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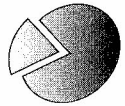
Money Issue by Unrestricted Banks



Chapter 2 examined how a gold standard determines the quantity of monetary gold and the purchasing power of the monetary unit. In a world where all money consisted of full-bodied gold coin, such a theory of the supply and demand for monetary gold would be enough to explain the quantity of money in general. In a sophisticated and freely evolved monetary system (as described in chapter 1), however, the public can be expected to use bank-issued money in the form of redeemable currency and transferable deposits, rather than full-bodied coin, for most payments. This chapter therefore examines how the value and quantity of bank-issued money are determined under free competition. In particular, if banks are subject to no legal ceiling on currency issues, or floor on reserve ratios, what economic forces, if any, compel banks to limit their issues and to hold positive reserves?

Historically, such questions arose where "free banking" was debated as an alternative to "central banking".[1] "Free banking" in that context meant a regime in which private banks could competitively issue paper currency notes (and transferable deposits, but the debates focused on note-issue), without significant legal restrictions, rather than a state-sponsored institution (the central bank) having a monopoly on the issue of notes. Today, the same questions arise where commercial banks, and other firms, are poised to re-enter the currency market by offering "cash cards," "pre-paid cards," or "smart cards." Like banknotes, the balances on these cards are (at least under some technologies) anonymously transferable bearer claims on

[1] Smith (1990) provides a classic survey of these debates in several nations. On the British debates, see White (1995).

banks, and can circulate from bearer to bearer without bank involvement. The claims are carried not as ink engraved on paper but as digital information encoded on a readable and writable microchip within a credit-card-sized piece of plastic. We explore, in this chapter, how a competitive issuing system – using paper or chip media – would work. We will use the term "currency" to refer both to traditional banknotes and circulating smart-card balances.

In the historical debates, given the evolved institutional setting, theorists assumed that bank-issued currency would be redeemable for full-bodied gold or silver coin (specie). Here, to be more general, it is convenient to speak of the medium of redemption as "reserves." Today, it is clear that a specie standard is not logically required for competitive currency issue, or even for the absence of a central bank. Allowing competing banks to issue currency does not, by itself, select any particular monetary standard. Competitive currency issue is possible under a fiat standard, with fiat money (residing in bank vaults, or on the balance sheet of the central bank if it remains open) serving as the unit of account and medium of redemption.[2] We briefly discuss below the determination of the purchasing power of money in such a system, but a fuller discussion of fiat money is left for chapter 5.

Other possible regimes for competitive money issue by unrestricted banks include a system with indirect redemption and a multi-commodity unit of account, and a system of competing *private* fiat-type (irredeemable) monies; see Selgin and White (1994a). We defer discussion of these possibilities to the last two chapters of this book.

We assume, based on historical experience, that a banking system with free entry would support active competition among a plurality of issuing banks. There is no apparent natural monopoly in the market for bank-issued money. Consistent with the limiting case of perfect competition, we treat each bank as a price-taker in deposit and loan markets. For reasons argued in chapter 1, we assume that all bank currencies and deposit transfers are accepted at par.

The Purchasing Power of Money

If we assume that bank-issued money is redeemable for full-bodied gold coin, so that gold is the basic money that both defines the medium of account and serves as the medium of redemption, the purchasing power of money is the purchasing power of gold (ppg). The supply and demand for gold determine the ppg, as analyzed in chapter 2. The monetary stock demand for gold is the sum of the banks' demand for reserves and, if bank-issued money has not completely displaced their use, the public's demand for full-bodied coins. The demand for bank reserves, in the absence of reserve requirements, derives from each bank solving a reserve-holding optimization problem we examine below.

[2] Friedman (1987) and Selgin (1988) suggest that the quantity of fiat central bank liabilities be frozen. Retiring the central bank from monetary policy in this way, or any other way, and retiring it from currency issue, are distinct propositions.

Chapter 2 analyzed the determination of the purchasing power of gold for a closed economy, the world as a whole. Here, it is convenient to treat the banking system as an open economy that is such a small subset of the international gold standard that its fraction of global demand for gold is negligible. The banking system then faces a flat long-run stock supply curve for gold, and the ppg is exogenous in the long run, given to the system as the ppg determined on the world market. In the event of a local money supply or demand shock, the stock quantities supplied and demanded for gold, G_m^s and G_m^d, are brought back into long-run equilibrium. Equilibration occurs not by accumulations or decumulations of coin that involve the mining industry, and may take decades, but by international flows of gold that operate much more quickly.

