Endogenous Money and the Lender of Last Resort of International Liquidity

Edward H.Y. Liu, SIFL[1]

The key to prevent financial crisis is to deal with the issue of the lender of last resort (LLR), and a network of swap lines among central banks may become the base infrastructure to provide the international liquidity.

In the modern financial system, money is largely generated endogenously, leading to the embedded possibility of financial crisis. In the time of intensified uncertainty, the deadly shrinking cycle may lead the enforced deleverage of the financial system into a self-fulfilling collapse. This is the time when only central bank could end the cycle by providing unlimited liquidity to the banks. By giving up the burden of "money convertibility" of golden standard, central banks gradually take up the duties of lender of last resort (LLR), which has substantially decreased the frequency and severity of financial crisis. However, due to the lack of an international lender of last resort (ILLR), many countries have encountered forex type of financial crisis since 1973 after Bretton Woods system collapsed. Build a network of swap lines among central banks of sovereign states could be a promising way to solve the problem. Under the principles of multilateralism, autonomy, transparency, gradualism and integration, this network, instead of any particular central bank or national institution, would be the basic infrastructure of ILLR.

The paper is organized as below. The first part discusses the endogeneity of money; the second part discusses central bank's function as LLR and its relationship with

---

[1] This is a working paper presented at the "China in the International Monetary System" conference, which co-organized by China Society for Finance and Banking, and Reinvent Bretton Woods Committee. Extra thanks to Shanghai Institute of Finance and Law (SIFL).

financial crisis; and the third part discusses the necessity for central banks to build up a network of swap lines which functions as basic infrastructure of ILLR.

Endogenous Money

In late 17th century, banks which issue bank vouchers based on the principle of fractional reserve started to rise in the Western Europe. Bankers soon found that banks almost have unlimited freedom as well as capacity to create credit for the lenders as requested.

From the perspective of accounting, a loan builds up debt-credit relationship between a bank and a lender. On banks' balance sheets, the added assets are those loans to borrowers, and added debts are issued bank vouchers. To borrower, the added assets are bank vouchers which are officially accepted, and the added debts are its payment obligations to the bank. Without considering any other factors, as long as the bank and the borrower reach an agreement, they can create new credit and debt at any scale. Thus, the tool of "payback promise" —the money—is no longer limited by the amount of coins. Whenever it is needed, banking system can create enough money by adding bank assets and liability at the same time. Meanwhile, as long as the convertible principle is honored, although the amount of money is increased, the value per unit of money hasn't been diluted. This is fundamentally different from the circulation of new mined precious metal, which dilutes the money. In this way, under the operation of modern financial system, the quantity of money is decided endogenously by bank responding to credit demand of the economy.

Hence for the expansion of the quantity of money, the more important mechanism is not "deposits create loans," but "loans create deposits". When a bank agrees to loan one million dollar to a company, what really happens is that the bank keeps accounts on both sides of its balance sheet: liability increased by one million, as deposits the company has with this bank, and assets increased by one million as loan the company owe to this bank. The changes in the balance sheet will look like as follows:

Old balance sheet of bank:

Asset	Liability
Loan: $90 million	Deposit: $90 million
Cash Reserve: $10 million	Capital Cushion: $10 million

New balance sheet of bank:

Asset	Liability
Loan: $91 million	Deposit: $91 million
Cash Reserve: $10 million	Capital Cushion: $10 million

The structure of both assets and liability changed after issuing the new loan. To address various requirements, such as capital ratio, reserve ratio and so on, the bank may need to undertake a variety of financial operations. In most of scenarios, a bank is capable to increase its loans and deposits as wished, without breaking any requirement; sometimes, though, a bank may need to conduct necessary financial operations. For instance, when there is a shortage of cash reserve, such as deposit reserve with central bank, a bank may need to raise more cash reserve by selling assets or repo; when capital ratio is too low, a bank may need to increase capital.

Most of the time, banks and clients use deposit transfer to settle payments and bank vouchers are more used in daily payment of small amount. Deposit is the major part of money now. Based on central bank's monetary base, modern banking system is able to create all kinds of payment tools, with different form, liquidity, and risk attribute, to function as payback promise. Whether or not these tools would be called money, or whether they are counted in the quantity of money, is only a matter of definition.

