Fletcher School of Law and Diplomacy, Tufts University

12. A Closer Look at Financial Markets, Interest Rates and Risk

E212 Macroeconomics

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A Closer Look at Financial Markets, Financial Intermediation and Risk

Until now we have been assuming that there are only two financial assets, money and one period bonds. Hence, we have been assuming that there is only one interest rate.

The financial system is more complicated than that. There are many more financial instruments, more than one interest rates and many financial institutions.

Before the 2008 crisis, the financial system was relatively downplayed in macroeconomics. All interest rates were assumed to move together with the rate determined by monetary policy.

The financial crisis made it clear that this view is too simplistic. The financial system can be subject to short run crises with major macroeconomic implications.

In order to analyze such possibilities, one has to take a closer look at the role of financial markets.

The Role of Finance and Financial Markets

Financial markets perform the essential economic function of channeling funds from households, firms and governments that have surplus funds by spending less than their income, to those that have a shortage of funds because they wish to spend more than their income.

Finance can be either *direct*, or *indirect*.

In direct finance, borrowers borrow funds directly from lenders in financial markets, by selling them *securities* (also called *financial instruments*), which are claims on the borrower's future income or assets. Securities are assets for the lender, but liabilities (IOUs) for the borrower.

Securities take the form of either *bonds* or *stocks*.

Bonds are debt securities that promise to make periodic payments for a specified period of time.

Stocks are securities that entitle the owner to a share of a company's profits or assets.

In indirect finance this exchange of securities takes place through *financial intermediaries*, usually *banks*.

Financial markets allow funds to move from those who lack productive investment opportunities to those who have such opportunities, and thus contribute to an efficient allocation of capital that increases economic welfare.

Debt versus Equity Markets

A borrower can obtain funds in financial markets in two ways:

A. Through issuing a *debt* instrument, such as a bond or a mortgage. This is a contractual agreement by the borrower to pay the holder of the instrument fixed dollar amounts at regular intervals (interest and principal payments), until a specified date (the maturity date), when a final payment is made. The *maturity* of a debt instrument is the number of years (term) until the instruments expiration date. A debt instrument is *short term* if its maturity term is less than a year, and *long term*, if its maturity term is ten years or longer. Debt instruments with a maturity term between one and ten years are said to be *intermediate term*.

B. Through issuing equities, such as common stock, which are claims to share in the net income and the assets of a business firm. Equities often make periodic payments (dividends) to their holders and are considered long-term securities because they do not have a maturity date. Owing common stock means that you own a portion of the firm and gives you the right to vote on issues important to the firm and the election of its directors.

Disadvantage of being an equity holder is that you are a residual claimant, i.e the corporation must satisfy debt holders before equity holders. As an equity holder you benefit from an increase in the firms profitability but also you lose from a decrease in the firms profitability. Bond holders receive fixed amounts. In the USA the bond market is larger than the equity market. At the end of 2013 the value of bonds was about $42 trillion, versus $21 trillion for the value of equities.

Primary versus Secondary Markets

A. A *primary market* is a financial market in which new issues of a security, such as a bond or a stock, are sold to initial buyers by the corporation or government agency borrowing the funds.

B. A *secondary market* is a financial market in which securities that have been previously issued can be resold.

Primary markets are dominated by *investment banks* which *underwrite* a corporation's or a government's securities and then sell them in the secondary market.

Secondary markets are important because they make financial instruments more liquid, thus increasing their attractiveness to investors. They are also important for the determination of the price of securities and thus affect the pricing of securities in the primary market as well. Conditions in secondary markets are therefore the most relevant for corporations and governments issuing securities.

Exchanges and Over the Counter Markets

Secondary markets are organized in one of two ways:

A. Exchanges, where buyers and sellers of securities (or their agents or brokers) meet in one central location to conduct trades. The New York Stock Exchange (NYSE) and the Chicago Board of Trade for commodities are examples of such organized exchanges.

B. Over the Counter Markets (OTC). Dealers in different locations stand ready to buy and sell securities "over the counter". The OTC market relies on electronic communication systems, trades and prices are known to everybody, and is thus very competitive.

Many stocks are traded OTC but the majority of the large corporations have their shares traded at organized stock exchanges. The US government bond market, with a trading volume larger than NYSE is entirely OTC. There are about forty dealers who establish the market in US government securities, standing ready to buy or sell. Other types of securities such as negotiable securities of deposit, federal funds and foreign exchange are also traded in OTC markets.

Money and Capital Markets

Another distinguishing characteristic of financial markets is the maturity term of the securities traded.

The money market is a financial market in which only short term debt instruments are traded, i.e those with original maturity terms of less than one year.

The capital market is the market in which longer term debt instruments and equity instruments are traded.

Money market securities are usually more widely traded than longer term securities, making them *more liquid*. They also tend to have smaller fluctuations in prices, making them *safer* instruments. Such instruments are US Treasury Bills, negotiable certificates of deposit, commercial paper, repurchase agreements (repos) and Federal Funds. Capital market instruments are corporate stocks, residential mortgages, corporate bonds, US government bonds, state and local government bonds, bank commercial loans, consumer loans and commercial and farm mortgages.

Money markets are used by banks and corporations to earn interest on surplus short term funds, while capital market instruments are held by insurance companies and pension funds which have long term liabilities.

Internationalization of Financial Markets

The internationalization of financial markets is the result of globalization, the deregulation of foreign financial markets and the existence of large pools of savings in Asia and elsewhere.

Foreign bonds, Eurobonds and Eurocurrencies are the main financial instruments exchanged in international financial markets. Foreign bonds are bonds sold in a foreign country, but denominated in its currency. Eurobonds are bonds denominated in a currency other than the one of the country in which they are sold. Eurocurrencies are foreign currencies deposited in banks outside their home country.

The foreign exchange market is by far the most important international financial market, but stock and bond markets have become internationalized as well.

Financial Intermediaries

Financial intermediaries stand between lenders-savers and borrowers-spenders and help transfer funds from one to the other. This is called *indirect finance*.

In fact, *financial intermediation* is the main route for moving funds from lenders to borrowers, and is mainly conducted by *depository institutions* (commercial banks, savings and loans associations, mutual savings banks and credit unions), by *contractual savings institutions* (life insurance companies, pension funds and government retirement funds), and by *investment intermediaries* (finance companies, mutual funds, hedge funds and investment banks).