David Hume's (1970) classic treatment of the equilibrating process – the "price-specie-flow mechanism" – assumed that the flows are not instantaneous, in which case the short-run supply curve is still upward sloping. If the flows are instantaneous, then the short-run curve collapses into the long-run curve. In either case, the banking system's stock of monetary gold is endogenous. In long-run equilibrium, with the ppg identical everywhere, the ith country's share of the world gold stock (G_i / G_w) corresponds to that country's share of world gold-holding demand:

$$\frac{G_i}{G_w} = \frac{G_i^d}{G_w^d}$$

at the equilibrium ppg, because in equilibrium $G_i = G_i^d$ and $G_w = G_w^d$.

In a closed economy, such as a gold-based global banking system or a frozen-fiat-base national system, by contrast, the purchasing power of money (ppm) cannot be taken as exogenous, but is determined by the interaction of the supply of reserve money and the demand for bank reserves. The ppm will respond to shifts in the demand for bank reserves. *Ceteris paribus*, greater economization of bank reserves (due to technological advance in clearing) will lower the ppm. In a system with fiat base money, complete economization of non-interest-bearing bank reserves would make the demand for fiat base money vanish, and with it any positive ppm. This limiting case is not a problem in a gold standard, because the ppg would still be positive due to non-monetary demand. In what follows, we consider both the open and closed economy cases.

Bank Optimization and the Equilibrium Quantity of Bank-issued Money

To capture the essential tradeoffs facing an issuing bank, we consider the simplified balance sheet shown in Table 3.1.

Table 3.1 A simplified balance sheet

Assets	Liabilities + Equity
R reserves	N notes or currency-card balances in circulation
L loans and securities	D deposits
	K equity capital

These balance sheet items are choice variables for the bank, which seeks the optimal total size and mix on each side of the balance sheet. To simplify, we assume K is given parametrically.[3] With K fixed, the balance sheet identity imposes the constraint

$$R + L = N + D + K$$

The objective function to be maximized is the profit function, given by

$$\pi = i_L L - i_D D - C - Q$$

where

π = expected profit
i_L = interest yield on loans and securities
i_D = interest rate on deposits
C = operating cost
Q = liquidity cost (see below).

We assume that i_L and i_D are not choice variables but given (the bank is a price-taker in loan and deposit markets). Operating costs are a continuous (and positive) function of each of the balance sheet items:

$$C = f(R, L, N, D);\ C_R > 0,\ C_L > 0,\ C_N > 0,\ C_D > 0$$

[3] In a more general treatment, K would be determined endogenously by maximizing the rate of return on equity, adjusted by insolvency risk (Baltensperger 1972).

where C_R is the marginal cost of holding greater reserves, and so on.

The bank's incentive to hold adequate reserves is to enhance its profit by reducing its liquidity cost, Q, which is the expected value of costs incurred in the event the bank runs out of reserves. The value of Q is found by multiplying the cost of reserves going negative by a certain amount by the probability of that happening, for each possible amount, and summing up all the products.[4] Graphically, the probability of illiquidity (negative reserves) is shown in figure 3.1 as the shaded area of the probability distribution. The cost of negative reserves may be a legal penalty, a penalty imposed by the clearinghouse which has to cover the shortfall, or the bank's cost of scrambling to liquidate assets on short notice to cover its position. The bank's choices of its reserve level R, and its currency and deposit circulation volumes N and D, depend on how the choices of N, D, and R influence Q. It is natural to assume that $Q_N > 0$ and likewise $Q_D > 0$. Having a greater volume of either currency or deposits in circulation increases the volume of claims against the bank that might be redeemed and thus naturally increases the probability of adverse clearings large enough to deplete reserves. Holding a larger reserve clearly reduces the probability of reserve depletion, so $Q_R < 0$.

Static profit maximization implies a set of six equi-marginal conditions:[5]

[4] More formally, we can assume a continuous probability density function for reserve losses, and integrate over the left tail for reserve losses greater than initial reserves. The liquidity cost function may be written

$$Q = p(X - R)\ \phi(X|\ N, D)\ dX$$

where

X = outflow of reserves
$\phi(X \mid N, D)$ = probability density function over X, conditional on N and D
p = penalty cost as a percentage of of realized illiquidity, $p = 0$ for $X - R\ 0$, $p >$ 0 for $X - R > 0$.

Note that to motivate the holding of positive reserves, when the cost of a reserve shortfall is thus proportional to the size of the shortfall, and the mean of ϕ is zero (so that the probability of an adverse clearing is .5), the penalty cost p must exceed twice the opportunity cost of holding reserves.