The only premise is that central banks keep their promise of “no-dilution”, which means that new issue of bank vouchers won’t dilute the unit value of money. Under the gold standard, this promise was kept by maintaining the “convertibility.” There is no difference between paper money and gold, both of which have the right to exchange same value of goods by ceding the money. Creating new money through loans of private banks does not dilute money because the value of asset and liability added is the same. The debtor does not become a penny richer by loan of 1 million dollar; he does not get money free but with the obligation to settle its debt by paying them in the future. Only base on this, new payment tool which created by private banks is legitimate, and won’t put the operation of economy in danger.

Government is the biggest possible threat to break the promise of no-dilution of money. Government feels temptations all the time to treat central bank as an ATM, and overdraws from it to cover its own deficit. If central bank is asked to supply money to government and government does not need to payback, the value of money is diluted and may lead to hyperinflation. The tragedies of Weimar republic (Germany) and recent Zimbabwe are two of best examples of such kind. The principle of convertibility can be abided, only when modern central banks have clear rules which forbid government from overdrawing the central bank account to cover its own deficit.

Last Lender of Resort

The evolution of the “convertible promise”, leads to The 1816 Act in England, which finally established the golden standard in the world. Ironically, soon after the establishment of the golden standard, banking system felt the limits brought by the convertibility rule, and the process of gold demonetizing started.

Banks surely can expand their balance sheets freely; meanwhile they expose themselves to the risk of bank run. Banks are responsible to pay back money (i.e. coins and vouchers of BoE) to clients when the later requests. The pressure of

competition drives banks expanding their balance sheets as far as they can, far beyond the size of the cash reserve. The essential of banking business is that it must manage its assets and liability so that the return on assets (basically interest of loans) is greater than the cost of liability (basically the payment of deposit interest). The return on asset and cost of liability are often proportional to the duration and risk associated, which leads to three essential features of banking business:

1. There is maturity mismatch between banks' assets and liabilities that the average maturity of liability is shorter than that of assets. By engineering short term liabilities into long term assets, banks support investment of the economy, and collect spread of interest earned and paid.
2. There is a risk mismatch between banks' assets and liabilities. Theoretically, depositors require their deposits (which to banks are liabilities) to be risk-free while bank assets bear risks. The risks that banks undertake are the major source of banks' income.
3. Banks hold diversified portfolio of assets and liabilities, in terms of duration, risk, and so on. By nature banks know that diversification can reduce risks. In order to fulfill clients' short term requirement, banks must have certain amount of currency, such as cash and deposits in central bank, which has the highest liquidity, lowest risk and lowest return. During repeated daily operation, banks soon acquire a relatively accurate idea about how much this kind of assets they exactly need. The amount of cash reserve which exceeds this level will be reduced. If clients' short-term cash requests exceed what banks have, banks need to get more liquidity through inter-bank trading. In Bagehot era (Bagehot, 2000), banks discounted bills for each other, and adjusted discount rate to pricing the liquidity. In modern time, banks manage the liquidity by purchasing and selling repo. Banks with rich liquidity lend liquidity to banks of shortage, and this kind of interaction can satisfy most banks' requirement of extra liquidity needed.

These three characteristics determine that banks must manage their assets dynamically and timely. Banks initiate liability by issuing loans and bonds and manage their liability by trading liquidity frequently on the monetary market. Loans, bond market, monetary market and capital market are thus all inter-connected.

This way the modern banking system has the ability to respond to the credit demand of the economy and to issue as much credit and loans as possible if needed. Every credit actually represents a sequential distribution of payback promise. The borrower gets cash now, and pays the debt in the future, a reverse of cash flow. Every economic agent, company and bank alike, is a creditor as well as a debtor at the same time. All the credit relationships among them form a super complicated network in which everyone's ability to honor its payback promise is largely constrained by other people's willingness and ability to pay. In this case, break of one promise could trigger a series of defaults and sudden collapse could emerge anytime anywhere in the financial system.

