

A Simple Model of Money, Credit and Banking

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1. Introduction

Money is generally defined as any object generally accepted and used as a medium of exchange. Throughout much of history, the term “money” has referred to a stock of commodity money, typically gold and silver. In modern contexts, the term “money” is most commonly used to refer to a stock of banknotes issued by a central bank and a stock of government-issued coins. The bulk of currency in use today in Japan, for example, consists of banknotes, representing debt obligations of the Bank of Japan. Bank notes and coins – the pocket money held by the public – are important components of the money supply. However, one of the largest components of the money supply today is demand deposits (or checking accounts), which are the debt of a private bank and can easily be used to make payments.

Historically, bank liabilities took the form of bank notes redeemable in specie (gold and silver coin) and were often a prominent source of an economy’s money supply. In time, the privilege of issuing notes was concentrated to a bank that became the central bank. The central bank took over the issue of bank notes, maintaining the promise to redeem them in specie on demand. The rest of the banks, which were prevented from issuing notes, transformed into banks of deposit (commercial banks). Commercial banks then started to issue demand deposits instead of bank notes¹⁾. Thus banks were divided into two categories: the central bank and commercial banks.

In the beginning, central bank notes circulated as the medium of exchange for most transactions among firms instead of specie, whereas transactions between consumers and firms were exclusively conducted in specie²⁾. Kawai (1970) refers to the former as “the commercial

1) Nowadays the issue of bank notes is in most countries a monopoly of the central bank.

2) Adam Smith (1937, p. 306) notes that “the circulation of every country may be considered as divided into two different branches; the circulation of the dealers with one another, and the circulation between the dealers and the consumers.”

circulation” and the latter as “the general circulation”³⁾. The medium of exchange was divided according to the transaction. The wholesale transaction in the commercial circulation was conducted in bank notes and the retail transaction in the general circulation was conducted in specie.

In the course of time, the high resource cost of specie led to substitution of convertible notes for specie as the medium of exchange for retail transactions⁴⁾. Central bank notes began to be used to conduct transactions between merchants and consumers, taking the place of specie. Then the central bank removed its promise to convert notes into specie on demand. Notes issued by the central bank have become inconvertible and intrinsically useless. Such money is referred to as definitive money⁵⁾. Central bank notes have been decreed by governments as legal tender, meaning that legally people must accept them in exchange. A strong motive for legal tender legislation was the government’s desire to earn revenue from seigniorage⁶⁾. Central bank notes and government-issued coins are mainly used to conduct retail transactions, typically of low values⁷⁾.

Private banks’ liabilities fill the vacancy on the medium of exchange for wholesale transactions. Nowadays the medium of exchange for wholesale transactions is not bank notes, but checks written on deposit accounts held in commercial banks⁸⁾. The liabilities of private banks, regarded as part of the money supply, consist of deposits that are redeemable for central bank notes on demand. Commercial banks’ liabilities are today a prominent source of money supply in any leading industrial economy.

This paper addresses a number of related questions concerning the activity of money creation and the business of banking. The first question concerns money. Why do private bank liabilities circulate from account to account and constitute an economy’s money supply?

3) Kawai employs the division of circulation to develop original discussions of the financial system. See Kawai (1981) and (1982).

4) For discussions of this point and specie shortage, see Kawai (1982).

5) Money that is not convertible into gold or precious metal is called definitive money. Money of this type is also called fiat money.

6) See Russell (1991, pp. 38–39). Kaufman (1995, p. 20) adduces another reason that specie was subject to variations in supply as the monetary and intrinsic values of specie changed relative to each other.

7) For example, Bank of Japan notes are unlimited legal tender within Japan, though each coin is limited legal tender of up to 20 of the same coin. Coins today are pure tokens whose value does not depend on their intrinsic content.

8) Strictly speaking, deposit accounts against which checks are drawn are regarded as money, rather than the checks themselves.

In other words, why do people accept private banks' liabilities as a means of payment rather than central bank notes or government-issued coins? The second issue concerns the business of banking. Commercial banks bear the responsibility of issuing new money into circulation, which they do by making loans. The basic business of banking is a combination of two functions: payments and lending. Banks carry out the creation of deposits through lending. In other words, banks combine the payment service and lending, thereby creating money.

Commercial banks also act as financial intermediaries, accepting deposits of existing money that people and businesses wish to save. However, there is a big difference between monetary and non-monetary financial intermediaries. Commercial banks differ from many other financial institutions in one critical respect. Banks have the power to create money in the form of new demand deposits through their payment services. Their dual functions of creating money and providing loans has made them "special" intermediaries⁹⁾. Then the second issue addressed here relates to the payment system, which enable its constituent institutions to carry out the creation of deposits through lending. This paper investigates how commercial banks issue new money into circulation, and investigates the mechanism by which new money is transferred between economic players when they make payments.

To appreciate the payment system, including the evolution and structure of its constituent institutions, it is necessary to understand not only its monetary aspects, but also its financial aspects¹⁰⁾. This paper provides a unified analysis of the underlying economic forces driving the evolution of the payment system and organization of its members¹¹⁾. The evolution of the payment system has been driven by economic benefits from substituting credit for money. This paper emphasizes that economic benefits of the substitution of credit for money are divided into two categories. First, the economic benefits from substituting bank notes for commodity money; second, the economic benefits from substituting credit for cash trading. Monetary economists have confused these with each other or have generally ignored the latter¹²⁾.

9) Though a bit obsolete, for a typical statement that banks are special, see Corrigan (1982).

10) Goodfriend (1990).

11) Of course, I am not the first to pay attention to the underlying driving forces of the development of the payment system. Kawai (1954) contains an excellent analytical description of the evolution of the payment system. More recently, Goodfriend (1990) employs contract theory to provide an analytical discussion of that evolution. They are independent of each other. I view my work as complementary to these works, though I owe much to Kawai.

12) Judging from his treatment of bank notes as commodity money, Goodfriend (1990) seems to be vague in differentiating between the two economic benefits.

