From standing dollar bid to digital currency

The balance sheet of the People's Bank of China

Daniel H. Neilson *

2021-09-03

Note

This is a premlinary draft. Comments are welcome, contents are subject to change. This work was presented in an earlier form in the following blog posts:

1. Onshore and offshore renminbi: Mechanics of RMB internationalization
2. The PBOC standing bid
3. The PBOC balance sheet, part 2
4. Smart contracts for monetary policy?

Introduction

Perhaps the most widely known datum concerning China's financial system is that the country owns foreign exchange reserves valued at over $3 trillion. To interpret that figure, however, requires that it be put into an appropriate context. China's FX reserves are held by its central bank, the People's Bank of China (PBOC). Like other central banks, the PBOC serves as a banker's bank, providing banking services to the country's commercial banks; like other central banks, it serves as a government bank, providing banking services to the Chinese state. The PBOC's circulating liabilities are the best domestic money and serve to clear all other claims through the country's payment system. These liabilities are a source of funds to the central bank, whose single largest use of funds is the FX reserve,

*dneilson@simons-rock.edu and daniel.neilson@umb.edu

valued at about 21 trillion yuan renminbi (CNY).[1]

China's foreign exchange reserves, that is, are an entry on the asset side of the balance sheet of a bank. This paper takes that entire balance sheet as the principal context for interpreting China's foreign exchange reserves. In that context, the main question is how the bank manages its balance sheet so that its liabilities continue to serve as money. All central banks establish, follow and revise policies and frameworks to achieve this goal. Many, though not all, of these management decisions have consequences for the composition of the central bank's balance sheet. The published version of the balance sheet provides a key window on how central bankers are approaching their task.

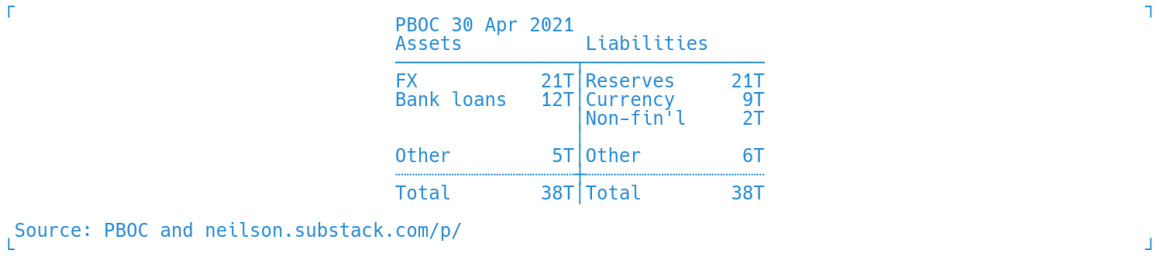
The PBOC, like other central banks, sits at the center of the domestic payment system. Because China maintains significant control over cross-border ownership claims, in particular of financial instruments, the PBOC also plays a pivotal role at the interface between the country's domestic financial system and the international financial system. Cross-border movements of capital, commodities and goods, and cross-border financial claims, are essential to the country's productive arrangements. The central bank thus plays two key roles in China, and it plays these roles by managing its balance sheet. Understanding the way that it does this, as I will argue in what follows, offers disproportionate insight into China's domestic and international financial position.

The PBOC's portfolio

To fix ideas, here is a snapshot of the PBOC's balance sheet as of April 30, 2021[2]:

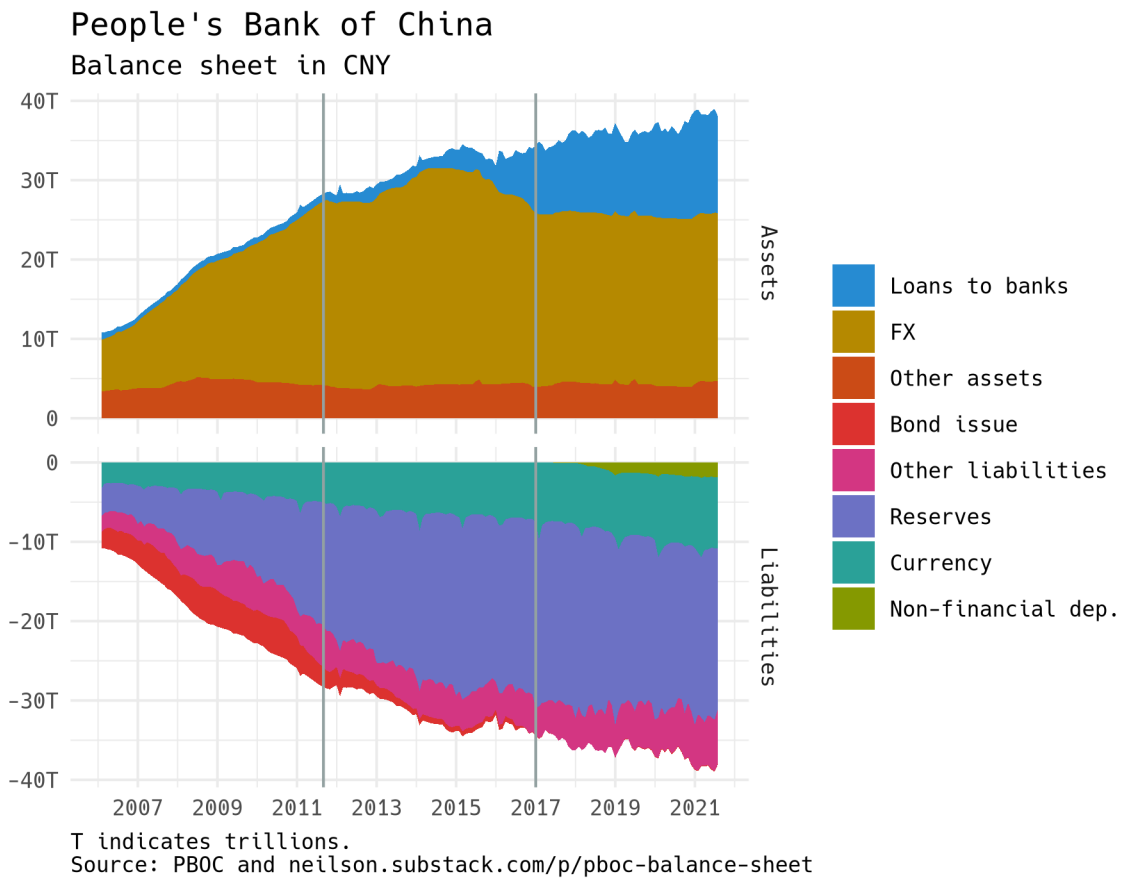
[1] Throughout the paper, I use "CNY," "yuan," and "yuan renminbi" to denominate quantities of Chinese domestic money. *Renminbi* "people's currency" is the name of the unit, analogous to "sterling;" *yuan* is the counter, analogous to "pounds." "CNH" denotes renminbi issued by banks outside of the mainland Chinese banking system, typically though by no means exclusively in Hong Kong.

[2] Here and elsewhere, balance sheets are represented using the accountant's tool of T accounts. Assets are written in the left column; liabilities in the right. The T account follows the principles of double-entry accounting, so that total assets are necessarily equal to total liabilities. This paper focuses on developing a high-level understanding of the central bank's interventions, so I have frequently rounded and combined balance-sheet entries for clarity.



The total size of the balance sheet is some 38 trillion CNY, about $6 trillion at the current exchange rate, or about three quarters of the current size of the balance sheet of the US central bank, the Federal Reserve. The balance sheet shows that the PBOC has a long position in foreign exchange—the world's largest sovereign FX reserve at 21 trillion yuan. Most of the rest of its assets is in the form of credit extended to the country's banking system. This asset portfolio is funded on the liability side by the reserves of those same banks, currency issue, and a number of smaller positions.

The PBOC's balance sheet, like those of other big central banks, has expanded significantly since 2007. This graph, which is the central piece of evidence in this paper, shows the PBOC's balance sheet over time. Assets are in the top panel, measured using positive figures; liabilities are below as negative figures. The regions show in different colors the balance-sheet entries over time and are stacked, so that the outer limit measures the overall scale of the balance sheet. The T account above matches the right edge of the graph.



The balance sheet data that is shown come directly from the published accounts of the central bank itself. In the graph, I have added two vertical lines, based on my views on the changing composition of the balance sheet. The first line is in the second half of 2011 and marks the beginning of the end of a sustained period of foreign exchange accumulation. The second is at the beginning of 2017 and marks the end of the beginning of a stable FX reserve position. Between, a period that can be understood as transitional.

The PBOC's balance sheet was managed according to different logic in the different periods, as the graph shows.