Every institution is constrained by the so called survival constrains (Merlin, 2012), i.e., the institution's net cash flow must be bigger than its payback promise. Banks have to decide the debt leverage they grant to the debtors based on their judgments of the future risks, to increase the leverage in the boom and to deleverage in the downturn. If there is no financial crisis, management of liquidity could be easy, but in the time of crisis it's not a single bank but the whole banking system demand liquidity, so called positive feedback loop could cause endless self-enforcing deleverage, which could end up with everyone going bankrupt. In this case the central bank must step in to provide unlimited liquidity if necessary.

More than 100 years ago Britain's Walter Bagehot proposed the so called Bagehot's rule in which the central bank should provide unlimited loans at punitive interest rate so to end the bank panic. This way, BoE took the responsibility of LLR gradually. However, Bagehot's rule contradicts with the convertible principle of golden standard.

Take BoE's operation for example (Kindleberger, 1984), it responded not only to the domestic banks' demand, but also, according to the golden standard, the international demand. Wars and crises could bring big demand of cash that exceed the capability of BoE's gold reserve. The fact is that during the Napoleon War (1797--821) and World War I (1914--1925), BoE had to abandoned the gold standard. During that time, the value of paper money was decided by law instead of gold endorsement. Similarly, France, during French Revolution (1848--1850) and Franco-Prussian War (1870--1871), the United States, during Civil War (1861--1879), and many western countries, during WWI (1914--1922) abandoned the gold standard and paper money was forced to trade by face value.

Every time, England, among other countries, tried its best to resume the gold standard, but the Great Depression in 1929 finished all these efforts. The causes of Great Depression were complicated, but there's no doubt that the collapse of credit system and the fracture of payback promises were the most essential ones. Under the gold standard, central banks only held limited gold reserve. Central banks providing of liquidity to banks will cause an outflow of gold and principle of convertibility will not hold. Because of this contradiction, in 1929 the fed reserve of the United States lacked the ability and willingness to provide liquidity to the banks when liquidity was most needed.

In the United States, from 1930 to 1933, the numbers of closed banks to the number of total banks were 5.6%, 10.5%, 7.8% and 12.9% respectively. More than 10000 banks closed during those years, proportionate to the decline of industry production. Many countries were forced to give up the gold standard, and central banks started to regain their abilities to support banks. How soon a country recovered from the depression was basically determined by how soon this country abandoned the gold standard.

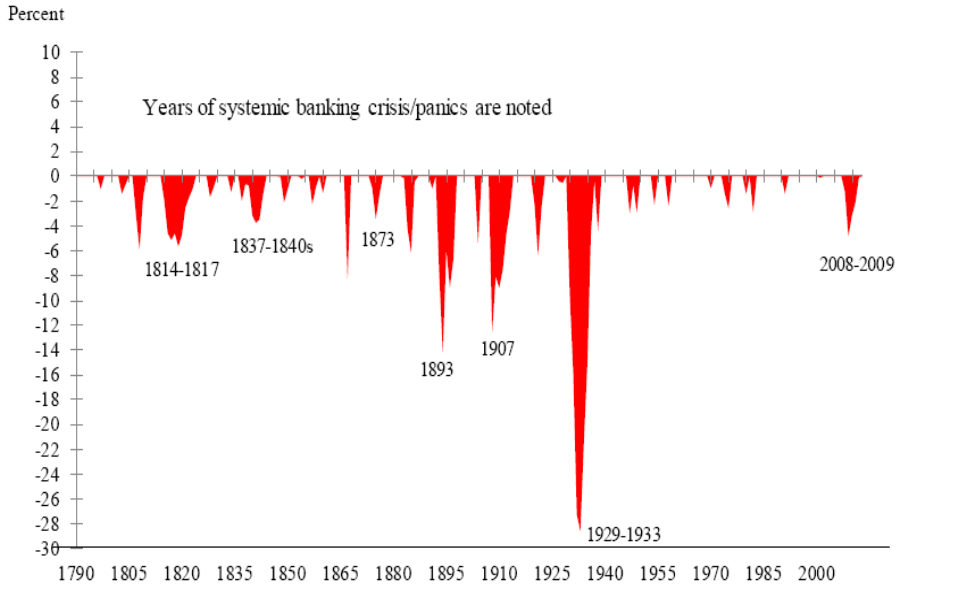
The Bretton Woods System, established after WWII, used U.S. dollar to replace gold, so that other country's currency adjusts its value to relate with the U.S. dollar. The connection between the U.S. dollar and gold maintains the advantage of convertibility. In fact, the Bretton Woods System respected the value tradition formed in the history, and created an ideal financial environment for economic development in post-war era. However, this deformed convertibility has its own "Achilles heel": in order to be the global reserve money, there must be a sizable outflow of the U.S. dollar. At the very beginning, the dollar out flowed through loans, such as Marshall Plan, and at later stage through trade deficit, which in turn brought depreciation pressure to the U.S. dollar. Because of the support of convertibility, the U.S. dollar was able to avoid depreciation realizing, but the cost was that the U.S. dollar was continuously over-priced in international trade, which worsened the U.S. trade deficit and depreciating pressure. This loop caused a drain pressure on U.S. gold reserves. The U.S. could not bear this situation anymore in 1970s and the Bretton Woods collapsed. The essential cause of the collapse of Bretton Woods System is not different from that of the collapse of gold standard—there is a contradiction between convertibility and wild volatility of financial system's demand on liquidity.