To understand the role and significance of financial intermediation one must understand the roles of *transaction costs*, *risk sharing* and *information costs* in financial markets.

Transactions Costs, Risk Sharing and Financial Intermediation

Financial intermediation implies lower transaction costs because of specialization, economies of scale and the provision of liquidity services.

In addition, because of the scale of their operations, financial intermediaries can reduce the risk of lending, by pooling different types of risk. Thus, they turn individually risky assets into safer composite assets, through diversification ("You should not put all your eggs in one basket").

By holding a larger and safer portfolio of risky assets, financial intermediaries are thus able to offer savers a safer menu of assets at a lower cost than if savers tried to do the same at a smaller scale.

Asymmetric Information: Adverse Selection and Moral Hazard

Another reason for the importance of financial intermediation is *asymmetric information*. Borrowers usually have better information than lenders about the risk and return of the investment they are about to undertake, and in addition, lenders cannot usually monitor the behavior of borrowers after they have lent them the money.

Asymmetric information creates two types of problems. Adverse selection and moral hazard.

Adverse selection is the problem created by asymmetric information before the transaction takes place. Adverse selection occurs when the riskier borrowers, the more likely to produce an adverse outcome, are the ones more actively trying to secure a loan. Because of adverse selection, lenders may decide not to make any loans, although good credit risks exist.

Moral hazard is the problem created by asymmetric information after the transaction occurs. It is the risk (hazard) that the borrower might ex post engage in activities that are undesirable (immoral) from the view point of the lender, because they reduce the probability that the loan might be re-paid. Hence, again, borrowing and lending may break down because of this risk.

With financial intermediation, small savers can deposit their funds with the financial intermediary who, because of the specialization and the scale of their operations, have better means to address asymmetric information, by screening aspiring borrowers and monitoring the behavior of borrowers ex post. Thus, financial intermediaries can mitigate the problems of asymmetric information and expand the market.

Economies of Scope and Conflicts of Interest

Most financial intermediaries provide a range of financial services to their customers. Banks take in deposits, offer loans, provide liquidity services through checking accounts, insurance services and so on. Thus, financial intermediation also implies *economies of scope*.

Economies of scope create the potential for *conflicts of interest*, a type of moral hazard problem that arises when an agent has multiple objectives (interests) some of which conflict with each other. Conflicts of interest are more likely to occur when a financial institution provides multiple services.

The Risks of Financial Intermediation

Financial intermediation increases the efficiency of the financial system, but is not without risks.

For a start, the problem of asymmetric information remain. Intermediaries have better information about risks than their lenders and worse information than their borrowers. Hence, the need for government regulation to reduce the problems of asymmetric information.

In addition, financial markets are vulnerable to *systemic risks*. A negative systemic shock can destabilize them, especially as there is a discrepancy between the maturity structure of the liabilities and the assets of financial intermediaries. The liabilities of financial intermediaries are typically safe short term securities (e.g. checking accounts), while their assets are riskier and longer term (e.g. long term loans and bonds). If there is a shock that reduces the return of their assets and at the same time shakes the confidence of lenders-savers, leading them to withdraw their deposits, financial intermediaries may run into liquidity or solvency problems. Again, the possibility of such systemic risks creates the need for regulation.

In the absence of regulation, adverse shocks may lead to a destabilization of the financial system and a *financial crisis*. We shall return to the risks of financial intermediation below.

Interest Rates and Expected Present Values

- Different debt instruments have different streams of cash payments (known as *cash flows*) to the holder.
- In order to understand similarities and differences between different debt instruments we need to understand how interest rates are measured. For this we need to understand the concept of present value.
- The concept of present value (or presented discounted value) is based on the notion that a dollar paid to you one year from now is less valuable than a dollar paid to you today. A dollar today can be invested in a debt instrument, say a time deposit, and yield more than one dollar in a year. Thus, if the interest rate is equal to i, a dollar today is equal to $1+i$ dollars in a years time. This means that a dollar in one year's time is only equal to $1/(1+i)$ dollars today, which is less than one dollar.
- This way of calculating the current value of future payments is called *discounting the future*.
- What is the value of a dollar T years from now. By analogy it is equal to $1/(1+i)^T$, where we have assumed that if we invest 1 dollar today for T years, at the end of the period we shall get $(1+i)^T$ dollars.

Loans versus Bonds

In terms of timing of their cash flow payments, there are four basic types of credit market instruments.

1. *Simple loans*: A simple loan is a loan in which the lender provides the borrower with an amount *L* that must be repaid to the lender at the maturity date, along with an additional payment for the interest. Commercial bank loans to businesses are of this type.

2. *Fixed payment*, or *fully amortized loans*: The borrower repays by making the same payment, consisting of part of the principal and interest every period, for a set number of periods. Auto loans and mortgages are of this type.

3. *Coupon Bonds*: The owner of the bond receives a fixed interest payment (coupon payment) every year, until the maturity date, when a specified final amount, the face value, is repaid. Thus a coupon bond is identified by a. the bond's face value, b. the issuer, c. its term (in years) and d. the bond's coupon rate. US treasury bonds and corporate bonds are examples of coupon bonds.

4. *Discount, or zero coupon bonds*: These are bought at a price below their face value, at a discount, and the face value is repaid at the maturity date. A discount bond does not make interest payments. They just pay off their face value when they mature. US Treasury bills, US savings bonds and long-term zero coupon bonds are examples of discount bonds.

The question that arises, is how can one calculate the rate of interest of these different types of debt instruments.

To solve this problem, we can calculate their so called *yield to maturity,* which is the interest rate that equates the present value of cash flow payments received from the a debt instrument with its value today. This is the appropriate interest rate and in asset market equilibrium is equal to the market interest rate.

In general the price (present value) of bonds is negatively related to the level of market interest rates. When market interest rates rise, the price of existing bonds falls and vice versa.

