Solvay Business School
Université Libre de Bruxelles
Faculté SOCO
2009-2010

ADVANCED FINANCE
GEST-D-410
Prof. H. Pirotte

LASTNAME : STUDENT Id :

FIRSTNAME :

Final Exam

Form A

Monday 11 January 2010

Indications

Please follow these indications:

1. The exam lasts 3 hours, all inclusive.
2. Please verify that your document contains exactly 8 pages.
3. There are 20 points. Each question is worth one point unless otherwise stated.
4. Please write your first name and last name on the first page.
5. Good work!!!

Problems

P1 Asset pricing

You live in a world where there exist only two assets: a risk-free bond and the share of an index fund (which can be considered as the market portfolio). This world is quite myopic since investors limit their time horizon to one year, the economy being then in one of the following two states: "bad" or "good". Your banker wants to sell you a structured product whose expected value next year is stated in the table below. As the market for this kind of product is completely dried, he did not manage to find a market price, but proposes to sell it to you at 4,36 €.

	Market Value (t=0)	Expected Value (t=1)	
		Bad State	*Good State*
Real Probability		0,3	0,7
Risk-Free Bond	1	1,1	1,1
Index Fund	1	0,5	2
Structured Product	?	2	6

Q1 Determine your own estimate of the value of the structured product. Do you buy it at 4,36€ ?

Q2 Can you determine the beta of the structured product?

Q3 If the real probability of the good state changes, other things being equal, will it change the value of the product? Explain carefully (max 5 lines, sanction if more).

P2 Cost of capital

We are in December 2010. Eric, a good friend of yours wants to sell the holding company inherited from his father. This holding is made of 3 subsidiaries that will be sold separately. Knowing that your scores in finance courses were always better than his, he asks you to help him find the values of the subsidiaries.

The first subsidiary (Metalco Ltd.) has the following yearly income statement (the income statement will be the same every year until infinity):

Income Statement (Metalco Ltd.)	
	2011 →∞
EBITDA	150'000
Depreciation	70'000
EBIT	80'000
Interest	20'000
Pre-Tax Earnings	60'000
Taxes	24'000
Net Income	36'000

Q4 If the cost of assets of Metalco is 10%, the tax rate is 40% and the debt level and ratio are constant until infinity (D/V= 0.18), what is the value of Metalco in 2010?

To help you find the value of the second subsidiary (Transco), Eric gathers some data which is summarized in the following tables:

kd	8%
ka	15%
Interest paid on debt	10%
tc	40%

	2010	**2011**	**2012**	**2013 →∞**
FCF Levered*	300'000	200'000	50'000	0
Debt	100'000	35'000	0	0

*after interest payments

Q5 Eric asks you to find the value of Transco, using a method handling the tax shields in the same way as the method you used for Metalco.

For the third subsidiary (Supco), things are more complicated... The debt of the company is currently at a level of 70'000, but should be equal to 20% of the value of the company in December 2013 (level adjusted continuously). He also told you that the growth rate of the earnings before interest and after taxes is 2% starting in 2013. All the other data available are summarized in the tables below:

ka	**10%**
kd	**8%**
tc	**34%**
EBIAT growth rate (2013 →∞)	**2%**
Target L	**20%**

Income Statement (Keuros)	2010	2011	2012	2013
EBIT		**10**	**15**	**20**
Interest				
Taxes				
Net Income				

Statement of CF				
Op. cash flows				
Invest. cash flows	0	0	0	0
Var Debt				
Balance Sheet				
Assets	90	90	90	90
Debt	70			
Equity	20			

Q6 Firstly, Eric ask you to find the present value (in 2013) of the cash flows going from 2014 until infinity.

Q7 Secondly, Eric ask you to find the value of the debt in 2013 and the annual debt repayment (constant repayments for years 2011-2012-2013) necessary to obtain the good level in 2013.

Q8 Thirdly, Eric asks you to find the present value (in 2010) of the cash-flows going from 2011 to 2013.

Q9 Fourthly, Eric asks to compute the equity's value, the value of tax shields and the total value of Supco.

Q10 In his paper of 1998: "The MM Propositions 40 years later", what is the opinion of Miller on the direct tests of MM propositions? Does he bring in a better way to test the propositions (max 7 lines, sanction if more)?

Eric forgot to mention that, buying the third subsidiary, the buyer acquires the option to extend the business over the next 5 years. The costs for the extension amount to 9,4 million € and the extension will not be undertaken if FCFs do not cover at least that extra investment. Current FCF expectations are of 5 million € and the volatility of this FCF stream is estimated at 49.5%, the continuous annual risk-free rate being at a level of 4%.

Q11 What is the value of this option?

In the article "Real Options Valuation: A Case Study of an E-commerce Company" by Sáenz-Diez and Gimeno, the authors present an approach where they treat uncertainty explicitly through a "certainty equivalent correction factor".

Q12 What kind of "certainty equivalent correction factor" do they use? What theoretical background does it rely on?

P3 Risky debt

You are a credit officer at La Banque du Coin and today, your boss asks you to determine the value of the zero-coupon issued by Falco South Ltd. The nominal value of this zero coupon is 1'000 mio € and its maturity is 2 years.

After some calculations and verifications of market values, you came to the conclusion that the total asset value base of Falcon South Ltd. could be estimated today at 1'000 mio €, with an annual volatility of its relative variations of 20%. The risk-free rate in the market today is estimated at 4% (We accept the working hypothesis of Merton's debt and use these in a binomial setting).

Q13 Use a two-period binomial tree with annual steps to compute the value of the zero-coupon bond.

