Life Insurance Products and Finance, First Printing
Errata. October 2004.

Changes to printed text appear in bold print.

Page 17.

Replace the first complete bullet point with the following:

- For the same age, sex, risk class, and premium, UK with-profit products typically provide lower guaranteed death benefits and cash values than their North American counterparts.

Replace the third complete bullet point with the following:

- With-profit products have two common forms of bonuses. The annual bonus increases the death benefit and cash value, much like the paid-up additions dividend option in North America. There is also a terminal bonus payable on death or maturity. The insurance company can vary terminal bonuses at any time. This can be done to reflect changes in the market value of the more volatile assets often used to back with-profit products.

Add the following additional bullet point before *"Nonparticipating permanent insurance":*

- Some with-profit products guarantee a minimum death benefit that functions much like a nonparticipating decreasing term rider: A supplementary death benefit decreases as the with-profit death benefit increases with annual bonuses, thereby providing a level total death benefit. This feature is similar to the low-cost term insurance riders offered on participating products as described in Section 1.4.1.2.

Page 17.

The sentence, "Regulatory constraints sometimes make it difficult to earn returns that are acceptable to stockholders" should say, "Regulatory constraints **on par products** sometimes make it difficult to earn returns that are acceptable to stockholders."

Page 26. First bullet point under "*Unit-linked*":

First sentence should begin, "VUL **and newer unit-linked** products tend to offset..."
Second sentence should begin, "**Older u**nit-linked products are more..."

Page 26. Second bullet point under "*Unit-linked"*:

First sentence should begin, "**Older u**nit-linked products {**delete "almost always"**} make use of a bid/offer..."
Add the following sentence to the end of the bullet point: "**Such hidden charges are less common with newer products.**"

Page 101. Fifth to last line from the bottom of the page: "non-par" should be "**nonpar**".

Page 121. The answer to "Exercise 2.5" is marked "Answer 2.6" and the answer to "Exercise 2.6" is marked "Answer 2.5".

Page 139. Delete the following two sentences that appear at the end of the first paragraph under "*Simplified issue":* "The mortality assumptions for simplified issue underwriting should fall between those for nonmedical underwriting and guaranteed issue underwriting. If a select period is used, it is often shortened and the effect of selection is scaled back."

Insert the following new paragraph in its place: "**Compared to nonmedical underwriting, simplified issue (SI) underwriting involves many fewer medical questions. Therefore, SI underwriting screens out fewer unhealthy risks. As a result, the mortality associated with SI underwriting is generally higher than that associated with nonmedical underwriting. However, compared to guaranteed issue (GI) underwriting, SI underwriting involves more medical questions and screens out more unhealthy risks. Therefore, SI mortality is generally lower than GI mortality."**

Page 235. Answer 3.3 should be:

1.25 NS = 37.5%.
NS = **30**%.
S = **60**%.

Page 236. Answer 3.3 should be:

Therefore, the new overall mortality will be:

$$\frac{(1.50\ NS + .25\ S)}{1.75} = \frac{(\mathbf{45.0}\% + \mathbf{15.0}\%)}{1.75} = \mathbf{34.3}\%.$$

Page 269. Delete the last column of Table 4.8.2, labeled *SurvFactorMid*.

Page 293. Add the following sentence after Formula 5.8.3: "**Note that FreeWithPct(*t*) assumes that a study of a company's experience has been performed, so that it represents the *average* percentage of account value that is not subject to surrender charges.**"

Page 298. AV_pu(12,t) should be AV_pu(**t,12**)**.**

Page 299 (Formula 5.9.4). DistExpPct should be **SalesExpPct**.

Page 302 (Table5.11.2). DistExpPct should be **SalesExpPct**.

Page 304. Exercise 5.2. Insert the following sentence at the end of the first paragraph, just before sub-paragraph a: "**(Assume that one-half of the deaths occur during the first half of the policy year, and the other half occur during the second half of the policy year.)**"

Page 305. Exercise 5.3. First sentence should be, "**Building on Exercise 5.1**, calculate acquisition expense and commissions per unit issued given the following information:"

Page 306. Exercise 5.7.

Exercise 5.7:

t	*Lapses(t)*	*CV_pu(t)*	*SurrBen(t)*
1	**0.0990**	0.00	
2	**0.0489**	2.00	
3	**0.0238**	8.00	

Page 307. Exercise 5.8.

