Options

Financial options contracts

- An option is a right (rather than a commitment) to buy or sell an asset at a pre-specified price

- The right to purchase is a call option; the right to sell is a put option

- The strike price (or exercise price) is the price at which an option can be exercised

- Options which can be exercised only at maturity are "European Options"; "American Options" can be exercise any time prior or at maturity

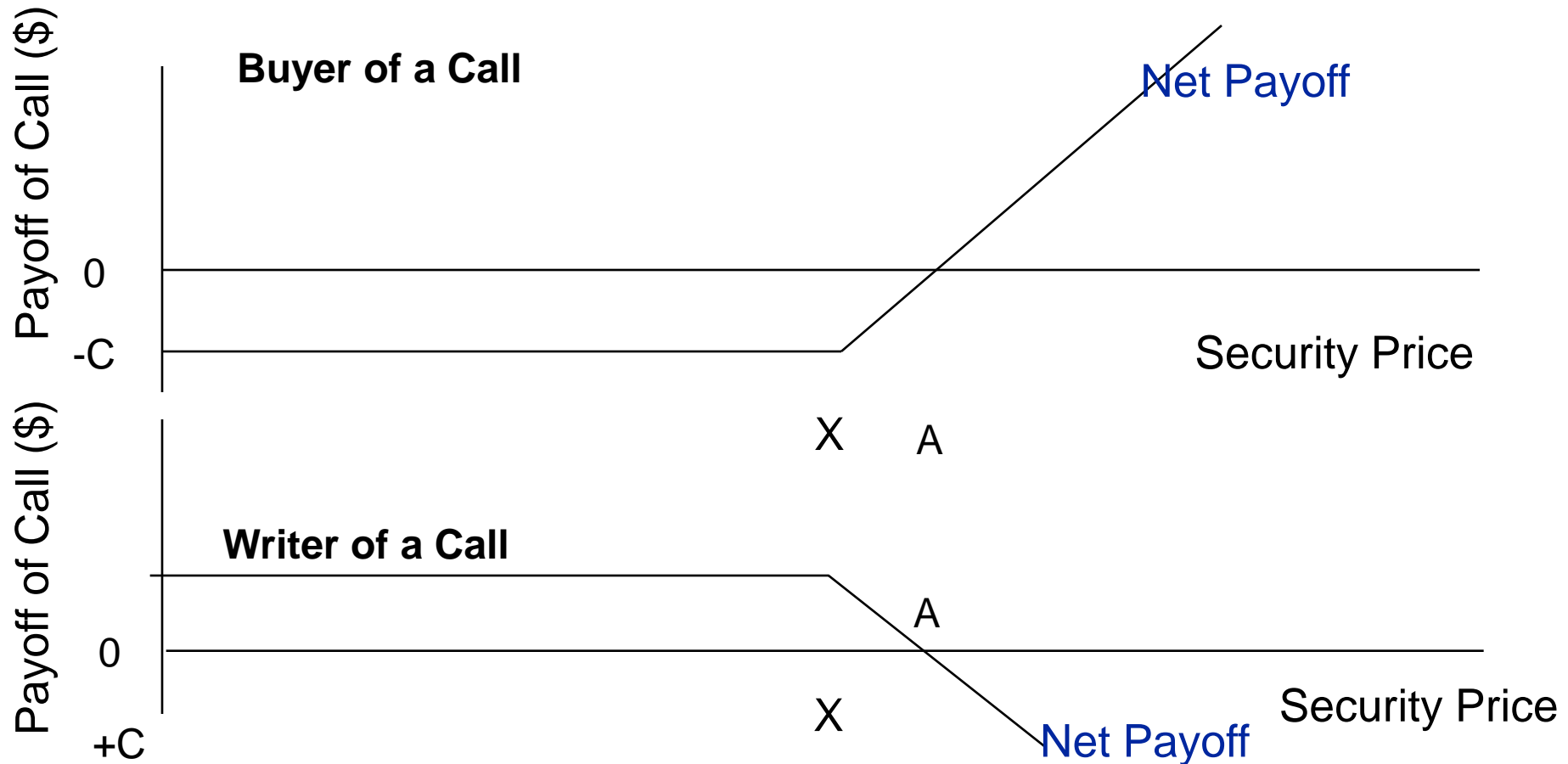- Options can be traded on exchanges or OTC markets.