Q14 Decompose the value of this risky debt into risk-free debt, and the discounted expected loss with the values of its internal parameters: the loss given default and the default probability.

Q15 Give and explain shortly 3 shareholder's behaviours that can reduce the value of the debt when the value of the equity is close to zero (max 7 lines, sanction if more)?

To reduce the yield of the debt, instead of issuing a zero-coupon, the CFO of Falco wants to issue 300 convertible zero-coupons with a total nominal value of 1'000 mio € and a maturity of 2 years (those bonds are convertible only at maturity).

Q16 If the conversion rate is 1 bond for 1 share and knowing that the current equity of the company is represented by 100 shares and that there is no other debt in the firm than these convertible bonds, what is the value of this issuance? (2 points)

Your boss asks you a last thing: he wants to find the value of an annuity issued by Ford. The annuity payment is 5 mio € per year (maturity 2 years, payment at the end of the year) and he heard that the risk-neutral annual default probability of Ford conditional on no prior default is 3% per year.

Q17 He asks you to compute the present value of the expected payments made at the end of each year (the risk-free rate is 4%). Working hypothesis: Assume that we verify for the survival (or default) only at the end of the year. (2 points)

P4 Capital structure (empirical study)

The following problem is based on the article : "Control Rights and Capital Structure: An Empirical Investigation", by MICHAEL R. ROBERTS, and AMIR SUFI, THE JOURNAL OF FINANCE • VOL. LXIV, NO. 4 • AUGUST 2009.

Table III

Covenant Violations and Net Debt Issuance

This table presents coefficient estimates of firm fixed effects regressions (Panel A) and first difference regressions (Panel B) of net debt issuance on covenant violation indicators and control variables. The specifications reported in columns (2)–(4) of Panel A include lagged natural logarithm of total assets, the lagged tangible assets to total assets ratio, the lagged market-to-book ratio, and a lagged "has S&P rating" indicator as control variables. In addition, the specification in column (2) of Panel A includes the 11 *covenant control variables*: the lagged book debt to assets ratio, the lagged net worth to assets ratio, the lagged cash to assets ratio, the lagged and current EBITDA to lagged assets ratio, the lagged and current cash flow to lagged assets ratio, the lagged and current net income to lagged assets ratio, and the lagged and current interest expense to lagged assets ratio. Column (3) of Panel A includes the covenant control variables in addition to four *covenant control interaction variables*: the lagged debt to assets ratio interacted with the lagged cash flow to lagged assets ratio, the lagged debt to assets ratio interacted with the lagged EBITDA to lagged assets ratio, the lagged debt to assets ratio interacted with the lagged net worth to assets ratio, and the lagged EBITDA to lagged assets ratio interacted with the lagged interest expense to lagged assets ratio. Column (4) of Panel A includes all covenant control variables and covenant control interaction variables, these variables squared and to the third power, and five quantile indicator variables for each of the controls. Columns (1)–(4) of Panel B include the first differenced analogs to control variables in Panel A, with the exception of measures using debt, which are differences lagged two quarters instead of one-quarter to avoid spurious correlations. All specifications include calendar year-quarter indicator variables and fiscal quarter indicator variables. Standard errors are reported in parentheses and are clustered by firm.

Panel A: Fixed Effects				
Dependent Variable: Net debt issuance$_t$/assets$_{t-1}$ (Basis Points)				
	(1)	(2)	(3)	(4)
Covenant violation$_t$	8.4	3.2	2.2	3.2
	(8.1)	(7.6)	(7.7)	(7.6)
Covenant violation$_{t-1}$	−62.2**	−50.3**	−54.3**	−50.3**
	(7.8)	(7.2)	(7.2)	(7.2)
Covenant control variables	None	Covenant control variables	Covenant control variables, covenant interaction control variables	Control variables, control variables squared, control variables to the third power, and quintile indicators for each control
Number of firm-quarters	135,736	135,736	135,736	135,736
Number of firms	6,381	6,381	6,381	6,381
R^2	0.051	0.183	0.187	0.204

Panel B: First Differences				
Dependent Variable: Change in Net debt issuance$_t$/assets$_{t-1}$ (Basis Points)				
	(1)	(2)	(3)	(4)
Covenant violation$_t$	9.2	−3.3	−2.3	2.2
	(11.0)	(10.1)	(10.1)	(10.0)
Covenant violation$_{t-1}$	−44.9**	−60.4**	−59.7**	−50.3**
	(11.2)	(10.3)	(10.3)	(10.3)
Covenant control variables	None	Covenant control variables	Covenant control variables, covenant interaction control variables	Control variables, control variables squared, control variables to the third power, and quintile indicators for each control
Number of firm-quarters	123,557	123,557	123,557	123,557
Number of firms	6,345	6,345	6,345	6,345
R^2	0.003	0.139	0.140	0.159

** Statistically distinct from zero at the 1% level.

Q18 Please comment the table linking the analysis presented in this paper with the theory on capital structure presented in class. Please make yourself self-explanatory. (max 7 lines, sanction if more)

N(x) & N(-x)=1-N(x)

