Financial Market Imperfections, Financial Crises and Macroeconomic Dynamics: The Contributions of Hyman Minsky and Joseph Stiglitz

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Introduction

Goal

- Present a selection of the theoretical contributions by Hyman Minsky and Joseph Stiglitz to the interpretation of macroeconomic dynamics

Main similarities between the two approaches

- Both focus on the role that financial variables and the distribution of risk in the economy play in determining the dynamics of aggregate real variables
- Both emphasize the heterogeneity of agents
- Both build on previous contributions by Keynes and Kalecki and allow a role for active government intervention

Main differences between the two approaches

- Minsky's approach is dynamic, mainly appreciative, and emphasizes the endogenous instability of capitalist economies
- Stiglitz' work is rooted in the New Keynesian (and Slutsky-Frisch) equilibrium modelling approach with rational expectations

Financial Dynamics and the Instability of Capitalist Economies: the contributions of Hyman Minsky

Minsky's contribution aims at demonstrating the following two propositions (see Minsky, 2008):

1. Capitalist market mechanisms cannot lead to a sustained, stable-price, full-employment equilibrium
2. Serious business cycles are due to financial attributes that are essential to capitalism

The argument for the above propositions is articulated into three main blocks

1. The role of prices in a capitalist economy based on financial relations
2. The role of financial variables in the determination of the investment level
3. The role of risk and money in the determination of the price of financial assets

1. The Role of Prices: Critique of the Neoclassical theory

- Prices in neoclassical theory have only the function of 1) allocating scarce resources; 2) allow the equilibrium between supply and demand
- Only relative prices matter. Absolute prices are ignored
- However, in a capitalist economy the financing of investment and the ownership of the stock of capital assets lead to commitments to make money payments, i.e. to contractual cash flows
- It follows that a system of cash-flow relations among agents is fully integrated with the real part of the economy
- The interplay between finance and the real side of the economy implies that prices (absolute prices) must also be carriers of profits. More precisely prices must assure that:
  1. A surplus over operating costs is generated, and resources for further investment are available
  2. Market prices for capital assets are consistent with the current production costs of output that become capital assets
  3. Obligations on business debts are fulfilled

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Macroeconomic Price Relations in a Capitalist Economy: A simple model

- Model originally due to Kalecki (1935)
- Economy with two sectors. One sector produces a consumer good, the other sector an investment good. Each sectors employs only labour.
- $P_C Q_C$ aggregate nominal consumption. $P_I Q_I$ is aggregate nominal investment.
- W_C: the nominal wage rate in the consumption sector. W_I is the nominal wage in the investment sector
- N_C: employment in the consumption sector. N_I: employment in the investment sector
- Workers spend all their income in consumer goods. Enterpreneurs do not consume.
- Under these hypotheses, if only consumer goods were produced we would get:

$$P_C Q_C = W_C N_C \quad \rightarrow \quad \pi_C = P_C Q_C - W_C N_C = 0$$

- If we allow for production in the investment good sector then:

$$P_C Q_C = W_C N_C + W_I N_I \quad \rightarrow \quad \pi_C = P_C Q_C - W_C N_C = W_I N_I$$

- From the last equation we also get:

$$P_I Q_I = W_I N_I + \pi_I = \pi_C + \pi_I$$

- Thus, aggregate realized investment is equal to aggregate realized profits!
- If $I > 0$ then prices must be such that $\pi > 0$
- Investment determines prices and income distribution
- The level of investment that is realized however crucially depends on the ways it is financed!

2. Firm's Financial Structure and Investment

- Neoclassical theory ignores financing considerations in the determination of the level of investment
- The demand price for investment the expected net present value of the flows of profits that the capital asset will provide

$$P_K = K(\pi_t), \quad t = 1, 2, ..., T$$

- $K(\pi_t)$ is a "capitalization function"
- Investment is mainly produced on a made-to-order basis.
- Technology sets limits to the possibility to produce investment goods,
- The supply price of investment will then be an increasing function of investment output after a given threshold.