Call Options

- Buying a Call Option--Gives the purchaser the right, but not the obligation, to buy the underlying security from the writer of the option at a pre-specified price

  » t=0 pay C   t=1 receive Max(0,PR-X)

- Writing a Call Option—Gives the writer the obligation to sell the underlying security at a pre-specified price

  » t=0 receive C   t=1 pay Max(0,PR-X)

   C   = Call Premium

   PR = Price of underlying security

   X   = Exercise Price

Call payoff

Value of a Call Option

Price ($)

Call Price

Intrinsic value
max(0,S-X)

X

Time Value
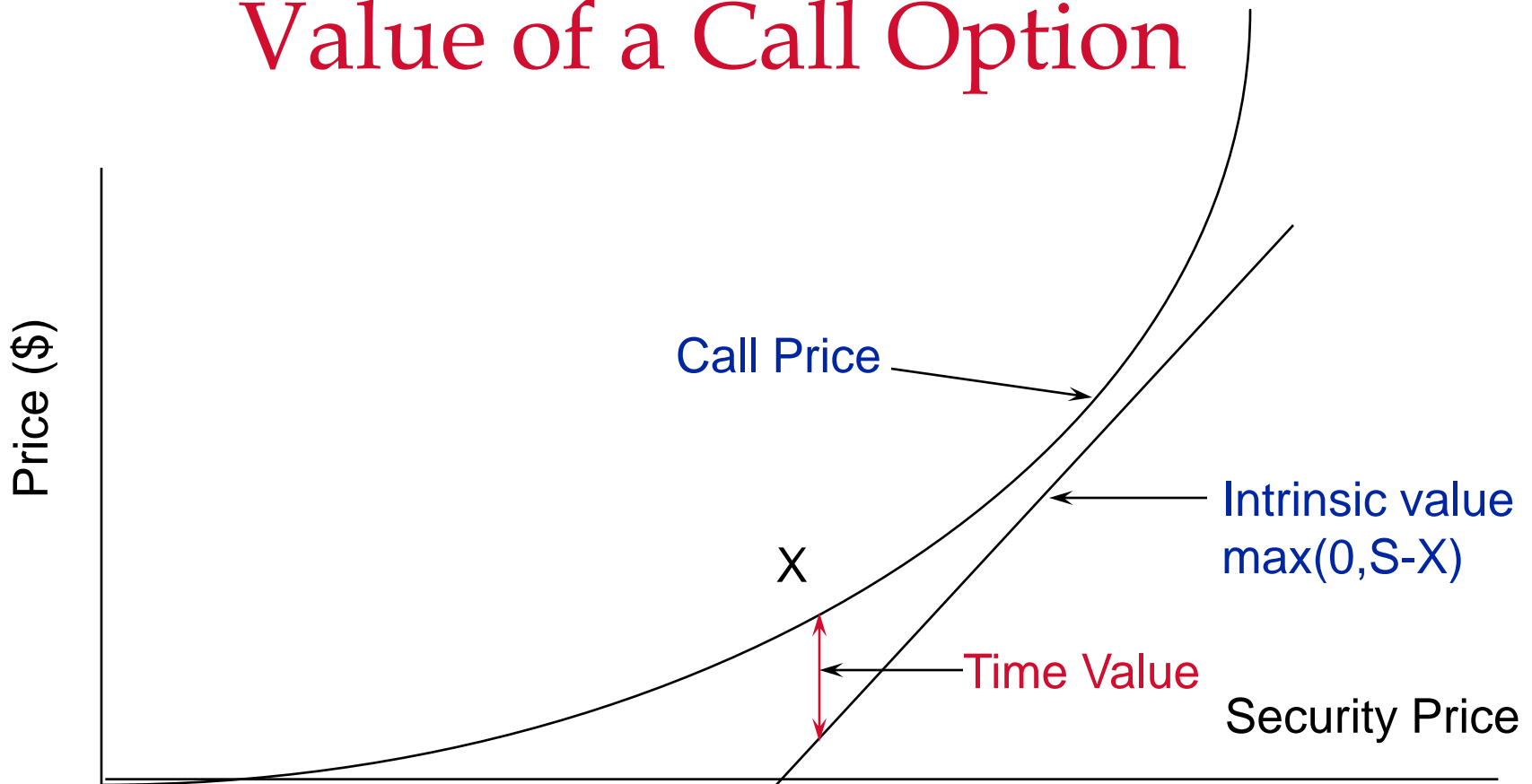
Security Price

Put Options