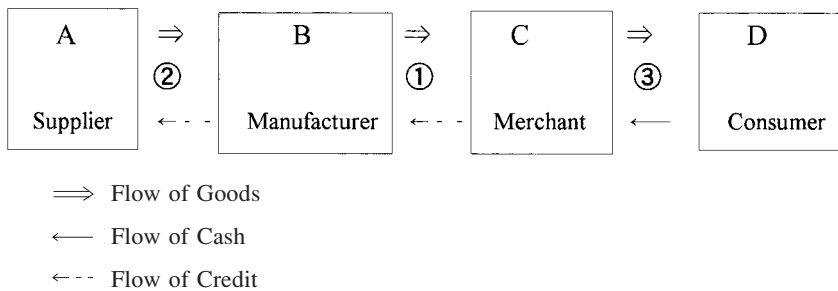
The efficiency gains from substituting credit for cash trading have been the fundamental driving forces in the development of the payment system.

This paper presents a simple environment that gives rise to banks that create new money through making loans. Money is here defined as any object that circulates widely as a medium of exchange. In the model, this object takes the form of a redeemable deposit. In this paper a simple story of transferable debt is developed. The paper is organized as follows. The next section describes the model in detail and presents its key features. Section 3 characterizes the business of banking. Section 4 contains a discussion of the structure of banking. The final section summarizes the findings and suggests directions for future research.

2. A Basic Model

The basic model is illustrated in Chart 1. To begin with, assume that there are four agents: a supplier, A; a manufacturer, B; a merchant, C; and a consumer, D¹³. Time is discrete and divided into three periods ($t = 0, 1, 2$). Supplier A owns raw materials and can provide manufacturer B with them in period 0. B uses the raw materials to make certain goods. He also owns merchandise made from raw materials in period 0. If merchant C has access to the merchandise, then she can transfer them into salable merchandise (consumer goods). In period 1, merchant C purchases merchandise from B in order to sell them to consumer D. Consumer D receives his salary in period 1. He uses it to purchase consumer

Chart 1 Trade in a Simple Model Economy



Sequence of Events

- ① B sells merchandise to C and receives C's debt in return.
- ② A sells materials to B and receives B's debt or C's debt in return.
- ③ C sells goods to D and D pays cash to C.

13) The model developed here is adapted from that of Kahn and Roberds (2002).

goods from merchant C in period 2. Merchant C collects money from consumer D in period 2. It takes a certain length of time for C to sell her goods for cash, and so C always holds a certain amount of average inventories¹⁴⁾.

How should exchange be organized in the basic model? Trade could proceed if C had enough money to purchase merchandise from B in period 1. However, C doesn't have enough money available for use, or is eager to economize on working capital. Hence, there may be a better arrangement available. The alternative would be trade credit. In a monetary economy, all businesses make substantial outlays before they obtain any revenue. Revenue coming in pays for past production, but there are always new expenses for ongoing day-to-day activities of the firm. This is true even after a business has started. In short, the basic problem is that businesses incur expenses before they can sell their products.

The funds required to cover the current expenses of producing and selling a product or service are known as working capital. The need for additional working capital is one reason why businesses borrow, or why businesses use trade credit. On the other hand, production requires long-term investment in equipment and facilities. The funds required are known as fixed capital. The need for fixed capital is the second reason businesses borrow. Monetary economists have exclusively paid attention to the second reason, ignoring the first one¹⁵⁾.

Trade credit is a form of short-term financing that arises from business transactions between firms. In contrast to cash terms, trade credit terms separate the payment date from the date of delivery. Returning to the model, merchant C could expect to get sales proceeds from consumer D in period 2, so C could issue debt (IOU) to manufacturer B in return for merchandise. With a trade credit, C obtains merchandise without paying any money. Although no money is lent, C succeeds in economizing on working capital. At the same time, B receives C's debt in lieu of cash. However, B must also get materials in order to continue his business operation. In the hope of economizing on additional working capital, B in turn asks A to sell raw materials to him on deferred payment in period 2. In this context, there are two ways for B to use bills of exchange as an instrument of trade credit¹⁶⁾.

14) Bulk order for goods leads to large inventories but may be worthwhile if merchant C can obtain lower prices from manufacturer B. C is often willing to hold a large inventory of goods because bulk orders yield quantity discounts.

15) While trade credit has been generally dealt with, in connection with working capital management, by financial economists, it has received relatively little attention from monetary economists.

16) Much of the discussion below is based on Kawai (1954), Moriyama (1994), and Kahn and Roberds (2002).

The first way is that B issues his own debt. B could issue his own debt to A in return for the materials. Both A's and B's debt claims are payable at a later date, meaning when C receives the proceeds of her goods sales from D in period 2. When the time comes, B presents C with the debt C issued in period 1 and A presents B with the debt B issued in period 1. If B and C are trustworthy debtors, C can, using the proceeds of her sale to D, repay B and B can use C's repayment to repay A.

In an environment where creditor's rights are limited, however, there is a good chance that B may be unreliable. Because B does not have merchandise any longer when the time comes for him to repay, A's ability to force payment by using the merchandise as collateral is limited. In such cases the credit chain may break: B may take the money and run¹⁷⁾.

The second way is that B transfers C's debt to A. B could use C's debt to settle with A in lieu of his own debt. This means that A gives credit to B, and that B's debt to A can be discharged by the transfer of C's debt to A. In contrast to the first situation, however, B does not hold C's debt but instead hands over C's debt to A. Then, when C's cash becomes available in period 2, C pays A directly, avoiding a possible default by B. As long as the original debtor C honored her debt, the intermediate party B were in effect removed from the credit chain. This removal reduces the need for payment in cash and limits the chance for default by B¹⁸⁾.

As mentioned above, it is quite obvious that buyers have a strong incentive to use trade credit, because they can economize on additional working capital by using trade credit. At the same time, sellers are willing to supply trade credit on economic grounds. In the context of the model, for example, B purchases materials from A while he supplies his products to C. He is a supplier on the one hand, and a customer on the other. Supplier and customer are changing positions with each other in their ongoing business operations¹⁹⁾. Then B offers trade credit to C, anticipating that he will be able to receive trade credit from A. B provides trade credit as a supplier and uses it as a customer²⁰⁾.

At any rate, trade credit could increase economic efficiency because it could induce offsetting out of obligations. However, the economic benefit gained from trade credit is

17) Kahn and Roberds (2002, p. 3).

18) Kahn and Roberds (2002) argue that the introduction of transferable debt provides efficiency gains by lessening room for default as well as economizing on using costly coin.

19) For the two-way nature of transaction in trade credit, see Peel, Wilson and Howorth (2000, p. 17).

