2. The competitive liquidity market model

1. Importance of financial assets

Financial assets are instruments to channel money (to make and receive a loan of money) from those who wish to lend to those who wish to borrow. Those wishing to borrow have a deficit: their planned expenditure is larger than their current income, so they would like to use now future savings. For those wishing to lend, planned expenditure is smaller than current income: they have a surplus and would like to save it for future use.

2. Properties of financial assets

The owner of a financial asset has a claim on someone else to pay a certain amount of money. The most significant properties associated with this claim are four.

- Maturity (or maturity time). Date at which the claim must be satisfied.
- Default risk. The likelihood that the claim will not be satisfied at maturity.
- Liquidity. Ease and rapidity with which the asset can be turned into money (be sold) before maturity (ease and rapidity with which the claim can be —partially— satisfied in advance).
- Rate of return. Ratio of the profit the asset generates to the cost of obtaining that profit (value of the claim in relation to the cost of being the beneficiary of the claim).

3. Basic types of financial assets I: currency

Currency can be considered a financial asset with instant maturity (€1 pays €1 now), no return, no risk and maximum liquidity.

4. Basic types of financial assets II: tradable and non-tradable financial assets

Financial securities (or, simply, securities) are tradable (they can be bought and sold) financial assets. A security is any fungible, negotiable financial instrument. Securities are divided into debt securities and equity. The market where securities are initially sold (by the issuer) is the primary market. Subsequent sales take place in the secondary market. Non-tradable financial assets (bank deposits, for instance) are those for which there is no secondary market.

5. Trade-off between properties

Financial assets can be viewed as money imitators. But as they cannot have in general maximum liquidity, they must offer something in return to be attractive.

- Liquidity versus profitability. If two assets differ only in liquidity and profitability, the more liquid must be the less profitable and vice versa (money versus T-bills).
- Risk versus profitability. If two assets differ only in risk and profitability, the riskier should be the more profitable and vice versa (shares versus deposits).

Having more of the favourable properties is balanced by having more of the unfavourable ones.

- More profitability is accompanied by less attractive qualities: more risk and/or less liquidity.
- More liquidity is accompanied by less attractive qualities: more risk and/or less profitability.
- More risk is accompanied by more attractive qualities: more profitability and/or more liquidity.

6. Interest rate of a financial asset

The nominal interest rate associated with a financial asset is the asset's rate of return (which is not easily ascertained for complex financial assets). For a T-bill (arguably, the simplest financial asset) promising to pay the face value $V = 1{,}000$ and bought at price $P = 800$, the associated interest rate (in per one terms) is $i_{T-bill} = \frac{profit}{cost} = \frac{V-P}{P}$. For instance, if $V = 1{,}000$ and $P = 800$, then $i_{T-bill} = \frac{1{,}000-800}{800} = \frac{1}{4} = 0.25 = 25\%$ (the rate of return of the T-bill is 25%).

7. 'The' interest rate of an economy

An economy has nearly as many interest rates as financial assets. But since they appear to move in parallel, it may be adopted the fiction that there is a unique interest rate i in the economy. Specifically, it will be assumed that the (nominal) interest rate i of an economy represents the average interest rate charged for a typical loan of currency.

8. The interest rate as reward for saving

The interest rate, between periods t and $t + 1$, defines the value in period $t + 1$ of one monetary unit of period t: 1 monetary unit in t becomes $1 + i$ units in $t + 1$. For the moneylender, i is the reward for saving: by giving up 1 today, $1 + i$ can be obtained in the future.

9. The interest rate as the cost of a loan

For a borrower, the interest rate i means that he or she must pay $1 + i$ for each unit borrowed: i measures the cost of receiving a loan of one unit. The interest rate allows $1 + i$ monetary units in $t + 1$ to be transformed into 1 monetary unit in t. For the borrower, i is then the cost of a loan (of bringing money from the future): having $1 + i$ in the future allow 1 unit to be obtained now.

