

Université Libre de Bruxelles
Faculté SOCO
2006-2007

Final Exam

1st session

Form A

Tuesday 9 January 2007

Indications

Please follow these indications:

1. The exam lasts 3 hours.
2. Please verify that your document contains exactly 9 pages.
3. Questions have a weight of 1 point each (a total of 18 points).
4. Please write your firstname and lastname on the first page.
5. Good work!!!

Problems

P1 Valuing a company...

Matthew Mackenzie (MattMax for the insiders), the long-time CEO of HydroFuse, comes to talk to his CFO, Kevin Larsson (Kevlar for the insiders). Both have founded the company some years ago and it has proven to be highly successful.

Matthew has always had some nice ideas of his but he has always depended on Kevlar to brainstorm about them. Kevlar is by far stickier to the details...

Matthew is today proposing to Kevlar to buy back together the firm, through an MBO (Management-Buy-Out). The operation is very similar to any other takeover operation, except that it is the management that takes over the firm...

But let's give you first some data about HydroFuse...

HydroFuse has never been publicly listed. The average asset beta of its competitors is 0.75, with an average debt-equity ratio (D/E) of 1.5. The tax rate bracket of all firms in the sector can be assumed to be similar, at 20%. The target debt-equity ratio (D/E) of HydroFuse is 2. The riskfree rate is 5% and the cost of debt is currently at 9%. The market premia is 5.5%.

Here is a snapshot of the Income Statement of HydroFuse (today is January 1st, 2007) :

Income Statement 2006 (in thousands €)	
Revenues	23'500.00
Costs	14'100.00
Depreciation	3'000.00
Interest expense	2'268.00
EBT	4'132.00
Taxes	826.40
Net income	3'305.60

First Name : _____ Last Name : _____

The last two balance sheets of the firm are:

Balance Sheet 2006 (in thousands €)

Assets		Liabilities	
Cash	6'000	Accounts payable	800
Inventory	4'000	Medium-term debt	2'000
Accounts receivables	10'000	Long-term debt	32'200
Fixed Assets	35'000	Equity	20'000
	55'000		55'000

Balance Sheet 2005 (in thousands €)

Assets		Liabilities	
Cash	1'400	Accounts payable	200
Inventory	3'000	Medium-term debt	1'000
Accounts receivables	10'000	Long-term debt	25'200
Fixed Assets	32'000	Equity	20'000
	46'400		46'400

A reinvestment of € 3'000 is planned every year (same amount as for the depreciation), irrespective of the change in fixed assets.

Q1 Compute the unlevered Free Cash Flow (FCF) for 2006.

Throughout the problem, please assume that we use Harris-Pringle's assumptions for the WACC and $\beta d=0$ as a simplifying assumption, even though in reality $k_d=9\%$ as stated earlier.

Q2 Compute the expected return on equity (k_e) for this firm.

Free Cash Flows are expected to grow at a rate of 10% over the next 2 years and then at 4% onwards.

Q3 Compute the value of the firm using the WACC method.

Q4 Matthew is not happy with that because he does not know how much comes from financing effects and how much comes from the "activity-based" net present value. Can you help him with that?

Q5 Compute the value of the firm using the Capital Cash Flows method (CCF). Hint: Take the terminal value computed under Q3 for granted. Focus on detailing the first 2 years only and use the terminal value computed earlier.

There are 1'000'000 shares.

Q6 What is the price per share if you use the results obtained under Q3?

Q7 Comment on the results obtained under Q3, Q4, Q5 and how these methods deal with the present value of tax shields. (This question may be partially answered even if you do not have results for Q3, Q4, Q5)

P2 Risk debt

A firm with a debt face value of €10'000'000 reimbursable in 5 years realizes that the market value of the same debt is only of €7'000'000. The debt is a zero-coupon issue. The riskfree rate is 5%.

Q8 How much is the yield of that bond?

Q9 If the present value of the recovery-at-default is estimated to be of 40%, how much do you estimate the cumulative probability of default to be?

In fact, this firm trades currently at a value of €20'000'000 and the volatility of assets is 35%.