Before 2011: The PBOC standing bid

Prior to 2011, the PBOC operated a system of FX accumulation. The charged discourse on this subject is largely unhelpful. But what happened is plain.

The PBOC established what amounts to a standing order to buy USD at the policy exchange rate: the central bank would buy, at a known price, the dollars that were entering the country through the books of its export sector. That exchange rate, adjusted over time, was set at a level that ensured profitable export opportunities. The export sector was ramped up to bring those dollars in. Throughout this period, the presence of the PBOC as a buyer of dollars at an advantageous price provided a key channel of CNY-denominated profit for the export sector.

The transactions could be represented like this:

PBOC		Onshore bank		Mainland exporter		Offshore Importer		
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	
	+CNY rsvs	+CNY rsvs	+CNY dep	+CNY dep				(1)
+USD T-bill				-goods		+goods -USD		(2)
	-CNY rsvs +Bond issue	-CNY rsvs +Bond issue						(3)
USD T-bill	CNY rsvs Bond issue	CNY rsvs Bond issue	CNY deposit	CNY deposit		goods		(4)

The PBOC standing bid, prior to mid-2011. The PBOC stood ready to issue CNY bank reserves against foreign exchange (1). The country's developmental capital was structured to generate those dollars through exports (2). The PBOC then absorbed some of the reserves with sterilization bonds (3). The result was a large accumulation of FX reserves at the PBOC, typically in the form of US Treasury debt (4).

Source: neilson.substack.com/p/pboc-balance-sheet

I have chosen to think of this policy as starting from the central bank's exchange-rate fix. One might instead think of it as starting from the initiative of exporters, or that of importers, or even the banks. But I say it starts with the central bank, acting in coordination with other institutions implementing China's development strategy. Other pieces of the strategy, importantly capital investment, were mobilized to build the export capacity that could take advantage of the central bank's willingness to buy dollars.

