

## **Chapter 1: Financial Institutions and Money: An Introduction**

### **Learning Objectives:**

- *To recognize, describe and differentiate various types of financial institutions*
- *To characterize money in its many forms and summarize its roles and functions in the economy*
- *To calculate money supply in a fractional reserve banking system*
- *To assess the importance of the payments system and the roles of banks therein*
- *To define central banks and various intergovernmental institutions and establish their functions*
- *To explain theories of financial intermediation and report on its functions in the economy*
- *To critically analyze arguments assessing the potential or degree of damage of financialization*

### **A. An Introduction to Financial Institutions**

A *financial system* is a set of financial procedures, institutions, instruments and technologies whose purpose is to facilitate trade and transactions. Financial systems play an essential role in allocating resources and risks across individuals and institutions and through time. *Financial institutions* are crucial to this process, providing financial services to their clients, particularly services related to transactions, deposits, lending and investments. Institutions interact in financial markets by issuing financial claims and contracts and by trading securities and other instruments. Markets for original issue of instruments are called *primary markets*, and *secondary markets* exist for trading of instruments that were previously issued, providing liquidity to the participants in primary markets. For example, firms issue stock in primary markets through IPOs (initial public offerings), and these shares are traded in secondary markets such as the New York Stock Exchange or the Borsa Italiana.

Table 1 below provides a partial listing of some of the more important categories of financial institutions in the U.S. and world economies. In this chapter, we will briefly introduce most of these types of institutions, but will focus on depository institutions and investment banks for most of the text.

There is significant overlap in the functions of these institutions. For example, while merchant banks might be defined as financial institutions that engage in underwriting, provide loans, financial advice, and foreign exchange and fundraising services for larger businesses and high net worth individuals, commercial banks and investment banks also provide some or all of these services. Thus, there often are not clear distinctions between pairs of these different categories of financial institutions.

This book will provide a general introduction to banking and will focus on the more specific activities related to corporate and investment banking. As implied by the title of this book, the two key financial activities will be corporate and investment banking. Corporate banking is typically conducted by corporate banking units of commercial banks and often include services to corporations and other businesses such as cash management, currency and trading services, liquidity management, credit management, risk management and other financial services. Of course, corporate banks will normally provide traditional deposit and loan-making services to their corporate clients. Investment banking activities are typically conducted by investment banking units of commercial banks or dedicated investment banks. These services often include the underwriting and distribution of new issues of securities to the public to fulfill corporate capital requirements. Investment banks also invest capital and trade securities for themselves and their clients, advise corporations on mergers and other corporate transactions, and provide other corporate advisory and financial services.

**Depository Institutions**

*Commercial banks:* Accept deposits from and make loans to individuals and institutions

*Savings associations* (savings and loans institutions, building societies, sparkassen): Accept deposits from consumers and institutions and make loans, specializing in mortgages

*Credit unions:* Are formed as non-profit cooperative institutions owned by their members that serve member depository and loan needs

**Investment Institutions**

*Investment banks:* Underwrite and distribute new issues of securities to the public, and more generally, invest capital and trade securities for themselves and clients, advise on mergers and other corporate transactions for clients and provide other corporate financial services

*Securities firms:* Trade securities on behalf of their own and client accounts

*Mutual funds:* Pool investor resources to invest on their behalf

**Unregistered Investment Institutions**

*Pension funds:* Invest funds to provide retirement income for beneficiaries

*Hedge funds:* Invest for wealthy or institutional clients as unregistered vehicles

*Private equity firms:* Invest in securities of unlisted firms

*Venture capital firms:* Invest in private portfolio companies typically in the early stages of their existence

**Insurance Companies**

*Life insurers:* Collect premiums and pay benefits to designated beneficiaries upon deaths of the insured

*Property-casualty insurers:* Collect premiums and pay benefits to designated beneficiaries upon covered losses to property and other coverage events incurred by the insured

**Other Financial Institutions**

*Governments:* Typically issue currency and debt instruments, regulate markets and money supply, manage payments systems, make tax policy and collect taxes.

*Central banks:* Set and implement policies that affect a country's supply of money and credit, may seek to promote financial stability and economic growth. May be a unit of government or privately owned.

*Government sponsored enterprises (GSEs):* Are shareholder-owned quasi-governmental entities with federal charters created to enhance the flow of credit to specific sectors of the U.S. economy

*Finance companies:* Make consumer and business loans primarily to and through retailers and individuals for the purchase of durable goods

*Exchanges:* Provide market venues for trading of securities, currencies and other instruments

*Clearing houses:* Facilitate and settle transactions among financial institutions

*Financial conglomerates:* Bank holding companies and other diverse groups of financial units

**Table 1: Partial Listing of Financial Institution Categories**

## B. An Introduction to Money

The topic of money is prerequisite to any discussion of banking. *Money* can be defined as anything that is generally accepted for the payment of goods and services or in the repayment of debts. Money functions as:

1. a *medium of exchange*, meaning that it can be used to buy commodities,
2. a *unit of account*, meaning that it is used to measure value and to denominate debts, taxes and to measure performance, and
3. a *store of value*, facilitating future consumption, savings and investment.

In a *subsistence economy*, each individual consumes what she produces, kills and gathers. Trade provides for a significant economic improvement. *Barter* involves the direct exchange of goods or services for other goods or services without using money (See Jevons [1875]). Barter requires a *coincidence of needs* before trade can be executed; that is, one party to barter must need exactly what the counterparty has to offer. This coincidence of needs is time-consuming and costly to arrange. Money permits values to be assessed and monetary equivalents to be exchanged for goods and services, diminishing the requirement for coincidence of needs and the number of independent prices that need to be established, from  $N(N-1)/2$  to  $N$ , where  $N$  is the number of goods. So, for example, a barter economy with  $N=10,000$  goods would require the establishment of 49,995,000 prices, one for each possible pair of goods. To effectively serve money's important functions, the following 6 qualities should characterize money:<sup>1</sup>

1. *durable*; that is, money should endure for a period of time,
2. *portable*; that is, money should be inexpensive to transport or transfer,
3. *divisible*; that is, money should be available in units necessary to exactly match values of goods and services,
4. *scarce*; that is, money should be in limited supply so as not to degrade its value, yet in sufficient supply to accommodate transactions and foster economic goals such as growth,
5. *uniform*; that is, money should be standardized, easily identified and compared to other units of desirable money, and, most importantly,
6. *acceptable*; that is, individuals and institutions should have confidence that money will be acceptable in exchange for goods and services in the future.

### Types and Backing of Money

What gives money value? Quite simply, the willingness of people to accept money as payment for goods and services and satisfaction of obligations gives money its value. Why should people be willing to accept money? Perhaps the willingness of other people to accept this money is sufficient to merit its value, though each of the 6 characteristics listed above play a role in its acceptability.

#### *The Gold Standard*

First, consider *commodity money* (physical goods used as money) such as coins minted with precious metals. Coins are durable, divisible if smaller denominations are available, somewhat scarce, uniform and generally acceptable as a medium of exchange. However, they are not easily portable, especially in large sums, and they can be debased by increasing their content

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<sup>1</sup> Clayton [2015]

of *base* (cheap) metals. However, *representative money* is backed by some valuable commodity such as gold. For example, United States Notes, Series 1882 were fully redeemable to the U.S. Treasury for specific quantities of gold. Earlier still, moneychangers and goldsmiths accepted gold deposits and issued titles or receipts whose ownership could be transferred, facilitating the process of payment. While not redeemable, the value of one U.S. dollar was set at 1/35th of one ounce of gold during the Great Depression (by Presidential Executive Order 6102 (1933) and the Gold Reserve Act of 1934) and remained fixed at this rate until 1971.

Under the gold standard, currencies are valued relative to gold. Countries (or other institutions) issuing currency agree to buy or sell gold at parity rates (related to gold). Gold would be used to settle national trade balances. Variations of the gold standard have been employed by ancient Egyptian, Greek and Roman civilizations. Great Britain fixed the price of gold in 1821 at £4, 17s, 10.5d (4 pounds, 17 shillings, 10.5 pence) per ounce and maintained this price until 1914. During most of this period, notes issued by the Bank of England were fully redeemable for gold. Prior to 1816, Great Britain employed a system based on *bimetallism*, where the currency values were simultaneously fixed with the price of gold and silver. The United States maintained a gold price of \$20.67 between 1834 and 1933, excluding the periods 1861-1878 and 1914-1919. Thus, the exchange rate between dollars and pounds was fixed at \$4.86656 per pound over the overlapping periods.

The gold standard does offer trade markets a number of benefits:

1. The gold standard tends to promote stability in exchange rates (currency value relative to other currencies).
2. The gold standard may facilitate corrections in trade imbalances. Suppose, for example, the U.S. and U.K. both operated under the gold standard in 1910 and the U.S. had a trade deficit with the U.K. This deficit would have resulted from the U.S. importing more from the U.K. than it was exporting to the U.K. In this case, U.K. claims on U.S. gold and money supply would correspondingly increase. This would increase prices in the U.K. and decrease them in the U.S., making U.S. exports cheaper and U.K. exports more expensive. This adjustment, known as the *price-specie-flow mechanism* would cause U.S. imports to decline and U.S. exports to increase, eliminating the trade imbalance.
3. The supply of gold is limited, which limits inflationary pressures.

In addition, the gold standard also poses certain disadvantages:

1. The gold standard imposes on government monetary and fiscal policies to manage the economy in order to meet the standard.
2. The gold standard imposes instabilities that can be expected if and when a country departs from the gold standard.

### *Bimetallism*

Sometimes money is backed by other assets. For example, between 1792 and 1873, the U.S. maintained a system based on bimetallism. Since many other countries employed a gold standard (such as France), silver (such as Germany) or bimetallic standard over much of these periods, prices and exchange rates were quite stable. For example, consider the gold and silver coins that were minted in the United States prior to 1965 (1932 in the case of gold). These coins were backed by the value of the metal used to mint them. The value of the metal in the currency

should not exceed the face value of the coins; otherwise, people would melt them for the metal.

### *Token and Fiat Money*

However, usually, and since the discontinuation of the use of silver in minting coins in 1964, coins in the U.S. are said to be *token money*. The metal has only token value. Obviously, paper currency is token money as well. So, what backs the value of token money? Gold, silver and other precious metals and stones are convenient commodities to back money. For example, a *gold standard* implies that a paper currency is backed by some quantity of gold. Until the Great Depression, when consumers began to hoard gold using money that otherwise could have been used to stimulate the economy, the U.S. dollar and the U.K. pound could be converted into gold. Until 1976, the U.S. dollar was still on the gold standard in that central banks could convert dollars into gold.

Since 1976, the U.S. has no longer been on a gold standard; the dollar is now considered a *fiat currency* because it is not backed by any commodity. Fiat paper money, originating in China during the 11th century has value often simply because the government has decreed so. More recently, the United States has decreed that the currency that it issues is legal tender for all debts, public and private. Since the U.S. accepts currency as payment for taxes, this government acceptance could be viewed as backing for its currency. We will discuss payments systems and digital currency shortly.