- Q10** What is the theoretical risk-neutral probability of default?
Hint: Use Merton's model and the newly supplied data.
- Q11** Where would you expect this bond to trade for in the market?
Hint: Use Merton's model and the newly supplied data.
- Q12** What do you conclude about the market value in the market? Could you arbitrage that?
How?
Hint: the "how" is to ask for your brainstorming and has to be considered as the "cherry on the cake" for this question.
- Q13** Would an equivalent coupon-bearing bond be more or less "credit"-risky for an investor compared to this zero-coupon bond? Do not answer just by "yes" or "no" but please provide your axes of brainstorming. You can freely complement your answer with elements used for scoring & rating, i.e. factors determining the default potential of a firm.
- Q14** Imagine now that an insurance product exist, namely a Credit Default Swap (a CDS, don't be worried about the name), that allows you to be insured against the potential default of the borrower. In this product, you would have to pay a regular "interest" as long as the original bond is not in default. If a default happens, you stop paying the insurance and receive a payment equivalent to the loss incurred. A priori, how much would you be ready to pay for this "interest" (insurance premium in annual terms)?

P3 Investing in a (really) emerging market...

Yesterday morning, Kevlar, was sitting at his desk reading the FT and read: "Vietnam joins the WTO this week". Kevlar remembered that they had an idea for HydroFuse to sell products in Vietnam but never wanted really to go there while Vietnam was not a member of the WTO. Now, things seem to change...

To be able to sell directly in Vietnam, HydroFuse should invest € 1.5 million to create a stake there, organize the activity and establish a network. The present value of expected future profits is estimated around € 1 million for the time being, but there is a lot of volatility in Vietnam, even more with the uncertainty arising from the good news of the belonging to the WTO. Therefore, he estimates that the expectation cited above could either increase or decrease by a factor of 1.82 per year. But given the current excitation of competitors for Asian countries, Kevlar thinks that there is only 2 years to choose to go or not to go. The annual riskfree rate is 5%.

Now, just after reading the newspaper, Kevlar had the surprise to receive the call from one of their main distributors in that part of the World. He would be interested in taking the risk of the future distribution in Vietnam by buying an exclusive right today to HydroFuse.

- Q15** Considering this possibility, how much would you sell an exclusive right to that distributor for today?

Now, let's get back to things a little bit less quantitative but that ask for a reflexion on your part...

- Q16** When we said here above "the present value of expected future profits", Kevlar was clearly using some sort of WACC to discount those cash flows. Let's imagine something simpler. Imagine that HydroFuse is just made of equity, so $WACC = k_e$. Taking back what you know about "portfolio theory" and the CAPM, do you think the k_e you have to apply to "Vietnam investments" should be higher/much higher/lower than the actual k_e of HydroFuse? And why? Or at least, how would you consider that problem?

The question has no precise answer and it ask for your brainstorming, so feel free to write down your thoughts.

Here are some other facts about Vietnam :

- “The opening up of the Vietnamese economy has brought growth of about 8% per year”
- “Corruption is one reason for the poor performance (of government capital resources)...The government...last year estimated that 20 to 40% of all state investment is lost in “leakage and waste”.”
- “Severe infrastructure bottlenecks loom, however, as facilities strain under existing demand. Electricity of Vietnam...estimates a 1'700 megawatt shortfall next year. Ports around Ho Chi Minh City,..., are already full and new ones are not due to open for three years at the earliest”.
- “Yet Vietnam is still burdened by the legacies of its old centrally planned, state-controlled economic system. Vietnam is following the path blazed by its powerful neighbour, China, whose economy been transformed into what some call “capitalism by central committee”...”
- “State-owned banks, which account for 70% of banking system assets, are already burdened with high levels of bad debt from poorly performing companies”

Q17 Imagine you would have to value a project in Vietnam, please cite and explain carefully 3 main difficulties in providing a consistent valuation estimate.

Q18 Given the 3 difficulties cited above, what kind of solution, information search, proxy or shortcut would you use for each of them to be able to still provide an estimate?

