What is Money? How is it Created and Destroyed?

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1 Introduction

What follows is a short essay on the theory of money. By a *theory of money*, I mean an explanation for *why* money is useful or necessary to facilitate trade. Having such a theory is useful because it helps us understand (or at least, interpret) the apparent demand for money. And as the demand for any product or service is likely to generate a supply to satisfy it, the theory can also help us understand the business of money creation; and whether the regulation of this business is in any way desirable.

But before we can begin theorizing about money, we need to define the term. My preferred definition is as follows: *Money* is an object that circulates widely as a *medium of exchange*.[1] Throughout the course of human history, a wide variety of objects appear to have fit this definition; including beads, seashells, metallic coins, and even salt (from which we derive the word *salary*). In the 19th century, money predominantly took the form of paper notes issued by private banks. More recently, governments have legislated themselves control of the paper money supply, with banks retaining a prominent role in managing (creating and destroying) the economy's "electronic" money supply.

With these thoughts in mind, my essay begins with describing a theory of money demand (that is, the demand for a circulating medium of exchange). The theory I present below is not likely to be familiar to you, as I have gleaned it from what currently exists at the frontier of the discipline.[2] Having provided an explanation for why money might be useful, I turn next to describing a theory of the money supply. Contrary to what may be commonly believed, the money supply is not entirely in the government domain. Because the supply of money is so intricately linked to the business of banking, I take some time to

[1] This definition is not entirely satisfactory, as it leaves undefined precisely what "widely" is supposed to mean; but I hope that the idea is intuitive enough.

[2] Unfortunately, the recent theory on this subject is highly technical. Kocherlakota (1998) makes an attempt at conveying the basic idea in a relatively simple manner.

develop a theory of banking as well. And finally, because the subject of banking features so prominently in periods of financial crisis, I take some time to explain to explain alternative interpretations concerning the alleged "fragility" of the banking sector and the desirability of various government policies designed to rectify this apparent shortcoming.

2 The Demand for Money

Why is there a demand for money? It seems clear enough that money facilitates the exchange process. But understanding precisely *why* money is useful or even necessary to facilitate exchange is not as obvious as it may first seem. Let me explain.

Money is useful, we are sometimes told, because it serves as a unit of account, as a store of value, and as a convenient means of settling debts. But while it is frequently true that money serves as a unit of account, there is nothing that logically prevents any object from serving the same role. For example, you might negotiate a salary in terms of so many loaves of bread per year and be paid in the dollar equivalent.[3] And while it is true that money is a store of value, it is frequently a poor one relative to other assets; like an interest-bearing bond. It is also true that debts are frequently settled with money. But if you do not settle your restaurant bill with money, you may very well be asked to settle it in some other manner; for example, by washing dishes. In fact, it is not that uncommon to observe debts settled with goods or labor. One might further note that a retaliatory debt is frequently delivered in-kind.[4]

The properties described above simply constitute a list of attributes that are commonly–but not exclusively–found in money. This list does not explain why money is useful or necessary as a *medium of exchange*.

2.1 A Lack of Double-Coincidence of Wants

Explanations for why money is useful or necessary typically center on the difficulties associated with barter exchange. Barter exchange requires that there exist *bilateral gains to trade* between two parties; this is sometimes called a *double-coincidence of wants*. Barter may involve a *quid-pro-quo* exchange of goods or services; for example, I'll scratch your back, if you'll scratch mine. But barter may also involve a credit arrangement; for example, I'll scratch your back today, if you'll scratch my back tomorrow. Barter may also involve an insurance

[3] This is not just a theoretical possibility. In high-inflation countries, merchants have been known to post their prices in units distinct from the medium of exchange. For example, a merchant may post prices in locally nonexistent U.S. dollars, but accept and make payments in the local currency at the prevailing exchange rate.

[4] The phrase *an eye for an eye* is a quotation from **Exodus 21:23–27** in which a person who has taken the eye of another in a fight is instructed to give his own eye in compensation.

arrangement; for example, let's agree to scratch each other's back whenever we feel an itch.

If all the gains to trade in an economy can be exhausted through bilateral relationships, then there is obviously no need for a circulating medium. People would simply trade directly for the goods they want in exchange for the goods they have. Evidently, it is not the case that all the gains to trade in an economy can be exhausted in this manner. Frequently, the gains to trade are *multilateral*–rather than bilateral–in nature. The existence of multilateral gains to trade implies a *lack of double-coincidence of wants*. To understand what I mean by this, it will be useful to consider an example.

2.1.1 An ABC Economy

Imagine a world inhabited by three people: Adam, Betty, and Charlie (ABC). Adam likes to eat bread in the morning; Betty likes to eat bread in the afternoon; and Charlie likes to eat bread at night. Adam has the ability to produce bread at night; Betty has the ability to produce bread in the day; and Charlie has the ability to produce bread in the afternoon. Assume that once it is produced, bread must be consumed immediately (it will otherwise spoil). Finally, assume that producing bread entails a cost (i.e., it requires some effort).