20) Merchants are an exception. They sell goods for cash, while they purchase goods on deferred payment.

twofold. The first benefit, well known to economists, is that the substitution of credit for cash trading can economize on the amount of cash needed to carry out an exchange. The second benefit of trade credit, which this article focuses on, is that businesses can economize on working capital by substituting credit for cash trading. The second benefit has received relatively little attention from monetary economists²¹⁾. This paper partially rectifies this omission by providing a basic idea of trade credit and its important role in the evolution of the payment system.

This paper emphasizes the difference between the efficiency gains from substituting credit for cash trading and the efficiency gains from substituting bank notes for commodity money. At the social level both of these gains provide an economic benefit by reducing transaction costs or the resource cost of coin. At the individual level, however, the reduced funds for working capital provide efficiency gains by minimizing funds needed for ongoing business operations. While, the substituting of bank notes for commodity money does not provide any efficiency at the individual level. In other words, it does not bring about any capital savings. It is the economic gains at the individual level that have played a crucial role in evolving the payment system. The development of the payment system has been primarily promoted by capital savings. The social benefits such as reduction of transaction costs or the resource cost of coin are concomitant benefits. They, as such, could not be the motivation for the evolution of the payment system.

Business firms usually make use of trade credit for economizing on working capital. Trade credit is the backbone of commercial finance. As an instrument of credit, bills of exchange have played a vital role in financing working capital. Bills of exchange with an endorsement started to circulate from hand to hand among business firms. However, the hand-to-hand circulation of these bills was very limited. Businesses met with difficulty in arranging trade credit with each other. The widespread use of trade credit suffered from at least three obstacles.

The first is the problem of debtors' (such as B or C) creditworthiness. If C had a bad reputation, B would not agree to sell his products in exchange for C's debt. Likewise, A would not accept C's debt, even it had B's endorsement. The second is a technical defect. Each bill had a specific face value based on the original transaction. For example, the trade volume between B and C was not necessarily the same as that between B and A. Therefore, B

21) Due to the same reason as footnote 15 above, there is little literature paying attention to capital saving, while there is an enormous amount of literature about cash or transaction costs saving.

faced difficulty in using C's debt in settlement of his own debt to A²²⁾. B could not always use C' debt as an instrument of trade credit.

The last obstacle is a fundamental drawback. The bills of exchange are not suitable for paying wages. They have a particular face value and specified maturity date in the future and are indivisible. Consumers face difficulty in using them for daily purchase. Therefore consumers refuse to receive them as payment of wages²³⁾. The creditworthiness problem also exists in credit trading between merchants and consumers. The merchants need information about the consumers' potential returns and risk associated with the credit trading. It is not easily or cheaply available, because transactions between them in the general circulation are spot transactions. The merchants are unwilling to receive the consumers' debt, too. Bills of exchange can not circulate in the general circulation. Due to these drawbacks, the use of bills of exchange was basically limited to wholesale transactions and did not become widespread²⁴⁾.

The transaction problems with bills of exchange created opportunities for private firms to make a profit by issuing notes in more convenient forms. The drawbacks of bills of exchange gave rise to banks becoming an issuer of "negotiable debt," such as bank notes. To overcome the defects of bills of exchange, a wealthy dealer (suppose Z), whose reputation was well known within the business community, started to provide guarantees to others. He provided credit enhancement by endorsing the bills of others – a practice known as acceptance. His acceptance alleviated creditworthiness constraints of debtors and enhanced the safety and the transferability of the bill of exchange.

In the model, for example, in order to eliminate the creditworthiness problem, Z accepts C's debt, endorsing it. C's debt with credit enhancement became safer and more negotiable. So, in exchange for his goods, B may receive C's debt with Z's guarantee without so much worry. The accepted bill, however, still had a few drawbacks. Firstly, each accepted bill had a particular face value arising from the original trade. Secondly, the accepted bills had a specific maturity date. Accordingly, the use of the accepted bills was still limited.

Next, to remove these drawbacks, Z began to issue his own debt, rather than accepting the other notes. Increasingly, Z issued his debt in exchange for C's debt. As Z was wealthier

22) For example, Ashton (1953, pp. 37–38) describes these inconveniences for merchants in the early history of bills of exchange in England.

23) In Japan, for instance, Article 24 of the Labor Standards Law stipulates that wages must be paid in cash and in full directly to the workers.

24) There were legal obstacles besides these technical drawbacks. For legal obstacles to the hand-to-hand circulation of bills obligatory, see Calomiris (2003).

and a stronger credit risk than C, Z's debt became more acceptable. Creditors would be delighted to accept Z's debt rather than the merchant's debt with Z's guarantee. However, there were still some defects to overcome. Z's debt had a specific maturity date and specified face value. B, for example, could use Z's debt in exchange for purchase of materials, but could not use it for the payment of wages. B needs to have the wherewithal to make payments of wages on payday. B could not economize on additional working capital for wages.

As described earlier, consumer goods at a shop have to wait for a certain length of time before they are sold for money. Similarly, the proceeds of consumer goods sales stay in the hand of the merchant for a period before being disbursed to repayments or to pay wages. In the model, for example, C holds cash collected from the sale of consumer goods to D until her debt becomes due in period 2. C therefore lodges the daily proceeds with Z, because she is in debt to Z. She must have the wherewithal to repay Z when her debt becomes due in period 2. Z begins to keep the proceeds in his vault for C's sake. These proceeds are the fundamental resources of reserve deposits of commercial banks²⁵).

Commercial banks today accept deposits not only from business firms, but also from private individuals. However, banks' fundamental funds mainly consist of the proceeds of the merchants selling goods to consumers. To keep things simple, in the simple model, banks are assumed to accept only the proceeds of merchants, and not to accept savings from households²⁶).

In the course of time, it becomes obvious to Z that money is coming in and gradually accumulating until C's debt becomes due. When C's debt falls due, C repays Z with her deposit at Z. As C's debt to Z could be canceled with C's deposit, Z could freely make use of funds that have been deposited by C at Z. It means that C repays her debt to Z little by little out of daily sales proceeds.

When C's debt becomes due, A and B bring Z's notes to Z in order to redeem them for specie. Z pays them in specie that C has lodged with him. A and B could receive their

25) It is worth noting that fundamental resources of funds of commercial banks are the proceeds of retailers, which are essentially different from household savings. This is a reason why commercial banks have tended to restrict themselves to short-term loans.