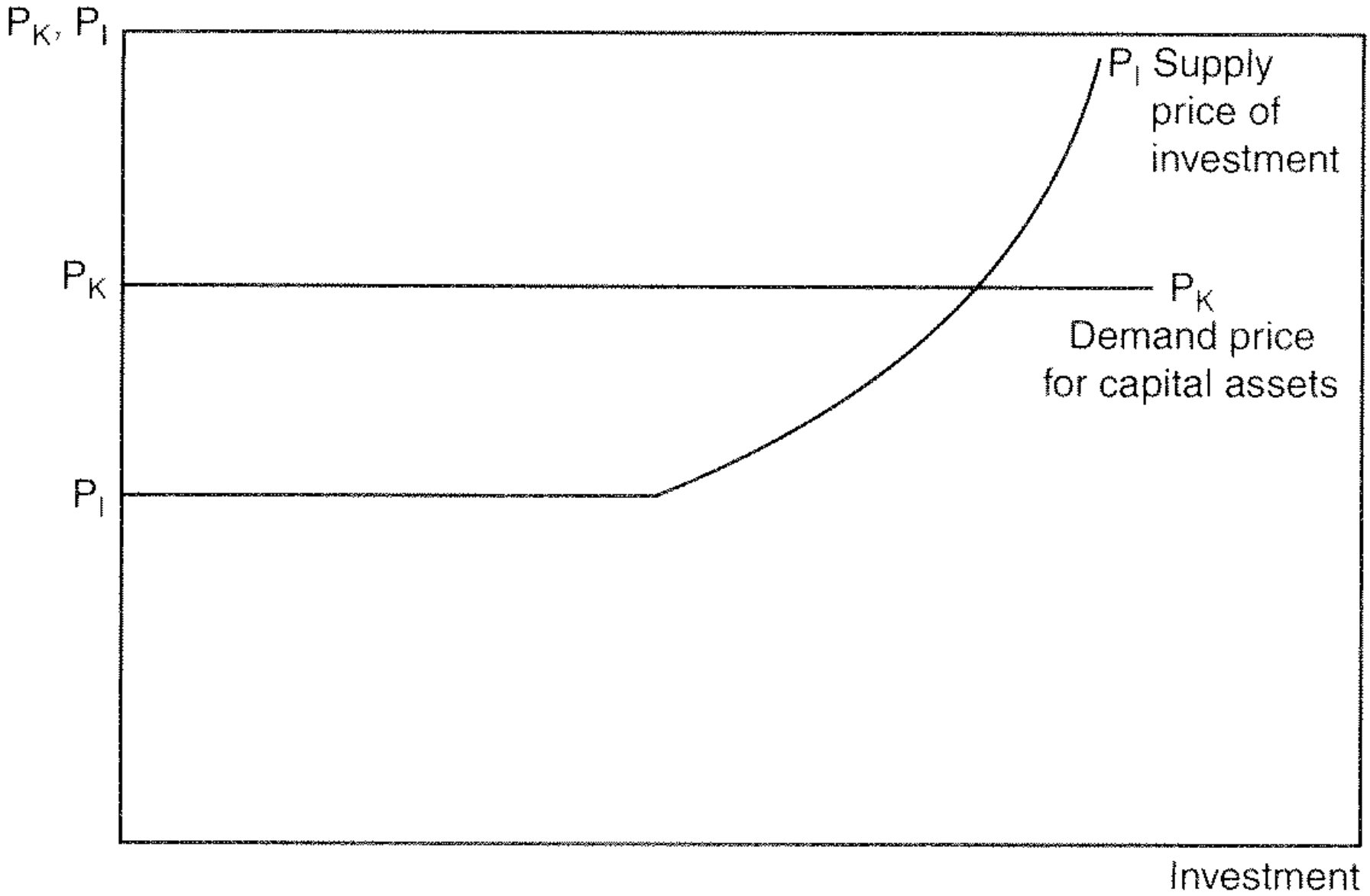

Figure 8.2: Investment: Ignoring Financing Considerations

- The foregoing discussion ignores the existence of a lag between the order of an investment good, its production and final delivery
- Such a lag implies that the supplier of investment goods bear the risk that its customer will not pay for the completed order (*lender's risk*)
- Note that the same type of risk is borne by the bank that finances the investment expenditures of the firm demanding
- Moreover, the firm investing in the asset will have to investment expenditures either through internal (e.g. cash reserves) or external sources (e.g. bank debt).
- The reduction of internal financing sources and/or the increase of external financing will increase the financial fragility of the firm and therefore the risk of going bankrupt (*borrower's risk*).
- The existence of a borrower's and lender's risk will in general imply that the level of investment is different from the one determined by simple technological and net present value considerations

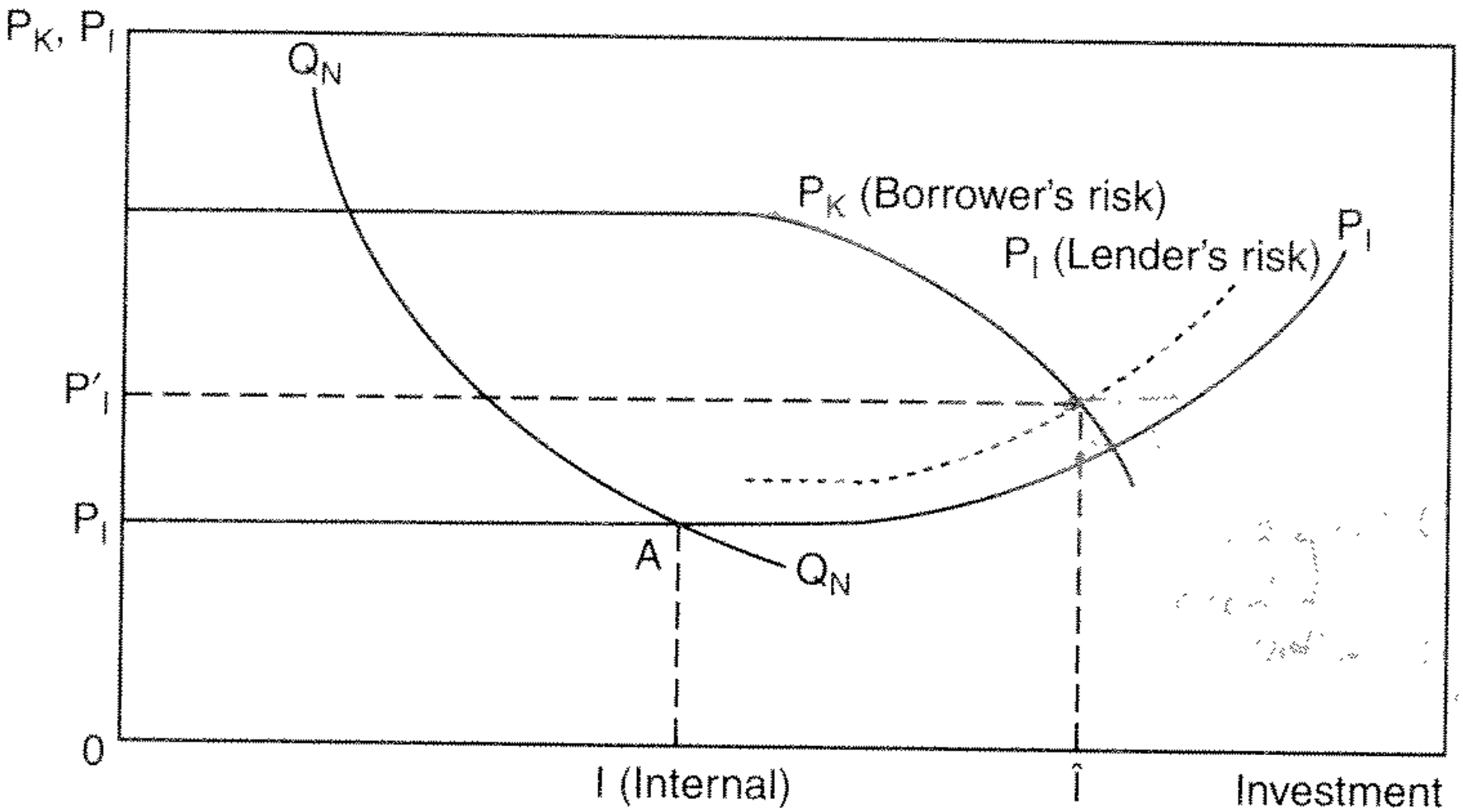

Figure 8.3: Investment: Impact of Internal Funds and External Finance

Firm's Financial Hierarchy

- Minsky identifies three different sources of financing for investment
  1. Cash and equivalent assets (e.g. Treasury bills, commercial paper) on hand that are not required by current operations
  2. The flow of profits after dividend and taxes that accrue while the investment is being produced
     - Let Q_N be the flows of internal internal funds available for investment. The demand schedule of internally financed investment is given by

$$P_I Q_I = Q_N \rightarrow P_I = \frac{Q_N}{Q_I}$$

  3. External funds (debt to banks and other financial intermediaries, bond issues, equity issues)

- The distribution of financing among the three different sources determine the level of bankruptcy risk faced by the firm (and its demand price for investment).
- According to Minsky, decisions about the financial structure are characterized by strong uncertainty. Therefore, the appropriate financial structure can be determined only on the basis of history, conventions and the pace of financial innovation.