After 1973, the world entered into an era of endogenous money that the creation of money was no long depend on precious metals, but only depend on banking system's organic response to the demand of credit.

International Lender of Last Resort

After central banks started to play the role of LLR, the probability of severe financial crisis was reduced rapidly. For instance, the United States gave up the gold standard in 1936, when the Federal Reserve (Fed) began its responsibility as a LLR, since then the frequency of the U.S.' financial crisis had dropped dramatically.

Figure 2. Deviation of Real per Capita GDP from its Previous Peak, United States 1790-2013
(deviation as a percent of previous peak level)



Sources: Reinhart and Rogoff (2014) and sources cited therein.

Figure 1. After the Fed functioned as LLR, the frequency and severity of U.S. financial crisis dropped dramatically

This phenomenon did not appear by accident. Reinhart and Rogoff's (2014) research shows that there was no severe financial crisis between 1936 (when gold standard was abandoned) and 1973 (when Bretton Woods System collapsed). It also shows that there were 22 severe financial crises before 1936, but only13 after 1936. All these13 severe financial crises shared two features: first, they were all after 1973; second, they were all international factors driven. This shows clearly that lack of the ILLR is the weakest link of the international monetary system.

As mentioned before, domestic financial crises happened frequently because of lack of LLR. As long as central banks could provide enough liquidity during crisis time, domestic financial crisis diminishes accordingly. However, if a country encounters a short of international liquidity instead of domestic one, then there's nothing the local central bank can do. Because of this reason, 80s' Latin American financial crisis, 1997' Southeast Asian financial crisis, and other severe financial crises are all forex

type of crises. The country under attack may lose the financial war due to exhaustion of its foreign exchange reserve. To protect limited foreign exchange reserves, local central banks had to implement austerity policies that hurt its economy and a severe financial crisis may follow. International aids were never timely and adequate, as show in the case of Korea in 1998 or Greek in 2010.

The threat of shortage of international liquidity has been forcing developing countries to accumulate foreign reserve.

