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Conanat, Susan, Nicholas L. Desoutter, Dani L. Long and Roberi MacGrogan, *Managing for Solvency and Profitability in Life and Health Insurance Companies*, LOMA, 1996

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< > Asset Share

20)

1. (asset share method)

가
가
가
가
가
가 (asset share method)²¹⁾
가
가

20) David B. Atkinson "Introduction to Pricing and Asset Shares"(SOA Study note) 가

21) 가 , 가 , 가

Albert E. easton and Timothy F. Harris, *Actuarial Aspects of Individual Life Insurance and Annuity Contracts*, ACTEX, 1999, pp. 158- 161

Kenneth Jr. Black and Harold Skipper Jr., *Life Insurance(13th ed.)*, Prentice Hall, 2000, pp. 773-774

가

가

20

가

가

(trial premium)

22) 가 10

35 가 , 20 3,147

23)

가 가

가

[가]

3 70%

5 10.5%, 6 11 9%, 11

20 8.5%

22) 3

7.5%, 가

30/1,000, 가 4/1,000,

3%

23)

80%, 20%, 85%, 85%, 80%

가

< - 1 >

| | | | | | | | | | | |
|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | 0.720 | 0.610 | 0.510 | 0.420 | 0.340 | 0.280 | 0.250 | 0.230 | 0.210 | 0.200 |
| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| | 0.194 | 0.188 | 0.182 | 0.176 | 0.170 | 0.167 | 0.164 | 0.161 | 0.158 | 0.155 |

20%,

60%,

가

24)

7

가 25)

24)

가 가
가

$$V_t = A_{x+t:\overline{n-t}} - {}_mP_{x:\overline{n}} \cdot \ddot{a}_{x+t:\overline{m-t}}$$

V_t :

$A_{x+t:\overline{n-t}}$: 가

${}_mP_{x:\overline{n}} \cdot \ddot{a}_{x+t:\overline{m-t}}$: 가

, = () -
 - ()
 가 <

-2>

< -2> (asset share)

| (1) | (2) | (3) 3 | (4) | (5) | (6) | (7) | (8) | (9) 10 | (10) 10 |
|-----|-------|----------|-------|--------|-----|-------|-------|-----------|------------|
| 1 | 0.720 | 0.00184 | 0.105 | 100000 | 129 | 27871 | 72000 | 2435 | 0 |
| 2 | 0.610 | 0.00199 | 0.105 | 72000 | 100 | 10900 | 61000 | 905 | 2494 |
| 3 | 0.510 | 0.00216 | 0.105 | 61000 | 92 | 9908 | 51000 | 395 | 5504 |
| 4 | 0.420 | 0.00234 | 0.105 | 51000 | 84 | 8916 | 42000 | 395 | 9220 |
| 5 | 0.340 | 0.00255 | 0.105 | 42000 | 75 | 7925 | 34000 | 395 | 12756 |
| 6 | 0.280 | 0.00279 | 0.09 | 34000 | 66 | 5934 | 28000 | 395 | 16514 |
| 7 | 0.250 | 0.00307 | 0.09 | 28000 | 60 | 2940 | 25000 | 395 | 20508 |
| 8 | 0.230 | 0.00338 | 0.09 | 25000 | 59 | 1941 | 23000 | 395 | 24328 |
| 9 | 0.210 | 0.00372 | 0.09 | 23000 | 60 | 1940 | 21000 | 395 | 28422 |
| 10 | 0.200 | 0.00411 | 0.09 | 21000 | 60 | 940 | 20000 | 395 | 32813 |
| 11 | 0.194 | 0.00456 | 0.085 | 20000 | 64 | 536 | 19400 | 395 | 37523 |
| 12 | 0.188 | 0.00508 | 0.085 | 19400 | 69 | 531 | 18800 | 395 | 42576 |
| 13 | 0.182 | 0.00566 | 0.085 | 18800 | 74 | 526 | 18200 | 395 | 48004 |
| 14 | 0.176 | 0.00629 | 0.085 | 18200 | 80 | 520 | 17600 | 395 | 53841 |
| 15 | 0.170 | 0.00701 | 0.085 | 17600 | 86 | 514 | 17000 | 395 | 60124 |
| 16 | 0.167 | 0.00780 | 0.085 | 17000 | 93 | 207 | 16700 | 395 | 66896 |
| 17 | 0.164 | 0.00865 | 0.085 | 16700 | 101 | 199 | 16400 | 395 | 74209 |
| 18 | 0.161 | 0.00955 | 0.085 | 16400 | 110 | 190 | 16100 | 395 | 82118 |
| 19 | 0.158 | 0.01049 | 0.085 | 16100 | 118 | 182 | 15800 | 395 | 90691 |
| 20 | 0.155 | 0.01159 | 0.085 | 15800 | 128 | 172 | 15500 | 395 | 100000 |