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

H. Pirotte - SBS/ULB - FinMetrics SA - Mai 2005

0.0	0.0000	0.5000	0.0100	0.0150	0.0200	0.0250	0.0300	0.0350	0.0400	0.0450	0.0500	0.0550	0.0600	0.0650	0.0700	0.0750	0.0800	0.0850	0.0900	0.0950
0.1	0.5398	0.5418	0.5438	0.5458	0.5478	0.5497	0.5517	0.5537	0.5557	0.5577	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	0.6369	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	0.9489	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	0.9932	0.9933	0.9934	0.9935	0.9936	0.9937	0.9937
2.5	0.9938	0.9939	0.9940	0.9941	0.9942	0.9943	0.9944	0.9945	0.9946	0.9947	0.9948	0.9949	0.9949	0.9950	0.9951	0.9952	0.9953	0.9954	0.9955	0.9955
2.6	0.9955	0.9956	0.9957	0.9958	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.7	0.9975	0.9976	0.9977	0.9978	0.9979	0.9980	0.9981	0.9982	0.9983	0.9984	0.9985	0.9986	0.9987	0.9988	0.9989	0.9990	0.9991	0.9992	0.9993	0.9994
2.8	0.9981	0.9982	0.9983	0.9984	0.9985	0.9986	0.9987	0.9988	0.9989	0.9990	0.9991	0.9992	0.9993	0.9994	0.9995	0.9996	0.9997	0.9998	0.9999	0.9999
2.9	0.9991	0.9992	0.9993	0.9994	0.9995	0.9996	0.9997	0.9998	0.9999	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3.0	0.9987	0.9987	0.9987	0.9987	0.9987	0.9987	0.9987	0.9987	0.9988	0.9988	0.9988	0.9988	0.9988	0.9988	0.9988	0.9989	0.9989	0.9989	0.9989	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	0.9993	0.9993	0.9993	0.9993	0.9994	0.9994
3.2	0.9993	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9997	0.9997
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998	0.9998	0.9998	0.9998	0.9999	0.9999
3.4	0.9997	0.9997	0.9997	0.9998	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
3.5	0.9998	0.9998	0.9998	0.9998	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
3.6	0.9998	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
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	0.9999
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: Sigma*SQRT(T)	Moneyness: $\frac{S e^{-qT}}{K e^{-rT}}$																								
	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%	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: Sigma*SQRT(T)	Moneyness: $\frac{S e^{-qT}}{K e^{-rT}}$																							
	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%

Put Prices with Black & Scholes Option Pricing H. Pirotte - SBS/ULB - FinMetrics SA - Juin 2006
 Price of a B&Sch call option where result=P/S