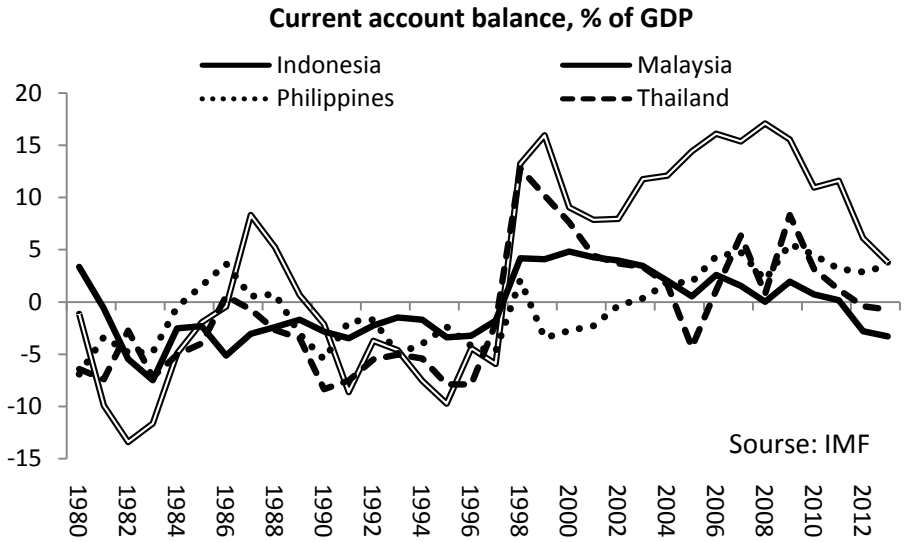


Figure 2: south-east countries turned trade balance from deficit to surplus after 1997

As shown in this chart, all four typical Southeast Asia countries converted themselves from trade deficit countries to surplus ones. According to Crowther's balance of payments stages model (Crowther, 1957), south-east countries are young debtor countries, with abundant investment opportunities and shortage of capital. These countries should accept international capital inflow instead of outflow. After 1997 financial crisis, however, southeast countries began accumulates trade surplus and precautious foreign reserve and as a result these poor countries began to provide capital to much richer countries. China is another outstanding case. This does not make economic sense.

Current solutions provided by international monetary system are not perfect. The IMF, Fed and ECB are often forced to organize international aids; meanwhile they have to worry about their own interests, like to ensure recipients to pay their money back. Unsurprisingly, this kind of international aids is often fragmented, slow and costly. Usually aids receiver was deprived of a lot of policy freedom, and had to accept austerity policies. Aids were often late, missing the critical time when the crisis could be ended at the smallest cost. Most of the time, aids were engineered after the crisis instead of preventing them. Aids often come with political concerns besides economic rationalities. The shortcomings of these kinds were obvious during the 1997 Asia financial crisis.

The problem is quite clear, unlike the situation where central banks can be the last resort of domestic liquidity and fight domestic financial crisis, there is no good arrangement of last resort of international liquidity. Neither sovereign central bank such as FED and ECB, nor international financial institution such as IMF, is the perfect candidate of ILLR.

While there's no single institution could be the solution provider, the network may do magic. Here I propose that a multi level network of currency swap among central banks should be constructed actively, which will function as the ILLR as a whole. Central banks all around the world should reach agreements on multilateral money swap that its counterpart can utilize unconditionally.

Currency swap is neither a new idea nor a theoretical one, which was practiced again in the 2008 crisis by the Fed in a very large scale. In October of 2008, the amount of the money swap between the Fed and other major western central banks was $580 billion, which accounted for 25% of Fed's total assets. In October 2013, the Fed signed permanent money swap agreements with central banks of Switzerland, England, Japan, Canada and Australia. In the arrange of the swap line, the foreign central bank sells a specified amount of its currency to the Federal Reserve in

exchange for dollars at the prevailing market exchange rate. At the same time, the Federal Reserve and the foreign central bank enter into a binding agreement for a second transaction that obligates the foreign central bank to buy back its currency on a specified future date at the same exchange rate. The second transaction unwinds the first. At the conclusion of the second transaction, the foreign central bank pays interest, at a market-based rate, to the Federal Reserve. Foreign central banks can lend U.S. dollars to their domestic institutions and bear credit risks. But the Fed undertakes little risk in the transactions because foreign central banks can almost always acquire enough U.S. dollar, by issue any amount of local money if necessary.

Fleming and Klagge (2010) pointed out that money swap during 2008 financial crisis effectively reduced the distortion of overseas dollar markets. Obstefeld and Taylor (2009) thought that the collapse of dollar-denominated assets may cause a shortage of dollar, especially for the purpose of international trading, which pushed up the price of dollar. Countries whose proportion of foreign exchange reserve to M2 is high tend to not devaluating, while the countries with low proportion may experience currency devaluation. Under this situation money swap between foreign central banks and Fed may bring benefits, depends on such three factors: the demand of the U.S. dollar for trading purpose, the opacity of economic agent's investment portfolio, and the illiquidity of it. Aizenman and Park (2011) thought that swap lines were more complements than substitutes of foreign exchange reserve, but the existence of money swap arrangement itself would lead the market choose equilibrium of "no run" instead of multi equilibria even the swap arrangement is not used. The selectivity of the swap lines indicates that only countries with significant trade and financial linkages can expect access to such ad hoc arrangements, on a case by case basis.