10. The interest rate as a measure of patience

The higher i, the more a borrower is willing to pay for having one unit of currency today instead of tomorrow and, accordingly, the less patient the borrower is. A positive i expresses a preference for the present: to have money today is preferred to have it tomorrow.

11. The competitive liquidity (or loan or loanable funds) market model

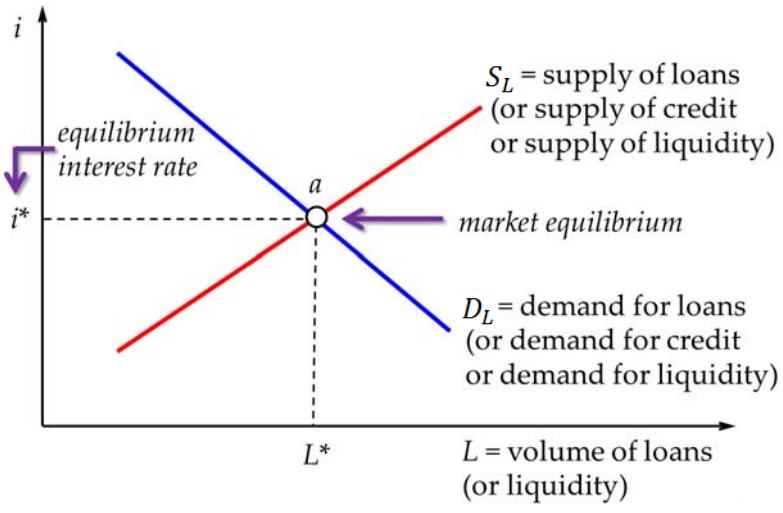


Fig. 1. *The competitive liquidity market model*

The competitive model, represented in Fig. 1, provides an explanation of how the nominal interest rate can be set. Specifically, the market equilibrium is supposed to determine the interest rate. A decreasing market demand function represents the demand for liquidity (for loans, for credit) in the economy. An increasing market supply function represents the supply of liquidity (loans, credit) in the economy.

12. The direct supply of liquidity

The direct supply of liquidity is provided by banks (who supply consumers, firms and other banks) and the central bank (who supplies banks).

13. The indirect supply of liquidity

The indirect supply of liquidity corresponds to purchases of (interest-bearing) financial assets. Purchasing a financial asset supplies liquidity since the buyer of an asset gives money in exchange. Consequently, the seller of a financial asset is in practice obtaining a loan of money. The difference is that a bank's loan is not generally marketable, whereas interest-bearing assets can be resold (a lender can easily become a borrower).

14. The market suppply of liquidity function

The market supply of liquidity function (S_L in Fig. 1) relates the total volume of liquidity supplied to the interest rate at which this volume is supplied. The supply of liquidity function represents the decisions by lenders (savers). The agents creating the supply of liquidity are banks, financial intermediaries, buyers of interest-bearing financial assets and the central bank.

15. The direct demand for liquidity

The direct demand for liquidity corresponds to loan applications typically addressed to banks; for instance, the demand for loans for house purchase.

16. The indirect demand for liquidity

The indirect demand for liquidity is given by the sale or issuing of interest-bearing financial assets, like T-bills, government bonds, corporate bonds… There is no substantial difference between the two components of liquidity demand: when a bank accepts a loan application, it is as if the applicant sold a financial asset to the bank (the loan).

17. The market demand for liquidity function

The market demand for liquidity function (D_L in Fig. 1) establishes, for each value of the interest rate, the total volume of liquidity demanded at that rate. The demand for liquidity function represents the decisions by borrowers (investors). The agents generating (net) demand for liquidity are consumers (consumer credits, loans for house purchase), firms (trade credit, issuance of corporate bonds) and the government (T-bills, bonds).

18. Liquidity market equilibrium

A liquidity market equilibrium is a pair (i^*, L^*) such that:

- when the interest rate is i^*, the total volume of liquidity demanded is L^*; and
- the interest rate at which suppliers are willing to supply exactly the amount L^* is i^*.