In the ABC economy described above, Adam is hungry in the morning and Betty has the ability to produce morning bread. Unfortunately, Betty does not value what Adam has to offer (night bread). In this meeting between Adam and Betty, there are no *bilateral* gains to trade. In fact, it should take no longer than a moment to realize that there are no bilateral gains to trade for *any* pairing of these people. In this economy, there is a complete lack of double-coincidence of wants (no bilateral gains to trade).

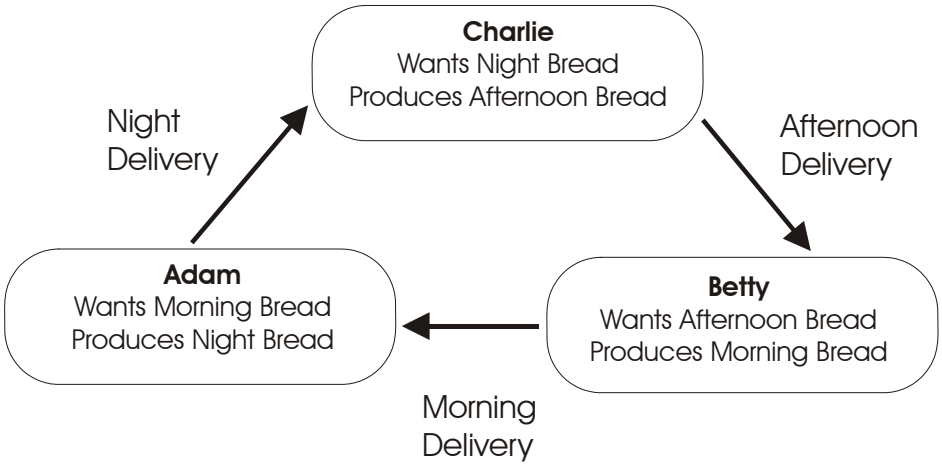
At the same time, it should be obvious that the people in this economy could be made better off by engaging in some form of trade (that is, there exist *multilateral* gains to trade). In fact, everyone would be made strictly better off if they were to follow these instructions: Betty produces bread in the morning for Adam; Charlie produces bread in the afternoon for Betty; and Adam produces bread at night for Charlie. In this way, everyone expends a little effort producing bread, and everyone gets to consume bread when they value it the most; see Figure 1.[5]

It is commonly asserted that a lack of double-coincidence makes money necessary. And indeed, one could well imagine how money might be used in the economy described above. That is, imagine that Adam is endowed with one dollar. Then Adam could pay for his morning bread with his dollar; that is, Betty produces morning bread in exchange for a dollar. Betty then takes her dollar and uses it to purchase bread in the afternoon from Charlie. In the evening,

[5] Figure 1 depicts a version of the famous Wicksellian Triangle; named after the Swedish economist, Knut Wicksell (1851-1926).

Charlie uses his dollar to purchase bread from Adam. In this manner, the dollar circulates as a medium of exchange over time.

Figure 1
Multilateral Gains to Trade
and a Lack of Double-Coincidence
in the ABC Economy



There is, unfortunately, a significant defect in explaining the role of money as a solution to the lack of double-coincidence problem. The defect is that money does not appear to be necessary. In particular, what is to prevent them from simply following my earlier instructions to produce bread when they have the ability to do so and to consume it when they are hungry? I have described nothing in this economy that would prevent it from functioning as a communal *gift-giving economy*; with each producer making a "gift" of output that is to be reciprocated by some other member of the community at a later date.[6]

To develop a theory of money, we need to ask what prevents the world from operating along simple "communist" principles.[7] If money is a solution, then there must be some problem it is solving. What is the problem? Evidently, the problem cannot simply be a lack of double-coincidence, as is commonly asserted. Evidently, there must be some other factor in the real world that explains why

[6] In fact, many primitive economies appear to have functioned precisely in this manner. Indeed, even today, exchange is commonly organized in this manner among small groups of people (for example, in families or clubs).

[7] In his 1875 *Critique of the Gotha Program*, Karl Marx wrote a phrase that is considered by many to be a defining principle of a communist system: *From each according to his ability, to each according to his needs.*

money is necessary.

2.2 Information and Incentives

Society might function well enough as a communal gift-giving network if people could generally be relied upon to behave in a socially responsible manner. So, for example, Adam meets Betty and expresses his genuine desire for bread; and Betty honestly reveals her ability to produce it. Note that Betty has no direct private incentive to produce bread for Adam (he has nothing to offer her in return). Is it reasonable to expect that people in Betty's situation will make the required sacrifice for the benefit of others? Our experience with human behaviour suggests that this is not likely to happen; at least, not as frequently as one might like to imagine. Individuals typically respond to real private incentives– not idealistic social obligations.