A Taxonomy of Agents based on their Financing Regimes

- Three different groups of agents can be identified according to their financial exposure: *hedge units*, *speculative units*, *Ponzi units*
  - For hedge-financing units the cash flow from operating capital assets is more than sufficient to meet interest plus principal commitments on debt
  - For speculative-financing units the cash flow from operating capital assets is lower than the sum of interest and principal debt commitments. However, it is enough to cover interest payments so that debt do not rise
  - For Ponzi-financing units the cash flow from operating capital assets is lower than the sum of interest rate and principal debt commitments. Moreover, it is not enough to cover interest payments, so that debt grows to cover past debt commitments
- Agents can move across different categories as a consequence of favourable and adverse shocks (e.g. to profits)
- Bankruptcy is one way of transforming Ponzi and speculative units into hedge units

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The Microfoundations of an alternative IS curve

- The demand price of investment is negatively influenced by the *long-term interest rate*
- Differently, the supply price of investment is positively influenced by the *short-term interest rate*. This because:
  1. financing costs enter in the determination of investment supply price
  2. the financing costs in the production process of investment goods is interim financing.
- It follows that the level of investment will vary inversely with interest rates (both short term and long term)
- However - differently from the Neoclassical Synthesis framework - the shifts of this negatively sloped relation are not exogenous. They are determined by the composition of financing structures of agents and (relatedly) by the distribution of borrower's and lender's risk in the economy.

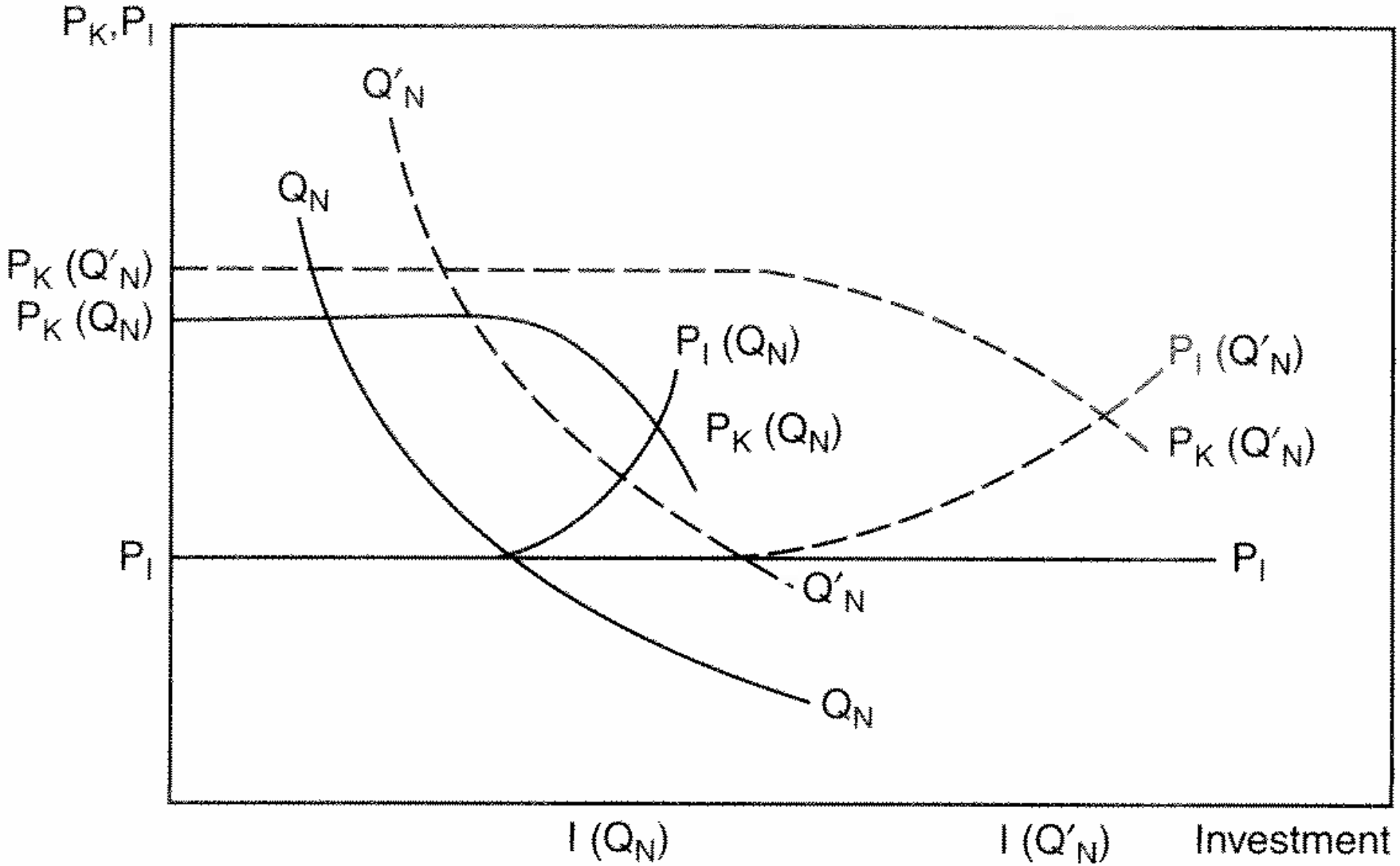

Figure 8.4: Investment Determination: Alternative Configurations of Internal and External Finance

Interest Rates, Investment and the Dynamic Forces toward Instability

- A regime of low interest rates will lower both the supply price and demand price of investment, this will foster investment.
- However, the cheaper financing terms will also induce a dynamic shift of firms' financial structures towards external financing
- The shift towards external financing will increase the financial fragility of firms and therefore the level of borrower's and lender's risk
- Thus, an investment burst generated by low interest rates contains in itself the seeds for the next phase of recession and crisis