### Money Supply

The central bank of a country (in the United States, the *Federal Reserve System*, often referred to as the Fed; in the Eurozone, the *European Central Bank* or ECB) typically conducts the monetary policy on behalf of that country or currency area. Measuring the supply of money in an economy is tricky because of the wide variety of instruments that perform the functions of money. One fairly narrow definition for money supply is *M1*, which includes total currency balances and demand deposit (checking) accounts in the economy. Currency includes paper money (Federal Reserve Notes in the U.S.) and coins. Demand deposit accounts are offered by commercial banks and thrift institutions, including savings and loans institutions and credit unions. *M1* also includes a number of relatively minor monetary devices such as money orders or overnight deposits (the case for the ECB). Currency normally accounts for somewhat more than half of *M1*. However, currency held in the banking system, including the U.S. Treasury, the Federal Reserve System and commercial banks is not included as part of *M1*. Since this currency is obtained by deposits, counting it would essentially mean counting the money twice – as the banking system's currency and again as checking or time deposits.

A broader measure of money supply is *M2*, which includes *M1* plus money market deposit accounts (offered by commercial banks and other depository institutions; not included in the ECB definition), FDIC insured time deposits and money market mutual funds (in the U.S. offered by mutual funds). Time deposits include savings accounts and FDIC insured certificates of deposit. The ECB definition of *M2* includes deposits for up to 2 years and deposits redeemable in up to 3 months along with *M1*.

Money *MZM* (Money with Zero Maturity, measuring financial assets redeemable on demand at par), which equals *M2* minus FDIC insured time deposits plus non-bank financial institution money market accounts. This measure is intended to include all money that individuals and businesses have instant or near instant access to. ECB *M3* monetary aggregates include repurchase agreements, money market fund units and debt securities for up to 2 years.

Note that monetary aggregates can differ markedly among countries and currency unions.

### Money Multipliers

Commercial banks play a vital role in the world economy. Among their important functions is their role in creating money by extending credit or loans. In fact, the bulk of money in a modern economy is created by banks and the banking system through lending of deposits.

To describe money creation and money multipliers, we start by assuming that the central bank of a country (the Federal Reserve system in the U.S., described in the next section) issues a fixed amount of currency (paper money, though it could include reserves, gold, etc.)  $K$  to the public and allows commercial banks to loan funds entrusted to them by depositors (in checking accounts, also known as demand deposits) of amount  $DD$ . Thus, businesses and consumers receive the currency from the central bank and deposit it into the commercial banking system in the form of demand deposits. Typically, the central bank requires that commercial banks hold on reserve a proportion  $r$  of their demand deposits; this proportion  $r$  is known as a *reserve requirement*. The required portion of this reserve cannot be loaned to the general public. More specifically, commercial banks leave on deposit (or reserve) with the central bank non-loanable reserves totaling  $r \times DD$ .

During the 20th century, the U.S. central bank (the Federal Reserve System) did not pay interest on its reserves. This changed in the early 21st century, and many banks maintain excess reserves in order to collect the interest paid by the central bank. If banks loan the remainder of their capital to clients, the money supply in the economy is calculated as follows:

$$M_1 = K + (1 - r)K$$

after a single round of deposits and loans. Thus, the economy's money supply thus far consists of paper currency  $K$  issued by the government which is deposited into the bank plus proportion  $(1 - r)$  which is loaned by the bank to its customers. The loaned funds are then spent and then re-deposited by their recipients into the banking system, allowing the process to repeat itself:

$$M_1 = K + (1 - r)K + (1 - r)^2K$$

with two rounds of deposits and loans. This process can continue perpetually. Whenever funds are loaned by a commercial bank, they are spent by the borrower. The borrower purchases goods from a seller; the seller then deposits its receipts into the commercial banking system, creating more funds available to loan. However, each deposit requires that the commercial bank increase its reserve left with the central bank by the proportion  $r$ . The level of money supplied  $M_1$  in such a system is determined as follows:

$$M_1 = K + (1 - r)K + (1 - r)^2K + \dots + (1 - r)^\infty K$$

$K$  is the currency originally issued by the central bank to the public and deposited in the commercial banking system. The amount  $rK$  fulfills the initial reserve requirement and the remainder  $(1-r)K$  is loaned to the public. The public re-deposits this sum back into the commercial banking system. Of the  $(1-r)K$  re-deposited into the banking system,  $(1-r)(1-r)K = (1-r)^2K$  is available to loan after the reserve requirement is fulfilled on the second deposit. This process continues forever; that is, it continues through  $(1-r)^4K$ . Where  $K$  is the level of currency

originally issued by the central bank and  $r$  is its reserve requirement, what is the total money supply for this economy? Obviously, since this series is extended through an infinite number of repetitions, its exact computation is impossible without simplification. We can determine total money supply through the following geometric expansion where we first multiply by  $(1 - r)$ :

$$(1 - r)M_1 = (1 - r)^1K + (1 - r)^2K + (1 - r)^3K + \dots + (1 - r)^{\infty+1}K$$

We subtract from this last equation the one immediately prior to obtain:

$$(1 - r)M_1 - M_1 = (1 - r)^{\infty+1}K - K$$

$$-rM_1 = -K$$

since  $(1 - r)^{\infty+1} = 0$ . The process of simplification leads to the following money supply:

$$M_1 = K/r$$

where we assume that  $K$  is positive and  $0 < r \neq 1$ . Thus, the money multiplier here equals  $1/r$ , and represents the proportional increase in money supply ( $M_1$ ) induced by an increase by one unit of currency. Money supply  $M_1$  is simply  $K/r$ . Thus, for example, a central bank issuing \$100 in currency with a reserve requirement equal to 10% will have a total money supply equal to \$1,000:

$$M_1 = K/r = 1000 = 100/.10$$

This reserve requirement confers on the central bank important tools for monetary policy. First, as we just discussed, the central bank can exercise control over the creation of money in the banking system as it varies the amount of currency it chooses to print. Second, the central bank can control the total money supply in the economy by directly controlling the reserve requirement. Increasing the reserve requirement, from, for example, 10% to 12% results in a significant decrease in money supply, in the example above, from 1000 to  $100/.12 = 833.33$ .

This type of system that allows banks to lend a fraction of their deposits subject to a reserve requirement is known as *fractional reserve banking*. Essentially, banks are free to loan out money left on deposit with them so long as they maintain reserves sufficient to meet depositor withdrawal needs.

### Cryptocurrency, Distributed Ledgers and Blockchains

*Cryptocurrency* or *altcoin* refers to a digital currency, in which encryption (cryptography) techniques are used to regulate its creation and supply and to verify its transfer among users. In theory, the currency can be created by a central bank, other financial institution or any other institution or individual, though in practice, its creation and circulation tend to be decentralized.

*Distributed ledgers* are accounting records maintained on multiple distinct computing systems. Independent computing systems maintaining ledgers improves the reliability of the records, and maintenance of consistency among the records is essential to the functioning of the currency. The *blockchain* is as an immutable electronic alternative to ownership ledgers based on traditional double-entry bookkeeping, with potential applications for ownership record-keeping

for assets ranging from stocks and bonds to real estate, including jewelry, fine and digital art and motor vehicles. The modern blockchain concept, used in accounting and authentication systems, was introduced by Haber and Stornetta [1991], which suggested that digital time stamping of documents in chronological sequence could be used to authenticate authorship of intellectual property. The blockchain technology has the potential to eliminate the need for third party transaction authentication. The first major implementation of this new technology was the launch of Bitcoin in 2009.

Economies require agreement, rules and reliable records on “who owns what.” For example, in many countries, real estate records have been poor, either non-existent downright corrupt or otherwise not clearly stating what real estate belongs to whom. This problem has been particularly egregious in developing and emerging economies such as India and Honduras, and remains a problem even in developed countries such as Greece. These poor ownership records have led to property disputes and evictions of residents from homes maintained by their families for generations. Ownership records are unclear, transfers of property are difficult and sometimes impossible, potentially leading to economic failures.

On the other hand, many localities in the United States maintain property records in county courthouses that are compiled by *title companies*, which prepare deeds and organize and record their transfers, adding their current transfer records to the historical records to those on file in courthouses and other facilities. These historical records, generally considered to be authoritative, detail how the deed to each piece of real estate (including improvements such as buildings) has been transferred over the centuries. These historical ownership records form a consensus mechanism to affirm reliable ownership status, and form the underlying basis for *blockchain* technology.

Blockchains refer to the technology used by many distributed ledgers. A blockchain is a type of distributed ledger, comprised of a chain of permanent digitally recorded transaction data in packages called *blocks*. For example, blockchains can be used to identify and record ownership and transactions involving gold (e.g., the Royal Mint in the U.K.) or diamonds, which, of course, can be subject to high risks of theft. The London-based firm, Everledger, which as of September, 2017, has digitized and recorded 1,600,000 diamonds by their 40 metadata points (analogous to fingerprints), their “4 C’s,” ownership chronology, etc. Each transfer of a diamond in their database is added to the blockchain record. Everledger is applying its technology to other luxury goods, including visual art, minerals and wines. Several jewelry chains and stores are using Everledger to provide gem grading and provenance reports to their customers. *Non-fungible tokens* (NFTs) represent ownership of original digital codes from which picture, video and print files can be displayed.

Securities markets are beginning to use some of the technologies popularized by cryptocurrencies. For example, certain securities exchanges (e.g., the Australian Securities Exchange, Nasdaq and Euroclear) are applying blockchain technology to securities transactions, in an effort to streamline the rather lengthy (2-3 days) transactions settlement process.

In the case of currency, a *block* refers to a specific transaction record, which, in turn, refers to the previous transaction, and when accepted by the community, is merged into the blockchain. The blockchain is simply a chronological record of transactions, trusted due in large part to its decentralized maintenance and control and availability for public inspection. Efforts to corrupt the record will create inconsistencies in the records, which normally can be easily rectified. Two of the better-known currencies based on blockchain technology are Bitcoin and Ether, the latter facilitated by the Ethereum Foundation, launched in July, 2015 and intended for



use as "smart contracts," which implement or transfer funds only after defined contingencies (e.g., events such as contract fulfillment or market conditions) are fulfilled or validated. A third blockchain-based currency, Tether, whose value is tied to that of the U.S. dollar, has been the subject of substantial skepticism related to its claims and transparency, and its market-makers have been accused of using it to manipulate bitcoin prices (See Griffin and Amin [2017]).

## Bitcoin

*Bitcoin* is a peer-to-peer (P2P) payment network and digital currency created in open-source C++ programming code. Bitcoin does not rely on a central monetary authority to issue, monitor, facilitate, verify and approve transactions. Instead, Bitcoin is underwritten by a peer-to-peer network akin to file-sharing services like BitTorrent (a protocol supporting the practice of peer-to-peer file sharing). The network and payment systems are based on an open source protocol that uses a public but anonymous transaction log. As of December 2018, over 17.45 million bitcoins have been issued out of 21mm planned, with an approximate dollar value of approximately USD56,698,8000,000 at USD3,845 per unit. The rate of increase in the number of bitcoin has been fairly uniform since its 2009 inception.