26) Historically, at the first stage, banks have accepted deposits of sales proceeds (such as demand deposits), and at the second stage, banks then have accepted savings deposits from households (such as fixed-term deposits). Nowadays, at the third stage, banks also accept demand deposits from households, reflecting the wide use of electronic funds transfer between bank accounts as a means of payment.

proceeds in a lump sum. However A and B leave some portion of their proceeds with Z, because they don't need to pay the proceeds all at a time. Rather they have to keep specie for the coming wage day. Z has a safeguarded vault. Then, A and B keep their surplus funds deposited at Z even after C's debt becomes due. This is another resource of reserve deposits of commercial banks.

When the payday comes, A and B withdraw specie from their account to pay wages to their employees or workers. At the same time, C begins again to accumulate her daily proceeds at Z in order to replenish her deposit and pay back her new debt. Z observes a considerable sum of specie always staying in his vault. Issuing notes redeemable for specie on demand out of these funds is a natural evolution of his business.

Then Z decides to issue notes redeemable in specie on demand rather than notes with a specific maturity date same as the original note, making use of specie in his vault for redemption of the notes. Z begins to issue his own notes with round numbered face values, redeemable in specie on demand. This note is known as a bank note. Finally Z has become a banker with his own note issuing. To eliminate the drawbacks of bills of exchange, a crucial step in the evolution of the payment system occurred with the development of modern banking: the birth of the issuing bank.

3. The Business of Banking

A bank issues its own bank note redeemable in specie on demand rather than accepting the other notes. In the model, for example, C brings her own promissory note to bank Z. If Z approves the loan to C, Z issues bank notes for C, and receives C's debt in exchange. This is a classical banking operation, known as discounting commercial bills. In other words, the bank buys promissory notes or bills of exchange, due at a specified date in the future, for a bank note redeemable on demand at a discount to the face value. The difference between the purchase price of the bill and the face value means interest at a certain rate for the intervening time.

Bank notes are redeemable for specie on demand and their face values are in round numbers. They are much more convenient for exchange purposes than bills of exchange. They circulate as the medium of exchange for most transactions between firms in lieu of bills of exchange, thereby taking the place of specie. In the model, for example, merchant C receives bank notes in exchange for her own promissory note. C purchases merchandise from

B with the bank notes. B will be delighted to accept the bank notes because they are redeemable for specie on demand and dividable. As bank notes are redeemable for specie on demand, B can get specie for making payments of wages on payday. B also can use some portion of them in exchange for the purchase of raw materials from A. Accordingly, B can save additional working capital, not only for materials but also for wages. B succeeds in financing additional working capital completely.

Bank notes circulate as the medium of exchange for wholesale transactions in the commercial circulation in place of specie. However, payment in bank notes initially developed as an alternative to private promises of payment (bills of exchange). Promise of payment by banks is more credible than promise of payment by firms and bank notes are redeemable on demand. Therefore, bank notes are much more convenient for exchange purposes among firms than bills of exchange. Payment in bank notes surely involves lower transaction costs than payment in specie. However these economic benefits are social and secondary benefits.

Now A and B hold bank notes. They could redeem them for specie as soon as they receive them. However, they must worry about theft. It is costly and cumbersome. There is a less costly alternative. Bank Z has a well-guarded vault so A and B decide to keep bank notes. They don't redeem bank notes until they need specie to spend. It essentially means that they have deposits redeemable on demand at bank Z. When the payday comes, they bring bank notes to Z, and redeem them for specie in order to pay wages to their employees or workers. This means, in effect, that they withdraw specie from their accounts at bank Z for the payment of wages. It was natural for business firms to understand that they hold deposits redeemable on demand at the bank.

On the other hand, as bank notes are redeemable for specie on demand, Z always needs to have the wherewithal to deliver the required amount of specie, called cash reserve or vault cash. However, C everyday deposits her daily proceeds in her account with Z for future repayment. As mentioned above, Z can make use of specie lying in his vault. In case of redemption, Z utilizes this specie in order to deliver the required amount of specie. Cash reserves of banks consist of cash collected from the sale of consumer goods²⁷⁾.

In the simple model, C's sales proceeds are assumed to be equal to the sum of added value of A, B, and C. For example, the money which A, B, and C spend in payment of wages

27) In our model, cash reserves of commercial banks comprise sales proceeds of merchants or cash from the general circulation.

arrives at merchant C because wage earners spend all of their incomes to purchase consumer goods from C²⁸). Merchant C collects money spent by consumers. Then C brings cash receipts to Z and lodges them with Z. When payday comes, A, B, and C again withdraw specie from their accounts to pay wages to their employees. Thus, specie circulates through banks between business firms and consumers. Bank notes exclusively circulate among business firms in the commercial circulation, whereas specie mainly passes from hand to hand in the general circulation.

Trades among firms are usually large. In the model, for example, C needs to carry large amounts of bank notes in order to pay B. Large sums might require secure transportation. The physical transfer of large amounts of notes is a bit cumbersome. On the other hand, bank Z needs to hold cash reserves against notes in order to accommodate redemption of notes and to avoid insolvency. Bank Z, however, has a strong incentive to minimize holdings of cash reserves because such reserves yield no interest. Bankers' desire to minimize cash reserves needed for redemption of notes was another driving force for the development of the payment system. Attempts by banks to reduce the need to hold large balances in reserves led to the next step in the evolution of the payment system, that is the development of modern banking: the emergence of deposit banking.

Accordingly, the bank allows customers to make payments by transferring ownership of deposits rather than by transferring the bank notes. The customer could use the funds in the account by ordering the bank to pay a particular amount to a third party named on the order. Such an order is called a check. Checks have a major advantage that they can be written for any amount up to the balance in the account. A check could have any specific face value. Therefore, checks are more suitable for conducting wholesale transactions than bank notes whose face values are in round numbers.

The accounts on which checks can be written are called demand deposits or checking accounts. Demand deposits are also bank liabilities on demand. There is little difference between bank notes and deposit liabilities. Banks voluntarily gave up issuing notes and began issuing deposit liabilities instead²⁹). Demand deposits soon replaced notes as the bank's major form of liability. All but one issuing bank was transformed into banks of deposit (deposit banking). As described earlier, banking institutions have been divided into two categories, the

28) To keep things simple, assume that households spend all of their income.