3. Financial Assets Prices and Money

- The previous analysis can be largely adapted to explain the determination of prices of financial assets
- Indeed, financial assets are much like capital assets in that their ownership entitles one to a future stream of cash
- Therefore financial assets prices are also determined by the net present value of the stream of cash they are expected to yield

Money

- Money is a very special financial asset, because its ownership does not yield a return
- However, money is the general mean of economic transactions, including financial transactions
- This implies that in an economy based on credit relations, money also has the function of protection against the risk of not meeting credit obligations (insurance against default risk)

The Microfoundations of an alternative LM curve

- All transactions involving financial assets are credit relations (money-now-for-money-later relations)
- It follows that - given the expected net present value of future cash streams - the price of financial assets will be determined by:
  1. the degree of liquidity of the financial asset
  2. the perceived value of default insurance that money provides
- Normally the price of financial assets will be an increasing and concave function of the quantity of money available (more money = cheaper insurance). Except in two cases:
  1. an increase in the amount of insurance does not lower the premium an agent is willing to pay for such insurance (infinitely elastic demand for money).
  2. the insurance provided by money is deemed to be of no or decreasing value, because inflation expectations are very high
- Finally, even in "normal times" the relation between asset price and money may shift as a consequence of changes in the expected net present value of assets (e.g. higher expected profits) or because of shifts in the perceived value of default insurance

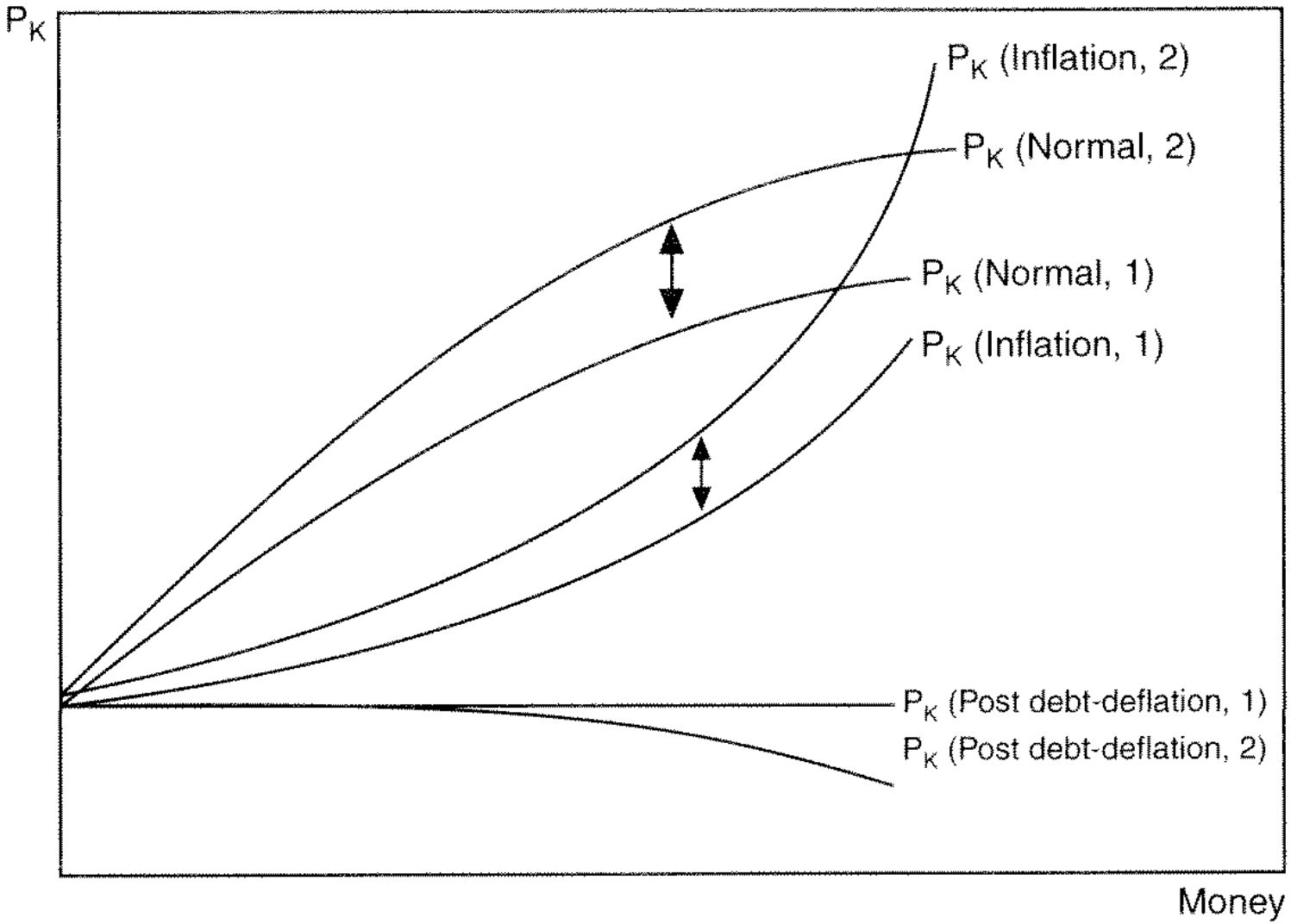

Figure 8.1: Price Level of Capital Assets: Relation to Money Supply and Alternative Expectations Environments

Financial Instability and the Rupture of the Patinkin Resolution

- Patinkin (1965) pointed to real money balances effect as an equilibrating force in situations of involuntary unemployment

$$U\uparrow \rightarrow \quad P\downarrow \rightarrow \quad \frac{M}{P}\uparrow \rightarrow \quad C\uparrow \rightarrow \quad U\downarrow$$

Critique N. 1

- The efficacy of the real money balances effect critically depends on the ratio between inside business debt (whose validation depends on profits) to outside financial assets (whose validation is independent of profits) being small
- When the above ratio is high, price deflation will deplete business profits, thereby inducing asset deflation and bankruptcies in the economy

Critique N.2

- Even when real money balances effect aggregate demand and profits and curb unemployment, the economy will not end up in a stable full-employment equilibrium. Differently, the economy will follow a path characterized by asset price inflation and increasing financial fragility
  - The increase in profits induced by real money balances will indeed raise the expected net present value of financial assets. Moreover, it will ease the constraints imposed by the current liability structures, thereby reducing the value of default insurance provided by money. Both effects will result in an upward shift of the $P_K M$ schedule, and in an increase of the price of financial assets
  - The foregoing process will be self-reinforcing since higher asset prices will generate further increases in consumption and improvements in the balance sheets situation of firms
  - Furthermore, asset price inflation will also induce agents to take more risk, by lowering the insurance value of money, borrower's and lender's risk!

