KU LEUVEN

Design of a structured product

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21.10.20

Contents

1 Introduction, Assumptions and relevant market data

In this assignment the design of two structured products for an underlying stock will be discussed. Namely the underlying stock is Advanced Micro Devices, Inc. , which is also known as AMD. AMD is an American multinational semiconductor company, which produces Computer processors and related technologies for business and consumer markets. For many investors AMD is a really interesting company, as it is beside of Intel (Intel Corp. v. Advanced Micro Devices) the biggest producer for computer processors with even growing partial of the market. Additionally the recent release of the new graphics processing units (GPUs) is very promising as these represent serious competition to Nvidia graphics cards, which dominated the market in the last years.

Following structured products will be introduced:

- Product 1: Partially principal protected note

- Product 2: Airbag note

As underlying Finance instruments we will basically consider three different assets:

- the risk-free bank account with an fixed interest rate r

- the stock S (in this case AMD)

- Call and Put options on the stock S

As starting date $t = 0$ Friday the 20st November is choosen. The maturity date of the products is Friday 21st January 2022. More precisely the structured product, which will be discussed later, are build on the data presented below, accessed at Friday 20st November at 4:45 pm (MEZ), which is one hour and a quarter after the market opening at that day. The data is shown in the tables at the end of this section.

To get a fixed interest rate for the whole time period we the daily treasure yield rate of the US treasure bond at the starting date $t = 0$ is picked, which we denote by $r = 0.11\%$. In the table below the relevant data is shown, which is published at [1] an official website of the United States Government. //todo includgraphic

The reason of choice is that the base interest rate of the United States, the United States Fed Funds Rate is given by a target range of $0 - 0.25\%$. Moreover the Daily Treasury Yield Curve Rates are given for different time periods exactly. Since the time period of our products is around one year and two months the rate for an investment over one year is picked. As the investment is even longer than one year, that is a rather cautious estimate for the interest rate. ·