[5] Formally, to derive the first-order conditions for profit maximization we write out the Langragean

$$\pi(R, L, N, D) = i_L L - i_D D - C - Q + \lambda\ (K - R - L + N + D)$$

from which we derive the first-order conditions

$\pi_R = -C_R - Q_R - \lambda = 0$
$\pi_L = i_L - C_L - \lambda = 0$ (we assume $Q_L = 0$)
$\pi_N = -C_N - Q_N + \lambda = 0$
$\pi_D = -i_D - C_D - Q_D + \lambda = 0.$

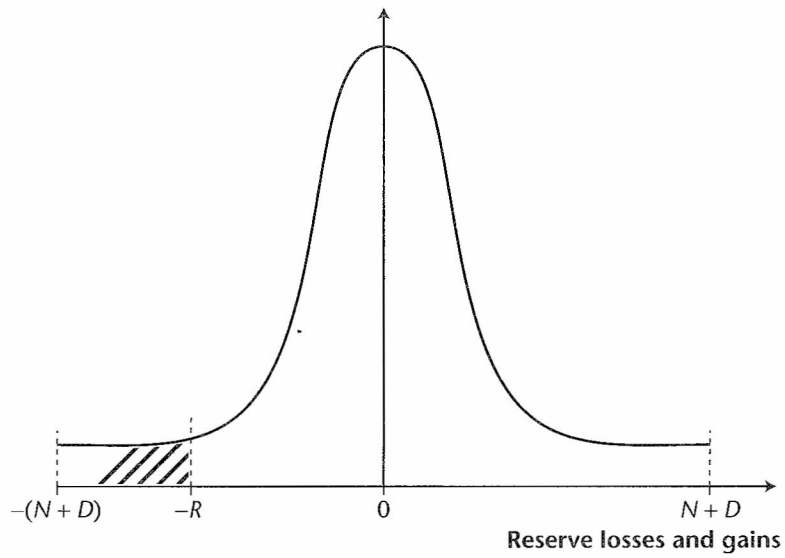


Figure 3.1 The probability of illiquidity: probability of reserve losses exceed starting reserves is represented by the shaded area to the left of $-R$ (area under the curve = 1)

$$i_L - C_L = -C_R - Q_R \tag{3.1}$$

The left-hand side of the equation is the marginal net revenue from making loans or holding securities (their interest yield minus the marginal operating costs of making loans). The right-hand side is the marginal net benefit from holding reserves (the reduction in liquidity cost minus the marginal operating costs of reserve holding). The profit-maximizing bank must be indifferent at the margin between holding extra loans or securities and holding extra reserves of the same market value, because it can trade one for the other.

$$i_L - C_L = C_N + Q_N \tag{3.2}$$

The marginal net revenue from making loans equals the marginal cost of maintaining currency in circulation, which is the sum of the marginal operating cost and marginal liquidity cost of currency circulation. An economic limit to the bank's extending loans or purchasing securities with its currency is set by the rising marginal costs associated with keeping a growing volume of currency outstanding.

$$i_L - C_L = i_D + C_D + Q_D \tag{3.3}$$

The marginal net revenue from making loans is equal to the total marginal cost of maintaining and servicing deposits, which includes interest payments, marginal operating cost, and marginal liquidity cost. The rising marginal cost of acquiring funds via deposits sets a limit to the amount of loans purchases profitably funded that way.

$$-C_R - Q_R = C_N + Q_N \tag{3.4}$$

$$-C_R - Q_R = i_D + C_D + Q_D \tag{3.5}$$

Equation (3.4), which is implied by equations (3.1) and (3.2), says that the bank's marginal net benefit from holding reserves is equal to the total marginal cost of maintaining currency in circulation. The rising marginal cost of maintaining currency in circulation limits the extent to which the bank can profitably increase its reserve holdings by issuing currency. A bank cannot just print up currency to buy reserves without limit, because it has to keep the currency in circulation. The costs of keeping currency in circulation are discussed in more detail below. Equation (3.5), which is implied by equations (3.1) and (3.3), similarly says that the marginal net benefit from holding reserves is equal to the total marginal cost of maintaining deposits. The rising marginal cost of expanding the deposit base limits the profitability of acquiring reserves by attracting additional deposits.

$$C_N + Q_N = i_D + C_D + Q_D \tag{3.6}$$

Finally, the marginal cost of expanding the currency circulation (in order to enlarge the bank's assets) is equal to the marginal cost of expanding the bank's deposit base. At the margin, the two sources of funds are equally costly in profit-maximizing equilibrium; otherwise, it would pay the bank to rely more heavily on the lower-cost source, and less heavily on the other.