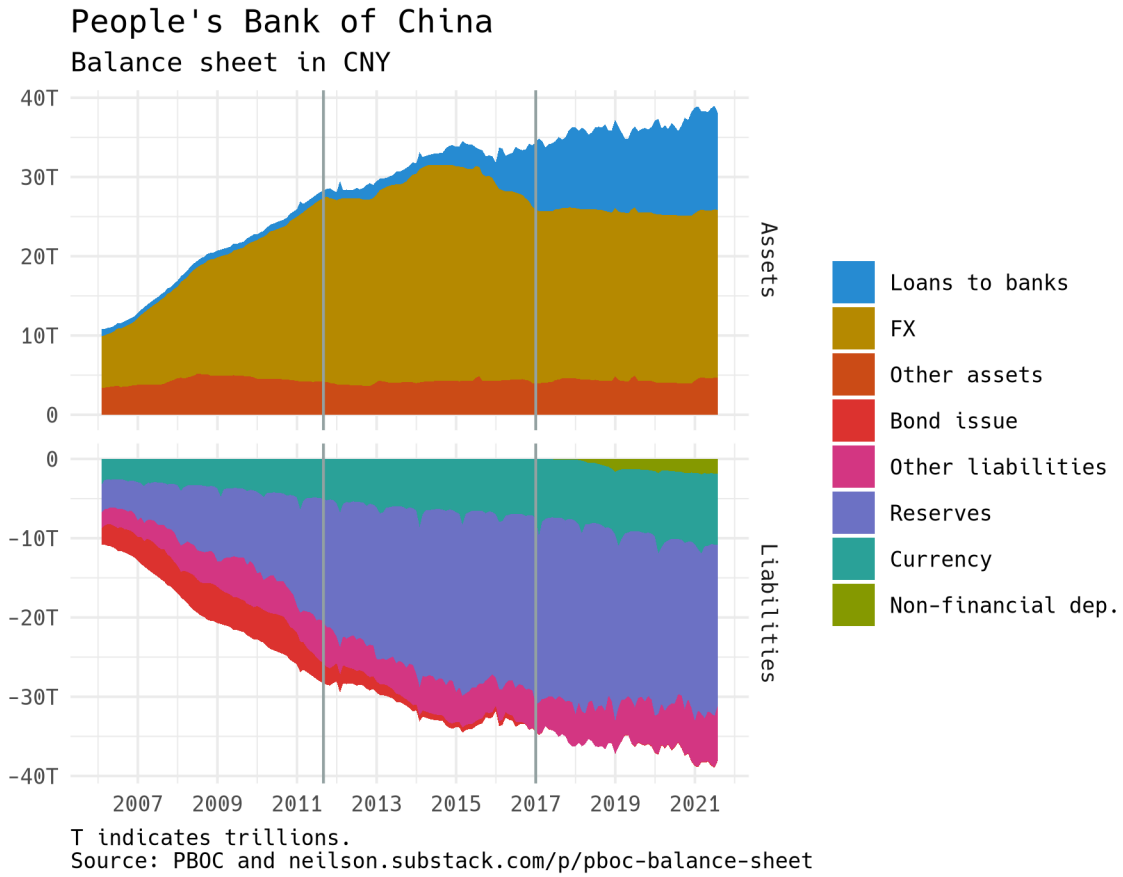
To be continued

These T accounts give a schematic view: they show the role of the PBOC in generating profits through the export sector using exchange rate policy.

As the graph shows, that pattern has changed: the PBOC has stopped accumulating FX reserves. I'll come back to the post-2017 logic in a future post.

The second regime

This is the second part of my analysis of the PBOC balance sheet. In the first part, I started from this graph of China's central bank's financial position over time:



The period up to the first vertical line, in the second half of 2011, represents the PBOC "standing bid"—an open-ended willingness to buy—dollars entering the country. The period after the second line, from 2017, is the focus of this post. But first, readers called my attention to a loose end from last time.

I have focused on current-account transactions, exports, as the source of FX accumulation, but said nothing about investment inflows, which were also large. It is certainly true that significant volumes of dollars entered China via FDI during this period. What happened to those dollars? Possibilities are three: 1) they were used to purchase inputs abroad, in which case there was no net reserve accumulation; 2) the investments were later paid back,

in which case there was also no net reserve accumulation; 3) the dollars were exchanged for yuan and spent domestically.

In this third case, the dollars would have been sold, no different from current-account inflows, and would indeed end up as FX reserves at the central bank. As long as, on net, the pool of accumulated FDI continues to grow, then the "standing bid" analysis still applies, and what is being exported is ownership claims on Chinese production.

I'll leave that aside for now, but let me say once more that I am trying to look through the central bank's balance sheet and get a macro window onto the entire Chinese financial system, which is sure to be incomplete. If readers know of different analyses, or have their own, please get in touch.

After 2017: Foreign assets in the banking system

Beginning in mid-2011, a series of changes brought about new pattern for the PBOC, which by 2017 had settled into the balance-sheet structure that is in operation today.

The differences are visible in the graph above: the PBOC continues to expand its portfolio, but no longer by buying foreign exchange. Instead, the expansion comes in the form of increased lending to the country's banking system. This has been funded, on the liability side, by issuance of currency and reserves, and more recently with a small but growing expansion of deposits to non-financial institutions. (Also notable is the increased month-to-month variability of the total size of the balance sheet: an important question for a future edition of *Soon Parted*.)

Dollars continue to flow into the country: China recorded a current-account surplus of CNY 487 billion (USD 75.1 billion) in the first quarter of 2021, mostly invoiced in foreign currency. Under the standing bid FX regime through 2011, the PBOC was buying a lot of those dollars, but since 2017 that is no longer the case. So what balance sheet in China is holding the continued FX inflow?

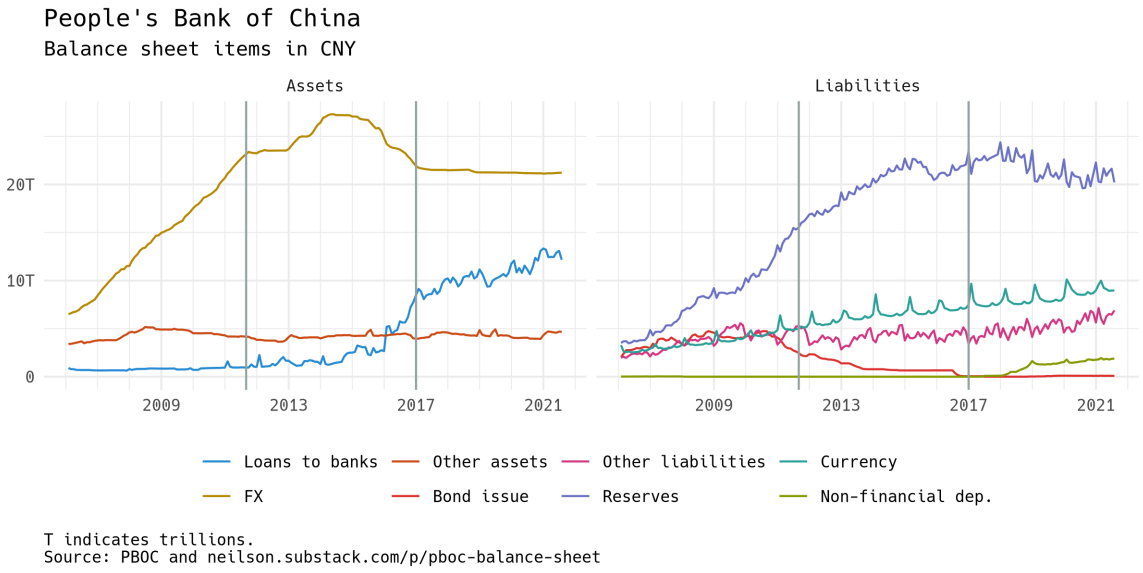
Several clues suggest the answer. This April speech points to an accumulation of foreign assets by the private sector, totaling 5.3 trillion USD at the end of 2020. In a surprise