If this is so, then the question becomes one of designing a system where people have the private incentive to achieve the social good. In the context of our example, Betty might be induced to produce bread for Adam if she can reasonably expect a reward for doing so. This reward cannot come from Adam; it must come from some other member of society (in this case, from Charlie). And, of course, the same holds true for everyone else. What sort of arrangement might Adam, Betty, and Charlie adopt that gives each of them the private incentive to do what is best for the community (and by extension, themselves)?

One arrangement that might work is for each of them to adopt a *tit-for-tat* strategy. That is, imagine that in the morning of the first day, Betty produces bread for Adam. And for every period following, imagine that each person produces bread for the person who desires it; but only in the event that the recipient has a record of having made a similar gift in the past. This type of behaviour is called tit-for-tat because each person is rewarded (or punished) on the basis of their own past contributions to society. If everyone adopts this mode of behaviour, then each person may have a private incentive to do the right thing. In particular, failing to produce when one has the opportunity to do so implies a short-term gain (a saving of work effort) in exchange for a future loss (foregone consumption). The threat of retaliation can be sufficiently strong to keep everyone working. If this is the case, then money is not necessary.

Social scientists frequently claim to observe tit-for-tat behaviour; interpreting it as a mechanism designed to induce cooperation among groups of people that are not intrinsically cooperative in nature.[8] The feasibility of a tit-for-tat system when there are multilateral gains to trade, however, relies on the public availability of information relating to personal trading histories. In practice, this type of information may not be easily observable; and if it is not, it may be subject to manipulation. In the context of our ABC model, for example, what

[8] See, for example, http://en.wikipedia.org/wiki/Live_and_let_live_(World_War_I)

is to prevent Adam from asking Betty for a little more food, justifying his claim by saying that he will supply Charlie with a little extra as well? And what is to prevent Adam from then supplying Charlie with a little less food, telling him that he too took a little less from Betty? Indeed, what is to prevent anyone from making false and mutually inconsistent claims such as these?[9]

Personal trading histories are like individual reputations. People with good reputations are rewarded (for example, a creditor is willing to extend credit to a person with a good credit history). Because a good reputation is valuable, people are motivated to take costly actions to maintain them (like paying back their debts when they come due). But reputations can only have value if they convey accurate information; moreover, this information must be easily accessible by others. Needless to say, this may not always be the case. We frequently encounter people that are strangers to us. And even among friends or casual acquaintances, we are not likely to be privy to all relevant aspects of their personal histories. If people can get away with it, they may be motivated to fabricate their personal histories (or even the histories of others; as in the spreading false rumours). Strangers may go so far as to pretend that they are someone else (a form of counterfeiting, or identity theft).

Imagine then that our ABC model is afflicted with this type of information problem. In particular, imagine that it is impossible for society to monitor the trading histories of its members. So, for example, while Adam may personally know whether Betty has produced bread for him, assume that there is no way for Charlie to observe that this was in fact the case. Likewise, while Betty may personally know whether Charlie has produced bread for her, assume that there is no way for Adam to observe this; and so on. Moreover, assume that there is no way to record information in the form of written records (that is, assume that written records can be costlessly counterfeited–so that issuing personal receipts or IOUs is infeasible). If this is the case, then absent any innovation, trade will not occur.[10]

2.3 Money as a Record-Keeping Device

Fortunately, the situation described above can be rescued with the innovation of monetary exchange. Imagine, for example, that Adam is endowed with a "dollar."[11] Moreover, imagine that he uses his dollar to buy his morning bread from Betty. In the afternoon, Betty approaches Charlie and asks him to produce bread. But how does Charlie know that Betty produced bread for Adam? The answer is simple: he can ask Betty to "show me the money." If counterfeiting

[9] This is an issue that was first made explicit by Ostroy (1973).

[10] These assumptions are admittedly extreme. But the logic of the argument that follows will continue to hold as long as there are some people who are difficult to monitor.

[11] Historically, the term "dollar" (derived from the German "thaler") referred to a specific quantity of silver. But for this example, you can think of a dollar as taking any form; for example, a shell or a token coin. For this dollar to possess exchange value, it must necessarily be difficult or impossible to counterfeit.

or theft is not a problem in this economy, then the only way for Betty to have acquired her dollar is by having earlier worked for it (i.e., to have made a gift to society). Upon seeing her dollar, Charlie asks that she pay for her bread with her dollar. The dollar in Charlie's hand now serves as evidence that he has made a gift to society; and at night, the evidence will pass back into Adam's hands. Note that people are motivated here to work hard for money in the same way that they were willing to work hard in the tit-for-tat economy to maintain their reputations. The inability to monitor individual trading histories makes money *necessary* for trade.

