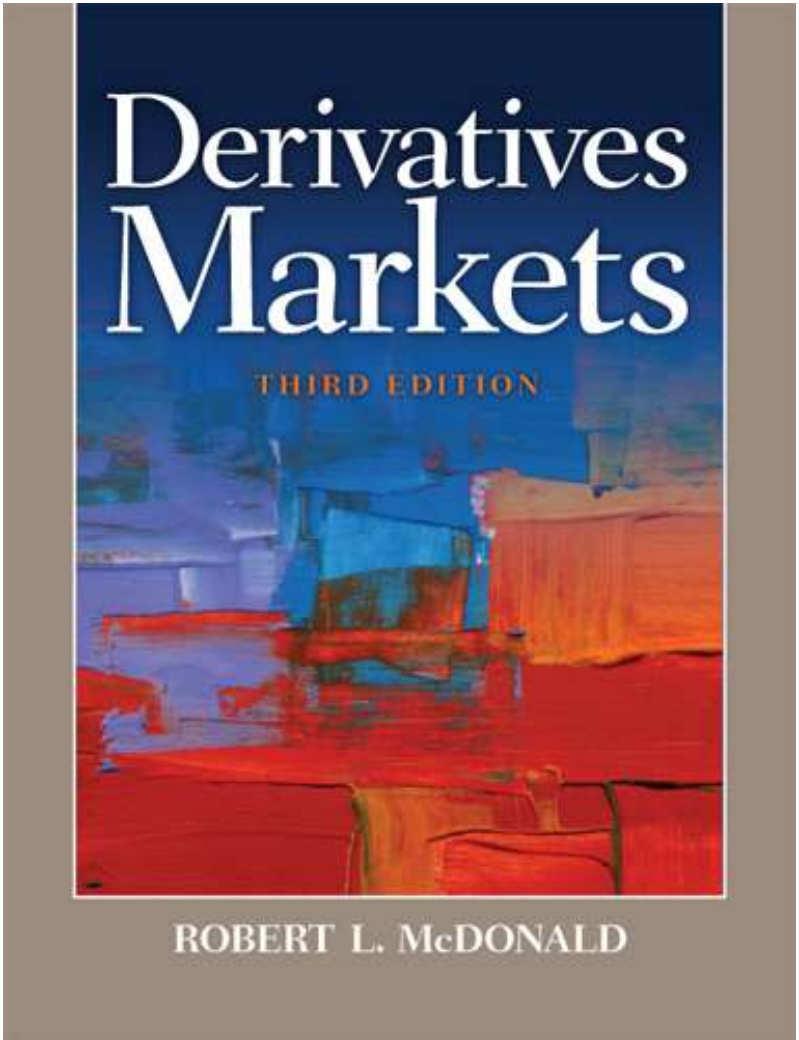


Chapter 2

Financial Markets

Points to Note

1. Steps for the trading of a financial asset, see P. 3 – 4.
2. Comparison of the exchange market and over-the-counter (OTC) market, see P. 5 – 6.
3. The role of the financial markets, see P. 7 – 8.
4. The uses of derivatives, see P. 9.
5. Perspectives on derivatives, see P. 10 – 11.
6. Transaction costs and bid-ask spread, see P. 12 – 13.
7. Futures market, see P. 14 – 16.
8. Options market, see P. 17 – 20.

An Overview of Financial Markets

- The trading of a financial asset involves at least four discrete steps:
  - A buyer and a seller must locate one another and agree on a price.
  - The trade must be *cleared* (the obligations of each party are specified).
  - The trade must be *settled* (the buyer and the seller must deliver the cash or securities necessary to satisfy their obligations in the required period of time.
  - Ownership records are updated.

Identify Buyer & Seller

Clearing House

An Overview of Financial Markets (cont'd)

- Much trading of financial claims takes place on organized exchanges. In the past, the exchange was solely a physical location where traders would buy and sell. Such in-person venues have largely been replaced by electronic networks that provide a virtual trading venue.
- After a trade has taken place, a **clearinghouse** matches the buyers and sellers, keeping track of their obligations and payments. To facilitate these payments and to help manage credit risk, a derivatives clearinghouse typically imposes itself in the transaction, becoming the buyer to all sellers and the seller to all buyers.

An Overview of Financial Markets (cont'd)

- It is possible for large traders to trade many financial claims directly with a dealer bypassing organized exchanges. Such trading is said to occur in the **over-the-counter** (OTC) market.
- Exchange activity is public and highly regulated.
- Over-the-counter trading is not easy to observe or measure and is generally less regulated.
- For many categories of financial claims, the value of OTC trading is greater than the value traded on exchanges.

Exchange Traded Contracts

- Contracts proliferated in the last four decades

TABLE 1.2 Examples of underlying assets on which futures contracts are traded.