Exercise 5.8:

t	*Div_pu(t)*	*SurvFactor(t)*	*Lapses(t)*	*Div(t)*
1	0.00	**0.9000**	**0.0990**	
2	0.50	**0.8500**	**0.0489**	
3	1.00	**0.8250**	**0.0238**	

Page 308. Answer 5.2. Insert the following formula before the formula for Prem(*t*):

SurvFactorMid(*t*) = SurvFactor(*t* – 1) x (1 – 0.5 x *qd*(*t*)).

Page 309. Answer 5.3.

Answer 5.3:

t	*AcqExp(t)*	*Comm(t)*
1	5.7500	10.5000
2	0.0000	1.0395
3	0.0000	0.9818

Page 309. Answer 5.4.

Answer 5.4:

t	*ExpPerPol(t) / AvgSize*	*ExpPrem(t) * Prem(t)*	*MaintExp(t)*
1	0.30	0.2100	0.5100
2	0.30	0.1890	**0.4590**
3	0.30	0.1785	**0.4335**

Page 310. Answer 5.7.

Answer 5.7:

t	*Lapses(t)*	*CV_pu(t)*	*SurrBen(t)*
1	**0.0990**	0.00	0.0000
2	**0.0489**	2.00	**0.0978**
3	**0.0238**	8.00	**0.1904**

Page 310. Answer 5.8.

Answer 5.8:

t	*Div_pu(t)*	*SurvFactor(t)*	*Lapses(t)*	*Div(t)*
1	0.00	**0.9000**	**0.0990**	0.0000
2	0.50	**0.8500**	**0.0489**	**0.4250**
3	1.00	**0.8250**	**0.0238**	**0.8250**

Page 310. Answer 5.10.

Answer 5.10:

t	*CashFlowBeg(t)*	*CashFlowMid(t)*	*CashFlowEnd(t)*
1	-6.2600	-1.0098	0.0000
2	**7.9515**	-1.1108	**-0.5228**
3	**7.5098**	-1.2064	**-1.0154**

Page 311. Answer 5.11.

Answer 5.11:

t	*Prem(t)*	*Exp(t)*	*Ben(t)*	*ProdCashFlow(t)*
1	10.5000	16.7650	1.0048	-7.2698
2	9.4500	**1.5040**	**1.6281**	**6.3179**
3	8.9250	**1.4159**	**2.2212**	**5.2880**

Page 339. Formula 6.3.16.

Formula should be:

max ratio =

$$\text{The lesser of } \left[\ 1\ ,\ \frac{\text{maximum initial expense}}{\text{PV of future interest and COI margins at issue}}\ \right]. \qquad (6.3.16)$$

Page 368. Table 6.7.1.

The figure under *SurvFactor* for $t = 9$ should be **0.94402.**

Page 371. Table 6.7.4, the last column should be headed **"SalesExpPct(t)".**

Page 372. In the last paragraph, the reference to page 52 should be **Page 369.**

Page 380 and 381. Answer 6.6.

Answer should be:

***p*(*s*) should be calculated based on both lapses and deaths. In other words,**

$$p(s) = (1 - qd(s))(1 - qw(s)).$$

Formula 6.3.14 can then be replaced with the following expanded version of the Fackler reserve accumulation formula:

$$\text{Res\_pu}(s) = [(\text{Res\_pu}(s-1) + \text{NetPrem\_pu}(s))\,(1 + i(s)) - \text{DB\_pu}(s)\,qd(s) - \text{CV\_pu}(s)\,(1 - qd(s))\,qw(s)] \,/\, p(s).$$

Page 411. Table 7.6.2.

The first value under *ResCredit* should be **0.47520.**

Page 458. Table 9.7.4.

Calculation of *TaxRes*:

The calculation of *TaxRes* is incorrect, which affects the following four columns of Table 9.7.4, also. The correct Table 9.7.4 is shown below. Note that this one correction also affects several tables in the following chapters, as shown below in this errata sheet.

Table 9.7.4 Calculation of Tax on Earnings

t	*SolvResIncr*	*TaxRes*	*TaxResIncr*	*TimingDiff*	*TaxableEarn*	*TaxOnEarn*
1	1.20555	**1.11639**	**1.11639**	**0.08915**	**-9.24080**	**-3.51150**
2	1.22228	**2.29481**	**1.17841**	**0.04386**	**2.07018**	**0.78667**
3	0.87169	**3.15393**	**0.85912**	**0.01257**	**1.88118**	**0.71485**
4	0.51740	**3.68358**	**0.52965**	**-0.01226**	**2.05566**	**0.78115**
5	0.16063	**3.87325**	**0.18966**	**-0.02903**	**2.00995**	**0.76378**
6	-0.09791	**3.81150**	**-0.06174**	**-0.03617**	**2.01902**	**0.76723**
7	-0.48280	**3.36698**	**-0.44453**	**-0.03828**	**2.10911**	**0.80146**
8	-0.89269	**2.50548**	**-0.86150**	**-0.03120**	**2.20239**	**0.83691**
9	-1.34045	**1.17887**	**-1.32661**	**-0.01384**	**2.28576**	**0.86859**
10	-1.16369	**0.00000**	**-1.17887**	**0.01519**	**1.68032**	**0.63852**

EarnTaxRate = 0.38 for all t.

