approach to determining holding of the rest-of-world bond is that the steady state portfolio allocations are independent of a scale shift in the z_j.

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