Central banks (CBs)

- The central bank is the monetary authority in an economy. It is the public institution that, typically,
  - provides and regulates the money supply (M1, M2, M3);
  - issues the currency (see the letter "ECB" in banknotes);
  - controls the interest rates and/or the inflation rate;
  - oversees the banking system;
  - acts as a lender of last resort to the banking system;
  - establishes mininum reserve requirements;
  - is independent of the government.
- For our purposes, the CB is the agent who determines an executes the monetary policy.

Monetary policy instruments (I)

- **Open market operations**. Consist of the sale or purchase of financial assets (government bonds, for instance). They try to control the money supply.

- Expansionary OMOs expand the money supply by buying bonds: the CB gets bonds in exchange for currency, so there is more currency in the economy.

- Contractionary OMOs contract the money supply by selling bonds: the CB injects bonds in the economy in exchange for currency, which, in entering the CB, is detracted from the economy.

Monetary policy instruments (II)

- **Reserve requirements**. They define the minimum amount of reserves that banks must deposit on the central bank. It is usually computed as a fraction (the reserve ratio) of (sight) deposits.

- By increasing the reserve ratio, the CB detracts lending funds from banks: less loans, less expenditure, less revenue, less deposits, smaller M1. This reduces the money multiplier: $\uparrow r \Rightarrow \downarrow mm$.

- A reduction of the reserve ratio has an expansive effect on M1: more fuel can be added to the flames.

Monetary policy instruments (III)

- One of the roles of a CB is to ensure the stability of the financial side. The reserve ratio is one of the tools to achieve this: the stability and sustainability of the banking system require than banks have enough liquidity to meet withdrawal requests.

- <u>**The interest rates at which the CB lends**</u>. Both in normal or in distress situations the CB may be interested in lending or borrowing. To reduce the money supply by borrowing, the CB must make lending more attractive by rising appropiately the rate offered.

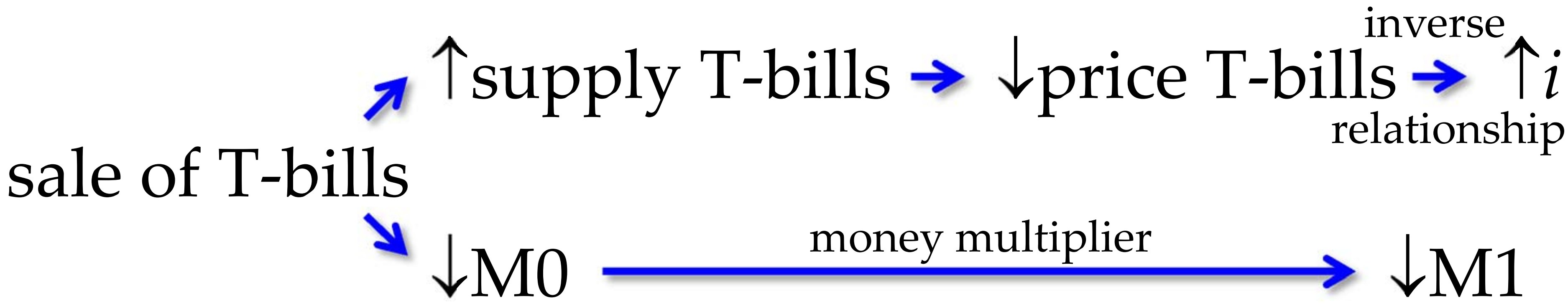
The CB cannot control both *i* and M1

- Suppose the CB wants to reduce the money supply by selling T-bills. To induce banks to buy T-bills, the CB must lower appropriately the current price of T-bills: otherwise, banks may not be willing to buy T-bills. But a reduction in the price of the T-bill raises its rate of return, so the average interest rate of the economy raises. In sum, ↓M1 implies ↑*i*.

- Conversely, if the CB wants to increase the money supply by buying T-bills, the demand for T-bills shifts to the right, making its price rise. This causes a fall in the rate of return of T-bills: ↑M1 implies ↓*i*.

Effects of OMOs on *i* and M1

- Suppose the aim of the CB is to reduce M1 by means of an OMO (for instance, a sale of T-bills).



- Hence, the attempt to control M1 entails a loss of control over *i*: the two cannot simultaneously be controlled (both cannot be reduced). If the sale of T-bills aims at rising *i*, then the loss of control is over M1.

The loan market model

- It is a model to determine the nominal interest rate.
- The loan market model is a competitive market model in which market equilibrium determines the nominal interest rate.
- The market demand function represents the demand for loans in the economy (demand for liquidity).
- The market supply function represents the supply of loans in the economy (supply of liquidity).

The demand for loans

- The market demand function for loans establishes, for each value of the nominal interest rate, the total amount of loans demanded at that rate.
- It represents the decisions by borrowers (investors).
- It is assumed downward sloping: the higher the rate, the smaller the volume of loans demanded.
- The agents generating the demand for loans are consumers (consumer credits, loans for house purchase), firms (trade credit, issuing of corporate bonds), and the government (T-bills, bonds).