Central banks would be better off if a network of swap lines is completed. For instance, if Malaysia has not access to the Fed but has an agreement with ECB, it could get euro from ECB when it needs, then transfer euro into the U.S. dollar to

response to the reserve demand; or Malaysia can even try to reach an agreement with ECB on a dollar-ringgit swap.

As soon as this super swap network is built, the problem of lack of ILLR could be greatly addressed. With the protection of the swap network, a country can adapt policies that similar to those during domestic financial crisis, without worrying about decline foreign reserve. Hence developing countries may rely on both foreign reserve and swap lines to provide the protection.

To succeed, the program has to insist some basic rules:

- Multilateralism. According to network science, the robustness of a network depends on the link density. The super swap network needs to build up sufficient swap lines among central banks to be functional. This means that the Fed should not be the only core of bilateral swap lines; central banks should establish money swap lines with each other as much as possible. Once swap arrangements come to a certain magnitude, the special status of the Fed will descend, and the protection every state shares will rise.
- Autonomy. Each central bank should be able to select swap partners and arrangements autonomously. The swap arrangement should be accomplished in negotiations of states without third party interference, given that connectivity of economic, trade and finance among states differs among each other.
- Transparency. Central banks should publish their swap program conditions and guidelines, as well as the scales, requirements and other detail regulations they have reached with other central banks. Transparency can significantly enhance the overall effectiveness of the global swap network.
- Gradualism. It takes time for this self-established multilateral arrangement to be effective, thus it will be a gradual, continuous improving process.
- Integration. At certain stage, when overall network is roughly shaped, international corporation is needed in order to regulate the swap network

effectively. The central banks which involve in the swap arrangements shall follow certain criteria and codes. To be qualified, central banks will not be allowed to print money to the treasury to cover the budget deficit, and they should be able to regulate domestic banking and financial system effectively. Undoubtedly, this process will gradually strengthen the disciplines of all central banks.

If this super swap network system operates smoothly, it may become the base infrastructure of a new international monetary system, providing a more stable environment for the global economy and financial operations. Developing countries will be released from the role of capital provider, global imbalances will be reduced, and the severity and frequency of international financial crisis are likely to decline.

References

Aizenman, J., Jinjarak, Y., & Park, D. (2011). International reserves and swap lines: Substitutes or complements? *International Review of Economics & Finance*, *20*(1), 5-18.

Adrian, T., Moench, E., & Shin, H. S. (2010). *Financial intermediation, asset prices, and macroeconomic dynamics* (No. 422). Staff Report, Federal Reserve Bank of New York.

Bagehot, W. (2000). *Lombard Street: a description of the money market*. Library of Alexandria.

Carmen M. Reinhart and Kenneth S. Rogoff (2014). Recovery from Financial Crises: Evidence from 100 Episodes. *American Economic Review Papers and Proceedings, forthcoming*

Crowther, G. (1957). *Balances and imbalances of payments*. Harvard University, Graduate School of Business Administration.

Fleming, M. J., & Klagge, N. J. (2010). The Federal Reserve's foreign exchange swap lines. *Current Issues in Economics and Finance*, (Apr).

Kindleberger, C. P. (1984). *A financial history of Western Europe*. Taylor & Francis.

Mehrling, P. (2010). *The New Lombard Street: How the Fed Became the Dealer of Last Resort*. Princeton University Press.

Obstefeld, M., Shambaugh, J. and Taylor, A. (2009). "Financial instability, Reserves, and Central Bank Swap Lines in the Panic of 2008," *The American Economic Review: Papers & Proceedings*, Vol. 99, No. 2, 480-486.

Yisheng Xu. (2013) “From ‘Jamaica System to the Atlantic System’”, *Chinese Business News*: December 13th.