Yield to Maturity of Loans and Bonds

The yield to maturity i of a *common one year loan* of L dollars, where the borrower has to repay C dollars, is given by the formula,

$$L = \frac{C}{1+i}$$

The yield to maturity i of an n period *fixed payment loan*, with loan value L and a fixed payment C per period, is given by,

$$L = \frac{C}{(1+i)} + \frac{C}{(1+i)^2} + \frac{C}{(1+i)^3} + ... + \frac{C}{(1+i)^n}$$

The yield to maturity i and the price P of an n year coupon bond with a coupon equal to C and a face value F is given by,

$$P = \frac{C}{(1+i)} + \frac{C}{(1+i)^2} + \frac{C}{(1+i)^3} + ... + \frac{C}{(1+i)^n} + \frac{F}{(1+i)^n}$$

The yield to maturity i and the price P of a *consol* or *perpetuity*, which is a coupon bond with infinite maturity and thus no repayment of principal, is given by,

$$P = \frac{C}{i}$$

Finally, the yield to maturity i and the price P of a one year zero coupon bond (discount bill) with face value F is given by,

$$P = \frac{F}{1+i}$$

Rate of Return on Bonds and Interest Rates

The *rate of return* on an n period bond is not the same as the interest rate.

For any security the rate of return is defined as the amount of each payment to the owner, plus the change in the security's value, expressed as a fraction of its purchase price.

The rate of return on a bond held from period t to period $t+1$ can be written as,

$$R = \frac{C + P_{t+1} - P_t}{P_t} = \frac{C}{P_t} + \frac{P_{t+1} - P_t}{P_t} = i + g$$

The rate of return depends on two factors: first the current interest rate i, and second the percentage change in the bond's price, the percentage capital gain on the bond. Since changes in interest rates cause bond prices to move in the opposite direction, the rate of return on bonds depends both on current interest rates (positively) and changes in interest rates (negatively).

The more distant a bond's maturity date, the greater the size of the percentage change in its price associated with a given change in interest rates. Therefore, the lower the rate of return that occurs as a result of an increase in interest rates. In fact, the rate of return for a bond with a distant maturity date may turn out to be negative following an interest rate rise.

Annual Rates of Return of One Year Discount Bills, 5 year bonds and Perpetuities, following a Rise in Interest Rates from 2% to 4%

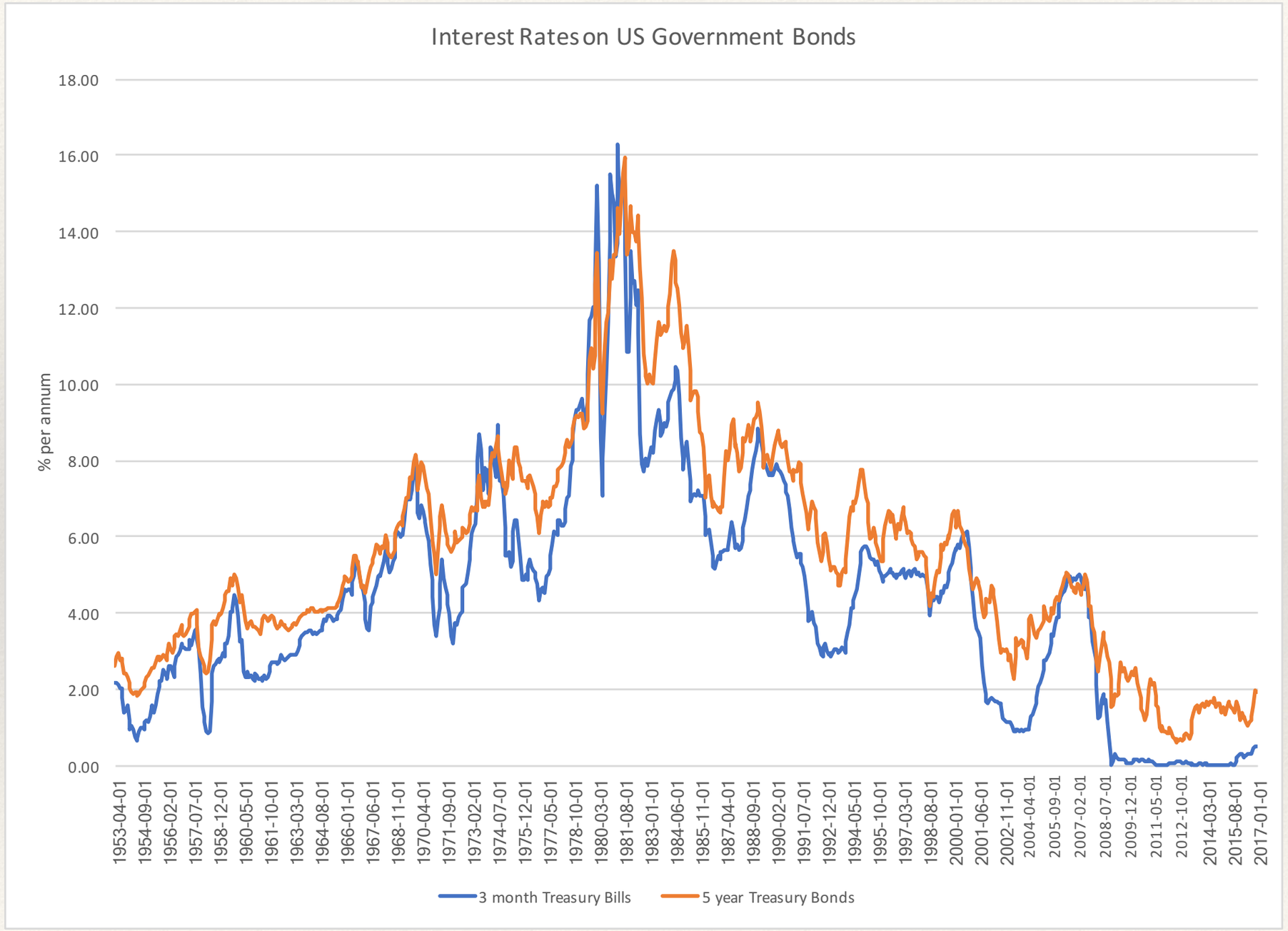
For a one year discount bill purchased when interest rates were 2%, the rate of return is equal to that interest rate, because at the end of the year the bill is sold at its face value. Thus, the rate of return is equal to +2%. This is the example we have been using so far in the IS-LM model.

For a five year coupon bond, with an annual coupon of $10 and a face value of $500, the initial price was equal to $500. Because of the increase in the interest rate, the price at the end of the year falls to $463.65, a capital loss of 7.27%. Since the coupon was 2% of the original price, the rate of return to the bond is equal to -5.27%.

For a perpetuity, with an annual coupon of $10, the initial price was equal to $10/2%=$500. At the end of the year, with the interest rate having risen to 4%, the price falls to $10/4%=$250. A capital loss of 50%. The annual rate of return is -48%, because of the catastrophic drop in the bond price.

