

## Efficiency and Market Equilibrium

In standard microeconomic theory, one argues that a competitive general equilibrium is efficient. When demand equals supply simultaneously in all markets, then the allocation of resources is efficient. Does this conclusion still hold when one adds monetary exchange to the model?

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## Alternate Systems of Monetary Exchange

We consider alternate systems of monetary exchange:

- commodity money versus fiat money;
- no banks versus banks;
- monopoly banks versus competitive banks.

Together there are six possible combinations, and we analyze the efficiency of each.

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## Commodity Money Versus Fiat Money

Commodity money is a good that has value independently of its value as money. An example is gold.

Fiat money has negligible intrinsic value, but nevertheless people accept it in exchange as having value. Paper money is fiat money.

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## Efficient Exchange

We present Johnson's model of efficient exchange [2]. The model considers two potential sorts of inefficiency:

- resources can be diverted away from the production of goods to the production and use of money;
- resources can be wasted as people economize on money holding.

Efficiency requires that neither occur. To prevent the first constitutes *production efficiency*, whereas to prevent the second constitutes *money-demand efficiency*.

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## Production Efficiency

That no resources be diverted away from the production of goods is necessary for efficiency.

Some argue that the gold standard violates production efficiency: some people dig holes in the ground to mine gold, and other people then store this gold in other holes (secure bank vaults). Both activities waste of resources, as these resources could instead be employed productively to make goods for consumption.

In contrast, because paper money is almost costless to produce, fiat money satisfies production efficiency.

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Does it follow that fiat money is more efficient than commodity money? We examine this matter further below.

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### Money-Demand Efficiency

A different inefficiency occurs when people economize needlessly on money holding. In Baumol's inventory model [1] of the demand for money, the individual economizes on his money demand by increasing the number of his trips to the bank. This economizing is wasteful, if it can be avoided.

To eliminate this inefficiency, the opportunity cost of holding money must be zero.

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### Production and Money Demand

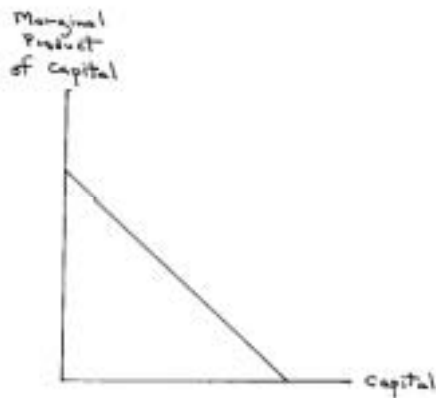
Two curves form the basis for the analysis.

Consider the one-sector neoclassical technology, in which there is only one produced good, and consumption and capital are the same good. Using more capital for production increases output.

Figure 1 shows the marginal product of capital as a function of capital. By the law of diminishing marginal returns, the marginal product declines as capital increases. Efficiency requires that no capital be diverted to money and away from production.

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Figure 1: Marginal Product of Capital

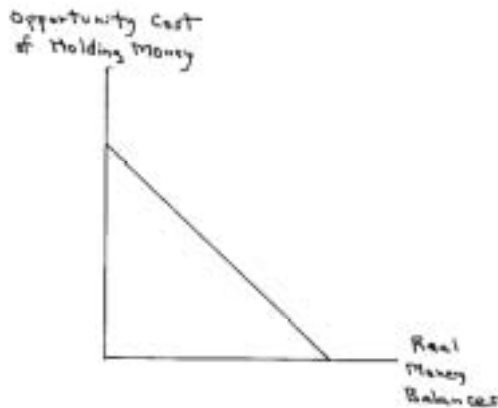


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In accord with the Baumol model [1], figure 2 shows the demand for real money balances as a function of the opportunity cost of holding money. As the opportunity cost rises, people economize on money holding, and the money demand falls. Efficiency requires that the opportunity cost of holding money be zero, so that no resources are wasted by economizing on money held.

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Figure 2: Money Demand



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Using these two curves, for each case below we work out the market equilibrium. The real interest rate is the marginal product of capital. The opportunity cost of holding money depends on the monetary and banking system.

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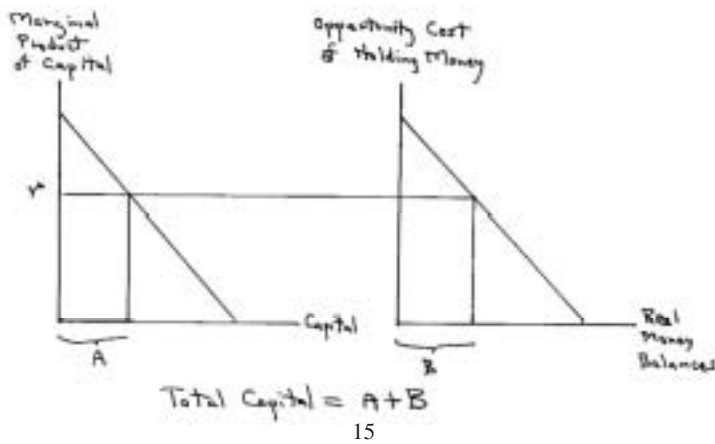
### Commodity Money

Under “commodity money,” the single produced good is the basis for money. Consequently the price of the good in terms of money is simply one.