LastTradeDate	Strike	LastPrice	Bid	Ask	Volume	ImpliedVolatility
2020-11-18 3:10PM EST	5.0	78.48	79.95	81.5	232	145.31%
2020-11-19 11:49AM EST	10.0	74.86	75.2	76.4	1	110.25%
2020-11-18 1:28PM EST	15.0	69.01	70.4	71.1	5	86.82%
2020-11-09 10:15AM EST	18.0	68.35	67.5	68.7	22	88.04%
2020-11-05 9:50AM EST	20.0	65.5	65.6	66.5	1	80.96%
2020-11-17 1:44PM EST	23.0	61.0	62.55	63.55	4	73.44%
2020-11-18 3:36PM EST	25.0	59.0	60.45	61.55	1	67.97%
2020-11-09 1:24PM EST	28.0	56.0	57.7	58.85	1	66.99%
2020-11-18 10:32AM EST	30.0	54.0	55.8	56.95	3	64.70%
2020-10-13 1:53PM EST	32.0	54.99	50.35	51.25	1	0.00%
2020-11-19 3:19PM EST	35.0	51.5	51.3	52.0	5	59.45%
2020-11-20 10:02AM EST	37.0	49.5	49.4	50.3	2	58.35%
2020-11-19 3:18PM EST	40.0	46.95	46.9	47.4	35	56.45%
2020-11-13 1:09PM EST	42.0	41.83	45.2	45.75	7	56.07%
2020-11-16 12:14PM EST	45.0	40.8	42.45	43.5	14	55.18%
2020-11-17 12:40PM EST	47.0	39.65	41.0	41.65	7	54.47%
2020-11-20 10:10AM EST	50.0	39.0	38.7	39.2	6	53.71%
2020-11-16 10:47AM EST	52.5	35.04	36.75	37.25	15	52.95%
2020-11-19 3:36PM EST	55.0	35.0	34.9	35.95	11	53.76%
2020-11-18 3:20PM EST	57.5	33.26	33.1	34.5	5	53.92%
2020-11-20 10:16AM EST	60.0	31.7	31.35	32.4	10	52.55%
2020-11-19 2:22PM EST	62.5	29.1	29.25	31.15	1	52.05%
2020-11-20 9:30AM EST	65.0	28.38	28.1	28.5	33	50.53%
2020-11-16 11:54AM EST	67.5	25.5	26.45	27.8	1	51.45%
2020-11-20 10:09AM EST	70.0	25.55	25.2	25.9	3	50.73%
2020-11-17 11:13AM EST	72.5	23.0	23.7	24.25	5	50.75%
2020-11-20 10:07AM EST	75.0	22.77	22.6	22.95	4	50.02%
2020-11-19 2:10PM EST	77.5	22.0	21.45	21.85	7	50.21%
2020-11-20 9:39AM EST	80.0	20.35	20.25	20.7	8	50.07%
2020-11-20 10:17AM EST	82.5	19.0	19.1	19.5	12	50.35%
2020-11-20 10:05AM EST	85.0	18.45	18.15	18.5	7	50.39%
2020-11-20 9:58AM EST	87.5	17.45	17.1	17.5	3	50.29%
2020-11-20 10:12AM EST	90.0	16.29	16.15	16.55	15	50.19%
2020-11-20 10:06AM EST	92.5	15.6	15.2	16.1	1	50.10%
2020-11-20 10:05AM EST	95.0	14.8	14.4	15.4	9	50.29%
2020-11-20 10:19AM EST	97.5	14.1	13.7	14.0	1	49.96%
2020-11-20 10:05AM EST	100.0	13.0	12.95	13.3	10	50.06%
2020-11-20 10:12AM EST	105.0	11.6	11.5	11.8	5	49.67%
2020-11-20 10:17AM EST	110.0	10.45	10.3	10.65	7	49.85%
2020-11-20 10:05AM EST	115.0	9.5	9.2	9.55	2	49.82%
2020-11-20 10:07AM EST	120.0	8.37	8.3	8.55	8	49.73%
2020-11-20 10:05AM EST	125.0	7.7	7.45	7.7	2	49.79%
2020-11-19 3:57PM EST	130.0	6.95	6.6	6.95	457	49.87%
2020-11-20 10:05AM EST	135.0	6.2	6.0	6.25	6	49.87%
2020-11-20 10:05AM EST	140.0	5.6	5.4	5.6	23	49.77%

Table 1: European Call Options AMD (data extracted from [2] at 20/11/2020 16:45:35)