Every market equilibrium is graphically represented by a point (i, L) where the supply and demand functions intersect; see point a in Fig. 1. It is an implicit assumption in the competitive model that the supply and demand functions intersect only once.

19. Rule of thumb for shifting the demand for liquidity function

Any event that, for any given interest rate, stimulates the demand for liquidity (for loans, for credit) shifts the market demand for liquidity function to the right; any event that discourages demand, shifts its function to the left. Fig. 2 shows the effect on the market of equilibrium of an expansion of the demand for liquidity: a demand shift to the right causes a rise in both the equilibrium interest rate and the volume of liquidity (as market equilibrium goes from a to b).

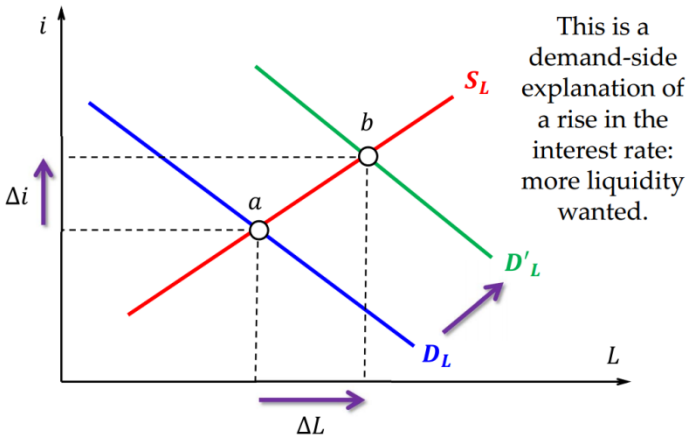


Fig. 2. *Effects of a demand shift to the right*

Events that pressumably shifts the demand function to the right: having more consumers, having more firms, a higher budget deficit, the expectation of a higher inflation rate, an improvement in indices of business or consumer confidence, an increase in wealth or profits (probably), an increase in the foreign demand for domestic loans… The opposite changes will tend to shift the demand function to the left.

20. Rule of thumb for shifting the supply of liquidity function

Any event that, for any given interest rate, stimulates the supply of liquidity shifts the market supply function of liquidity to the right; any event that discourges supply, shifts its function to the left. Fig. 3 shows the effect on the market of equilibrium of a contraction of the supply of liquidity: a supply shift to the left causes a rise in the equilibrium interest rate and a decline in the volume of liquidity (as market equilibrium goes from a to b).

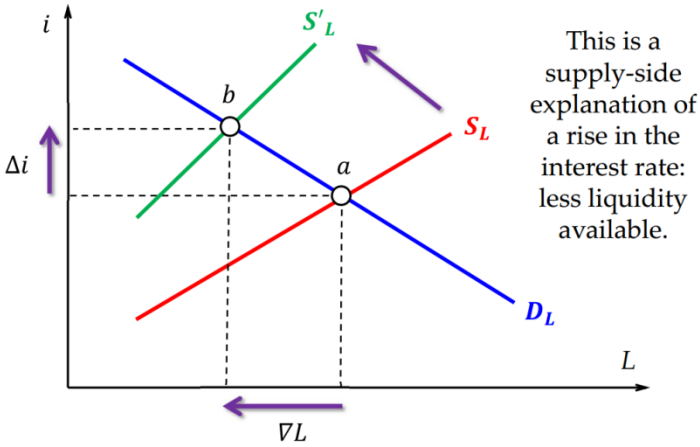


Fig. 3. *Effects of a supply shift to the left*

Events that pressumably shift the supply function to the right: having more banks, the expectation of a higher inflation rate, an increase in the consumers' or the firms' saving rate, expansionary open market operations (see §24) by the central bank, lifting credit controls imposed on banks, fiscal advantages granted for purchasing financial assets… The opposite changes will tend to shift the supply function to the left.

