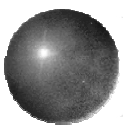


# *Capital, Interest, and Corporate Finance*

**The Role of Time In Production and Consumption**  
**Present Value and Discounting**  
**Corporate Finance**

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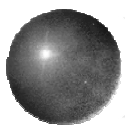
1



## *Production, Saving, and Time*

- ⊕ **Production takes time**
  - ⊗ **Cannot occur without prior saving**
  
- ⊕ **Ex: Jones, a farmer, waiting for his crop to grow,**
  - ⊗ **Rely on food saved from prior production**
  - ⊗ **Could spend time to make a plow (犁)**
    - **Increase his future productivity**
    - **making the plow is time consuming**

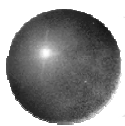
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## *Roundabout Production*

- ⊕ **Making the plow → *roundabout production***
  - ⊞ Produces capital to increase future productivity
  
- ⊕ **An increased amount of roundabout production**
  - ⊞ more capital accumulates
  - ⊞ more goods can be produced in the future
  
- ⊕ **In modern economies,**
  - ⊞ producers need not rely exclusively on their own prior saving
  - ⊞ by relying on *financial intermediaries* for funds

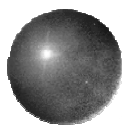
3



## *Consumption, Saving, and Time*

- ⊕ **Most consumers value present consumption more than future consumption**
  - ⊞ *Positive rate of time preference*
  - ⊞ Present consumption is valued more than future consumption
  - ⊞ Must be rewarded to postpone consumption

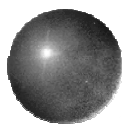
4



## *Consumption, Saving, and Time*

- ⊕ **By the saving in financial institutions,**
  - ⊞ Forgo present consumption
  - ⊞ Consume in the future
  
- ⊕ ***Interest* is the reward for forgoing present consumption**
  
- ⊕ **The *interest rate* is the annual interest as a percentage of the amount saved**
  
- ⊕ **Higher the interest rate**
  - ⊞ More rewarded for saving
  - ⊞ More willing to save

5

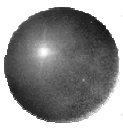


## *Optimal Investment*

- ⊕ **In modern economy, firms**
  - ⊞ need not produce their own capital,
  - ⊞ need not rely upon their own saving
  - ⊞ can purchase capital using borrowed funds
  
- ⊕ **Ex: Six pieces of farm machinery that Jones has ranked from most to least productive**

See next slide

6



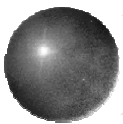
# Optimal Investment

## The payoff Table

Farm Equipment (1)	Total Product (bushels) (2)	Marginal Product (bushels) (3)	Marginal Revenue Product (4) = (3×\$4)	Marginal Resource Cost (5)
No equipment	200	-	-	-
Tractor-Tiller	1,200	1,000	\$4,000	\$10,000
Combine	2,000	800	3,200	10,000
Irrigator	2,600	600	2,400	10,000
Harrow	3,000	400	1,600	10,000
Crop Sprayer	3,200	200	800	10,000
Post-Hole Digger	3,200	0	0	10,000

- ⊕ Suppose Jones sells corn in a perfectly competitive market at \$4 per bushel
- ⊕ Marginal Revenue Product = Marginal Product \* 4
- ⊕ Suppose each piece of farm equipment costs \$10,000

7

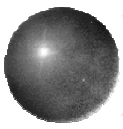


# Optimal Investment

## Determine the Optimal Strategy

- ⊕ Let equipment
  - ⊗ is durable that it lasts indefinitely,
  - ⊗ price remain the same
  - ⊗ increases revenue every year into the future
- ⊕ Jones needs to find the optimal investment

8

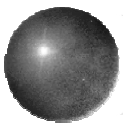


## *Optimal Investment*

### *Determine the Optimal Strategy*

- ⊕ Jones can't construct optimal strategy by
  - ⊠ MRC=MRP
  - ⊠ Since MRC is for this year,
  - ⊠ marginal product is an annual amount for each year into the future
  