	0.000	0.005	0.010	0.015	0.020	0.025	0.030	0.035	0.040	0.045	0.050	0.055	0.060	0.065	0.070	0.075	0.080	0.085	0.090	0.095
0.0	0.5000	0.5020	0.5040	0.5060	0.5080	0.5100	0.5120	0.5140	0.5160	0.5179	0.5199	0.5219	0.5239	0.5259	0.5279	0.5299	0.5319	0.5339	0.5359	0.5378
0.1	0.5398	0.5418	0.5438	0.5458	0.5478	0.5497	0.5517	0.5537	0.5557	0.5576	0.5596	0.5616	0.5636	0.5655	0.5675	0.5695	0.5714	0.5734	0.5753	0.5773
0.2	0.5793	0.5812	0.5832	0.5851	0.5871	0.5890	0.5910	0.5929	0.5948	0.5968	0.5987	0.6006	0.6026	0.6045	0.6064	0.6083	0.6103	0.6122	0.6141	0.6160
0.3	0.6179	0.6198	0.6217	0.6236	0.6255	0.6274	0.6293	0.6312	0.6331	0.6350	0.6368	0.6387	0.6406	0.6424	0.6443	0.6462	0.6480	0.6499	0.6517	0.6536
0.4	0.6554	0.6573	0.6591	0.6609	0.6628	0.6646	0.6664	0.6682	0.6700	0.6718	0.6736	0.6754	0.6772	0.6790	0.6808	0.6826	0.6844	0.6862	0.6879	0.6897
0.5	0.6915	0.6932	0.6950	0.6967	0.6985	0.7002	0.7019	0.7037	0.7054	0.7071	0.7088	0.7106	0.7123	0.7140	0.7157	0.7174	0.7190	0.7207	0.7224	0.7241
0.6	0.7257	0.7274	0.7291	0.7307	0.7324	0.7340	0.7357	0.7373	0.7389	0.7405	0.7422	0.7438	0.7454	0.7470	0.7486	0.7502	0.7517	0.7533	0.7549	0.7565
0.7	0.7580	0.7596	0.7611	0.7627	0.7642	0.7658	0.7673	0.7688	0.7704	0.7719	0.7734	0.7749	0.7764	0.7779	0.7794	0.7808	0.7823	0.7838	0.7852	0.7867
0.8	0.7881	0.7896	0.7910	0.7925	0.7939	0.7953	0.7967	0.7981	0.7995	0.8009	0.8023	0.8037	0.8051	0.8065	0.8078	0.8092	0.8106	0.8119	0.8133	0.8146
0.9	0.8159	0.8173	0.8186	0.8199	0.8212	0.8225	0.8238	0.8251	0.8264	0.8277	0.8289	0.8302	0.8315	0.8327	0.8340	0.8352	0.8365	0.8377	0.8389	0.8401
1.0	0.8413	0.8426	0.8438	0.8449	0.8461	0.8473	0.8485	0.8497	0.8508	0.8520	0.8531	0.8543	0.8554	0.8566	0.8577	0.8588	0.8599	0.8610	0.8621	0.8632
1.1	0.8643	0.8654	0.8665	0.8676	0.8686	0.8697	0.8708	0.8718	0.8729	0.8739	0.8749	0.8760	0.8770	0.8780	0.8790	0.8800	0.8810	0.8820	0.8830	0.8840
1.2	0.8849	0.8859	0.8869	0.8878	0.8888	0.8897	0.8907	0.8916	0.8925	0.8934	0.8944	0.8953	0.8962	0.8971	0.8980	0.8988	0.8997	0.9006	0.9015	0.9023
1.3	0.9032	0.9041	0.9049	0.9057	0.9066	0.9074	0.9082	0.9091	0.9099	0.9107	0.9115	0.9123	0.9131	0.9139	0.9147	0.9154	0.9162	0.9170	0.9177	0.9185
1.4	0.9192	0.9200	0.9207	0.9215	0.9222	0.9229	0.9236	0.9244	0.9251	0.9258	0.9265	0.9272	0.9279	0.9285	0.9292	0.9299	0.9306	0.9312	0.9319	0.9325
1.5	0.9332	0.9338	0.9345	0.9351	0.9357	0.9364	0.9370	0.9376	0.9382	0.9388	0.9394	0.9400	0.9406	0.9412	0.9418	0.9424	0.9429	0.9435	0.9441	0.9446
1.6	0.9452	0.9458	0.9463	0.9468	0.9474	0.9479	0.9484	0.9490	0.9495	0.9500	0.9505	0.9510	0.9515	0.9520	0.9525	0.9530	0.9535	0.9540	0.9545	0.9550