From the equi-marginal conditions, we see that the desired currency circulation for an issuing bank is limited by the rising marginal cost of keeping currency in circulation. While it is cheap to print up notes, or load smart cards with digital balances, and to put them into circulation, a bank can use currency issue to expand its portfolio of earning assets only if the currency *stays* in circulation. To keep a volume of redeemable currency in circulation in a competitive environment, the issuing bank must have a clientele which in the aggregate will *hold* that currency, rather than exercise the option to redeem it for reserves or exchange it for deposits or the currency of another bank. Given a rising marginal cost of cultivating such a clientele, legally unrestricted currency-issuers will not issue without limit nor earn unlimited profits.

The costs of cultivating a larger clientele for a particular bank's brand of currency include the costs of

1 enhancing its spendability by recruiting more retailers to accept the brand;
2 making redemption easier by opening more branch offices, hiring more tellers, staying open more hours;
3 boosting public awareness of, and confidence in, the brand through advertising;
4 reducing the public's risk of holding the brand by anti-counterfeiting measures; and
5 making the currency devices (notes or cards) more physically attractive.

These forms of non-price competition are similar to the forms used in competition for checking account customers. Historical experience suggests that currency competition took place *exclusively* along non-price dimensions because there was no cost-effective means to pay interest on paper currency. In chapter 6, we will discuss whether an exclusive focus on non-price competition is consistent with efficiency, or is instead wasteful. In chapter 14, we will discuss the view of the "legal restrictions theory" that all currency should be expected to bear interest under laissez faire.

Correcting Over-issue by an Individual Bank

For any particular bank, there is an equilibrium size of its currency circulation that satisfies the above equi-marginal conditions. (The same is true for its deposits, but, for convenience, we focus on currency.) This size is the value of the public's desired holdings of currency issued by bank i, given the bank's optimizing expenditures on non-price competition (which we categorize as operating costs). We denote this value N_p^{i*}, where the subscript p indicates the public for whom the currency is an asset, the superscript i denotes the issuing bank for whom it is a liability, and * means that it is a desired value. What happens if the bank's actual circulation exceeds the desired level, $N_p^i > N_p^{i*}$? Nineteenth-century writers, in their various attempts to answer this question, spoke of the return of excess currency to the over-issuing bank as a process of "reflux".[6] (They paid more attention to the potential for over-issue than to under-issue, presumably because the incentive not to under-issue is more obvious.) We aim to explain here how N_p^i converges on

[6] John Fullarton's (1845) "law of the reflux" is probably the most famous attempt. Unfortunately, it is not the most cogent. For a critique, see White (1995, pp. 127–8).

N_p^{i*} as the public adjusts toward its desired portfolio of assets.

Suppose that excess currency is introduced by means of loans. The borrowers spend the currency. The recipients of the spending now have balances of bank i currency in excess of their desired levels. A recipient individual q for whom $N_q^i > N_q^{i*}$ can respond in any of three ways. *Direct redemption* for reserves at the issuer's counter is the least likely way, especially in a mature system where little or no reserve money is held by the public, but it clearly would directly reduce N^i and simultaneously reduce the bank's reserves R_i. *Deposit of the excess currency* into another bank (the bank where q keeps his demand deposit account) is presumably more common. It brings the currency-exchange mechanism into play, generating adverse clearings for the over-issuer as the recipient bank presents the deposited currency claims for redemption at the clearinghouse. Settling the clearing balances entails a loss of reserves R_i just as direct redemption does. The volume of currency in circulation N^i is reduced by the return of the excess currency to bank i, unless the bank immediately re-issues it. However, the reserve loss signals to bank i that reissuing the currency would lead to further hemorrhaging of reserves, so it should accept the reduction in its circulation. Deposit of the excess currency into bank i itself, an event that is less likely the smaller is bank i's share of the deposit market, does not generate adverse clearings. However, it does mean a higher marginal interest cost of liabilities, and a higher liquidity cost, than before the expansion. An issuer that was maximizing profit before will thus find the expansion now unprofitable.[7] *Spending* the excess currency transfers the excess to a new individual who also has the same three options. With some probability, this new individual will directly redeem or deposit the currency, leading again (with a slightly longer lag) to a reserve loss for bank i and a contraction of N^i.

As a consequence of reserve losses, bank i finds its reserves lower than it desires ($R_i < R_i^*$). The marginal net benefit of holding reserves now exceeds the marginal net revenue from making loans or holding securities, prompting the bank to sell securities (or not roll over maturing loans) in order to increase its reserves. Reserves return to bank i from the rest of the banking system.