- ⊕ Markets bridge this time discrepancy with the interest rate

9



## *Optimal Investment*

### *Compute Marginal Rate of Return*

- ⊕ Compute the marginal rate of return on investment he would earn each year by investing in farm machinery
  - ⊠  $\text{marginal rate of return on investment} = \frac{\text{capital's marginal revenue product}}{\text{marginal resource cost}}$

10

# Optimal Investment

## Compute Marginal Rate of Return

• For example,

• Tractor-Tiller

- MRP: \$4,000/year
- MRC: \$10,000
- Marginal rate of return =  $4000/10000 = 40\%$

• The rates of return for all the farm equipment are shown in next slide

11

# Optimal Investment

## Table of Marginal Rate of Return on Investment

$$\text{Marginal Rate of Return} = \frac{\text{MRP}}{\text{MRC}}$$

Farm Equipment (1)	Total Product (bushels) (2)	Marginal Product (bushels) (3)	Marginal Revenue Product (4) = (3×\$4)	Marginal Resource Cost (5)	Marginal Rate of Return (6) = (4/5)
No equipment	200	-	-	-	-
Tractor-Tiller	1,200	1,000	\$4,000	\$10,000	40%
Combine	2,000	800	3,200	10,000	32%
Irrigator	2,600	600	2,400	10,000	24%
Harrow	3,000	400	1,600	10,000	16%
Crop Sprayer	3,200	200	800	10,000	8%
Post-Hole Digger	3,200	0	0	10,000	0%

12

# Optimal Investment

## Determine the Optimal Strategy

- ⊕ How much should Jones invest in order to maximize profits?
- ⊕ Suppose he can borrow the money, at the market interest rate
  - ⊗ Buy more capital if
    - marginal rate of return > market interest rate
- ⊕ Ex: market interest rate = 20%
  - ⊗ Invest in the first three pieces of equipment = \$30,000
- ⊕ Ex: Interest rate = 10%,
  - ⊗ Invest in the Harrow
- ⊕ Ex: Interest rate = 6%
  - ⊗ Invest in the Crop Sprayer

13

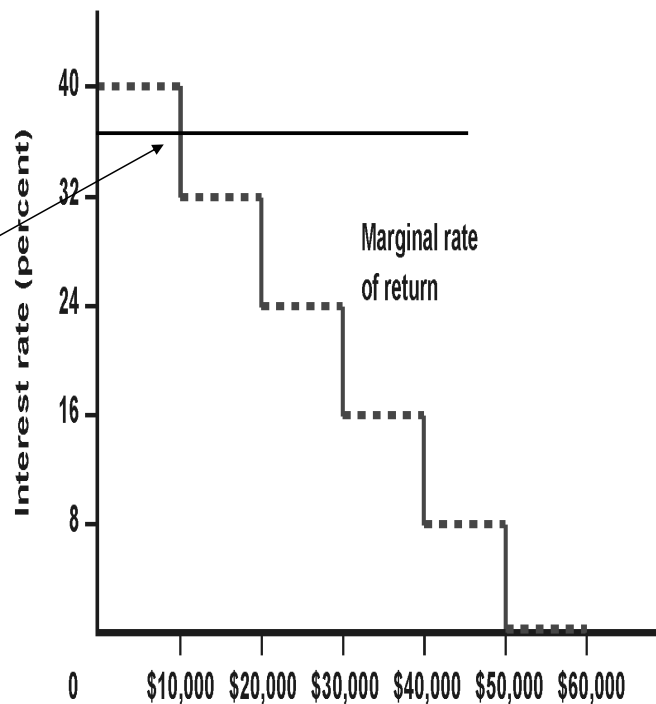
# Optimal Investment

## Figure of Marginal Rate of Return on Investment

The data in column (6) provide the information for the step-like curve

For example, if the market interest rate is between 32% and 40%, Jones should invest in the first piece of equipment

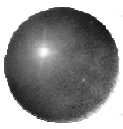
This step-like curve → the farmer's demand for investment.  
It is a derived demand, based on equipment's marginal productivity.