Category	Description
Stock index	S&P 500 index, Euro Stoxx 50 index, Nikkei 225, Dow-Jones Industrials, Dax, NASDAQ, Russell 2000, S&P Sectors (healthcare, utilities, technology, etc.)
Interest rate	30-year U.S. Treasury bond, 10-year U.S. Treasury notes, Fed funds rate, Euro-Bund, Euro-Bobl, LIBOR, Euribor
Foreign exchange	Euro, Japanese yen, British pound, Swiss franc, Australian dollar, Canadian dollar, Korean won
Commodity	Oil, natural gas, gold, copper, aluminum, corn, wheat, lumber, hogs, cattle, milk
Other	Heating and cooling degree-days, credit, real estate

The Role of Financial Markets

Risk-Sharing

- Insurance companies and individual communities/families have traditionally helped each other to share risks.
- Diversifiable risk – it is unrelated to other risks.
- Nondiversifiable risk – risk that does not vanish when spread across many investors.

The Role of Financial Markets (cont'd)

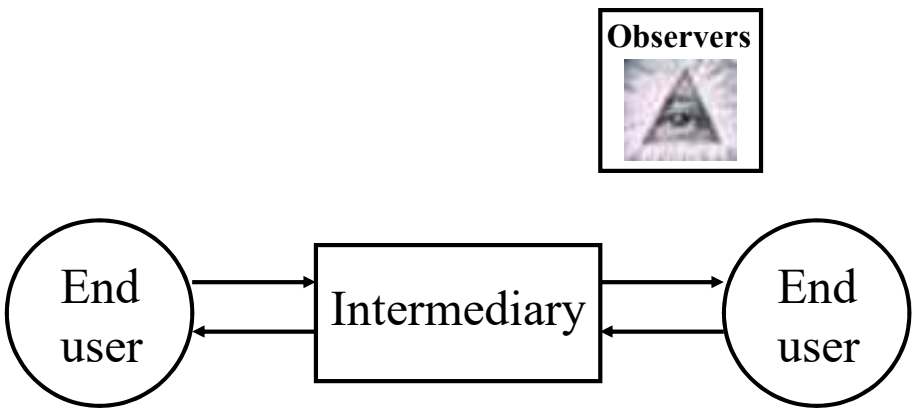
- Markets make risk-sharing more efficient
  - Markets permit diversifiable risk to be widely shared. So, diversifiable risk vanishes.
  - Non-diversifiable risks are reallocated to those most willing to hold it.

The Uses of Derivatives

- Uses
  - **Risk management**. Derivatives are a tool for companies and other users to reduce risks.
  - **Speculation**. Derivatives can serve as investment vehicles.
  - **Reduce transaction costs**. Sometimes derivatives provide a lower cost way to undertake a particular financial transaction.
  - **Regulatory arbitrage**. It is sometimes possible to circumvent regulatory restrictions, taxes, and accounting rules by trading derivatives.

Perspectives on Derivatives

- End users
  - Corporations
  - Investment managers
  - Investors
- Intermediaries
  - Market-makers
  - Traders
- Economic Observers
  - Regulators
  - Researchers



Perspectives on Derivatives (cont'd)

- End users:

  They enter into derivatives contracts for the reasons listed in P.8.
- Market-makers:
  - They will buy derivatives from customers who wish to sell, and sell derivatives to customers who wish to buy.
  - They make money by charging a spread (buy at low price and sell at higher price.
- Economic observers:

  They look at the use of derivatives, the activities of the market-makers, the organization of the markets and the logic of the pricing models and try to make sense of everything.

Transaction Costs and the Bid-Ask Spread

- Buying and selling a financial asset
  - Brokers: commissions.
  - Market-makers: bid-ask (offer) spread

    ask (offer) price: price that you buy the stock from market makers.

    bid price: price that you sell the stock to market makers.

    ask price > bid price

Transaction Costs and the Bid-Ask Spread (cont'd)

- Example 1.1: Buy and sell 100 shares of XYZ
  - XYZ: bid = $49.75, offer = $50, commission = $15
  - Buy: (100 x $50) + $15 = $5,015
  - Sell: (100 x $49.75) – $15 = $4,960
  - Transaction cost: $5015 – $4,960 = $55

= bid / ask + commission

Futures Market

- Shanghai Futures Exchange
- Hong Kong Exchanges and Clearing Limited
- Chicago Mercantile Exchange
- ….

Reading Price Quotes

Futures = Forwards

Daily *low*
Daily *high*
The *open* price
Expiration month
Settlement price
Daily change
Open interest

FIGURE 2.1

Index futures price listings.