move earlier this month, the PBOC increased reserve requirements on FX deposits. And the renminbi has been been on an upswing (one yuan buys more dollars; one dollar buys fewer yuan) since the beginning of the pandemic.

It seems that the commercial banks are holding the incoming foreign exchange. Banks face a reserve requirement as they expand their foreign-exchange deposits, and we can see from the graph above that the marginal supply of those reserves comes from PBOC lending to the banking system. The PBOC is issuing reserves, and lending the funds back into the banking system, presumably at longer term. In T accounts:

FX reserve accumulation is still happening in the broader state financial sector, but through a clear shift in policy, it is happening on the balance sheets other than that of the central bank. Exchange risk is now being housed on banks' balance sheets rather than the PBOC's.

Key to this system are the PBOC's loans to banks, which in the post-2017 system provide both the secular expansion and the month-to-month fluctuation in reserves. In my still-imperfect understanding, PBOC loans to banks come in the form of liquidity facilities, which are accessed on the initiative of the banks. This graph, which uses the same data as above but unstacks the balance-sheet entries, makes it easier to see how this works:



Loans to banks, the blue line on the asset side, is the only asset entry with significant month-to-month fluctuations. On the liability side, these are balanced by seasonal fluctuations in

currency issue, and monthly variation in reserves and government deposits (under other liabilities).

Connection to other financial changes in China

There are other big shifts going on in China's financial system—the rollout of a central bank digital currency, the domestic crackdown on crypto mining and transactions, regulation of fintech companies, and a number of recent ventures by global banks setting up shop in the country. The PBOC's balance sheet is one place where all of these come together.

Onshore and offshore renminbi: Mechanics of RMB internationalization

It is not possible, I think, for a single person to be fully informed about China's financial system. Just in the last couple of months, there has been a significant acceleration of involvement of US banks in China, at least superficially in contradiction with the country's recent crackdown on fintech groups. At the same time, the country has made an extremely rapid push toward the launch of its DC/EP digital currency platform.

There is no substitute for detailed knowledge of each of these situations. But there are at least two important issues that can be understood, at least partly, on their own, and which frame the others: the internationalization of the renminbi and the central bank's balance sheet. This post draws from my contributions to joint work on this CIGI piece on the RMB. I'll come back to the PBOC balance sheet in a future edition of *Soon Parted*.

Offshore RMB: two mechanisms

There has been and continues to be a lot of noise about internationalizing the RMB. Usually this is cast as a contest for global hegemony between the US and China. Regardless of one's stance in that debate, it seems helpful to understand the mechanics by which China allows offshore users of its currency to bring their funds into China.

To be clear about how it works, we have to be clear about the terminology: *renminbi* is

the name of the currency, *yuan* is the unit in which it is denominated (so "yuan" is to "renminbi" as "pound" is to "sterling"). *CNY* is the symbol for onshore renminbi, i.e. funds on deposit or invested in securities that trade in mainland China. *CNH* is the symbol for offshore renminbi funds, i.e. on deposit or invested in securities that trade outside of mainland China. Hong Kong is the most established trading hub for CNH (thus the "H"), but substantial volumes of CNH now trade elsewhere as well. *RMB* is either (when used carefully) shorthand for the combined CNY–CNH system, or (when used sloppily) a generic symbol for either CNY or CNH.