According to this theory then, the economic function of money is to serve as a *record-keeping device*.[12] Specifically, the monetary object described above serves as a cost-efficient substitute for the information that might otherwise have been gathered and recorded by some public monitoring device. Money would be completely superfluous (even with a lack of double-coincidence) if people either did not behave opportunistically or if their past actions were publicly observable at zero cost. To the extent that this is true, one may legitimately take the view that "evil is the root of all money."[13]

3 The Money Supply

In the previous section, I described the circumstances that give rise to a demand for money. According to the theory outlined there, the role of money is to serve as a record-keeping device. The question concerning the supply of money might therefore be cast in terms of asking how society might best arrange this record-keeping service.

The idea of money as a record-keeping device implies that the role of money is to encode a certain type of information; in particular, information relating to one's past contributions to society. There is no unique way in which to record information. Physically, information can be encoded in either a tangible or intangible manner. Examples of *tangible money* include physical tokens, coins, or paper notes. Examples of *intangible money* include abstract book-entry items; like the electronic digits contained in your bank account.

The key difference between tangible and intangible money appears to be whether some third party (an intermediary) is involved in any transaction. When you purchase a good using a cheque or a debit card, you are in effect instructing an intermediary to transfer monetary digits from your account to that of the merchant. Alternatively, if you choose to pay with cash, you are in effect debiting your pocket of notes or coin and crediting the merchant's cash

[12] Alternatively, money is sometimes said to be a *communication device*; as its possession communicates information concerning a personal trading history; see, for example, Townsend (1987).

[13] This phrase, used by Kiyotaki and Moore (2002), is a play on **1Timothy 6:10** "For the love of money is the root of all evil."

register without the aid of an intermediary. This example highlights the distinction to be made between a *means* of payment and a *method* of payment. Here, money (either in the form of cash or electronic digits) is both a means and method of payment; whereas debit/credit cards or cheques are only different methods of payment.

Another important distinction to be made in terms of monetary objects is whether they are *backed* or *unbacked*. A backed monetary instrument is a debt instrument (an IOU) that represents a claim against something of intrinsic value. An example of this would be a government operating under a *gold standard*; with small denomination government paper notes representing claims against gold. Another example would be private banks issuing paper notes (banknotes) redeemable in specie (gold or silver coins) and representing senior claims against the bank's physical capital (land and buildings) in the event of bankruptcy. There have also been several historical episodes in which private companies have issued paper notes or coupons redeemable in store merchandise (much like *Canadian Tire* money or *Airmiles* reward points). Finally, any form of commodity money is in a sense backed by the intrinsic value of the underlying commodity.

Unbacked money, as the name suggests, is a monetary object that does not represent a claim against anything of intrinsic value. I am unaware of any private agency ever issuing unbacked money; although the practice appears to be widespread among modern day governments. Most of the world's currencies today, like the U.S. dollar, the Euro, and the Yen, are essentially unbacked; they derive their value primarily by *government fiat* (so that unbacked money is commonly referred to as *fiat money*). In other words, governments around the world have typically legislated themselves monopoly control over the business of small denomination paper note issue; and these notes have value to the extent that people find making cash payments useful. At the same time, private agencies with government charters are allowed to create money in electronic form; although money in this form is typically required to be made redeemable for government cash.

3.1 Private Money

Although the business of money creation has almost always been subject to heavy government regulation, if not outright control, it is not immediately obvious why this should be the case. To see how private money-issue might work in theory, it will be useful to refer back to the ABC economy described above. In that model, I assumed that it was impossible to monitor the trading histories of all the members of society. I also assumed that Adam was endowed with a "dollar," without explaining where this money came from.

Let me now modify the information structure in this ABC economy. In particular, assume that Adam can be costlessly monitored; that is, his actions are observable (and remembered) by all members of society. I continue to assume

that Betty and Charlie cannot be monitored. It may be useful to think of Adam as some "famous" person (or agency) and everyone else as "anonymous" people.

Because Adam now has a reputation, he can use it to his advantage. In particular, he is in a position to make promises that others might value.[14] Imagine that Adam issues a security (an IOU) that, if presented to him at night by any person, entitles that person to a loaf of bread. Note that Adam has an incentive to keep this promise; as failing to do so would destroy his reputation (no one would ever value his promises again).

Now, recall that Adam wants bread in the morning and that Betty is in a position to produce it. The only thing that Adam has to pay for morning bread is his personal IOU; that is, a promise to deliver bread at night. Of course, Betty does not value bread at night; she values bread in the afternoon. Would it ever make sense for Betty to work hard producing bread in the morning in exchange for a promise of night bread? The answer to this question is "yes;" at least, as long as Betty can expect to use the IOU to purchase bread from Charlie in the afternoon. Would it ever make sense for Charlie to work hard producing bread in the afternoon in exchange for a promise of bread at night? As Charlie is the person who values bread at night, the answer to this question is "yes;" at least, as long as Charlie can be assured that Adam will make good on his promise. Adam will keep his promise, if he values his reputation.