	Open	Contract High	hilo	Low	Settle	Chg	Open Interest
Index Futures							
DJ Industrial Average (CBT)—$10 x index							
June	10981	11070 ▲		10977	**11065**	102	6,972
Sept	10977	10977 ▲		10977	**11002**	103	13
Mini DJ Industrial Average (CBT)—$5 x index							
June	10979	11072 ▲		10975	**11065**	102	84,086
S&P 500 Index (CME)—$250 x index							
June	1195.30	1207.00		1194.50	**1206.60**	13.50	313,917
Dec	1193.00	1197.60 ▲		1192.00	**1197.10**	13.50	3,301
Mini S&P 500 (CME)—$50 x index							
June	1195.50	1207.25 ▲		1194.50	**1206.50**	13.50	2,412,904
Sept	1190.50	1202.00 ▲		1190.00	**1201.75**	13.50	11,460
Nasdaq 100 (CME)—$100 x index							
June	2010.00	2027.00 ▲		2007.25	**2026.50**	25.25	16,139
Mini Nasdaq 100 (CME)—$20 x index							
June	2009.8	2026.8 ▲		2006.8	**2026.5**	25.3	308,163
Sept	2005.8	2024.0 ▲		2005.0	**2024.3**	25.5	377
Mini Russell 2000 (ICE-US)—$100 x index							
June	706.50	721.00 ▲		705.80	**720.10**	15.40	373,776
Sept	706.70	718.00 ▲		706.30	**717.70**	15.40	2,835
Mini Russell 1000 (ICE-US)—$100 x index							
June	661.50	665.70 ▲		659.50	**665.30**	7.50	19,004
U.S. Dollar Index (ICE-US)—$1,000 x index							
June	80.56	80.52 ▲		80.14	**80.29**	–.33	44,534
Sept	80.81	80.86 ▲		80.51	**80.57**	–.34	2,231

Open interest

Data from the *Wall Street Journal*, April 15, 2010, p. C-7.

Reading Price Quotes (cont'd)

- Open Interest

  Number of contracts outstanding. (Since each trade of a contract has both a buyer and seller, a buyer-seller pair counts as one contract).

Options Market

- Shanghai Exchange
- Hong Kong Exchanges and Clearing Limited
- Chicago Mercantile Exchange
- ….

Read Price Quotes

UBS HK Warrants

Non-collateralized nature of structured products
Hotline: +852 2971 6668 ol-hkwarrants@ubs.com

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12499 PUT Tencent (0700) — Share — Refresh

Bid / Ask	$0.315 / $0.325	Last	$0.315
High / Low	$0.345 / $0.300	Change	0.050 / 13.70%
Open	$0.340	Previous Close	$0.365
Board Lot	10,000	Turnover (HKD)	$10.2m

Updated: 2018-08-03 16:01

$K - S_0 = 378.58 - 349.8 = 28.78$, $28.78 / 349.8 = 8.23\%$

Moneyness	Implied Volatility	Days to Maturity	Eff. Gearing
ITM 8.23%	22.82%	49 days	9.04x

Type	Put	Maturity	2018-09-21
Strike Price	378.58	Last Trading Date	2018-09-17
30 Historical Volatility (30-days)	24.55%	Premium	0.8%
Outstanding Quantity	52.0m	Conversion Ratio	100
Delta	81.40%	Time Decay Per Day	-0.34%

Tencent (0700)

349.80 4.800 1.39%

Open	348.20
Previous Close	345.00
Turnover (HKD)	10,587.8m
Volume (shares)	30.3m
Day Range	346.60 - 354.60
52 Week Range	305.38 - 476.60

Updated: 2018-08-03 16:20:00(15 min delay)

Stock Info

Result	2018-08-15
P/E	37.827x
P/B	10.660x
Maket Cap.	3,285.2b
1 Month Avg. Turnover	7,619.6m

Information Provided by DB Power Online Limited

Read Price Quotes (cont'd)

- Conversion ratio

  The number of warrants required to be converted into a unit of the underlying asset at the strike price on the expiry date.

- Moneyness

$$\text{Put}: \frac{\text{Strike} - S_0}{S_0}; \quad \text{Call}: \frac{S_0 - \text{Strike}}{S_0}$$

Read Price Quotes (cont'd)

- Effective gearing $\approx$ $\frac{\%\text{ change of option price}}{\%\text{ change of underlying price}}$

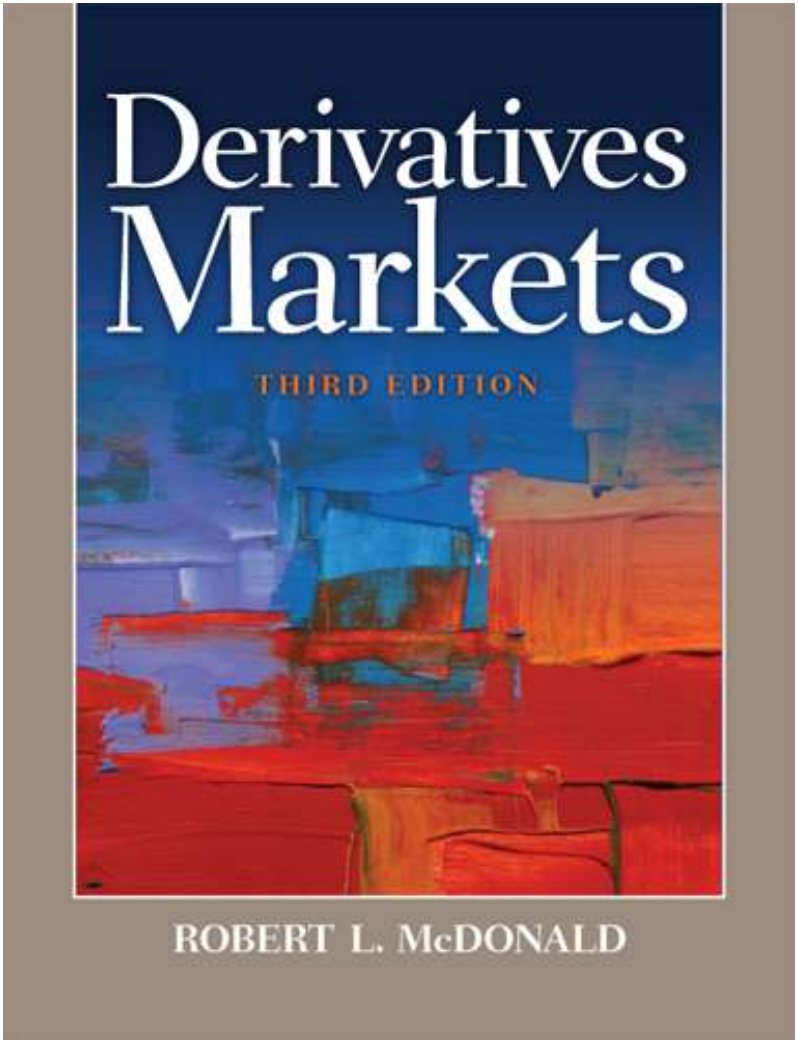
  Effective gearing is the relative % change of the value of the option for 1% change in the price of the underlying stock.