The CNY–CNH structure is comparable to on- and offshore markets for other currencies. For example, banks around the world create dollar deposits, most famously in London. Whether in dollars or in renminbi, the crux of the matter is whether and how these funds can be used in their respective home financial systems. China allows such remittance in two main ways.

In the first scenario, dollars are received by an offshore bank authorized to transact with the PBOC. Typically this is the foreign office of a mainland bank, for example Bank of China's Hong Kong branch, BOC (HK). At this point, the offshore bank has offshore CNH deposits against a reserve position in onshore CNY. It can then use the onshore reserves to complete payment on behalf of its depositor:

PBOC		Onshore bank		Mainland exporter		BOC (HK)		
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	
						+USD	+CNH dep	(1)
+USD T-bill	+CNY rsvs BOC(HK)					-USD +CNY rsvs		(2)
				-goods				(3)
	-CNY rsvs BOC(HK) +CNY rsvs onshore	+CNY rsvs	+CNY dep	+CNY dep		-CNY rsvs	-CNH dep	(4)
USD T-bill	CNY rsvs	CNY rsvs	CNY dep	CNY dep				

Mechanisms: Trade Settlement. Invoiced in RMB, settled offshore. The balance sheet of the offshore importer is omitted. (1) BOC (HK) accepts dollars from and creates a CNH deposit for the foreign importer; (2) BOC (HK) buys CNY at the PBOC using the USD as reserves; (3) Goods are delivered; (4) BOC (HK) makes payment to the exporter's bank, which credits the exporter's deposit account in CNY. Source: neilson.substack.com/p/rmb-i18n

A second, slightly more involved mechanism achieves the same result using correspondent banking. Instead of the offshore bank transacting directly with the PBOC, an onshore bank

can serve as its agent. The mainland bank has access to reserve money at the central bank, while the offshore bank is able to issue deposits outside of mainland China. A correspondent relationship connects the two. The onshore bank creates a channel by which the offshore funds can reach the onshore, CNY-denominated payment system:

PBOC		Onshore agent bank		Mainland exporter		Offshore bank		
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	
						USD	USD dep	
		+USD	+nostro USD			-USD +nostro USD		(1)
+USD T-bill	+CNY rsvs	-USD +CNY rsvs	-nostro USD +nostro CNY			-nostro USD +nostro CNY	-USD dep +CNH dep	(2)
				-goods				(3)
			-nostro CNY +CNY dep	+CNY dep		-nostro CNY	-CNH dep	(4)
USD T-bill	CNY rsvs	CNY rsvs	CNY dep	CNY dep				

Trade settlement, invoiced in RMB, settled onshore. The balance sheet of the offshore importer is omitted. (1) Offshore bank opens a USD correspondent (nostro) account with an onshore bank; (2) Onshore bank exchanges USD for CNY at the PBOC on behalf of the offshore bank; (3) Goods are delivered; (4) Offshore bank pays in CNY against CNH deposit.
Source: neilson.substack.com/p/rmb-i18n

Comments

1. The PBOC still has to purchase dollars, even though payments are being made using offshore RMB. Internationalization by itself doesn't stop the accumulation of FX reserves.

2. To bring offshore CNH onshore for domestic payments in China, there must be a bank that transacts in both. In the first example, this is BOC (HK); in the second, the offshore correspondent bank. Either way, this bank has offshore liabilities and onshore assets, and makes a market between them. Whether this market can be made, and whether the price is stable at one, is the main issue for internationalization.

China's digital currency: Smart contracts for monetary policy?

