

MONEY: IN TRANSACTIONS AND FINANCE

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Summary: Money, the money market (trade in debt and financial instruments), and financial institutions (banks, insurance companies, other financial intermediaries) all serve to separate, to make independent and decentralized, a complex of interdependent transactions. Money is the intermediary instrument that separates commodity buying and selling transactions. Money is the financial instrument that separates saving and investment transactions. By separating linkages among related actions, money and finance simplify them and allow them to be successfully and independently pursued.

The concept of decentralization is familiar in many economic contexts. Markets and the price system decentralize allocation decisions in a market economy. Money and the financial system similarly allow decentralization of the transactions, exchange, saving and investment process. The saving and investment decisions --- necessarily linked for the economy as a whole --- are made separate and independent for the individual decisionmaker by the buffer, the decoupler, provided by money and financial institutions.

The use of paper or fiduciary money instead of commodity money is resource saving, allowing commodity inventories to be liquidated. Government-issued fiat (unbacked) money eliminates the commodity inventory backing altogether, completing the resource saving. The market value of (fundamentally worthless) fiat money is supported by the government's willingness to accept fiat money in payment of taxes.

Money and finance allow necessarily interdependent decisions to be made independently, coordinated by money, prices, and yields. Money allows successful decentralization of the process of exchange. Money, financial instruments, and financial institutions allow successful decentralization of the process of saving and investment. Decentralization of the exchange, saving and investment process by money and financial institutions simplifies and facilitates the allocation and investment process in a market economy, leading to economically efficient resource allocation.

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Exchange, like production and consumption, is a fundamental economic activity. The transaction function of money is to facilitate exchange. Though the monetary instrument may vary, in practice, trade is almost always monetary. *Money*, like *written language* and the *wheel*, is one of the fundamental discoveries of civilization. Financial markets for debt instruments (intertemporal contracts for money) and claims on capital, serve to implement an efficient allocation of consumption and capital across time. They rearrange the control of capital from those who have saved it (and retain their claim on it) to others who can make the most productive (or most profitable) use of it.

The Scope of this Article

The study of money reaches into several branches of economics: macroeconomics, business cycles, unemployment, inflation, the price level; international finance and trade; asset market prices and yields including the term structure of interest rates. The present article will concentrate more narrowly, on the role of money as a facilitator of transactions and allocation, at a point in time and intertemporally. These are primarily the functions attributed to money as a medium of exchange and a store of value, money in transactions and in finance.

What is money?

Over the course of history money has taken an immense variety of forms: cattle, blocks of salt or compressed tea, rum, cigarettes, tobacco, wrought iron and copper, stones, shells, gold and silver both coined and by weight, paper notes promising gold or silver on demand, paper notes declared by law to be money without additional guarantee (fiat money), paper drafts (checks) on accounts of other forms of money, promises (e.g. credit cards) of other forms of payment. The conventional or physical form of money does not define it; the forms are immensely varied.

The defining property of money is the functions it performs. Money is what money does. Money is the commodity or fiduciary instrument (credit or paper money) that carries purchasing power between trades and over time. This function of money is universal: money appears in some form wherever there is active trade, in every advanced economy and many primitive economies.

What money does

Money, the money market (trade in debt and financial instruments), and financial institutions (banks, insurance companies, other financial intermediaries) all serve to separate, to make independent and decentralized, a complex of interdependent transactions. By separating linkages among related transactions, money and finance simplify and allow them to be successfully and independently pursued.

The concept of *decentralization* is familiar in many economic contexts. Decentralization means allowing interdependent transactions to be pursued independently

but consistently. Markets and the price system are said to decentralize consumption and production decisions. The quantity of a good produced will typically be equivalent to the amount consumed; they are strongly interdependent. Do the producers and consumers then have to consult with one another to determine the appropriate quantity? In a market economy the answer is 'no.' They merely consult the market price, which adjusts to bring production and consumption into balance. The price system decentralizes allocation decisions in a market economy.

Money and the financial system similarly allow decentralization of transactions, exchange, saving, and investment. They implement trade of goods for money to replace barter, the direct trade of goods for goods. Money's functions are often described then as *medium of exchange, store of value, unit of account, standard of deferred payment*.

Medium of Exchange

The medium of exchange function of money is its most evident. We carry paper money around with us and use it to buy what we want. Checks and credit cards perform the same function and are alternative forms of money. The concept of a *medium of exchange* here is that money is the carrier of value between two interdependent transactions. The property that allows the transactions successfully to take place independently is the availability of the medium of exchange. Money allows separation of related sale and purchase transactions. Think for example of a worker who wants his wages to buy some consumer goods. First the worker provides his labor to an employer, who pays him in money. Then the worker uses the money to buy consumer goods.

The worker is trading his labor for his consumption. The transactions are strongly linked: the worker will not work if he cannot acquire his desired goods in exchange; the goods will be available to the worker only in exchange for his labor. Money temporarily frees the link between the two coordinated transactions¹. Money appears in the middle of the trading process and dramatically simplifies it. Money is not essential to the underlying exchange of labor for goods, but it makes it much easier. The laborer's employer does not need to know or arrange for the laborer's consumption. The employer merely has to pay money. The consumer goods merchant does not need to know or arrange for the laborer's employment. The seller has merely to accept money. Thus the trade of labor for goods that the worker undertakes is separated into two far simpler elementary transactions: labor for money and money for goods.

The notion of separating complex interdependent decisions into simpler independent decisions appears repeatedly in economic analysis. It is usually termed *decentralization*, reflecting the notion that interdependent decisions ordinarily need central coordination, but that nevertheless, successful systematic structure can allow them to be pursued independently. Such a structure is said to *decentralize* the process. In this sense, money as a medium of exchange helps to decentralize the process of exchange.

Store of Value

The notion of a *store of value* represents money as means of saving and of allocating capital. The store of value allows a transfer of purchasing power across time. Saving may take the form of holding currency, bank accounts, or debt instruments

¹ Following Prof. Martin Shubik, we can say that money acts as a 'strategic decoupler.'

(denominated in monetary terms) issued by a borrower, or holding an accumulation of a commodity money like gold. By holding money --- or by lending it out --- the owner can shift his purchasing power from the present into the future. If a household's income is variable or uncertain, high at some times, low at others, the household may wish to smooth out consumption by saving during high income periods and spending out of savings in low income periods. The typical life-cycle model of income includes a high income period during mature middle age and a low income period of old age (retirement). Saving in money and money-denominated forms allows the household to transfer purchasing power from one time of life to another. Of course there are other stores of value, other ways to save, for example holding land or capital. The advantage of holding money as a means of saving is that money is liquid and certain (in nominal value in a monetary economy). Monetary savings can be transformed at will into new spending and consumption when the time is right.

Unit of account

The notion of a *unit of account* is that money is the common measure of quantities evaluated in an economy. The total output of the economy, GDP, is measured in monetary terms. Prices of goods are measured in a common monetary unit. Personal incomes are measured in the same monetary unit. Having this single common unit available makes the arithmetic of prices and outputs relatively easy. Using the common measure of value it is easy to tell that beef at \$5 a pound is twice as expensive as chicken at \$2.50 per pound, and that a pound of beef represents 1% of the weekly income of a household receiving \$500 per week. These are the sorts of calculations that households and firms must perform many times daily in ordinary commerce. Having a common unit in which to calculate them renders them simple and intuitive.