The curve steps down to reflect diminishing marginal productivity of capital

Investment

14

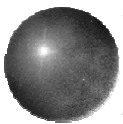


## *Optimal Investment*

### *Opportunity Cost for Investing*

- ⊕ **If Jones could save at the market interest rate**
  - ⊗ The results would not change even if Jones used his funds
  
- ⊕ **That is, whether Jones**
  - ⊗ borrows the money
  - ⊗ uses savings on hand,**the market interest rate represents his opportunity cost of investing**

15



## *Summary of Steps*

- ⊕ **1. Compute the MRP of capital**
- ⊕ **2. Compute marginal rate of return**  
**=MRP/MRC**
  - ⊗ demand curve for investment
- ⊕ **Market interest rate = opportunity cost of investing**
- ⊕ **Firm should invest more if**
  - ⊗ marginal rate of return > market interest rate

16



# Market for Loanable Funds

## Demand Side

- ⊕ Major demanders of loans:
  - ▣ firms → borrow to invest
- ⊕ Firm has a variety of investment opportunities
  - ▣ Rank their opportunities based on expected marginal rates of return
  - ▣ Increase investment until
    - expected marginal rate of return = market interest rate
- ⊕ Households are often willing to pay extra to consume now (Ex: 房貸, 現金卡)
  - ▣ greater willingness and ability to borrow at lower interest rates

17

## 卡奴的產生及拯救教訓

(2005/12/15 05:00:00 時報資訊)

- 在社會大眾譁然、立法院試圖立法管制，以及金管會軟硬兼施的催促下，銀行公會終於昨日開會做成多項決議，包括屬於逾放戶之現有持卡人，如果負債收入比在二十五倍以上者，可藉由八十期零利率優惠措施清理舊債，以及嚴格限制銀行同業浮濫發卡、銀行得視個人信用狀況不同給予差別利率水準等。我們認為，銀行公會的決議，從拯救卡奴到正本清源還給塑膠貨幣應有功能及規範，都已經有良好規畫，值得朝野支持；另一方面，社會大眾更應記取此次教訓，避免浮濫發卡、企圖用公權力不當干預市場的風波再度發生。
- 銀行公會的決議，一言以蔽之，就是讓業已失控的信用卡及現金卡發放、使用及處罰亂象得到導正，回歸正常運作模式，同時明白拒絕民粹及法治暴力的不當介入市場機制。這種理性的做法，在經濟先進國家也許是一般作業標準，不值得大聲嚷嚷，但對於凡百事務都要訴諸民意，都要陷入黨派或政治角力的台灣而言，卻是一個值得行政及立法部門，乃至社會大眾深思及參考借鏡例子。
- 簡單講，卡奴的產生，固然是使用人在自由意志下的決定，怨不得發卡機構，也不該隨意將自己應承擔的法律責任推給銀行或政府部門。但長期來從經驗得知及確認，民粹可以發揮可觀爆發力，甚至影響社會觀感乃至政府決策的我國民眾，卻在快樂享受信用卡及現金卡的方便後，將償債責任推給銀行的浮濫發卡，甚至要求藉著立法管制利率來減輕法律責任。殊不知，管制利率的法律若果通過，縮減銀行利潤事小，模糊個人法律責任、破壞市場經濟法則事大，不但可能引發另一種形式的金融風暴，也可能讓台灣淪落為法律暴力國家之列。