Direct & indirect demand for loans

- The direct demand for loans is given by loan applications typically addressed to banks; for instance, the demand for loans for house purchase.
- The indirect demand for loans corresponds to the <u>sale or issuing of (interest-bearing) financial assets</u>, like T-bills, government bonds, corporate bonds…
- There is no substantial difference between the two components of loan demand, because when a bank accepts a loan application, it is as if the applicant sold a financial asset to the bank: the loan.

Shifts in the demand for loans function

- Any event that, for any given interest rate, stimulates [discourages] the demand for loans shifts the market demand function for loans to the right [left].

- <u>Shift to the right</u>: more consumers, 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 (may be), an increase in the foreign demand for domestic loans... The opposite changes shift the demand function to the left.

The supply of loans

- The market supply function for loans establishes, for each value of the nominal interest rate, the total amount of loans supplied at that rate.
- It represents the decisions by <u>lenders</u> (savers).
- It is assumed <u>upward sloping</u>: the higher the rate, the larger the volume of loans supplied.
- The agents creating the supply of loans are <u>banks & financial intermediaries</u>, <u>buyers of interest-bearing financial assets</u>, and the <u>central bank</u>.

Direct & indirect supply of loans

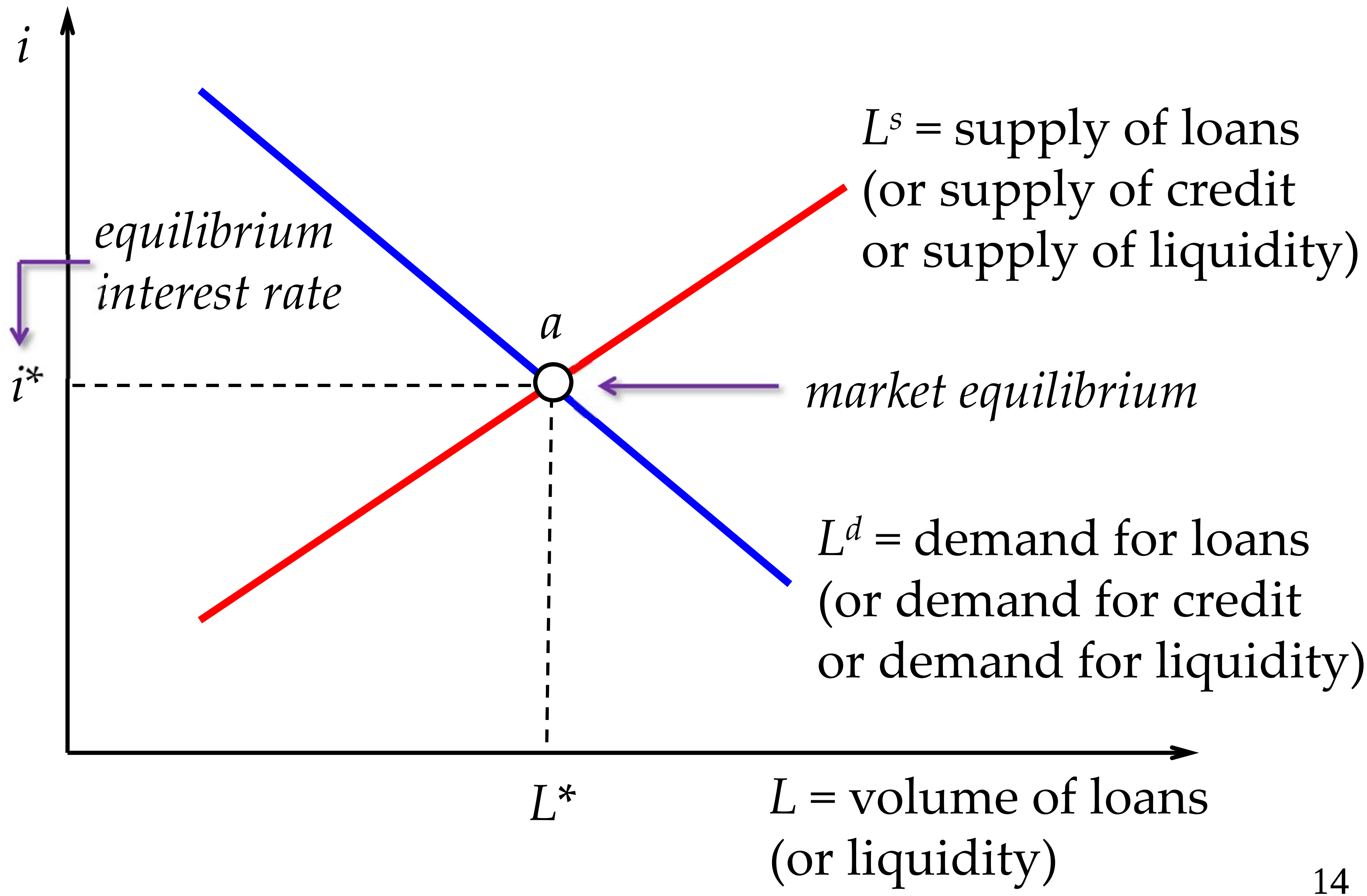
- The direct supply of loans is provided by banks (who supply consumers, firms, and other banks) and the central bank (who supplies banks).
- The indirect supply of loans corresponds to purchases of (interest-bearing) financial assets.
- Purchasing a financial asset supplies liquidity since (s)he who buys the asset gives money in exchange, so the seller is in practice obtaining a loan. 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).