Cumulative Volatility	Moneyness: Se^{-qt} / Ke^{-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	150.00%	122.22%	100.00%	81.82%	66.67%	53.85%	42.86%	33.33%	25.00%	17.65%	11.11%	5.26%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0.05	150.00%	122.22%	100.00%	81.82%	66.67%	53.85%	42.86%	33.33%	25.00%	17.65%	11.14%	5.26%	1.99%	0.43%	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0.10	150.00%	122.22%	100.00%	81.82%	66.67%	53.85%	42.86%	33.34%	25.05%	17.88%	11.90%	7.25%	3.99%	1.97%	0.87%	0.34%	0.12%	0.04%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
0.15	150.00%	122.22%	100.00%	81.82%	66.67%	53.86%	42.91%	33.52%	25.50%	18.80%	13.36%	9.12%	5.98%	3.76%	2.27%	1.32%	0.74%	0.40%	0.21%	0.11%	0.05%	0.03%	0.01%	0.01%
0.20	150.00%	122.22%	100.00%	81.83%	66.71%	53.98%	43.21%	34.11%	26.48%	20.19%	15.10%	11.07%	7.97%	5.62%	3.90%	2.66%	1.79%	1.19%	0.78%	0.50%	0.32%	0.20%	0.13%	0.08%
0.25	150.00%	122.23%	100.03%	81.91%	66.91%	54.38%	43.88%	35.11%	27.83%	21.84%	16.97%	13.05%	9.95%	7.51%	5.63%	4.18%	3.09%	2.27%	1.65%	1.20%	0.87%	0.62%	0.45%	0.32%
0.30	150.01%	122.28%	100.15%	82.17%	67.36%	55.10%	44.90%	36.43%	29.42%	23.64%	18.90%	15.05%	11.92%	9.41%	7.40%	5.80%	4.53%	3.53%	2.75%	2.13%	1.65%	1.28%	0.99%	0.77%
0.35	150.08%	122.42%	100.44%	82.65%	68.10%	56.11%	46.19%	37.96%	31.15%	25.52%	20.87%	17.04%	13.89%	11.31%	9.20%	7.47%	6.07%	4.92%	3.99%	3.24%	2.63%	2.13%	1.73%	1.40%
0.40	150.23%	122.73%	100.94%	83.40%	69.10%	57.36%	47.67%	39.65%	32.99%	27.46%	22.86%	19.03%	15.85%	13.21%	11.01%	9.18%	7.66%	6.39%	5.34%	4.46%	3.73%	3.12%	2.62%	2.19%
0.45	150.54%	123.22%	101.67%	84.37%	70.32%	58.81%	49.31%	41.44%	34.89%	29.42%	24.85%	21.02%	17.80%	15.10%	12.82%	10.90%	9.28%	7.91%	6.75%	5.77%	4.94%	4.23%	3.63%	3.11%
0.50	151.01%	123.93%	102.61%	85.55%	71.72%	60.40%	51.06%	43.30%	36.83%	31.41%	26.84%	23.00%	19.74%	16.98%	14.63%	12.63%	10.92%	9.46%	8.21%	7.14%	6.21%	5.41%	4.73%	4.13%
0.55	151.68%	124.83%	103.75%	86.91%	73.27%	62.11%	52.89%	45.22%	38.80%	33.40%	28.84%	24.96%	21.67%	18.85%	16.44%	14.37%	12.58%	11.04%	9.70%	8.54%	7.54%	6.66%	5.89%	5.22%
0.60	152.53%	125.92%	105.06%	88.41%	74.94%	63.90%	54.77%	47.16%	40.78%	35.39%	30.82%	26.92%	23.58%	20.71%	18.24%	16.10%	14.24%	12.62%	11.21%	9.98%	8.90%	7.95%	7.11%	6.37%
0.65	153.55%	127.17%	106.51%	90.03%	76.69%	65.76%	56.70%	49.14%	42.77%	37.38%	32.79%	28.86%	25.48%	22.56%	20.03%	17.83%	15.90%	14.22%	12.74%	11.44%	10.29%	9.27%	8.37%	7.56%