29) In many countries, although banks were legally prevented from issuing notes, they were not particularly affected by the ban. Banks must have quit issuing notes regardless of the ban.

central bank of issue and private commercial banks, thereby constituting a two-tiered banking structure.

The medium of exchange has been also divided over transactions. Commercial banks' liabilities are used for conducting wholesale transactions in the commercial circulation. On the other hand, central bank notes are used for conducting retail transactions in the general circulation, taking the place of specie. Then central bank notes have evolved into definitive money decreed by a government as legal tender but not convertible into specie, that is, cash with finality. As previously noted, nowadays the provision of definitive money is a normal function of most central banks.

Checks are a kind of IOU payable in cash on demand that allows transactions to take place without the need to carry around large amounts of cash. Payment in bank deposits often involves lower transactions costs than payment in cash. However, payment in bank deposits initially developed as an alternative to payment in bank notes, not to payment in cash. The bankers' incentive to minimize cash reserves has been a driving force that caused the invention of checks. One of the major advantages of a check is that banks can reduce cash reserves against deposits with it. Reserve savings have been the motivation for the introduction of checks that improve the efficiency of the payment system, thereby reducing transaction costs associated with payments.

Returning to the model, if Z approves the loan to C, Z accepts C's note and creates for C his deposit in exchange³⁰. C's deposit derives from the proceeds of his note. He has deposit without ever having deposited any cash with the bank. This is the so called the credit creating activity by banks.

The next section investigates how commercial banks issue new money and how they facilitate its use in transactions in the economy.

4. The Banking Structure

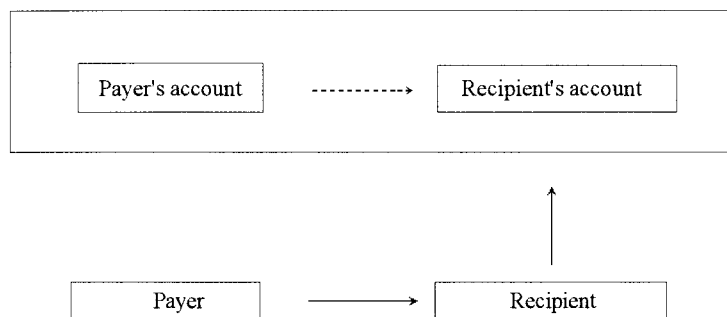
Payment with hand-to-hand currency (cash) is straightforward: you just hand it over. Payment with bank deposits is more complicated. You need some way to transfer ownership of the deposit to the recipient. Because, unlike bank notes, checks do not circulate hand to hand, collecting funds from the bank on which the check was written – the paying bank

30) This is also called discounting commercial bills.

– increased in importance. Clearing payments within the same bank is quicker and cheaper than clearing payments between banks. Therefore, it is very important for the paying bank to accept the checks which were written on it.

Let us take the case of clearing within a bank. C pays his supplier, B, with a check that he draws on his bank. If B has an account at the same bank, he is credited. The check has effected the payment without physically delivering cash (see Chart 2). The bank can reduce reserves against deposits. Accepting checks which are drawn on the bank itself is as important as accepting the checks which are drawn on the other banks. Then the paying bank also endeavors to receive the checks drawn on it. The best way to receive the checks drawn on it is to have branch offices at places where offices of recipients of the checks are located. Banks organize a network to follow credit flow, that is, to collect checks drawn on themselves. The advantage of a branch banking system is obvious. The bank's branch network gives a substantial advantage in executing payments between business firms.

Chart 2 Transfer of Funds within Bank



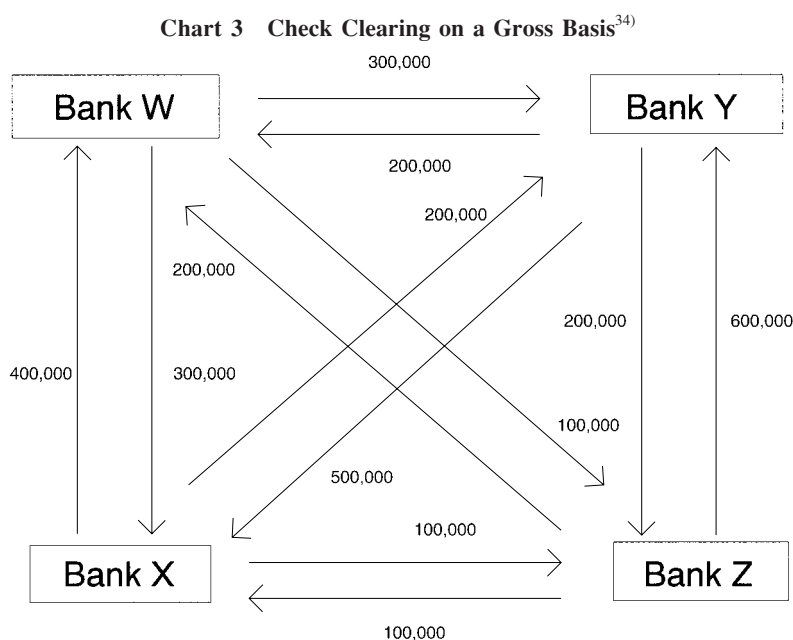
However, even under a branch banking system, the greater part of the checks are not deposited at the same bank on which they are written. Banks mutually receive checks drawn on the other bank. By itself, receiving a check drawn on the other bank does not do a bank much good. It needs to collect the funds from the bank on which the check is drawn. For payment, checks have to be presented physically at the paying bank. Until the funds were collected, the receiving bank could not utilize the proceeds.

The process by which the check is sent from the receiving bank to the paying bank and payment is transmitted the other way is termed check clearing³¹⁾. In the early days, the

31) Along with checks, bills (promissory notes and bills of exchange) that have reached their payment date are sent from the receiving bank to the paying bank.

receiving bank sent a messenger with checks to the bank on which they were drawn in order to collect funds. The messenger received the proceeds in cash and returned to the bank. At the same time, the other banks sent their messengers to the bank for collection, too. It was time consuming and cost a lot.