Hence, bonds with longer maturities will command higher interest rates to compensate for their more volatile (risky) rates of return. This will determine the *term structure of interest rates*. The longer the maturity, the higher the interest rate.

The Term Structure of Interest Rates
3 month Treasury Bills and 5 year Treasury Bonds



Risk and Risk Premia

Bonds do not differ only in terms of maturity. They differ in terms of *risk*. Some bonds are nearly riskless, in the sense that the probability that the borrower will not repay is almost zero. Other bonds are risky, in the sense that there is a non-negligible probability that the borrower will be unable, or unwilling, to repay, i.e that the borrower will *default*.

Households and firms cannot borrow at the federal funds rate or the Treasury bill rate, or the same terms as the US government because they have a higher probability of not repaying than banks or the US government. Hence bond holders of corporate bonds, and banks extending mortgages require a *risk premium*.

Two key factors determine the size of the risk premium. The *probability of default* and the *risk aversion* of investors.

Assume a riskless one period bond or loan that has an interest rate of i. A risky bond or loan of the same maturity will have a higher interest rate, say $i+x$, where x is the risk premium. Why? Because of the positive probability of default. The riskless bond pays $1+i$ with certainty. The risky bond pays $1+i+x$ with probability $1-p$, and 0 with probability p. $0<p<1$ is the probability of default. If investors are risk neutral, they will require the same expected return from both types of bonds if they are to hold both. Hence, in equilibrium, the rate of return of the riskless bond will be equal to the expected rate of return of the risky bond.

$$1+i = (1-p)(1+i+x)$$

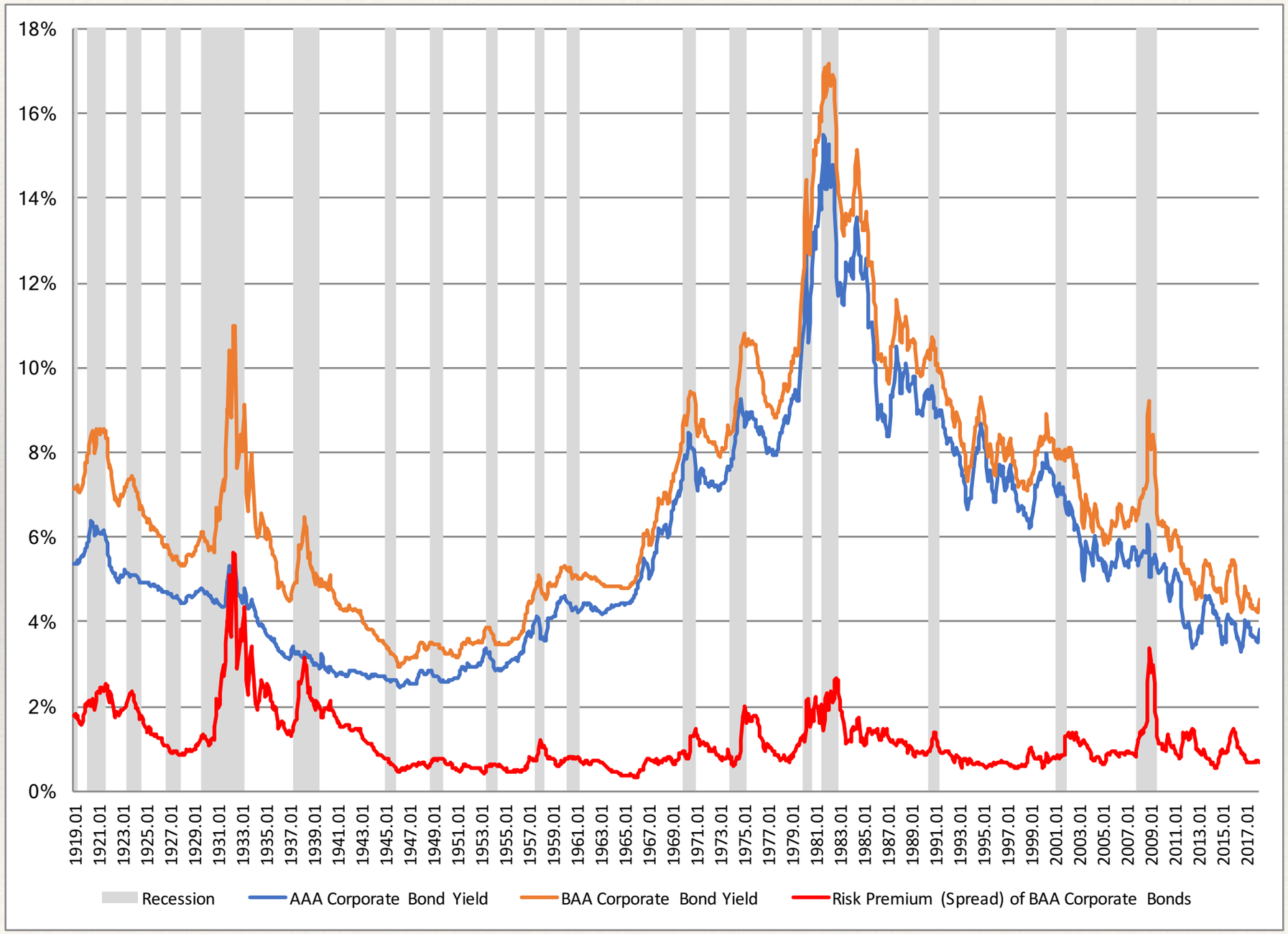
Solving for the risk premium x, we get,

$$x=(1+i)p/(1-p)$$

Hence, the higher the interest rate and the higher the probability of default, the higher the risk premium.

Risk aversion will make the risk premium even higher than in the case of risk neutrality, as investors will require a higher expected return from risky bonds. Hence, if risk aversion increases, risk premia will increase even with unchanged default probabilities.

The Risk Premium of US Corporate Bonds



Financial Intermediaries and the Risks of Leverage

We have already alluded to the risks of financial intermediation. We shall now look at them in more detail.

The discussion will focus on three aspects of financial intermediation:

The relation between *leverage and profitability* (positive)

The relation between *leverage and risk of insolvency* (positive)

The relation between leverage and the risk of financial crises (positive)

Central to these relations is the concept of *leverage*, which is defined as the ratio of assets to capital. Leverage is nothing but the inverse of the capital ratio of a bank.