Correcting Over-issue by the System as a Whole

If there is some spending and respending of excess currency, might this not have system-wide or macroeconomic effects? In a price-specie-flow model,

[7] Glasner (1997, p. 22) emphasizes the role played in Fullarton's (1845, pp. 92–93) theory of the reflux by the public's conversion of unwanted currency into interest-bearing deposits. Fullarton did not, however, lay much stress on the adverse clearings that result when notes issued by bank i are deposited into bank j.

the answer is yes. The effects presumably vary in magnitude with the size of the overissue, and the length of time before it is corrected.

There are two routes for the transmission of the overissue into system-wide reserve losses (traditionally known as an "external drain"). The *direct* effect is that some of the extra spending, prompted by the excess stock of currency, will be on imports. The imports will be paid for (the trade deficit settled) by exporting specie, which comes out of bank reserves. The *indirect* effect operates via the domestic price level. If the domestic and world ppm can temporarily diverge, and if all currency brands continue to trade at par, then the extra spending on domestic goods raises prices and reduces the domestic purchasing power of money generally, not just the value of the currency brand overissued. Exports will be depressed and imports stimulated by the high price of domestic goods. Again, the resulting balance of payments deficit will be settled by exporting reserve money from bank vaults. The outflow of reserves is driven by, but also corrects, the excess supply of money and the price level divergence, returning the domestic price level to equality with the world price level. The direct effect impinges only on the over-issuing bank, as only its currency is in excess supply. The indirect effect, acting through the price level, draws reserves from all banks, not just the over-issuer, and thus raises the possibility of that innocent banks may suffer reserve losses. Simultaneously, however, the innocent banks are enjoying positive clearings as the domestically spent excess currency is received and deposited by their customers.

Where the overissuing bank is small, the price level effect, and thus indirectly prompted spending on imports, will be small relative to the adverse clearings resulting from interbank deposits and directly prompted import spending, so that the effects of over-issue will not be significantly shifted onto other banks.[8] The larger the overissue as a percentage of domestic currency, the greater will be the adjustment through external drain rather than adverse clearing. The size of the overissue is the product of the percentage of overissue by bank i times bank i's initial share of total circulation. For example, if a bank that has 10 percent of the total circulation overissues by 20 percent, then the aggregate overissue is only 2 percent of the total currency circulation. Because plurality in currency issue reduces any one issuer's share of the circulation, it limits the danger of a large-scale overissue. Provided that banks act independently (do not expand in concert), random money-supply errors will tend to offset one another in the aggregate. When a single issuer has a 100 percent share of the circulation,

[8] If international goods arbitrage is so strong that domestic prices cannot rise relative to world prices, even in the short run, then the indirect spending effect is completely absent, and the spillover effect on other banks is zero.

on the other hand, the likelihood of a random large-scale overissue is greatest.

A currency monopolist's overissue, or an error by plural issuers hypothetically acting in concert, will not be corrected in the usual way by domestic adverse clearings. In an open economy – i.e. where the banks acting in concert are a subset of the entire world's banks – it will be corrected by external drain.[9]

But what if, going beyond the open-economy assumption, *all* the banks in the world over-issue? In this limiting case, which is of more theoretical interest than practical relevance, neither interbank adverse clearings in the usual fashion, nor external drain, limit the expansion. That is, there is no *systematic* tendency for any bank or set of banks to lose reserves to another set. Stochastic reserve losses, however, do remain a concern for every bank. Each bank continues to have a determinate demand for reserves related to the threat of reserve depletion arising from random adverse clearings. As George Selgin (1988) has shown, the desire to maintain a certain level of safety against reserve depletion thus establishes a definite limit to bank expansion. An in-concert expansion will increase the threat to every bank by increasing the volume of payments made in its liabilities. (We hold constant the banks' real expenditures on non-price competition, and, so, the public's demand to hold bank liabilities relative to its spending.) The mean of net clearings (the mean of the $\phi(X|\, N, D)$ distribution mentioned in footnote 4 above) can remain zero for each bank. Yet the risk of reserve depletion increases because the increase in *gross* clearings widens the reserve-loss probability distribution and thus enlarges the area of the left tail beyond any given level of reserves. (See figure 3.2.) Each bank will feel its risk of running out of reserves too great. Because the closed system has a limited quantity of total reserves available, relief from the excess demand for reserves requires the banks to contract their liabilities (N and/or D) in order to re-establish their desired levels of illiquidity risk. Given the marginal cost functions the individual banks face for expanding mean demand to hold their liabilities, the volume of system reserves, the stochastic process generating adverse clearings, and the level of safety each bank desires against reserve depletion, there exists a unique equilibrium volume of system liabilities. Beginning from such an equilibrium, with no change in any of these

[9] This point is sometimes considered an objection to competitive currency issue, because it indicates that the domestic adverse clearing mechanism *as such* is not enough to pin down the system as a whole. It is hardly a point in favor of monopoly currency issue, however, to argue that, in the limiting case of in-concert over-expansion, a system of plural issuers is no more constrained by adverse clearings than is a single issuer. (We will see below that this argument is not even correct.) It provides no reason to believe that a single issuer is constrained more effectively.