- Buying a Put Option - Gives the purchaser the right, not the obligation, to sell the underlying security to the writer of the option at a pre-specified exercise price.

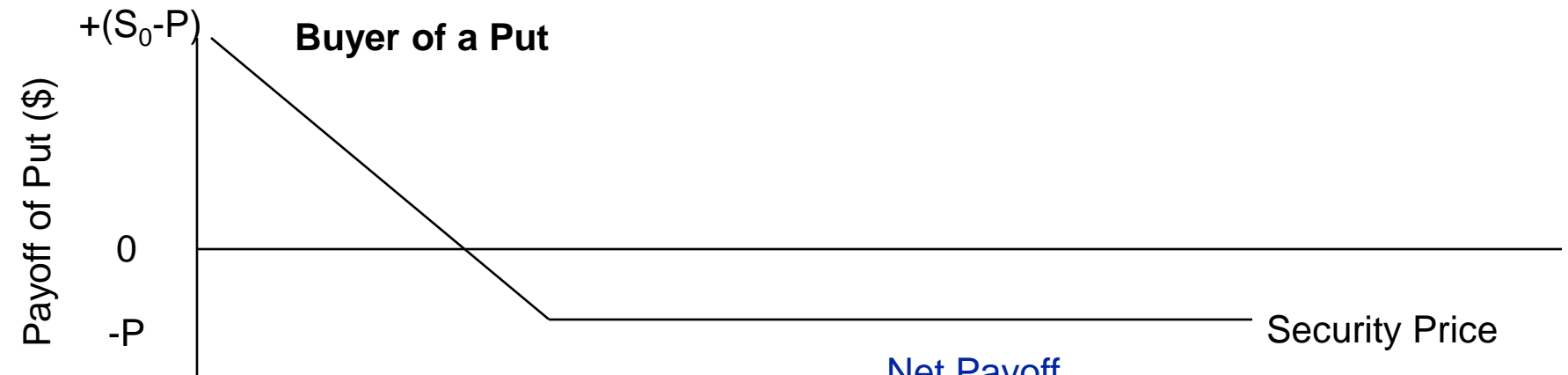 » t=0 pay P   t=1 receive Max(0,X-PR)

- Writing a Put Option - Gives the writer the obligation to buy the underlying security at a pre-specified price.

  » t=0 receive P   t=1 pay Max(0,X-PR)

        P   = Put Premium

Net Payoff of a Put Option

Buyer of a Put

Payoff of Put ($)

$+(S_0-P)$

0

$-P$

B   X

Net Payoff

Security Price

Writer of a Put

Payoff of Put ($)

$+P$

0

Net Payoff

B   X

Security Price

$-(S_0-P)$

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Value of a Put Option

Put Price

Time Value

Intrinsic value
max(0,X-S)