In the economy just described, the instrument that serves as money is a privately-issued debt instrument (Adam's IOU). As before, the economic function of this monetary instrument is to serve as a record-keeping device (in particular, Betty and Charlie can present this IOU as evidence of their past contributions to society). We also get a hint here of how the process of money creation and destruction works. First, money is created to fill the demand for an economywide means of payment (not everyone is in a position to issue credible promises). Second, money is "destroyed" (taken out of circulation) when it is ultimately redeemed by the issuer.

Well, this is the way that things might work in theory, at least. Is there any evidence which suggests that this has ever happened in history? The answer is most certainly yes. A prominent example is the paper money (called *scrip*) issued by private companies in the 19th century U.S. Railway companies would, for example, pay their workers in their own scrip; and the scrip was then used by workers to purchase output at the company store. Another example is provided by Bodenhorn (1993), who quotes an Italian General Secretary of the Banco D'Italia who explained how, prior to 1874, "everyone was issuing notes, even individuals and commercial firms; the country was overrun with little notes of 50, 25, and 20 centimes issued by everyone who liked to do so." The author also notes that when state legislation banned U.S. banks from issuing notes of less than $5, railroad companies, public houses, merchants and even churches filled the void with their own notes.

[14] The promises of anonymous people are not likely to count for anything, as they can always deny having made them.

The author's remark concerning the legislation that banned the private issue of small denomination notes goes a long way in explaining why the phenomenon is not so widespread today. The motivation for such legislation was for a long time a hotly debated issue. Advocates for such legislation typically rested their case on the idea that the private sector cannot be trusted to manage the supply of small denomination paper (implicitly suggesting that the government can be better trusted). Private money issuers evidently had an incentive to "overissue" paper (making promises that they could not keep); even though the evidence for whether this was ever a problem more serious than "government overissue," or the "overissue" of other types of financial instruments, is not entirely clear.

3.2 Government Money

There is a long tradition of government involvement in the business of money creation. It was very common for a local sovereign to legislate on behalf of the crown monopoly control over the minting of coins. Coin clipping–the practice of clipping of pieces of gold and silver coin and melting the shavings into counterfeit coin–was frequently considered an offense punishable by death. Over the course of time, some governments supplemented the supply of money by issuing paper notes (either directly, or by contracting out the service to some privileged private sector agency) backed by gold or silver. More recently, most governments have abandoned any pretense of backing their paper money.

In principle, the public provision of money poses no obvious theoretical obstacle. Indeed, a case could be made that the business of money creation is a sort of natural monopoly; i.e., that a single, uniform currency, might naturally dominate a system with multiple currency issuers (a similar argument is used by advocates of common currency areas). In the context of the ABC model above, Adam's private IOU might easily be replaced by a government money that performs the same essential function.

In practice, however, the public provision of money has not always worked so smoothly. This is because there is frequently a great temptation on the part of the money supplier to exploit its monopoly position to extract *seigniorage revenue* from the population. The way this might work in the context of the ABC model is as follows. First, the government passes legislation to prohibit private note issue (so that Adam is not allowed to create his IOU). But as there is a demand for money in some form, people will be induced to work (or supply goods) for it. The government can exploit this demand for money by simply printing new money to pay for what it wants. At every date, people who are holding "old money" (money that they worked for) will be competing with the "new money" created by the government to purchase some of the economy's output. Inevitably, this process results in inflation; i.e., a systematic rise in the price of goods and services (or, equivalently, a systematic decline in the purchasing power of money). The resulting inflation acts like a tax on money holdings; and for this reason, it is sometimes called an *inflation tax* (another

name for seigniorage).

There are, of course, both economic and political limits associated with the government's ability to extract seigniorage revenue from the population. The economic limits are governed by the demand for money (people may not be willing to hold as much money during periods of high inflation; an effect which reduces the tax base) and the availability of currency substitutes (which the government may try very hard to suppress through legislation).[15] The political limits are those commonly associated with oppressive taxation. In any case, it should not be surprising to learn that periods of intense fiscal stress (e.g., a period of war) are frequently associated with high rates of inflation.

3.3 Banking

There is probably no other business less well understood than that of banking. The reason for this no doubt lies in the fact that the business of banking is in practice multifaceted and highly complicated. But in fact, the basic principles of banking are easy to understand; even if the details are sometimes messy and confusing.

The first thing to keep in mind is that a bank is a financial intermediary; but that not all financial intermediaries are banks. Financial intermediaries are best thought of as *asset-transformers*. To understand what I mean by this, keep in mind that the distinction between a financial asset and a financial liability is simply a matter of perspective. For example, Adam's IOU constitutes a financial liability as far as he is concerned; but it constitutes a financial asset for the person who holds it. With this in mind, consider the following.