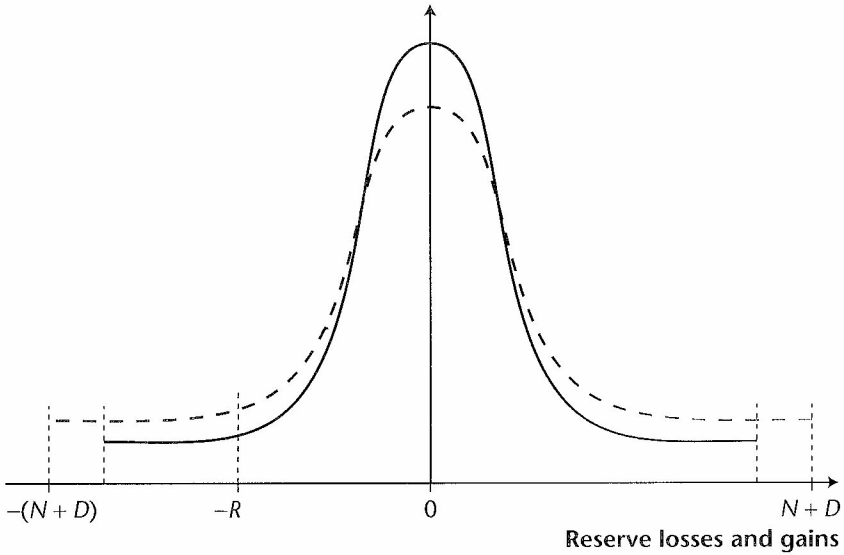


Figure 3.2 An in-concert expansion by all banks broadens the probability distribution over reserve losses and, thereby, increases a representative bank's probability of illiquidity with a given level of starting reserves

fundamentals, an in-concert expansion is inconsistent with sustaining an equilibrium in which all banks are optimizing.[10]

Responding to Shifts in Demand

An overissue need not come about because a bank has increased the supply of its liabilities. It can equally well come about as a result of a drop in

[10] Suppose, for the sake of argument, that as the proponents of in-concert-expansion scenarios sometimes suggest, any aggregate volume of bank liabilities is potentially an equilibrium, provided only that the movement to it is concerted among the banks. (We hold constant the banks' expenditures on demand-enhancing non-price competition.) By implication, a continuum of reserve ratios are consistent with equilibrium. If so, why couldn't the banks acting in concert, holding their liabilities constant, equally well reduce the quantity of reserves they hold to an arbitrarily low figure? If there is a unique optimizing volume of reserves for a bank, given its mean liability volume and the distribution of clearing gains and losses around that mean, then there is an optimizing volume of liabilities, given that distribution and the bank's reserves. If arbitrary in-concert reserve reduction is non-optimizing, so too is arbitary in-concert liability expansion.

demand. Beginning with a drop in demand, the same processes discussed above come into motion to correct the excess of liabilities in circulation.

Now consider the opposite case of an individual bank i experiencing a rise in demand to hold its currency (for simplicity we will continue to speak in terms of currency, but the analysis again applies equally to deposits). An increase in the demand to hold bank i's currency, unmatched by an increase in the supply, creates the reverse of an overexpansion. The actual circulation *falls short* of the desired circulation:

$$N_p^i < N_p^{i*}$$

A simple (and unrealistic) way to see that the bank's profit motive compels it to remedy the under-issue is to imagine that customers come to the bank to borrow the precise quantity of additional currency they wish to hold, and credibly promise to keep their currency balances permanently higher.[11] Making the loans increases N and L on bank i's balance sheet, increasing the bank's marginal revenue ($i_L - C_L$) more than its marginal cost ($C_N + Q_N$). By hypothesis, the demand to hold i-currency has risen without additional selling costs by bank i, so its marginal operating cost (C_N) is no higher, and because the currency will not be spent the marginal liquidity cost (Q_N) is likewise no higher than before, despite the larger volume.

In a more realistic scenario, the bank customers, whose demand for i-currency has risen, hold on to more i-currency instead of spending it. Less i-currency enters the clearing system, and bank i enjoys positive clearings. As a result, bank i finds its reserves greater than desired ($R_i > R_i^*$), and is prompted by the profit motive to expand its loans and securities holdings, increasing its interest income and ridding itself of undesired reserves. In the new equilibrium reserves R_i are returned to (or nearly to) their old level, with a larger volume of i-currency in circulation and a larger portfolio of earning assets. In this way, the supply of money by an individual bank is *demand-elastic*: bank i finds it profitable to respond to a rise in N_p^{i*} by raising N_p^i, and the reverse for a fall.