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Equity Rationing, Risk-Averse Firms and Business Cycles: The Contributions of Stiglitz (and Greenwald)

Analogies and Differences with the contribution of Minsky, and with New Keynesian models

1. New Keynesian equilibrium framework with rational expectations
2. Model with heterogeneous agents
3. Aggregate Fluctuations from small microeconomic shocks
4. Changes in the distribution of risk among agents as the main driver of business cycles
5. Emphasis put on asymmetric information problems in financial, output and labour markets
6. Business cycles emerge in the presence of perfect wage and price flexibility
7. Real rigidities in labour market as the source of unemployment in the labour market

Equity, Debt and Firm Risk Aversion

- In the presence of asymmetric information between the firm and the stockholders, firms will be hampered in raising equity in financial markets
  - This because (with rational expectations) new equity issues will be perceived as a signal that the shares of the firm are overvalued (adverse selection effect)
- Since the firm is equity-rationed it must finance its activities with debt
- With equity the firm shares the risk of business activity with those who provide finance. With debt it has a fixed obligation to pay. If it fails to meet this obligation, it will be forced to bankruptcy
- Therefore, with equity rationing and debt finance the firm will display risk aversion
  - For this to work, bankruptcy must be costly. Moreover, bankruptcy costs must rise with the scale of the firm, e.g.

$$CB_i = cq_i, \quad c > 0$$

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The Portfolio Theory of the Firm

Main Ingredients

- Firms are uncertain about the consequences of their actions
- Firms display risk aversion toward bankruptcy

Consequences for Firm's Behaviour

- The firm will treat its decisions - e.g. about prices, wages, employment, production, etc. - as portfolio decisions affecting its stock of assets, e.g. the stock of cash, fixed assets, the group of employees, the set of customers, etc.
- In particular, the firm will be concerned about how its decisions change the composition of its assets, and in turn, how this affect their risk of going bankrupt.
- Changes in the firm's willingness to bear the risk of bankruptcy and/or in the perceived riskiness or value of the various assets will lead it to change its assets portfolio

The basic aggregate supply quandary and its firm portfolio theory resolution

The Quandary

- Perfectly competitive economy. Labour l is the only input. Nominal wage is ω
- Output q. The production function is $q = \Phi(l), \quad \Phi' > 0, \Phi'' < 0$
- In the firm equilibrium

$$P = \omega / \Phi'$$

.

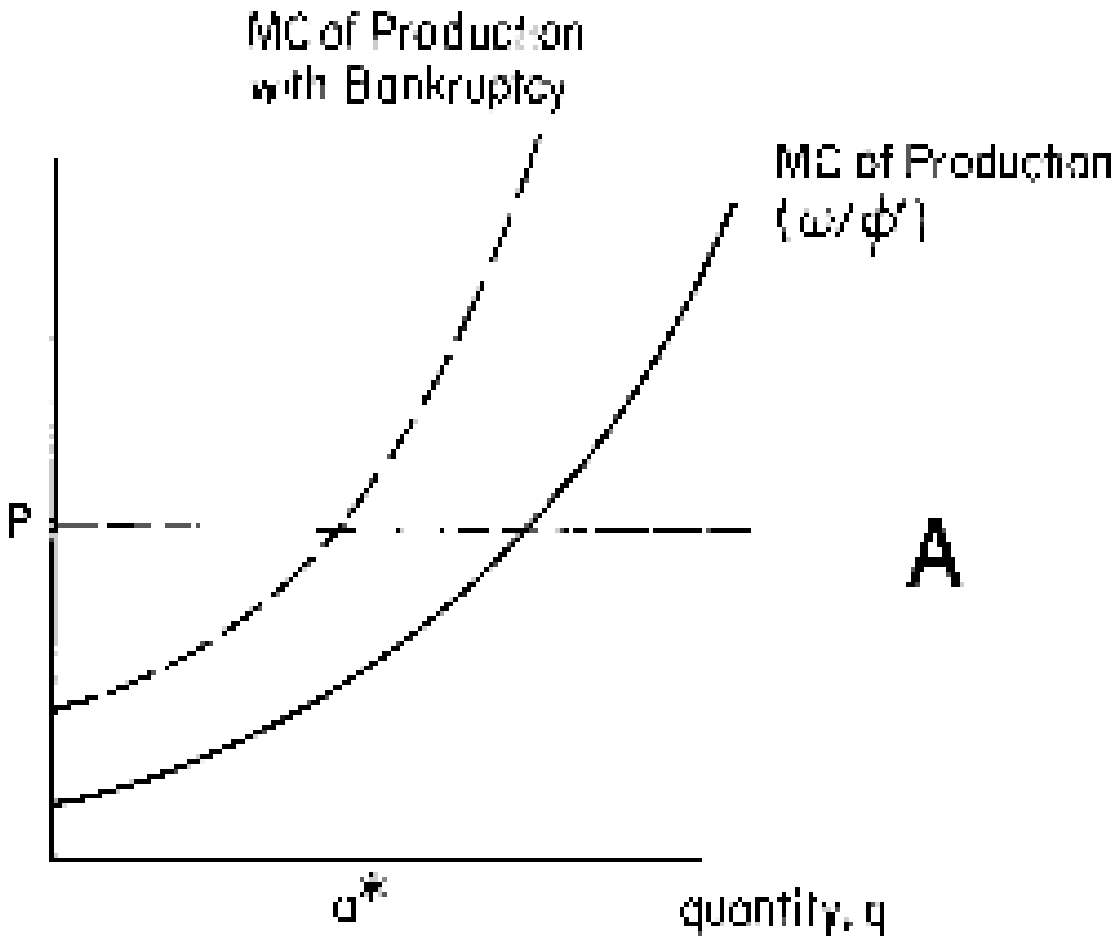
- Dividing both sides by P we get $1 = w/\Phi'$, where w is the real wage.
- Empirically real wages display a pro-cyclical or an a-cyclical behavior
- However the equilibrium condition above implies that real wages are counter-cyclical, $l \uparrow \rightarrow \Phi' \downarrow \rightarrow w \uparrow$