detail in Chapter 10 (Chapter 12 Textbook)

$$\text{Effective gearing} = \frac{S_0}{\text{Conversion ratio} \times \text{Warrant bid price}} \times \text{Delta}$$

- Implied volatility & Delta

  Will be discussed in "Chapter 12 The Black-Scholes Formula"



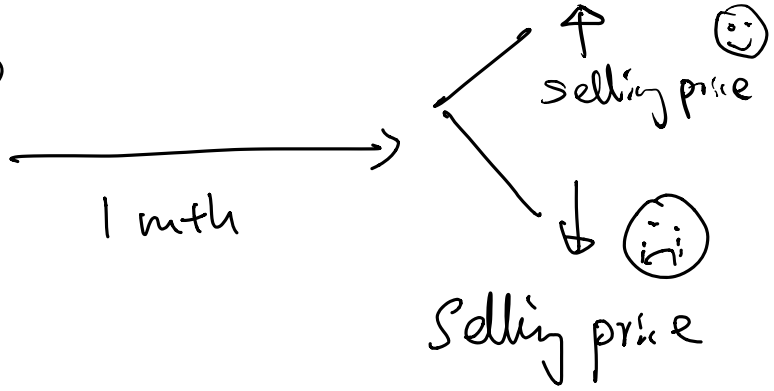
Chapter 3

Insurance, Collars, and Other Strategies

Points to note

1. Basic insurance strategies
   a. Floor, see P. 4 – 7.
   b. Cap, see P. 8 – 11.
   c. Covered call/put, see P. 12 – 17.
2. Synthetic forwards, see P. 18 – 19.
3. Put-call parity, see P. 20 – 22.
4. Spread (see P. 23 – 24)
   a. Bull spread, see P. 25 – 27.
   b. Bear spread, see P. 28.
   c. Box spread, see P. 28.
   d. Ratio spread, see P. 29.
   e. Collars, see P. 30 – 40.
5. Speculating on volatility (see P. 41)
   a. Straddles, see P. 42 – 44.
   b. Strangles, see P. 45 – 47.
   c. Butterfly spreads/asymmetric spreads, see P. 48 – 55.

① Long Tencent $100 (Buy)



Ⓐ Long Tencent + Long a put option

Payoff Ⓐ

	$t=0$	$t=T$	
Long Tencent	$-S_0$	S_T	
Long put	$-P$	$\max(K-S_T, 0)$	
Total	$-S_0-P$	$K<S_T$	$K \geq S_T$
	$=-(S_0+P)$	S_T	K

Basic Insurance Strategies

- Options can be
  - Used to insure long asset positions (floors).
  - Used to insure short asset positions (caps).
  - Written against asset positions (selling insurance).
- Use the following information in this section:
  - a S&R index price of $1,000
  - a 2% effective 6-month interest rate
  - premiums of $93.809 for the 1,000-strike 6-month call
  - premiums of $74.201 for the 1,000-strike 6-month put

Insuring a Long Position: Floors

Long underlying + Long put

- A put option is combined with a long position in the underlying asset.
- Goal: to insure against a fall in the price of the underlying asset.

Insuring a Long Position: Floors (cont'd)

- Example: S&R index and an S&R put option with a strike price of $1,000 together.