To improve the efficiency of interbank check clearing in a given market area, banks joined together to establish a clearinghouse³²⁾. The operation of a clearinghouse may be seen best by employing a hypothetical model of the banking system³³⁾. Let us take the case of a four-bank system (see Chart 3). Assume that at the end of a business day, bank W has received ¥400,000 in checks drawn on bank X, ¥200,000 in checks drawn on bank Y, ¥200,000 in checks drawn on bank Z. Bank X has received checks of ¥300,000 drawn on bank W, ¥500,000 on bank Y, and ¥100,000 on bank Z. Bank Y has ¥300,000 in checks on bank W, ¥200,000 on bank X, and ¥600,000 on bank Z. Bank Z, in turn, has ¥100,000 in checks on bank W, ¥100,000 in checks on bank X, and ¥200,000 in checks on bank Y.



32) Japan's first clearinghouse was founded in Osaka in 1879. The Tokyo Clearinghouse followed in 1887. At present, there are 418 clearinghouses in Japan (as of the end of March 2005) and 272 of them are administered by individual bankers associations.

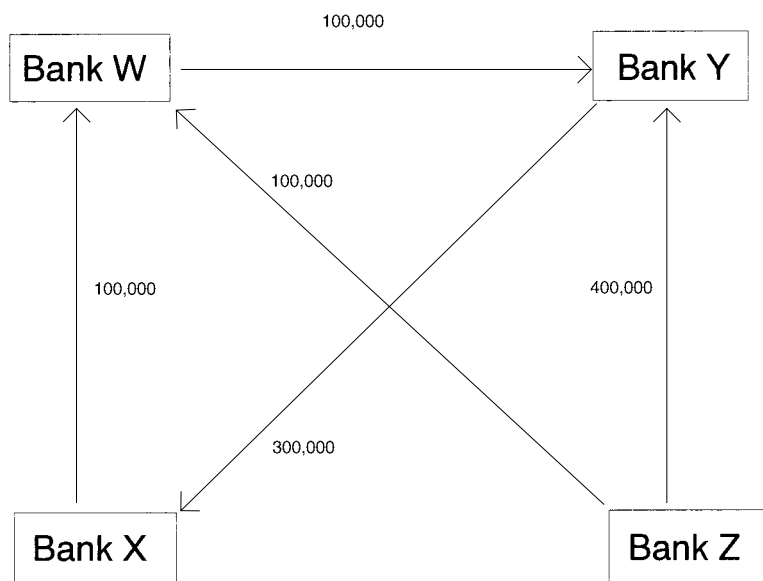
33) The description of the operation of a clearinghouse below is based on Van den Bergh (1994) and Kaufman (1995).

34) Based on Van den Bergh (1994, p. 36).

If there is no clearinghouse, banks settle each and every payment individually on a gross basis. Each bank could send messengers the next morning to deliver the checks to the appropriate bank for immediate payment in cash. Thus, bank W would send messengers to banks X, Y and Z to collect ¥400,000, ¥200,000 and ¥200,000, respectively, from each. There is a good chance that they might run into the messengers sent by the other banks to collect payment on the checks drawn on bank W. Or they are likely to pass each other carrying cash to each other's banks. The messenger from bank W carries cash from bank X while the messenger from bank X carries cash from bank W. In total, the messengers carry ¥3,200,000 from bank to bank.

It quickly becomes obvious to banks that the clearing process could be greatly expedited if everyone brought their checks to a central location. The banks collect checks by a bilateral exchange and settlement with each other. For example, bank W owes ¥300,000 to bank X. And bank X owes ¥400,000 to bank W. Then bank X would pay the difference of ¥100,000 in cash to bank W. Bank W owes ¥300,000 to bank Y. Bank Y owes ¥200,000 to bank W. Then bank W would pay the difference of ¥100,000 in cash to bank Y and so on. In total, the amount of ¥1,000,000 now changes hands. The bilateral net settlement reduces the necessary amount to ¥1,000,000 (see Chart 4). The banking system's need for settlement of balances is

Chart 4 Check Clearing on a Bilateral Net Basis³⁵⁾



35) Based on Van den Bergh (1994, p. 37).

reduced by two-thirds.

When the participants in a clearinghouse exceed a certain number, however, the check clearing becomes long and complicated. The formula for the number of clearing operations in the check clearing on a bilateral basis is:³⁶⁾

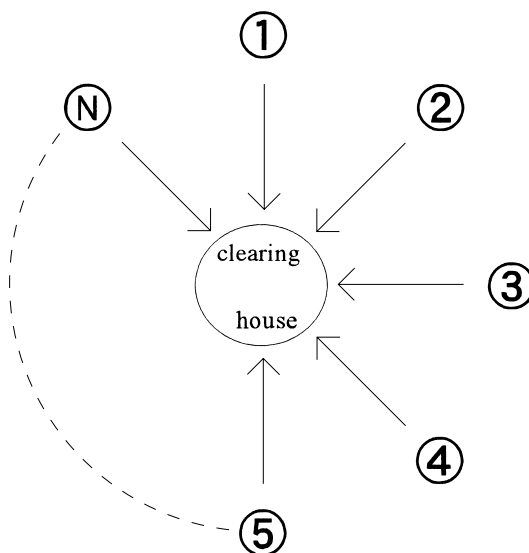
$$N = n(n - 1) \div 2$$

Where: N = total number of clearing operations

n = number of member banks

In a clearinghouse of 20 member banks, there would be 190 clearing operations. This large number of operations would make check clearing both costly and inefficient. To reduce the number of clearing operations and simplify clearing, all banks could send messengers to a clearinghouse and the exchange could be made with one party, namely, the clearinghouse. This would reduce the number of clearing operations to n, that is the number of member banks (see Chart 5).

Chart 5 Check Clearing through a Clearinghouse



A further reduction in the value of actual settlements is achieved through multilateral clearing, as shown in Table 1. The clearinghouse would sum all the checks by bank. It would find that banks W, X, Y and Z had ¥700,000, ¥700,000, ¥900,000 and ¥900,000 in

36) This formula also applies to the number of different prices in a barter economy. (where: N = total number of prices, n = number of different goods)

Table 1 Clearing Chart Showing Transaction between Four Banks³⁷⁾

	Bank receiving payment				Total owed
	W	X	Y	Z	
Bank sending payment					
W	—	300,000	300,000	100,000	700,000
X	400,000	—	200,000	100,000	700,000
Y	200,000	500,000	—	200,000	900,000
Z	200,000	100,000	600,000	—	900,000
Total received	800,000	900,000	1,100,000	400,000	
Total owed	700,000	700,000	900,000	900,000	
Net	100,000	200,000	200,000	△500,000	

checks drawn on them respectively and deposited at the other three banks. The sums owed by them are shown in the vertical columns. This payment would be deducted from the amount each bank would collect from the others. The sums owed to the banks are shown in the horizontal rows.