18

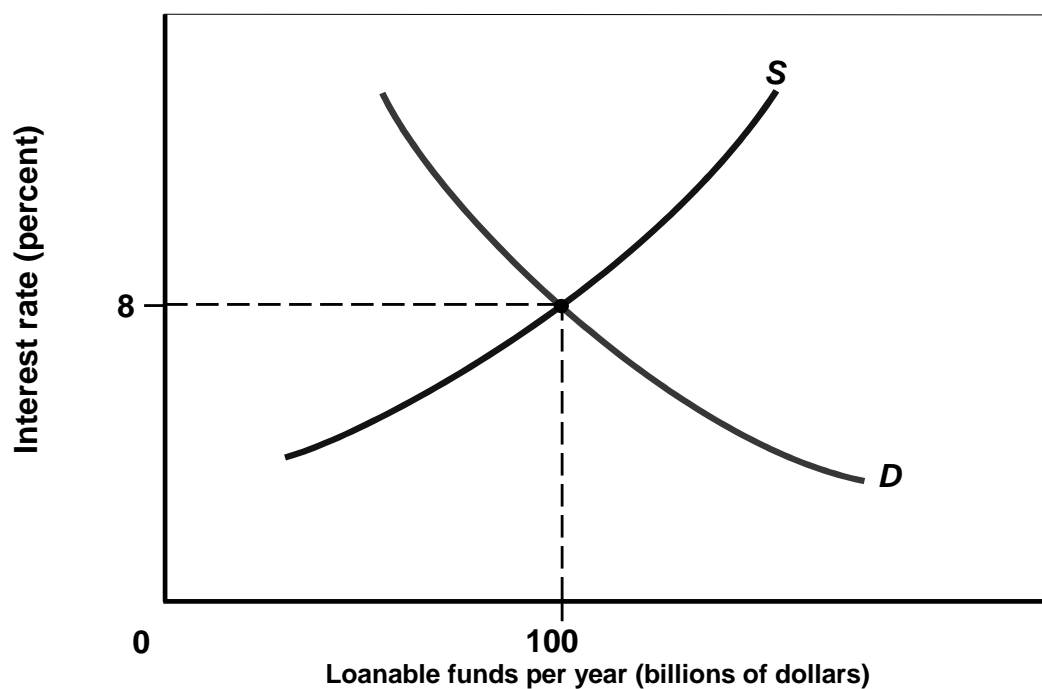
# Market for Loanable Funds

- ⊕ Banks play the role of financial intermediaries in the *loanable funds market*
  - ⊗ brings together
    - savers, or suppliers of loanable funds,
    - borrowers, or demanders of loanable funds,
- ⊕ determine the market rate of interest
  
- ⊕ Higher the interest rate, other things constant,
  - ⊗ → greater the reward for saving
  - ⊗ → the larger quantity of loanable funds

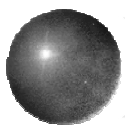
19

# Market for Loanable Funds

*Higher interest rate → Large quantity for loanable funds*



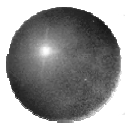
20



## *Demand for Loanable Funds*

- ⊕ **Diminishing marginal productivity**
  - ⊠ → declining marginal rate of return
  - ⊠ → demand curve for investment slope downward
- ⊕ ***The demand for loanable funds* is based on the expected marginal rate of return of these borrowed funds**
- ⊕ **The demand for loanable funds by each firm can be summed horizontally to yield the demand for loanable funds by all firms**