Shifts in the supply of loans function

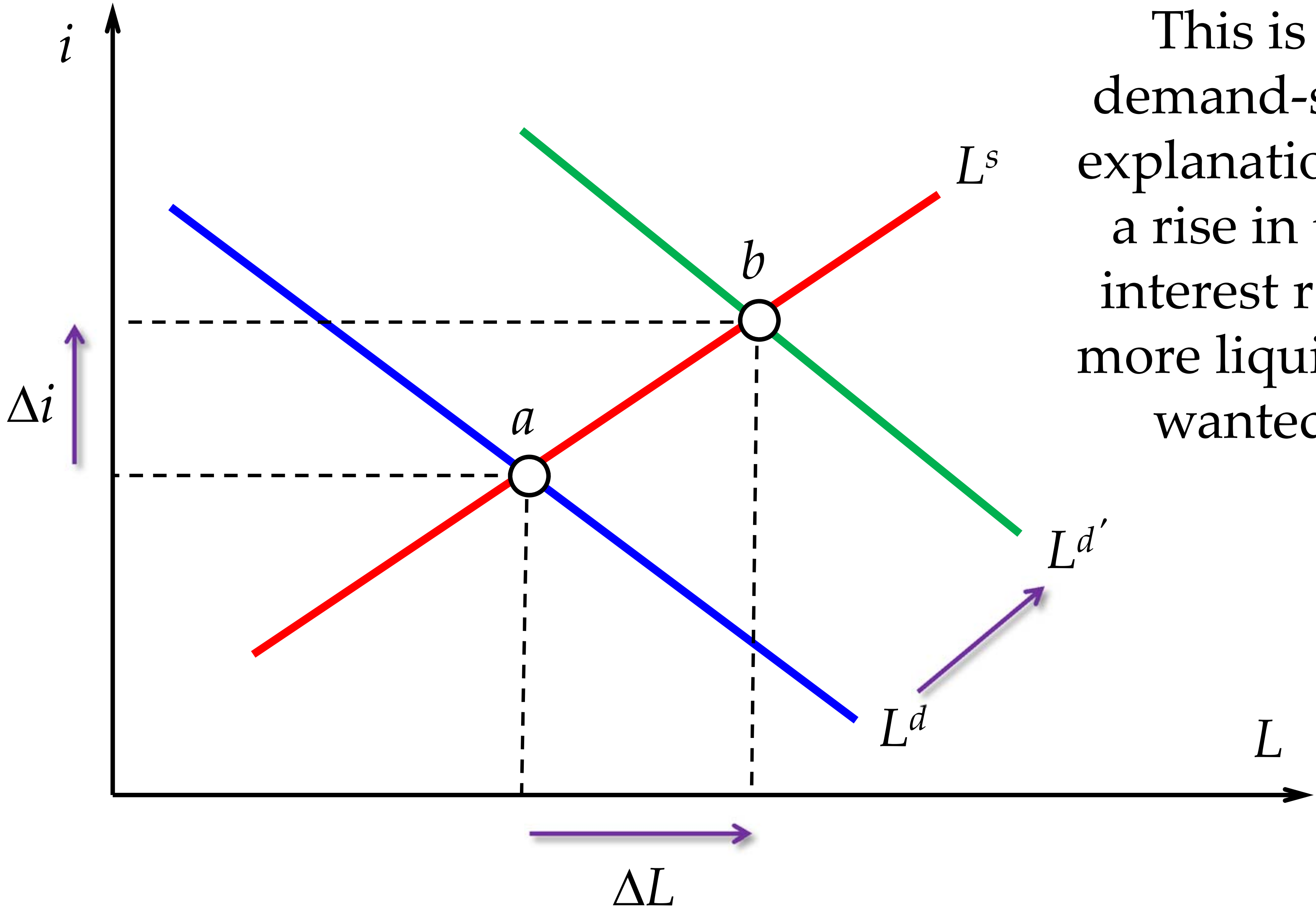
- Any event that, for any given interest rate, stimulates [discourages] the supply of loans shifts the market supply function of loans to the right [left].

- Shift to the right: more banks, the expectation of a higher inflation rate, an increase in the consumers' or the firms' saving rate, expansionary open market operations by the central bank, fiscal advantages granted for purchasing financial assets... The opposite changes shift the supply function to the left.