1.7	0.9554	0.9559	0.9564	0.9568	0.9573	0.9577	0.9582	0.9586	0.9591	0.9595	0.9599	0.9604	0.9608	0.9612	0.9616	0.9621	0.9625	0.9629	0.9633	0.9637
1.8	0.9641	0.9645	0.9649	0.9652	0.9656	0.9660	0.9664	0.9667	0.9671	0.9675	0.9678	0.9682	0.9686	0.9689	0.9693	0.9696	0.9699	0.9703	0.9706	0.9710
1.9	0.9713	0.9716	0.9719	0.9723	0.9726	0.9729	0.9732	0.9735	0.9738	0.9741	0.9744	0.9747	0.9750	0.9753	0.9756	0.9759	0.9761	0.9764	0.9767	0.9770
2.0	0.9772	0.9775	0.9778	0.9780	0.9783	0.9786	0.9788	0.9791	0.9793	0.9796	0.9798	0.9801	0.9803	0.9805	0.9808	0.9810	0.9812	0.9815	0.9817	0.9819
2.1	0.9821	0.9824	0.9826	0.9828	0.9830	0.9832	0.9834	0.9836	0.9838	0.9840	0.9842	0.9844	0.9846	0.9848	0.9850	0.9852	0.9854	0.9856	0.9857	0.9859
2.2	0.9861	0.9863	0.9864	0.9866	0.9868	0.9870	0.9871	0.9873	0.9875	0.9876	0.9878	0.9879	0.9881	0.9882	0.9884	0.9885	0.9887	0.9888	0.9890	0.9891
2.3	0.9893	0.9894	0.9896	0.9897	0.9898	0.9900	0.9901	0.9902	0.9904	0.9905	0.9906	0.9907	0.9909	0.9910	0.9911	0.9912	0.9913	0.9915	0.9916	0.9917
2.4	0.9918	0.9919	0.9920	0.9921	0.9922	0.9923	0.9925	0.9926	0.9927	0.9928	0.9929	0.9930	0.9931	0.9931	0.9932	0.9933	0.9934	0.9935	0.9936	0.9937
2.5	0.9938	0.9939	0.9940	0.9940	0.9941	0.9942	0.9943	0.9944	0.9945	0.9945	0.9946	0.9947	0.9948	0.9948	0.9949	0.9950	0.9951	0.9951	0.9952	0.9953
2.6	0.9953	0.9954	0.9955	0.9955	0.9956	0.9957	0.9957	0.9958	0.9959	0.9959	0.9960	0.9960	0.9961	0.9962	0.9962	0.9963	0.9963	0.9964	0.9964	0.9965
2.7	0.9965	0.9966	0.9966	0.9967	0.9967	0.9968	0.9968	0.9969	0.9969	0.9970	0.9970	0.9971	0.9971	0.9972	0.9972	0.9972	0.9973	0.9973	0.9974	0.9974
2.8	0.9974	0.9975	0.9975	0.9976	0.9976	0.9976	0.9977	0.9977	0.9977	0.9978	0.9978	0.9978	0.9979	0.9979	0.9979	0.9980	0.9980	0.9980	0.9981	0.9981
2.9	0.9981	0.9982	0.9982	0.9982	0.9982	0.9983	0.9983	0.9983	0.9984	0.9984	0.9984	0.9984	0.9985	0.9985	0.9985	0.9985	0.9986	0.9986	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9987	0.9987	0.9988	0.9988	0.9988	0.9988	0.9988	0.9989	0.9989	0.9989	0.9989	0.9989	0.9989	0.9990	0.9990	0.9990	0.9990
3.1	0.9990	0.9990	0.9991	0.9991	0.9991	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993	0.9993	0.9993	0.9993
3.2	0.9993	0.9993	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998	0.9998	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9998	0.9998	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.7	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.8	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	1.0000
3.9	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
4.0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Call Prices with Black & Scholes Option Pricing