X

Security Price
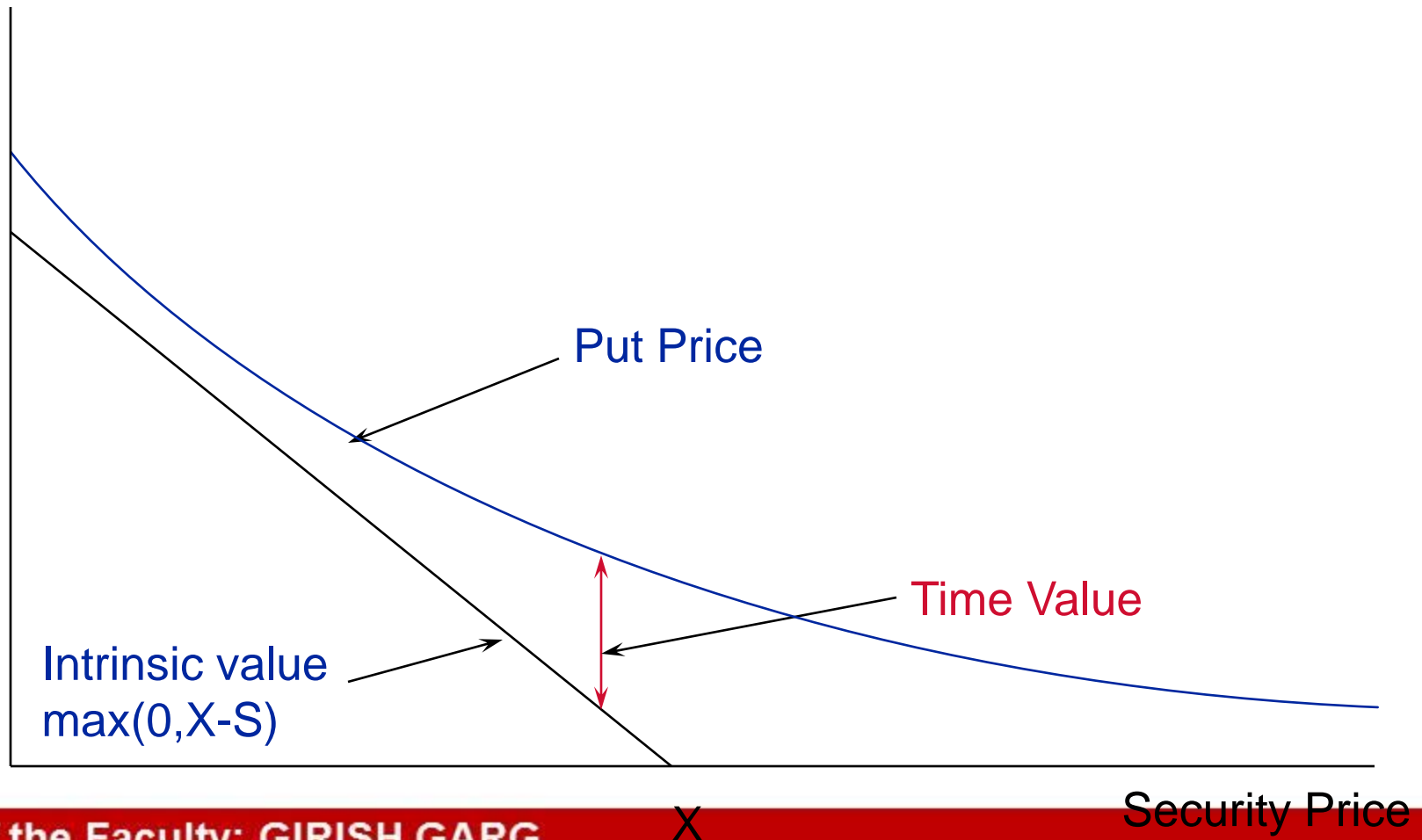
Caps, Floors, and Collars

- A cap is a call option where the seller guarantees to pay the buyer when the designated reference price exceed a predetermined cap price. The buyer pays a cap fee.

- A floor is a put option where the seller guarantees to pay the buyer when the designated reference price falls below a predetermined floor price. The buyer pays a floor fee.

- A collar is a position that simultaneously buys a cap and sells a floor.

