

EDUCATION AND EXAMINATION COMMITTEE OF THE SOCIETY OF ACTUARIES (SOA)

SPRING 2007  
EXAM MFE

ACTUARIAL MODELS—FINANCIAL ECONOMICS SEGMENT

INTRODUCTORY STUDY NOTE

- 1 The Actuarial Models—Financial Economics Segment examination for Spring 2007 will be given on **Thursday, May 17, from 1:30 p.m. to 3:30 p.m.** The examination will consist of 19 multiple-choice questions.

The score for the examination is determined solely on the basis of correct answers. Therefore, candidates should answer every question to maximize their scores.

- 2 Any changes in the Course of Reading for this exam since the publication of the *Spring 2007 Basic Education Catalog* of the SOA are reflected in this Introductory Study Note and will also be posted on our Web site. **If any difference exists between information contained in this Introductory Study Note and that contained in the *Spring 2007 Basic Education Catalog*, this Introductory Study Note will govern.**
- 3 The following list contains all study notes for this exam in Spring 2007. Candidates who have ordered the complete set of study notes, should verify immediately that they have copies of the listed items. Items marked with # are new/updated for this session.

MFE-05-07# Introductory Study Note (this study note)

MFE-09-07# Exam MFE Sample Questions with solutions

MFE-27-07# Some Remarks on *Derivative Markets*

- 4 The study notes for this exam include sample questions and solutions. The sample questions provide the candidate with the opportunity to practice on the types of questions that are likely to appear on the examination. New sample examinations will be released periodically or whenever the nature of the examination changes substantially.
- 5 Enclosed are errata for the following texts:

*Derivative Markets*, 2006 Second Edition, first printing, by R. McDonald  
[http://www.kellogg.northwestern.edu/faculty/mcdonald/htm/typos2e\\_01.html](http://www.kellogg.northwestern.edu/faculty/mcdonald/htm/typos2e_01.html)

- 6 A set of values from the standard normal distribution will be available for use on Exam MFE. Also, a brief note which includes standard assumptions that will apply to exam questions and instructions on how to use the values from the standard normal distribution will be available for use on Exam MFE. Copies of these are included with this note. Note that candidates will not be allowed to bring copies of the tables into the examination room.

7. A survey for examinations FM, MLC, MFE and C will be available on the SOA and CAS web sites after the examinations have been administered. Candidates are encouraged to provide feedback on the course readings and the examinations that they have taken.
8. Several book distributors carry some or all of the textbooks for the Society of Actuaries exams. A list of distributors appears in the *Spring 2007 Basic Education Catalog*. A set of order forms from these distributors is included with this study note package.

The order forms contain information about prices, shipping charges, mailing policy and credit card acceptance. Any book distributor who carries books for SOA exams may have their order form included in this set unless the SOA office receives substantial complaints about service. Candidates should notify the Publication Orders Department of the SOA in writing if they encounter serious problems with any distributor.

9. The examination questions for this exam will be based on the required readings for this exam. If a conflict exists (in definitions, terminology, etc.) between the readings for this exam and the readings for other exams, the questions should be answered on the basis of the readings for this exam.
10. Candidates may use the battery or solar-powered Texas Instruments BA-35 model calculator, the BA II Plus\*, the BA II Plus Professional\* or TI-30X or TI-30Xa or TI-30X II\* (IIS solar or IIB battery). Candidates may use more than one of the approved calculators during the examinations.

Calculator instructions cannot be brought into the exam room. During the exam, the calculator must be removed from its carrying case so the supervisor can confirm it is an approved model. Candidates using a calculator other than the approved models will have their examinations disqualified.

Candidates can purchase calculators directly from: Texas Instruments, Attn: Order Entry, PO Box 650311, Mail Station 3962, Dallas, TX 75265, phone 800/842-2737 or <http://epsstore.ti.com>

*\*The memory of TI-30X II, BA II Plus and BA II Plus Professional will need to be cleared by the examination supervisor upon the candidates' entrance to the examination room.*

11. Order forms for various seminars/workshops and study manuals are included with this set of study notes. These seminars/workshops and study manuals do not reflect any official interpretation, opinion, or endorsement of the Society of Actuaries.
12. A candidate planning to seek admission to the SOA should submit the Application for Admission as Associate *before* completing the education requirements for Associateship as detailed in the *Spring 2007 Basic Education Catalog*.
13. In addition to the examination requirements, all prospective SOA Associates will be required to attend and successfully complete a seminar on professionalism prior to admission as a member. See the *SOA Spring 2007 Basic Education Catalog* for more information.
14. The Society of Actuaries provides study notes to persons preparing for this examination. They are intended to acquaint candidates with some of the theoretical and practical considerations involved in the various subjects. While varying opinions are presented where appropriate, limits on the length of the material and other considerations sometimes prevent the inclusion of all possible opinions. These study notes do not, however, represent any official opinion, interpretation or endorsement of the Society of Actuaries. The SOA is grateful to the authors for their contributions in preparing study

notes.

The American Academy of Actuaries (AAA) and the Conference of Consulting Actuaries (CCA) jointly sponsor the Associateship and Fellowship examinations with the SOA.