Bitcoin came into being in 2009, due to its pseudonymous developer Satoshi Nakamoto. Units of bitcoin (BTC) are created by evidence of *forced work*, also known as mining. Bitcoins are awarded in blocks of up to BTC50 to bitcoin "miners" for solving increasingly difficult proof-of-work computational problems related to public and private keys (discussed below), which are used to confirm transactions and prevent double-spending. Essentially, miners receive bitcoin in exchange for verifying the legitimacy of a block of other bitcoin users' transactions; miners provide the essential service necessary for the accounting of bitcoin.

Generally, one owns money (for example, cash or coins) by being in physical possession of it. One "owns" bitcoin by being able to execute transactions with it; bitcoin exist only as records. Transactions by bitcoin are executed by *hashing*, an update to a public transaction log called a blockchain. Payments are made to and from Bitcoin addresses (public keys), which are associated with "wallets," which might be as simple as a scrap of paper with a public key written on it or a webpage requiring a UserID and password.. Bitcoin addresses are 33-character alphanumeric strings, such as, for example, *15rDbFcbedaDsYUIerBppokCh8XbbstDfi*. The log to which this address is added is the blockchain, the complete listing of previous bitcoin transactions. A transaction derives from two keys:

1. A *private key*, a 64-character random or difficult to guess alpha-numeric string analogous to an email password along with a digital signature that is, as we just discussed, derived (hashed) from the private key, but cannot be used to derive or decode the private key.
2. A *public key*, as described above, a 33-character alphanumeric string derived from the private key based on a cryptographic Elliptic Curve Digital Signature Algorithm used to ensure that funds can be spent only by their rightful owners.<sup>2</sup> The public key might be analogous to an email address; everyone knows the address, but only the owner can access its contents or send a message from it. The signature associated with the public key can be used to verify the identity of the sender, but cannot be duplicated by anyone without access to the private key.

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<sup>2</sup> An encryption algorithm simply makes a message difficult to decipher without a code. A simple encryption code might change the letter A to the number 1, B to 2, and so on. In this case, the code is quite simple. ECDSA is a more sophisticated procedure based on equations for elliptic curves, which are often used in random number generators.

If the signature can be matched to the public key by computers in the network, the transaction is validated. Essentially, the matching ensures that the bitcoin exists in the wallet and has not been used before. Thus, all transactions are cleared by a database housed on user computers known as *nodes* and verified by miners. Any fraudulent change to any part of the record, represented by a 64-character "hash" will necessitate changes to every other part of the blockchain, also represented by hashes, and on every record maintained by every individual participant in the system. Thus, the blockchain itself protects the integrity of each hash or block in the chain. Node records are publicly available and must be in agreement to validate transactions.

Currencies issued by governments and banks may be perceived as being subject to political whims (e.g., India, November 2016, when Prime Minister Modi demonetized the 1,000 rupee note), unpredictable inflation, counterfeiting and outright theft. Such perceptions enhance the relative value of Bitcoin, which are issued outside of the political and banking realms and are quite mechanical in nature. On the other hand, lack of governmental authority and regulation may well engender the volatility of Bitcoin, which in 2017, ranged in value from less than USD800 to higher than USD19,000, while Ethereum's price rose by over 8,900% and Ripple's price rose over 36,000%. By late December, 2018, prices of the three cryptocurrencies were, respectively, USD3,864, USD128 and USD0.037.

If you are interested in viewing Bitcoin activity in near real-time, have a look at <https://blockchain.info>. For example, you can link from this site to view recent transaction validation listings. Recent block validations can be viewed at [www.blockchain.com/explorer](http://www.blockchain.com/explorer). From these sites and others, you can link to services that will allow you to learn more practical aspects of managing Bitcoin (e.g., [www.coinbase.com](http://www.coinbase.com) (free accounts for beginners) and [www.localbitcoins.com](http://www.localbitcoins.com)), acquiring a Bitcoin wallet and begin to buy and exchange Bitcoin. As of mid-2019, major bitcoin markets include Coinbase, Bitstamp, Bitfinex, BitFlyer and Bithumb. Futures contracts on Bitcoin are traded on the Cboe Futures Exchange and the Chicago Mercantile Exchange. General Bitcoin mining and recent historical price and volume information can be found at <https://data.bitcoinity.org/markets/volume/30d?c=e&t=b>.

### **C. The Payments System**

The *payments system*, essential to commerce and trade, is the economy-wide mechanism for making payments and settling accounts with checks (paper demands directing a given bank to pay a specified sum of money to the nearer), wire transfers, currency, debit cards (point-of-sale transfers), credit cards, other electronic funds transfers, direct credits, direct debits, internet banking, person-to-person (PTP) transfer systems, e-commerce payment systems, cryptocurrency and other transactions processes. In recent years, electronic funds transfer systems (EFTS), largely based on computer, wire, laser, fiber optics and microwave technology, have been gaining in importance relative to currency transfers and checking deposit transfers. Most larger accounts today are settled by reasonably inexpensive wire transfers. Currency transfers in settlement of large accounts have always been unwieldy, and check transfers, due to paper, writing, mailing, clearing and depositing costs are expensive as well.

As we will discuss in the next chapter, written orders of payment, or *polizza*, rather analogous to paper checks (or cheques), originated in Florence in the fourteenth century, significantly simplifying the payment process. Checks are now cleared and collected (the process through which bank and customer account balances are revised to reflect check issues and

deposits; more details following shortly) through local clearing houses or, in the U.S., by the Fed. This process can take several days and involves some cost, perhaps as much as several cents per paper check. The total cost associated with check issuance, including posting, routing and collecting of checks has been estimated at about 30-50 cents per check.

### Transfer and Clearing Systems

Before the advent of modern electronic communications systems, transferring money without currency between individuals or businesses could be rather awkward. If the sender and receiver of funds had accounts with the same bank, the process was fairly straightforward, otherwise, intermediaries were needed. Intermediary or correspondent banks could facilitate these transfers as could special institutions created for this purpose (discussed below).

In the United States, Western Union began wire service money transfers in 1872 on its existing telegraph network, enabling a sender to pay money to one telegraph office so that its operator could transmit a message instructing the operator in another office to make a payment to a recipient. Western Union still provides such services, along with several competitors such as MoneyGram and TransferWise.

Automated payroll and social security disbursement systems based on electronic computer storage media have been in use for over thirty years. In this type of system, automatic payroll deposits and other disbursements are made directly to recipient accounts as computer data is transferred to an automated clearing house. In addition, consumers and businesses can arrange for automated transfers by computer or telephone to pay their bills.

*Clearing* is the process of settling accounts by delivering money and/or financial instruments, turning a payment document such as a check or electronic payment request into an actual change in account values at payer and payee financial institutions. *Clearing houses* facilitate the process of clearing, which normally takes more time than the actual transaction executions. Clearing is processed either in real time, that is one transaction at a time as it is executed, or in batches. *Batch processing* of transfers allows for both debits and credits to accounts to accumulate for each institution, then settle at a later time or date in a single large batch, in a process known as *netting*. This simplified process of netting is used by clearing institutions by adding all of a given bank's transaction debits, adding the credits of each transaction, deducting credits from debits to determine the net cash change for each bank, and computing the net cash flows associated with all transactions. Since most of the transactions are of fairly small monetary amounts, this batch processing and netting are less costly than real-time processing.

Wire transfers are used extensively by business and financial institutions to settle accounts. The Federal Reserve System has operated *FedWire* since 1918, which routes and facilitates inter-bank payments by wire on behalf of roughly 9,000 Fed-member banks. FedWire transactions, which are often time-critical and tend to be large in monetary amounts, are settled in real time, and once settled, are final and irrevocable.

The *Automated Clearing House (ACH)* was developed by banks and the Fed in the 1970s as an electronic payments network, intended to be less costly and more efficient than the system based on paper checks. ACH processes large volumes of transactions in batches, rather than in real time, including approximately 23 billion transactions in 2018 with a cumulative monetary value over \$50 billion. ACH transactions tend to include smaller transactions on behalf of consumers, small businesses such as payroll direct deposits, payments to utility companies, mortgage loan payments, vendor payments, government transfer payments such as Social

Security and federal tax refunds. There are numerous other automated clearing houses around the world, many of which being operated by central banks. For example, in Italy, Banca d'Italia, Nexi and SIA function as clearing houses.

The *Clearing House Interbank Payment System (CHIPS)*, owned by roughly 47 large U.S. and non-U.S. financial institutions that use its services, has been in operation since 1853, and settled approximately \$2 trillion daily in domestic and international payments in 2018. Because CHIPS employs a netting system to settle most of its payments, it is less expensive but slower than Fedwire, and tends to be used for larger transactions that have less sensitivity to time. In 2017, The Clearing House, the parent firm of CHIPS, launched its RTP payment network, its 24/7 parallel real-time settlement system for FDIC-insured institutions. RTP transactions tend to be smaller, limited to \$25,000.

The *Single Euro Payments Area (SEPA)* seeks to integrate national and domestic payment schemes into a single set of European schemes to make euro a single and fully operational currency. SEPA provides for international bank euro-denominated transfers within Europe, including 27 EU member states and the U.K., Iceland, Monaco, Switzerland, Liechtenstein, Norway, Andorra, Vatican City and San Marino. SEPA is administered by the European Commission and the European Central Bank. SEPA seeks to make cross-border payments in euro as easy as within national boundaries.

#### Messaging Systems and Routing Information

*SWIFT (Society for Worldwide Interbank Financial Transactions)* is an international cooperative, initiated in 1977 by 239 banks in 15 countries to provide a secure global messaging platform, facilitating payments messaging and financial flows between financial institutions. As of 2019, SWIFT focuses its real-time messaging operations in the international arena, connecting over 11,000 banks and other financial institutions in 222 countries. SWIFT does not actually transfer funds itself. Instead, SWIFT transmits payment orders between institutions and for institutions' accounts.

Several types of numbers or codes are used to identify sending and receiver banks and accounts for money transfers and messaging. For example, SWIFT assigns financial institutions individual codes for messaging and BIC (Bank Identifier Codes) for money transfers. An *International Bank Account Number (IBAN)* contains up to 34 alphanumeric digits identifying country, bank and individual accounts for use in transfers involving the E.U., Norway, Switzerland, Liechtenstein and Hungary. In the U.S., *American Banking Association (ABA)* routing numbers, which can be used along with account numbers to route domestic transfers.

#### Securities and Foreign Exchange Clearing and Settlement

Banks are heavily involved in securities and exchange transactions, which require clearing and settlement just as do domestic monetary instruments. The general securities clearing process involves three primary tasks: *trade confirmation*, *trade comparison* (matching of trades) and *settlement* (delivery of securities or book entry).

The operations department of a bank or financial institution, often referred to as the institution's back office, is responsible for handling or overseeing the clearing and settlement processes. A clearing firm is authorized by a clearing house to manage trade comparisons and other back office operations. Clearing houses clear transactions for major markets such as securities exchanges and are often owned by that market or members of that market. A clearing house facilitates the trade settlement between two clearing firms or banks and seeks to ensure

that the clearing firms honor their trade settlement obligations. The clearing house will typically guarantee the obligations of its member firms, and often require collateral to ensure that settlement obligations are fulfilled. The clearing house will step into a transaction to be settled by its members and assume the settlement obligations of both counterparties to the transaction, in effect becoming the counterparty to both sides of every transaction, a process known as *novation*. Thus, the clearing house, acting as a central counterparty, acts as the counterparty for each party to every security transaction in the market it represents, and assumes all credit risk associated with each party.