For example, bank W collects ¥800,000, but owes ¥700,000; bank X collects ¥900,000, but owes ¥700,000; bank Y collects ¥1,100,000, but owes ¥900,000; bank Z collects ¥400,000, but owes ¥900,000. The clearing process makes it possible to compare very quickly how much each member bank owes to every other member bank and how much each of the other member banks owes it. The difference for each bank between what is owed to it and what it owes is called the clearing balance. The minus differences are referred to as negative clearing balances, which must be paid.

However, unlike the bilateral clearing, the bank with a negative balance can not specify the bank to which the balance is to be paid. Because it's negative balance means net debt

37) Reproduced from Van den Bergh (1994, p. 39) and Kaufman (1995, p. 261).

towards every other member bank as a whole. Therefore, bank Z, in our case, pays ¥500,000 to the clearinghouse. The clearinghouse, in turn, pays banks, W, X and Y, ¥100,000, ¥200,000 and ¥200,000 respectively. Thus the clearing of payments among banks is organized through the clearinghouse.

Bank Z could pay this amount by physically delivering cash. However, there are less costly alternatives. Banks W, X and Y could simply agree to hold a ¥500,000 deposit at bank Z: it may well have to use it the next day to settle with bank Z. Or the member banks could keep clearing deposits at a third bank, on which each could write checks to the other. The role of the third bank was undertaken by the central bank. Accordingly, banks usually hold some deposit balances at the central bank for settlement of clearing balances³⁸⁾. The clearing balance for the individual banks is normally settled through transfers of balances between accounts held at the central bank³⁹⁾. These deposit balances of banks held at the central bank are called reserves⁴⁰⁾.

For each debt there is a corresponding claim, so that the balance of accounts with the clearinghouse is always nil. Then, through the account of the clearinghouse, clearing balances are settled in deposits at the central bank. In our case, for example, bank Z is therefore debited ¥500,000 and banks W, X and Y are credited with ¥100,000, ¥200,000 and ¥200,000 respectively. The overall mass of payment, i.e. ¥3,200,000, has ultimately been carried out by only ¥500,000 in deposits at the central bank, without the use of cash. Therefore, the clearinghouse could minimize the reserves needed for check clearing for the entire banking system⁴¹⁾. Reserve savings through the multilateral clearing method were the motivation for the organization of the clearinghouse.

As the scope of trade expanded, trade between firms geographically spread out. Checks might travel, for payments, to distant locations where the bank has no branch offices. If a check is drawn on a bank outside the area of the local clearinghouse, the procedures become more involved. Your client deposits a check with you for collection. However, you can not

38) Therefore, we often refer to the central bank as the bankers' bank.

39) In Japan, for areas where the Bank of Japan does not have branches, settlements are carried out through inter-bank deposits at specified banks.

40) In Japan, the reserve requirements system was introduced in 1957. Needless to say, banks voluntarily had held reserve deposits at the Bank of Japan to accommodate clearing balances, even before the system was introduced.

41) If the paying banks are independent (isolated) banks, receiving banks would require immediate payment in cash from the paying banks. So independent banks must hold large amounts of cash reserves in order to avoid insolvency.

take the check to the clearinghouse for clearing, because the bank on which the check was written is not a member bank of the clearinghouse. For payment, checks have to be presented physically at the bank on which they were written. The physical transportation of checks is costly and likewise shipping notes back is costly too.

Then banks in different parts of the country collect checks and transmit payment through other banks with which they have working agreements. These banks are called correspondent banks⁴². Banks maintain deposit balances at correspondent banks to which proceeds from check collection could be credited and payments debited. Upon receipt of a check on a distant bank, the receiving bank would send the check to a correspondent closer to the paying bank for collection. This bank might, in turn, bring the check to the local clearinghouse for clearing.

This process could reduce the cost of collection and reserves against deposits. However, bilateral check clearing through a correspondent bank is still costly and inefficient, same as the check clearing on a bilateral basis in the local clearinghouse. To improve the efficiency of interbank check clearing between distant market areas, banks joined together to establish the intercity clearing system⁴³. While the regionally based clearing system is a system of settlement for checks for the banks of a specified area, the domestic interbank exchange system is a nation-wide system that settles the net positions among banks participating in the domestic exchange operations.

Previously, banks settled each other's differences between debits and credits through deposits accounts established with each other. The central bank has become the settlement institution of this system. Checks from remote locations are mailed to the paying bank, and then the domestic exchange system is used to make interbank settlement⁴⁴. The settlement amount of checks passing between the various banks is computed once a day at the system's center and each bank's balance is transmitted to the central bank. As a result, banks are able to concentrate the settlement of their exchange balances at the central bank. It is efficient for banks to concentrate settlement of their exchange balances at the central bank.

42) Correspondent banks are also referred to as "vostro banks." See Blommestein & Summers (1994).

43) In Japan, the concentrated domestic interbank exchange settlement system was introduced in 1943.

44) Nowadays the domestic exchange settlement system in Japan is the Zengin System that is operated by the Tokyo Bankers Association. The system handles remittance as well as collection of checks and bills from distant places between banks participating in the system. Most of the transactions under the domestic exchange system are processed electronically by the Zengin System.

Accordingly, banks hold reserve deposits at the central bank for interbank settlement resulting from check clearing and domestic exchange operations, which are originally arising from customer payments. Clearinghouses and the domestic exchange system make possible the safe, reliable, and speedy transfer of funds to any branch of a member bank. Thus customer service has improved and funds settlement capacity has increased.

However, every bank cannot completely avoid cash withdrawal. When payday comes, firms pay their workers wages in cash. Business firms withdraw cash from their bank accounts. This causes a cash drain, not only for each bank, but also for the banking system as a whole. In addition to reserve deposits at the central bank, banks must hold as reserves, vault cash to meet such deposit withdrawal. Banks need to hold not only reserve deposits for interbank settlement but also vault cash for withdrawals. In practice, bank reserves consist of reserve deposits at the central bank and vault cash. Banks acquire cash from merchants who sell households consumer goods for cash. Cash comes from households through merchants to banks.