Insurance companies collect premiums which they use to purchase assets (e.g., bonds and asset-backed commercial paper). At the same time, insurance companies create *state-contingent liabilities* that are backed by the assets they hold. To put things another way, insurance companies transform their assets into *insurance policies* that promise a cash payout in certain states of the world (for example, in the event your house burns down). Similarly, pension funds collect contributions which they use to purchase assets; at the same time, they create *time-dependent liabilities* that are backed by the assets they own. To put things another way, pension funds transform their assets into *pension plans* that promise a cash payout in the event of retirement. The liabilities created by insurance companies and pension funds are typically *illiquid*; for example, it is difficult to purchase your morning coffee by selling off a part of your insurance policy or pension plan.

As with other financial intermediaries, banks collect assets (deposits of cash and collateral); which they transform into *demandable liabilities*. Demandable liabilities are securities that can be redeemed for cash on demand (for example,

[15] Governments sometimes prevent their citizens from using foreign currency or opening foreign currency accounts, for example.

when you choose to withdraw cash from a bank machine). Note that by "cash" what I mean here is a tangible monetary object; today primarily in the form of small denomination government paper, but historically also found in the form of specie (gold and silver coins).

The distinguishing characteristic of banks *vis-à-vis* other financial intermediaries is that the demandable liabilities created by banks are commonly used as a form of money; which is to say that they are *liquid* (as in the case of Adam's circulating IOU). To put things in another way, banks are financial intermediaries specialized in the business of money creation. In days gone by, private banks regularly issued small denomination paper notes redeemable in specie. For example, in the U.S. "free banking" era (1836-63), there were literally hundreds of banks that issued their own currency (a practice that was abolished by both the northern and southern governments during the U.S. civil war). The demand-deposit liabilities issued by chartered banks today no longer exist in paper form; instead, they exist in the form of electronic digits recorded in centralized accounts. Moreover, this modern "bank money" is redeemable not for specie, but for government cash. It is of interest to note that most of the "money supply" in any well-developed economy is created by the private sector.

3.3.1 The ABC's of Banking

Let us again consider the ABC economy, but with the following modifications. First, assume that Adam, Betty, and Charlie cannot be publicly monitored; so that their personal IOUs are worthless as a circulating medium. Second, assume the existence of another agent (or agency) called "the bank." Unlike Adam, Betty, and Charlie, the bank has no ability to produce output. The bank's only advantage is that its reputation is publicly observable.

The situation now is as follows. Adam has an asset (his IOU), but no reputation that would support its value in the market. The bank, on the other hand, has a reputation, but no assets to exploit it. Adam and the bank each have something that the other values; perhaps they can strike a deal for their mutual benefit (and incidentally, for the benefit of society).

Imagine that Adam and the bank agree to the following "contract." Adam is required to "deposit" his IOU with the bank as collateral for a loan. The bank creates paper notes that are backed by the value of this collateral and lends them to Adam. Adam agrees to pay back the money loan at the end of the night (he might throw in a little extra bread as interest–after all, bankers have to eat too).

Note that while Adam's reputation (credit history) is not publicly observable, it is observable to the bank. Adam is therefore motivated to pay back his loan; at least, if he wishes to maintain his future access to bank credit. To pay back his loan at night, Adam will have to produce night bread and sell it for banknotes

(money). Hence, Charlie should be willing to produce bread in the afternoon in exchange for banknotes; and likewise, Betty should be willing to produce bread in the morning for banknotes too. Of course, morning bread is precisely what Adam values; to acquire this bread, he will first have to agree to the contract described above.

The bank's reputation in this story is important for the purpose of maintaining the integrity of its money. As the value of the bank's money ultimately rests on the quality of its loan portfolio, the bank will have to ensure that its loan applicants have sound business plans. A bank that creates banknotes and lends them out in a haphazard manner would quickly see the value of its money (and hence, its business) fall to zero. This is why screening loan applicants, managing portfolio risk, and collecting on money loans are some of the important activities associated with the business of banking. At the end of the day, however, the essential function of banking is to transform illiquid assets (like Adam's IOU) into liquid liabilities (banknotes).

3.3.2 Demandable Liabilities

The example of banking described above, while accurate in some respects, is missing an important aspect of the way in which banks operate in reality. Most monetary systems are in fact what one might term *dual money regimes* in that there are usually (at least) two coexisting monetary objects; a *primary* money and a *secondary* money. The primary money supply–sometimes also called *base money*–is usually more liquid. Historically, base money took the form of specie (gold or silver coin); in modern times, it comes in the form of small denomination government paper notes and coin. The secondary money supply is somewhat less liquid; it is typically issued by private banks and made convertible (on demand) for base money. Historically, these demandable liabilities took the form of private banknotes convertible into specie; in modern times, they take the form of electronic digits convertible into government cash.

The demandability property found in secondary money (as well as other debt instruments) is a peculiar financial innovation. In the language of high-finance, it is called an *American put option;* that is, the seller (a bank) issues a liability that gives the buyer (the depositor or borrower) the right, but not the obligation, to sell the liability back to the issuer at any time (on demand) in exchange for cash at a prespecified strike price (usually par). This may sound complicated, but all it really means is that if you deposit cash at a bank, or take out a money loan, your account is credited with electronic digits in the amount of the deposit or loan; and that moreover, you may, at any time, convert your electronic digits into cash (this is what happens, for example, when you withdraw cash from an ATM).