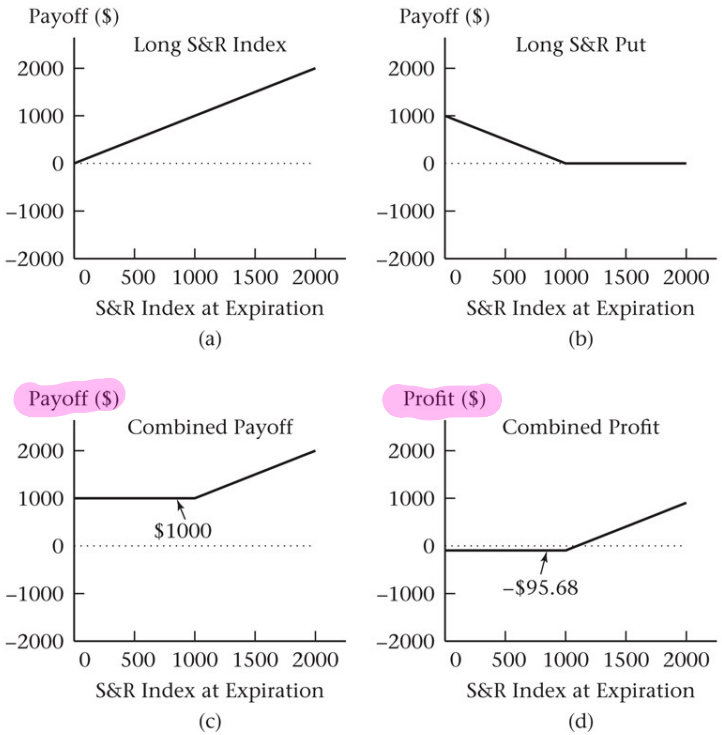
Insuring a Long Position: Floors (cont'd)

TABLE 3.1

Payoff and profit at expiration from purchasing the S&R index and a 1000-strike put option. Payoff is the sum of the first two columns. Cost plus interest for the position is ($1000 + $74.201) × 1.02 = $1095.68. Profit is payoff less $1095.68.

Payoff at Expiration				
S&R Index	S&R Put	Payoff	−(Cost + Interest)	Profit
$900	$100	$1000	−$1095.68	−$95.68
950	50	1000	−1095.68	−95.68
1000	0	1000	−1095.68	−95.68
1050	0	1050	−1095.68	−45.68
1100	0	1100	−1095.68	4.32
1150	0	1150	−1095.68	54.32
1200	0	1200	−1095.68	104.32

Insuring a Long Position: Floors (cont'd)



Buying an asset and a put generates a position that looks like a call!

Insuring a Short Position: Caps

- A call option is combined with a short position in the underlying asset.
- Goal: to insure against an increase in the price of the underlying asset.

Caps = Long a Call + Short the underlying

	$t=0$	$t=T$
Long Call	$-C$	$\max(S_T-K, 0)$
Short underlying	$+S_0$	$-S_T$
Total	$-C+S_0$	$\max(S_T-K, 0)-S_T$

Insuring a Short Position: Caps (cont'd)

- Example: short-selling the S&R index and holding a S&R call option with a strike price of $1,000.

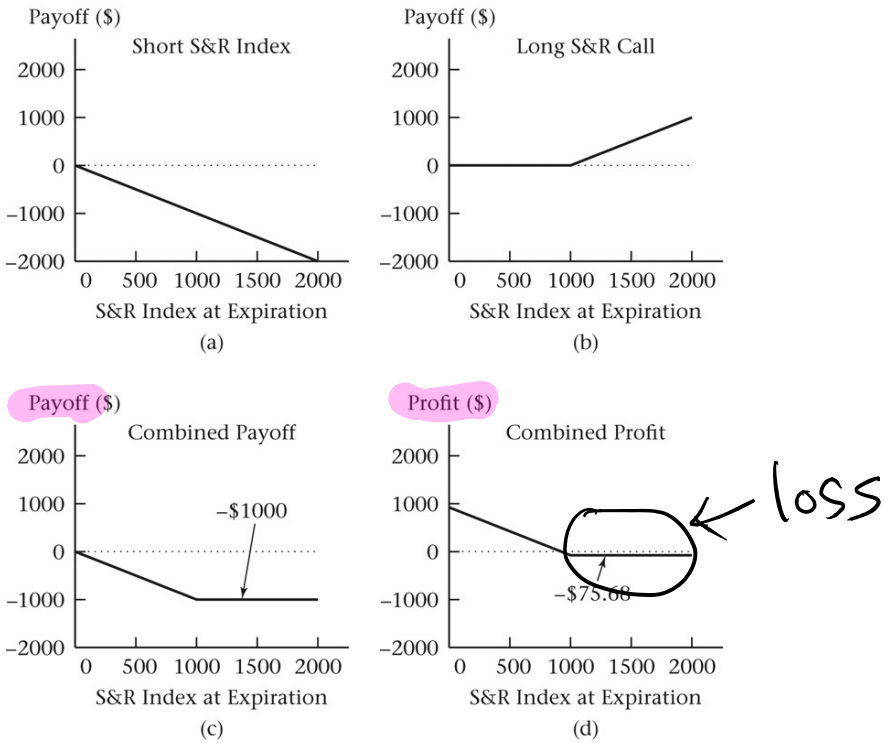
Insuring a Short Position: Caps (cont'd)

TABLE 3.2

Payoff and profit at expiration from short-selling the S&R index and buying a 1000-strike call option at a premium of $93.809. The payoff is the sum of the first two columns. Cost plus interest for the position is (−$1000 + $93.809) × 1.02 = −$924.32. Profit is payoff plus $924.32.