Page 494. Table 10.9.2.

Table 10.9.2 Required Capital Components

t	*AssetDefRisk*	*MortRisk*	*IntRateRisk*	*IntSpreadRisk*	*OtherRisk*	*ReqCap* *	*InvIncRC*	*TaxInvIncRC*
1	0.02411	0.78956	0.01206	0.00904	**0.19500**	**1.02977**	**0.00000**	**0.00000**
2	0.04856	0.73182	0.02428	0.01821	**0.15908**	**0.98195**	**0.08238**	**0.03131**
3	0.06599	0.69269	0.03300	0.02475	**0.14379**	**0.96022**	**0.07856**	**0.02985**
4	0.07634	0.65560	0.03817	0.02863	**0.13354**	**0.93227**	**0.07682**	**0.02919**
5	0.07955	0.62051	0.03978	0.02983	**0.12426**	**0.89392**	**0.07458**	**0.02834**
6	0.07759	0.59973	0.03880	0.02910	**0.11576**	**0.86098**	**0.07151**	**0.02718**
7	0.06794	0.57981	0.03397	0.02548	**0.11015**	**0.81734**	**0.06888**	**0.02617**
8	0.05008	0.56075	0.02504	0.01878	**0.10457**	**0.75922**	**0.06539**	**0.02485**
9	0.02327	0.54252	0.01164	0.00873	**0.09883**	**0.68499**	**0.06074**	**0.02308**
10	0.00000	0.00000	0.00000	0.00000	**0.00000**	**0.00000**	**0.05480**	**0.02082**

*** Uses Formula 10.7.1; assumes *AssetDefFactor* includes a provision for required capital on required capital**

***Note*: For all *t*, EarnTaxRate = 0.38.**

Page 502. The following sentence: "This can be done by explicitly releasing the *n*th year required capital into the final year of distributable earnings, or by setting the lapse rate equal to 100% at the end of year *n*."

should be changed to say,

"**For some components of the required capital formula, t**his can be done by explicitly releasing the *n*th year required capital into the final year of distributable earnings**; for other components, this can be accomplished** by setting the lapse rate equal to 100% at the end of year *n*. **Note that both approaches are used in year 10 of Table 10.9.2.**"

Page 535. Table 11.7.1.

Table 11.7.1 Calculation of Distributable Earnings

t	*PreTaxSolvEarn*	*Tax*	*AfterTaxSolvEarn*	*ReqCapIncr*	*ATInvIncRC*	*DistrEarn*
1	-9.32995	**-3.51150**	**-5.81845**	**1.02977**	**0.00000**	**-6.84822**
2	2.02632	**0.78667**	**1.23965**	**-0.04782**	**0.05108**	**1.33855**
3	1.86862	**0.71485**	**1.15377**	**-0.02173**	**0.04870**	**1.22420**
4	2.06792	**0.78115**	**1.28677**	**-0.02795**	**0.04763**	**1.36235**
5	2.03899	**0.76378**	**1.27520**	**-0.03834**	**0.04624**	**1.35979**
6	2.05519	**0.76723**	**1.28796**	**-0.03294**	**0.04434**	**1.36524**
7	2.14738	**0.80146**	**1.34592**	**-0.04364**	**0.04270**	**1.43227**
8	2.23359	**0.83691**	**1.39668**	**-0.05812**	**0.04054**	**1.49534**
9	2.29960	**0.86859**	**1.43101**	**-0.07423**	**0.03766**	**1.54290**
10	1.66513	**0.63852**	**1.02661**	**-0.68499**	**0.03398**	**1.74557**

Page 535. Table 11.7.2.

Table 11.7.2 Various Profit Measures

Discount Rate	*PV of Premium* d	*PV of DistrEarn*	*Profit as a Percentage of Premium*
7.00%	**33.4037**	**2.1756**	**6.51%**
4.34% a	**36.4077**	**3.3732**	**9.27%**
12.00% b	**28.9284**	**0.5233**	**1.81%**
14.11% c	**27.3948**	**0.0000**	**0.00%**

a After-tax interest rate.

b Using a hurdle rate of 12%, embedded value is **0.5233**.

c The ROI is 14.11%.

d PV of Premium is net of the effect of YRT reinsurance premiums paid.