Standard of deferred payment

A *standard of deferred payment* is the mirror image of a store of value. Just as some economic units --- firms and households --- save their income, others borrow from them. This puts the savings to work forming capital or smoothing out the consumption streams of those who borrow to support spending. Just as the savers' (lenders') asset position is denominated in monetary terms, the borrowers' debt position is measured in the same way. Thus the debt is payable in monetary form --- the same form the borrower expects his income to accrue in --- and is certain (in nominal value).

Efficiency and exchange

Money arises to facilitate trade and exchange. In the typical production economy, individuals and households provide their labor to firms (employers) that use the labor to produce desirable output. In this way, labor is allocated to production activities for which it is most productive and firms can take advantage of economies of scale (mass production) by increasing the number of those employed to provide an efficient scale of operation. Self-employed workers specialize in a particular line of work to take advantage of the increase in productivity that comes with specialization. As labor specializes in employment and self-employment, its production is specialized, but desired

consumption is diverse. The economy provides the diverse consumption households require through commerce, trade and exchange.

The fundamental functions of an economy are production, investment (provision for the future through accumulating inventory and creating lasting equipment), and consumption. These can all take place in an autarkic (no trade) economic setting. In literary fiction this setting would be Robinson Crusoe on his island. In actual economies it would occur in subsistence agriculture where a family farm provides virtually all its own needs by growing and harvesting its food, setting aside seed for the coming planting season, and preparing its own clothing, shelter, and transportation. In an autarkic setting there is no role for exchange and hence no role for money and financial institutions.

The process of trade and exchange allows each economic agent to specialize in producing those goods and activities for which he can be most productive (where he has a comparative advantage) while adjusting his acquisitions (as inputs to production or for consumption) to suit his needs. This is summarized in economic analysis by saying that a competitive equilibrium allocation leads to an efficient allocation of resources. This claim for the efficiency of the use of resources in a market economy goes back in economic analysis as far as Adam Smith (1776) and is as modern as several recent Nobel Prizes in economics (to Arrow and to Debreu). In order for the trade and exchange process to work successfully, the process itself must proceed at very low cost. Selling what you have and buying what you want should be an easy process. If the process of trade itself is unnecessarily difficult that difficulty will prevent the allocation process from achieving efficiency. The role of money is to make the exchange process easy. When you sell your labor or the output of your work, the means of payment should itself be the simplest part of the process. When you buy food, clothing, a car, those purchases may all be time consuming activities; the means of payment should be the simplest part of it. A start-up business may find it hard to convince investors to support it; the easiest part of the job is handling the money forwarded for the purpose.

A particularly powerful implication of the availability of money to facilitate trade is the use of scale economies in production. Scale economies require specialization. Adam Smith (1776) noted that what drives scale economies is division of labor, allowing each worker to specialize in a small task allowing work to become routinized and the worker to be well practiced and well-trained. Scale economies imply that firms --- or their operating units --- will be specialized as well. A specialized worker employed by a specialized firm necessarily has a narrow range of output, for which he may have no use as a consumer. In order to sustain specialization in production as a market equilibrium, workers with specialized output must have ready access to diverse consumption. If the economy cannot provide them with the diversity in consumption they require, then the equilibrium may move to autarky. The worker would then find it preferable to produce inefficiently as a yeoman farmer sure of his consumption, rather than produce efficiently as an industrial worker who could not trade his output for his desired consumption. Hence money --- the facilitator of exchange --- is an essential element of allowing division of labor in production. Money and the facilitation of the trading process it provides is a necessary step in industrialization and the specialization typical of a modern economy.

Adam Smith (1776) summarized this view two centuries ago

When the division of labour has been once thoroughly established, it is but a very small part of a man's wants which the produce of his own labour can supply. He supplies the far greater part of them by exchanging ...

But when the division of labour first began to take place, this power of exchanging must frequently have been very much clogged and embarrassed in its operations...The butcher has more meat in his shop than he himself can consume, and the brewer and the baker would each of them be willing to purchase a part of it. But they have nothing to offer in exchange, except the different productions of their respective trades, and the butcher is already provided with all the bread and beer which he has immediate occasion for. No exchange can, in this case, be made between them. He cannot be their merchant, nor they his customers; and they are all of them thus mutually less serviceable to one another. In order to avoid the inconveniency of such situations, every prudent man in every period of society, after the first establishment of the division of labour, must naturally have endeavoured to manage his affairs in such a manner, as to have at all times by him, besides the peculiar produce of his own industry, a certain quantity of some one commodity or other, such as he imagined few people would be likely to refuse in exchange for the produce of their industry.

An economy without money

To better understand what money does for us in an economy, a common classroom exercise is to conceive of how an economy would work without money. Economic analysis has actually done quite a thorough job of modeling this idea, known as the Arrow-Debreu model of general equilibrium. Once we understand the complexity of running an economy without money, the comparative ease of a monetary economy becomes evident.

Trade in a central marketplace

The economy consists of firms and households. Each firm has a technology that specifies how it can turn inputs (of labor, capital, intermediate goods) into outputs (of finished goods, services). Each household has an endowment: its own labor, possibly ownership of some land or capital. In addition, households own shares of firms and accept a share of the firms' profits. There is a price setting mechanism, the Walrasian auctioneer (named after the economist who first fully articulated the general equilibrium model, Leon Walras).

The Walrasian auctioneer calls out prices. The prices are denominated in a *numeraire*, either one of the existing commodities or a pure number. The units of the prices are unimportant; the important element is relative prices, the ratios (rates of exchange) at which the goods and services can be traded for one another. These ratios tell a household how much labor must be sacrificed for a pound of steak or what the rate of tradeoff is between wine and beer. In response to the prices called out --- and the implied rates of exchange --- firms announce their planned input demands, planned output supplies, and projected profits. Similarly, households recognize their incomes in the value of their endowments and their share of firm profits. The household budget constraint is the restriction that the value of household consumption plans at prevailing prices must be no more than the value of household income (all calculated in the numeraire). Income and prices let the households plan their desired consumptions (consistent with income). Households announce to the auctioneer the supplies (from

endowment) they plan to deliver to the market and their demand for goods and services. Based on the announced supply and demand plans of firms and households the auctioneer calculates excess demands and supplies. Some goods and services may be in surplus at the announced prices, others in shortage.

The Walrasian auctioneer then adjusts the numeraire prices, upward for goods and services in excess demand, downward for those in excess supply. The process is repeated. Firms formulate new plans for inputs to purchase, outputs to produce and sell, and they report new profit levels to their shareholders. Households form new consumption plans based on the new prices and income levels. Firms and households report their buying and selling plans to the Walrasian auctioneer. The auctioneer again computes excess demands and supplies, and once again adjusts prices. This process continues until it converges to market equilibrium, an array of numeraire prices so that demand equals supply for all goods and services. Once the Walrasian auctioneer has found general equilibrium prices (an array of prices for the many goods and services so that supply equals demand for all), he announces the prices to firms and households, and trade proceeds.