Leverage and Profitability of a Bank

Loans etc	L	Deposits etc	D
Reserves	R	Capital	C
Total Assets	A	Total Liabilities	A

$$\text{Capital Ratio} = C/(L+R) = C/A \qquad \text{Leverage } \lambda = (L+R)/C = A/C$$

Assume that the expected yield of assets such as loans etc and reserves is $i+x$ and the expected cost of deposits etc is $i-z$.

Then, the expected rate of return on capital C is given by,

$$i_C=(A(i+x)-(A-C)(i-z))/C = (i-z) + (A/C)(x+z) = (i-z) + \lambda(x+z)$$

It is clear than *increasing leverage, increases the expected rate of return on capital* for the bank.

The Risks of Leverage

Higher leverage increases the expected profitability of a bank.

On the other hand, bank assets yield more than the cost of bank liabilities like deposits exactly because they are associated with longer maturities and higher risk. Therefore, higher leverage increases the risk of losses for the bank, which may lower the value of its assets below the value of its liabilities and make the bank insolvent. Thus, the higher the leverage ratio, the higher the risk of insolvency for the bank.

Thus, a bank must choose a leverage ratio that will balance the expected returns to capital against the risk of insolvency.

Bank Losses, Deleveraging and Insolvency

A=100, C=20, i=2%, x=1%, z=1% . Leverage λ is equal to 5. Expected return on capital is given by,

$$i_C = (i\text{-}z) + \lambda(x+z) = 1\% + 5(2\%) = 11\%$$

Assume that because of a financial shock, the bank makes losses on its risky assets, and assets *A* fall by 10%. Its total assets *A* fall to 90 and its capital *C* falls to 10. Leverage λ now increases to 10.

The bank considers a leverage ratio of 10 as too risky, and tries to bring it back to 5. It has a number of options.

- Increase capital by 10 and extend more loans.
- It can reduce its loans by 40 and use the 40 to reduce its deposits etc. Its total assets will fall to 50, but the leverage ratio will return to 5. This process is called *deleveraging*, and if all banks were to follow it, it would result in a significant reduction in bank lending, deposits and liquidity.

If the fall in its assets were higher than 20%, the bank would immediately become insolvent, as its capital would become negative. In such a case, depositors would lose their deposits and bank loans would have to be liquidated. The result would again be a fall in bank assets and liabilities, and if many banks were affected, it would result in a significant reduction in bank lending, deposits and liquidity.

In the presence of uncertainty about the true financial position of a bank, these effects can come about even in the absence of a decline in the assets of banks. If investors and depositors withdraw their loans and deposits to the bank, a so called *bank run*, the bank may have to sell its assets at knock down prices through a *fire sale*, or may even be unable to repay depositors. Thus, a bank run can make banks insolvent even if they are fundamentally sound. Again the reason is leverage.

The Macroeconomic Effects of Financial Crises

To summarize, leverage makes banks and other financial intermediaries vulnerable to financial shocks and confidence crises. Because their assets are less liquid than their liabilities and carry higher risks, financial shocks can destabilize the banking system, causing bank failures and deleveraging. This reduces liquidity, increases the rate of return of risky assets and may have serious macroeconomic consequences.

In effect, through its liquidity effects and the rise in risk premia a financial crisis causes a reduction in aggregate demand and may tilt an economy towards recession. This is what happened both in 1929, with the stock market crash and the wave of bank bankruptcies, and in 2007-2009 with the subprime and Lehman crisis.

To analyze the effects of a financial crisis, we must first extend our basic *IS-LM* framework.

Extending the IS Framework

In the IS-LM framework so far we had assumed that there is only one nominal interest rate, determined by the open market operations of the central bank.

Following our extension of the treatment of financial markets, we can distinguish between at least two interest rates, the risk free interest rate, i, determined by the central bank, and the risk adjusted interest rate faced by borrowers, which given by $i+x$. The real interest rates corresponding to these two nominal interest rates are given by $r=i-\pi^e$ and $r+x$, where π^e is expected inflation.

The risk premium x captures the set of factors we have discussed in our analysis of financial markets. It may be high or low depending on the perceptions of lenders and financial intermediaries about the probability that borrowers may default, or because of the degree of risk aversion of lenders and financial intermediaries

Assuming that investment depends on the the *risk adjusted real interest rate*, we can rewrite the *IS* relation as,

$$Y=C(Y-T)+I(Y, i-\pi^e+x)+G$$

Thus, we now assume that investment depends on the risk adjusted real interest rate, $r+x=i-\pi^e+x$ instead of the central bank nominal interest rate. This is obviously more realistic.

Extending the LM Framework

Following our discussion about inflation and the natural rate, instead of the usual LM we shall now assume that the central bank follows an interest rate rule, of the form,

$$i=i_n + \phi(\Upsilon - \Upsilon_n)$$

ϕ measures the responsiveness of the central bank nominal interest rate to deviations of output Υ from its "natural rate", and i_n is the interest rate target of the central bank when output is equal to its natural rate.

Thus, there are two policy parameters that determine monetary policy. ϕ which determines the slope of the *LM* curve, and i_n which determines its position.

In what follows we shall treat ϕ as given, and consider changes in the target interest rate of the central bank, i_n.

The LM curve can be rewritten in terms of the central bank real interest rate $r=i-\pi^e$, after we subtract expected inflation π^e from both sides of the *LM* curve.

The Extended IS-LM-PC Framework

Hence, we can rewrite the extended *IS-LM* framework as,

$$Y=C(Y-T)+I(Y, r+x)+G$$

$$r=r_n + \phi(Y - Y_n)$$

Thus, in the short run, the extended IS-LM framework determines output relative to its natural rate, and the risk free real interest rate r.