Price of a B&Sch call option where result=C/S

Cumulative Volatility:	Moneyness: S/K*exp(-rT)																							
Sigma*SQRT(T)	**0.40**	**0.45**	**0.50**	**0.55**	**0.60**	**0.65**	**0.70**	**0.75**	**0.80**	**0.85**	**0.90**	**0.95**	**1.00**	**1.05**	**1.10**	**1.15**	**1.20**	**1.25**	**1.30**	**1.35**	**1.40**	**1.45**	**1.50**	**1.55**
0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.76%	9.09%	13.04%	16.67%	20.00%	23.08%	25.93%	28.57%	31.03%	33.33%	35.48%
0.05	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.41%	1.99%	5.19%	9.14%	13.05%	16.67%	20.00%	23.08%	25.93%	28.57%	31.03%	33.33%	35.48%
0.10	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.05%	0.24%	0.79%	1.99%	3.99%	6.73%	9.96%	13.39%	16.79%	20.04%	23.09%	25.93%	28.57%	31.03%	33.33%	35.48%
0.15	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.05%	0.18%	0.50%	1.15%	2.25%	3.86%	5.98%	8.52%	11.36%	14.37%	17.41%	20.40%	23.29%	26.04%	28.63%	31.06%	33.35%	35.49%
0.20	0.00%	0.00%	0.00%	0.01%	0.04%	0.14%	0.35%	0.77%	1.48%	2.54%	3.99%	5.81%	7.97%	10.39%	12.99%	15.71%	18.46%	21.19%	23.85%	26.43%	28.89%	31.24%	33.46%	35.56%
0.25	0.00%	0.01%	0.03%	0.09%	0.24%	0.53%	1.03%	1.78%	2.83%	4.19%	5.86%	7.79%	9.95%	12.28%	14.72%	17.23%	19.75%	22.27%	24.73%	27.13%	29.44%	31.66%	33.78%	35.80%
0.30	0.01%	0.05%	0.15%	0.35%	0.70%	1.25%	2.04%	3.10%	4.42%	5.99%	7.79%	9.78%	11.92%	14.17%	16.49%	18.84%	21.20%	23.53%	25.83%	28.06%	30.23%	32.32%	34.32%	36.25%
0.35	0.08%	0.20%	0.44%	0.84%	1.44%	2.26%	3.33%	4.63%	6.15%	7.87%	9.76%	11.78%	13.89%	16.07%	18.29%	20.52%	22.73%	24.92%	27.07%	29.16%	31.20%	33.16%	35.06%	36.88%
0.40	0.23%	0.50%	0.94%	1.58%	2.43%	3.52%	4.82%	6.31%	7.99%	9.81%	11.75%	13.77%	15.85%	17.97%	20.10%	22.22%	24.32%	26.39%	28.42%	30.39%	32.30%	34.16%	35.95%	37.68%
0.45	0.54%	1.00%	1.67%	2.55%	3.66%	4.96%	6.45%	8.10%	9.89%	11.77%	13.74%	15.76%	17.80%	19.86%	21.91%	23.94%	25.95%	27.91%	29.83%	31.69%	33.51%	35.26%	36.96%	38.60%
0.50	1.01%	1.70%	2.61%	3.74%	5.06%	6.55%	8.20%	9.97%	11.83%	13.76%	15.73%	17.73%	19.74%	21.74%	23.72%	25.68%	27.59%	29.46%	31.29%	33.06%	34.78%	36.45%	38.06%	39.61%
0.55	1.68%	2.61%	3.75%	5.09%	6.61%	8.26%	10.03%	11.88%	13.80%	15.75%	17.72%	19.70%	21.67%	23.61%	25.53%	27.41%	29.25%	31.04%	32.78%	34.47%	36.11%	37.69%	39.23%	40.71%
0.60	2.53%	3.69%	5.06%	6.60%	8.27%	10.05%	11.91%	13.83%	15.78%	17.75%	19.71%	21.66%	23.58%	25.48%	27.33%	29.14%	30.91%	32.62%	34.29%	35.91%	37.47%	38.98%	40.44%	41.86%
0.65	3.55%	4.95%	6.51%	8.22%	10.03%	11.91%	13.84%	15.80%	17.77%	19.74%	21.68%	23.60%	25.48%	27.32%	29.12%	30.87%	32.57%	34.22%	35.82%	37.36%	38.86%	40.30%	41.70%	43.05%
0.70	4.74%	6.34%	8.08%	9.93%	11.85%	13.82%	15.80%	17.79%	19.77%	21.72%	23.64%	25.53%	27.37%	29.16%	30.90%	32.59%	34.23%	35.81%	37.35%	38.83%	40.26%	41.65%	42.98%	44.27%
0.75	6.07%	7.86%	9.76%	11.72%	13.73%	15.76%	17.78%	19.78%	21.76%	23.70%	25.59%	27.44%	29.23%	30.98%	32.67%	34.30%	35.88%	37.41%	38.88%	40.31%	41.68%	43.01%	44.29%	45.52%
0.80	7.52%	9.48%	11.51%	13.58%	15.65%	17.72%	19.77%	21.78%	23.74%	25.66%	27.52%	29.33%	31.08%	32.78%	34.42%	36.00%	37.52%	39.00%	40.42%	41.78%	43.11%	44.38%	45.61%	46.79%
0.85	9.08%	11.19%	13.33%	15.48%	17.61%	19.71%	21.76%	23.77%	25.72%	27.61%	29.44%	31.21%	32.92%	34.56%	36.15%	37.68%	39.16%	40.58%	41.94%	43.26%	44.53%	45.75%	46.93%	48.07%
0.90	10.74%	12.97%	15.20%	17.41%	19.58%	21.70%	23.76%	25.75%	27.68%	29.54%	31.34%	33.07%	34.73%	36.33%	37.87%	39.35%	40.77%	42.14%	43.46%	44.73%	45.95%	47.13%	48.26%	49.35%
0.95	12.47%	14.81%	17.12%	19.37%	21.57%	23.69%	25.75%	27.72%	29.63%	31.46%	33.21%	34.90%	36.52%	38.08%	39.57%	41.00%	42.38%	43.70%	44.97%	46.19%	47.37%	48.50%	49.59%	50.64%
