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ABSTRACT

Currently both the International Monetary System (IMS) and the International Price Systems (IPS) are dominated by the U.S. The emergence of China, both as reserve currency and as a currency of invoicing, is likely to disrupt this status quo. We provide a framework to understand the forces that will shape this transition and identify sources of instability. We highlight the risk of an abrupt shift triggered by a run on the dollar.

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The international monetary system is currently dominated by an established Hegemon, the U.S. However, it does not take much imagination to realize that in the not-too-distant future, the emergence of China is likely to challenge this status quo. The resulting confrontation could be a significant source of instability. Our goal is to outline some of the economic forces that will shape the China vs. U.S. international currency power struggle.

In Farhi and Maggiori (2017) we developed a model of the international monetary system.[1] We emphasized two key attributes of dominant currencies: their widespread use as safe reserve assets in the International Monetary System (IMS); and their widespread use as a currency of pricing and invoicing in the International Price System (IPS). We showed that pervasive pricing and invoicing in a currency helps cement a leadership position of its issuer in the safe asset market. In this paper, we adapt this model to analyze the upcoming competition between China and the U.S. along these two complementary dimensions.

Currently, the U.S. dominates both the IMS and the IPS (Gopinath, 2015; Farhi and Maggiori, 2017), but this hegemony is likely to be challenged by China in the coming decades. Indeed, China has taken rapid proactive steps to internationalize the role of its currency. For example, Ito and Chinn (2015) and Ito and Kawai (2016) document a rapid increase in the use of the renminbi for trade invoicing. IMF data show that central banks have even started holding renminbi in their official reserves, with the amount doubling from 90 to 193 dollar billions between 2016 and 2018.[2] The rise of the renminbi might also be favored by the diminished international role of the euro, the other potential competitor to the dollar. Maggiori, Neiman and Schreger (2018*a*,*b*), indeed, document a decreased role of the euro starting with the global financial crises and extended by the European sovereign debt crisis. The further rise of the dollar, the diminished role of the euro, and the start of the internationalization of the renminbi are broad asset market phenomena occurring in both sovereign and private debt markets.

The expansion of China's role in the international monetary sphere is still in its infancy, but its fast and predictable growth makes it one of the most important long-term disrupting forces for the IMS and the IPS.

We take a first step towards an economic analysis of this phenomenon. We show that the emergence of China as a key player in the IMS and in the IPS is likely to significantly erode the U.S. exorbitant privilege. It will also act as a powerful destabilizing force on the fiscal front, by confronting the U.S. with an acute version of the new Triffin dilemma: reduce its debt or risk a confidence crisis. This situation is reminiscent of an momentous historical precedent: the end of the Bretton Woods gold exchange standard following the devaluation of the dollar (the Nixon shock), foretold a decade earlier in Triffin (1961).

Of course, a lot will ultimately depend on the reaction of the U.S. The deterioration of its fiscal situation and the weakening of its institutions raise new questions. Would the U.S. exert enough fiscal discipline in the face of increasing interest rates and a reduced tolerance of international investors? Or could we witness a U.S. debt crisis? If we did, would the U.S. uphold its strong dollar policy

[1] Other recent models include He et al. (2018); Chahrour and Valchev (2017); Gopinath and Stein (2018).

[2] Source: IMF COFER database.

or would it succumb to fiscal dominance, let the dollar depreciate, and trigger a new Triffin event? Would this Triffin event put an end to the dollar dominance? It is hard to answer these questions with confidence, but it is important to work out their economic determinants and to trace out possible scenarios.

I A Model of the IMS and of the IPS

In this section, we briefly summarize our model of the IMS. Most of the set-up follows Farhi and Maggiori (2017) and we direct the reader to that paper for a full description. We extend our treatment of the IPS by allowing for different intermediate fractions of prices denominated in U.S. dollars and Chinese renminbi.[3]

In a world order dominated by the U.S,, we think of China as a new entrant with two important characteristics: it issues a small but growing amount of safe assets; and a small but growing share of world traded goods are invoiced in its currency.

There are two periods 0 and 1 and three classes of agents: the Hegemon country which we think of as the U.S., en emerging competitor, which we think of as China, and the rest of the world (RoW), where the latter is composed of a competitive fringe of international investors and consumers. For simplicity, there is no home bias in consumption, so all countries consume the same basket. There is a single final composite good, but a continuum of intermediate goods. At $t = 0$, the U.S. and the RoW are endowed respectively with w and w^* units of the composite good.