Payoff at Expiration				
Short S&R Index	S&R Call	Payoff	−(Cost + Interest)	Profit
−$900	$0	−$900	$924.32	$24.32
−950	0	−950	924.32	−25.68
−1000	0	−1000	924.32	−75.68
−1050	50	−1000	924.32	−75.68
−1100	100	−1000	924.32	−75.68
−1150	150	−1000	924.32	−75.68
−1200	200	−1000	924.32	−75.68

Insuring a Short Position: Caps (cont'd)



An insured short position looks like a put!

Selling Insurance

- For every insurance buyer there must be an insurance seller.
- Strategies used to sell insurance
  - **Covered writing** (or option overwriting or selling a covered call) is writing an option when there is a corresponding long position in the underlying asset is called covered writing.
  - **Naked writing** is writing an option when the writer does not have a position in the asset.

Covered Writing: Covered Calls

- Example: holding the S&R index and writing a S&R call option with a strike price of $1,000.

Covered call = Short a call + Long the underlying

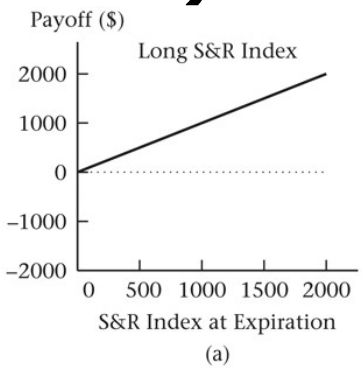
Covered Writing: Covered Calls (cont'd)

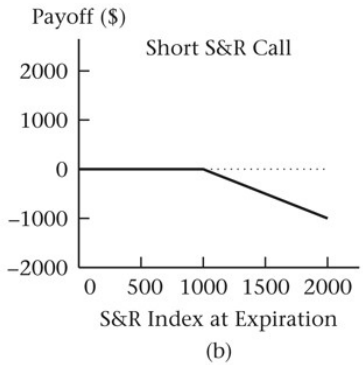
TABLE 3.3

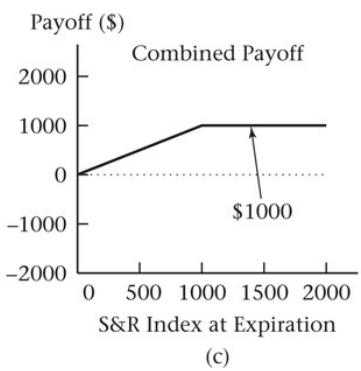
Payoff and profit at expiration from purchasing the S&R index and selling a 1000-strike call option. The payoff column is the sum of the first two columns. Cost plus interest for the position is ($1000 − $93.809) × 1.02 = $924.32. Profit is payoff less $924.32.

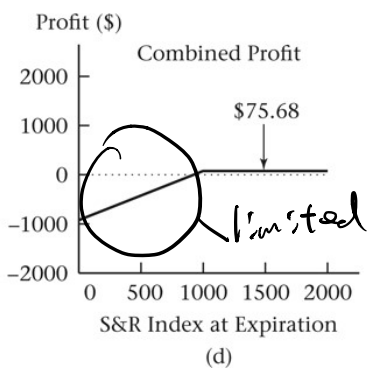
Payoff at Expiration				
S&R Index	Short S&R Call	Payoff	−(Cost + Interest)	Profit
$900	$0	$900	−$924.32	−$24.32
950	0	950	−924.32	25.68
1000	0	1000	−924.32	75.68
1050	−50	1000	−924.32	75.68
1100	−100	1000	−924.32	75.68
1150	−150	1000	−924.32	75.68
1200	−200	1000	−924.32	75.68

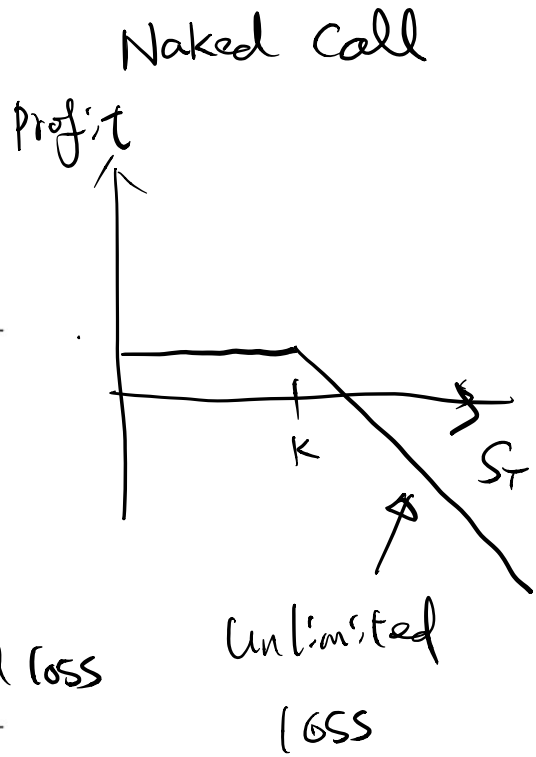
Covered Writing: Covered Calls (cont'd)