1.00	14.27%	16.70%	19.06%	21.35%	23.56%	25.68%	27.73%	29.68%	31.56%	33.35%	35.07%	36.72%	38.29%	39.80%	41.25%	42.64%	43.97%	45.24%	46.47%	47.65%	48.78%	49.87%	50.92%	51.92%
1.05	16.13%	18.62%	21.03%	23.34%	25.55%	27.67%	29.69%	31.62%	33.47%	35.22%	36.90%	38.51%	40.04%	41.51%	42.91%	44.25%	45.54%	46.77%	47.96%	49.09%	50.18%	51.23%	52.24%	53.21%
1.10	18.03%	20.58%	23.01%	25.33%	27.54%	29.65%	31.65%	33.55%	35.35%	37.08%	38.72%	40.28%	41.77%	43.19%	44.55%	45.85%	47.09%	48.28%	49.43%	50.52%	51.57%	52.58%	53.55%	54.48%
1.15	19.96%	22.55%	25.00%	27.33%	29.53%	31.61%	33.58%	35.45%	37.22%	38.90%	40.50%	42.02%	43.47%	44.85%	46.17%	47.43%	48.63%	49.78%	50.88%	51.93%	52.95%	53.92%	54.85%	55.75%
1.20	21.92%	24.53%	27.00%	29.32%	31.50%	33.56%	35.50%	37.33%	39.06%	40.71%	42.26%	43.74%	45.15%	46.49%	47.76%	48.98%	50.14%	51.25%	52.31%	53.33%	54.31%	55.24%	56.14%	57.01%
1.25	23.89%	26.53%	28.99%	31.30%	33.46%	35.48%	37.39%	39.19%	40.88%	42.48%	44.00%	45.44%	46.80%	48.10%	49.33%	50.51%	51.63%	52.71%	53.73%	54.71%	55.65%	56.56%	57.42%	58.25%
1.30	25.88%	28.52%	30.98%	33.26%	35.40%	37.39%	39.26%	41.02%	42.68%	44.24%	45.71%	47.11%	48.43%	49.69%	50.88%	52.02%	53.10%	54.14%	55.13%	56.08%	56.98%	57.85%	58.69%	59.49%
1.35	27.87%	30.51%	32.95%	35.21%	37.31%	39.28%	41.11%	42.83%	44.44%	45.96%	47.39%	48.75%	50.03%	51.25%	52.41%	53.51%	54.55%	55.55%	56.51%	57.42%	58.29%	59.13%	59.93%	60.70%
1.40	29.87%	32.50%	34.91%	37.14%	39.21%	41.14%	42.93%	44.61%	46.18%	47.66%	49.05%	50.36%	51.61%	52.79%	53.90%	54.97%	55.98%	56.94%	57.86%	58.74%	59.58%	60.39%	61.16%	61.91%
1.45	31.86%	34.47%	36.86%	39.06%	41.09%	42.97%	44.72%	46.36%	47.89%	49.32%	50.68%	51.95%	53.15%	54.29%	55.38%	56.40%	57.38%	58.31%	59.20%	60.05%	60.86%	61.63%	62.38%	63.09%
1.50	33.84%	36.42%	38.78%	40.94%	42.93%	44.78%	46.49%	48.08%	49.57%	50.96%	52.27%	53.51%	54.67%	55.78%	56.82%	57.81%	58.76%	59.65%	60.51%	61.33%	62.11%	62.86%	63.57%	64.26%
1.55	35.81%	38.36%	40.68%	42.81%	44.75%	46.55%	48.22%	49.77%	51.22%	52.57%	53.84%	55.04%	56.17%	57.23%	58.24%	59.20%	60.11%	60.97%	61.80%	62.59%	63.34%	64.06%	64.75%	65.41%
1.60	37.76%	40.28%	42.56%	44.64%	46.55%	48.30%	49.92%	51.43%	52.84%	54.15%	55.38%	56.54%	57.63%	58.66%	59.63%	60.56%	61.43%	62.27%	63.06%	63.82%	64.55%	65.24%	65.90%	66.54%
1.65	39.69%	42.17%	44.41%	46.45%	48.31%	50.02%	51.60%	53.06%	54.42%	55.70%	56.89%	58.01%	59.06%	60.06%	61.00%	61.89%	62.74%	63.54%	64.31%	65.04%	65.73%	66.40%	67.04%	67.65%
1.70	41.61%	44.04%	46.24%	48.22%	50.04%	51.70%	53.24%	54.66%	55.98%	57.21%	58.37%	59.45%	60.47%	61.43%	62.34%	63.19%	64.01%	64.78%	65.52%	66.23%	66.90%	67.54%	68.15%	68.74%
1.75	43.49%	45.88%	48.03%	49.97%	51.74%	53.36%	54.85%	56.23%	57.51%	58.70%	59.81%	60.86%	61.84%	62.77%	63.64%	64.47%	65.26%	66.00%	66.71%	67.39%	68.04%	68.65%	69.24%	69.81%
1.80	45.36%	47.70%	49.79%	51.68%	53.40%	54.98%	56.42%	57.76%	59.00%	60.15%	61.23%	62.24%	63.19%	64.08%	64.93%	65.72%	66.48%	67.20%	67.88%	68.53%	69.15%	69.75%	70.31%	70.86%
1.85	47.19%	49.48%	51.52%	53.37%	55.04%	56.56%	57.97%	59.26%	60.46%	61.57%	62.61%	63.59%	64.50%	65.36%	66.18%	66.95%	67.67%	68.37%	69.02%	69.65%	70.25%	70.82%	71.36%	71.88%
1.90	48.99%	51.23%	53.22%	55.01%	56.64%	58.12%	59.47%	60.73%	61.88%	62.96%	63.97%	64.91%	65.79%	66.62%	67.40%	68.14%	68.84%	69.51%	70.14%	70.74%	71.32%	71.86%	72.39%	72.89%
1.95	50.76%	52.95%	54.89%	56.63%	58.20%	59.63%	60.95%	62.16%	63.28%	64.32%	65.29%	66.19%	67.04%	67.84%	68.60%	69.31%	69.98%	70.62%	71.23%	71.81%	72.36%	72.89%	73.39%	73.87%
2.00	52.50%	54.63%	56.51%	58.20%	59.73%	61.12%	62.39%	63.56%	64.64%	65.64%	66.58%	67.45%	68.27%	69.04%	69.76%	70.45%	71.10%	71.71%	72.30%	72.85%	73.38%	73.89%	74.37%	74.83%