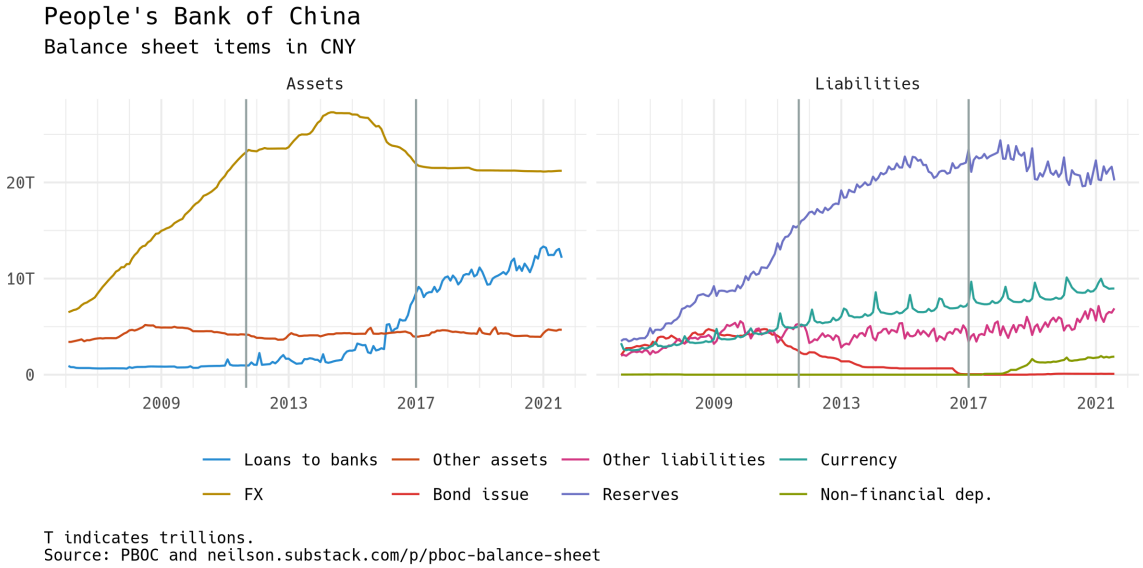
China's new digital currency, called the e-CNY in the People's Bank of China's own recent publications (elsewhere e-yuan, DCEP, digital RMB, etc.), has prompted commentary on its payment innovations, privacy implications, role in international transactions, and potential

financial stability implications. There is another angle that deserves attention: digital currency as a transmission vector for monetary policy. Joseph Wang mentions in his book that fine-grained monetary intervention is a key motivation for central bankers (not only in China) to pursue digital currency projects.

One still has to dig a bit for good English-language sources on the e-CNY project, but a July 2021 PBOC working paper offers a helpful official overview (PBOC 2021). A January 2021 piece by Yaya J. Fanusie and Emily Jin (2021) focuses on developing CNAS's liberal critique of China's digital currency, but also offers a comprehensive bibliography. From these sources, it is possible to say quite a bit about what central bankers at the PBOC hope to achieve with the e-CNY.

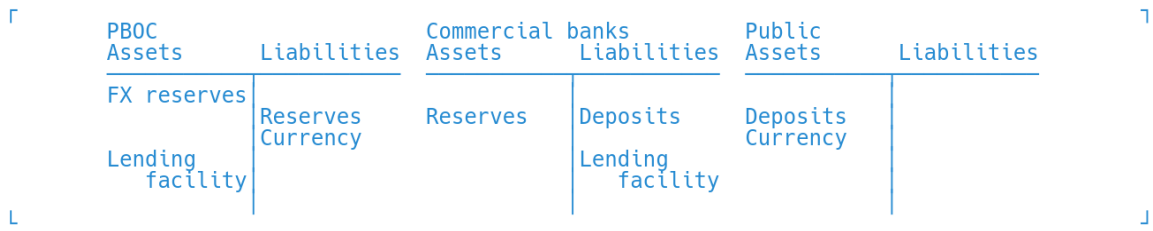
E-CNY on the PBOC balance sheet

Start with the central bank's balance sheet. The graph below shows the largest components of the Chinese central bank's balance sheet since 2011, with assets to the left and liabilities to the right. (The vertical lines in 2011 and 2017 mark changes in the FX reserve accumulation regime, which I wrote about here and here.) The quantities are in Chinese yuan renminbi, which trades at about 6.5 to one USD at this writing.



The PBOC has already begun issuing e-CNY, but the quantities are still tiny and they are

not reported on the balance sheet. This picture can still be helpful, however, in interpreting what the central bank hopes to achieve with its digital currency design. Note that on the asset side, only the entry for bank lending fluctuates from month to month. On the liability side, there are several fluctuating entries. Because the balance sheet balances (total assets equal total liabilities), all of these fluctuations on the liability side are absorbed by fluctuations in just the bank lending line on the asset side. These T accounts illustrate central bank's financial relationships:



Source: https://neilson.substack.com/p/e-cny

CBDC on the central bank's balance sheet

Where does CBDC fit into these pictures? E-CNY will appear as a liability entry to the central bank, so on the right panel of the graph above. It will substitute, to some extent, for banknotes and reserves. Banknotes' physicality means that they will always be stickier than reserves, which are electronic, so I will focus on the latter.