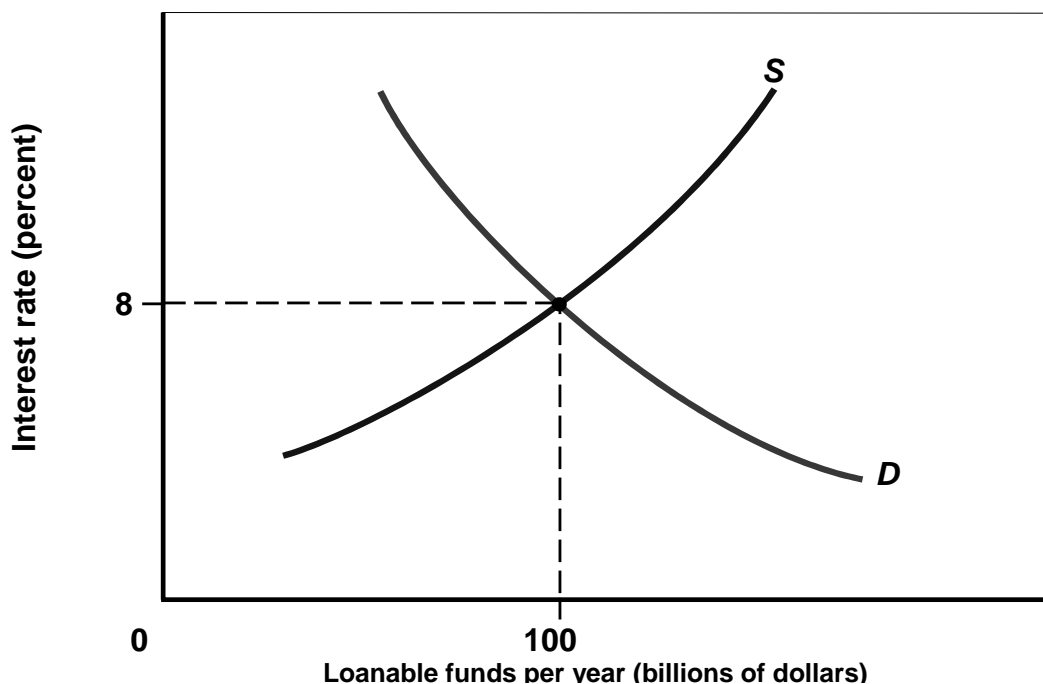
21



## *Market for Loanable Funds*

The demand for loanable funds by all firms is shown as D.

Other things constant: prices of resources, the level of technology, and the tax laws.



22

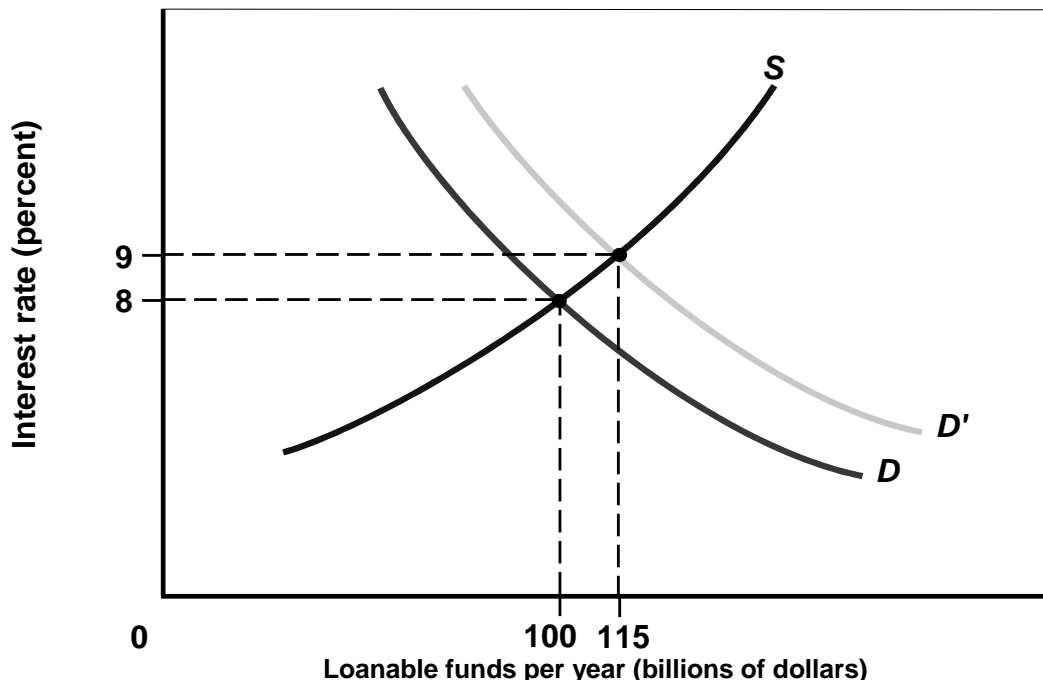
# Market for Loanable Funds

Change in the demand or supply for loanable funds → change the market interest rate.

Ex: Technological breakthrough that increases the productivity of capital

→ Demand for loanable funds shifts from D to D'

→ Higher interest rate and an increase in the quantity of loanable funds



23

# Observe Interest Rate Difference:

檔案(F) 編輯(E) 檢視(V) 我的最愛(A) 工具(T) 說明(H)

← 上一頁 → 搜尋 我的最愛 媒體

網址(AD) [https://postserv.prsb.gov.tw/Trade/03\\_a.jsp](https://postserv.prsb.gov.tw/Trade/03_a.jsp) 移至 連結 >>