*Confirmation* is the first step of the securities clearing process. When trades are executed, buyers and sellers record trade details. Brokers and dealers receive confirmations that the trade has been executed and pass on details of the confirmation to clients. Trade comparison is the second step in the clearing process. *Comparison* matches counterparties in transactions, verifying that transactions were as recorded and confirmed. Trades are compared and are said to be cleared when the counterparties' records are identical. This happens for the vast majority of trades. Trade reports with discrepancies resulting from recording errors, misunderstanding and fraud are sent back to traders to resolve or reconcile.

The number of securities transactions that occurs each day is huge, requiring some sort of process to simplify the process of changing title to securities and moving corresponding cash proceeds between accounts. Netting is the simplification process used by clearing firms, and is one of the most important functions of the clearing process. *Netting* is the process of adding all of an institution's purchases of each security, adding the sales of each security, deducting sales from buys to determine the net change in holdings of that security for the institution and computing the net cash flows associated with all transactions.

*Trade settlement*, the final step in the clearing and settlement process occurs when buyers receive their securities and when sellers receive payment for their securities. As late as the 1960s, securities clearing involved the physical transfer by messenger of paper securities and checks. However, by 1967, this system was failing due to the tremendous paperwork backlogs associated with increasing securities market activity. The *Depository Trust Corporation* (DTC) was set up in 1973 to handle the clearing business for the major stock exchanges.

#### **D. An Introduction to Central Banks**

A *central bank* is an institution responsible for setting and implementing policies that affect a country's supply of money and credit. While monetary policy is key to the central bank's function, it also seeks to promote financial stability and some seek to promote economic growth. Central banks typically issue cash and provide for the payments and settlement system. Bordo [2007] characterizes typical objectives of a central bank as:

1. managing monetary policy so as to maintain a low and stable long-term inflation rate,
2. maintaining a stable and growing real economy (low unemployment and sustainable growth rate) and to smooth business cycles and offset shocks to the economy. Countries do differ in the responsibility that their central bank assumes for the real sector.
3. maintaining an effective and efficient payments system.

Most central banks have at their disposal a number of policy instruments to implement its policy objectives:

1. *Issue currency*
2. *Reserve requirements and the interest rate paid on reserves*
3. *Open market operations*: Purchasing (selling) securities increases (reduces) money supply
4. *Discount window lending*: Central banks often play the role of lender of last resort.
5. *Intervention in foreign exchange markets*: Or fix exchange rates
6. *Overnight rate*: In the U.S., the Fed sets the Fed Funds rate
7. *Capital requirements*: Central banks play a central role in setting capital requirements
8. *Margin requirements* in securities markets

These policy tools will be discussed in greater detail shortly. Nevertheless, a key role of the central bank is to control or regulate damaging upswings and downswings in the financial system. Less formally, one might claim that the primary role of the central bank is "to remove the punch bowl at the party just as it is starting to get fun."

### The Federal Reserve System

Numerous banking crises throughout the 19th century, and a particularly damaging Financial Crisis of 1907 (we will discuss this crisis in Chapter 8) along with its resolution requiring assistance from J.P. Morgan, all highlighted the need for a government-based mechanism to prevent and mitigate bank crises. After roughly five years of study, hearings (e.g., the National Monetary Commission formed to study solutions to the banking crisis problem) and legislative debate, The Federal Reserve Act of 1913 was signed into law by President Wilson. The result of this Act was the establishment of the Federal Reserve System (the Fed), which would serve as the Central Bank of the United States. As such, its principal responsibility is setting monetary policy for the United States. This means that the Fed exercises control over the supply of money, money demand and interest rates. The Fed's conduct of monetary policy is intended to promote price stability, full employment, balanced economic growth and stability in exchange rates. In addition, as will be discussed later, the Fed maintains regulatory authority over most commercial banks, particularly with respect to issues that might affect the stability of the banking system. The Fed also operates and oversees important U.S. payments systems and aids in the distribution of currency and coinage through the economy.

The Federal Reserve, as stated by 1977 U.S. legislation has a "Dual Mandate," oddly enough expressed as the following three goals: to "promote effectively the goals of maximum employment, stable prices, and moderate long-term interest rates." Perhaps the Dual Mandate derives from any one of the three goals being attained when the other two are attained.

Directing the activities of the Federal Reserve System is its Board of Governors, known as the Federal Reserve Board, which is comprised of seven members appointed by the president with the Senate's consent to fourteen year terms (which are staggered). One of these members is the chairman who serves as the chief spokesman, serves functions for the International Monetary Fund, the Bank for International Settlements, etc. and wields substantial power over the economy. Note that the long terms of members of the Board of Governors, in addition to its financial independence due to its autonomy from the U.S. Treasury whose securities that it purchases is intended to promote the independence of the Federal Reserve System from political processes and popular sentiments.

The primary policy tools of the Fed are establishing and enforcing regulations, setting bank reserve requirements (the fraction of their deposits banks must leave on deposit with the

Fed), moral suasion, open market operations (discussed below), exercising control over discount and federal funds rates and setting brokerage firm margin requirements (stating levels of down payments or maximum deposit amounts to be required of brokerage firms for stock purchases financed with loans).

The rather odd and complicated structure of the Federal Reserve System draws from the large numbers of compromises needed to obtain the political mandate for its creation and functions. In the next chapter, we will discuss the problems encountered with the first two efforts at U.S. central banking. A key feature of the Federal Reserve System is its system of 12 Federal Reserve Banks, which operate check clearing facilities, route wire transfers, conduct bank examinations, provide discount loans to member banks, perform research activities and other services as well. These 12 district banks are located in New York, Boston, Dallas, Philadelphia, Kansas City, San Francisco, Richmond Virginia, Chicago, Cleveland, Minneapolis, and Saint Louis. Each of these 12 district banks is a private corporation with voting stock owned by the member private banks it serves. Member private banks receive some payout for their holdings, but most of the system's profits are sent to the United States Treasury. Each district bank is overseen by nine directors, six of whom are elected by member banks and three of whom are appointed by the Board of Governors of the Federal Reserve System. These nine directors, in turn, elect a president of the district bank. The twelve district banks also oversee a total of 25 branch banks. These branch banks provide a variety of services to member banks, approximately 38% of all commercial banks, including all of those with federal charters.

The Federal Reserve System also maintains its Federal Open Market Committee (FOMC) of twelve, comprised of seven members from Board of Governors and five from district banks. This FOMC membership includes the President of the Federal Reserve Bank of New York along with four other Federal Reserve Bank presidents, serving one-year terms on a rotating basis. The Chairman of the Board of Governors chairs the FOMC. The Committee meets eight times per year in Washington, D.C. to set its policy. This committee sets the Federal Funds Rate (the overnight interest rate at which member banks borrow and lend funds held by the Fed to one another) and conducts open market operations, which constitutes selling and purchasing treasury securities for the purpose of controlling money supply in the economy and for financing federal government debt. When the Fed sells treasury securities, money supply is reduced. The Fed increases money supply by purchasing treasury securities. The FOMC is the Federal Reserve System's monetary policy committee, which manages the nation's monetary supply, providing for stable prices and economic growth.

### The European Central Bank

The *European Central Bank* (ECB), headquartered in Frankfurt was established by the Treaty of Amsterdam in 1998 as the central bank of the *Eurozone* (the 19 EU members that adopted the euro as their official currency since 2002). Its stock, totaling roughly €5 billion, is held by the broader coalition of 28 member EU states. As such, the ECN's principle mandate is to maintain price stability, a somewhat more narrow mandate than that of the Fed in the U.S. The ECB's principal responsibility is setting monetary policy for the Eurozone. This means that the ECB exercises control over the supply of money and foreign exchange operations, and exercises some control over money demand and interest rates.

As of November 2014, through its *Single Supervisory Mechanism* (SSM), the ECB maintains regulatory authority over the largest 123 Euro area banks, accounting for approximately 85% of the area's aggregate banking assets. The majority of European banks are

still monitored by national supervisory bodies such as the Deutsche Bundesbank and non-Eurozone EU country banks are exempt from participation. More generally, the *Eurosystem*, comprised of the ECB and Member States central banks seek to safeguard financial stability and promote European financial integration.

### Crisis-Free Banking Systems

With a major exception, the experiences of the U.K. and the U.S. do strongly suggest that central banks have played a major role in preventing and mitigating bank crises. The lone exception in the U.S. was the U.S. bank panic during the 1930s, where the Fed declined to employ the important tools at its disposal. While the Fed did provide liquidity to the system after the 1929 stock market crash, it failed to do so as the banking system failed in the 1930s (Bernanke [2013]).

On the other hand, Canada, sometimes considered the world's safest banking system (e.g., World Economic Forum (2013), has never experienced a banking crisis, despite not having established a central bank until 1935. Williamson [2016] reports that "between 1923 and 1985, no Canadian banks failed; but from 1930 to 1933, more than 9,000 U.S. banks suspended operations." There were also two short Canadian suspensions of convertibility in the 1830s in response to U.S. banking crises. The source of stability in the Canadian banking system remains a matter of controversy. Forwarded explanations have included diversification benefits from national branch banking, a prudent regulatory environment, limited competition, higher capitalization requirements, less off-balance sheet activity and stability in real estate markets.

Calomiris and Haber [2014] argue that political machinations governing banking rules and supply of credit are key factors in banking system stability. They argue that populist democracies such as the U.S. tend to create dysfunctional banking regulation that serve a coalition's interests at the expense of others. Such dysfunction would include the political cronyism prevailing during the 19th century in the U.S. Furthermore, countries such as Canada, Australia and New Zealand have not produced the types of political coalitions that weaken banking regulations that favor one political coalition (e.g., as in loosening of credit standards for less affluent housing mortgage applicants) over others. Other countries without histories of banking crises, Malta, Singapore and Hong Kong were very small city-states. Thus, perhaps the political climate creates a need for a central bank to manage and eliminate banking crises.

### **E. Intergovernmental Financial Institutions**

The activities of banks are related to, and often regulated by a number of international institutions that seek to perform coordination and development functions. Intergovernmental Institutions are created by treaties among sovereign nations that serve as charters establishing them. Examples of such institutions include the United Nations and the European Union, though, here, we will focus on introducing only a few of the more important intergovernmental financial institutions.

#### The Bank for International Settlements

*The Bank for International Settlements* (BIS) was founded as a result of the Hague agreement of 1930 to facilitate Germany's payments of reparations for World War I. Obviously, its original purpose was rather short-lived. Since this time, the BIS has evolved into a sort of "bank for central banks," providing for regulation and supervision of central banks and commercial banks, fostering transparency and coordination among central banks and promoting



monetary and financial stability. The BIS is headquartered in Basel, Switzerland, where it has hosted national representatives for a number of important banking treaties, including the Basel I, II and III Capital Accords in 1988, 2004 and 2011 that, among other things, set standards for bank risk management. Countries regularly adopt standards and practices set forth by treaties such as these, in part, to coordinate international banking activities and to promote stability and efficiency in the world banking system. However, it is important to note that the BIS has no actual regulatory enforcement power. Such power is retained only by countries that adopt BIS standards, typically by votes in their own legislatures or by their own regulatory systems. We will further discuss the BIS and its regulatory activities in later chapters.