0.70	154.74%	128.56%	108.08%	91.75%	78.52%	67.66%	58.66%	51.12%	44.77%	39.37%	34.76%	30.79%	27.37%	24.40%	21.81%	19.55%	17.56%	15.81%	14.27%	12.91%	11.69%	10.61%	9.65%	8.79%
0.75	156.07%	130.08%	109.76%	93.54%	80.40%	69.60%	60.64%	53.12%	46.76%	41.34%	36.70%	32.70%	29.23%	26.21%	23.57%	21.26%	19.21%	17.41%	15.81%	14.38%	13.11%	11.97%	10.96%	10.04%
0.80	157.52%	131.70%	111.51%	95.39%	82.32%	71.57%	62.63%	55.11%	48.74%	43.31%	38.64%	34.60%	31.08%	28.02%	25.33%	22.95%	20.86%	19.00%	17.34%	15.86%	14.53%	13.34%	12.27%	11.31%
0.85	159.08%	133.41%	113.33%	97.29%	84.27%	73.55%	64.62%	57.10%	50.72%	45.26%	40.55%	36.47%	32.92%	29.80%	27.06%	24.64%	22.49%	20.58%	18.87%	17.33%	15.96%	14.72%	13.60%	12.58%
0.90	160.74%	135.19%	115.20%	99.23%	86.25%	75.54%	66.61%	59.09%	52.68%	47.19%	42.45%	38.33%	34.73%	31.57%	28.78%	26.31%	24.11%	22.14%	20.39%	18.81%	17.38%	16.09%	14.93%	13.87%
0.95	162.47%	137.03%	117.12%	101.19%	88.23%	77.54%	68.60%	61.06%	54.63%	49.10%	44.33%	40.16%	36.52%	33.31%	30.48%	27.96%	25.71%	23.70%	21.90%	20.27%	18.80%	17.47%	16.26%	15.15%
1.00	164.27%	138.92%	119.06%	103.17%	90.23%	79.53%	70.58%	63.01%	56.56%	51.00%	46.18%	41.98%	38.29%	35.04%	32.16%	29.59%	27.30%	25.24%	23.39%	21.72%	20.21%	18.83%	17.58%	16.44%
1.05	166.13%	140.84%	121.03%	105.16%	92.22%	81.52%	72.55%	64.96%	58.47%	52.87%	48.02%	43.77%	40.04%	36.75%	33.82%	31.21%	28.87%	26.77%	24.88%	23.16%	21.61%	20.19%	18.90%	17.72%
1.10	168.03%	142.80%	123.01%	107.15%	94.21%	83.49%	74.50%	66.88%	60.35%	54.72%	49.83%	45.54%	41.77%	38.43%	35.46%	32.81%	30.43%	28.28%	26.35%	24.59%	23.00%	21.55%	20.22%	19.00%
1.15	169.96%	144.77%	125.00%	109.15%	96.19%	85.46%	76.44%	68.78%	62.22%	56.55%	51.61%	47.29%	43.47%	40.09%	37.08%	34.38%	31.96%	29.78%	27.80%	26.01%	24.38%	22.88%	21.52%	20.27%
1.20	171.92%	146.76%	127.00%	111.13%	98.17%	87.40%	78.35%	70.66%	64.06%	58.35%	53.38%	49.01%	45.15%	41.73%	38.67%	35.94%	33.47%	31.25%	29.24%	27.41%	25.74%	24.21%	22.81%	21.52%
1.25	173.89%	148.75%	128.99%	113.11%	100.12%	89.33%	80.25%	72.52%	65.88%	60.13%	55.11%	50.70%	46.80%	43.34%	40.24%	37.47%	34.97%	32.71%	30.65%	28.79%	27.08%	25.52%	24.09%	22.77%
1.30	175.88%	150.74%	130.98%	115.08%	102.06%	91.24%	82.12%	74.35%	67.68%	61.88%	56.82%	52.37%	48.43%	44.93%	41.79%	38.98%	36.44%	34.14%	32.05%	30.15%	28.41%	26.82%	25.35%	24.00%
1.35	177.87%	152.73%	132.95%	117.03%	103.98%	93.12%	83.97%	76.16%	69.44%	63.61%	58.51%	54.01%	50.03%	46.49%	43.31%	40.46%	37.89%	35.55%	33.43%	31.49%	29.72%	28.10%	26.60%	25.22%