### NORMAL DISTRIBUTION TABLE

Entries represent the area under the standardized normal distribution from  $-\infty$  to  $z$ ,  $\Pr(Z < z)$

The value of  $z$  to the first decimal is given in the left column. The second decimal place is given in the top row.

$z$	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	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	0.9999	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
3.8	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

Values of $z$ for selected values of $\Pr(Z < z)$							
$z$	0.842	1.036	1.282	1.645	1.960	2.326	2.576
$\Pr(Z < z)$	0.800	0.850	0.900	0.950	0.975	0.990	0.995

Unless otherwise stated in the question, assume:

- The market is frictionless. There are no taxes, transaction costs, bid/ask spreads, or restrictions on short sales. All securities are perfectly divisible. Trading does not affect prices. Information is available to all investors simultaneously. Every investor acts rationally (i.e. there is no arbitrage)
- The risk-free interest rate is constant.
- The notation is the same as used in *Derivatives Markets*, by Robert L. McDonald.

When using the normal distribution, choose the nearest z-value to find the probability, or if the probability is given, choose the nearest z-value. No interpolation should be used

Example: If the given z-value is 0.759, and you need to find  $\Pr(Z < 0.759)$  from the normal distribution table, then choose the probability for z-value = 0.76:  $\Pr(Z < 0.76) = 0.7764$ .

## Typos and errors in *Derivatives Markets*, Second Edition, first printing

Page	Item
198	Last line: "stock hedge" should be "stack hedge".
200	The definition of "Heating Degree Day" should be "the maximum of zero and the difference between 65 degrees fahrenheit and the average daily temperature."
264	In the box about the P&G swap, bottom of the first column: the spread evaluated to -.17, which is -17 <i>percent</i> , not basis points.
309	Problems 9.17 and 9.18. Table 9.1 was updated without the problem having been updated. The appropriately revised problems are <a href="#">here</a> .
316	Footnote 2: the superscript "Sh" should be a "delta h"
344	The early exercise condition $rK > \Delta S$ is correct only for infinitely-lived options. (The demonstration of this condition is on pp. 566-567.)
384-386	Figures 12.1-4: The phrase "at-the-money" should be deleted from the figure captions.
431	Equation (13.11) applies for a delta-hedged <i>long</i> call. To be consistent with the text there should be a minus sign in front of equation (13.11)
431	Footnote 5: "Variance" should be "standard deviation".
456	<p>Example 14.2: There are two corrections.</p> <ol style="list-style-type: none"> <li>The CallOnPut calculation should use the prepaid forward price (\$95.0987) as the stock price, instead of \$100. This gives a compound option value of \$1.7552. The correct value for the American option is therefore \$13.5325.</li> <li>The Black-Scholes value should be \$11.764.</li> </ol> <p>For more details, see <a href="#">an expanded discussion</a> of this section and example 14.2.</p>
466	Appendix 14.A: The text should say that 1) The pricing formulas for barrier options are covered in Section 22.3 and 2) All of the options discussed in this chapter have pricing formulas (and VBA code) available in the spreadsheet accompanying the book.
493	Figure 15.1 "prepair" should be "prepaid"
502	Problem 15.22: the bullet list should be enumerated (i.e., as parts "a", "b", and "c")
508	Fourth line of text, "of the equity increases by \$0.735 and ..."

518	Figure 16.4, Panel F. The value 5361.58 should be italicized since the firm calls the bond.
560	The formula for " $\sigma^2$ " right below equation (17.3) should not have an H in it. (By analogy, if you were pricing an option to exchange one share of S for k shares of Q, the option price would depend on the volatility of the return difference between S and Q, and not depend on k.)
612	Figure 18.6. In the bottom two panels, the plotted distribution is normal with mean 3 and standard deviation 5, not standard normal.
655	Equation (20.9) is an Ornstein-Uhlenbeck process even when $\alpha$ is not equal to zero.
779	Sixth line from bottom: Duration is defined in Section 7.3, not 7.8.
787	Line below equation 24.27: "variance" should be "standard deviation"
787	Line above equation 24.28: "risk premium" should be "Sharpe ratio"
789	Figure 24.1. In the bottom panel, the fourth tick mark should be "20", not "0".
795	Example 24.3, first line: "Figure 24.2" should be "Figure 24.3"
799	Table 24.2, caption: "Volatility refers to the volatility of the bond <b>yield</b> " (not "price").
800	Fourth line: "time-t" should be "time-h".
800	Fifth line: It would be clearer to say "The <i>annualized</i> yield of the bond is"
800	Equation 24.48: The right-hand side should be divided by $\sqrt{h}$ in order to annualize the volatility. (This doesn't affect any of the calculations, since $h=1$ throughout the example.)
800	Figure 24.4. In Period 1, at the upper node an equals sign is missing (should be $R_u=R_h$ etc.)
804	The sixth line of text should say "Both yield volatilities match ..."
805	In the caplets and caps example: 1) the loan should be referred to as a 4-year loan, since (in Fig 24.9) the final payment is made four years from the initiation date. 2) the reference to "2-year caplet" and "year-2 cap payment" should be changed to "3-year caplet" and "year-3 cap payment" for consistency with the caplet definition on p. 792.
910, 912	The definitions of "heating degree day" and "cooling degree day" are reversed.

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