Page 535. The sentence in the paragraph in the middle of the page should read, "The ROI for our sample product is calculated as **14.11%.**"

Page 536. Table 11.7.3.

Table 11.7.3 Calculation of Pre-Tax Stockholder Earnings

t	*PreTaxSolvEarn*	*SolvResIncr*	*BenResIncr*	*DACAmort*	*InvIncRC*	*PreTaxStockEarn*
1	-9.32995	1.20555	1.87402	-10.45881	**0.00000**	**0.46039**
2	2.02632	1.22228	1.21920	0.93363	**0.08238**	**1.17815**
3	1.86862	0.87169	0.67102	0.88887	**0.07856**	**1.25897**
4	2.06792	0.51740	0.30414	1.13728	**0.07682**	**1.22071**
5	2.03899	0.16063	0.00446	1.12371	**0.07458**	**1.14603**
6	2.05519	-0.09791	-0.25431	1.21548	**0.07151**	**1.06762**
7	2.14738	-0.48280	-0.49857	1.24200	**0.06888**	**0.99003**
8	2.23359	-0.89269	-0.76538	1.27172	**0.06539**	**0.89994**
9	2.29960	-1.34045	-1.08314	1.30478	**0.06074**	**0.79826**
10	1.66513	-1.16369	-1.47144	1.34135	**0.05480**	**0.68633**

Page 536. Table 11.7.4

Table 11.7.4 Calculation of After-Tax Stockholder Earnings

t	*PreTaxStockEarn*	*Tax*	*TaxInvIncRC*	*AccruedTax*	*DefTaxProv*	*AfterTaxStockEarn*
1	**0.46039**	**-3.51150**	**0.00000**	**0.17495**	**3.68645**	**0.28544**
2	**1.17815**	**0.78667**	**0.03131**	**0.44770**	**-0.37028**	**0.73045**
3	**1.25897**	**0.71485**	**0.02985**	**0.47841**	**-0.26629**	**0.78056**
4	**1.22071**	**0.78115**	**0.02919**	**0.46387**	**-0.34647**	**0.75684**
5	**1.14603**	**0.76378**	**0.02834**	**0.43549**	**-0.35663**	**0.71054**
6	**1.06762**	**0.76723**	**0.02718**	**0.40569**	**-0.38871**	**0.66192**
7	**0.99003**	**0.80146**	**0.02617**	**0.37621**	**-0.45142**	**0.61382**
8	**0.89994**	**0.83691**	**0.02485**	**0.34198**	**-0.51978**	**0.55797**
9	**0.79826**	**0.86859**	**0.02308**	**0.30334**	**-0.58833**	**0.49492**
10	**0.68633**	**0.63852**	**0.02082**	**0.26081**	**-0.39854**	**0.42553**

Page 537. Table 11.7.5

Table 11.7.5 Calculation of Stockholder Assets and Liabilities

t	*SolvRes*	*ReqCap*	*DAC*	*StockAssets*	*BenRes*	*DefTaxLiab*	*StockLiabilities*
1	1.20555	**1.02977**	10.45881	**12.69413**	1.87402	**3.68645**	**5.56047**
2	2.42783	**0.98195**	9.52519	**12.93496**	3.09322	**3.31618**	**6.40939**
3	3.29951	**0.96022**	8.63632	**12.89605**	3.76424	**3.04988**	**6.81412**
4	3.81691	**0.93227**	7.49904	**12.24822**	4.06838	**2.70341**	**6.77179**
5	3.97754	**0.89392**	6.37534	**11.24680**	4.07284	**2.34678**	**6.41962**
6	3.87963	**0.86098**	5.15986	**9.90047**	3.81854	**1.95807**	**5.77661**
7	3.39682	**0.81734**	3.91785	**8.13202**	3.31996	**1.50665**	**4.82661**
8	2.50413	**0.75922**	2.64614	**5.90949**	2.55458	**0.98687**	**3.54146**
9	1.16369	**0.68499**	1.34135	**3.19003**	1.47144	**0.39854**	**1.86998**
10	0.00000	**0.00000**	0.00000	**0.00000**	0.00000	**0.00000**	**0.00000**

Page 537. Table 11.7.6.