Suggested Resolution

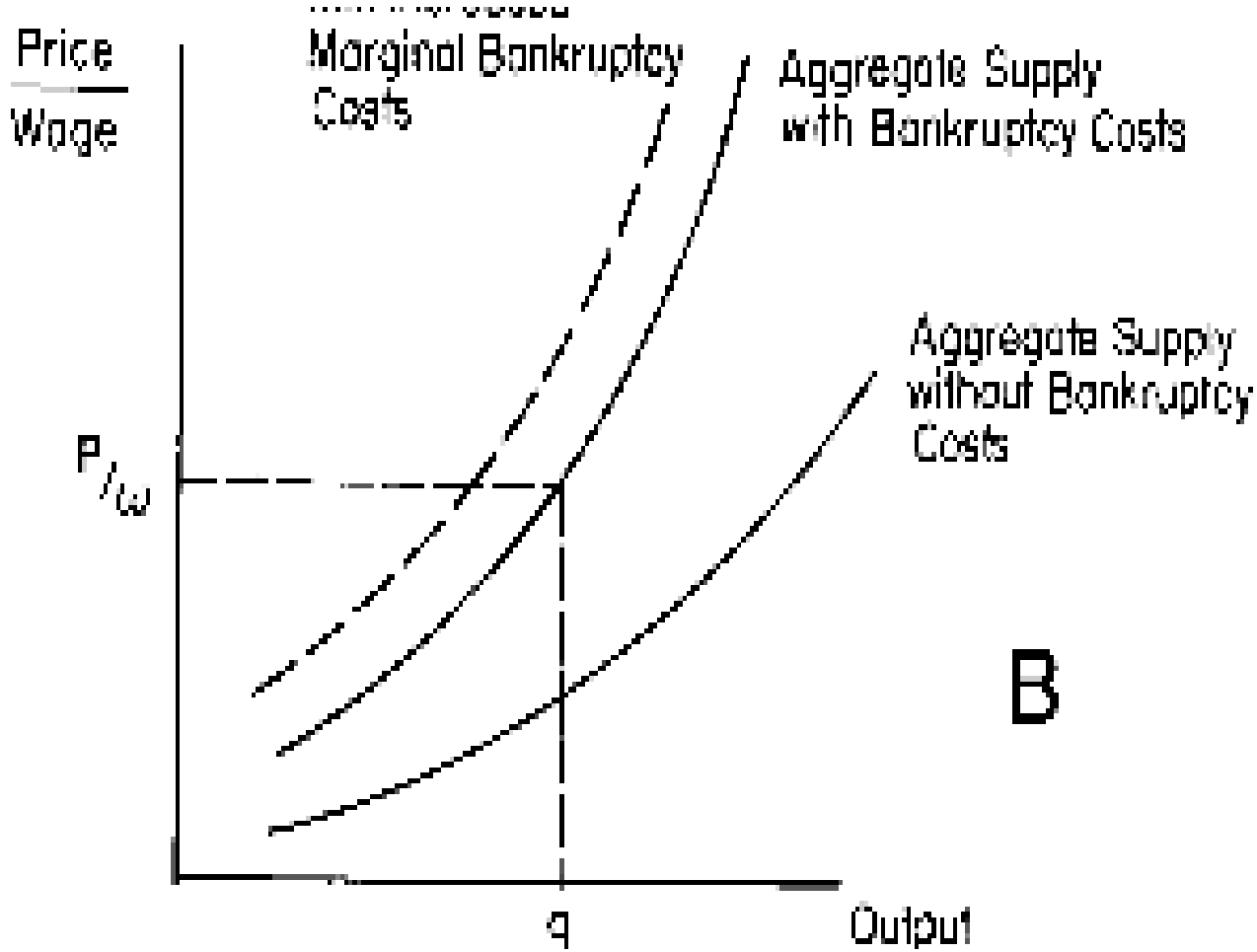
- Firms take into account the marginal bankruptcy cost in their output decision
- Marginal bankruptcy costs *MBC* are an increasing function of output, $\frac{\partial MBC}{\partial q} > 0$
- The firm's equilibrium condition can be re-written as

$$P = \omega / \Phi' + MBC$$

- Dividing both sides by P we get $1 = w/\Phi' + \rho$, where ρ is the real marginal bankruptcy cost


MC of Production
with Bankruptcy
MC of Production
(w/φ')
P
A
q*
quantity, q

- From the firm equilibrium condition we can obtain - through aggregation - an aggregate supply curve with bankruptcy costs
- Aggregate fluctuations in output will therefore be driven by:
  - shifts in the marginal bankruptcy cost curve for all firms in the economy
  - a redistribution of marginal bankruptcy costs across agents
- Note that according to this theory the debate about the type of shocks generating fluctuations (demand vs. supply shocks) loses importance. Any type of shock is able to generate fluctuations as soon as it leads to a shift in the firm marginal bankruptcy cost schedule or to a redistribution of marginal bankruptcy costs in the economy


Price
Wage
Marginal Bankruptcy Costs
Aggregate Supply with Bankruptcy Costs
Aggregate Supply without Bankruptcy Costs
P/ω
B
q
Output

The Determinants of Bankruptcy Costs

- Expected bankruptcy costs play a key role in the Greenwald and Stiglitz' framework. Their expression is given by:

$$BC_i = F(q_i, a_i, w, \frac{P_i}{P^e}, 1 + r_i, \theta) \cdot cq_i$$

- where $F(q_i, a_i, w, \frac{P_i}{P^e}, 1 + r_i, \theta)$ is the probability of bankruptcy

Factors affecting the probability of bankruptcy

- q_i: the production scale. Higher (lower) production levels implies higher (lower) probability of bankruptcy (technology has CRTS)
- a_i: the cash position of the firm. Higher (lower) level of the cash stock implies a lower (higher) probability of bankruptcy
- w: the real wage rate. Higher (lower) labour costs imply higher (lower) probability of bankruptcy
- $\frac{P_i}{P^e}$: the expected relative price of the firm. Higher (lower) prices imply a lower (higher) probability of bankruptcy
- $1 + r_i$: the real interest rate on debt. Higher (lower) financing costs imply higher (lower) probability of bankruptcy
- θ: the expectations about the overall state of the economy. Increased pessimism (optimism) or uncertainty about the state of the economy can have real consequences by increasing (lowering) the probability of bankruptcy