The idea of being able to convert your bank money into cash whenever you want is an attractive one; and no doubt, this is one reason why banks eager to attract business offer their clients this option. To put things another way, the

demandability clause makes bank money more widely acceptable as a means of payment; allowing banks to better fulfil the economy's need for a supply of liquidity that responds rapidly to changing business conditions.

The demand for cash likely stems from the fact that (even in this age of electronic payments), it is a more economical method of payment for small purchases. Moreover, not all merchants are willing to accept cheques; and not all points-of-sale are hooked up to an electronic payments system.[16] For these reasons, banks will keep cash in reserve to meet the need for daily withdrawals. At the same time, these reserves are replenished by merchants making cash deposits out of their daily sales. The upshot of all this is that the balance sheet for a bank (or the consolidated banking sector) looks something like this:

Assets	Liabilities
Cash Reserves: \$10,000	Demandable Liabilities: \$100,000
Illiquid Assets: \$90,000	
Total Assets: \$100,000	Total Liabilities: \$100,000

According to the balance sheet above, the bank has \$100,000 in "demand-deposit liabilities;" that is, the bank's clients have \$100,000 credited to their accounts that they can–if they want–convert into cash at any time. Note that while the bank's clients may believe that there is \$100,000 of money in their bank, this is subject to an important qualification. That is, there is indeed \$100,000 in the form of money; but there is only \$10,000 in the form of cash (the remainder is in the form of electronic digits). For some reason, people are frequently shocked to discover this fact; but it is an essential property associated with the business of banking (which is to convert the \$90,000 of illiquid assets into a liquid form).

4 Financial Crises

As described above, the demandability clause built into bank liabilities enhances their use as a means of payment. But this peculiar property has a potential downside risk attached to it. Demandable liabilities are, by construction, "short-term" debt instruments; that is, they give people the right to cash out on very short notice. In contrast, the asset side of a bank's balance sheet consists predominantly of "long-term" illiquid assets; for example, personal loans, like Adam's IOU, or a portfolio of individual mortgages. The illiquid nature of a bank's assets and the liquid nature of its liabilities is termed by accountants a *security mismatch*.

[16] The underground economy, whose participants are not eager to leave records of their transactions, is also a major source of the demand for cash.

4.1 Bank Runs

The potential problem with security mismatch is as follows: what happens if (for whatever reason) everyone wants to withdraw their money from the bank (or banking system) at the same time? In such an event (called a *bank run*), the bank is clearly not in a position to honour its obligations; there is not enough cash in reserve to do so. The only way that the bank can acquire the cash that people want is to start selling off its assets. But a bank's assets are by nature illiquid; which means that they will either have to wait a long time before finding someone willing to pay full value, or that they will have to dispose of their assets at firesale prices. If people want their cash now, the bank has only one of two options; either: [1] start selling off assets at a large discount to their "true" market value (which may threaten the bank's solvency); or [2] suspend withdrawals (which will put the bank in technical default, potentially leading to bankruptcy). Neither option appears particularly attractive.

The interesting theoretical possibility associated with security mismatch is the idea that a bank run may become a *self-fulfilling prophesy.*[17] That is, imagine that (for some unexplained reason), people become fearful that their bank is insolvent. The particular reason for this expectation does not matter; for example, it may simply be based on an unsubstantiated rumour. Nevertheless, conditional on the expectation, it will make sense for each individual depositor to "run" their bank; that is, to withdraw cash, even if they have no pressing need for it. But if all depositors act in this manner, the bank may have to dispose of its assets at firesale prices, which may then lead to insolvency–an event that would confirm the initial expectations. In other words, if everyone believes that their bank is insolvent, this belief may in the end come true (whether or not the bank was truly insolvent to begin with).

This same line of reasoning, applied to the banking sector as a whole, is thought by many to give rise to the prospect of a widespread *banking panic.* This perceived "fragility" of the banking sector is what undoubtedly motivates the vast array of banking regulations designed to correct or mitigate the potential problem of a widespread banking panic. For example, banks are frequently subject to "reserve requirements;" i.e., laws that stipulate a minimum level of cash reserves. They are also subject to "capital requirements;" i.e., laws that stipulate a minimum level of "safe" assets (like government securities). They are also typically required to join a government sponsored insurance program that protects depositors up to some legislated maximum amount per account.[18]

[17] This idea was first formalized by Diamond and Dybvig (1983). See also Diamond (2007).

[18] Banks are frequently subject to many other regulations; for example, limitations on branch banking, prohibition on the sale of insurance, entry restrictions, prohibition on mergers, etc. Most of these regulations appear to be politically motivated; they serve no obvious economic purpose.