21. Simultaneous shifts of supply and demand functions: the case when both functions contract

Fig. 4 analyzes the effect on market equilibrium of a simultaneous shift of both functions to the left. To establish the result of such changes it is convenient to investigate each shift separately and next combine the effects. If, on Fig. 4, only the change in demand took place, in equilibrium, both liquidity and interest rate would fall. If only the supply change occurred,

then, in equilibrium, liquidity would fall but the interest rate would shoot up. Therefore, when both changes happen, it follows that liquidity decreases but the effect on the interest rate cannot be determined: the demand shift pressures down, whereas the supply shift pressures up. Without knowing which effect dominates, the net impact on the interest rate remains uncertain. Fig. 4 shows two possibilities: if the supply function shifts from S_L to S_L', the demand impact dominates and the interest rate falls (equilibrium going from a to a'); if the supply function shifts from S_L to S_L'', the supply impact dominates and the interest rate goes up (equilibrium going from a to a'').

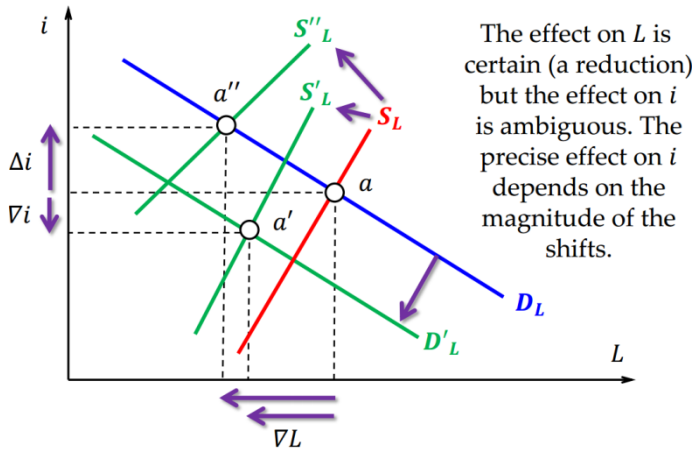


Fig. 4. *Effects of both functions shifting to the left*

22. Simultaneous shifts of supply and demand functions: one contracts, the other expands

Fig. 5 analyzes the case of a demand surge and a supply contraction. Each event separately causes a rise in the equilibrium interest rate; thus, when combined, they produce an interest rate increase. On the other hand, the demand surge increases equilibrium liquidity, whereas the supply crunch causes a liquidity contraction. The net effect is uncertain: equilibrium liquidity could go up (when market equilibrium moves from a to a'') or down (from a to a').

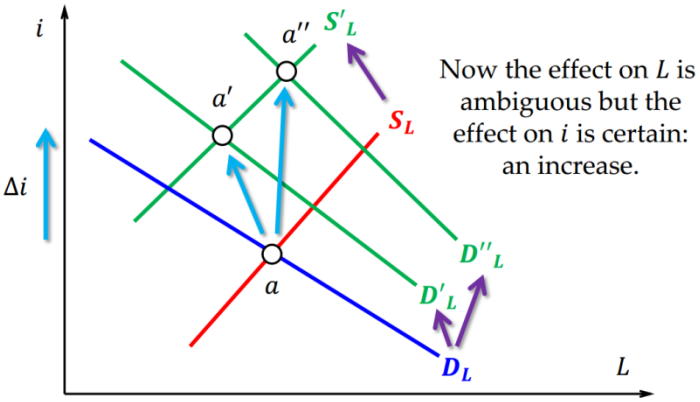


Fig. 5. *Supply to the left, demand to the right*

23. Monetary policy instruments of a central bank (CB)

There are three standard tools by means of which a central bank can influence the money stock.