Option Price
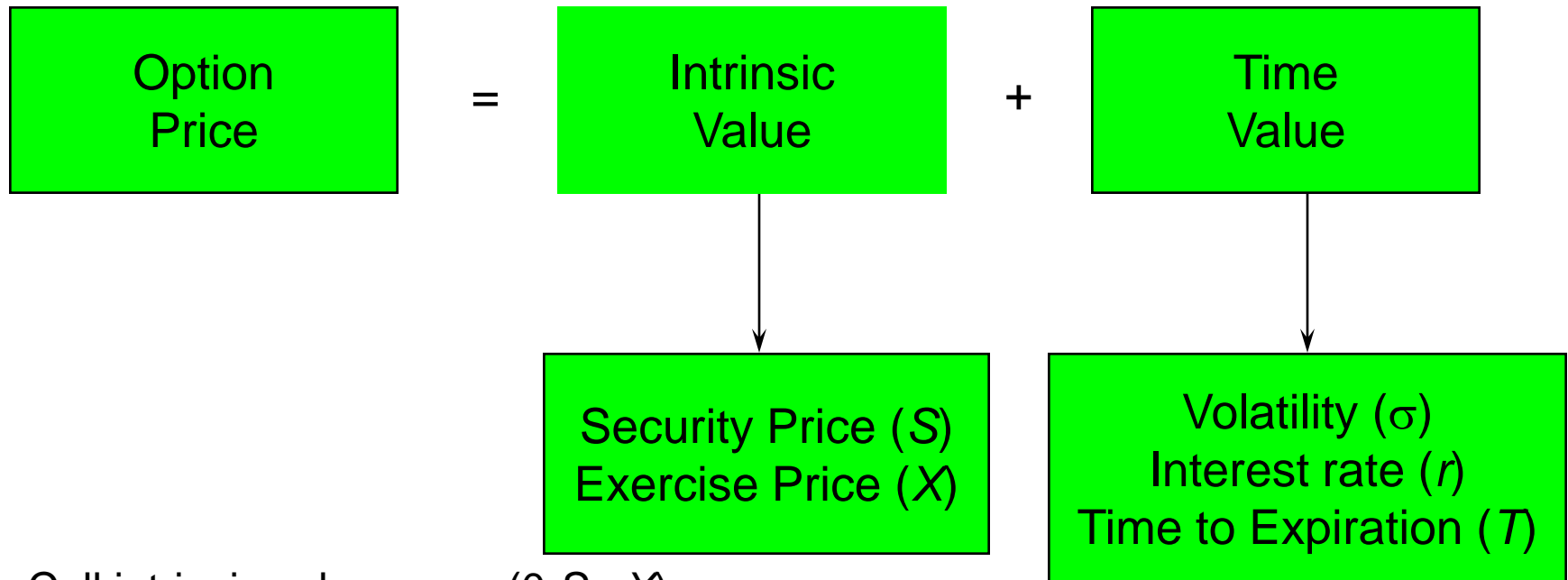
| Option Price | = | Intrinsic Value | + | Time Value |

Intrinsic Value → Security Price (S) / Exercise Price (X)

Time Value → Volatility (σ) / Interest rate (r) / Time to Expiration (T)

Call intrinsic value = max(0,S - X)
Put intrinsic value = max(0,X - S)

	COPPER	2,204.60	lbs per metric tonne
Cash Buyer	4814	$2.18	price per pound
Cash Seller & Settlement	4815	$2.18	
3-months Buyer	4838	$2.19	
3-months Seller	4840	$2.20	
Dec 3 2017 Buyer	4930	$2.24	
Dec 3 2017 Seller	4940	$2.24	