### 郵政儲金利率表(年息)

資料日期: 93年5月3日

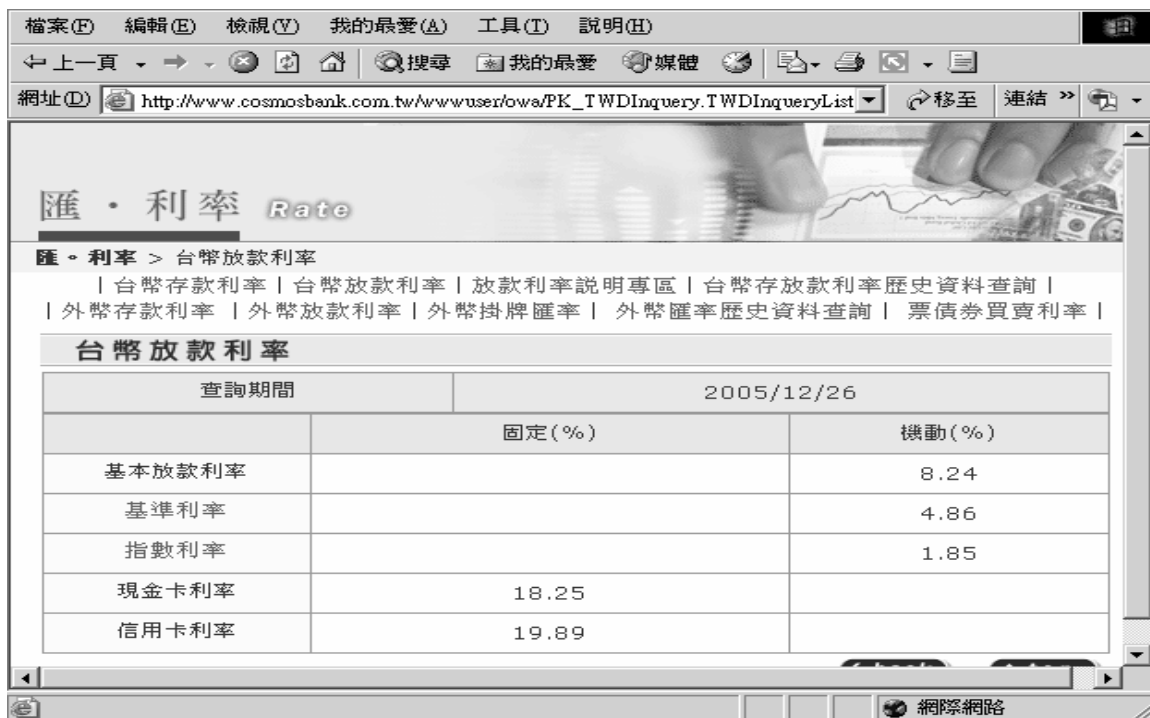
※查詢儲金利率歷史資料, 請點選相關現行利率欄位!!

存簿儲金	(免扣一切稅捐)	0.55%
媒體轉帳薪資存款	(免扣一切稅捐)	1.0%
公教存款		1.0%
(以上係半年結息一次)		
定期儲金	(固定)	(機動)
1月~未滿3月期	1.0%	1.075%
3月~未滿6月期	1.0%	1.125%
6月~未滿9月期	1.0%	1.175%
9月~未滿一年期	1.0%	1.225%
一年~未滿二年期	1.0%	1.525%
二年~未滿三年期	1.0%	1.55%
三年期	1.0%	1.55%
劃撥儲金		0.15%

網際網路

24

## Observe Interest Rate Difference



匯 · 利率 Rate

匯 · 利率 > 台幣放款利率

| 台幣存款利率 | 台幣放款利率 | 放款利率說明專區 | 台幣存放款利率歷史資料查詢 |  
| 外幣存款利率 | 外幣放款利率 | 外幣掛牌匯率 | 外幣匯率歷史資料查詢 | 票債券買賣利率 |

**台幣放款利率**

查詢期間	2005/12/26	
	固定(%)	機動(%)
基本放款利率		8.24
基準利率		4.86
指數利率		1.85
現金卡利率	18.25	
信用卡利率	19.89	

25

## Why Interest Rates Differ

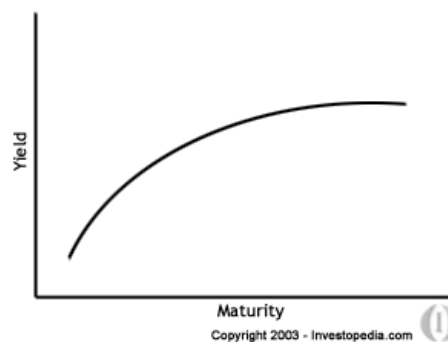
- Previous arguments imply that only one interest rate prevails in the loanable funds market
- However, a range of interest rates coexist in the economy
- Why do interest rates differ?
  - Risk → some borrowers are more likely to default

