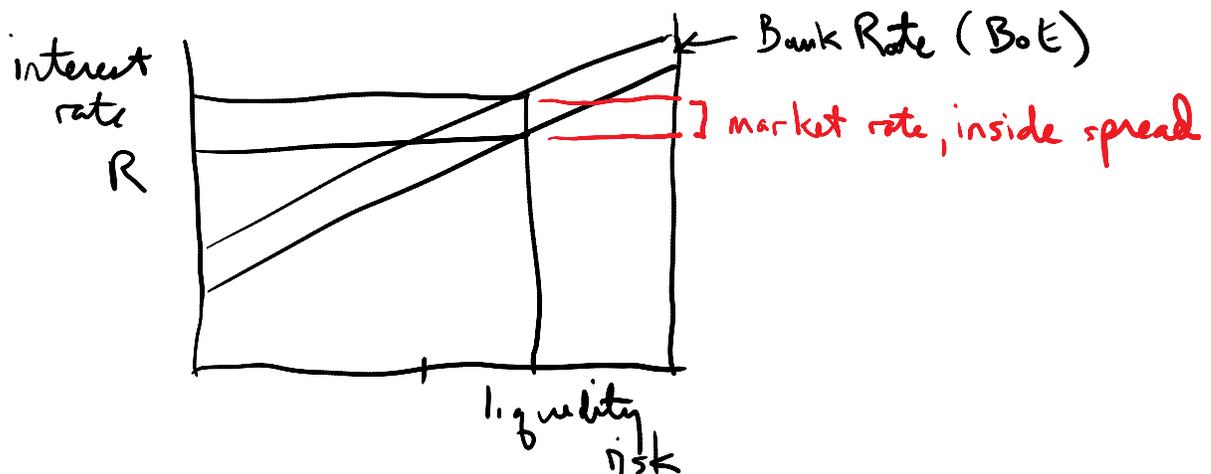
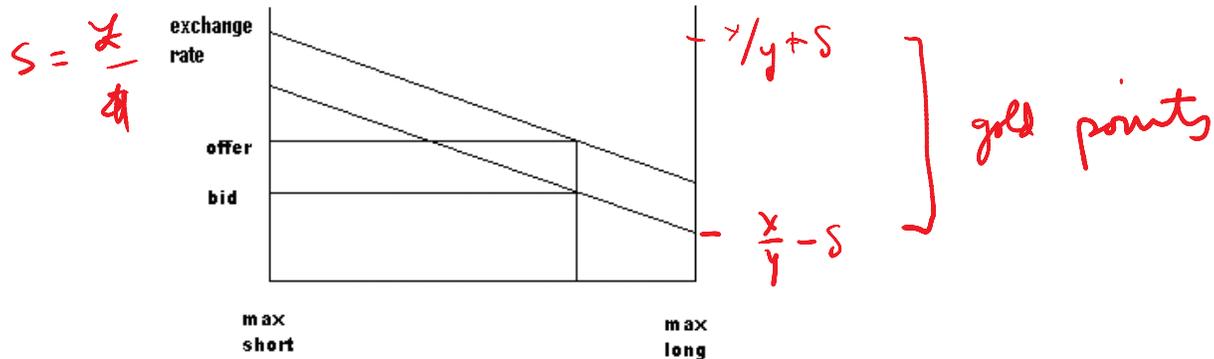


## 16. Foreign Exchange

Last time we introduced two new Dealer diagrams in order to help us understand our third price of money, the exchange rate, but under the special conditions of the gold standard.



In both cases we are treating the pound as the world reserve currency, and quote exchange rates as pounds per dollar, so lower exchange means depreciation of the dollar against the pound. The bank rate we discussed was the Bank of England's bank rate at the center of the system.

Today we build on that analysis to develop a more general theory of exchange rate determination without a gold standard anchor.

In the first lecture of this series, I contrasted metallist and chartalist explanations, and suggested that the money view involves a third approach that somewhat melds the two, but goes beyond them. Figure 1 shows the stylized example I used then of how a deficit country might acquire dollars by relying entirely on the **private FX dealing system**. This is only the starting point; the role of central banks will be introduced later.

**Figure 1**

Surplus Country		FX Dealers		Deficit Country	
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
\$10 due from					\$10 due to
-\$10 due from +\$10 spot		+10S FX spot +\$10 term R	+\$10 spot +\$10S FX term R*	-\$10S FX spot	-\$10 due to
		+\$10S FX term R*	+\$10 term R		

The first row shows the net positions of the two countries before settlement.