How does trade take place in an economy without money? Once equilibrium prices are announced, each firm consults its production technology and chooses a profit maximizing production plan consisting of a list of inputs to be demanded and outputs to be supplied. It reports its profits to shareholders. Households compute the value of endowment and shares of firm profits to determine their available budget. Households plan out desired supplies (from endowment) to the market and desired purchases from the market. Firms and households report their planned supplies and demands to the central clearinghouse. Since prices are general equilibrium prices, supply and demand balance for each good and markets clear.

The mechanics of trade in a nonmonetary setting requires some rethinking. The simplest notion of trade is that there is a central marketplace with a clearinghouse. The firms and households go there and announce their supply and demand plans. The clearinghouse accepts delivery of their supplies and returns their demands to them. Since the prices are equilibrium prices, supply equals demand for each good and there is no unsatisfied demand or undelivered supply (except of free goods).

Futures contracts

If we accept the nonmonetary trading story above for an economy at a single point in time, there remains the issue of intertemporal allocation. How do saving and investment decisions take place in an economy without money? A household may have high income at some periods and low income at others. How can it smooth out its consumption? A firm may have highly profitable plans that will pay off in the future. How can it assure needed inputs in the present?

Intertemporal allocation takes place through the use of futures contracts (or dated commodities, Hicks (1939)). Each good and service is described by what it is, and at what date it is to be delivered to the economy. Note that this is common usage in actual commerce for commodities futures contracts (traded for example at the Chicago Board of Trade). A commodity (good or service) is defined by what it is, where it is deliverable, and when it is deliverable. Thus, a liter of milk deliverable in Sydney Australia in 2001 is a different commodity from an otherwise similar liter of milk deliverable in Marseilles

in 2003. Both goods will be actively traded and they may have different equilibrium prices.

Thus a firm that needs inputs in 2002 and 2003 to produce saleable output in 2004 buys inputs dated 2002 and 2003 and sells output dated 2004. This is not surprising. The distinctive element of this model is that all of these trades take place on the same market at the same date, prior to any real activity. They are all futures transactions. How does the firm pay for its inputs --- on the current market --- inputs that are deliverable in 2002 and 2003? It pays for them from the value of its sales of output deliverable in 2004. It sells futures contracts on the output and uses the proceeds of the sale to finance the purchase of inputs. Though deliveries of the actual goods and services contracted takes place in the future, payment takes place at the market date, prior to production and consumption. Firm profits and household budgets are calculated effective with the market date, far in advance of actual delivery or consumption.

A household with a large endowment to sell in 2001 and 2002 may wish to spread consumption evenly over 2001 to 2025. To do so, the household sells endowment on the currently available futures market and buys consumption deliverable in 2001, 2002, 2003, 2004, ..., 2025, on the currently available futures markets. The household finances the purchase of consumption in the near to distant future from the proceeds of the sales of futures contracts deliverable in 2001 and 2002.

In this way the futures markets perform the function that in a monetary economy would be performed by the capital markets. Saving and investment are financed through the futures markets rather than in separate capital markets.

Firms and households formulate their supply and demand plans (for dated commodities) just as they did above for a single period economy. The market for their supplies and demands meets before any economic activity (other than the original price adjustment) takes place. The Walrasian auctioneer works just as before, though he has many more commodities and prices to keep track of --- as have the households and firms. Households and firms report supplies and demands (for dated commodities) to the central clearinghouse and the Walrasian auctioneer adjusts prices so that markets for current goods and for futures contracts clear. The balance of economic activity consists of fulfilling the contracted plans made on the market. At each date households and firms deliver on their promises contracted at the market date and accept delivery of their previously arranged demands. Spot markets do not open at future dates. They have no function. All of the desired supplies and demands have been arranged already on the market for futures contracts.

Uncertainty: contingent commodity contracts

In an economy without money futures markets are used to overcome the barrier of time. In actual economies financial assets and insurance contracts are held to overcome uncertainty. How can an economy without money accommodate uncertainty? Though the future is uncertain, it may be possible to write out a list of the possible economically relevant events that can take place in the future. A farmer faces a finite variety of possible future weather conditions. Consumers face a finite variety of unpredictable changes in health and family situation. Firms face a finite variety of shocks to their productivity. Make an exhaustive list of these events. Each one is known as a 'state of the world.'

Now we introduce the notion of a contingent commodity. Households and firms trade in contracts specifying delivery of goods and services at a place, date, and a state of the world. Thus a household may buy an umbrella deliverable next Tuesday in the event that the weather on Tuesday includes rain. A household may buy a medical doctor's attention and a hospital room deliverable in 2005 in the event the household has suffered a major injury then. A household can buy the services of an automobile body shop in 2004 deliverable in the event that the household's car has suffered damage in a collision then.

All of these transactions in an economy without money take place at a single market date prior to the start of economic activity. A household's endowment takes the form of contingent commodities: labor at 2002 (if healthy), labor at 2003 (if healthy), and so forth. A firm's technology shows it how to combine contingent commodities to create contingent output. The prices of these contingent commodities are however certain. It's like buying a lottery ticket or an insurance contract. Buyers pay up front whether the uncertain event on which the deal depends occurs or not. The firm computes the value of the inputs it needs and the value of the output it plans. The plans are all contingent on events but the value of inputs and outputs is known at the market date, so the value of firm profits is known at the market date.

The firm reports profits to its shareholders. Households know their income from the sale of contingent commodity endowment (they get paid up front whether delivery is needed or not) and firm profits. Firms and households report their supplies and demands of contingent commodities to the Walrasian auctioneer who adjusts the prices of contingent commodities so that the markets clear. Trade proceeds as before. Firms come to the clearinghouse with a production plan in contingent commodities, acquire their needed (contingent) inputs and sell their planned (contingent) outputs. Households come to the clearinghouse with a portfolio of contingent commodity endowment and leave with a portfolio of contingent commodity planned consumption. The rest of economic activity consists of fulfillment of the firms' and households' contingent plans as events unfold.

What's wrong with this picture?

The description above represents how allocation decisions would be implemented in a market economy without money. The processes of price setting, budget constraint enforcement, delivery and exchange described above are much more centralized and coordinated than in actual economies. Market economists usually seek structures and institutions that are self-enforcing and self-implementing, reflecting the notion of decentralization. The advantages of a monetary economy are implicit in the centralized structure of the economy without money presented above. They show up wherever the representation above differs awkwardly from the everyday usage with which we are familiar.

The first point of greater centralization is in price setting. The Walrasian auctioneer may be a harmless fiction in economic theory, but it reflects a price adjustment process rather more centralized than in actual market economies. Prices in actual economies are set in separate markets: prices for apples and oranges are calculated by those dealing in them independently of the price of cars and steel. In the absence of money, a common medium of exchange and unit of account, those prices must be calculated as buying and selling (ask and bid) rates of exchange between commodity

pairs. If there are N goods in the economy, that makes $\frac{1}{2} N(N-1)$ commodity pairs with price ratios for each. Calculating so many prices, even though only N of them can be independent of one another (by arbitrage -- cross market trading), is an overwhelming task. The price setting process is far simpler with a common unit of account.