### The International Monetary Fund

*The International Monetary Fund* (IMF) was established as part of the Bretton Woods agreement of 1944 to provide assistance to countries defending their currencies against cyclical or unwanted fluctuations in values and to provide assistance to member countries with structural trade problems, especially those problems contributing to the Great Depression of the 1930's.<sup>3</sup> Over time, the broad intent of the IMF has become to serve as a central institution of the world monetary system to aid the world economy by expanding world trade and preventing and helping to solve crises in the monetary system. In more recent years, particularly after 2008, this crisis resolution function has increased in importance (e.g., Iceland, Ireland, Portugal, and perhaps most significantly, Greece). The IMF may also provide assistance to non-member countries. Under the old Bretton Woods system, the IMF was required to approve currency devaluations exceeding 10%, though, of course, this provision is no longer relevant given the demise of Bretton Woods.

A major objective of the IMF after the demise of the Bretton Woods system is still to assist in the maintenance of an international payments system, which stimulates international trade and growth among member nations. The IMF functions primarily as a lender to countries experiencing balance of payments difficulties.

IMF Quotas (membership fees) are assessed for each member (184 members in 2004) based on trading patterns. Quotas also determine borrowing limits (currently up to 600% over a three-year period). IMF quotas also determine voting proportions. For example, In 2006, the U.S. had slightly more than 17% of IMF votes. This is one of the reasons that the IMF is a frequent target of criticism for being a U.S. puppet.

In 2006, the IMF assessed approximately SDR213.5 billion (\$317.3 billion) in quotas resources and may borrow additional funds if needed. These Special Drawing Rights (SDR's) were created as a currency in 1969 as part of IMF reserves to be distributed according to each member's quota. They are traded only among central banks and are convertible into any IMF member currencies. The value of the SDR (trading code: XDR) currently equals the weighted value of a portfolio comprising currencies of five member country currencies - USD, EUR, CNY, JPY and GBP).

### The World Bank

*The World Bank* (the International Bank for Reconstruction and Development - IBRD) was also created by the Bretton Woods Agreement of 1944. It was originally intended to provide capital for the reconstruction and development of member countries devastated by World War II,

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<sup>3</sup>See <http://www.imf.org/external/pubs/ft/exrp/what.htm> for an excellent discussion of the IMF.

and more generally, to address imperfections in capital markets. While many countries participated in its creation, the U.S. and U.K. were the dominant creators. Currently, the World Bank's primary goal is the reduction of extreme poverty. It makes loans with somewhat conventional terms for projects with high economic priority and for projects that have a high expectation of profitability. Government guarantees are required.

The World Bank is often criticized for emphasizing public sector loans at the expense of potentially more enterprising private sector loans. On the other hand, the World Bank is also criticized for emphasizing potential profitability of loans rather than concentrating its efforts on making loans that are of greatest value to host countries. For this reason, related institutions have been created to join the IBRD to comprise the World Bank Group. These institutions related to the World Bank include the following:

1. International Development Association (IDA) which finances with grants and low-interest loans (\$13 billion in 2014 disbursements) low profitability projects at easy terms with government guarantees, typically to countries with very-low per capita income.
2. International Finance Corporation (IFC) which finances projects in private sector without government guarantees (\$9 billion in 2014 disbursements). The IFC sometimes participates in equity of these projects.
3. Multilateral Investment Guarantee Agency (MIGA), which promotes foreign direct investment in developing countries by selling insurance policies to private investors against noncommercial political risks.
4. International Center for Settlement of Investment Disputes (ICSID), which provides a forum between investors and governments.

The World Bank Group also manages trust funds supported by donors for purposes such as public health and promoting access to education in the developing world.

In fiscal year 2018, the World Bank Group disbursed approximately \$45 billion, with approximately \$17 billion loaned by the IBRD (The World Bank [2019]). However, this relatively small sum is probably exceeded in importance by the non-monetary and political and advisement influence (soft power) that the Bank projects.

### Regional Development Banks

*International financial institutions* (IFIs) are financial institutions chartered by more than one country and include *multilateral development banks*, which are institutions that provide financial support and professional advice for economic and social development in developing countries. This term usually applies to the World Bank Group and to several Regional Development Banks including the Asian Development Bank, the European Investment Bank, the Islamic Development Bank, the Inter-American Development Bank Group and the African Development Bank. There also exist many non-affiliated regional development institutions or sub-regional multi-lateral financial institutions including the Eurasian Development Bank, the Central American Bank for Economic Integration, Caribbean Development Bank, the European Commission, the East African Development Bank, Arab Fund for Economic and Social Development and the Nordic Development Fund. The primary function of these institutions is to provide funding to assist in development of underdeveloped areas. Also among these regional development banks is the African Development Bank.

Because of economic success in a number of developing nations, several regional development banks have experienced some difficulties in determining their members' contributions. For example, in 1995, East Asian countries other than Japan had contributed only .3% of the expenses of the Asian Development Fund. Taiwan and Hong Kong do not contribute due to their relationships with China, Singapore does not contribute to such funds "on principle" and many of the rapidly expanding southeast nations are being assessed based on their previously low levels of national income.

## F. An Introduction to Financial Intermediation

In addition to facilitating trade, the primary purpose of the *financial system* is to channel funds from agents with surpluses to agents with deficits. A *financial facilitator* acts as a broker to arrange deals, by buying and selling assets on behalf of its clients without transforming those assets. More generally, in *money markets* (markets for short-term instruments) and in *capital markets* (markets for long-term instruments), investors channel their surpluses directly to deficit firms, creating marketable securities and instruments in the process. Alternatively, a *financial intermediary* facilitates this channeling process from surplus to deficit agents by transforming assets (Gurley and Shaw [1960]) such that both parties of the financial exchange receive their preferred terms. For example, a depositor might place a short-term deposit such as a checking or demand account in a bank account, whereupon the bank might loan out the funds by purchasing a 10-year note from a corporation. Preferred terms can be affected by transformations to contractual terms such as maturity, risk or size:

1. *Maturity transformation*: convert short-term (long-term) liabilities to long-term (short-term) assets. Since short-term deposits are unlikely to be withdrawn all at once, banks can make longer-term loans as long as they can adequately predict or cover their depositors' liquidity needs.
2. *Risk transformation*: convert risky (safe) investments into safe (risky) investments. Banks and insurance companies engage in a variety of risk management techniques (introduced later) to manage these risks, enabling them to make risky investments safer.
3. *Size transformation*: match small (large) deposits with large (small) loans. For example, the mortgage extended by a savings and loans institution to a borrower is likely to be larger than the typical consumer deposit received by that institution.

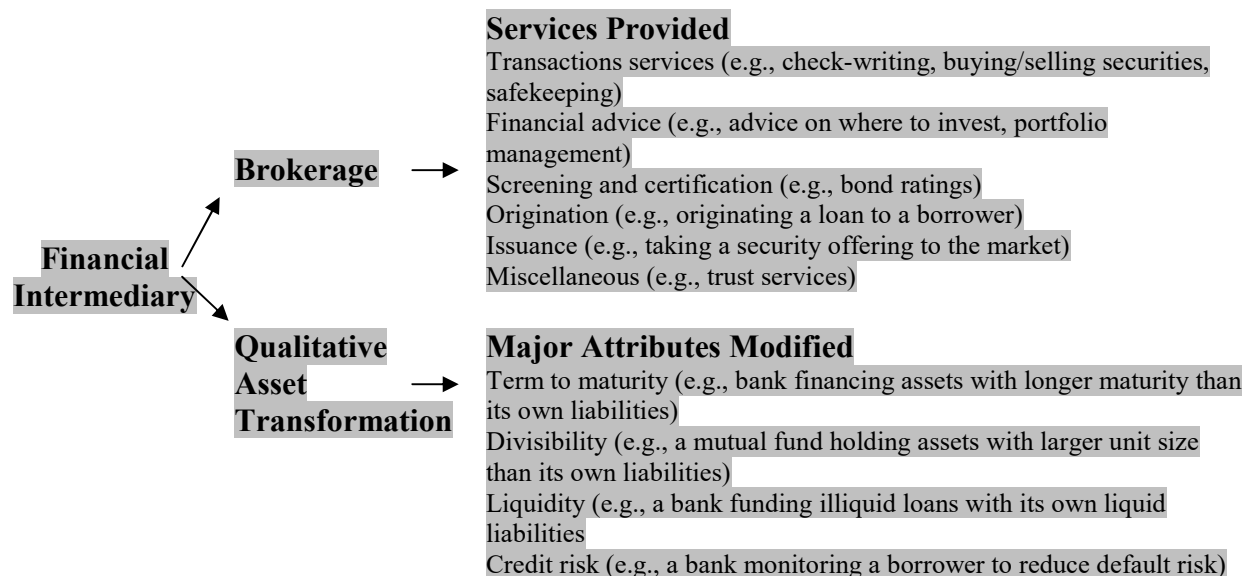
### Financial Intermediary Functions

Gorton and Winton [2002] characterize financial intermediation as "the root institution in the savings-investment process." Financial intermediaries typically provide a range of services, ranging from traditional brokerage activities to qualitative asset transformation (Bhattacharya and Thakor [1993]; see Figure 1 in the paper and duplicated below). Among the important functions of financial institutions are to provide liquidity (Diamond and Dybvig [1983]), allocate resources fairly (Gorton and Pennacchi [1990]) and to provide for monitoring of clients' activities and operations (Diamond [1984]). Financial institutions play a pivotal role in the dissemination of information (Leland and Pyle [1977], Fama [1985], Diamond [1984] and James [1987]). Financial intermediaries can play an important role in the governance and control of firms (See Frankel [1985]).

Institutions that accept deposits from and make loans directly to borrowers are depository institutions, and include commercial banks and thrift institutions. Institutions that lend through

the purchase of securities in capital markets tend to be non-bank intermediaries, and include insurance companies, pension funds and the various types of investment companies and trusts.

Asset price risk is of less importance to depository institutions than is default risk. Depository institutions manage default risk through the acquisition of information (screening borrowers, such as with credit applications), direct monitoring (e.g., directly by shareholders as in Leland and Pyle [1977]) and delegated monitoring (e.g., by board members appointed by shareholders as in Diamond [1984] and [1996]), diversification, syndication, collateralization, maintenance of capital requirements and securitization.



**Figure 1: Functions of Financial Intermediaries (Bhattacharya and Thakor [1993])**

### Why Do Financial Intermediaries Exist?

What is the importance of asset transformation as described above? Why do investors lend to banks, which then lend to borrowers, rather than lend to borrowers directly? First, consider that physical assets needed for the production of goods and services are risky, their useful lives can be of any duration, their acquisition imposes transaction costs on their purchasers and they tend to be indivisible. Thus, the asset transformation process is necessary, and financial intermediaries play the primary role in this process. Here, we explore some of the primary fields of theories explaining the need for financial intermediaries. These theories should not be taken to be mutually exclusive.