### Commodity Money, No Banks

Figure 3 shows the market equilibrium. There is inefficiency in production, as some capital is diverted away from production, for use as money. Money earns no interest, so the opportunity cost of holding money is the real interest rate. Thus there is also inefficiency in money demand.

Figure 3: Commodity Money, No Banks

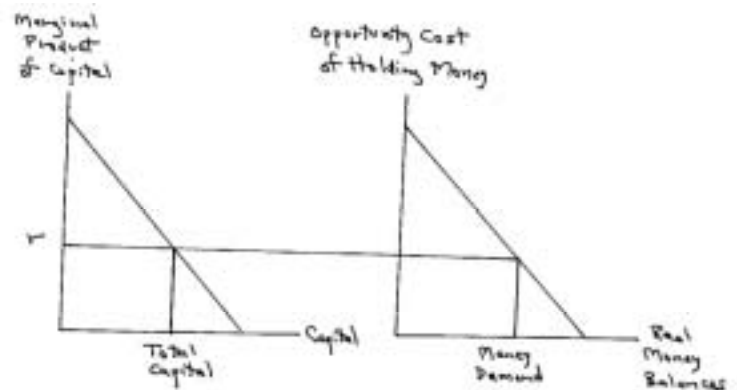


In equilibrium, capital is allocated between production and money demand so that the capital employed in production plus the capital used as money sum to total available capital. An increase in the total capital is allocated partly to production and partly to money demand. The increase in capital allocated to production implies a reduction in the real interest rate, and the lower real interest rate raises the money demand.

### Commodity Money, Monopoly Banks

For commodity money with monopoly banks, figure 4 shows the market equilibrium. We interpret “banking” to mean that people pay with checks, denominated in terms of the commodity money, rather than with commodity money itself. There is efficiency in production, as all capital is used for production, and none is diverted to use as money. Compared to commodity money with no banks, that all capital is now used in production makes the marginal product of capital and thus the real interest rate lower.

Figure 4: Commodity Money, Monopoly Banks

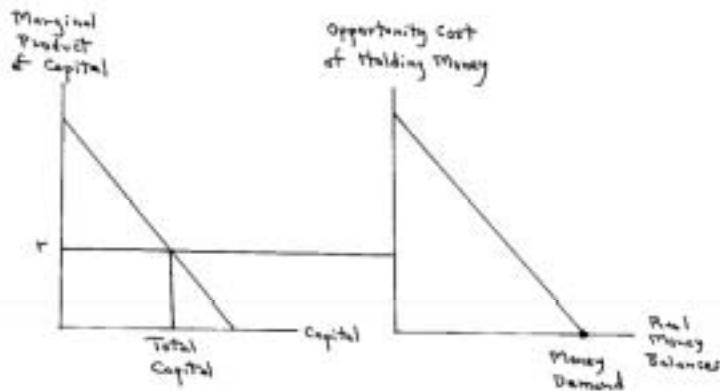


We interpret “monopoly” in banking to mean that the banks pay no interest on deposits and do not compete for deposits by offering interest. For simplicity, suppose that the cost of providing banking services to depositors is negligible. Banks make an economic profit, equal to the real interest rate times money demand. The real interest rate is the opportunity cost of holding money. There is inefficiency in money demand, as people economize on money holding.

### Commodity Money, Competitive Banks

For commodity money with competitive banks, we obtain efficiency (figure 5). Like the monopoly bank case, there is production efficiency. However competitive banks pay interest on deposits. Competition makes the economic profit of the banks zero, as banks pay the real interest rate on deposits. Consequently the opportunity cost of holding money is zero, so there is efficiency in money demand.

Figure 5: Commodity Money, Competitive Banks



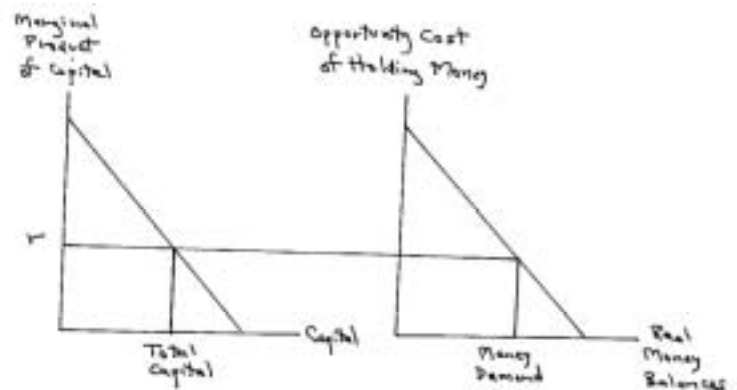
### Fiat Money

Market equilibrium determines the real demand for money. Given the nominal money supply, the price level adjusts so the real money supply equals the real money demand. For simplicity, assume that inflation is zero.