Graphical depiction of the loan market

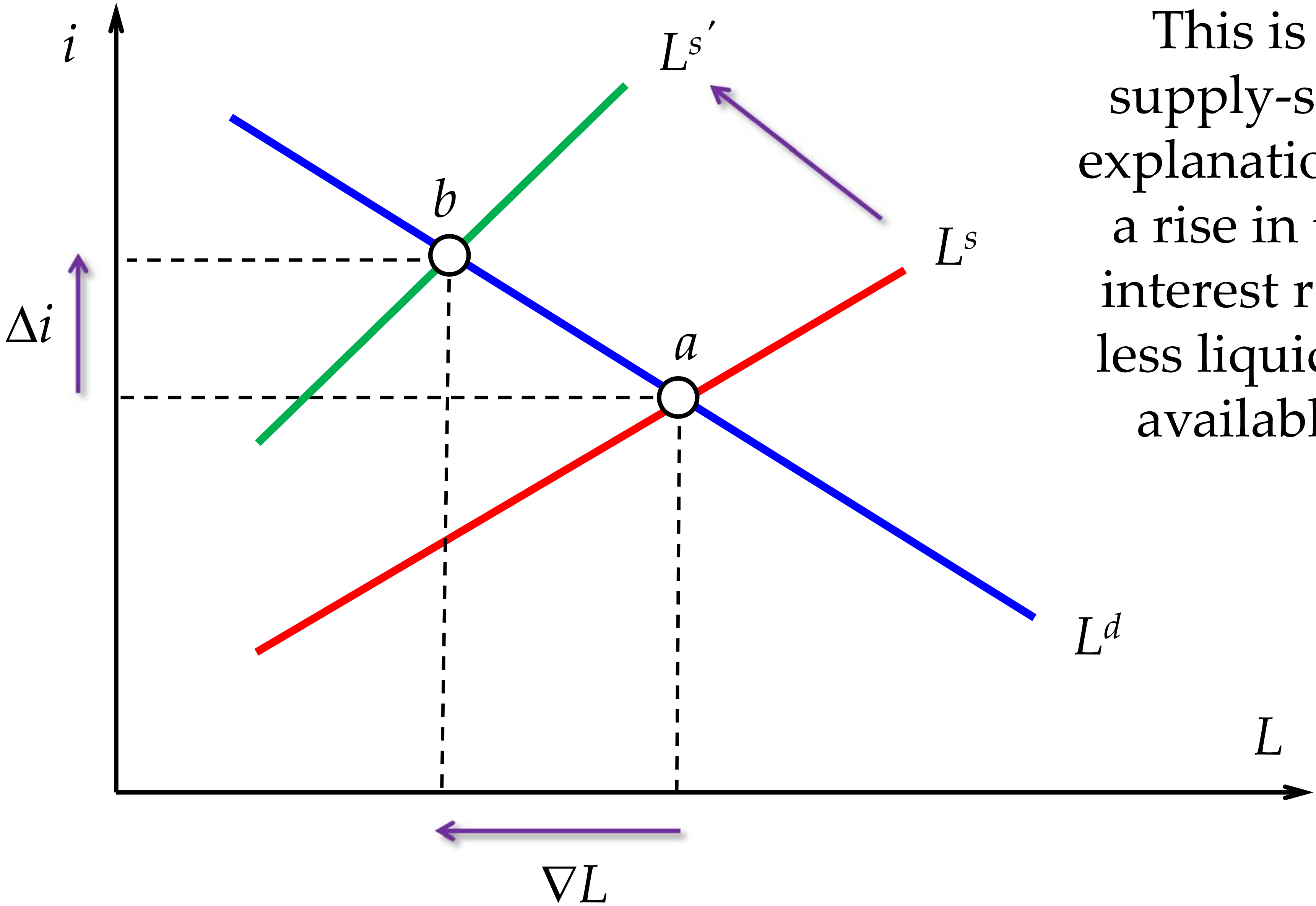


Effects of a demand shift to the right



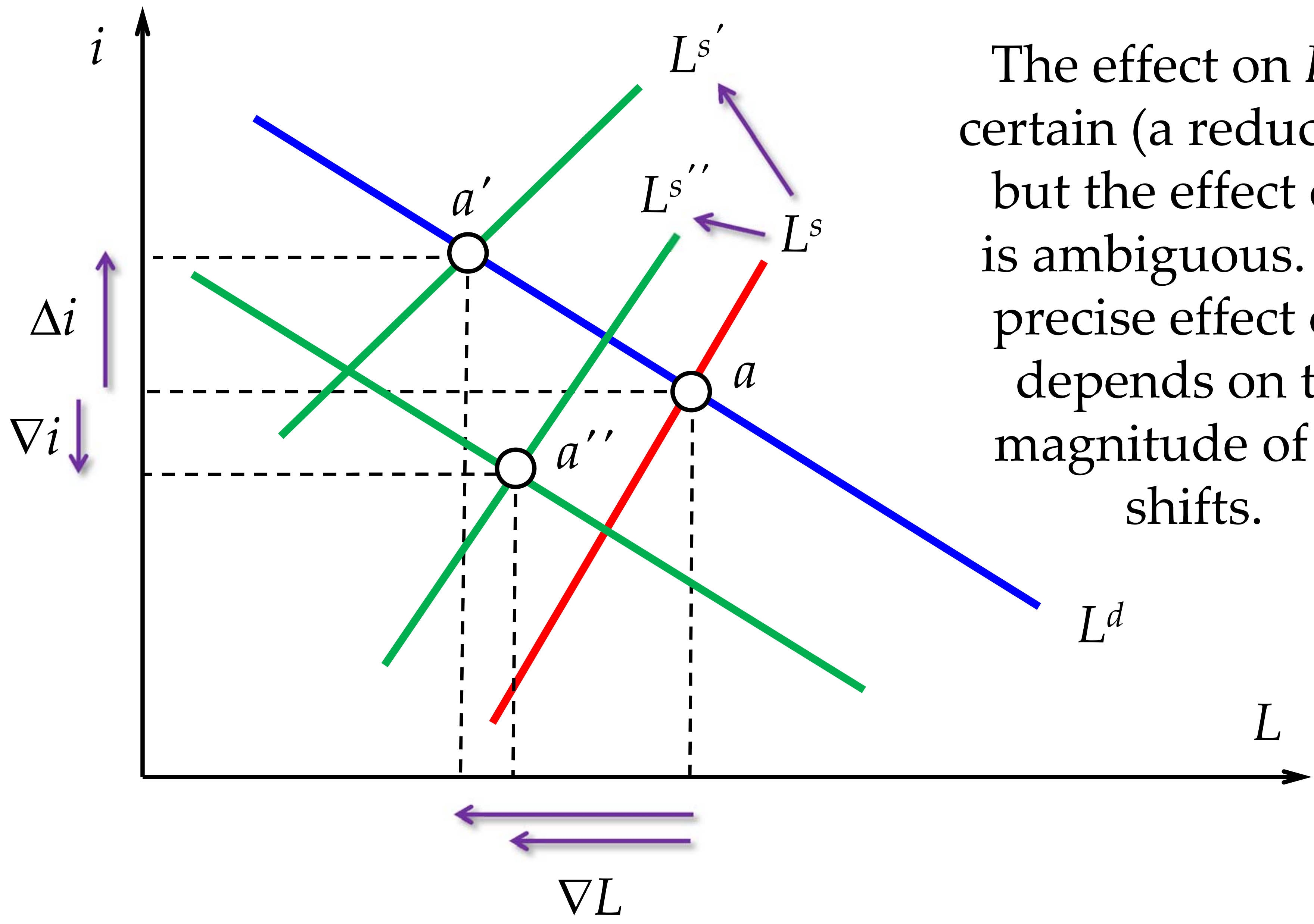
This is a demand-side explanation of a rise in the interest rate: more liquidity wanted.