The mechanics of the trading process is too complex in the moneyless economy as well. Though we think of market mechanisms as decentralized, the trading and record keeping process presented above is centralized in a single clearinghouse. This isn't the way trade takes place in actual economies. In actual economies, there are many separate buyers and sellers to deal with, each of whom needs to be sure that those he sells to are not exceeding their budget constraints and that he will be compensated when he deals with them. A highly centralized accounting system (essentially a checking account system) or a portable currency are effective means of record keeping and enforcing budget constraint. Currency is a fully decentralized means of enforcing budget constraints. The alternative to a common currency is to accept goods in trade, true barter. The difficulty of barter is the complexity of the informational requirements or of the vast number of markets, $\frac{1}{2} N(N-1)$, that barter requires successfully to implement an economically efficient allocation of resources. The multiplicity of markets or the informational requirements (how do we get goods from those who hold them to those who need them through bilateral, budget- balanced trades?) once again imply great costs or centralization.

The notion of intertemporal trade using futures markets in the moneyless economy above seems far fetched. There are futures markets in actual market economies (for contracts specifying large quantities of agricultural commodities, petroleum, metals, and financial instruments), but their use is over a relatively narrow range of standardized goods. They are not in common usage. Why is that? The transaction costs (broadly conceived) of using futures markets outweigh their benefits. These costs include the out of pocket costs of writing and enforcing intertemporal contracts along with the (unpriced) resources used to plan and implement so complex a procedure. These resources include the time and attention of all those active in the markets as well as the cost of procedures to write and implement contracts. It certainly sounds complicated to plan out all of our supply and consumption activities for the indefinite future.

A related reason why full reliance on futures markets for intertemporal allocation is impractical is time discounting. Transaction costs incurred for arranging plans for many years in the future mean incurring costs in the present to implement plans for the future. If there is (explicit or implicit) time discounting of costs, the costs incurred may exceed the (present) value of the benefits from contracting.

The alternative to using a full set of futures markets to plan consumption and production into the future is to use money and debt instruments to move purchasing power over time and to use spot markets to allocate actual goods. Contrary to the futures market economy without money, in this setting markets must reopen over time. A firm requiring inputs in the present to produce profitable output in the future borrows money and buys inputs in the present, sells output and repays debt with money in the future. A household with endowment principally in the present wishing to consume in the future,

sells endowment and saves (or lends) in the present and uses its savings to purchase consumption in the future. To avoid the costs of futures markets we use spot markets at a sequence of dates and money to carry value between them.

The argument for substituting money and reopening markets for the contingent commodity markets is very similar. It's largely a matter of transaction costs. Having a full set of contingent commodity markets for every good in every contingency in an uncertain world would multiply the number of rather complex markets and the record keeping and enforcement that they require. Since most contingent events will not take place, those transaction costs can be avoided without seriously misallocating resources by recourse to spot markets. Of course insurance is required to deal with uncertain events, but it can be written in monetary terms (assuming sufficient price foresight on the part of firms and households). Reliance on the vast array of contingent commodity markets with their transaction costs incurred at the market date is prohibitively costly. The economy, and the optimizing agents in it, find that it is far more economical to substitute money, debt, insurance (in money terms), and the reopening of spot markets instead of the elaborate structure of contingent commodities posited in the moneyless economy above.

Medium of exchange

Decentralization of the trading process and the absence of double coincidence of wants

In the economy without money described above trade takes place with a single central clearinghouse that accepts a household's supplies from endowment and delivers desired consumption. The household makes only one big transaction. Trade takes place only with the central clearinghouse so the budget constraint is easily enforced at the single transaction. Trade in actual economies is much more diffuse. A single household may sell its labor to one firm, buy food from several others, clothes from several more, and so forth.

Two (essentially equivalent) classic descriptions of the transactions function of money in this setting are *nonsynchronization* and *absence of double coincidence of wants*. The notion of nonsynchronization says that buying and selling transactions do not take place at the same time. The household sells its labor at one instance and buys its food at another (presumably from separate counterparts). The role of money in this setting is to be the 'temporary abode of purchasing power.' That is, since buying and selling transactions are separate, the trader needs a carrier of value between the buying and selling transactions.

The notion of an absence of double coincidence of wants recognizes that there are rare conceivable trade settings where there seems to be no role for money. That will occur when traders' supplies and demands are precisely reciprocal and barter trade may be practical. A hungry shoemaker and a barefoot baker do not need money to arrange for a mutually satisfactory trade. They are said to have a double coincidence of wants. But this is a rare situation. A typical household's employer seldom provides more than a small fraction of his desired consumption; barter of labor for goods would be possible in that limited setting. The household purchases the rest of his consumption from others and must be able to provide them with some valuable consideration in payment.

One possibility is merely to exchange equal values of the goods the household has in excess supply for those it wants. This poses severe difficulties in the form of time, information, or co-ordination requirements. How will a variety of goods move from those who hold them to those who need them through bilateral, budget-balanced trades? The answer in a barter economy is that this process will incur great difficulty, high costs. The alternative is to pay for purchases with a common medium of exchange, to use money. The information and co-ordination requirements of monetary trade are modest. All that buyers need to know is that sellers accept money. Sellers in their turn --- when they become buyers of other goods --- will rely on the same usage. Since prices are in equilibrium, supply and demand for each nonmonetary good are in balance. Therefore, the volume of money sales and purchases balances out as well and the money market clears as a consequence of market clearing in all other goods.

Jevons (1875) summarized the classic difficulty of barter particularly well:

“The earliest form of exchange must have consisted in giving what was not wanted directly for that which was wanted. This simple traffic we call barter ...and distinguish it from sale and purchase in which one of the articles exchanged is intended to be held only for a short time, until it is parted with in a second act of exchange. The object which thus temporarily intervenes in sale and purchase is money...The first difficulty of barter is to find two persons whose disposable possessions mutually suit each other’s wants...to allow an act of barter there must be a double coincidence which will rarely happen.

Menger (1892) gave a more formal statement:

Even in the relatively simple ... case, where an economic unit, A, requires a commodity possessed by B, and B requires one possessed by C, while C wants one that is owned by A—even here, under a rule of mere barter, the exchange ...would ... be ... left undone.

The Prehistoric Origin of Money and Sustaining a Monetary Equilibrium

Though the discussion above suggests that it is generally convenient for an economy to operate with a common medium of exchange, a money, it does not follow directly from that argument that monetary trade can be sustained as a common usage. Inconvenience of barter is the reason why monetization of trade is efficient but it does not explain why monetary trade is a market equilibrium, the self-confirming behavior of rational self-interested economic buyers and sellers. No agent can choose individually to monetize; monetization is the common outcome of the equilibrium of the trading process. Monetary trade requires voluntary co-ordination among households and firms. All must undertake to trade in the common medium. But it is by no means obvious that households and firms will voluntarily choose to trade in the commonly accepted money. Monetary trade involves one party to a trade giving up something desirable (labor, his production, or a previous acquisition) for something useless (a fiduciary token or a commonly traded commodity for which he has no immediate use) in the hope of then advantageously retrading this latest acquisition. How can this arrangement be voluntarily sustained?

