FINM3405 Derivatives and risk management

Tutorial Sheet 4: Options - Introduction

August 8, 2024

Question 1.   1. What is the difference between call and put options?

2. What is the difference between the taker/holder and writer of an option?

3. What is the difference between European and American options?

4. Why do options have premiums and which party pays it to which?

5. What do the terms in-the-money, at-the-money and out-of-the-money mean?

6. What is the difference between writing an option naked vs covered?

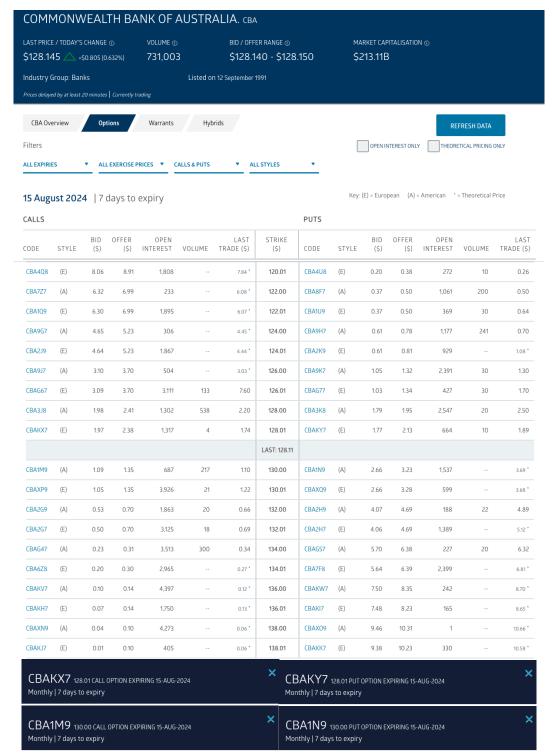7. What is the intrinsic value and time value of an option?

Question 2. What does it mean to exercise an option? Which party gets to choose whether they exercise an option?

Question 3. How do you use options to speculate on an increase in the price of the underlying asset? What about a decrease?

Question 4. What is the maximum profit an option writer can earn, and what is their potential loss? Why would you ever consider writing options?

Question 5.   1. You own 500,000 shares in the E Fund SSE STAR 50 ETF on the Shanghai Stock Exchange and are worried that the STAR 50 Index will fall in value. What options contracts are available for you to insure your holding and how would you do it? What would be the outcome if the CSI 300 Index fell 10% between now and next month?

2. You also own 500,000 shares in the Harvest CSI 300 ETF on the Shenzhen Stock Exchange. You seek additional income on your holding and expect the CSI 300 Index to go sideways. What options contracts are available for you to do this and how would you do it? What would be the outcome if the CSI 300 Index went sideways between now and next month?

COMMONWEALTH BANK OF AUSTRALIA. CBA

LAST PRICE / TODAY'S CHANGE	VOLUME	BID / OFFER RANGE	MARKET CAPITALISATION
$128.145 △ +$0.805 (0.632%)	731,003	$128.140 - $128.150	$213.11B