1.40	179.87%	154.72%	134.91%	118.96%	105.88%	94.98%	85.79%	77.94%	71.18%	65.30%	60.16%	55.63%	51.61%	48.02%	44.81%	41.92%	39.31%	36.94%	34.79%	32.82%	31.01%	29.36%	27.83%	26.42%
1.45	181.86%	156.69%	136.86%	120.87%	107.75%	96.82%	87.58%	79.69%	72.89%	66.97%	61.79%	57.21%	53.15%	49.53%	46.28%	43.36%	40.71%	38.31%	36.12%	34.12%	32.29%	30.60%	29.04%	27.61%
1.50	183.84%	158.65%	138.78%	122.76%	109.60%	98.62%	89.34%	81.41%	74.57%	68.61%	63.38%	58.77%	54.67%	51.02%	47.73%	44.77%	42.09%	39.65%	37.43%	35.40%	33.54%	31.82%	30.24%	28.78%
1.55	185.81%	160.58%	140.68%	124.62%	111.42%	100.40%	91.08%	83.10%	76.22%	70.22%	64.95%	60.30%	56.17%	52.47%	49.15%	46.15%	43.44%	40.97%	38.72%	36.66%	34.77%	33.02%	31.41%	29.93%
1.60	187.76%	162.50%	142.56%	126.46%	113.21%	102.15%	92.78%	84.76%	77.84%	71.80%	66.49%	61.80%	57.63%	53.90%	50.54%	47.51%	44.77%	42.27%	39.99%	37.90%	35.98%	34.21%	32.57%	31.06%
1.65	189.69%	164.40%	144.41%	128.27%	114.97%	103.86%	94.45%	86.39%	79.42%	73.34%	68.00%	63.27%	59.06%	55.30%	51.91%	48.85%	46.07%	43.54%	41.23%	39.11%	37.16%	35.37%	33.71%	32.17%
1.70	191.61%	166.27%	146.24%	130.04%	116.71%	105.55%	96.10%	87.99%	80.98%	74.86%	69.48%	64.71%	60.47%	56.67%	53.24%	50.15%	47.34%	44.78%	42.45%	40.30%	38.33%	36.50%	34.82%	33.26%
1.75	193.49%	168.11%	148.03%	131.79%	118.40%	107.20%	97.70%	89.56%	82.51%	76.35%	70.92%	66.12%	61.84%	58.01%	54.55%	51.43%	48.59%	46.00%	43.64%	41.47%	39.47%	37.62%	35.91%	34.33%
1.80	195.36%	169.92%	149.79%	133.50%	120.07%	108.82%	99.28%	91.09%	84.00%	77.80%	72.34%	67.50%	63.19%	59.32%	55.83%	52.68%	49.81%	47.20%	44.80%	42.61%	40.58%	38.71%	36.98%	35.37%
1.85	197.19%	171.70%	151.52%	135.18%	121.70%	110.41%	100.82%	92.59%	85.46%	79.22%	73.72%	68.85%	64.50%	60.60%	57.09%	53.90%	51.01%	48.37%	45.95%	43.72%	41.68%	39.78%	38.03%	36.40%
1.90	198.99%	173.45%	153.22%	136.83%	123.30%	111.96%	102.33%	94.06%	86.88%	80.61%	75.08%	70.17%	65.79%	61.86%	58.31%	55.10%	52.18%	49.51%	47.06%	44.82%	42.74%	40.83%	39.05%	37.41%
1.95	200.76%	175.17%	154.89%	138.44%	124.87%	113.48%	103.81%	95.49%	88.28%	81.97%	76.40%	71.46%	67.04%	63.08%	59.51%	56.27%	53.32%	50.62%	48.15%	45.88%	43.79%	41.85%	40.06%	38.39%
2.00	202.50%	176.85%	156.51%	140.02%	126.40%	114.96%	105.25%	96.89%	89.64%	83.29%	77.69%	72.71%	68.27%	64.28%	60.67%	57.41%	54.43%	51.71%	49.22%	46.93%	44.81%	42.85%	41.04%	39.35%