One view is simply that at some early moment of prehistory, by consensus, legislation, or by dictatorial edict, a decision was undertaken to adopt a common medium of exchange, e.g. gold, silver, salt, This is the *cartalist* theory, going back as far as Plato. Such a decision, once enforced, would be self sustaining. Money is what money does; once everyone starts using a single medium of exchange, its role as money is self-confirming. However, no historical record of such an undertaking in an early economy seems to exist. Monetary usage antedates recorded monetary legislation.

The alternative, *metallist* or *commodity* viewpoint, with antecedents in Aristotle, is that money and monetary exchange evolve as an economic equilibrium through the self-interested actions of buyers, sellers, and merchants. In this treatment, at least initially, money must start as just another commodity, its value derived by underlying supply and demand (though eventually its demand as a monetary instrument may help to determine its value). Modern economists tend to favor this viewpoint; prices --- including the value of money --- and transaction decisions are made in the market.

Over a century ago, Carl Menger presented precisely this problem, explaining the origin of money and sustaining a monetary equilibrium. Further he proposed an outline of its solution, a theory of market liquidity, Menger (1892):

It is obvious ... that a commodity should be given up by its owner ...for another more useful to him. But that every[one] ... should be ready to exchange his goods for little metal disks apparently useless as such ... or for documents representing [them] ...is...mysterious....

why...is...economic man ...ready to accept a certain kind of commodity, *even if he does not need it*, ... in exchange for all the goods he has brought to market[?]

The problem ... consists in giving an explanation of a general, homogeneous, course of action ...which ... makes for the common interest, and yet which seems to conflict with the ... interests of contracting individuals.

Menger's proposed solution to this puzzle focused on the liquidity of trading opportunities. "[Call] goods ... *more or less saleable*, according to the ... facility with which they can be disposed of ... at current purchasing prices or with less or more diminution." That is, a good is very saleable (liquid) if the price at which a household can sell it (the bid price) is very near the price at which it can buy (the ask price). "Men ... exchange goods ... for other goods ... more saleable...[which] become *generally* acceptable media of exchange [emphasis in original]." Menger suggests that liquid goods, those with narrow spreads between bid and ask prices, become principal media of exchange, money: Liquidity creates monetization. Thus,

when any one has brought goods not highly saleable to market, the idea uppermost in his mind is to exchange them, not only for such as he happens to be in need of, but...for other goods...more saleable than his own...By...a mediate exchange, he gains the prospect of accomplishing his purpose more surely and economically than if he had confined himself to direct exchange...Men have been led...without convention, without legal compulsion,...to exchange...their wares...for other goods...more saleable...which ...have ...become generally acceptable media of exchange.

Menger posits an evolution of the patterns of trade from primitive barter to monetary exchange and a rationale for sustaining a monetary equilibrium. Because of the absence of double coincidence of wants, most markets for the trade of goods of one variety versus another are thin and have high transaction costs. It is individually rational to trade one's own wares for more liquid commodities, goods that can be acquired and resold with little loss in value. Because all traders face essentially the same difficulties, they act similarly, creating a high trading volume in the markets for the trade of all goods for the (relatively small number of) liquid goods. High trading volume (particularly in the presence of economies of scale in the trading process) enhances liquidity. The economy then converges to a pattern of trade where all goods are sold for the most liquid goods which are then traded for final demands. These most liquid goods are the natural moneys. Their inherent liquidity (from naturally low transaction costs) is enhanced by the liquidity imparted by high trading volume. They become the conventional and sole monetary instrument of the economy. This convention is self-enforcing; high trading volume implies high liquidity which sustains high trading volume.

What characterizes a monetary economy's equilibrium then is that the monetary instrument, 'money,' is liquid. The bid-ask spread on money, the difference between the buying and selling price (or wholesale versus retail) is narrow (or zero) whereas the spread on other goods may be quite wide. Money is the good you can accept in trade without suffering a significant loss in purchasing power on spending it for another good. This property secures its position as a common medium of exchange, one that everyone willingly accepts in exchange, knowing that subsequent retrades will occur without loss. Though this notion develops from a conjectural prehistory, it represents as well a theory of monetary equilibrium for a modern economy. Rational businesses and households willingly accept money in trade in the expectation of re trading it because the transaction cost of doing so (the bid-ask spread on money) is very low. As a conjecture, consider on the contrary what would happen if the transaction cost of dealing in conventional money (dollar bills, pound notes, rupee notes) were dauntingly high: Other media of exchange -- - gold, cigarettes, foreign currency --- with lower transaction costs would be commonly used and become an alternative preferable money. Liquid money would drive out the illiquid. Hence Menger's analysis is a model not only of a conjectural monetary prehistory but an analysis of the structure of current monetary equilibrium as well.

Uniqueness of money

In any economy, even without government restriction on private money issue, there is usually a unique or a small number of media of exchange: government-issued currency only, currency and banknotes redeemable in currency, gold and currency, cigarettes and currency, cigarettes only.... This uniqueness or near-uniqueness of the monetary instrument reflects a scale economy, economies of specialization. In a barter economy with N commodities, there will need to be trading arrangements --- and costly market-makers --- for each pair of goods, $\frac{1}{2} N(N-1)$ commodity pairs. In a monetary economy there need to be only N market makers each making a market in a single good for money. Scale economies in the transactions technology mean that the move from

$\frac{1}{2} N(N-1)$ active trading arrangements to N results in significant resource savings.

Uniqueness of the monetary instrument is sustained as an equilibrium by an external economy: The presence of $N-1$ other markets for trade in money for $N-1$ other goods means that the N^{th} market maker finds a ready-made clientele for his services in making a market in money versus the N^{th} good. Thus the choice of a unique money is self-enforcing. As Prof. Tobin(1980) describes it,

The use of a particular language or a particular money by one individual increases its value to other actual or potential users. Increasing returns to scale, in this sense, limits the number of languages or moneys in a society and indeed explains the tendency for one basic language or money to monopolize the field.

Store of Value

There are many intertemporal stores of value in an economy: land, housing, capital, inventories, common stock, and money. Money is not unique as a store of value, but it is distinctive. It is liquid and predictable in (nominal) value. Technical issues distinguishing 'money' from 'debt' become a bit picky here. Is a bank savings account 'money'? Is a bank deposit with a fixed term 'money'? Traditionally, technical characterizations of money stock in the economy may or may not include these specific instruments, but they reflect the underlying notion that money is what money does. A savings account or a Treasury bill --- though it cannot immediately be spent --- is money under some definitions since it is a secure store of value fixed in monetary terms.

Monetary equilibrium where money is a store of value

Why do households, firms, and the financial system arrange their intertemporal holdings and obligations in monetary terms? Why are money and instruments denominated in monetary terms voluntarily used as stores of value over time? The alternative, noted above, is that the economy could substitute intertemporal contracts (futures contracts) for money and debt instruments. Why is holding money as a store of value over time and using spot markets at the consumption date to buy the actual goods preferable to using intertemporal contracts? The advantage of money combined with spot markets is that the transaction costs of the alternative, using futures contracts, would exceed the cost of using money as a store of value and relying on spot markets to allocate real goods.