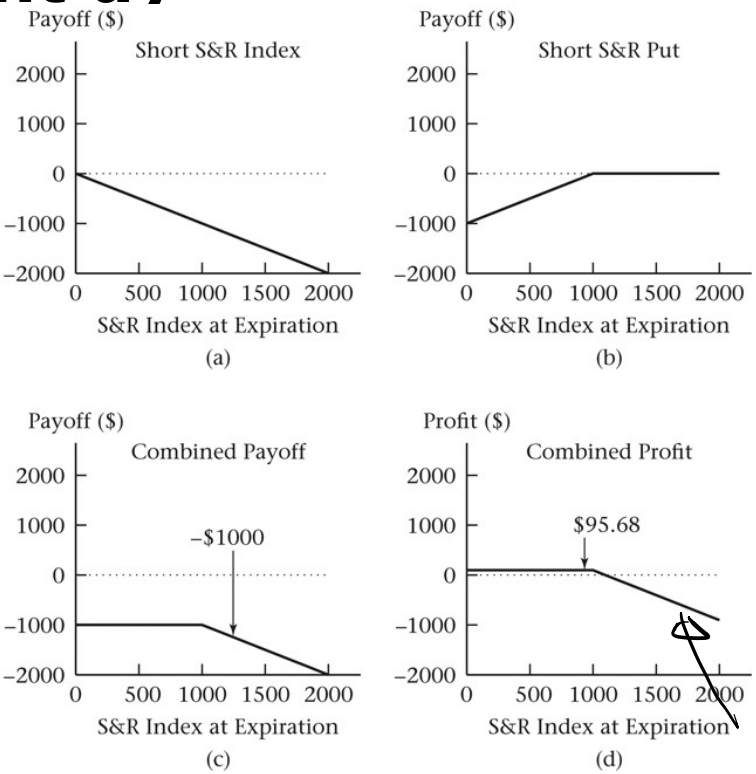
Writing a covered call generates the same profit as selling a put!

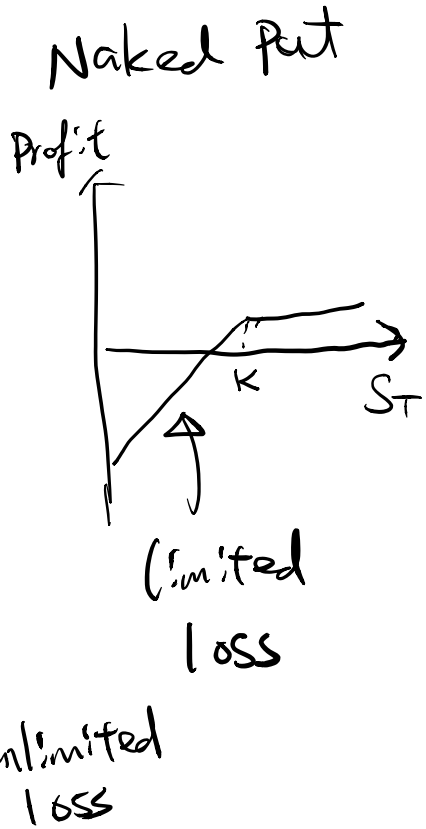
Covered Writing: Covered Puts

- Example: shorting the S&R index and writing a S&R put option with a strike price of $1,000.

Covered put = Short put + Short underlying

Covered Writing: Covered Puts (cont'd)



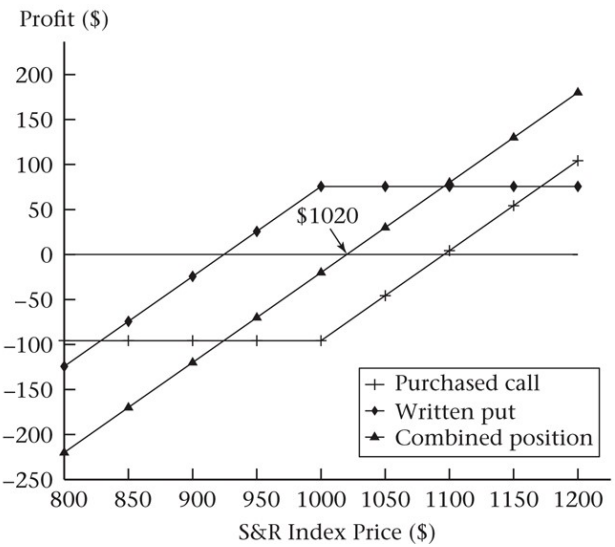


Writing a covered put generates the same profit as writing a call!