Put Prices with Black & Scholes Option Pricing

H. Pirotte - SBS/ULB - FinMetrics SA - Juin 2006

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

Cumulative Volatility Sigma*SQRT(T)	Moneyless: Se^{-qT} / Ke^{-rT}																							
	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	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%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0.05	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%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0.10	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%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0.15	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%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0.20	0.05%	0.03%	0.02%	0.01%	0.01%	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%	0.00%	0.00%	0.00%	0.00%	0.00%
0.25	0.23%	0.16%	0.12%	0.08%	0.06%	0.04%	0.03%	0.02%	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0.30	0.59%	0.46%	0.35%	0.27%	0.21%	0.16%	0.13%	0.10%	0.07%	0.06%	0.04%	0.03%	0.03%	0.02%	0.02%	0.01%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
0.35	1.14%	0.92%	0.75%	0.61%	0.50%	0.40%	0.33%	0.27%	0.22%	0.18%	0.15%	0.12%	0.10%	0.08%	0.07%	0.05%	0.04%	0.04%	0.03%	0.02%	0.02%	0.01%	0.01%	0.01%
0.40	1.84%	1.55%	1.30%	1.10%	0.92%	0.78%	0.66%	0.56%	0.47%	0.40%	0.34%	0.29%	0.24%	0.21%	0.18%	0.15%	0.13%	0.11%	0.09%	0.08%	0.07%	0.06%	0.05%	0.04%
0.45	2.68%	2.30%	1.99%	1.71%	1.48%	1.28%	1.11%	0.96%	0.83%	0.73%	0.63%	0.55%	0.48%	0.42%	0.37%	0.32%	0.28%	0.24%	0.21%	0.19%	0.17%	0.15%	0.13%	0.11%
0.50	3.62%	3.17%	2.78%	2.45%	2.15%	1.90%	1.67%	1.48%	1.31%	1.16%	1.03%	0.91%	0.81%	0.72%	0.64%	0.57%	0.51%	0.45%	0.41%	0.36%	0.33%	0.29%	0.26%	0.23%
0.55	4.64%	4.12%	3.67%	3.27%	2.92%	2.61%	2.33%	2.09%	1.88%	1.69%	1.52%	1.36%	1.23%	1.11%	1.00%	0.90%	0.82%	0.74%	0.67%	0.61%	0.55%	0.50%	0.46%	0.42%
0.60	5.72%	5.14%	4.63%	4.17%	3.76%	3.40%	3.08%	2.79%	2.53%	2.30%	2.09%	1.90%	1.73%	1.58%	1.44%	1.32%	1.21%	1.10%	1.01%	0.93%	0.85%	0.78%	0.72%	0.66%
0.65	6.85%	6.21%	5.64%	5.13%	4.67%	4.26%	3.89%	3.56%	3.26%	2.98%	2.74%	2.51%	2.31%	2.13%	1.96%	1.80%	1.67%	1.54%	1.42%	1.31%	1.22%	1.13%	1.05%	0.97%
0.70	8.02%	7.33%	6.70%	6.14%	5.63%	5.18%	4.76%	4.38%	4.04%	3.73%	3.45%	3.19%	2.95%	2.74%	2.54%	2.36%	2.19%	2.04%	1.90%	1.77%	1.65%	1.54%	1.43%	1.34%
0.75	9.22%	8.47%	7.80%	7.19%	6.64%	6.13%	5.68%	5.26%	4.88%	4.53%	4.21%	3.92%	3.65%	3.40%	3.17%	2.96%	2.77%	2.59%	2.43%	2.27%	2.13%	2.00%	1.88%	1.77%
0.80	10.43%	9.64%	8.92%	8.27%	7.67%	7.13%	6.63%	6.17%	5.75%	5.37%	5.02%	4.69%	4.39%	4.11%	3.86%	3.62%	3.40%	3.20%	3.01%	2.83%	2.67%	2.52%	2.37%	2.24%
0.85	11.66%	10.83%	10.06%	9.37%	8.73%	8.15%	7.61%	7.12%	6.66%	6.25%	5.86%	5.50%	5.17%	4.87%	4.58%	4.32%	4.07%	3.85%	3.63%	3.43%	3.25%	3.08%	2.91%	2.76%
0.90	12.90%	12.02%	11.22%	10.48%	9.81%	9.19%	8.62%	8.09%	7.60%	7.15%	6.73%	6.35%	5.99%	5.65%	5.34%	5.05%	4.78%	4.53%	4.30%	4.07%	3.87%	3.67%	3.49%	3.32%
0.95	14.15%	13.23%	12.39%	11.61%	10.90%	10.24%	9.64%	9.08%	8.56%	8.08%	7.63%	7.21%	6.83%	6.47%	6.13%	5.82%	5.52%	5.25%	4.99%	4.75%	4.52%	4.31%	4.11%	3.92%
1.00	15.40%	14.44%	13.56%	12.75%	12.00%	11.31%	10.67%	10.08%	9.53%	9.02%	8.54%	8.10%	7.69%	7.30%	6.94%	6.60%	6.29%	5.99%	5.71%	5.45%	5.20%	4.97%	4.75%	4.54%
1.05	16.64%	15.65%	14.73%	13.89%	13.11%	12.38%	11.71%	11.09%	10.51%	9.98%	9.47%	9.00%	8.57%	8.16%	7.77%	7.41%	7.07%	6.75%	6.45%	6.17%	5.90%	5.65%	5.41%	5.19%