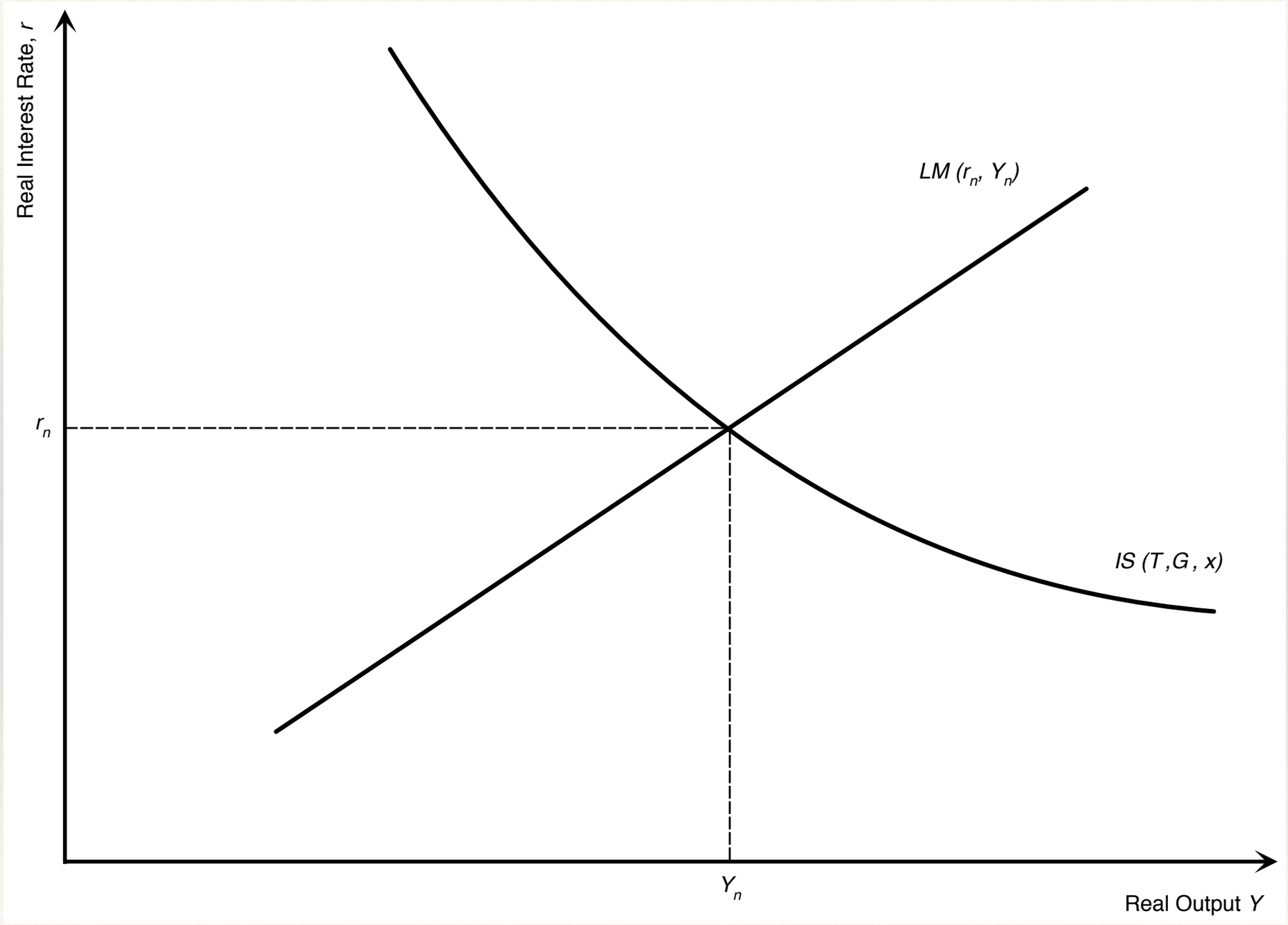
The risk adjusted real interest rate faced by borrowers is given by $r+x$, where x is an exogenous risk premium.

Actual inflation is determined by the expectations augmented Phillips curve which, in view of our model of wage and price setting is given by,

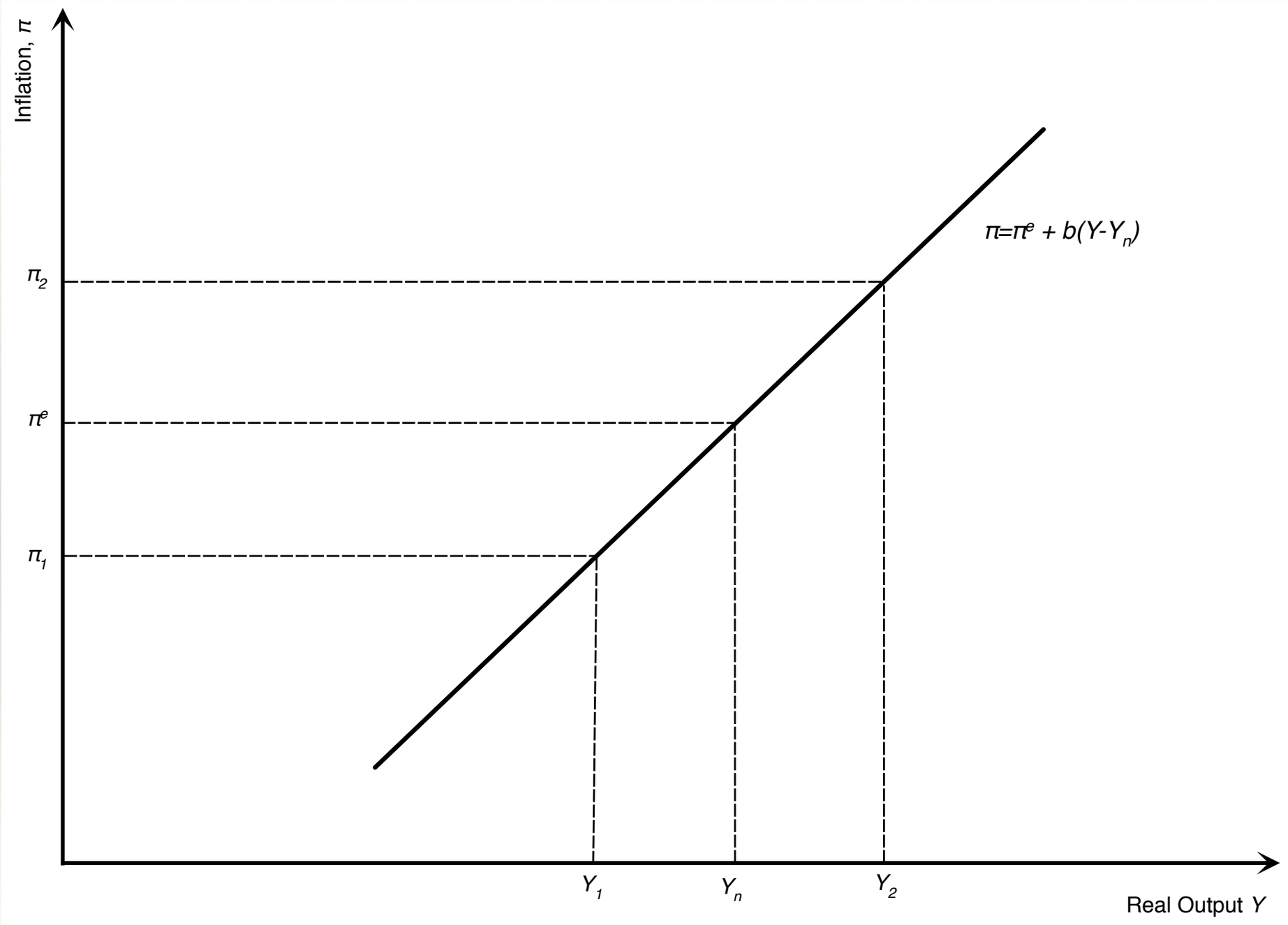
$$\pi = \pi^e + b(Y - Y_n)$$

where $b=(a/AL)$.