LastTradeDate	Strike	LastPrice	Bid	Ask	Volume	ImpliedVolatility
2020-11-20 10:12AM EST	5.0	0.04	0.03	0.04	2	103.13%
2020-11-16 2:39PM EST	10.0	0.07	0.06	0.17	5	88.87%
2020-11-16 2:10PM EST	15.0	0.12	0.1	0.22	36	75.20%
2020-11-12 11:11AM EST	18.0	0.15	0.1	0.26	7	68.56%
2020-11-17 2:49PM EST	20.0	0.22	0.15	0.3	33	66.21%
2020-11-04 9:30AM EST	23.0	0.35	0.25	0.36	3	63.14%
2020-11-19 1:38PM EST	25.0	0.34	0.25	0.46	1	60.89%
2020-11-10 10:33AM EST	28.0	0.54	0.35	0.63	3	58.94%
2020-11-09 10:25AM EST	30.0	0.66	0.5	0.75	12	58.30%
2020-11-09 3:49PM EST	32.0	0.85	0.5	0.86	584	55.96%
2020-11-18 2:57PM EST	35.0	0.95	0.75	1.08	15	54.79%
2020-11-05 11:50AM EST	37.0	1.41	0.76	1.2	2	52.59%
2020-11-19 3:08PM EST	40.0	1.42	1.35	1.5	152	53.05%
2020-11-19 2:43PM EST	42.0	1.74	1.61	1.81	37	52.73%
2020-11-19 3:26PM EST	45.0	2.24	2.01	2.2	155	51.54%
2020-11-19 3:13PM EST	47.0	2.59	2.3	2.61	13	51.16%
2020-11-20 9:30AM EST	50.0	2.95	2.6	3.1	43	50.92%
2020-11-19 2:43PM EST	52.5	3.7	3.5	3.65	23	50.01%
2020-11-19 3:44PM EST	55.0	4.2	4.15	4.3	23	50.13%
2020-11-19 2:43PM EST	57.5	4.9	4.85	5.0	13	49.81%
2020-11-19 2:43PM EST	60.0	5.8	5.55	5.75	17	49.43%
2020-11-19 2:43PM EST	62.5	6.5	6.4	6.6	14	49.22%
2020-11-19 2:43PM EST	65.0	7.6	7.35	7.5	38	48.95%
2020-11-19 2:43PM EST	67.5	8.6	8.3	8.5	12	48.82%
2020-11-19 3:55PM EST	70.0	9.25	9.35	9.5	47	48.46%
2020-11-20 9:45AM EST	72.5	10.5	10.45	10.65	100	48.41%
2020-11-20 10:26AM EST	75.0	11.8	11.65	11.8	3	48.15%
2020-11-19 2:43PM EST	77.5	13.25	12.9	13.15	10	48.32%
2020-11-19 3:25PM EST	80.0	14.36	14.3	14.45	17	48.16%
2020-11-20 10:26AM EST	82.5	15.7	15.6	15.85	2	48.11%
2020-11-20 10:15AM EST	85.0	17.25	17.05	17.35	26	48.19%
2020-11-17 2:07PM EST	87.5	18.8	18.55	19.55	2	50.07%
2020-11-17 2:10PM EST	90.0	20.4	20.1	20.7	3	48.87%
2020-11-20 10:13AM EST	92.5	22.0	21.7	22.05	2	48.11%
2020-11-20 10:13AM EST	95.0	23.65	23.35	23.65	1	47.91%
2020-11-12 3:01PM EST	97.5	25.35	24.0	26.3	1	50.43%
2020-11-17 3:06PM EST	100.0	28.07	26.7	27.65	2	49.30%
2020-11-13 2:49PM EST	105.0	33.4	29.85	31.35	3	49.46%
2020-11-10 3:29PM EST	110.0	39.2	34.1	34.5	4	47.69%
2020-10-28 9:18AM EST	115.0	45.85	38.0	38.35	1	47.47%
2020-11-06 2:25PM EST	120.0	43.0	42.0	42.65	10	48.21%
2020-10-09 11:29AM EST	125.0	51.85	44.65	48.0	21	51.79%
2020-11-04 10:51AM EST	130.0	55.12	50.3	51.15	10	48.55%
2020-11-02 2:45PM EST	135.0	64.1	54.5	55.55	1	48.82%
2020-11-17 3:06PM EST	140.0	60.73	59.0	59.55	2	47.47%

Table 2: European Put Options AMD (data extracted from [2] at 20/11/2020 16:45:35)

2 Product 1: Partially principal protected note (PPPN)

2.1 Descriptive part: What is a PPPN and why is it interesting?

2.2 Technical Part: How does a PPPN work?

3 Product 2: Airbag note (AN)

3.1 Descriptive part: What is a AN and why is it interesting?

3.2 Technical Part: How does a AN work?

4 Appendix

4.1 Screenshots of the market data

References

[1] Daily treasury yield curve rates - the united states government. `https://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yield`. Accessed: 2020-11-20 - 16:45:35.

[2] yahoo! finance - advanced micro devices, inc.(amd) - options. `https://finance.yahoo.com/quote/AMD/options?p=AMD&date=1642723200`. Accessed: 2020-11-20 - 16:45:35.