Industry Group: Banks — Listed on 12 September 1991

Prices delayed by at least 20 minutes | Currently trading

CBA Overview | **Options** | Warrants | Hybrids — REFRESH DATA

Filters — ☐ OPEN INTEREST ONLY ☐ THEORETICAL PRICING ONLY

ALL EXPIRES ▼ | ALL EXERCISE PRICES ▼ | CALLS & PUTS ▼ | ALL STYLES ▼

15 August 2024 | 7 days to expiry

Key: (E) = European (A) = American * = Theoretical Price

		CALLS					STRIKE			PUTS				
CODE	STYLE	BID ($)	OFFER ($)	OPEN INTEREST	VOLUME	LAST TRADE ($)	($)	CODE	STYLE	BID ($)	OFFER ($)	OPEN INTEREST	VOLUME	LAST TRADE ($)
CBA4Q8	(E)	8.06	8.91	1,808	--	7.84 *	120.01	CBA4U8	(E)	0.20	0.38	272	10	0.26
CBA7Z7	(A)	6.32	6.99	233	--	6.08 *	122.00	CBA8F7	(A)	0.37	0.50	1,061	200	0.50
CBA1Q9	(E)	6.30	6.99	1,895	--	6.07 *	122.01	CBA1U9	(E)	0.37	0.50	369	30	0.64
CBA9G7	(A)	4.65	5.23	306	--	4.45 *	124.00	CBA9H7	(A)	0.61	0.78	1,177	241	0.70
CBA2J9	(E)	4.64	5.23	1,867	--	4.44 *	124.01	CBA2K9	(E)	0.61	0.81	929	--	1.08 *
CBA9J7	(A)	3.10	3.70	504	--	3.03 *	126.00	CBA9K7	(A)	1.05	1.32	2,391	30	1.30
CBAG67	(E)	3.09	3.70	3,111	133	7.60	126.01	CBAG77	(E)	1.03	1.34	427	30	1.70
CBA3J8	(A)	1.98	2.41	1,302	538	2.20	128.00	CBA3K8	(A)	1.79	1.95	2,547	20	2.50
CBAKX7	(E)	1.97	2.38	1,317	4	1.74	128.01	CBAKY7	(E)	1.77	2.13	664	10	1.89
							LAST: 128.11							
CBA1M9	(A)	1.09	1.35	687	217	1.10	130.00	CBA1N9	(A)	2.66	3.23	1,537	--	3.69 *
CBAXP9	(E)	1.05	1.35	3,926	21	1.22	130.01	CBAXQ9	(E)	2.66	3.28	599	--	3.68 *
CBA2G9	(A)	0.53	0.70	1,863	20	0.66	132.00	CBA2H9	(A)	4.07	4.69	188	22	4.89
CBA2G7	(E)	0.50	0.70	3,125	18	0.69	132.01	CBA2H7	(E)	4.06	4.69	1,389	--	5.12 *
CBAG47	(A)	0.23	0.31	3,513	300	0.34	134.00	CBAG57	(A)	5.70	6.38	227	20	6.32
CBA6Z8	(E)	0.20	0.30	2,965	--	0.27 *	134.01	CBA7F8	(E)	5.64	6.39	2,399	--	6.81 *
CBAKV7	(A)	0.10	0.14	4,397	--	0.12 *	136.00	CBAKW7	(A)	7.50	8.35	242	--	8.70 *
CBAKH7	(E)	0.07	0.14	1,750	--	0.13 *	136.01	CBAKI7	(E)	7.48	8.23	165	--	8.65 *
CBAXN9	(A)	0.04	0.10	4,273	--	0.06 *	138.00	CBAXO9	(A)	9.46	10.31	1	--	10.66 *
CBAKJ7	(E)	0.01	0.10	405	--	0.06 *	138.01	CBAKK7	(E)	9.38	10.23	330	--	10.58 *

CBAKX7 128.01 CALL OPTION EXPIRING 15-AUG-2024 — Monthly | 7 days to expiry ✕

CBAKY7 128.01 PUT OPTION EXPIRING 15-AUG-2024 — Monthly | 7 days to expiry ✕

CBA1M9 130.00 CALL OPTION EXPIRING 15-AUG-2024 — Monthly | 7 days to expiry ✕

CBA1N9 130.00 PUT OPTION EXPIRING 15-AUG-2024 — Monthly | 7 days to expiry ✕

1. What do I mean when I say "either side of the money"?

2. Which options are in-the-money? Which are out-of-the-money?

3. What is your profit if you took 10 just out-of-the-money calls and CBA closed at $135 in 7 days? What about at $125? What if you wrote the calls? What about for puts? Use the last traded prices. Plot profit diagrams.

4. What is the intrinsic and time values of the options close to at-the-money?

Question 7. Using the data and market outcomes from Question 5, what would be your final position if you held 500 CBA shares and insured it with just out-of-the-money options? What about if you wrote just-in-the-money call options?

Question 8. What is the relation between the prices C and P of European call and put options over the same underlying asset and with expiry T if their strike price K equals the fair price X of a futures/forward contract also with maturity T and over the same underlying asset?

Question 9.   1. What is the payoff of a portfolio consisting of 1 long European put with strike K and expiry T, and 1 stock with price S?

2. What is the payoff of a portfolio consisting of 1 long European call also with strike K and expiry T, and $e^{-rT}K$ invested at the risk-free rate r?

3. What can you say about the values of these portfolios? What do you get?

Question 10.   1. Why are American options worth at least as much as their European counterparts over the same underlying asset with the same strike price and time to expiry?

2. Why are American options worth at least their intrinsic value?

3. We claimed that American calls cannot be worth more than the underlying asset and American puts cannot be worth more than the strike price:

$$C^{\text{Am}} \leq S \qquad \text{and} \qquad P^{\text{Am}} \leq K.$$

Use no-arbitrage arguments to show these two inequalities.

Question 11. In the following scenarios, state which European option pricing bounds (or put-call parity) are violated and outline how you can construct an arbitrage trade to take advantage of the mispricing. In each scenario, the price of the underlying is $S = \$53$ and the risk-free rate is $r = 2\%$.

1. A 6 month European call with strike $K = \$50$ is quoted at $C = \$3.10$.

2. A 6 month European put with strike $K = \$55$ is quoted at $P = \$1.20$.

3. A 3 month European call is quoted at $C = \$1.20$ while the put is $P = \$2.50$. The strike price for both is $K = \$55$.