- The quantity tool: changes in the supply of reserves to the banking system through open market operations or direct lending through standing facilities.
- The price tool: changes in the interest rate at which the CB lends (the CB's policy interest rate).
- The formal regulatory tool: changes in the reserve requirement.
- The direct control of the volume of bank credit is an unofficial, extra-legal, informal regulatory tool: the CB informs the banks of how much lending can increase and punishes violation.

24. Open market operations (OMOs)

Open market operations by the central bank are sales or purchases of financial assets (normally, government securities, like T-bills, and central bank bills) to certain counterparties (typically, the main banks of the economy). In the textbook view, the immediate aim of OMOs is to control the money stock: an OMO modifies **M0** and, through the money multiplier, the change in **M0** alters **M1** in the desired direction.

25. Expansionary OMO

An expansionary OMO expands the monetary base (and, supposedly, the money stock) by buying financial assets: the CB gets financial assets and pays these assets with currency, which increases the liquidity in the economy, or, more typically, by enlarging the amount of reserves that the banks that sold the assets hold in the CB. Fig. 6 represents an expansionary OMO.

26. Contractionary OMO

A contractionary OMO (see Fig. 7) contracts the monetary base (and, supposedly, the money stock) by selling financial assets: the CB injects financial assets in the economy and drains currency out of it (or reduces reserves that the banks that bought the assets have in the CB).

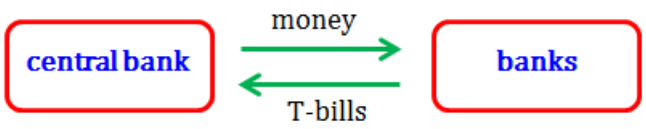


Fig. 6. *Expansionary* OMO

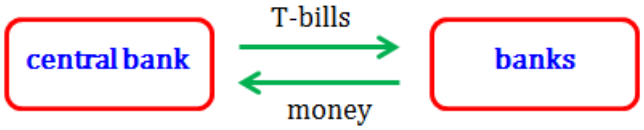


Fig. 7. *Contractionary* OMO

27. Classification of OMOs according to the nature of the transaction I: outright transactions

An outright transaction is an OMO in which the rights embodied in the financial asset bought or sold are permanently transferred to the buyer (the asset is said to be bought or sold outright).

28. Classification of OMOs according to the nature of the transaction II: repo transactions

A repurchase agreement (or repo, for short) is an OMO in which the rights embodied in the financial asset that is bought or sold are temporarily transferred to the buyer: in a repo, the seller of the financial asset must buy it back in a future date and at a preestablished price. In a repo transaction liquidity is drained (absorbed) by the central bank temporarily: the CB sells financial assets with the compromise of repurchasing them in the future.

29. Classification of OMOs according to the nature of the transaction III: reverse-repo transactions

A reverse repurchase agreement (or reverse-repo, for short) is an OMO in which the buyer of the financial asset must sell it back in a future date and at a preestablished price. By means of a reverse-repo transaction liquidity is injected by the central bank temporarily: the CB buys financial assets with an agreement of selling them back in the future. Fig. 8 shows the structure of a reverse-repo.

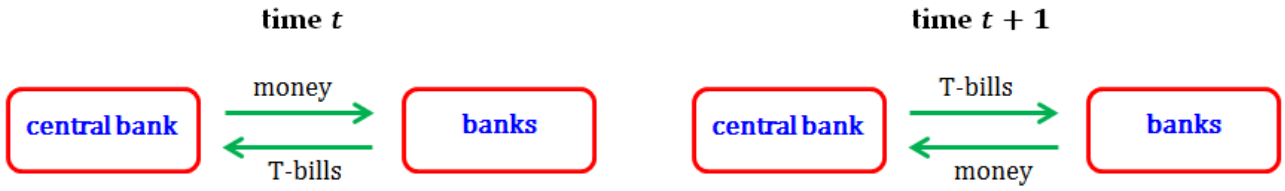


Fig. 8. *A reverse repurchasement agreement by the central bank (reverse-repo transaction)*

30. Standing facilities

A standing facility is a procedure by means of which banks can borrow or lend funds directly with the central bank. With OMOs the CB intervenes directly in financial markets. With standing

facilities, the CB deals directly with some counterparties (the main banks) and afterwards lets financial markets determine how founds are allocated among financial institutions. Such facilities are passive tools to neutralize or smooth out the excessive volatility to which financial markets are prone, so that the market interest rates are in line with (or not pushed too far away from) the interest rate target of the CB (as signalled by the CB's interest rate policy).

