Financial Mathematics

MATH 5870/6870¹ Fall 2021

Le Chen

lzc0090@auburn.edu

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Auburn University
Auburn AL

¹Based on Robert L. McDonald's *Derivatives Markets*. 3rd Ed. Pearson. 2013.

Chapter 3. Insurance, Collars, and Other Strategies

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- § 3.1 Basic insurance strategies
- § 3.2 Put-call parity
- \S 3.3 Spreads and collars
- § 3.4 Speculating on volatility
- § 3.5 Problems

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Options can be

- 1. Used to insure long positions (floors)
- 2. Used to insure short positions (caps)
- 3. Written against asset positions (selling insurance)

Covered call writing

Covered put writing

Four positions

positions w.r.t. asset	put option	call option
long	purchased (floor)	written
short	written	purchased (cap)

Buying insurance	Selling insurance
floor = buying a put option	Covered put writing
cap = buying a call option	Covered call writing

We will work under the following setup

${\rm S\&S}$ index

index price today	\$1,000
6-month interest rate	2%
premium for 1000-strike 6-month call	\$93.809
premium for 1000-strike 6-month put	\$74.201

Insuring a long position – Floors

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owning a home owning a stock index insuring the house buying a put (floor)
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Goal: to insure against a fall in the price of the underlying asset.

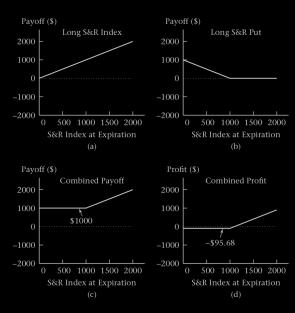
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Example 3.1-1 Under the following scenario, compute the combined profit of insuring a long position via buying a put for the following S&R index.

index price today	\$1,000
6-month interest rate	2%
premium for 1000-strike 6-month put	\$74.201
index price at expiration	\$900

Solution.

$$\underbrace{\$900 - \$1,000 \times 1.02}_{\text{profit on S\&R index}} + \underbrace{\$1,000 - \$900 - \$74.201 \times 1.02}_{\text{profit on put}} = -\$95.68.$$





Insuring a short position — Caps

If we have a short position in the S&R index, we experience a loss when the index rises.

We can insure a short position by purchasing a call option (cap) to protect against a higher price of repurchasing the index.

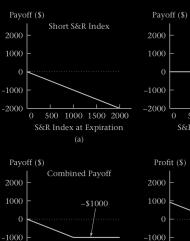
Example 3.1-2 Under the following scenario, compute the combined profit for insuring a short position via buying a call of the following S&R index.

index price today	\$1,000
6-month interest rate	2%
premium for 1000-strike 6-month call	\$93.809
index price at expiration	\$1,100

Solution.

$$$1,000 \times 1.02$$$
 - $$93.809 \times 1.02$$ - $$1,000$ = -\$75.685. future value of short S&R index FV of premium for call exercise the call option

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500 1000 1500 2000

S&R Index at Expiration

-2000



Long S&R Call

500 1000 1500 2000

Selling insurance

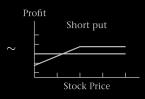
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Strategies used to sell insurance

- ► Covered writing (option overwriting or selling a covered call) is writing an option when there is a corresponding long position in the underlying asset.
- ▶ Naked writing is writing an option when the writer does not have a position in the asset.

Covered call writing

Long position of the asset + Sell a call option



Covered put writing

Short position of the asset + Sell a put option



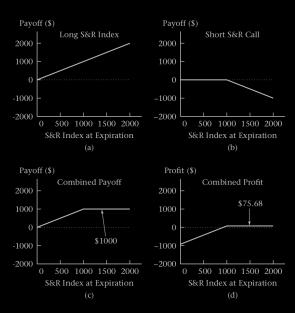
Covered call writing

Example 3.1-3 Under the following scenario, compute the combined profit for writing a covered call for S&R index.

index price today	\$1,000
6-month interest rate	2%
premium for 1000-strike 6-month call	\$93.809
index price at expiration	\$1,100

Solution.

$$\underbrace{\$1,100-\$1,000\times 1.02}_{\text{profit on S\&R index}} + \underbrace{\$1,000-\$1,100+\$93.809\times 1.02}_{\text{profit on written call}} = \$75.68.$$



Covered put writing

Example 3.1-4 Under the following scenario, compute the combined profit for writing a covered put for S&R index.

index price today	\$1,000
6-month interest rate	2%
premium for 1000-strike 6-month put	\$74.201
index price at expiration	\$900

Solution.

$$\underbrace{\$1,000\times 1.02 -\$900}_{\text{profit on selling S&R index}} + \underbrace{\$900 -\$1,000 +\$74.201\times 1.02}_{\text{profit on written put}} = \$95.685.$$