Effects of a supply shift to the left



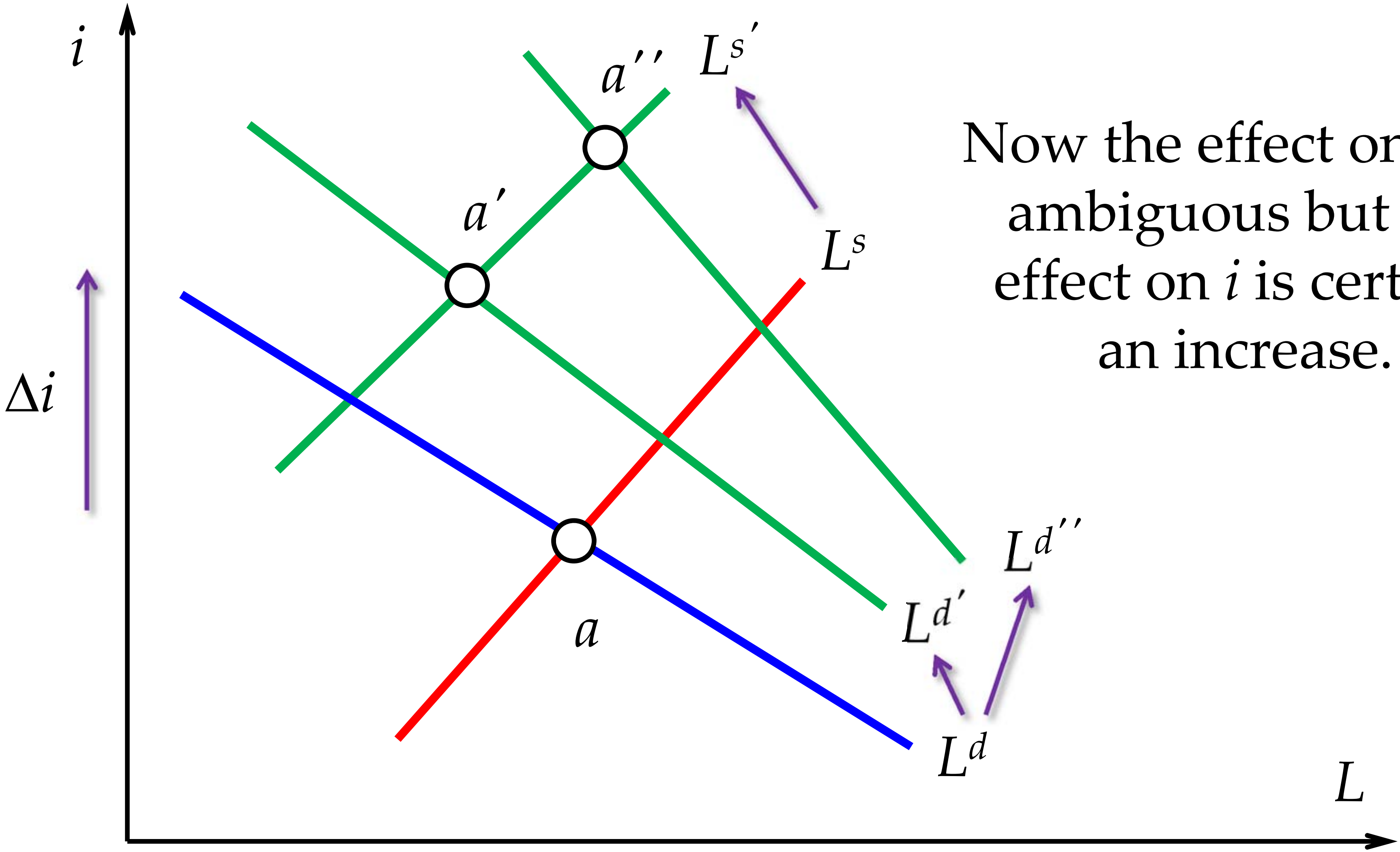
This is a supply-side explanation of a rise in the interest rate: less liquidity available.

L^s to the left + L^d to the left