31. Deposit facility

A deposit facility is a standing facility that allows selected banks having an excess of liquidity (that is, excess funds) that cannot be used in the markets to deposit that excess in the central bank and in return be paid an interest rate normally below the market rate.

32. Lending facility

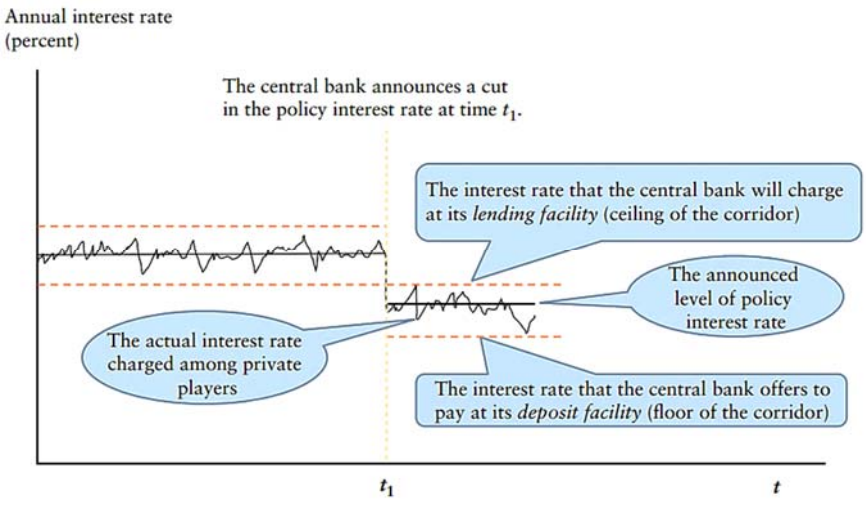
A lending facility is a standing facility that allows selected banks unable to obtain short-term liquidity in the markets to borrow directly from the central bank, normally at an interest rate higher than the market rate.

33. The CB's policy interest rate and the interest rate corridor

The policy interest rate is a short term interest rate that the central bank uses to publicly signal or reveal the aims and goals of monetary policy. By making public the policy interest rate, the central bank tries to induce market rates to be close to the policy interest rate. OMOs and standing facilities constitute tools to induce market rates to be near the policy interest rate. Knowing that the central bank is willing to intervene to put market rates in line with the policy interest rate, banks would normally accept borrowing and lending at the central bank's desired rate. If the central bank finds more convenient to regulate market conditions without stepping in (because direct intervention would be too frequent or involve too much funds), then banks can deal with temporal liquidity shortages or surpluses by resorting to the standing facilities.

34. The interest rate corridor

The interest rate corridor refers to the combined use of standing facilities and the policy interest rate with the aim of keeping market rates within a specified corridor (fluctuation band) around the policy interest rate; see the figure on the right, taken from Thammarak Moenjak (2014), *Central banking*, p. 128. The interest rate the CB charges for using the lending capacity is higher than the policy interest rate to induce banks to look first in markets for a solution to their problems of liquidity shortages. This makes the interest rate of the lending facility a ceiling for short-term market rates. Symmetrically, the interest rate of the deposit facility is a floor for market rates to encourage banks with liquidity



surpluses to find borrowers in the markets, so that such banks turn to the central bank's deposit facility only as a last resort (when there is no better option).