Banks whose customer base embraces merchants receive cash much more than banks whose customer base embraces manufacturers. Banks of merchants find themselves with surplus funds in their deposits. At the same time, banks of manufacturers find themselves with deficit funds in their deposits, although they have much more bills to deliver to the other banks than bills to receive in exchange at the meeting of the clearinghouse.

In the context of the model, for example, manufacturer B might agree to sell his merchandise to merchant C in exchange for the promissory note that C wrote on her bank Z. Then B brings C's note to his bank Y and asks him to buy it. Y agrees to buy it and issues a demand deposit for B in exchange. Everyday Z receives cash collected from the sale of consumer goods from C until C's note becomes due. Z finds himself with excess reserves until C's note reaches its payment date. On the contrary, Y finds himself with reserve deficiencies until C's note becomes due. When the time comes, Y will be able to deliver C's note to Z for collection at the clearinghouse.

A market developed in which banks with excess reserves would lend them to those with reserve deficiencies. This market came to be known as the inter-bank market⁴⁵⁾. The bank with excess reserves, however, will soon receive the bills drawn on it at the meeting of the clearinghouse. The bank accordingly has to prepare for a future negative clearing balance.

45) In Japan, this market is called the call market, which is the equivalent of the federal funds market in the US.

It means that the bank's reserve surplus is temporary. On the contrary, banks of manufacturers temporarily face a cash shortage, because they will have positive clearing balances when the bills that they discounted fall due.

Banks of merchants, for instance, utilize their temporary reserve surplus to make call loans (loans repayable on demand) to banks with temporary reserve deficiencies. When the bills fall due, banks of merchants could settle their negative clearing balances with their call loans. Call loans are so liquid that they are an excellent secondary reserve for the banks with temporary excess reserves. In conjunction with clearinghouses, the interbank market makes possible a more efficient distribution of reserves throughout the banking system, thereby contributing toward reducing the efficient quantity of reserves which the banking system as a whole has to hold⁴⁶⁾.

To reduce the need to hold large balances in reserves for settlement purposes – deposits at the central bank and vault cash – banks joined together to build a banking structure which is composed of branch networks, clearinghouses, the domestic exchange system and the interbank money market. The central bank plays an axial role in the structure of banking as the final institution of settlement. The central bank forms a critical link in the process of clearing and settlement, because settlement of claims among banks can finally be effected by transfers between accounts held at the central bank. The payment system makes possible the safe, reliable and speedy transfer of funds to any branch of member banks and the efficient use of reserves among banks. Accordingly, funds settlement capacity has increased, and the efficiency of the economy in reserves has improved as well. The payment system spreads reserves throughout the banking system, reducing each bank's necessary level of reserves and allowing the system as a whole to provide the maximum amount of lending for a given level of reserves.

5. Conclusion

This paper has studied an economy in which banks have incentives to issue circulating

46) The principal feature of the call market in the high growth period in Japan was that city banks were typically borrowers while regional banks, credit co-operatives, and mutual savings banks were typically lenders. This one-way relationship of funds flows was referred to as "maldistribution of funds" (Suzuki, 1987, p. 24). However, this phenomenon, as long as it is the counterpart of multilateral net clearing positions, does not mean a structural defect in the Japanese banking system. For further discussion of this point, see Moriyama (1994), chapter IV.

liabilities as part of the money supply. It solved the question of why the activity of lending has typically been coupled with the activity of issuing a payments medium. Most modern theories of intermediaries focus on the role of banks in making loans or taking deposits. In these theories, bank liabilities play no particular role in making payments. Many economists have argued that it is important to separate the activity of lending from the activity of issuing liabilities used in making payments⁴⁷⁾.

This paper has analyzed the evolution and structure of the institutions comprising the payment system: branch networks, clearinghouses, the domestic exchange system, the interbank money market and the central bank. It explained efficiency gains from substituting credit for cash trading as the underlying economic forces driving the evolution of the payment system. It began by constructing a model in which cash must be paid out to cover expenses before any cash is collected from the sale of merchandise. In this environment a liability will be issued by the firms which desire to invest early and sell or produce later. The firms employ trade credit in order to save on additional working capital. As an instrument of trade credit, bills of exchange have played a vital role in financing working capital. Bills of exchange, however, have some drawbacks as circulating liabilities.

The transaction problems with bills of exchange created opportunities for bodies which were not yet banks to make a profit by issuing notes in more convenient forms. This led to the birth of the issuing bank. Issuing banks need to hold some amount of cash reserves against notes. Banks have a strong incentive to minimize holdings of cash reserves because such reserves yield no interest. Bankers' incentive to minimize cash reserves led to the invention of checks and the emergence of deposit banking, thereby constituting a two-tiered banking structure: the central bank of issue and private commercial banks.

To improve the efficiency of interbank check clearing or to reduce the need to hold large reserves, commercial banks joined together to build a banking structure which is composed of branch networks, clearinghouses, the domestic exchange system and the interbank money market. The central bank plays a pivotal role in the structure of banking as the final institution of settlement.

The capital savings associated with trade credit have been the fundamental motivation for

47) For example, in the US, Milton Friedman (1960, pp. 65–76) urged that all banks should hold reserves equal to 100 percent of their deposits, prohibiting them from making loans through issuing deposits. In the 1980s, facing increasing financial crises, the same notion was advocated as “narrow banking,” see Litan (1987). In the 1990s, a similar financial crisis in Japan also stimulated the narrow bank proposal. See, for example, Royama (1997).

banking business. At the banking level, the reserve savings through establishing a banking structure have been the motivation for the evolution of the financial system. There are three levels of economic gains serving as driving forces that caused the evolution of the payment system. At the base stands capital savings of firms through trade credit; in the middle stands reserve savings of banks with the development of modern banking; and at the top stand costs savings of money from the substitution of inconvertible banknotes for commodity money.

This paper scarcely deals with the role of the state in the evolution of central banking. Regardless of legal reserve requirements, banks always need to hold a fraction of their deposits in the form of reserves. This is known as the reserve ratio. This ratio is set by the bank's need to provide liquidity for its customers. Then what economic factors underlie the bank's needs? These are topics for future research.

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