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Bankruptcy Risk and Unemployment

- The theory exposed so far is only able to explain shifts in the demand for labour
- In the presence perfectly flexible real wages these shifts would not be enough to generate involuntary unemployment. Thus, real wage rigidities must be introduced.
- One explanation for real wage rigidity is efficiency wage theory. If demand for labour falls, firms will not have the incentive to lower the real wage they pay, because lower real wages reduce the productivity of workers (e.g. by increasing shirking, see Shapiro and Stiglitz, 1991)

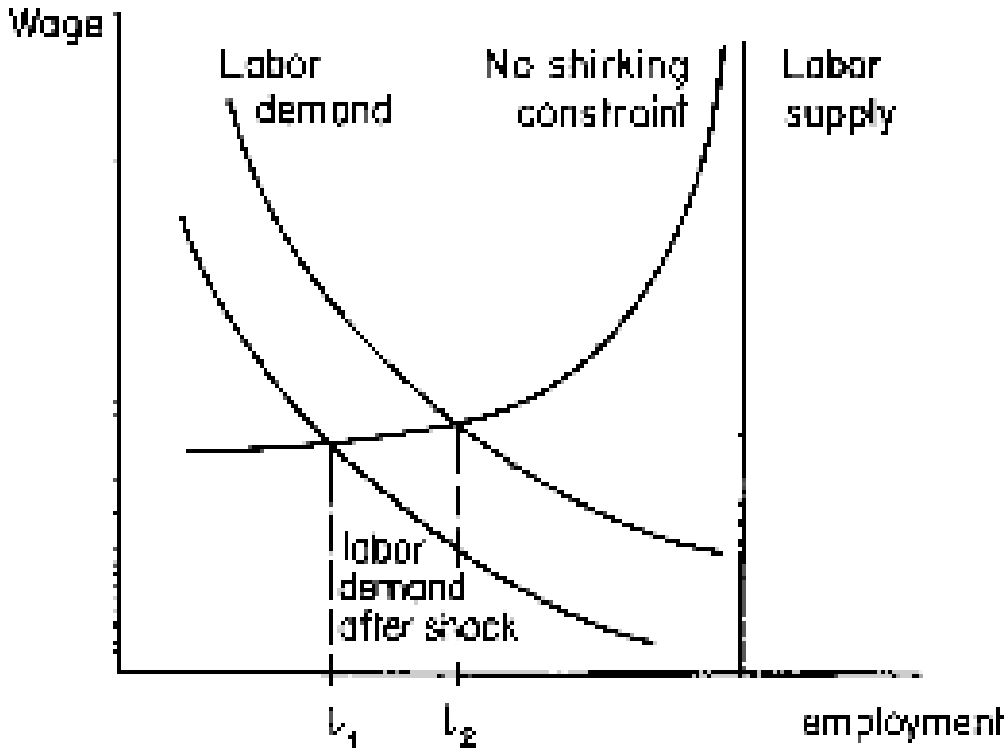

FIGURE VII

Labor Market Equilibrium in a New Keynesian Model

Equilibrium occurs at the intersection of the labor demand curve and the no-shirking constraint. Shocks to the economy shift the demand curve for labor, leading to increased unemployment.

Bankruptcy Risk and the Portfolio Theory of Banks

- The previous analysis can be largely adapted to explain the behaviour of banks
- Indeed banks face the same equity rationing problems of firms
- In addition they also have fixed obligations to account for (deposits, debt towards other banks and financial institutions)
- Thus - if bankruptcy is costly - banks will also display risk aversion in the decisions they take (loans to grant, screening activity, interest rates to charge)
- Similarly to firms, bank's expected bankruptcy risk will be determined by the bank net worth, as well as by the expectations about the overall state of the economy

Bankruptcy Costs and the Supply of Credit

- The aggregate supply of credit will be determined by the distribution of expected bankruptcy costs in the population of banks
- Changes to this distribution, in the form of a change in banks' net worth or in a change of the expectations about the overall state of the economy, will map into a change in the supply of credit
- Banks' risk aversion can also exacerbate phenomena like equilibrium credit rationing, that emerge also with risk-neutral lenders

Bankruptcy Costs and Credit Rationing

- Stiglitz and Weiss (1981) show that in the presence of asymmetric information (and with risk-neutral agents) the optimal interest rate for lenders can be lower than the one equating the demand and supply of credit
  - Because of adverse selection the expected returns from loans will be an inversely U-shaped function of the interest rate charged
- The presence of bankruptcy costs imply that the optimal interest rate for the bank will be lower than the one without bankruptcy costs, thus increasing the possibility of credit rationing
- Moreover, shifts in the marginal bankruptcy costs will cause a leftward shift of the credit supply curve, thereby increasing the amount of credit rationing (at a given interest rate)