Table 11.7.6 Calculation of Equity Base and ROE

t	*AfterTaxStockEarn*	*StockEquity*	*Beginning of Year*		*Average Equity*	
			EquityBase	*ROE*	*EquityBase*	*ROE*
1	**0.28544**	**7.13366**	**0.00000**	**N/A**	**3.56683**	**8.00%**
2	**0.73045**	**6.52557**	**7.13366**	**10.24%**	**6.82961**	**10.70%**
3	**0.78056**	**6.08193**	**6.52557**	**11.96%**	**6.30375**	**12.38%**
4	**0.75684**	**5.47642**	**6.08193**	**12.44%**	**5.77918**	**13.10%**
5	**0.71054**	**4.82718**	**5.47642**	**12.97%**	**5.15180**	**13.79%**
6	**0.66192**	**4.12386**	**4.82718**	**13.71%**	**4.47552**	**14.79%**
7	**0.61382**	**3.30541**	**4.12386**	**14.88%**	**3.71463**	**16.52%**
8	**0.55797**	**2.36803**	**3.30541**	**16.88%**	**2.83672**	**19.67%**
9	**0.49492**	**1.32005**	**2.36803**	**20.90%**	**1.84404**	**26.84%**
10	**0.42553**	**0.00000**	**1.32005**	**32.24%**	**0.66002**	**64.47%**

Page 542. Answer 11.2.

The answer in the textbook used 40% as the tax rate when calculating TaxInvIncRC(t). The table below uses 30%, as stated in the problem.

t	*InvIncRC(t)*	*TaxInvIncRC(t)*	*AfterTaxSolvEarn(t)*	*DistrEarn(t)*
1	**0.00**	**0.000**	-7.00	**-10.000**
2	0.18	**0.054**	1.75	**0.876**
3	0.24	**0.072**	1.40	**0.568**

Page 577. In the table, *HighCommPrem* should be 1.00 in months 1 through 7, and *LowCommPrem* should be 1.00 in months 9 through 12:

Month	*YTDPrem_pu*	*HighCommPrem*	*LowCommPrem*
1	1.00	1.00	0.00
2	2.00	**1.00**	0.00
3	3.00	**1.00**	0.00
4	4.00	**1.00**	0.00
5	5.00	**1.00**	0.00
6	6.00	**1.00**	0.00
7	7.00	**1.00**	0.00
8	8.00	0.50	0.50
9	9.00	0.00	1.00
10	10.00	0.00	**1.00**
11	11.00	0.00	**1.00**
12	12.00	0.00	**1.00**

Page 625. The first set of parentheses should be multiplied by 1/4th.

$$\text{MaintExp}(t,Q) = \left(\text{Exp\_pu}(t) + \frac{\text{ExpPerPol}(t)}{\text{AvgSize}} \right) \times \text{SurvFactor}(t, Q-1) \times \left(1 - \frac{\text{qdQ}(t)}{3} - \frac{\text{qw}(t,Q)}{3}\right) / \mathbf{4} + \text{ExpPrem}(t)\,\text{Prem}(t,Q).$$

Page 686 (Middle of the page.) DistExpPct should be **SalesExpPct**.

Page 689 (Middle of the page.) DistExpPct should be **SalesExpPct**.

Page 784. Answer 14.12. *Liability Cash Flow* at t = 2.50 should be **–100.00**, not 100.00.

Page 859. Exercise 15.5 should read:

Use Table **15.4.3** to calculate the number of deaths assuming S = 0.78967.

Page 863. Answer 15.3 should be:

Using Formula 15.3.1 and solving for X_n, we know that the above three values correspond to X_n = 12, 19, and 23, respectively. From Table 15.3.1, f(12) = **0.0770**, f(19) **= 0.0505**, and f(23) = **0.0035**.

Page 867. Answer 15.9. Formula 15.5.3 exponent should be Z10year and not Z90day.

Using Formula 15.5.3:

$$\begin{aligned} i10year(1) &= i10year(0)\, e^{\textbf{Z10year}\ VolFactor} \\ &= 9.25\%\ e^{(0.06986)\ (0.25)} \\ &= 9.4130\%. \end{aligned}$$

Page 868. Answer 15.9. Formula 15.5.3 exponent should be Z10year and not Z90day.

Using Formula 15.5.3:

$$\begin{aligned} i10year(2) &= i10year(1)\, e^{\textbf{Z10year}\ VolFactor} \\ &= 9.413\%\ e^{(-0.59687)\ (0.25)} \\ &= 8.1082\%. \end{aligned}$$

Page 1013. Definition of unit-linked life insurance. Second sentence should read, "**Older u**nit-linked products often have..."