Monetary equilibrium

Intertemporal allocation in a monetary equilibrium then looks like this. A firm with needs for capital in the present and the prospect of profitable sales in the future floats debt denominated in money in the present. The debt is to be repaid with interest in the future. In the present, proceeds of the borrowing are used to buy capital equipment on the current spot market. Production proceeds as planned. Goods are sold in the future for money, and the money is used to repay the debt with interest.

Households whose income and desired expenditures are out of balance in any single time period, save in money terms in periods of surplus income and borrow or draw down savings in periods of deficient income. Debt and spot markets arrange an

intertemporal allocation that could otherwise be achieved at far greater transaction cost through futures contracts over time.

The rate of interest

Since money represents a claim on capital and capital is productive, there will typically be a rate of interest on money greater than zero, even if the monetary instrument itself is not directly productive. The rate of interest is effectively the rental rate of capital². Even in the nonmonetary economy described above there is an effective rate of interest implicit in the futures market prices. Prices of goods (calculated in the numeraire as present discounted values) for distant future delivery will typically be lower than the prices of corresponding goods for spot delivery. Discounting the future in this way represents the time value of capital, just as does the rate of interest --- the time value of money.

Liquidity

Economies seldom use futures markets and even less contingent commodity markets. For major uncertain events in people's lives --- fire, flood, calamity --- they carry explicit insurance contracts payable in money. For other uncertain events --- minor repairs, a change in tastes or fashion, price changes --- they hold money balances to allow them to make any purchases needed to deal with the surprising event. For this purpose it is essential that money be *liquid*, that is, that it can immediately be spent. Other assets ---capital, land --- may be productive and stores of value, but they cannot immediately be converted to consumption at a time of need. Hence the liquidity of money, its ability immediately to be converted into purchases is an essential quality, allowing money to perform a generalized insurance function. The formal term for this role of money is the 'precautionary demand for money.'

Properties of the Monetary Instrument

Money should be easy to trade, as Menger noted above. It should have low transaction costs. If money is to carry value between transactions and across time it must do so easily to perform that function well. The properties of the monetary instrument --- gold, cattle, paper money --- that will allow it to do so are traditionally described as that it should be: portable, cognizable (easily recognized), divisible, durable, predictable (in value), and generally acceptable. Acceptability and predictability are properties that, in part, are conveyed simply by the market equilibrium, the consensus that the instrument is money, the common medium of exchange and store of value of the economy. The others are inherent qualities of the instrument.

Portability: base metals at their commodity value are suitable for small change, but precious metals (similarly valued) or fiduciary instruments (paper money) are more suitable for large denominations. A week's income in commodity copper is too heavy for most of us to carry about conveniently. Paper money, credit cards, and checks on a bank account are easily carried. The essential point here is to facilitate transactions by making it easy to use money in the trading process.

² The positive (greater than zero) interest rate on lending has been a source of controversy for millennia. At least since Aristotle, it has been thought inappropriate or immoral (regarded as usury) to charge interest for the use of 'barren' money.

Cognizability: In order to be sure of one's money, it should not be easily falsified, mistaken, or counterfeited. Hence the effort that governments regularly exercise to make their currencies difficult to duplicate. The early popularity of the precious metals as currency derives in part from the availability of tests of their purity. Standardization of coinage in minted coins is designed to facilitate recognition of the quality and quantity of the coined metal. Once again, cognizability of money makes it easy to use money in the trading process.

Divisibility: Trading in money implies making change in money. An easily divided monetary instrument or the availability of fractional units is helpful in speeding the trading process since transactions will seldom be valued at an integer number units of a monetary instrument. Thus, XVIth century Spanish doubloons (known as 'pieces of eight') had division marks allowing them to be easily divided into fractions. Cattle and large stones are not fully functional media of exchange because of their indivisibility.

Fiat money --- Government and Money

As Tobin's remarks above noted, there is an externality or public good property to the choice of monetary instrument. There is an efficiency gain to being sure that the choice is unique within an economy. Such a formalization of prevailing custom is a traditional function of government, like standardizing the time of day, weights and measures, or rules of the road. Thus in past centuries governments ran mints, standardizing the coinage of precious metals and extracting a fee, *seigniorage*, for the service. The mint serves a significant monetary purpose. By standardizing the coinage, assuring the fineness and weight of the metal, it reduces the transaction costs of dealing in the monetary instrument (as contrasted with weighing and evaluating the metal at each trade).

It is particularly tempting for government to create a fiat money (an unbacked currency decreed by law to be legal tender, money) to be issued by the government. That means after all, that the government has accorded to itself the right to print money, to turn paper into gold. At the least, this means that the government accords itself the right to interest-free borrowing from the public to the extent the public wishes to use currency. Government pays for its purchases with currency and later accepts the currency in payment of taxes. The outstanding stock of currency in the hands of the public at any moment represents the value of purchases by the government that government has not had to pay for by any means other than printing money. Eventually the government must accept the currency in payment of taxes, but until then, it has use of the purchases made earlier while having given nothing of real value in return. The annual *seigniorage* then consists of the interest cost saved by government in its interest free borrowing from the public money-holders who provide real goods and services to the government in exchange for the government's (non-interest bearing) paper promise.

Resource cost of commodity money

For a large portion of recorded history, money has meant commodity money, in recent centuries in the form of gold or silver. Paper money consisted of notes backed by a promise to deliver the monetary commodity. We distinguish commodity money and commodity-backed paper money from a currency without commodity backing. An unbacked currency is known as a *fiat money*.

Money is typically held as an inventory. We hold cash in our wallets; stores hold cash in their tills; households and firms hold balances in checking accounts; banks hold cash in their vaults. Use of a commodity money then implies that the economy will hold large balances of the commodity not for its direct consumption or productive use but rather as the monetary instrument. This inventory of commodity money then constitutes a significant portion of the economy's capital stock, held not for direct production but rather to facilitate the process of trade. A significant resource saving is then possible by substituting paper money for the commodity money. The paper money may consist of banknotes backed by the promise of delivering the monetary commodity on request of the noteholder. This substitution of paper for commodities makes more effective use of the economy's capital. As Adam Smith notes

The substitution of paper in the room of gold and silver money, replaces a very expensive instrument of commerce with one much less costly, and sometimes equally convenient...

When paper is substituted in the room of gold and silver money, the quantity of ...capital ... may be increased by the whole value of gold and silver... The operation...resembles that of the undertaker of some great work, who, in consequence of some improvement in mechanics, takes down his old machinery, and adds the difference between its price and that of the new to his...capital.

The gold and silver money which circulates in any country...is...all dead stock. It is a very valuable part of the capital of the country, which produces nothing to the country. The judicious operations of banking, by substituting paper in the room of a great part of this gold and silver, enable the country to convert a great part of this dead stock into active and productive stock.

Nevertheless, to support a commodity-backed paper currency, a significant quantity of the commodity backing must be maintained in inventory to successfully back the currency.