Call Prices with Black & Scholes Option Pricing

Price of a B&Sch call option where result=C/S

Cumulative Volatility:	Moneyness: S/K*exp(-rT)																							
Sigma*SQRT(T)	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75
0.00	37.50%	39.39%	41.18%	42.86%	44.44%	45.95%	47.37%	48.72%	50.00%	51.22%	52.38%	53.49%	54.55%	55.56%	56.52%	57.45%	58.33%	59.18%	60.00%	60.78%	61.54%	62.26%	62.96%	63.64%
0.05	37.50%	39.39%	41.18%	42.86%	44.44%	45.95%	47.37%	48.72%	50.00%	51.22%	52.38%	53.49%	54.55%	55.56%	56.52%	57.45%	58.33%	59.18%	60.00%	60.78%	61.54%	62.26%	62.96%	63.64%
0.10	37.50%	39.39%	41.18%	42.86%	44.44%	45.95%	47.37%	48.72%	50.00%	51.22%	52.38%	53.49%	54.55%	55.56%	56.52%	57.45%	58.33%	59.18%	60.00%	60.78%	61.54%	62.26%	62.96%	63.64%
0.15	37.50%	39.40%	41.18%	42.86%	44.44%	45.95%	47.37%	48.72%	50.00%	51.22%	52.38%	53.49%	54.55%	55.56%	56.52%	57.45%	58.33%	59.18%	60.00%	60.78%	61.54%	62.26%	62.96%	63.64%
0.20	37.55%	39.42%	41.20%	42.87%	44.45%	45.95%	47.37%	48.72%	50.00%	51.22%	52.38%	53.49%	54.55%	55.56%	56.52%	57.45%	58.33%	59.18%	60.00%	60.78%	61.54%	62.26%	62.96%	63.64%
0.25	37.73%	39.56%	41.29%	42.94%	44.50%	45.99%	47.40%	48.74%	50.01%	51.23%	52.39%	53.49%	54.55%	55.56%	56.52%	57.45%	58.33%	59.18%	60.00%	60.78%	61.54%	62.26%	62.96%	63.64%
0.30	38.09%	39.85%	41.53%	43.13%	44.65%	46.11%	47.49%	48.81%	50.07%	51.28%	52.43%	53.52%	54.57%	55.58%	56.54%	57.46%	58.34%	59.19%	60.01%	60.79%	61.54%	62.27%	62.97%	63.64%
0.35	38.64%	40.32%	41.93%	43.47%	44.94%	46.35%	47.70%	48.99%	50.22%	51.40%	52.53%	53.61%	54.64%	55.64%	56.59%	57.50%	58.38%	59.22%	60.03%	60.81%	61.56%	62.28%	62.98%	63.65%
0.40	39.34%	40.94%	42.48%	43.95%	45.37%	46.72%	48.03%	49.27%	50.47%	51.62%	52.72%	53.77%	54.79%	55.76%	56.70%	57.60%	58.46%	59.29%	60.09%	60.86%	61.61%	62.32%	63.01%	63.68%
0.45	40.18%	41.70%	43.16%	44.57%	45.93%	47.23%	48.48%	49.68%	50.83%	51.94%	53.01%	54.04%	55.02%	55.97%	56.89%	57.77%	58.61%	59.43%	60.21%	60.97%	61.70%	62.41%	63.09%	63.75%
0.50	41.12%	42.56%	43.96%	45.30%	46.60%	47.84%	49.04%	50.20%	51.31%	52.38%	53.41%	54.40%	55.35%	56.27%	57.16%	58.02%	58.84%	59.64%	60.41%	61.15%	61.86%	62.56%	63.22%	63.87%
0.55	42.14%	43.52%	44.85%	46.13%	47.36%	48.55%	49.70%	50.81%	51.88%	52.90%	53.90%	54.85%	55.77%	56.66%	57.52%	58.35%	59.15%	59.92%	60.67%	61.39%	62.09%	62.77%	63.42%	64.05%
0.60	43.22%	44.53%	45.80%	47.03%	48.21%	49.35%	50.45%	51.51%	52.53%	53.52%	54.47%	55.39%	56.28%	57.14%	57.96%	58.76%	59.54%	60.29%	61.01%	61.71%	62.39%	63.05%	63.68%	64.30%
0.65	44.35%	45.61%	46.82%	47.99%	49.12%	50.21%	51.26%	52.28%	53.26%	54.20%	55.12%	56.00%	56.86%	57.68%	58.48%	59.25%	60.00%	60.72%	61.42%	62.10%	62.76%	63.39%	64.01%	64.61%
0.70	45.52%	46.72%	47.88%	49.00%	50.08%	51.12%	52.13%	53.10%	54.04%	54.95%	55.83%	56.68%	57.50%	58.29%	59.06%	59.80%	60.52%	61.22%	61.90%	62.55%	63.18%	63.80%	64.40%	64.98%
0.75	46.72%	47.87%	48.98%	50.05%	51.08%	52.08%	53.04%	53.98%	54.88%	55.75%	56.59%	57.41%	58.19%	58.96%	59.70%	60.41%	61.10%	61.78%	62.43%	63.06%	63.67%	64.26%	64.84%	65.40%
0.80	47.93%	49.03%	50.10%	51.12%	52.12%	53.07%	54.00%	54.89%	55.75%	56.59%	57.40%	58.18%	58.94%	59.67%	60.38%	61.07%	61.73%	62.38%	63.01%	63.62%	64.21%	64.78%	65.34%	65.88%
0.85	49.16%	50.22%	51.24%	52.22%	53.17%	54.09%	54.98%	55.84%	56.66%	57.47%	58.24%	58.99%	59.72%	60.42%	61.11%	61.77%	62.41%	63.03%	63.63%	64.22%	64.79%	65.34%	65.88%	66.40%
0.90	50.40%	51.42%	52.40%	53.34%	54.25%	55.13%	55.98%	56.81%	57.60%	58.37%	59.11%	59.84%	60.53%	61.21%	61.86%	62.50%	63.12%	63.71%	64.30%	64.86%	65.41%	65.94%	66.46%	66.96%
0.95	51.65%	52.62%	53.56%	54.47%	55.34%	56.19%	57.01%	57.79%	58.56%	59.30%	60.01%	60.70%	61.37%	62.02%	62.65%	63.26%	63.86%	64.43%	64.99%	65.53%	66.06%	66.57%	67.07%	67.55%