Now consider a *general* rise in the public's desired holdings of currency (across all brands). A simultaneous rise in demand for several banks – which might be due to a general rise in an economy's real income – creates the reverse of an in-concert over-issue. We can again imagine a simple and unrealistic scenario, in this case *all* banks facing customers who apply to borrow more currency, and promise to hold larger average currency

[11] An individual's currency balances are, of course, an inventory that fluctuates. "Holding additional currency" or "keeping currency balances higher" means holding a larger inventory *on average* over time.

balances permanently. Although no bank systematically gains reserves, each bank can safely and profitably expand: because the public is not spending more, but only *holding* more of its currency, its risk of reserve depletion is no greater despite its lower reserve ratio. In the more realistic scenario, customers seek to accumulate a greater stock of currency in proportion to their spending by temporarily spending less or trying to earn more. Spending flows fall relative to the stocks of bank-issued money and reserves. Again, in contrast to the single-bank case, no bank enjoys systematically positive clearings from the others.

In the open-economy case, the banks do enjoy net positive clearings against the rest of the banks in the world. As net spending on imports is curtailed by the public's attempt to build up its money balances, reserves flow in from abroad to settle the balance of payments. The banks thereby gain additional reserves.

In the closed-economy case, a *general* rise in the public's desired holdings of currency, shared by *all* the banks in the world, creates the reverse of a global in-concert over-issue. The banks' reserves are made more than sufficient by the reduction in liquidity costs from reduced spending per unit of currency. The reduction in *gross* clearings reduces desired reserves R_i* by reducing the chance of reserve depletion for any given starting level of reserves. In response, the banking system will expand its liabilities, raising banks' desired reserves, until desired reserves again match the given stock of reserves. In these ways, the supply of money by *the banking system as a whole* is demand-elastic: the banks as a group find it profitable to respond to a general rise in N_p* by raising N_p.

In the new equilibrium, real intermediation through the banking system has increased: the banking system has a larger volume of currency liabilities and a larger portfolio of assets. This indicates that the voluntary holding of bank-issued money is one component of the supply of loanable funds. To hold a bank's currency or deposit liabilities is to lend it funds which it can then intermediate (re-lend). Whether an increase in the holding of bank-issued currency is associated with a *net* increase in the supply of loanable funds depends on whether it is matched by a fall in the public's savings in other forms. The spending that the public sacrifices to build up its money balances need not be consumption spending; it might, instead, be spending on acquisition of alternative financial assets.

A general *fall* in the demand to hold currency or deposits sets in motion the adjustments to an overissue, which correspond to the adjustments just described but take the opposite signs. Spending rises relative to the stock of bank-issued money, as holders try to spend off excess balances. In an open economy, reserves are lost to the rest of the world via the price-specie-flow mechanism, and the money stock declines. In a closed economy, the probability of reserve depletion increases, and the volume of desired reserves

R_b* rises above the given stock of available reserves. The volume of currency and deposits must fall to restore reserve-holding equilibrium.

The demand-elasticity of the currency supply N_p in a closed economy can be described another way: a fall or rise in the "velocity" of bank-issued money leads to an offsetting change in the stock of bank-issued money by changing the money multiplier. A rise in the demand to hold bank-issued money relative to spending implies a fall in velocity (the ratio of spending to money balances). By reducing spending flows, and thus the "turnover" of bank-issued money, the shift reduces the probability of large adverse clearings. Liquidity cost thus falls, and the banks can safely keep more liabilities in circulation, and correspondingly can make more loans. The rise in its liabilities ($N + D$) restores equilibrium by pushing back up the marginal benefit of holding reserves (Q_R) for the representative bank.

The supply of bank-issued money is thus endogenous even in a closed economy, in contrast with the usual thought experiments involving fiat money. Holding real income constant, a 10 percent rise in the demand for (fall in the velocity of) bank-issued money, unlike a similar rise in the demand for fiat money, is *not* equilibrated by a 10 percent fall in the price level P. If P were to fall 10 percent, nominal income and spending would also fall 10 percent, rendering the unchanged nominal stock of reserves R_b excessive, prompting banks to expand.

Because M moves to offset changes in V in the closed-economy case, the system acts automatically to stabilize MV, nominal aggregate demand for goods, or Py, nominal income (Selgin 1994b).[12] A number of monetary theorists have argued that nominal income stabilization has desirable macroeconomic properties, and have advocated that central banks should pursue it as a policy. Our analysis, here, suggests that a competitive issuing system tends to stabilize nominal income automatically in the face of velocity shocks.