The second row shows how the FX dealer system facilitates settlement by creating credit, specifically a spot dollar liability which we suppose the deficit country buys from the dealer at the spot exchange rate using local currency, and then transfers to the surplus country. The consequence is expansion of the dealer's balance sheet on both sides, expansion that exposes the dealer to exchange risk, namely the risk that the dollar price of its new FX asset might fall. Note that we are quoting exchange rates as units of FX per dollar, so that a lower number means dollar depreciation or FX appreciation, and that R\* is the interest rate on FX term deposits.

As a hedge against this price risk, the second line further shows the dealer entering into an offsetting forward exchange contract by borrowing term FX and lending term dollars, taking its cue from the Covered Interest Parity condition.

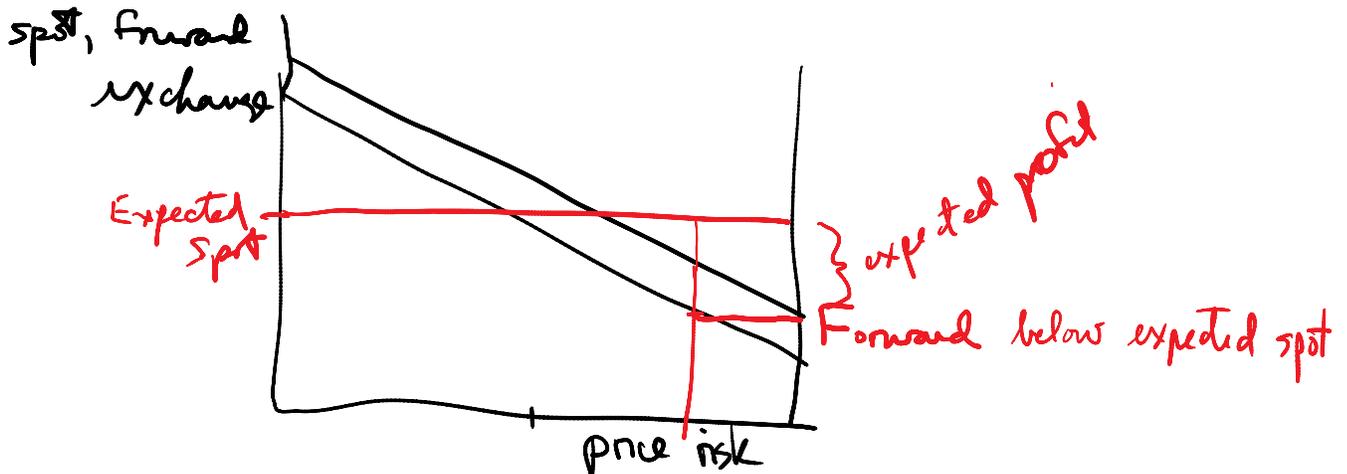
CIP: 
$$[1+R^*(0,T)]S(0) = [1+R(0,T)]F(T)$$

Taking our own cue from CIP, we adopt the convention of booking forward transactions as a pair of term credits, lending in one currency and borrowing in another. At the end of the day our FX dealer has “matched book”—if the dollar price of its new FX spot asset falls, then so also will the dollar value of its new FX term liability. It does however still face liquidity risk since maintaining the hedge requires rolling over its spot dollar liability position until maturity of its term dollar asset position.

The third row shows the position of a second “speculative” dealer who provides the forward hedge to the first dealer. This second dealer does not have matched book and so faces exposure to exchange risk, but in the forward market not the spot market. (In practice he might himself hedge with a futures position, or an FX options position, but that doesn’t eliminate the risk, only shift it to someone else.) In effect this second speculative dealer is engaged in a “carry trade”, paying the dollar interest rate and receiving the FX interest rate. If the realized spot rate is different from the forward rate, this speculation will make a profit or a loss.