### Fiat Money, No Banks

If there are no banks, the nominal money supply is just the monetary base. Figure 6 shows the equilibrium; the figure is identical to figure 4. Money pays no interest, so the opportunity cost of holding money is the real interest rate. There is production efficiency but not efficiency in money demand.

Figure 6: Fiat Money, No Banks

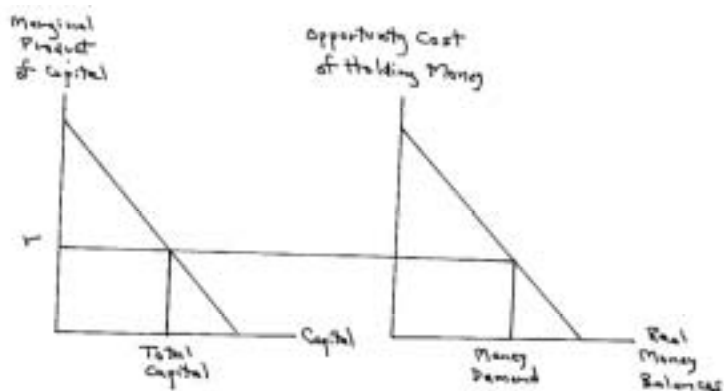


### Fiat Money, Monopoly Banks

Banks create money. Suppose that the reserve requirement on banks is to keep the fraction  $f$  of deposits as non-interest bearing reserves. Take the money multiplier as  $1/f$ , so the nominal money supply is the money multiplier times the monetary base.

With monopoly banks that pay no interest on deposits, the market equilibrium is much like the no bank case just treated. Figure 7 showing the market equilibrium is identical to figures 4 and 6. The real interest rate is the same, and the real money supply is the same. That banks create money makes the nominal money supply higher, so the price level is higher in proportion, with real money balances unaffected.

Figure 7: Fiat Money, Monopoly Banks

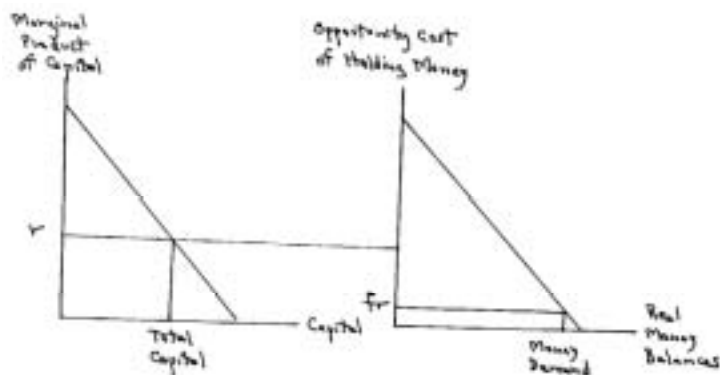


The banks make an economic profit equal to the total interest earned on investments. The amount invested is  $1 - f$  times the real money demand, so bank profits rise as the reserve requirement is decreased.

### Fiat Money, Competitive Banks

Figure 5 shows the market equilibrium. Competition forces banks to pay interest on deposits equal to the interest earned on investments, to make the economic profit zero. For each dollar of deposits, the fraction  $1 - f$  is invested to earn the real interest rate  $r$ , and the fraction  $f$  earns no interest. The interest earned per dollar of deposits is thus  $(1 - f)r$ , so this value is the interest rate paid on deposits. The opportunity cost of holding money is the real interest rate  $r$  less the interest  $(1 - f)r$  on deposits, so the net opportunity cost is  $fr$ . As the reserve requirement approaches zero, there is efficiency in money demand.

Figure 8: Fiat Money, Competitive Banks



### Efficiency via Competitive Banking

The following table summarizes the findings. As in standard microeconomic theory, we find that a *laissez-faire* competitive market economy is efficient.

Without any action by the government, commodity money comes into use, to facilitate transactions. Competitive banking results in both production efficiency and money-demand efficiency.

If the government imposes its fiat money on the economy, competitive banking again achieves efficiency, as long as the reserve requirement is low.

### Exchange Efficiency

	Production Efficiency?	Money-Demand Efficiency?	Opportunity Cost of Holding Money
<i>Commodity Money</i>			
No Banks	No	No	$r$
Monopoly Banks	Yes	No	$r$
Competitive Banks	Yes	Yes	0
<i>Fiat Money</i>			
No Banks	Yes	No	$r$
Monopoly Banks	Yes	No	$r$
Competitive Banks	Yes	Yes (low $f$ )	$fr$

### References

- [1] William J. Baumol. The transactions demand for cash: An inventory theoretic approach. *Quarterly Journal of Economics*, LXVI(4):545–556, November 1952. HB1Q3.
- [2] Harry G. Johnson. Inside money, outside money, income, wealth, and welfare in monetary theory. *Journal of Money, Credit and Banking*, I(1):30–45, February 1969. HG201J6.