26

# Why Interest Rates Differ

## ❖ Duration of the loan

- Future is uncertain,
- More further into the future
  - more uncertain that repayment
  - ➔ Lenders require a higher interest rate
- *Term structure of interest rates* :
  - the relationship between the duration of the loan and the interest rate charge



27

# Why Interest Rates Differ

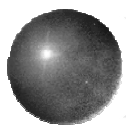
## ❖ Cost of administration

- Costs of executing the loan agreement, monitoring the loan, and collecting the payments
- These costs, as a proportion of the total amount of the loan, decrease as the size of the loan increases (Ex:開辦費)

## ❖ Tax treatment

- Interest earned on loans to local government
  - Not subject to Federal tax
- Low interest rate

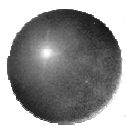
28



## *Present Value and Discounting*

- ⊕ Present consumption is valued more than future consumption,
  - ⊞ Can't be directly compared
- ⊕ To standardizing the discussion
  - ⊞ Measure all consumption in terms of its present value
- ⊕ *Present value (PV)* is the current value of a payment(s) that will be received in the future

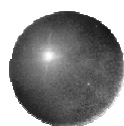
29



## *Present Value One Year Hence*

- ⊕ Suppose the market interest rate is 10%,
  - ⊞ You can either lend or borrow at that rate
- ⊕ To determine how much you should pay to receive \$100 one year later
  - ⊞ Equivalent to how much you should save now, at the market interest rate, to get \$100 one year from now
  - ⊞  $PV \times 1.10 = \$100$
  - ⊞  $\rightarrow PV = (\$100/1.10) = \$90.91$

30



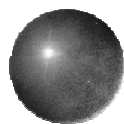
## *Present Value One Year Hence*

### ✦ *Discounting:*

$$PV = \frac{\text{amount received one year from now}}{1 + \text{interest rate}}$$

- ✦ The interest rate used to discount future payments is called the *discount rate*
- ✦ Note that PV depends on the interest or discount rate
  - The higher the interest rate,  
→ the lower its PV
  - The lower the interest rate,  
→ the greater its PV

31



## *Present Value One Year Hence*

- ✦ The more that present consumption is preferred to future consumption,
  - ✦ the higher the interest rate must be offered to defer consumption
  
- ✦ The less present consumption is preferred to future consumption,
  - ✦ the less savers need to be paid to defer consumption

32



## *PV in Later Years*

- ⊕ Consider the PV of \$100 two years later
  - ⊠ What amount of money, should be saved to yield \$100 two years from now?
  - ⊠ Let interest rate=5%
- ⊕ At the end of the first year,
  - ⊠ Value=PV x 1.05
- ⊕ At the end of the second year,
  - ⊠ See next slide

33

## *Present Value in Later Years*

Present value x 1.05 x 1.05 =  
present value x (1.05)<sup>2</sup> = \$100

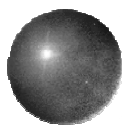
$$PV = \frac{\$100}{(1.05)^2} = \frac{\$100}{1.1025} = \$90.70$$

*A generalize equation for \$M t years later at rate i.*

$$PV = \frac{M}{(1 + i)^t}$$

- ⊕ Remark: (1 + i) is greater than 1 (利率>0)
- ⊕ PV of a given payment will be smaller the further into the future that payment is to be received

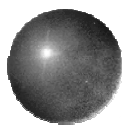
34



## *Present Value of an Income Stream*

- ⊕ **Most investments yield a stream of income over time**
  - ❖ **PV of each receipt can be computed individually**
  - ❖ **The results summed to yield the PV of the entire income stream**

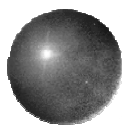
35



## *Present Value of an Annuity*

- ⊕ **A given sum of money received each year for a specified number of years is called an *annuity*(年金)**
  - ❖ **使用等比級數計算**
- ⊕ **Such an income stream is called a *perpetuity* if it continues indefinitely into the future**
  - ❖ **使用無窮等比級數計算**