### Economics of the Dealer Function

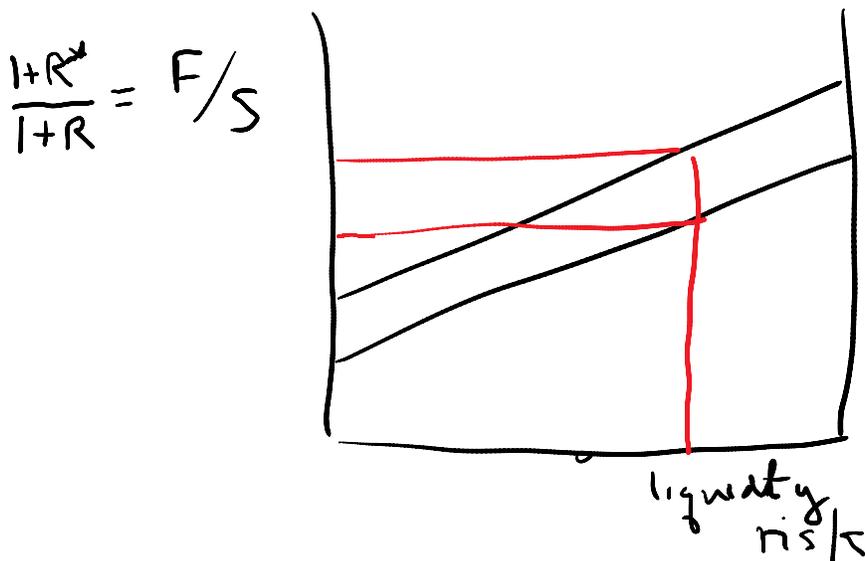
Now think about the economics of the dealer function, and let’s start with the speculative dealer. He is concerned about price risk. He will be willing to shoulder more only if the forward rate for FX depreciates relative to expected spot, so he has a larger expected profit. I am showing this depreciation as a downward sloping forward curve (quoting FX forward as  $1/F$ , and FX spot as  $1/S$ )



Notice how the economics of the speculative dealer function require violation of UIP, Uncovered Interest Parity. The expected profit that lures the dealer into a naked forward position is entirely about deviation between forward and expected spot.

Notice also how the expected spot plays the role, in a flexible exchange rate system, that the mint par ratio plays in a gold standard system. Deviations from mint par create opportunities for dealer profit, so long as there is some expectation that the system will at some time return to mint par—mint par is a kind of long run expected spot. In a flexible exchange rate system, there is not so much of a long run anchor for expected spot. Indeed, if people believe UIP then they believe that forward rates are unbiased forecasts of future spot rates, so depreciation of forward rates which arises to encourage dealers to absorb imbalances can easily be interpreted instead as a sign that future spot rates will also involve depreciation. This is a source of potential volatility in the flexible exchange rate system.

The matched book dealer faces dollar liquidity risk; the larger his book, the larger the risk. He is buying FX spot and selling FX forward. He is willing to enlarge his book, and hence his liquidity exposure, but will insist on buying spot relatively more cheaply than forward, so  $F/S$  increases with the size of the book. (S goes up, but F goes up more; spot depreciates but forward depreciates more.)



The first thing to notice now, by contrast to the gold standard case, is that the outside spread is not set by the central bank, at least not directly. Modern central banks typically operate on the overnight interest rate, not the term rate. Supposing the US and foreign country maintain constant overnight interest rates, that still leaves scope for payments pressure to move around term rates. But by CIP,  $F/S = (1+R^*)/(1+R)$ , so as positions build up term interest rates have to move apart as well. Assuming that the dollar rate is unaffected, that means FX term rates rise.

Central banks are involved indirectly because of the expectations hypothesis of the term structure, which states that term rates should be the same as the expected result from rolling over a series of short term deposits. EH fails empirically, of course, but that is because the implied arbitrage (borrowing short and lending long) exposes to liquidity risk. Our FX dealer is borrowing short and lending long in dollars, hence exposed to liquidity risk, and will be willing to do more of it only if he is compensated. One way to compensate him is to keep overnight rates low even as term rates rise.

**Aside: Note that we have here a story that makes sense of the failure of EH and UIP both. They are both a consequence of the need to offer dealers expected profit in order to make liquid markets.**

## Central Bank Backstop

But there is a limit to this. If private dealers hit their limit, and the central bank is still not willing to let the overnight rate go, the central bank itself can get into the speculative dealer business, selling the hedges that the matched book dealers want. And if that isn't enough, the central bank can get into the matched book business by doing liquidity swaps with other central banks.

The point to emphasize is the way that central bank's commitment to target overnight rates implies FX intervention whenever the F/S ratio moves to the extreme end of the possible range. Simply put, central banks that target overnight interest rates are inevitably drawn into serving as FX dealers of last resort.

Figure 4 shows the limiting case in which the deficit central bank borrows reserves from the surplus central bank for a certain term at interest rate  $R^g$ , trades those reserves with the private citizen at the spot rate  $s^g$ , and then sterilizes the consequent domestic monetary contraction by buying a domestic Treasury bill. The surplus central bank, for its part, lends term reserves by creating a spot deposit to the credit of the deficit central bank, which winds up in the hands of its own private citizen, and then sterilizes the consequent domestic monetary expansion by selling a domestic Treasury bill. (For simplicity, we do not show explicitly the private citizen counterpart to either of the sterilization operations.)