#### *Transactions Costs*

Transactions costs are incurred in the channeling of funds from surplus to deficit agents. Transactions costs include the costs of finding a counterparty to take the opposite position in a desired trade, screening costs, monitoring costs (ensuring that counterparties fulfill their obligations) and enforcement costs (taking action in the event of contract abrogation). Benston and Smith [1976] argue that the "*raison d'être* for this [financial intermediation] industry is the existence of transaction costs." Financial intermediaries reduce the contracting costs between providers and users of capital. For example, a market (e.g., the New York Stock Exchange) provides a meeting place for buyers and sellers to interact, thereby reducing the costs of financial

transactions. A dealer acts as an intermediary between buyers and sellers. More generally, the financial intermediary reduces the costs of transacting by engaging in a variety of services, ranging from brokering to asset transformation. Scale economies and diversification are key factors leading to transactions costs reduction.

### *Delegated Monitoring*

One of the central roles of banks is in the monitoring of the firms to which they extend financing. Diamond [2006] characterizes monitoring as "the observation of information that is not freely available to all, either because it is costly to observe or requires specialized skills to observe." Banks take significant stakes in the firms that they monitor, justifying their roles in corporate governance, and can maintain flexibility to renegotiate loans when necessary. Bonds sold to widely dispersed public investors do not normally lead to comparable monitoring, governance and renegotiating activities as costly monitoring is simply not in the best interest of a bondholder with only a small stake in the firm. Banks also provide a variety of services that public bond markets do not provide. Banks acquire private information that would not be available to the public in the loan application and screening process, information that would not be available in the sale of bonds to the general public. Banks often hold demand deposits of their client borrowers, providing them with further special information concerning their clients (Fama [1985]). In addition, banks often maintain long-term relationships with their client borrowers, reducing the cost of screening over time.

Diamond [1984] regards the essential role of the bank to serve as a delegated monitor for borrowers. The bank specializes in this monitoring task, and due to economies of scale, its ability to diversify and for other reasons just described above, is uniquely suited for the specialty role as delegated monitor. The following are typical bank monitoring activities:

1. Screening bad loan applications from good. Banks frequently require business plans from borrowers and develop expertise in the evaluation of such applications.
2. Evaluating borrower creditworthiness. Again, development of expertise is key.
3. Observing the extent to which borrowers adhere to the terms of their borrowing contracts.

The bank's ability to diversify is essential in the Diamond [1984] model of cost-effective financial intermediation, facilitating the bank's monitoring activities and enabling it to overcome the free-rider problem in which other stakeholders in the borrower costlessly benefit from the bank's monitoring efforts.

### *Providers of Liquidity*

Banks have always played a major role in money creation by lending deposits. Bryant [1980] and Diamond and Dybvig [1983] and others argue that a central role of a bank is to create and enhance liquidity. Banks do so primarily by financing relatively illiquid assets with more liquid liabilities. Bank liabilities, particularly demand deposits, function as a medium of exchange, as do other services such as credit cards and provisions of ATMs. Issuance of instruments such as standby letters of credit (guarantee of payment by client) also enhance client liquidity. Banks also provide liquidity to borrowers off their balance sheets through loan commitments (e.g., Holmstrom and Tirole [1998]).

Diamond and Dybvig [1983] describe how agents deposit their endowments in interest-bearing bank claims that enable them to finance future, perhaps unanticipated consumption

needs. Such deposits enhance consumption flexibility and increases utility of consumption. Alternatively, agents could have invested their endowments in illiquid production technologies, where higher than anticipated consumption needs in earlier periods force them to liquidate investments too early, reducing overall consumption. In effect, the deposit serves as an insurance contract against the costs of unanticipated consumption in earlier periods. Of course, bank runs can occur as depositor withdrawal requests are honored sequentially until the bank runs out of liquid assets, imposing a default risk on depositors.

### *Resolving Problems Related to Incomplete Markets and Asymmetry of Information*

In complete capital markets (*a la* Arrow-Debreu, who describe how and when prices for all securities can be calculated based on arbitrage-free methodologies from a set of already priced securities), financial intermediaries would not be needed to transform the attributes of securities. Strong form inefficiencies necessitate banking functions. Information asymmetries can lead to moral hazard and adverse selection, which inhibit the channeling of funds from surplus to deficit agents. Banks contribute to funding efficiency by engaging in activities that mitigate these information problems:

1. Banks enjoy scale economies that enable them to more efficiently obtain information and share that information among members of lending coalitions (loan syndicates; See Leland and Pyle [1977] concerning provision of information through signaling). Asset diversification is realized from the scale economies.
2. Banks monitor their borrowers, decreasing information asymmetries, and further improve information dispersion when other agents in the economy can draw inferences from banks' willingness to lend.
3. Banks that provide capital seek long-term financial relationships. Such long-term relationships (commitments) enable banks to execute contracts in the absence of complete contracts and markets.

### **G. Financial Sector Growth and Real-Sector Productivity**

The financial services industry plays a crucial role in national and world economies by creating, trading and settling financial instruments, which are associated with the capital needed for production of goods and services, for shifting funds from "surplus agents" to "deficit agents" and for risk mitigation and shifting. In a 1781 letter to Robert Morris, Alexander Hamilton wrote that "Most commercial nations have found it necessary to institute banks and they have proved to be the happiest engines, that ever were invented for advancing trade" (Syrett [1961]).

Based on data drawn from 35 countries, Goldsmith (1969) found a positive correlation between the size of financial systems and long-run economic growth. These results were confirmed in a more expansive study by King and Levine (1993), who, on page 18, argued that "policies that alter the costliness and efficiency of financial intermediation exert a first order influence on economic growth." Growth in financial service sectors often accompanies growth in real production sectors, as was clear in the U.S. during the 1920s era, which was characterized by technological improvements and the post-1980s IT growth era. Further, as we will discuss in the next chapter, it is also clear that significant economic growth accompanied financial sector development in 16th-18th century Netherlands, 17th-18th century Great Britain and late 18th-19th century U.S.A. (Rousseau and Sylla [2005] and Calomiris and Haber [2014]), with economic growth following financial development. Rousseau and Sylla extend this argument

based on a statistical study extending across 17 economies from around the world during the 19th and 20th centuries. Similarly, Calomiris and Haber [2014] argue that "higher levels of financial development produce faster rates of physical capital production, faster economic growth, more rapid technological progress, faster job creation and increased opportunities for social mobility" (p.9).

But, it might not always hold that economic and real-sector productivity growth requires growth in the financial system. For example, as we will discuss shortly, the U.S. economy also experienced significant productive growth during the post-War period 1945-70, with only a modest share of growth in the financial services sectors. A number of more recent studies found non-linear relationships between financial industry and overall economic growth. For example, Cournède and Denk (2015), based on samples of all OECD and OECD plus G-20 nations from 1960 to 2011 found that increasing levels of financial output seemed to fuel overall economic growth in countries with low levels of financial development, but showed diminishing marginal returns. In fact, they found that overall economic growth decreased in response to financial sector growth for countries whose financial industries that were sufficiently large relative to GDP.

Banking activity and the issue and trading of financial instruments is key to planning, production and distribution in a capitalist economy. Thus, it is important to critically evaluate the important roles of the financial sector to the real economy. We certainly know from recent experience that tremendous growth of financial services industries has helped fuel significant overall economic growth, produced huge compensation packages for financial executives and even larger profits for financial firms. But has this growth translated effectively into improved real-sector productivity? We discuss this issue in the following section.

## **H. Financialization**

While Alexander Hamilton endeavored to develop a sophisticated banking system in the fledgling United States, many of his contemporaries were less enthusiastic. For example, John Adams wrote that "banks have done more injury to the religion, morality, tranquility, prosperity, and even wealth of the nation, than they ever have done or ever will do good." Regardless, systematic study is necessary to inform us as to the appropriate emphasis and investment in the financial service industries.

First, to what extent has society shifted its investment in the financial service sectors? Philippon (2013) reported that "total compensation of financial intermediaries (profits, wages, salary and bonuses) as a proportion of GDP [adjusted for government defense spending] is at an all-time high." We see in Table 2 that this proportion was 7.2% in 2015, based on 2015 GDP of approximately \$18 trillion and the share of the financial industry at about \$1.3 trillion (the latter two nominal figures are not listed in Table 2). This proportion had risen from a 1947 post-war level of 2.3%, based on 1947 GDP of \$250 billion and the financial industry's share of \$5.9 billion. Thus, this tremendous growth in U.S. economic output has been accompanied by more than triple the growth rate in the financial services industries, although much of this financial sector growth has occurred after 1980.

	1947	1955	1965	1975	1985	1995	2005	2015
<b>Gross domestic product</b>	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
<b>Agriculture, forestry, fishing, and hunting</b>	8.0	4.4	3.0	3.0	1.8	1.2	1.0	1.0
<b>Mining</b> (including oil & gas extraction)	2.3	2.4	1.5	2.0	2.5	1.0	1.7	1.8
<b>Utilities</b>	1.4	1.9	2.1	2.3	2.6	2.3	1.5	1.6
<b>Construction</b>	3.6	4.3	4.5	4.4	4.1	3.9	5.0	4.1
<b>Manufacturing</b>	25.4	27.6	25.7	20.9	18.5	16.5	13.0	12.0
<b>Wholesale trade</b>	6.2	5.9	6.3	6.8	6.2	6.0	5.8	6.1
<b>Retail trade</b>	9.3	7.8	7.6	7.6	7.2	6.9	6.5	5.9
<b>Transportation and warehousing</b>	5.7	4.9	4.0	3.6	3.2	3.1	2.9	3.0
<b>Information</b> (incl. publishing, software, motion picture & sound recording, telecom)	3.1	3.3	3.7	3.9	4.6	4.7	4.9	4.7
<b>Finance and insurance</b>	2.3	3.1	3.5	4.3	5.4	6.4	7.6	7.2
<b>Real estate and rental and leasing</b>	7.9	9.3	10.3	10.4	11.7	12.0	12.6	13.1
<b>Professional and business services</b> (including legal, computer, technical, management)	3.3	3.8	4.5	5.2	7.4	9.1	11.0	12.2
<b>Educational services, health care, and social assistance</b>	1.8	2.2	2.9	4.3	5.2	6.9	7.3	8.3
<b>Arts, entertainment, recreation, accommodation, and food services</b>	3.2	2.7	2.7	2.8	3.1	3.4	3.7	3.9
<b>Other services, except government</b>	3.0	2.7	2.7	2.4	2.4	2.6	2.4	2.2
<b>Government</b> (including military, non-military, state & local, government enterprises)	13.5	13.7	15.0	16.2	14.1	14.1	13.2	13.0

**Table 2: Value Added by Industry as a Percentage of Gross Domestic Product**

Adapted from: Bureau of Economic Analysis; Release Date: November 3, 2016 and Teall [2018]

While the financial sector's share of GDP has set new records since 2000, it was nearly as high during the 1920's before collapsing in the 1930s and 40s. As we noted above, the growth of the financial services industries was not always correlated with the economic growth rate, such as during the relatively strong post-War economy before the 1980s, when regulatory and other structural factors restrained financial sector growth. With some growth in the 1970s and larger growth rates afterwards, we see from Table 2 that the U.S. financial sector has more than tripled in size relative to GDP. Significant growth rates have also been recorded in U.K., Australian, Canadian and Swiss economies.