Copper Futures, price per pound, 25,000 pounds per contract

Daily Settlements for Copper Future Futures (FINAL) - Trade Date: 09/23/2016

Month	Open	High	Low	Last	Change	Settle	Estimated Volume	Prior Day Open Interest
SEP 16	2.1885	2.1960	2.1885	2.1915	+.0050	2.1925	723	1,439
OCT 16	2.1910	2.1995	2.1810	2.1950	+.0030	2.1940	960	3,344
NOV 16	2.1920	2.2035	2.1850	2.1975	+.0050	2.1975	134	1,094
DEC 16	2.1885	2.2065	2.1855	2.2000	+.0065	2.2010	58,725	136,614
JAN 17	2.1945	2.2095	2.1945	2.2090	+.0070	2.2055	25	699
FEB 17	-	-	-	-	+.0070	2.2080	0	562
MAR 17	2.2005	2.2155B	2.1950	2.2090	+.0075	2.2105	5,618	32,826
APR 17	-	-	-	-	+.0080	2.2150	0	328
MAY 17	2.2145	2.2215B	2.2010A	2.2165	+.0080	2.2170	1,345	5,612
JUN 17	2.2215	2.2215	2.2215	2.2215	+.0085	2.2215	1	297
JLY 17	2.2110	2.2225	2.2100A	2.2220	+.0090	2.2225	103	2,318
AUG 17	2.2275	2.2275	2.2275	2.2275	+.0095	2.2270	1	297
SEP 17	2.2280	2.2280	2.2280	2.2280	+.0100	2.2280	28	1,027

Understanding Option Quotes
Copper Options on Futures (Call in Dec)

Strike	Type	Open	High	Low	Last	Change	Settle	Estimated Volume	Prior Day Open Interest
217	Call	-	-	-	-	+.0045	.0795	0	20
218	Call	-	-	-	-	+.0045	.0735	0	4
219	Call	-	-	-	-	+.0050	.0680	0	1
220	Call	.0625	.0625	.0625	-	+.0050	.0630	10	47
221	Call	-	-	-	-	+.0040	.0570	0	0
222	Call	-	-	-	-	+.0035	.0520	0	0
223	Call	-	-	-	-	+.0025	.0465	0	0
224	Call	-	-	-	-	+.0015	.0415	0	0

Understanding December Quotes
Put in Dec

- How much does it cost to purchase:

  » one **call** of **Copper Futures Options** contract (exercise price of 217)?
  Call = .0795 / lb * 25,000 lb per contract = $1,987.50 per contract

- What is the intrinsic value of a **call** on **Copper Futures Options** (exercise price of 317)?
  Call = max(0,F-X) = max(0,2.20 – 2.17) = 0.03 cents
  Use the futures copper price (not the cash price)

  What is the time value of money?
  Option Price - Intrinsic Value = 0.0795 – 0.03 = 0.0495 / lb

- What is the intrinsic value of a **call** on **Copper Futures Options** (exercise price of 224)?
  Call = max(0,F-X) = max(0,2.20 – 2.24) = 0 cents
  Use the futures copper price (not the cash price)

  What is the time value of money?
  Option Price - Intrinsic Value = 0.0415 – 0 = 0.0415 / lb

- What is the intrinsic value of a **call** on **Copper Futures Options** (exercise price of 220)?
  Option Price - Intrinsic Value = 0.0630 – 0 = 0.0630 / lb

- Why there greater intrinsic value for options near the money.

Understanding Option Quotes
Copper Options on Futures (Put in Dec)