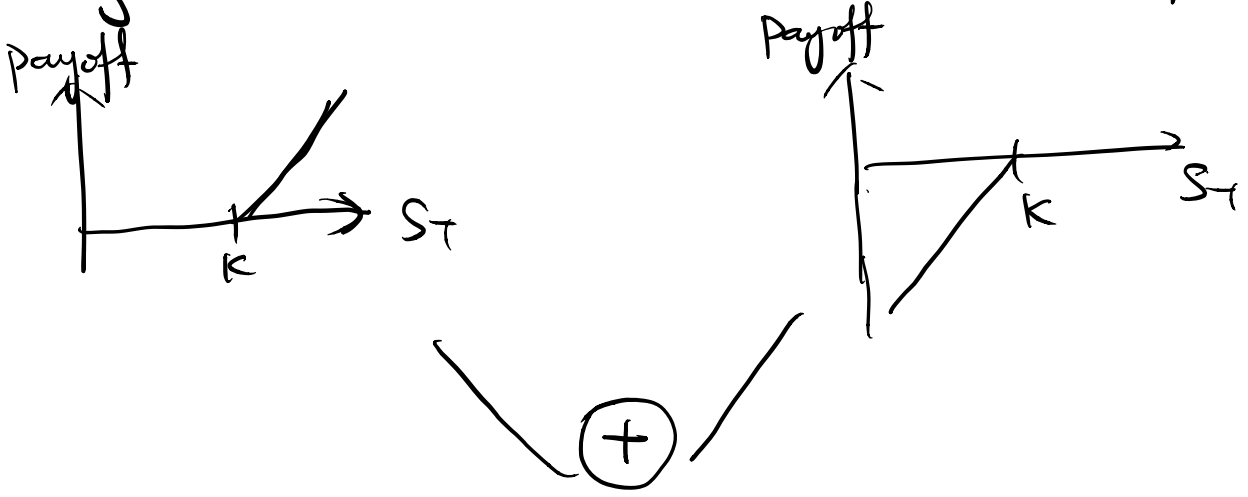
Synthetic Forwards = Long K-strike call + Short K-strike put

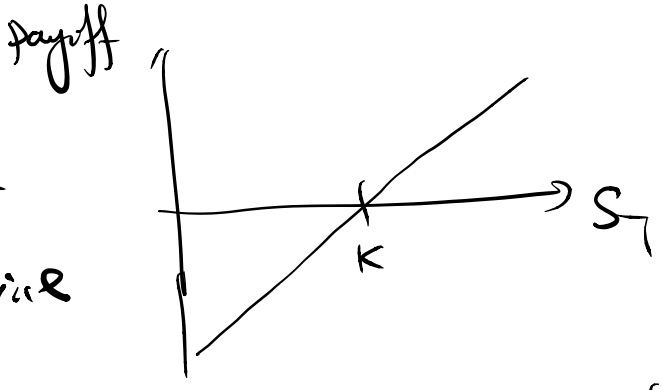
- A synthetic long forward contract
  - Buying a call and selling a put on the same underlying asset, with each option having the same strike price and time to expiration.
  - Example: buy the $1,000-strike S&R call and sell the $1,000-strike S&R put, each with 6 months to expiration.

Synthetic forward (K=1000)



Long K-strike call + short K-strike put





like a forward contract with forward price = K

synthetic forward

Long K-strike call + K-strike put $\Rightarrow$ Forward contract with forward price = K

Cost of the synthetic forward

$= C - P$

$= 0$ (Not sure depends on K is fair or NOT)

Synthetic Forwards (cont'd)

- Differences between a synthetic long forward contract and the actual forward
  - The forward contract has a zero premium, while the synthetic forward requires that we pay the net option premium (net cost = $93.81 – $74.20 = $19.61).
  - With the forward contract, we pay the forward price, while with the synthetic forward we pay the strike price.

Call put

Put-Call Parity

- The net cost of buying the index using options must equal the net cost of buying the index using a forward contract.
- Let Call (K, t) and Put (K, t) denote the premiums of options with strike price K and time t until expiration, and $F_{0,t}$ be the forward price.

put-call parity

(A)	$t=0$	$t=T$
① Long call	$-C$	$\max(S_T-K, 0)$
② Short put	$+P$	$-\max(K-S_T, 0)$
③ Buy a bond (FV = K)	$-PV(K)$	K
total	$-C+P-PV(K)$	S_T

(B)	$t=0$	$t=T$
① Long a forward (forward price $=F_{0,T}$)	0	$S_T - F_{0,T}$
② Buy a bond with (FV $= F_{0,T}$)	$-PV(F_{0,T})$	$F_{0,T}$
total	$-PV(F_{0,T})$	S_T

$F_{0,T}$: fair forward price

Cost of (A) = cost of (B)

$$-C+P-PV(K) = -PV(F_{0,T})$$

Put-Call Parity (cont'd)

- PV of the net cost via options

  Call (K, t) – Put (K, t) + PV(K) (1)

- PV of the net cost via forward

  $PV(F_{0,t})$ (2)

- (1) = (2) ⇒

  Call (K, t) – Put (K, t) = PV ($F_{0,t}$ – K)

Call (k,t) = Put (k,t) + PV ($F_{0,t}$ – k)

This is one of the most important relationships in derivatives!

Long a put + buy a bond

Put-Call Parity (cont'd)

No arbitrage

The transaction has no risk of loss and generates a positive cash flow. Taking advantage of such an opportunity is called *arbitrage*, and the idea that prices should not permit arbitrage is called *no-arbitrage pricing*.

The put-call parity is derived from the no-arbitrage.