**Figure 4**

	Surplus Country		Deficit Country	
	Assets	Liabilities	Assets	Liabilities
Private Citizen	\$10 due from			\$10 due to
			-10 $S^g$ FX spot +\$10 spot	
	-\$10 due from +\$10 spot		-\$10 spot	-\$10 due to
Central Bank	+\$10 term, $R^g$	+\$10 spot	+\$10 spot	+\$10 term, $R^g$
		-\$10 spot, CB +\$10 spot, PC	-\$10 spot +10 $S^g$ FX spot	
	-\$10 Treasury bill	-\$10 spot	+10 $S^g$ FX term	+10 $S^g$ FX spot

The first point to emphasize here is that, at the end of the day, the deficit country central bank is borrowing dollars term and lending FX term, which is essentially a naked forward position analogous to the position our speculative private dealer was induced to take by the expectation of private profit (compare Figure 1). But the central bank need not, and probably does not, expect

to profit from its speculation. For one, the interest rate at which it borrowed from the surplus central bank need not, and probably does not, match the term funding rate in private credit markets. And the spot rate at which it sold dollars to its own citizen need not, and probably does not, match the spot rate in private FX markets. These are both, at least potentially, policy rates and as such can be expected to reflect the non-commercial relationship between one central bank and another internationally, and the non-commercial relationship between the central bank and the needy private citizen domestically.

The second point to emphasize is that, at the end of the day, the surplus country central bank is lending dollars term to a foreign central bank, instead of to its parent government. This is very unlikely to be a move about which the parent government is neutral, hence our characterization of it as a limiting case. But other counterparties, other than the surplus country central bank, would also work. There are sources of reserves other than the Fed, sources such as regional liquidity pooling arrangements or the International Monetary Fund which do not depend on the goodwill of the surplus country's government.

Even more, once it is recognized that deficit country dealer of last resort essentially involves willingness to take on a naked forward position when no one else will, it becomes clear that the whole operation need not involve another central bank as counterparty at all. The deficit country central bank could, if it so chose, instead facilitate private matched-book dealing by serving as the speculative dealer to enable forward hedging of spot exposures. Or it could go even farther, facilitating the term dollar borrowing of its own private citizens by directly offering them forward hedges, so taking their exchange risk onto its own balance sheet. Again, all of this is policy, so pricing of these forward contracts need not be, and probably will not be, on commercial terms. The limiting case along these lines comes when central banks offer forward cover to all comers at the same rate as current spot exchange, in effect fixing the exchange rate as a matter of policy.

The danger, of course, whenever you offer to trade with all comers at non-commercial prices, is that in doing so you offer arbitrage opportunities for speculators.<sup>1</sup> The positive case for doing so must therefore rest on an argument that commercial prices are in some sense wrong. We have seen (in section II) that one consequence of the view that the exchange rate is the relative price of money is to draw attention to the way that order flow can push prices around for reasons that are not fundamental. The potential problem is that private agents take these distorted prices as parametric for their economic decisions, and so make distorted decisions.

There is thus potentially an argument for central bank intervention, certainly in extremis to prevent breakdown of the payments system, but also in less extreme situations where, for one reason or another, private markets are not making markets at all, or only reluctantly doing so at

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<sup>1</sup> Just so, DeRosa (2009, p. 80): "...all these crises were preceded by the accumulation of substantial at-risk positions that were short the U.S. dollar and long local currency. When the crises occurred, the entire market, not counting the central bank, had to buy dollars and sell the local currency immediately in order to hedge."

the cost of substantial price distortion. But it is an argument that applies only under specific conditions, not universally. The exchange rate is not a free variable left open for state choice, but neither is it a market price that always fully reflects fundamental valuation.

## **Renminbi**

McCauley reports on the state of play in terms of the internationalization of the renminbi. China has very strict controls over most of its money and credit system (track one) with some periphery allowed to price competitively (track three). What is happening now is a third track, basically centered in Hong Kong, both money markets and capital markets. It is clear that McCauley has in mind as an analogy the evolution of the Eurodollar market, which took the US authorities by surprise when it happened, but then they allowed it. Today world funding markets are dollar funding markets.

That's a long way away for the renminbi probably. The first thing will be breaking down the barriers between track three and track two, and then also track one. Central bank control will in the course of this shift from a gold-standard like price setting function to a modern price backstopping function.

The concern in all of this is exchange rate instability. The key player in everything is the speculative dealer who is willing to take a position only if the forward rate is lower than the expected spot. But what anchors expectations about expected spot? Depreciation of forward looks like a forecast of future spot, and if that forecast leaks into expectations of actual future spot, then the whole system can get unhinged.