With a new form of money in place, the central monetary authority may wish to regulate it.

Central banks generally have three tools available:

1. money creation;
2. reserve requirements; and
3. loans to banks.

If the rate of return on inside money net of transaction costs exceeds that of fiat money, nobody will use fiat money. This may cause some problems.
Central Banking

- To maintain a demand for fiat money the government can:
  1. institute reserve requirements;
  2. outlaw some forms of private money.

- A reserve requirement obliges financial intermediaries to hold a specified fraction of their deposits in the form of fiat money.

- In the U.S. these reserves have to be in the form of vault cash or deposits with the Federal Reserve Banks.

- On the first 46.5 million of checkable deposits, the reserve requirements are 3%. After that they are 10%.
Reserve Requirements

- Consider the three period economy again.
- Let money supply grow at rate $z$ and population grow at rate $n$.
- Let the initial middle-aged hold the fiat money stock.
- Assume intermediation is costless and competitive.
- There is a reserve requirement: for each good deposited, the bank must hold fiat money worth $\gamma < 1$ goods. The remaining $1 - \gamma$ may be invested in capital.
- The banks’ operations can be summarized in a balance sheet showing that the banks’ assets equal its liabilities plus its net worth.
- The banks’ assets are either reserves or interest bearing assets. Its liabilities are the deposits.
Prices

- As usual, the price level is \( p_t = \frac{1}{v_t} \).

- The market clearing equation for fiat money is now
  \[ v_t M_t = \gamma N_t h_t. \]

- This means the value of the stock of fiat money equals the total amount of required reserves in real terms (fraction \( \gamma \) of total deposits).

- The price level is proportional to the stock of fiat money:
  \[ p_t = \frac{1}{v_t} = \frac{M_t}{\gamma N_t h_t}. \]

- Note that in this model if \( \gamma = 0 \), \( p_t = \infty \). This is just because we are missing an important source of demand for fiat money.
Seigniorage

- Seigniorage, the revenue from fiat money creation, equals:

\[ v_t[M_t - M_{t-1}] = v_t M_t \left(1 - \frac{1}{z}\right) \]

- Using the money market clearing equation we found, seigniorage revenues equal:

\[ v_t M_t \left(1 - \frac{1}{z}\right) = \gamma N_t h_t \left(1 - \frac{1}{z}\right). \]

- Seigniorage increases as:
  - reserve requirements \(\gamma\) increase;
  - bank deposits increase; and
  - money creation rate \(z\) increases.
Real output is the sum of the endowment and returns to capital.

The return to capital comes from direct investment $k_t$, as well as investment through intermediaries $(1 - \gamma)h_t$.

Total output is:

$$GDP_t = N_t y + N_{t-2} X k_{t-2} + N_{t-2} X (1 - \gamma) h_{t-2}.$$ 

An increase in reserve requirements reduces output because less capital is intermediated.

An increase in the monetary base $M_t$ has no direct effect on output.
Deposits

- So far we took deposits as given, but the willingness to make deposits changes with the rate of return they offer.

- The two period return on capital is $X$, so the one period return on intermediated capital is $x = \sqrt{X}$.

- Competition and no intermediation costs force banks to offer the same on deposits as they earn on the assets they hold.

- The equilibrium rate-of return on deposits is then:

$$r^* = \gamma \left( \frac{n}{Z} \right) + (1 - \gamma)x = x - \gamma \left[ x - \left( \frac{n}{Z} \right) \right].$$

- $r^*$ is a decreasing function of $\gamma$. 
Welfare

- What are the effects of reserve requirements on the welfare of the different generations?

- The middle aged, the money holders, benefit from an increase in the rate of reserve requirements because as $\gamma$ increases, the value of their money holdings, $v_t$, increases.

- The future generations are made worse off by an increase in the rate of reserve requirements because the rate-of-return on deposits would decrease.

- They are forced to hold more of the asset with the lower rate of return. They are taxed more through the increase in seignorage.