The next step in economizing on the capital tied up in backing the currency is to use a fiat money. Substituting a government decree for commodity backing frees up a significant fraction of the economy's capital stock for productive use. No longer must the economy hold gold, silver, or other commodities in inventory to back the currency. No longer must additional labor and capital be used to extract them from the earth. Those resources are freed up and a simple virtually costless government decree is substituted for them.

Paradox of positivity of value of fiat money

Fiat money, an easily recognized portable divisible fiduciary instrument with low transaction and inventory costs is an ideal medium of exchange if it has positive equilibrium value. But money is what money does. In order to perform the function of a medium of exchange and store of value, money must have a positive value itself (the prices of goods denominated in money terms must be well defined and finite). A government decree that its notes are 'money' does not however convey any particular value. Worthless paper printed with the name of the government remains worthless paper. Prof. Lerner (1947) notes "a simple declaration that such and such is money will

not do, even if backed by the most convincing constitutional evidence of the state's absolute sovereignty.” Thus, for a fiat money there is always the possibility that it will not be able to serve its function because it may have no value in trade. Equivalently, the price level denominated in fiat money may become infinitely high if participants in the economy are unsure that the currency has a positive value.

Taxation and the value of Fiat money

The same government that issues fiat money typically has the power to ensure its value. As Prof. Lerner reminds us, simply issuing a decree announcing its value is a meaningless gesture. Prices of goods --- and conversely the value of currency --- are determined in the market. But a government with the power to issue currency typically also has the power to tax. It can ensure the value of its currency issue by making it acceptable in payment of taxes due to the state, Li and Wright(1998), Starr(1974). Then says Prof. Lerner (1947),

If the state is willing to accept the proposed money in payment of taxes and other obligations to itself the trick is done. Everyone who has obligations to the state will be willing to accept the pieces of paper with which he can settle the obligations, and all other people will be willing to accept these pieces of paper because they know that the taxpayers, etc., will be willing to accept them in turn.

The recognition that the power to tax is the power to create a fiat currency goes back to classical economics. Adam Smith (1776) writes, "A prince, who should enact that a certain proportion of his taxes be paid in a paper money of a certain kind, might thereby give a certain value to this paper money..."

Fiat Money as ‘Non-interest-bearing debt’

Government-issued fiat money is sometimes described as ‘non-interest-bearing’ government debt³. The government currency issue allows the government to acquire needed goods and services for government operations in exchange for its (non-interest bearing) paper currency. The currency constitutes a promise that it can be exchanged as fulfillment of a tax obligation in the future. This promise constitutes the government’s debt in this transaction. Since the debt instrument is non-interest-bearing, the government is receiving an interest free loan. The value of this foregone interest is known as *seigniorage*, using the same term as the charge that royal mints used to extract for coining precious metals.

Banks and Banking, Monetization of Capital

Money is held as an inventory, as a desired money balance (*encaisse désirée*). This reflects the use of money as a medium of exchange with nonsynchronization in transactions as well as the precautionary demand for money to deal with uncertain events. The most elementary function of banks is to hold those inventories, the desired money balances, for the benefit of their depositors with safety and liquidity. If that were all that

³ There is no reason in principle why currency cannot bear interest, but it is generally regarded as impractical actually to pay interest on currency, simply because of the transaction cost of doing so.

banks did, they would be providing a useful service but would not have the profound influence they actually exert on actual economies.

If banks act only as warehouses for the inventory of money then the money stays in the form in which it was deposited, as gold, silver, cattle, tobacco, or government-issued currency. Specifically, in the last case, government issued currency, if all bank deposits were held by the bank in the form in which they were deposited, two results would follow. First, all of the economy's money supply would represent a non-interest bearing source of government finance. Second, the bank would be following a policy of 100% reserves. There could never occur a 'run' on the bank that would cause it to be unable to meet required withdrawals, to fail.

Modern banks typically follow a fractional reserve policy. They lend out to borrowers a portion of the deposits entrusted to them. The monetary base (the money issued by government) supports a much larger money supply consisting of the currency in the hands of the public plus the deposits of the banking system. Only a fraction of the deposits is backed directly by currency or claims on currency from the government issuer (deposits in the central bank). The bulk of deposits is backed by loans to borrowers, who have used the loans to buy capital. Thus liquid deposits finance illiquid capital. This is sometimes described as the *monetization of capital*. The money supply, instead of supporting only interest-free lending to the government, supports a smaller volume of such lending plus a volume of loans to the private sector.

Fractional reserve banking is sometimes described by saying *the bank borrows short and lends long*. This means that bank deposits (which really are the bank's borrowing from its depositors) are available to depositors immediately on request. The loans that back them have a fixed term and the bank cannot immediately liquidate them. The fractional reserve policy is sustainable for the banks because only a small fraction of deposits is liquidated each day, and they are generally balanced by a similar volume of new deposits. This situation reflects two elements. For every expenditure in the economy there is a receipt. To the extent that both sides of a trade use the banking system, there need be no net change in the level of deposits when money is spent; it merely moves between accounts. In the case of precautionary balances, they behave like insurance: always needed, seldom used. It is rare that liquidation of precautionary balances causes a significant net reduction in bank deposits. To deal with that possibility, a bank will typically hold sufficient currency to provide for withdrawal in excess of usual requirements.

Financial Markets and Financial Intermediaries

Markets for commercial paper (short term business debt), common stock and corporate bonds can perform much the same function that fractional reserve banking does --- they reallocate household money holdings to investment in productive firms. When the resale markets for these assets are very liquid, such assets can provide the same liquidity as bank deposits. Nevertheless, investment in these markets includes the risk of a liquidity crisis and of possible default by a creditor. To the extent that banks insulate their depositors from these risks, in part by expert assessment of credit risks, they perform a distinctive function in financing illiquid capital with liquid liabilities. They can do so in part by internalizing some costs that would otherwise go through the market, in part by taking advantage of the scale economies available to them through substantial

size. One of the advantages of size in banking is the ability predict fairly reliably the level of net liquidations of deposits required. Since there is a large number of depositors, a law of large numbers comes into play. Typically the volume of outgoing withdrawals on any day will be nearly equal to the volume of incoming deposits. Since net withdrawals are small, there is only a small risk that the bank will need to liquidate any significant fraction of its loan (asset) portfolio. The same logic applies to financial markets; desired sales by wealth holders needing cash on each day will typically be nearly matched by desired purchases by wealth holders with excess cash.

Liquid financial markets and financial intermediary institutions (banks and other lenders) providing asset liquidity (the ability to convert fixed assets into current purchasing power) greatly facilitate the investment process. They mean that physically illiquid assets can be turned into consumption as the need arises, thereby reducing the risks investors face in committing wealth to illiquid form. Indeed Sir John Hicks attributes an essential role in the industrial revolution to the financial sector's ability to provide liquidity:

What happened in the Industrial Revolution...is that the range of fixed capital goods that were used in production...began noticeably to increase... But fixed capital is sunk; it is embodied in a particular form, from which it can only gradually ...be released. In order that people should be willing...to sink large amounts of capital it is the availability of liquid funds which is crucial. This condition was satisfied in England...by the first half of the eighteenth century... The liquid asset was there, as it would not have been even a few years earlier.