There are three assets: a risky real asset in perfectly elastic supply, a dollar nominal bond issued by the U.S., and a renminbi nominal bond issued by China. There are two states of the world at $t = 1$, indexed by H and L. The L state, which we refer to as a disaster, occurs with probability $\lambda \in (0, 1)$. The expected return on the risky asset is given by $\bar{R}^r$.

At time $t = 1$, if a disaster has occurred, the U.S. may devalue its currency vis à vis China and the RoW. The bilateral exchange rate between the dollar and the renminbi is normalized at 1 at $t = 0$, and can take one of two values at $t = 1$: $e \in \{1, e_L\}$, where e is the renminbi price of a dollar, so that $e_L < 1$ corresponds to a depreciation of the dollar. If the dollar is devalued, the U.S. pays a fixed cost τ. We abstract away from active monetary policy decisions by China and the RoW.

The preferences of the U.S. representative agent are given by: $C_0 + \delta E(C_1)$. In period 0, the U.S. chooses how many bonds to issue. RoW demand for U.S. bonds depends on whether these bonds are expected to be safe or risky, i.e. on whether the dollar is expected to depreciate in a disaster or not. If U.S. bonds are expected to be safe, then the demand is finitely elastic and given by:

$$R^s(b^{US}) = \bar{R}^r - \gamma(w^* - b^{CN} - b), \tag{1}$$

where b is the dollar value of bonds issued by the U.S., and b^{CN} is the dollar value of safe China bonds, which we take to be exogenous. These bonds include both public and private safe debt issued by institutions in the respective countries.[4] If U.S. bonds are expected to be risky, then the demand is

[3] Farhi and Maggiori (2017) modeled the extreme case of a 0 or 100 percent fraction.

[4] See Farhi and Maggiori (2017) for a discussion, and related modeling, of the aggregation of both public and private

infinitely elastic and the rate of return on the bonds is the same as that of the risky asset.[5]

The production sector in each country consists of a continuum of measure one of firms that produce intermediate varieties, denoted by $Y_t(j)$, and a retail sector that bundles these varieties into the final consumption good

$$Y_t = \left[\int_0^1 Y_t(j)^{\frac{\sigma-1}{\sigma}} dj \right]^{\frac{\sigma}{\sigma-1}}.$$

Consequently, the demand function for firm j's variety is given by

$$Y_t(j) = \left[\frac{P_t(j)}{P_t}\right]^{-\sigma} Y_t,$$

where $P_t(j)$ is the price set by firm j and

$$P_t = \left[\int_0^1 P_t(j)^{1-\sigma} di \right]^{\frac{1}{1-\sigma}}$$

is the aggregate price index, where without loss of generality, we use the dollar as the numéraire. Since there is no home bias and the law of one price holds, P_t can be thought of as the world dollar price of the consumption bundle.

Firms produce intermediate goods with a linear production technology: $Y_t(j) = L_t(j)$, where $L_t(j)$ is firm j's demand for labor. Labor is inelastically supplied in each country, with total labor given by L. We order firms in the interval $[0, 1]$ so that the prices of firms $i \in [0, x]$ are sticky in dollars and those of firms $i \in (x, 1]$ are sticky in renminbi. Labor market clearing implies

$$\begin{aligned} \int_0^1 Y_t(j)dj &= (1-x)Y_t^{RMB} + xY_t^{USD} \\ &= \int_0^1 L_t(j)dj = L, \end{aligned}$$

where Y_t^{USD} is the output produced by the set of dollar-sticky firms and Y_t^{RMD} is analogously output produced by renminbi-sticky firms. For simplicity, we assume that these firms are uniformly distributed across the world.

At date 1 in state H, there is no dollar depreciation. All prices are kept at 1, the normalized level from period 0, since prices are sticky, and so $P_H = 1$.

Now consider state L in which there might be a dollar depreciation. If the dollar is depreciated, the prices of all firms remain sticky in their respective currencies. That is, the price charged by dollar-sticky firms is $P_L^{USD} = 1$. The dollar price of goods produced by renminbi-sticky firms, however, changes to $P_L^{RMB} = 1/e_L > 1$. The aggregate dollar price of the consumption bundle after a dollar

debt. We set the constant in the demand curve in equation (1) to be $\bar{R}^r$ for tractability, and a more general treatment is offered in our earlier work.