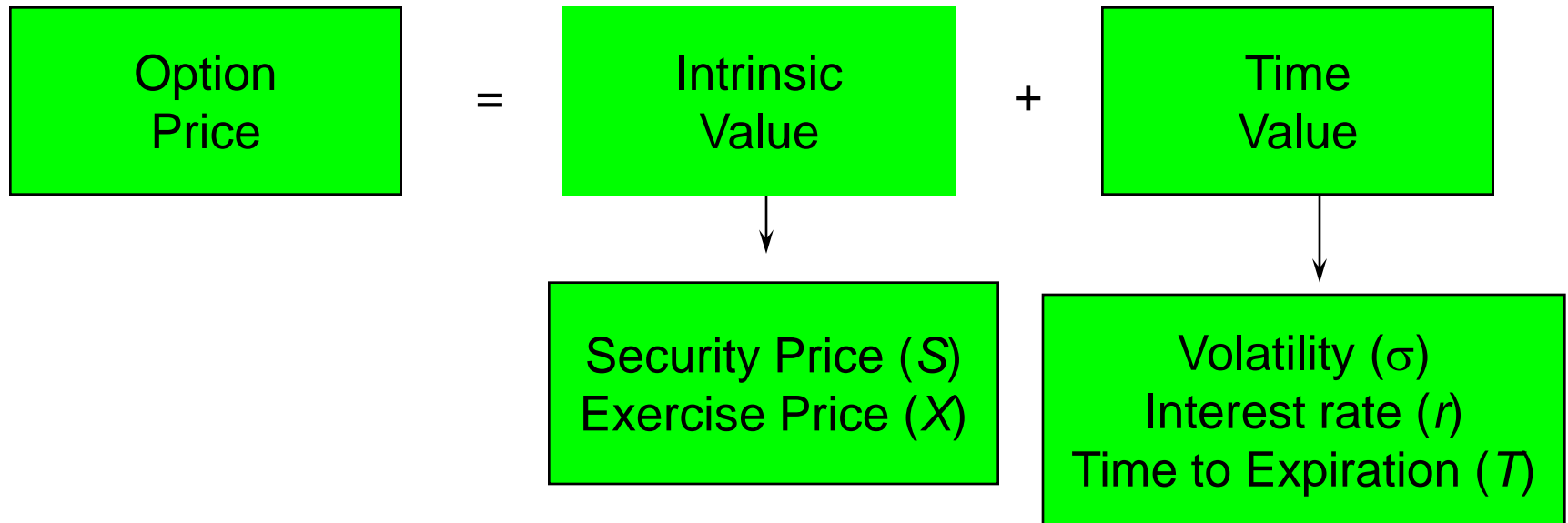| Strike	Type	Open	High	Low	Last	Change	Settle	Estimated Volume	Prior Day Open Interest
217	Put	-	.0510B	-	-	-.0020	.0485	0	13
218	Put	-	.0555B	-	-	-.0020	.0525	0	2
219	Put	-	.0600B	-	-	-.0015	.0570	0	3
220	Put	-	.0650B	-	-	-.0015	.0620	0	24
221	Put	-	.0710B	.0680A	-	-.0025	.0660	0	0
222	Put	-	.0765B	.0735A	-	-.0035	.0705	0	0
223	Put	-	-	.0790A	-	-.0040	.0755	0	0
224	Put	-	-	.0840A	-	-.0050	.0805	0	0

Understanding December Quotes
Put in Dec

- How much does it cost to purchase:

  » one **put** of **Copper Futures Options** contract (exercise price of 217)?
  Call = .0485 / lb * 25,000 lb per contract = $1,212.50 per contract

- What is the intrinsic value of a **put** on **Copper Futures Options** (exercise price of 317)?
  Call = max(0,X-F) = max(0,2.17 – 2.20) = 0.0 cents
  Use the futures copper price (not the cash price)

  What is the time value of money?
  Option Price - Intrinsic Value = 0.0485 – 0.0 = 0.0485 / lb

- What is the intrinsic value of a **put** on **Copper Futures Options** (exercise price of 224)?
  Call = max(0,X-F) = max(0,2.24 – 2.20) = 0.04 cents
  Use the futures copper price (not the cash price)

  What is the time value of money?
  Option Price - Intrinsic Value = 0.0805 – 0.040 = 0.0405 / lb

- What is the intrinsic value of a **put** on **Copper Futures Options** (exercise price of 220)?
  Option Price - Intrinsic Value = 0.0620 – 0 = 0.0620 / lb

- Why there greater intrinsic value for options near the money.

Understanding Option Prices

Option Price	=	Intrinsic Value	+	Time Value

Intrinsic Value ↓

Security Price (S)
Exercise Price (X)

Time Value ↓

Volatility (σ)
Interest rate (r)
Time to Expiration (T)

Call intrinsic value = max$(0, S - X)$
Put intrinsic value = max$(0, X - S)$

References:

- srivastava, r. (2017). *financial derivative and risk management.* new delhi: oxford university press.
- hull, j. c. (1988). *options, futures and other derivatives.* (9th, Ed.) pearson.

Thank you