Thus, the financial revolution (XVIIIth century growth of financial markets and institutions) was a necessary precursor to the industrial revolution. As important as finance was to industry in the XVIIIth century, it is still important today. That banks finance capital with their money deposits means that liquid safe monetary liabilities are financing illiquid physical capital.

This function of banks can be sustained through a law of large numbers. Any single depositor in the bank can withdraw his deposit successfully, inasmuch as his withdrawal is uncorrelated with deposits and withdrawal of others. Similarly, wealth holders can rely on the liquidity of financial markets to allow them to sell their assets for money when the need arises. This observation depends on the independence of the liquidation decisions. If all the bank's depositors seek to withdraw their funds at once, the bank will fail. If all wealth holders seek to liquidate their assets at once, the market will experience a liquidity crisis.

Central Banking

A well managed bank's assets, the loans it makes, will have a small, predictable, and manageable level of default. Part of the bank's job as a lender is to assess these risks and deal with them intelligently. There is however a systemic risk that no fractional reserve bank can deal with successfully on its own: a run on the bank. In the nature of fractional reserve banking, there is always a danger, no matter how remote, of insolvency, that the bank's assets (its cash and loan portfolio) may be insufficient to cover its liabilities (deposits). The difficulty is that to the uninformed depositor, there is no way to distinguish a bank's possible insolvency from illiquidity. The former means

that the bank is essentially bankrupt --- its assets are insufficient to cover its liabilities; the latter merely means that its assets are ample but not in cash form.

Exacerbating possible instability is the competitive timing of depositors concerned about the soundness of the bank that holds their deposits. Whenever a depositor suspects that his bank is unsound, the best policy for him is to withdraw his deposits. Even if there is insufficient cash in the bank to honor all its deposits, the first of its depositors to ask for a withdrawal will get his money. This is a prescription for a banking panic. Just as the first one to get to the exit in a fire will survive, the first to withdraw his money in a bank failure will come out whole. The suspicion of possible failure of a bank is like the cry of 'fire' in a crowded theater. Everyone rushes for the teller's window at the bank just as all the theatergoers rush for the door. This setting creates an unnecessary and destructive instability in the financial system, as the flow of credit can be disrupted unpredictably by fears of illiquidity.

There are two principal responses to this concern: laissez faire and central banking. The laissez faire view is that a bank is like any other business subject to competition. Customers must assess the quality and safety of the service provided and make their choice. Competition among banks will assure that poorly managed banks, those that cannot maintain desired liquidity will be weeded out by competition. Depositors will understand that making a deposit is a risky proposition and that part of their duty as depositors is intelligently to assess that risk.

The central banking view, on the contrary, is that the risk of bank runs is a systemic risk to the financial system. A run on one bank can create a banking panic leading to runs on others. No fractional reserve banking system, no matter how well managed, could systematically cope with this instability. Therefore a central bank is needed, a bank that can make loans to other banks to cover their short term need for liquidity. The way to stop a bank run is to throw money at it. Once all depositors recognize that their deposits are safe, they will no longer wish to withdraw their funds. The bank run can be stopped before it starts by creating a central bank, an institution strong enough to deal decisively with a bank run. This lending function of the central bank is known as acting as a 'lender of last resort,' being the final guarantor of the liquidity of deposits at individual banks.

Prior to the general availability of government-sponsored central banks such as the Bank of England or the Federal Reserve System, groups of individual commercial banks could co-operate to forestall bank runs and bank failures. The most fully institutionalized form of co-operation was branch banking, a single bank with many branch offices. A run at any single branch would then be met with funding from all of the branches. The run would never have time to turn into a panic. Alternatively, many smaller local banks would routinely co-operate in check clearing associations. When one of their number faced a run, they could choose whether to support it for the common good. Since these arrangements were ad hoc, they were unreliable, but often avoided destructive banking panics. Government-sponsored central banks have a great advantage over clearing associations and branch banking in dealing with a liquidity crisis. The central bank can print currency; it can provide liquidity without limit. A policy of uncontrolled monetary expansion might of course appear to be an irresponsible encouragement to inflation. However, so long as central bank policy in a liquidity crisis represents an accommodation to a shift in wealth-holder preferences, substituting safe

currency for demand deposits subject to possible default, central bank provision of liquidity during a liquidity crisis need imply no significant monetary expansion or risk of inflation. The risks are much more on the other side; failure to accommodate demands for liquidity raises the liquidity premium on debt instruments causing deflation and a contraction in lending, allowing a liquidity crisis to lead to a business recession.

Conclusion

Money, the money market (trade in debt and financial instruments), and financial institutions (banks, insurance companies, other financial intermediaries) all serve to separate, to make independent and decentralized, a complex of interdependent transactions. By decentralizing arrangements, separating linkages among related actions, money and finance simplify them and allow them to be successfully and independently pursued.

The concept of decentralization is familiar in many economic contexts. Markets and the price system are said to decentralize consumption and production decisions. The quantity of a good produced will typically be equivalent to the amount consumed; they are strongly interdependent. Do the producers and consumers then have to consult with one another to determine the appropriate quantity? In a market economy the answer is 'no.' They merely consult the market price, which adjusts to bring production and consumption into balance. The price system decentralizes allocation decisions in a market economy. Money and the financial system similarly allow decentralization of the transactions, exchange, saving and investment process.

Money decentralizes the process of exchange. The worker wants to trade his labor for food. Finding a precisely matching trade --- a farmer or butcher who wants labor or a merchant specializing in the trade of food for labor and labor for food --- may be difficult and costly. Separating these linked transactions into two apparently independent trades --- labor for money, money for food --- significantly reduces the complexity, co-ordination, and transaction costs required to implement the trade.

Money decentralizes the process of saving and investment. The saver wants to forego current consumption in exchange for future consumption. Direct trade of current income for contracts for future consumption is complicated, costly, and may be costly to reverse if unforeseen events occur. Money and finance provide a simple alternative. Save in money terms, either in debt instruments or through a financial institution; convert the savings to cash when consumption is desired and spend the cash.

The economy's savings necessarily go into investment. Absent money and financial institutions, the individual saver would have to choose and manage the investment himself (either in the form of actual ownership of the capital or by direct ownership of a share in the firm undertaking the investment). In a monetary economy, the saving and investment decision can be separated. The saver holds merely a claim on money in the future. The investor borrows the money (either directly or from a financial intermediary) and undertakes to repay it. The saving and investment decision --- necessarily linked for the economy as a whole --- are made separate and independent for the individual decisionmaker by the buffer, the decoupler, provided by money and financial institutions.

Money and finance allow necessarily interdependent decisions to be made independently, co-ordinated by money, prices, and yields. Money allows successful decentralization of the process of exchange. Money, financial instruments and financial institutions allow successful decentralization of the process of saving and investment. Decentralization of the exchange, saving and investment process by money and financial institutions simplifies and facilitates exchange and investment in a market economy, leading to economically efficient resource allocation.

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