[5] In which case, the yield on the bond is set at: $R_H = \frac{\bar{R}^r - \lambda R e_L}{1-\lambda}$. We further assume that $\delta = \bar{R}^r$, where $\bar{R}^r$ is the expected real return on the risky asset.

depreciation can thus be written as

$$P_L = [x(P_L^{USD})^{1-\sigma} + (1-x)(P_L^{RMB})^{1-\sigma}]^{\frac{1}{1-\sigma}}$$
$$= [x + (1-x)e_L^{\sigma-1}]^{\frac{1}{1-\sigma}}.$$

A dollar depreciation, $e_L < 1$, leads to a higher world dollar price level $P_L > 1 = P_H$. World dollar price inflation P_L is inversely proportional to the fraction of world prices that are sticky in dollars. Intuitively, if all prices are sticky in dollars ($x = 1$), then the real value of the dollar is constant despite its nominal depreciation. If all prices are sticky in renminbi ($x = 0$), the dollar depreciates in real terms as much as in nominal terms. As China's importance in world trade increases, which we capture here by a fall in x, the pass-through of nominal to real dollar depreciations increases.

Dollar Devaluation At date 1 in state L, the U.S. must choose whether or not to let the dollar depreciate. This decision is taken with the objective of maximizing real U.S. income. The dollar is devalued if:

$$-bR + L \leq -\frac{bR}{P_L} + \frac{\Pi_L}{P_L} - \tau,$$

where the left- and right-hand sides are respectively real income under no devaluation and under a devaluation. If there is no devaluation, the real value of output is L and debt repayment costs bR, where b is the dollar value of U.S. bonds and R is the rate on these bonds. If there is a devaluation, real debt repayment is lower at bR/P_L, but the fixed cost τ is incurred. The term Π_L/P_L is the real value of output, which, given the misallocation from the dispersion in prices resulting from the dollar depreciation, is given by:[6]

$$\frac{\Pi_L}{P_L} = x\frac{P_L^{USD}}{P_L}Y_L^{USD} + (1-x)\frac{P_L^{RMB}}{P_L}Y_L^{RMB}$$
$$= \frac{[x + (1-x)e_L^{\sigma-1}]^{\frac{\sigma}{\sigma-1}}}{x + (1-x)e_L^{\sigma}}L.$$

In what follows, we focus on the effect of price stickiness on real debt repayment via the term $\frac{bR}{P_L}$. We assume that the change in real income due to the misallocation effect is small in comparison. Formally, we take the limit of small L.

Of course, this simple static model does not do justice to the dynamic adjustment of prices. In practice, prices adjust over time, although that adjustment can take a long time in the presence of sticky wages, real rigidities and other institutional frictions. In any case, what really matters for the fiscal relief from devaluation is the maturity of the debt in relation to the rigidity of prices. The longer the maturity of the debt, and the shorter the time that prices take to adjust, the bigger the effect.

The determination of the exchange rate captures the realistic idea that in bad-enough fiscal situations, there is a regime shift from monetary to fiscal dominance. Monetary policy is then de facto

[6] The devaluation increases the relative demand for dollar goods compared to renminbi goods. Given our assumption of inelastic labor supply and flexible wages, the only equilibrium is such that the overall level of demand ensures that all labor is employed.

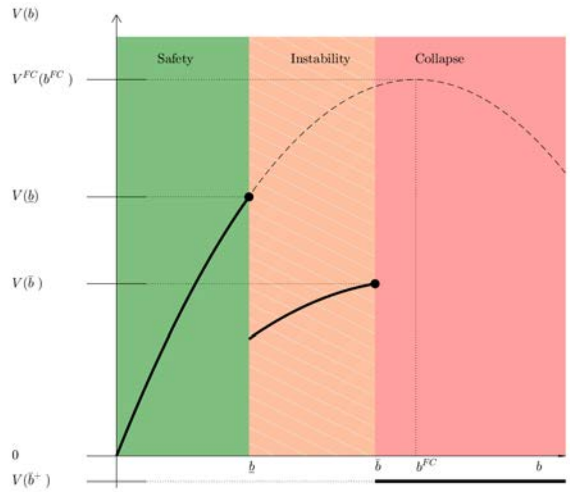

Figure I: Equilibrium with US Safe Debt

Depicts an equilibrium in which the U.S. optimally chooses to issue at the boundary of the Safety zone ($\underline{b}$). This level of debt is no longer safe once China's economic weight increases.