Clearly, financial intermediation, and trading in particular have played ever-increasing roles in national and world economies. With substantial resources and talents directed towards financial services, we might expect or at least hope that productive firms have better and less expensive access to capital than ever. So, have these increasingly important roles of the finance sector actually delivered value-added to real economies? Or, has financial sector growth crowded out competing real economic sector growth? To what extent has financial sector growth improved human welfare and heightened economic stability?

Krippner (2005) and Arrighi (1994) defined *financialization* as "a pattern of accumulation in which profits accrue primarily through financial channels rather than through trade and commodity production." We now ask whether our increased economic focus on the financial sector has improved our ability to direct resources to production or merely shifted resources away from real production.



### Costs of Financialization

Philippon (2015), in his examination of these issues, characterizes the cost of financial intermediation as "the sum of all spreads and fees paid by non-financial agents to financial intermediaries," which is "also the sum of all profits and wages in the finance industry." Philippon estimated these costs over each of 142 years in the U.S., finding them to range around 1.5% to 2% of intermediated assets, showing a constant rather than an increasing return to scale and remarkable consistency over time despite drastic improvements in technologies. These results are surprising. Firms were able to obtain needed capital at pretty much the same per-unit cost in 1870 as in 2012, despite huge growth and prodigious applications of new technologies in finance industries. How is it that the per-unit costs to firms seeking financial services do not decrease, even as the technological innovation would seem to reduce the financial institutional costs for providing these services? Philippon argues that these efficiencies were consumed as compensation and profits by finance professionals and financial institutions rather than passed on to firms in real sectors as either service improvements or cost reductions. Thus, he suggests, financialization did not so much improve the process of intermediating capital between surplus and deficit agents, but instead was associated with increased creation and trading of financial instruments, which served to increase compensation to financial executives and profits to financial institutions.

However, the compensation captured by finance professionals and the profits realized by their employers do not fully capture the costs of financialization to society. Consider, for example, the investment of \$300 million into the Spread Networks high-speed fiber optic cable that, starting in 2010, enabled competing financial traders to reduce their communication times between markets in Chicago and New York from 16 to 13 milliseconds (a very fast blink of a human eye is approximately 200 milliseconds). This installation was quickly followed in 2011 by microwave technology (constructed by data networks provider McKay Brothers) that reduced the time to 9 milliseconds, and with further investment, 8.5 and then 8.1 milliseconds (Budish, Camton & Shim 2015). Similar communications investments were made connecting Tokyo and Singapore markets, New York and London (the Hibernia Express 4,600 km transatlantic submarine cable) in 58.95 milliseconds, and numerous market centers around the globe. It is not easy to believe that such minute improvements in trading speed reduce the cost of capital for real-sector firms.

The technological arms race is probably dwarfed by the race for brain power. Consider that thousands of brilliant minds that are focused on trading problems and technology rather than on health research, building transportation infrastructure and pursuing other pressing social problems. While it is sensible for individual financial firms to seek the best talent, does Wall Street provide the most long-term benefit to society relative to alternative uses of this human capital? At a minimum, resources used in the human capital deployment decision do represent a significant opportunity cost to society.

On the other hand, it is easy to understate the benefits conferred by financial activity because they are simply more difficult to readily isolate and evaluate. Financial activity is the process of capital accumulation and deployment for the production of goods and services in the economy. Trading in a free-market is essential to the production and flow of information, planning and managerial decision-making, capital formation, risk transfer, etc. The strength of the economy depends on the resources devoted to the financial sector. We do know that capital allocation is a necessary component of a healthy economy; trading is an essential component of

this process. Shouldn't such essential activities command society's best minds and resources?

What is society's payback from this resource deployment? Turner (2010) argued that "There is no clear evidence that the growth in the scale and complexity of the financial system in the rich developed world over the last 20 to 30 years has driven increased growth or stability." If financialization did not significantly improve growth, stability or firms' access to capital, how did it impact the economy? Turner suggests that we see little evidence, either at macro or individual investor levels that financial and economic risk has been substantially mitigated by increased market liquidity and trading. In fact, he suggests, speculation required to produce liquidity might have produced destabilizing and excessive momentum effects. Dabla-Norris and Srivisal [2013] argue that while financial depth dampens "the volatility of output, consumption and investment growth, but only up to a certain point," while amplifying consumption and investment volatility at higher levels.

Furthermore, Godechot (2016), based on his study of 18 OECD countries, argues that the GDP share of the finance sector is a substantial driver of world wealth inequality, explaining between 20 and 40 percent of the increase in wealth inequality from 1980 to 2007. In particular, he argues that rise in financialization's contribution to inequality was driven largely by the increase in equities trading volume on national stock exchanges and by the large balances of shares held by banks. In a study of much narrower scope, Phillipon and Reshef (2012) find that ratio of the average wage in the financial industry to the average wage in the overall private sector has substantially increased in the post-1980 era since WWII.

### Mitigating Financialization

Finance academics and professionals have traditionally accepted that trading, risk shifting, speculation, financial innovation and liquidity are beneficial to economies. This is surely true, at least to a point. Perhaps, increased levels of each are even more beneficial. Highly liquid financial markets reduce costs of capital, and, when functioning properly, they reduce uncertainty and improve information flows. But, does more liquidity and more activities that enhance liquidity always improve the economy? Clearly, there are benefits and costs to increased liquidity, but what are the appropriate trade-off levels between benefits and costs of additional financial activities? Has our economy reached the point of diminishing marginal returns to liquidity? At what point should we consider taking action to reduce the of financialization in the global or U.S. economies? And once we reach that point, what action should we take?

A number of potential corrective measures have been proposed. Two potential measures might be to limit bank size and/or leverage (Johnson and Kwok [2011] and Admati and Hellwig [2013]). Preventing banks from getting too big would be better than preventing them from failing once they become too big. Much financial innovation concerns new ways to employ and market debt. Perhaps, corporate interest deductions and other tax policy that favors increased leverage should be ceased. Perhaps, too many of society's resources are expended to develop new and innovative financial products, suggesting that regulators could consider encouraging markets with a smaller range of financial products that are allowed to vary only along specific dimensions. This might be useful if much of the innovation of new financial products focus complexity or on opaque means of increasing fees to financial institutions.

Numerous economists have proposed transactions taxes discourage excessive devotion of resources to areas of economy that might need scaling back (See, for example, Summers and Summers [1989]). Such taxes on the buying and selling of financial assets have been used by the U.S. government and New York State during much of the 20th century. Financial transactions

taxes are currently used by much of the E.U., the U.K., Hong Kong, Singapore, South Korea and Switzerland. Such taxes might be imposed to reduce resources devoted to financial issues, reduce market volatility, "harmful" speculation, destabilizing high-frequency trading, might reduce wealth inequality and be a low-cost method of increasing government revenues. On the other hand, other observers have argued that transactions taxes might have exactly the opposite of their intended impacts, and would increase trading spreads while reducing market liquidity. Regardless, issues related to financialization and its remedies are of increasing interest to many economists.

## Exercises

1. a. Cigarettes in the limited economies of prisons, such as in World War II U.S. prisoner of war camps, have been known to serve as commodity money. What were the qualities of cigarettes that enabled them to serve as effective commodity money?
  - b. Coca paste (the primary ingredient of cocaine) has been used in recent years as commodity money in Guerima and in the Guyabero region of Colombia. What were the qualities of coca paste that enabled it to serve as effective commodity money?
  
2. In the first millennium, gold was considered an important type of money. Yet, for long-distance trading, including commerce requiring long ship or caravan transport, use of gold as a commodity money was rather problematic.
  - a. Which of the 6 key qualities of money did gold possess?
  - b. Which of the 6 key qualities of money did gold lack?
  
3. The central bank of an economy issues \$1,000,000 in new currency. The deposit reserve requirement in this economy equals 8%.
  - a. What will be the total money supply ( $M_1$ ) in this economy?
  - b. Suppose that consumers and business elect not to spend or deposit all of their money. Instead, they maintain 4% of their money "in their pockets" as currency. With this currency "leakage," what is the total money supply ( $M_1$ ) of this economy?
  - c. Instead of holding currency, suppose that consumers purchase and hoard gold with their money. Suppose that 50% of their currency leaks out of the system to be held as gold. What will be the money supply in this economy, assuming a reserve requirement of 8% and a total currency level of \$1,000,000?
  
4. In Section 1.B, we introduced the concept of fractional reserve banking. The alternative to fractional reserve banking is full reserve banking, in which banks cannot loan funds placed in demand deposits; banks would be required to maintain all funds in demand deposits available to depositors at all times. The idea regularly appears in academic circles (e.g., the "Austrian School" and the University of Chicago in the 1930s. In 2018, the voting population of Switzerland voted on a referendum to replace fractional reserve banking with full reserve banking. The referendum was soundly defeated.
  - a. What would be the advantages of a full reserve banking system over a fractional reserve system?
  - b. What would be the disadvantages of a full reserve system over a fractional reserve system?
  
5. Why does counterfeiting undermine the effectiveness of currency as a type of money?
  
6. Leanne Kemp, founder and CEO of Everledger, claims that provenance "is the life story of an item and in the world of luxury goods, provenance matters, because you cannot separate the value of an item from its origin and its history," continuing to remark that provenance relates to diamonds (a primary business area for Everledger), to watches, to art, and to jewelry.
  - a. Describe the primary features of modern blockchain technology that prevents tampering with ownership records.
  - b. Bitcoin transactions are digitally time-stamped. Describe how this further validates the

legitimacy of bitcoin transactions, including prior and subsequent transactions.

7. a. Loyalty programs, including those offering customers airline frequent-flyer miles, hotel points, credit card points (as well as S&H Green stamps from the 1930s to 1980s) are (were) intended to bind consumers into longer-lasting relationships with firms maintaining the programs. How might the modern versions of such loyalty programs be considered to provide a form of digital currency?

b. Why might such loyalty programs *not* be considered to provide a form of digital currency?

8. Although the supply of bitcoins is currently increasing (16.9 million as of February 2018), the long-term money supply of bitcoin is said to be deflationary. Why is this?

9. The value of bitcoin has been dramatically volatile over its early existence, from \$0.00076 in 2009 to over \$19,000 in 2017 before dropping to below \$7,000 in 2018.

a. While many market conditions and features might contribute to this volatility, to what extent might volatility have been intensified by lack of government intervention and regulation? Why?

b. How might this volatility diminish the usefulness of bitcoin as a currency?

10. Transactions involving currency, bank checks, bills of exchange, etc. require "trusted third parties," typically financial institutions or governments who promise in some manner to back the paper that they issue.. Cryptocurrency transactions rely on blockchain records for validation. How might blockchain validation fail?

11. *Netting* and *novation* are important activities of most clearing firms. What is the difference between these two activities?