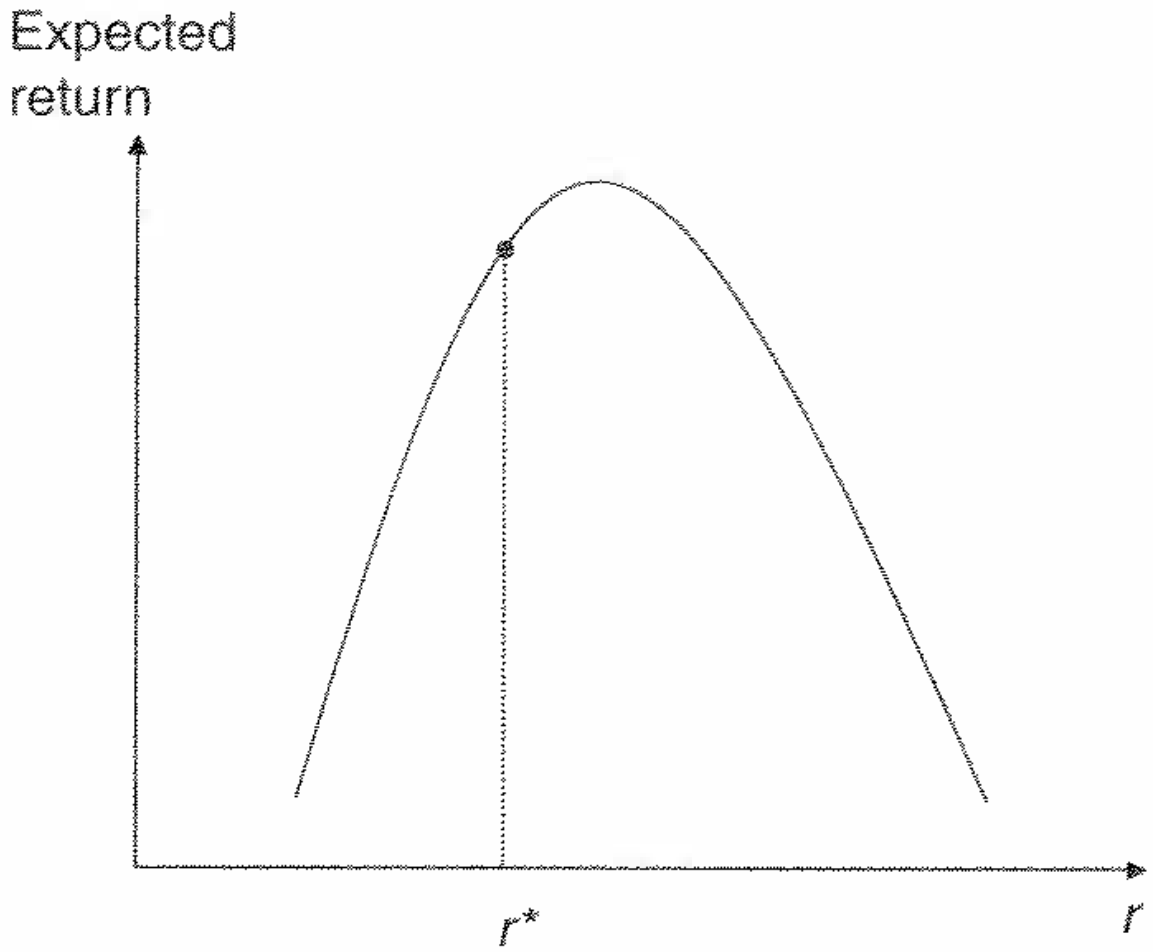

Figure 3.6 *Interest rate determination with credit rationing and bankruptcy*

The bank chooses an interest rate which is below that which maximizes the expected return, because further increases in the interest rate would increase the probability of bankruptcy.

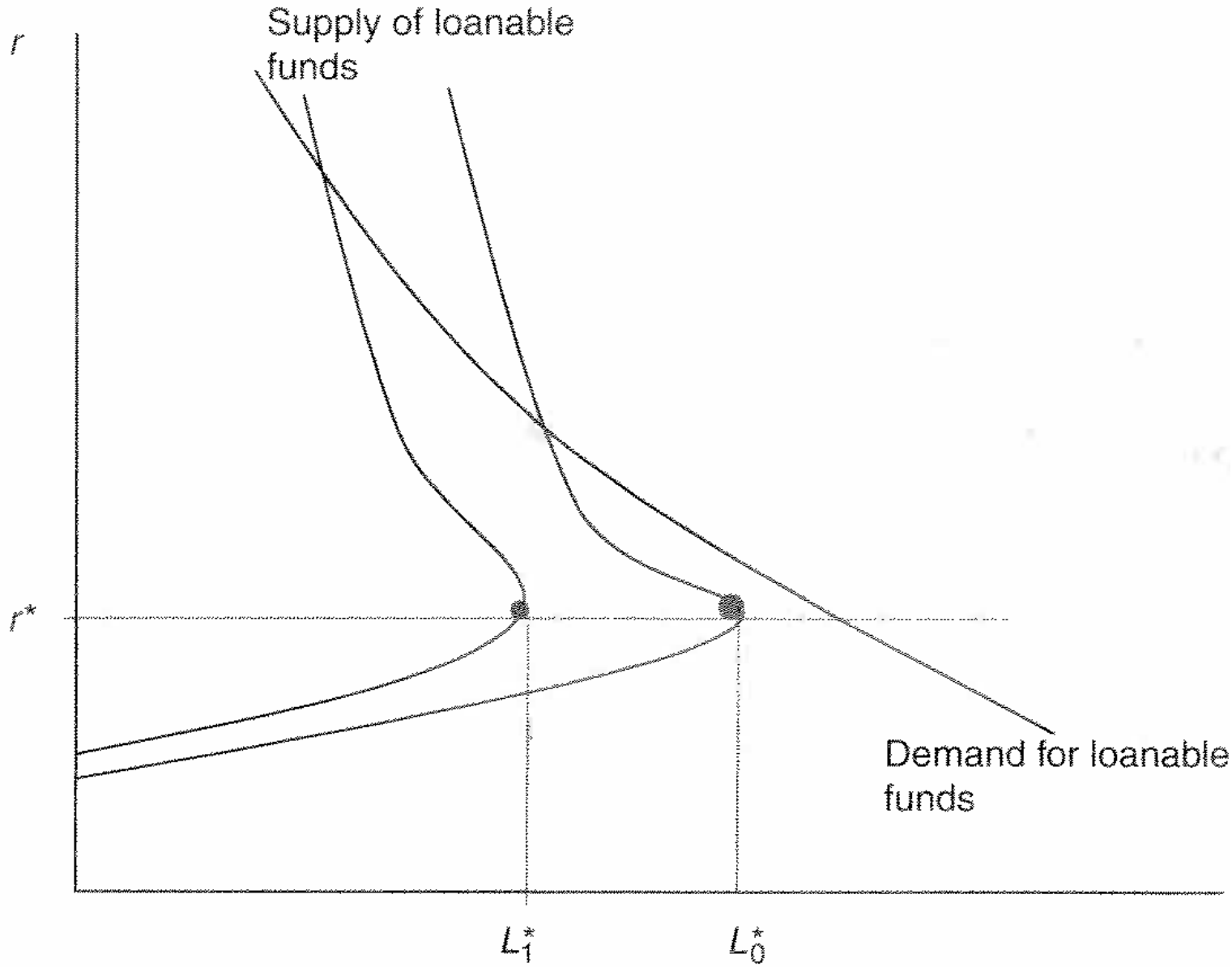

Figure 3.2 *Loanable funds model with credit rationing*