(not de jure) determined by fiscal considerations. Of course, ex-post U.S. misbehavior is anticipated by investors ex ante, and the latter are completely compensated in the form of higher yields. The U.S. is left worse off because of the devaluation costs. The U.S. would be better off if it could commit ex-ante not to misbehave ex post, but institutional weakness makes it hard to commit.

In Farhi and Maggiori (2017), we show that the set of possible equilibria given an amount of U.S. debt b depends on which of the three following zones the debt falls into: a Safety zone, an Instability zone, and a Collapse zone. If $b \leq \underline{b}$ only the safe equilibrium exists. If $b \geq \bar{b}$ only the risky equilibrium exists. If $b \in (\underline{b}, \bar{b}]$, both the safe and the risky equilibria exist, and we assume that the risky equilibrium is selected with probability α. When debt is in the Instability zone, the model therefore features the possibility of self-fulfilling confidence crises: if investors expect the debt to be safe, the interest rate on U.S. debt is low, and then indeed, the U.S. does not devalue in case of a disaster; if investors expect the debt to be risky, the interest rate on U.S. debt is high, and then indeed the U.S. devalues in case of a disaster. Following Farhi and Maggiori (2017), we refer to such a confidence crisis as a "Triffin event", in reference to the famous Triffin dilemma. We make clear that the underlying mechanism is fiscal.

The U.S. issues debt to maximizes the expected utility of its representative agent given a downward-sloping demand curve for the debt. The corresponding monopoly rents are the much-discussed "exorbitant privilege". For the purposes of illustration, we consider an equilibrium in which the probability α of a confidence crisis is sufficiently high that the U.S. finds it optimal to issue at the upper boundary of the Safety zone ($\underline{b}$). This equilibrium is illustrated in Figure I. The U.S. faces a new Triffin dilemma: it could issue more debt and collect more exorbitant-privilege rents with some probability, but it would then also risk losing all of its privilege if a confidence crisis materialized. Under the chosen parametrization, the U.S. displays relative fiscal discipline by issuing at the boundary of the Safety zone. In the following subsections we work through three separate effects through which the emergence of China could disrupt this world order.

I.A Increased World Trade Denomination in RMB

Starting from the equilibrium in Figure I, imagine that China's economic weight increases, in the sense that the fraction $1 - x$ of goods denominated in renminbi rises and the fraction x of goods priced in dollars falls. This development implies that the original level of U.S. debt $\underline{b}$ is no longer in the Safety zone. Instead, it now falls in the Instability zone.

To understand this effect, note that

$$\underline{b} = \tau \ \frac{1}{1 - 1/P_L} \ \frac{1 - \lambda}{\bar{R}^r (1 - \lambda / P_L)},$$

where $P_L = [x + (1 - x) e_L^{\sigma - 1}]^{\frac{1}{1-\sigma}}$. The first term on the right-hand side has an immediate interpretation: the Safety zone is larger, the larger the cost τ of a devaluation. The interpretation of the second term is as follows: the lower x, the higher P_L, the more a dollar devaluation reduces U.S. real debt repayment, the higher the ex-post benefit of a devaluation, the smaller the Safety zone. The last term captures a further indirect effect, which compounds the second term: the lower x, the higher P_L, the riskier the debt, the higher its yield, the higher the ex-post benefits of a devaluation, and the smaller the Safety zone. It also shows that the higher the rate $\bar{R}^r$, the higher the fiscal burden, the stronger the incentives to devalue, and the smaller the Safety zone.

Intuitively, when the dollar hegemony in pricing and invoicing is challenged by the rise of China, the pass-through of nominal to real dollar devaluations increases.This magnifies the fiscal pressures on U.S. monetary policy and increases the likelihood of ex-post U.S. misbehavior. Investors anticipate the possibility of this misbehavior and, consequently, the Safety zone shrinks. The new Triffin dilemma reasserts itself: the U.S. must then either reduce its debt or risk a self-fulfilling confidence crisis (a Triffin event). Furthermore, its "exorbitant privilege" is eroded.