12. Describe how real-time clearing differs from batch processing. Why is netting less expensive than real-time processing?

13. An essential component of the U.S. Federal Reserve System is its twelve Federal Reserve Banks, which perform a variety of important activities throughout the U.S. Each of these district banks is overseen by nine directors, six of whom are elected by member banks in the private sector and three of whom are appointed by the Board of Governors of the Federal Reserve System. These nine directors, in turn, elect a president of the district bank. How do these geographic and governance structures support the credibility and acceptance of the U.S. Federal Reserve System with respect to its crucial functions?

14. What is a bank? That is, what are the core functions of a bank?

15. Demir [2007] reported that in 1973, the ratio of the value of foreign exchange transactions to global trade was 2:1; in 2004 this ratio had increased to 90:1. What are some of the factors that may have contributed to this increase in financial transactions relative to actual trade?

16. Suppose that investing \$10 million on eradicating mosquitoes carrying the Zika or other infectious viruses will have a clear and significant impact on the spread of this or another

disease, saving over 500 lives and preventing disabling conditions in another 500 persons. Suppose that an equal investment into a new trading platform will produce \$300 million in additional revenues to a brokerage firm. Consider the following rhetorical questions:

- a. Which investment is likely to produce more social benefits? Which investment is likely to produce more private benefits to the decision-maker?
- b. Would an institution that makes the investment that produces more social benefit be more highly regarded by society than the institution making the investment with higher private benefits?
- c. Should governments play a significant role in making such decisions?

## Exercise Responses

1.a. First, prisoners who smoke cigarettes or know that cigarettes are of value to other inmates (they are acceptable and scarce) who will smoke them are likely to use them as a medium of exchange. Cigarettes are useful as units of account because they are uniform and easily countable. Cigarettes are useful as stores of value (they are durable) given the limited (presumably) planning horizons of prisoners and the desire to smoke them, limiting their supply (enhancing their scarceness). They retain value because they are not easily debased (they are durable). Cigarettes are easily portable within prison walls, and packs and cartons of cigarettes are easily divisible. While individual cigarettes themselves are not divisible, packs and cartons of cigarettes are divisible.

b. First, residents and businesses in these locales know that coca paste is of value to other residents and businesses (it is acceptable and relatively scarce) who will use them as a medium of exchange. Coca paste is useful as units of account because it uniform and easily identified and weighed. Coca paste is useful as a store of value (it is durable). Coca paste retains its value because it is not easily debased (it is durable). Small amounts of coca paste is easily portable within these areas due to weak drug enforcement, and the paste is easily divisible.

2.a. As a commodity money, gold seemed to main the following qualities: gold was durable, easily divisible, scarce, uniform and acceptable in exchange for goods and services in the future.

b. As a commodity money during the first millennium, gold was not easily portable largely due to its weight and propensity to be lost during sea voyages, pirate raids and ship wrecks and its propensity to be lost to thieves, plundering bandits and armies when being transported over land.

3.a. The economy will have a total money supply equal to \$12,500,000:

$$M_1 = K/r = 1,000,000/.08 = \$12,500,000$$

b. Currency leakage ( $c$  in this exercise) reduces the level of deposits that result from any currency issue in much the same way as the reserve requirement. Thus, its effect on total money supply is similar to that of the reserve requirement. Thus, the economy will have a total money supply equal to \$8,333,333:

$$M_1 = K/(r+c) = 1,000,000/ (.08+.04) = \$8,333,333$$

c. The economy will have a total money supply equal to \$1,724,138:

$$M_1 = K/r = 1,000,000/.58 = \$1,724,138$$

4.a. Full reserve banking provides central banks complete control over money creation (might at times be a disadvantage), reduces the risk of uncontrolled inflation, prevents bank runs, enhances bank safety as deposits are always backed by cash, limits amplification of financial crises, limits the "subsidy" given to banks by having the ability to create money

b. Changes the banking model (might be an advantage), reduces bank profitability, might result in higher bank client fees, would probably grow the shadow banking (non-banks that perform banking functions) industries leading to less effective regulation in the banking system and likely increased economy-wide financial risk, increased incidence of negative interest rates as banks try to recover operating costs.

5. First, counterfeiting currency reduces the scarcity of currency, undermining its value.

Counterfeiting, and perhaps even more important, the concern for counterfeiting, undermines the acceptability of currency as a medium of exchange.

6.a. The two primary blockchain features that inhibit tampering are provenance records, consistent with "hash" representations and public distributions of these records. Provenance can be established through the historical ownership and transfer records, facilitating discovery of exactly what is owned and by whom and when, and public distribution establishes widespread agreement, rendering the fraudulent tampering of any single record useless.

b. Each time a blockchain is verified, it further verifies the previous transactions associated with the chain and makes it even more difficult to tamper with the records of bitcoin transactions. Compromising a recent bitcoin transaction would require tampering with the bitcoin's provenance, or all of its historical transactions. Each new block's transactions stand on the shoulders of previous transactions, contributing to the integrity of the entire blockchain.

7.a. Loyalty programs issue points or miles analogous to a currency that can enable consumers to purchase and upgrade flight tickets, receive credit card rebates, purchase and upgrade hotel rooms, and purchase travel and other consumer goods. Points and miles have no physical form and are not backed by central banks, precious metals or any government authority. Nevertheless, points and miles can be considered to a limited extent to be useable as mediums of exchange, units of account and stores of value. Generally speaking, though with limitations, miles and points from loyalty programs can be durable (they last until they are taken away or continued), portable, divisible, scarce, uniform (one loyalty program's point is directly comparable to any other point from that program), and acceptable, at least with the one or small group of companies sponsoring the program until the miles or points cancel or are otherwise discontinued.

b. The liquidity and fungibility of points and miles are limited. Issuers of points and miles usually restrict the circulation of their "currency," prohibiting trading and exchanging points and miles. For example, some airlines prohibit the trading and sale of their miles. The range of goods that can be purchased with points and miles is limited. No blockchain technology is currently being used to track ownership of points and miles; in fact, ownership of this "currency" might actually remain with their issuers. Thus, the extent to which that points and miles can be considered to be useable as mediums of exchange, units of account and stores of value is limited. Their effectiveness as money is limited; they are not perfectly durable because they can be debased (more points or miles can be required for the same flights or goods), they can be canceled or discontinued, and they are acceptable only through the companies that sponsor them and their affiliates.

8. In recent years, and likely for the foreseeable future, the supply of bitcoin has been increasing, which, if it continues to increase at a rate that exceeds economy-wide productivity, might contribute to inflation, at least with respect to bitcoin pricing levels. However, the long-term supply of bitcoin is capped at 21 million. Thus, if bitcoin were to become a dominant or at least major currency, as the supply of goods and services expands, the value of each bitcoin might be expected to increase given its constant supply. Bitcoin would be subject to deflation in this scenario.

9.a. Bitcoin is not issued by any government or centralized authority, nor are its values or rate managed or fixed by any government. No government recognizes bitcoin as being legal tender.



No government regulates bitcoin or its markets as securities, commodity or currency. Since bitcoin exchanges lack government sanction, they are more subject to manipulation and other activities that are prohibited on regulated exchanges.

b. Important functions of money cannot be fulfilled by highly volatile currencies or tokens. For example, a volatile type of money cannot serve as a reliable store of value or as a unit of account in markets for goods and services. Furthermore, since few financial contracts trade on bitcoin, and few commodities are consistently priced in terms of bitcoin, these volatilities cannot be easily hedged away.

10. Blockchain validation can fail in the event of fraud. Stealing of private keys does happen and, at least in theory, blockchain records could fail should most or all participants in the blockchain network choose to forge or manipulate historical blockchain records.

11. Netting occurs when the clearing house assumes the settlement obligations of both counterparties to a transaction, in effect becoming the counterparty to both sides of the transaction. Netting is the simplification process used by clearing institutions of adding all of a given firm's purchases of each security, adding the sales of each security, deducting sells from buys to determine the net change in holdings of that security for the firm, then finally computing the net cash flows associated with all transactions. The net reflects what each clearing member receives or pays.

12. Real-time processing allows for transactions to be processed as soon as they are executed, enabling them to produce funds and financial instruments that can be spent, transferred or otherwise used immediately. Netting is a form of batch processing that requires transactions to accumulate for a period of time, and with the clearing firm or house counterparty to each transaction (in the process known as novation), clear in a single batch at the end of the period. This process is much less expensive than real-time clearing because a large number of transactions can be cleared simultaneously.

13. First, financial institutions or institutions that are too concentrated one or two major northeastern cities such as New York or Washington D.C. provoke concerns. Many Americans do not trust such eastern big-city institutions and don't feel like they are being properly represented. The 12 district banks are located in New York, Boston, Dallas, Philadelphia, Kansas City, San Francisco, Richmond Virginia, Chicago, Cleveland, Minneapolis, and Saint Louis allow for more dispersion of power and diverse geographic representation in the financial system. Second, many Americans have been skeptical of excessive control exerted by the U.S. federal government, suggesting that private control of financial institutions is more effective and trustworthy. Each of the 12 district banks is overseen by nine directors, six of whom are elected by private-sector member banks and three of whom are appointed by the Board of Governors of the Federal Reserve System. These nine directors, in turn, elect a president of the district bank. This blend of private and public sector control reflects a political compromise that expends the sense of confidence that Americans have in their central bank. Note that the European Central Bank structure is the product of a similar set of political compromises.

14. A bank is a financial institution that accepts monetary deposits and makes loans.

15. Among the contributing factors are the complete breakdown in the Bretton Woods monetary system (not actually discussed in this book until Chapter 2), growth in the development in exchange instruments and trading technologies, the introductions and proliferations of program, algorithmic and high-frequency trading, the process of securitization, improved information technology and dissemination, reduced transactions costs, continuing financial deregulation, shadow banking and other financial institutions and higher levels of monetary compensation in the financial industries.

16. There are probably no correct solutions for this rhetorical exercise; it is intended to provoke some opinions.

a. The quick and easy answers are that the mosquito eradication program produces more social benefits and the trading technology program produces more private benefits, particularly if high values are placed on life and on health improvement. However, for the sake of argument, do consider that it is very difficult to measure the social benefits produced by the financial sector (the efforts of Philippon (2015) notwithstanding), partly because much of this value is captured by other industries and individuals. For example, what is the total benefit of a \$500 million loan to start a new hospital? Or to build a pharmaceutical factory employing 1000 workers? In fact, to begin with, who among us is even qualified to decide what values to associate with the programs?

b. Financial, especially trading activities tend to be held in low esteem. The general perception is that financial activities do not directly enhance peoples' lives (it is easy to overlook indirect enhancements), are akin to gambling (transferring risk is an important activity in finance), create wealth inequality, and are rife with fraud (finance is where the money is, and where it can be stolen).

c. Certainly, many individuals prefer outcomes with high private benefits for themselves to outcomes that produce large social benefits. In fact, this is the nature of the "Prisoner's Dilemma" problem from game theory. A society, however this term might be defined, can mitigate this problem by forming governments to make decisions concerning projects with high social benefits. On the other hand, are the incentives and private benefits consumed by government agents any less harmful than those held and consumed by agents of financial institutions?

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