1.00	52.90%	53.83%	54.73%	55.60%	56.44%	57.26%	58.04%	58.80%	59.53%	60.24%	60.93%	61.59%	62.23%	62.86%	63.46%	64.05%	64.62%	65.17%	65.71%	66.23%	66.74%	67.23%	67.71%	68.18%
1.05	54.14%	55.04%	55.91%	56.74%	57.55%	58.33%	59.08%	59.81%	60.51%	61.20%	61.85%	62.49%	63.11%	63.71%	64.29%	64.86%	65.40%	65.93%	66.45%	66.95%	67.44%	67.91%	68.38%	68.82%
1.10	55.38%	56.25%	57.08%	57.88%	58.66%	59.41%	60.13%	60.83%	61.51%	62.16%	62.79%	63.41%	64.00%	64.58%	65.14%	65.68%	66.20%	66.71%	67.21%	67.69%	68.16%	68.62%	69.06%	69.49%
1.15	56.61%	57.45%	58.25%	59.02%	59.77%	60.49%	61.18%	61.85%	62.50%	63.13%	63.74%	64.33%	64.90%	65.45%	65.99%	66.51%	67.02%	67.51%	67.98%	68.45%	68.90%	69.34%	69.76%	70.18%
1.20	57.84%	58.64%	59.41%	60.15%	60.87%	61.56%	62.23%	62.87%	63.50%	64.10%	64.69%	65.25%	65.80%	66.33%	66.85%	67.35%	67.84%	68.31%	68.77%	69.21%	69.65%	70.07%	70.48%	70.88%
1.25	59.05%	59.82%	60.56%	61.28%	61.97%	62.63%	63.27%	63.90%	64.50%	65.08%	65.64%	66.18%	66.71%	67.22%	67.71%	68.20%	68.66%	69.12%	69.56%	69.99%	70.40%	70.81%	71.20%	71.59%
1.30	60.26%	61.00%	61.71%	62.40%	63.06%	63.70%	64.32%	64.91%	65.49%	66.05%	66.59%	67.11%	67.61%	68.11%	68.58%	69.04%	69.49%	69.93%	70.35%	70.76%	71.16%	71.55%	71.93%	72.30%
1.35	61.44%	62.16%	62.84%	63.50%	64.14%	64.76%	65.35%	65.92%	66.48%	67.01%	67.53%	68.03%	68.52%	68.99%	69.45%	69.89%	70.32%	70.74%	71.15%	71.54%	71.93%	72.30%	72.67%	73.02%
1.40	62.62%	63.30%	63.96%	64.60%	65.21%	65.80%	66.37%	66.92%	67.46%	67.97%	68.47%	68.95%	69.42%	69.87%	70.31%	70.74%	71.15%	71.56%	71.95%	72.33%	72.70%	73.06%	73.41%	73.75%
1.45	63.78%	64.44%	65.07%	65.68%	66.27%	66.84%	67.39%	67.92%	68.43%	68.92%	69.40%	69.87%	70.32%	70.75%	71.17%	71.58%	71.98%	72.37%	72.74%	73.11%	73.46%	73.81%	74.15%	74.47%
1.50	64.92%	65.55%	66.16%	66.75%	67.32%	67.86%	68.39%	68.90%	69.39%	69.87%	70.33%	70.77%	71.20%	71.62%	72.03%	72.42%	72.80%	73.17%	73.54%	73.89%	74.23%	74.56%	74.88%	75.20%
1.55	66.04%	66.65%	67.24%	67.81%	68.35%	68.87%	69.38%	69.87%	70.34%	70.80%	71.24%	71.67%	72.08%	72.48%	72.87%	73.25%	73.62%	73.98%	74.32%	74.66%	74.99%	75.31%	75.62%	75.92%
1.60	67.15%	67.74%	68.30%	68.84%	69.37%	69.87%	70.36%	70.83%	71.28%	71.72%	72.14%	72.55%	72.95%	73.34%	73.71%	74.08%	74.43%	74.77%	75.10%	75.43%	75.74%	76.05%	76.35%	76.64%
1.65	68.24%	68.80%	69.34%	69.87%	70.37%	70.85%	71.32%	71.77%	72.21%	72.63%	73.04%	73.43%	73.81%	74.18%	74.54%	74.89%	75.23%	75.56%	75.88%	76.19%	76.49%	76.78%	77.07%	77.35%
1.70	69.31%	69.85%	70.37%	70.87%	71.35%	71.82%	72.27%	72.70%	73.12%	73.52%	73.91%	74.29%	74.66%	75.02%	75.36%	75.70%	76.02%	76.34%	76.64%	76.94%	77.23%	77.51%	77.79%	78.05%
1.75	70.35%	70.87%	71.37%	71.86%	72.32%	72.77%	73.20%	73.61%	74.02%	74.40%	74.78%	75.14%	75.50%	75.84%	76.17%	76.49%	76.80%	77.10%	77.40%	77.68%	77.96%	78.23%	78.50%	78.75%
1.80	71.38%	71.88%	72.36%	72.82%	73.27%	73.70%	74.11%	74.51%	74.90%	75.27%	75.63%	75.98%	76.32%	76.64%	76.96%	77.27%	77.57%	77.86%	78.14%	78.42%	78.68%	78.94%	79.20%	79.44%
1.85	72.39%	72.87%	73.33%	73.77%	74.20%	74.61%	75.01%	75.39%	75.76%	76.12%	76.47%	76.80%	77.12%	77.44%	77.74%	78.04%	78.33%	78.60%	78.88%	79.14%	79.40%	79.64%	79.89%	80.12%
1.90	73.37%	73.83%	74.28%	74.70%	75.11%	75.51%	75.89%	76.26%	76.61%	76.95%	77.29%	77.61%	77.92%	78.22%	78.51%	78.80%	79.07%	79.34%	79.60%	79.85%	80.10%	80.33%	80.57%	80.79%
1.95	74.33%	74.78%	75.20%	75.61%	76.00%	76.38%	76.75%	77.10%	77.44%	77.77%	78.09%	78.40%	78.70%	78.99%	79.27%	79.54%	79.80%	80.06%	80.31%	80.55%	80.78%	81.01%	81.24%	81.45%
2.00	75.27%	75.70%	76.11%	76.50%	76.88%	77.24%	77.59%	77.93%	78.26%	78.57%	78.88%	79.17%	79.46%	79.74%	80.00%	80.26%	80.52%	80.76%	81.00%	81.23%	81.46%	81.68%	81.89%	82.10%