Shifts between Deposits and Currency

Where a competitive bank issues both deposits and currency as liabilities, the bank can meet shifts by the public from deposits into currency, or vice versa, with a simple change in the liability mix. The change has no impact on the actual stock of the bank reserves, R_i. If marginal liquidity costs are

[12] The equivalence of MV stabilization to Py stabilization follows from the income version of the equation of exchange, $MV = Py$, so far as changes in income velocity match changes in total transactions velocity. The turnover of its liabilities a bank must worry about is not only from spending on final goods and services, but from all transactions. Thus, the theory really applies better to transactions velocity, and indicates a stabilization not of nominal income (Py or nominal GDP) but of total nominal transactions volume (PT).

equal for the two liabilities, $Q_N = Q_D$, then the change in the liability mix does not affect the bank's desired reserves, R_i^*, either.[13] The bank remains at its reserve-holding optimum, and has no reason to change total quantity of its liabilities. Shifts between currency and deposits thus have no impact on the quantity of money.

In contrast, in a system where the public holds "high-powered" currency that banks also use as reserves, a shift from deposits to currency draws reserves out of the banks, prompting a multiple contraction of the money stock. Contractions of this sort were historically a problem in the banking panics of the late 1800s in the USA. When the public wanted to switch at the margin from deposits to currency, e.g. to pay farmworkers during "crop-moving" season, banks were prevented by the National Banking laws from issuing more notes; for more details, see chapter 4. The banks could offer depositors only reserve currency (specie or greenbacks). A shift toward currency thus led to a liquidity crisis and monetary contraction as banks' reserves were depleted. Where banks can issue currency on the same basis as deposits, a multiple contraction can happen only if the public desires to hold more reserve money in particular rather than currency in general, which was not the case in these historical panics. In a fiat money system, where the public's currency is (as today) a liability of the central bank that also serves as bank reserves, changes in the currency–deposit ratio will (ceteris paribus) alter the money stock. To prevent such alterations, the central bank must expand, or contract, the monetary base in timely fashion, and in the right magnitude. Its monopoly of currency issue thus makes the central bank's job more difficult. A return to competitive currency issue would simplify the conduct of monetary policy (Selgin 1997a).

Questions

1 Assume that Georgia is one state within a larger dollar-standard continent, banks are state-specific, and dollar-denominated currency is entirely bank-issued. If all the banks in Georgia were to overissue currency in concert, what, if anything, returns the system to its initial equilibrium?

2 Nineteenth-century "free banking school" authors, like Henry Parnell, concluded that over-issues of money are likely to be more serious under central banking (a single currency issuer) than under free banking (competitive currency issue). What case might they have made?

3 Discussing the competitive issue of redeemable currency, Kevin Dowd (1988) writes: "A bank can put as many notes into circulation as it likes, but the public will determine how many of them actually stay there." Assuming that the public commonly accepts payment in Bank *X*'s notes, is Dowd correct? Does anything actually limit the willingness of the public to hold more Bank *X* notes?

4 In the absence of government guarantees, Morris J. Markowitz (1993, p. 76) writes, notes issued by fractional-reserve banks would take the form of interest-bearing commercial paper and "never would achieve the status of money." Instead "100-percent backed notes . . . will circulate as money, by the natural workings of the market." Do you agree or disagree with this prediction? Provide relevant theoretical or historical support for your position.

5 "A banknote promising $10 to the bearer on demand, issued by a bank with a one-fifth reserve, is the equivalent of a lottery ticket with a one-fifth chance of winning $10, and will therefore trade for about one-fifth of its face value ($2)." Is this correct or incorrect? Why?

6 "The United States had no central bank until 1913, so every bank issued its own dollar bills. In the early days these bills were different colors and sizes, and some of them weren't worth the paper they were printed on. The same thing is happening with smartcards. 7-Eleven [a chain of convenience stores] is issuing smartcards." (Wriston 1996, p. 142)
   (a) Why were the notes issued by most banks worth *more* than the paper they were printed on?
   (b) What restrained those banks from issuing an unlimited amount of notes?
   (c) Assume that 7-Eleven really does get into the business of issuing currency smart cards (as far as I can ascertain, the chain to date has only issued *phone* cards). What would restrain 7-Eleven from issuing an unlimited amount of smartcard balances?

[13] If liquidity costs are identical for the two liabilities at every circulation volume, then only their sum matters to the bank. Formally, the probability-of-reserve-loss function $\phi(X \mid N, D)$ could be written $\phi(X \mid N + D)$.