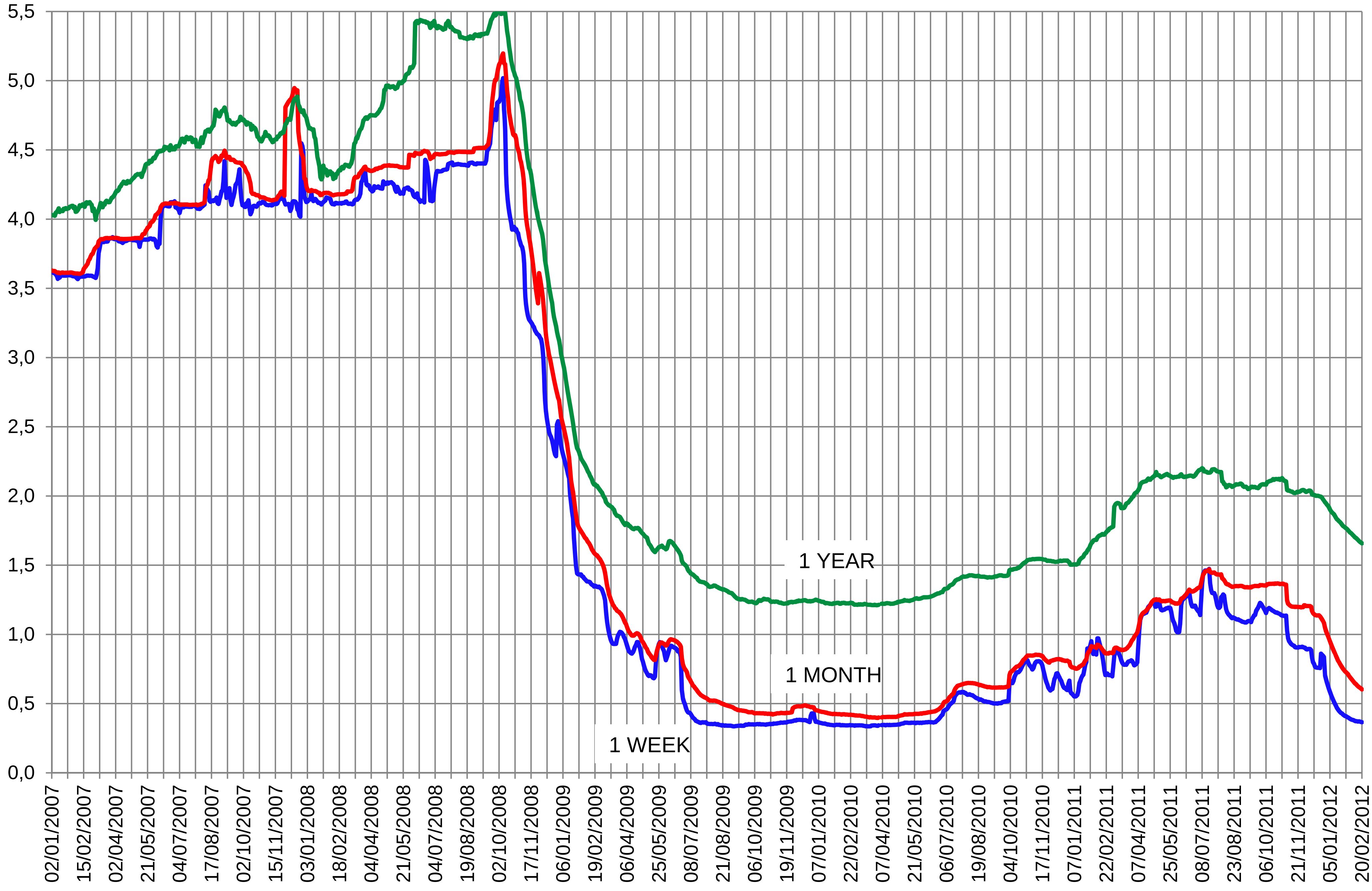
The effect on L is certain (a reduction) but the effect on i is ambiguous. The precise effect on i depends on the magnitude of the shifts.