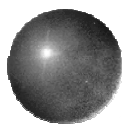
36



## *Corporate Stock and Retained Earnings*

- ✦ Corporations acquire funds for investment in three ways
  - ❑ Issuing stock
  - ❑ Retaining some of their profits
  - ❑ borrowing
- ✦ An *entrepreneur*
  - ❑ profit-seeking decision-maker
  - ❑ organizes an enterprise
  - ❑ Pays resource owners to use their resources in the firm

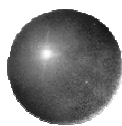
37



## *Corporate Stock and Retained Earnings*

- ✦ The initial sale of stock to the public is called an *initial public offering*, or an **IPO**(初次公開發行)
- ✦ A *share of corporate stock*
  - ❑ A claim on the net income and assets of a corporation
  - ❑ The right to vote on
    - corporate directors
    - important matters
  - ❑ One share of stock leads to one vote

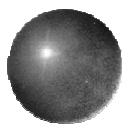
38



## *Corporate Stock and Retained Earnings*

- ⊕ Corporations must pay corporate income taxes on any profit
  
- ⊕ After-tax profit is either paid as
  - ❑ Dividends to shareholders
  - ❑ Reinvested profit is called retained earnings and allows the firm to finance expansion
  
- ⊕ Corporations are not required to pay dividends

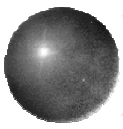
39



## *Corporate Bonds*

- ⊕ *Corporate bond*: the corporation's promise to pay back the holder
  - ❑ a fixed sum of money (Face value)
  - ❑ on the designated maturity date
  - ❑ plus annual interest payments (coupon)
  
- ⊕ The payment stream for bonds is more predictable than that for stocks
  
- ⊕ Unless the corporation goes bankrupt, it is obliged to pay the promised amounts  
→ less risky
  - ❑ Corporations are not required to pay dividends

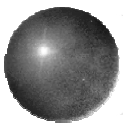
40



## *Securities Exchanges*

- ⊕ Once stocks and bonds have been issued and sold, owners of these securities are free to resell them on security exchanges
  
- ⊕ There are seven security exchanges in the U.S. with the two largest:
  - ⊠ New York Stock Exchange
  - ⊠ Nasdaq
  
- ⊕ *Secondary market* for securities(次級市場), exchanges enhance the liquidity of these securities

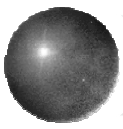
41



## *Securities Exchanges*

- ⊕ Institutional investors, such as
  - ⊠ banks,
  - ⊠ insurance companies
  - ⊠ mutual fundsaccount for over half the trading volume on major exchanges
  
- ⊕ The secondary markets for stocks also determine the current market value of the corporation

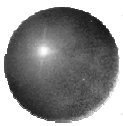
42



## *Securities Exchanges*

- ⊕ The share price reflects the PV of the discounted stream of expected profit
  
- ⊕ Security prices give the firm's management some indication of the wisdom of raising investment funds through
  - ❖ retained earnings,
  - ❖ new stock issues,
  - ❖ new bond issues

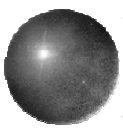
43



## *Securities Exchanges*

- ⊕ The greater a corporation's expected profit, other things constant,
  - ❖ higher stock price
  - ❖ lower the interest (coupon) rate on new bond issues
  
- ⊕ Securities markets allocate funds more readily to successful firms than to firms in financial difficulty

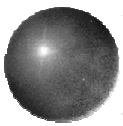
44



## 課堂報告

- ⊕ 請解釋何謂roundabout production
- ⊕ 請解釋市場上會有不同的利率
- ⊕ 請解釋在透過借貸進行投資時,如何讓投資達到最佳化
- ⊕ 請說明如何計算年金(annuity)的現值
- ⊕ 請說明企業有哪三種不同的集資管道

45



## *Homework:*

- ⊕ 9. Analyze the optimal investment
- ⊕ 10. 分析市場利率的走向
- ⊕ 11. 計算 present value

46