35. Reserve requirements as a tool for monetary control

Reserve requirements constitute the minimum amount of reserves that banks must have at the CB. Reserve requirements are usually computed as a fraction (the reserve ratio) of (sight) deposits. Reserves help to control the money stock by altering the portion of any deposit that has to be retained: under a zero reserve requirement, banks would have no constraint to create deposits. By increasing the reserve ratio, the CB detracts lending funds from banks: according to the textbook model of **M1** creation, less loans, less expenditure, less revenue, less deposits, smaller **M1**. This reduces the money multiplier: $\uparrow r \Rightarrow \downarrow mm$. A reduction in the reserve ratio has an expansionary effect on **M1**: more fuel can be added to the flames of the money creation process. The banks' reserves held on account at the CB are simply numbers, like bank deposits.

36. Reserve requirements as a tool for settling interbank payments

The reserves system helps to settle interbank payments. This is why banks must retain each day enough reserves to facilitate the interbank clearing process plus enough cash reserves to meet the withdrawal requests by depositors. Fig. 9 (taken from Sergio Rossi, 2007, *Money and payments in theory and practice*) shows how payments in an economy involve an exchange of CB reserves between banks.

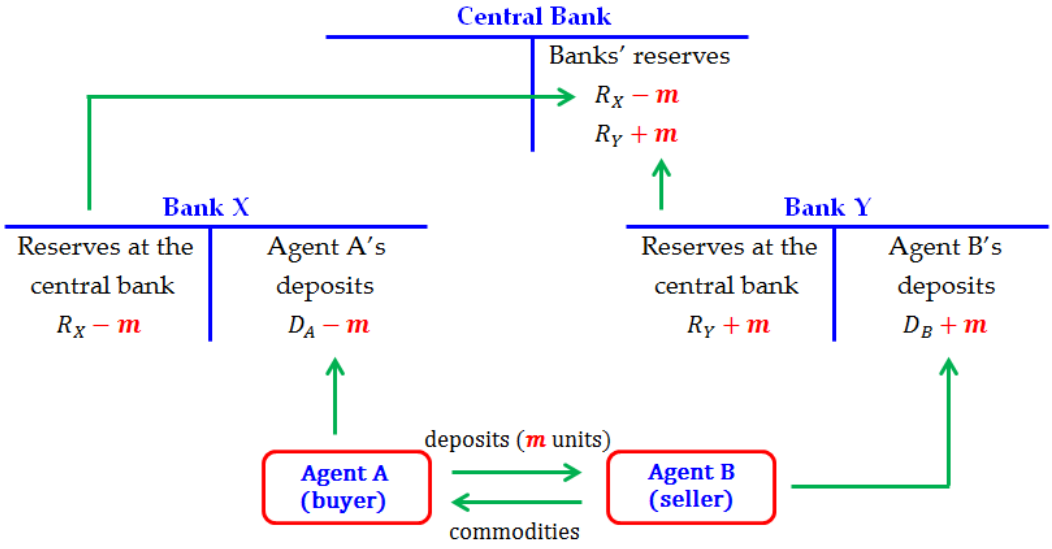


Fig. 9. *The CB and the economy's payment system*

37. The central bank dilemma: *i* and M1 cannot be simultaneously controlled

Suppose the CB intends to lower **M1** by selling T-bills (contractionary OMO). To encourage banks to buy T-bills, the price P of T-bills must fall. This raises its rate of return $i_{T-bill} = \frac{V-P}{P} = \frac{V}{P} - 1$: $\uparrow P \Rightarrow \downarrow i_{T-bill}$, which contributes to lower the interest rate i of the economy. In sum, $\downarrow$**M1** implies $\uparrow i$; see the figure below. This conclusion can also be reached in the liquidity market model, as the CB's action shifts the supply of liquidity to the left. Thus, by regulating **M1**, the CB loses control over i. Conversely, if the CB plans to raise **M1** by buying T-bills, the demand for T-bills expands, causing a rise in P. This reduces the rate of return of T-bills and the interest rate i of the whole economy. Hence, $\uparrow$**M1** implies $\downarrow i$.