L^s to the left + L^d to the right



Now the effect on L is ambiguous but the effect on i is certain: an increase.

The Euribor (2007-2012)



The real interest rate

- The real interest rate r of an economy is its nominal interest rate i expressed in terms of goods.
- The nominal rate i means that, by lending 1 currency unit today, you get $1 + i$ currency units tomorrow.
- The real rate r means that, by lending 1 unit of goods today, you get $1 + r$ units of goods tomorrow. Therefore, r expresses purchasing power: which amount of goods is obtained from each unit of good lent.

Real & nominal interest: an example

- Let "goods" be represented by the basket defining the CPI. Suppose i = 10% and that P_1 = 204 € is the cost of the basket of the CPI. If 612 € are lent today, then 612(1 + i) = 612(1 + 0.10) = 673.2 € are obtained tomorrow.

- In period 1, the purchasing power of 612 € was $612/P_1 = 3$ baskets. What is the purchasing power of the 673.2 € received in period 2? It depends on P_2, the CPI in period 2. Imagine that P_2 = 220. Then 673.2 € can purchase 673.2/220 = 3.06 baskets. As a result, r satisfies $3(1 + r) = 3.06$; that is, $r = 0.02$ (2%).

Sketch of the previous example

inflation rate

$P_1 = 204$ → $P_2 = 220$

$t = 1$ $\quad \pi = 7.84\% \approx 8\%$ $\quad t = 2$

nominal interest rate

612 € → 673.2 €

$i = 10\%$

↓ ↓

PURCHA-SING POWER

$612/P_1$ $\qquad$ $673.2/P_2$

= $\qquad$ =

real interest rate

3 baskets → 3.06 baskets

$r = 2\%$

The Fisher equation

- The Fisher equation provides an approximation of the relationship between i and r.

$$i = r + \pi \quad \text{or equivalently} \quad r = i - \pi$$

- This says that the real interest rate is the difference between the nominal interest rate and the inflation rate.

- In the preceding example, $i = 10\%$ and $\pi = 7.84\%$ (as P rises from 204 to 220). According to the Fisher equation, $r = i - \pi \approx 10 - 7.84 \approx 2.16$, which is close to the correct value of 2%.

Negative real interest rates

- Though it is impossible to observe negative nominal interest rates in a modern economy, negative real interest rates may arise.
- For this to happen it suffices to have $\pi > i$.
- In the previous example, if the price level raised to, say, 269.28 instead of 220, then 673.2 € could only buy 2.5 baskets. Hence, after the loan is repaid one can purchase less baskets than the initial 3. In this case, $r = i - \pi = 10\% - 32\% = -22\%$ (actually, there is a loss of 16.6% in passing from 3 to 2.5 baskets).

The Fisher effect

- The Fisher hypothesis holds that the real interest rate is approximately constant.

- The Fisher effect is an implication of the Fisher hypothesis and asserts that there is a one-to-one relationship between i and π: every additional point of the inflation rate becomes an additional point of the nominal interest rate.

- The Fisher effect is consistent with the empirical evidence: economies with high inflation rates tend to be economies with high nominal interest rates.