1.10	17.88%	16.85%	15.90%	15.03%	14.21%	13.46%	12.76%	12.11%	11.51%	10.94%	10.41%	9.92%	9.46%	9.02%	8.61%	8.23%	7.87%	7.53%	7.21%	6.91%	6.62%	6.35%	6.10%	5.86%
1.15	19.11%	18.05%	17.07%	16.16%	15.32%	14.54%	13.81%	13.13%	12.50%	11.91%	11.36%	10.84%	10.35%	9.90%	9.47%	9.06%	8.68%	8.32%	7.98%	7.66%	7.36%	7.07%	6.80%	6.54%
1.20	20.34%	19.25%	18.23%	17.30%	16.43%	15.62%	14.86%	14.16%	13.50%	12.88%	12.31%	11.77%	11.26%	10.78%	10.33%	9.90%	9.50%	9.12%	8.77%	8.43%	8.11%	7.80%	7.51%	7.24%
1.25	21.55%	20.43%	19.39%	18.42%	17.52%	16.69%	15.91%	15.18%	14.50%	13.86%	13.26%	12.69%	12.16%	11.66%	11.19%	10.75%	10.33%	9.93%	9.56%	9.20%	8.86%	8.54%	8.24%	7.95%
1.30	22.76%	21.60%	20.53%	19.54%	18.61%	17.75%	16.95%	16.19%	15.49%	14.83%	14.20%	13.62%	13.07%	12.55%	12.06%	11.60%	11.16%	10.74%	10.35%	9.98%	9.63%	9.29%	8.97%	8.67%
1.35	23.94%	22.76%	21.67%	20.65%	19.70%	18.81%	17.98%	17.20%	16.48%	15.79%	15.15%	14.54%	13.97%	13.44%	12.93%	12.45%	11.99%	11.56%	11.15%	10.76%	10.39%	10.04%	9.71%	9.39%
1.40	25.12%	23.91%	22.79%	21.74%	20.77%	19.86%	19.00%	18.21%	17.46%	16.75%	16.09%	15.46%	14.87%	14.32%	13.79%	13.29%	12.82%	12.37%	11.95%	11.54%	11.16%	10.79%	10.44%	10.11%
1.45	26.28%	25.04%	23.90%	22.83%	21.83%	20.89%	20.02%	19.20%	18.43%	17.70%	17.02%	16.38%	15.77%	15.19%	14.65%	14.14%	13.65%	13.18%	12.74%	12.32%	11.92%	11.54%	11.18%	10.84%
1.50	27.42%	26.16%	24.99%	23.89%	22.87%	21.92%	21.02%	20.18%	19.39%	18.65%	17.95%	17.28%	16.66%	16.07%	15.51%	14.97%	14.47%	13.99%	13.54%	13.10%	12.69%	12.30%	11.92%	11.56%
1.55	28.54%	27.26%	26.06%	24.95%	23.91%	22.93%	22.01%	21.15%	20.34%	19.58%	18.86%	18.18%	17.54%	16.93%	16.35%	15.81%	15.29%	14.79%	14.32%	13.88%	13.45%	13.04%	12.65%	12.28%
1.60	29.65%	28.34%	27.12%	25.99%	24.92%	23.93%	22.99%	22.11%	21.28%	20.50%	19.76%	19.07%	18.41%	17.78%	17.19%	16.63%	16.10%	15.59%	15.10%	14.64%	14.20%	13.78%	13.38%	13.00%
1.65	30.74%	29.41%	28.17%	27.01%	25.92%	24.91%	23.95%	23.05%	22.21%	21.41%	20.65%	19.94%	19.27%	18.63%	18.02%	17.44%	16.90%	16.37%	15.88%	15.40%	14.95%	14.52%	14.11%	13.71%
1.70	31.81%	30.45%	29.19%	28.01%	26.91%	25.87%	24.90%	23.98%	23.12%	22.30%	21.53%	20.80%	20.11%	19.46%	18.84%	18.25%	17.69%	17.15%	16.64%	16.16%	15.69%	15.25%	14.82%	14.42%
1.75	32.85%	31.48%	30.20%	29.00%	27.88%	26.82%	25.83%	24.90%	24.02%	23.18%	22.40%	21.65%	20.95%	20.28%	19.65%	19.04%	18.47%	17.92%	17.40%	16.90%	16.42%	15.97%	15.53%	15.12%
1.80	33.88%	32.49%	31.18%	29.97%	28.82%	27.75%	26.74%	25.79%	24.90%	24.05%	23.25%	22.49%	21.77%	21.09%	20.44%	19.82%	19.24%	18.68%	18.14%	17.63%	17.15%	16.68%	16.23%	15.81%
1.85	34.89%	33.47%	32.15%	30.92%	29.76%	28.67%	27.64%	26.67%	25.76%	24.90%	24.08%	23.31%	22.58%	21.88%	21.22%	20.59%	19.99%	19.42%	18.88%	18.35%	17.86%	17.38%	16.92%	16.49%
1.90	35.87%	34.44%	33.10%	31.84%	30.67%	29.56%	28.52%	27.54%	26.61%	25.73%	24.90%	24.12%	23.37%	22.66%	21.99%	21.35%	20.74%	20.15%	19.60%	19.07%	18.56%	18.07%	17.60%	17.16%
1.95	36.83%	35.38%	34.03%	32.75%	31.56%	30.44%	29.38%	28.38%	27.44%	26.55%	25.71%	24.91%	24.15%	23.43%	22.74%	22.09%	21.47%	20.87%	20.31%	19.76%	19.24%	18.75%	18.27%	17.82%
2.00	37.77%	36.31%	34.93%	33.64%	32.43%	31.30%	30.22%	29.21%	28.26%	27.35%	26.50%	25.68%	24.91%	24.18%	23.48%	22.82%	22.18%	21.58%	21.00%	20.45%	19.92%	19.41%	18.93%	18.46%