Similar to Swedish Riksbank's e-krona pilot, the e-CNY uses a two-tier system of financial relationships. The first tier, between the central bank and commercial banks, is based on issuance and redemption of e-CNY in exchange for reserves; the second tier, between banks and the public, is based on e-CNY payments and exchange between deposits and e-CNY. Reserves, deposits, currency and e-CNY are all meant to serve as money, so all of these exchanges are meant normally to occur at par, a constant fixed price of one.

The problem faced by the banks in this two-tier system is to finance an inventory of e-CNY so as to be able to sell them to customers in exchange for deposits. Whenever a bank's customer uses deposits to buy e-CNY, this inventory shrinks, the deposits are destroyed, and the bank's balance sheet contracts. This could increase the fluctuations that the PBOC's balance sheet is already absorbing.

If flows between deposits and e-CNY become large enough to threaten par clearing or bank balance sheet positions, policymakers may feel they need to offer banks a channel for refinance. As the balance-sheet graph above shows, they are already using the bank lending channel to manage the availability of reserves, so it could likely be used to support e-CNY issuance as well. These T accounts illustrate the two possibilities:

PBOC		Commercial banks		Public		
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	
FX reserves Lending facility	Reserves Banknotes	Reserves	Deposits Lending facility	Deposits Banknotes		
	-Reserves +e-CNY	-Reserves	-Deposits	-Deposits +e-CNY		(1)
+Lending facility	+e-CNY		-Deposits +Lending facility	-Deposits +e-CNY		(2)

Two strategies for e-CNY issuance. (1) Allow disintermediation of banks. (2) Use lending facility to reintermediate. Source: https://neilson.substack.com/p/e-cny

In the first strategy, bank balance sheets are allowed to contract, while the central bank's balance sheet holds steady. In the second strategy, central bank balance sheet expansion prevents commercial bank balance sheets from contracting. Note that these T accounts do not have any particular sense of time: it could be that the first strategy is used over the long term, while the second is used in the short term.

Smart contracts and monetary policy transmission

So far so good, but none of this really makes clear what the central bank hopes to gain. Why not just impose tighter regulations on banks and fintech payment providers, get the benefits of electronic payment innovation and call it a day? The answer, as former central banker Yao Qian suggests (Yao 2018a; Yao 2018b), lies in the use of the smart contract funtionality built into the e-CNY design. Smart contracts allow conditional logic to be programmed into financial agreements in the payment system itself. The logic is automatically tested and the contract is executed accordingly. One might think of an options contract that is executed automatically if it is in the money at expiry, or an automatic expiration for an equity share order. E-CNY smart contracts expand on this idea by operating in the monetary system itself, and by enabling a more complete set of logical conditions.

One example from Yao's paper is a time-contingent smart contract that causes e-CNY to be created when a bank closes a commercial loan. Using the central bank's lending facility, for example, a commercial loan could be structured as shown in the T accounts below. When the loan was agreed, the commercial bank could borrow from the lending facility, and the smart contract would trigger the immediate issuance of the e-CNY: transactions that are economically connected could be automatically synchronized. From the central bank's point of view, this has the benefit of reducing the transaction float, the payment initiated but not completed at any given time.

PBOC		Commercial bank		Public	
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
+Lending facility	+e-CNY	+Loan	+Lending facility	+e-CNY	+Loan

Smart contracts allow all parts of a commercial loan transaction to execute simultaneously. Source: https://neilson.substack.com/p/e-cny

The types of contingency that the PBOC has built into its e-CNY give a sense of the central bank's ambitions for the project. Smart contracts could depend on timing, as in the example above, on characteristics of the counterparties, or on prices or other economic variables. Such an architecture would give the central bank extensive and fine-grained control over transaction flows. For example, a smart contract contingent on a macroeconomic variable could automatically expand or contract credit in response to changing conditions. Rather than having to hold a monetary policy committee meeting to raise or lower a reserve ratio requirement, the central bank could pre-program its response function and have it execute automatically.

Outlook

This ambition is still far from being a reality, and experience will be the only way to judge whether smart contracts mark a decisive new paradigm for central banking. For now, the PBOC is forging ahead with its CBDC project. Other central banks are moving more slowly while watching China's experiment closely. If central banks can really become "not only the decision-maker of money supply but also the designers of algorithms and rules," as Yao suggests, then substantial new thinking on monetary policy will be needed.

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