4.2 Lender of Last Resort

Most countries (or common currency areas) have a *central bank* that is responsible for managing the supply of base money. The central bank (the *monetary authority*) serves as a banking agent for the government (the *fiscal authority*); as well as for commercial banks and other financial agencies. Chartered banks typically hold some cash reserves in their accounts with the central bank; and the government holds deposits at both the central bank and designated chartered banks.

Contrary to what some may believe, a central bank cannot simply create money and inject it into the economy. When the monetary authority wishes to expand the supply of base money, it will do so by swapping government bonds for cash; either by "monetizing" the government bonds that the central bank holds as assets, or by selling the government bonds it holds in the bond market (an *open market operation*).[19]

One important function of the central bank is to serve as a "lender of last resort" for chartered banks. The idea here is the central bank may be in a position to avoid a banking panic if it stands ready to lend cash to banks who (through no fault of their own) are being subject to a bank run. Normally, such emergency lending is performed through a *discount window* facility; the central bank "injects" cash reserves into a troubled bank in exchange for high-grade assets (typically, government bonds); i.e., a form of collateralized lending.

In periods of unusual financial stress, such as what we have experienced during the financial crisis of 2008, a central bank may expand the list of eligible securities that it will accept as collateral (such as prime-grade mortgages) for short-term cash loans. The securities in question are typically illiquid (since otherwise, a troubled bank could have raised the cash it needs by disposing of these securities on the open market). The whole idea behind a bank run, however, is that illiquid securities can only be disposed of quickly in the market at a huge discount. Rather than bear the cost of a firesale on its assets, a troubled bank can offer them to the central bank at a much more "reasonable" discount. Once the crisis passes, a (formerly) troubled bank will be able to pay off its debt (and reacquire the illiquid assets it put up as collateral). At least, this is the way things are supposed to work in theory.

4.3 Bank Runs: An Alternative Interpretation

Are banks really as fragile as some would like to make them out to be? Is it really possible for a bank to fail as the result of a self-fulfilling prophesy? Have self-fulfilling bank runs even ever occurred in history? You will not be surprised to learn that economists frequently disagree on the answers to these questions.

[19] In Canada, the central bank can also alter the supply of cash reserves available to chartered banks by shifting cash out of its government accounts into the government accounts of the banking sector.

The idea of bank sector fragility appears to be firmly ingrained in our popular culture. Who can forget that famous scene in the Christmas classic *It's a Wonderful Life* (1946) where George Bailey (James Stewart) begs his account holders to limit their cash withdrawals as they storm his bank?[20] The widespread banking failures experienced in the U.S. during the 1930s no doubt did much to promote this view.

Of course, no one doubts the fact the banks sometimes fail and that, at times, many banks fail during an economic crisis. The point of disagreement is in terms of what precipitates bank failure. The popular view is that a sudden loss of confidence can in itself become a self-fulfilling prophesy. But an alternative interpretation is that the loss of confidence is merely a symptom–and not the cause–of a financial crisis. After all, even non-bank firms are known to fail; and there are typically many such failures during an economic crisis. The crisis is likely caused by bets (risky investments) that turn out badly, leading to a *fundamental* decline in the value of assets throughout the economy (or the firm in question).[21]

At issue then, between these two very different interpretations, is the direction of causality. The popular view is that a loss of confidence can ultimately lead to a deterioration of economic fundamentals (justifying the initial loss of confidence). The alternative view is that deteriorating fundamentals are normal occurrences in the process of economic development; and that a loss of confidence is symptomatic of these unfortunate events.[22]

Empirically, it is very difficult to discriminate between these two competing views. This is unfortunate because the two views deliver very different policy implications. The self-fulfilling view generally justifies the use of government policies to "stabilize" the banking sector. The fundamental view, in contrast, suggests that many "stabilizing" policies are likely to be counterproductive. Limitations on branch banking, for example, likely contributed to the wave of bank failures in the United States during the Great Depression.[23] Moreover, lender-of-last-resort facilities and federal deposit insurance programs may induce banks to finance riskier bets than they might otherwise undertake if such policies were absent.

[20] You can view the clip on YouTube: www.youtube.com/watch?v=MJJN9qwhkkE

[21] One might note that the "run" on George Bailey's bank was in fact precipitated not by unsubstantiated rumour, but by the fact that he had lost a substantial part of the bank's assets.

[22] See, for example, Allen and Gale (1998).

[23] Support for this view can be found in the fact that Canada experienced no bank failures during the Great Depression (Canadian banks were allowed to open branches across the country; whereas U.S. banks were largely prohibited from opening branches beyond their state borders).

5 Further Readings

For an accessible and short history of private money-issue and banking in the United States, see Champ (2007). Rolnick and Weber (1985) dispel some commonly held myths concerning a famous episode in the history of banking. Rolnick, Smith, and Weber (2000) examine an interesting historical episode of a private central bank. Smith (1936) documents the early debates concerning the relative merits of central banking in several countries.

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