Why the Fisher effect? (I)

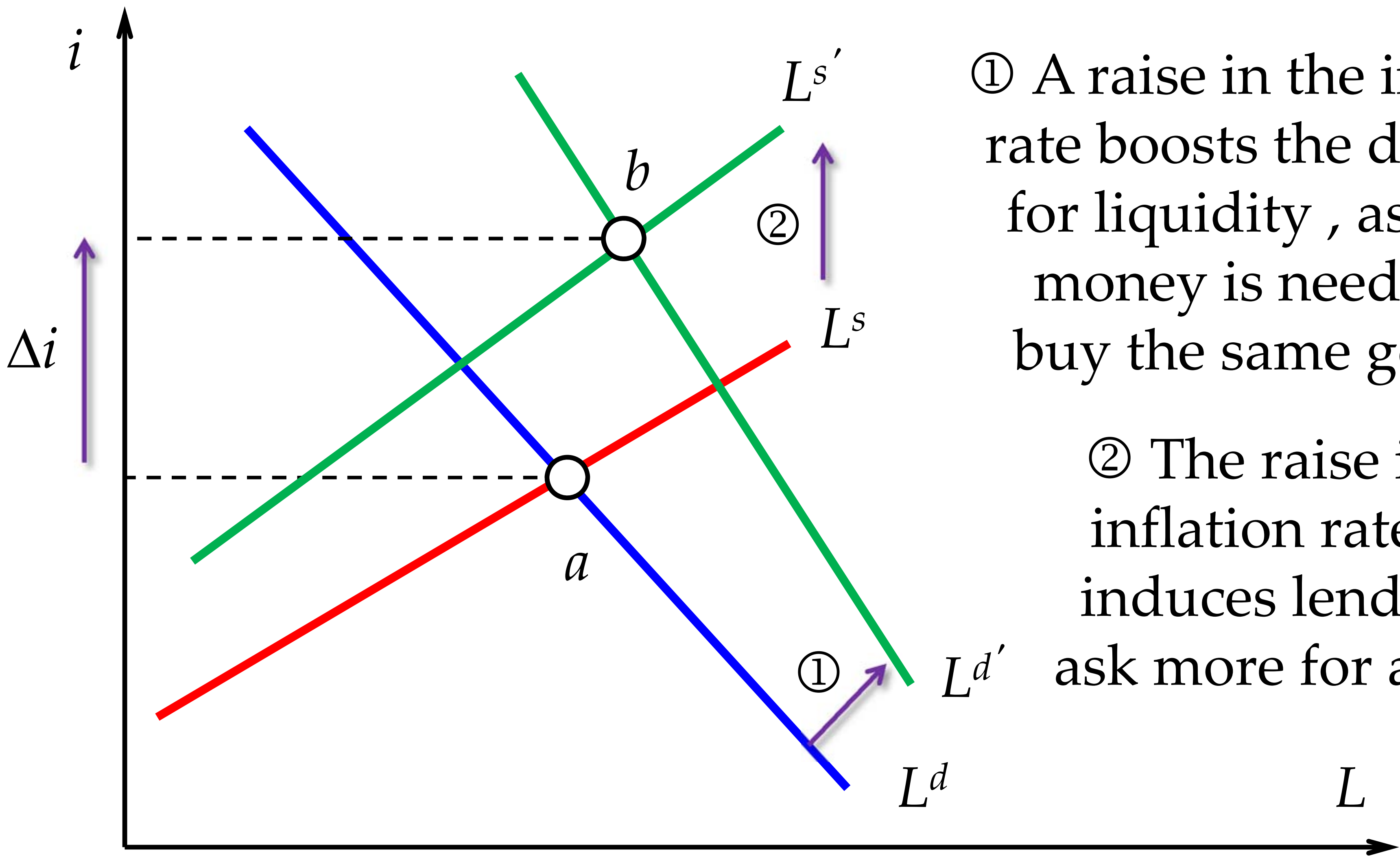
- When the inflation rate raises, it is natural to expect that lenders will demand a higher (nominal) interest rate to get back the purchasing power lost due to the increase in prices.

- Let $P_0 = 100$, $P_1 = 110$, and $P_2 = 132$, so $\pi_1 = 10\%$ and $\pi_2 = 20\%$. Suppose $r_1 = 5\%$: from period 0 to 1 lenders obtain a 5% increase in purchasing power. So for each equivalent to 1 basket lent in period 0, the equivalent of 1.05 basket should be received in period 1. That is, if 100 € are lent in period 0, 115.5 € must be received in period 1.

Why the Fisher effect? (II)

- In sum, using the Fisher equation, the i_1 ensuring that $r_1 = 5\%$ when $\pi_1 = 10\%$ is $i_1 = r_1 + \pi_1 = 15\%$.
- If the Fisher hypothesis holds, $r_2 = 5\%$. If i_2 remained at the 15%, by lending 110 € (the value of the basket in period 1), in period 2 the amount received would be $110(1 + i_2) = 110(1 + 0.15) = 126.5$. Given $P_2 = 132$, the purchasing power of 126.5 € is 0.958 baskets: there is a loss of purchasing power.
- By the Fisher equation, the i_2 needed to preserve the purchasing power of a money loan is $i_2 = r_2 + \pi_2 = 5\% + 20\% = 25\%$: from period 1 to period 2, π goes up 10 points and i also goes up 10 points.

The Fisher effect in the loan market model



① A raise in the inflation rate boosts the demand for liquidity , as more money is needed to buy the same goods.

② The raise in the inflation rate also induces lenders to ask more for a loan.