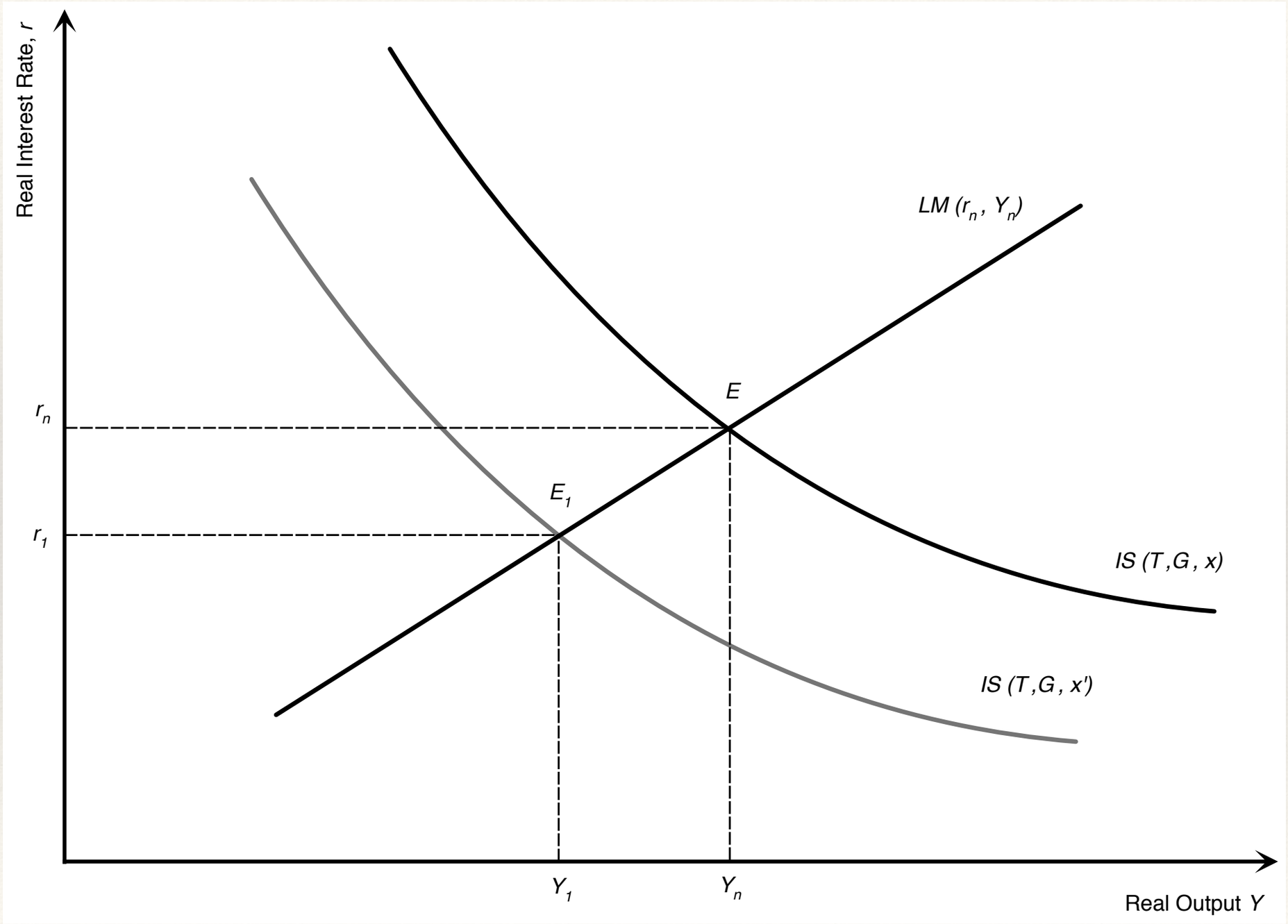
The Extended IS-LM Framework



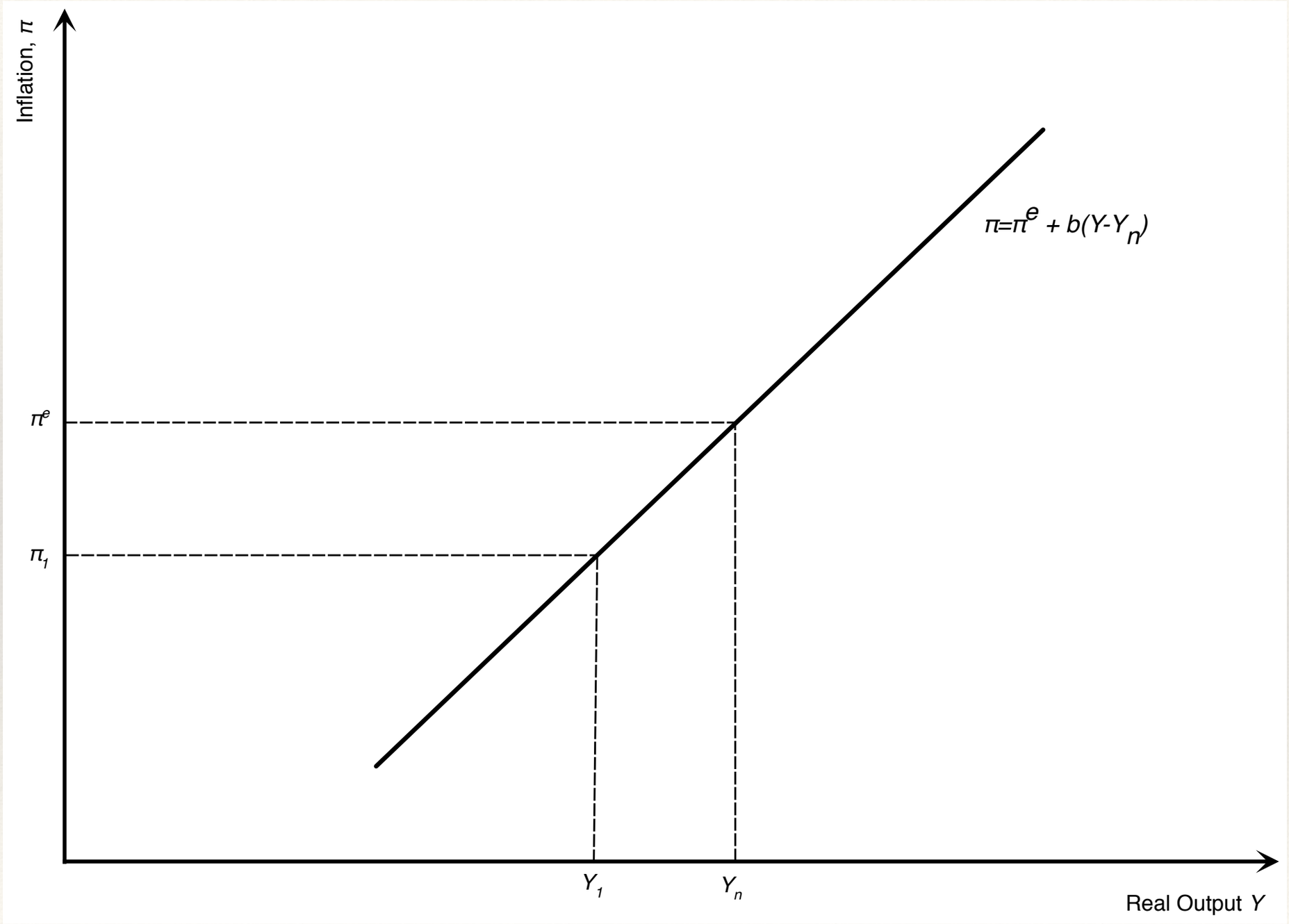
The Expectations Augmented Phillips Curve



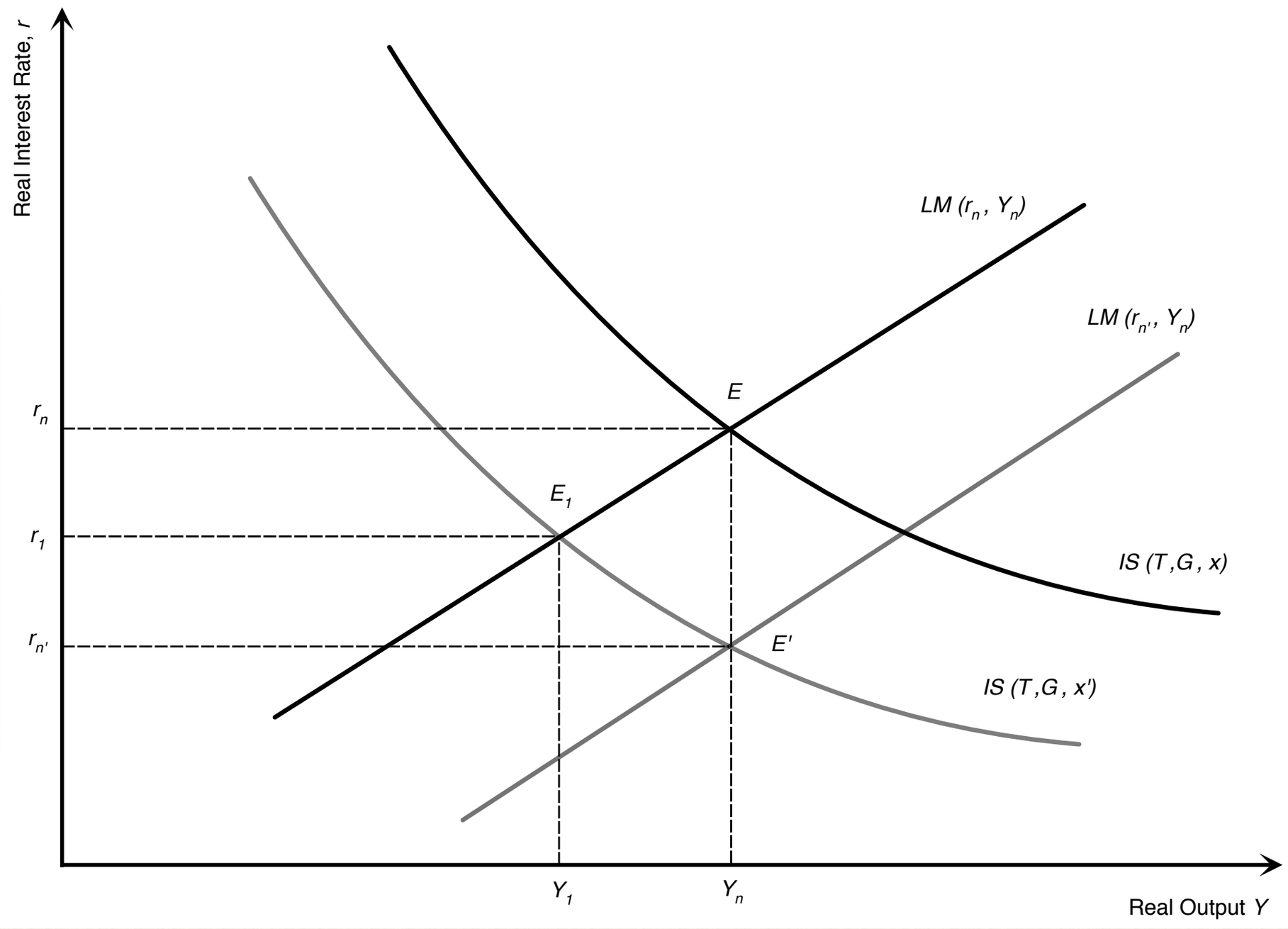
The Short Run Output Effects of a Financial Crisis



The Short Run Inflation Effects of a Financial Crisis



The Appropriate Monetary Policy Response to a Financial Crisis



The Zero Lower Bound on Nominal Interest Rates