We can also introduce a small modification to the model to capture the idea that as the fraction x of goods denominated in dollars decreases, a given amount of nominal dollar volatility now translates into higher real dollar volatility, which reduces the demand for U.S. assets and increases their expected return. Suppose that there are two classes of risky assets depending on the variance of their real returns. Relatively safe assets have an expected return of $\bar{R}^r$ as in the baseline model. Relatively-risky assets have a higher expected return $\bar{R}^{r+} > \bar{R}^r$. Suppose that in the original equilibrium, before the decrease in the fraction x of goods denominated in dollars, when investors expect the dollar to depreciate in a disaster, U.S. bonds still remain relatively-safe and have an expected return $\bar{R}^r$. The modified model is then the same as the baseline model, and the U.S. issues at the upper boundary $\underline{b}$ of the Safety zone. If the decrease in x is large enough, there is an additional destabilizing effect in the modified model. If the dollar is expected to depreciate in a disaster, U.S. bonds jump in the relatively-risky category, their expected return increases to $\bar{R}^{r+}$. A given amount of nominal dollar volatility now translates into higher dollar real volatility, which reduces the demand for U.S. assets and increases their expected return. This effect shrinks the Safety zone further.

I.B Chinese Net Issuance of Safe Assets

Starting from the equilibrium in Figure I, imagine that China's economic weight increases along a different dimension: the net supply of safe Chinese bonds b^{CN} increases. Currently, and certainly for the next few years, Chinese issuance of safe assets is limited. Given large Chinese holdings of U.S. Treasuries, China is currently a net buyer of safe assets. This situation might change in the not-too-distant future. Indeed, China has put a number of initiatives in place to start providing safe assets to Asian economies. Furthermore, what matters in the model is the Chinese net supply of safe assets, not its gross supply. Chinese savings rate are likely to decrease in the future as social safety nets and retirement systems develop.

This development reduces the U.S. exorbitant privilege. The residual demand for safe assets faced by the U.S. in equation (1) is decreasing in the amount of safe assets issued by China. The total revenue loss to the U.S. $\underline{b}\ \gamma\ b^{CN}$ is proportional to the size of Chinese issuance b^{CN}. However, under this modeling, the Safety zone is unchanged. The reaction of the U.S. depends on the size of the shift: if the shift is small enough, U.S. debt remains unchanged; if the shift is large enough, the U.S. starts reducing its debt.

Using the modified model introduced at the end of the previous section, it is easy to capture a further effect of a decrease in Chinese demand for or an increase in Chinese supply of relatively-safe assets. These developments would lead to an increase in the interest rate $\bar{R}^r$ on relatively-safe assets. This would in turn shrink the Safety zone and confront the U.S. with a renewed Triffin dilemma: reduce its debt or risk a confidence crisis.

I.C Future Chinese Net Issuance of Safe Assets

We now consider a slightly different situation to illustrate a dynamic destabilizing effect of an increase in Chinese net issuance of safe assets. We assume that in the initial equilibrium, the probability α of a confidence crisis is small enough and the demand for safe assets is high enough (w^* high enough) that the U.S. finds it optimal to choose the risky option of the Triffin dilemma and issue within the Instability zone. To make the point more starkly, we actually assume that the U.S. issues at the upper-boundary ($\bar{b}$) of the Instability zone.

Furthermore, we consider a repeated version of the model. In the dynamic model, the cost of a devaluation is no longer physical and is instead determined by the selection of the equilibrium in the continuation game. We assume that following a devaluation, investors anticipate that the U.S. is more likely to devalue in the future, and so the U.S. is given bad expectations $\alpha^+ > \alpha = 0$ from then on, which means higher future interest rates on its debt and reduced future U.S. exorbitant-privilege rents. In reduced form, this means that τ now depends on the net-present-value reduction of exorbitant-privilege rents when expectations shift from good (α) to bad expectations (α^+) following a devaluation (see Farhi and Maggiori (2017) for a full formal treatment).

Interestingly, future Chinese net issuance of safe assets decreases U.S. commitment today. To see this, consider the extreme case in which $\alpha = 0$ and $\alpha^+ = 1$. In this case, the U.S. exorbitant privilege completely disappears following a dollar devaluation. Since the U.S., after the first devaluation, can no longer be punished by worse future expectations, it will always devalue in a disaster from that point onwards. Following a devaluation, the U.S. can therefore only issue risky debt and the net-present-value of future exorbitant-privilege rents is zero. By contrast, if the U.S. does not devalue, the net-present-value of U.S. exorbitant-privilege rents is positive, but decreases with the amount of Chinese competition. As a result, Chinese competition reduces the net-present-value loss of exorbitant privilege rents following a devaluation. The erosion of franchise value by future increases in Chinese net issuance of safe assets weakens the discipline of the U.S. today. It immediately expands the Collapse zone. If the U.S. does not cut back its debt, it faces a crisis, is forced to devalue, and from then on loses its exorbitant privilege.

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