25)

| (1) | (11) | | | (12) | (13) | (14) | (15) |
|-----|------|----|-----|-----------|-----------|-----------|----------|
| | 10 | | | | | | |
| | | | | | | | |
| 1 | 0 | 37 | 37 | 0 | 314700000 | 243500000 | 12900000 |
| 2 | 45 | 39 | 84 | 75218500 | 226584000 | 65160000 | 10000000 |
| 3 | 99 | 41 | 140 | 220650071 | 191967000 | 24095000 | 9200000 |
| 4 | 166 | 43 | 209 | 356362228 | 160497000 | 20145000 | 8400000 |
| 5 | 230 | 46 | 276 | 445786525 | 132174000 | 16590000 | 7500000 |
| 6 | 149 | 48 | 197 | 497509062 | 106998000 | 13430000 | 6600000 |
| 7 | 185 | 51 | 236 | 530061538 | 88116000 | 11060000 | 6000000 |
| 8 | 219 | 54 | 273 | 587079088 | 78675000 | 9875000 | 5900000 |
| 9 | 256 | 56 | 312 | 653562504 | 72381000 | 9085000 | 6000000 |
| 10 | 296 | 59 | 354 | 711342674 | 66087000 | 8295000 | 6000000 |
| 11 | 225 | 61 | 286 | 793147860 | 62940000 | 7900000 | 6400000 |
| 12 | 255 | 63 | 318 | 887432076 | 61051800 | 7663000 | 6900000 |
| 13 | 288 | 65 | 353 | 984375988 | 59163600 | 7426000 | 7400000 |
| 14 | 323 | 65 | 388 | 1.084E+09 | 57275400 | 7189000 | 8000000 |
| 15 | 361 | 65 | 426 | 1.186E+09 | 55387200 | 6952000 | 8600000 |
| 16 | 401 | 62 | 463 | 1.292E+09 | 53499000 | 6715000 | 9300000 |
| 17 | 445 | 57 | 502 | 1.421E+09 | 52554900 | 6596500 | 10100000 |
| 18 | 493 | 49 | 542 | 1.557E+09 | 51610800 | 6478000 | 11000000 |
| 19 | 544 | 38 | 582 | 1.703E+09 | 50666700 | 6359500 | 11800000 |
| 20 | 600 | 22 | 622 | 1.857E+09 | 49722600 | 6241000 | 12800000 |

| (1) | (16) | (17) | (18) | (19) | (20) | (21) | (22) |
|-----|-----------|---------|-----------|-----------|--------|--------|--------|
| 1 | 0 | 2664000 | 19582500 | 75218500 | 1045 | 2364 | - 1319 |
| 2 | 27184600 | 5124000 | 26316171 | 220650071 | 3617 | 4894 | - 1277 |
| 3 | 54533632 | 7140000 | 38713789 | 356362228 | 6987 | 7604 | - 617 |
| 4 | 82205520 | 8778000 | 48455817 | 445786525 | 10614 | 10505 | 109 |
| 5 | 101091300 | 9384000 | 54113837 | 497509062 | 14633 | 13614 | 1019 |
| 6 | 97994076 | 5516000 | 49094552 | 530061538 | 18931 | 16943 | 1988 |
| 7 | 60293520 | 5900000 | 52155070 | 587079088 | 23483 | 20508 | 2975 |
| 8 | 47220648 | 6279000 | 57083064 | 653562504 | 28416 | 24328 | 4088 |
| 9 | 55138680 | 6552000 | 62174850 | 711342674 | 33873 | 28422 | 5451 |
| 10 | 30844220 | 7080000 | 67937406 | 793147860 | 39657 | 32813 | 6844 |
| 11 | 20112328 | 5548400 | 71304944 | 887432076 | 45744 | 37523 | 8221 |
| 12 | 22607856 | 5978400 | 79041368 | 984375988 | 52360 | 42576 | 9784 |
| 13 | 25250104 | 6424600 | 86997631 | 1.084E+09 | 59562 | 48004 | 11558 |
| 14 | 27997320 | 6828800 | 95176094 | 1.186E+09 | 67413 | 53841 | 13572 |
| 15 | 30903736 | 7242000 | 103583739 | 1.292E+09 | 75985 | 60124 | 15861 |
| 16 | 13847472 | 7732100 | 113076678 | 1.421E+09 | 85073 | 66896 | 18177 |
| 17 | 14767591 | 8232800 | 123891754 | 1.557E+09 | 94968 | 74209 | 20759 |
| 18 | 15602420 | 8726200 | 135366542 | 1.703E+09 | 105755 | 82118 | 23637 |
| 19 | 16505762 | 9195600 | 147558449 | 1.857E+09 | 117532 | 90691 | 26841 |
| 20 | 17200000 | 9641000 | 160532196 | 2.021E+09 | 130412 | 100000 | 30412 |

: (2) (11), (20) (22) 1 , (12) (19)

(1) :

(2) : 가

(3) : 3

(4) :

(5) : (2)

(6) : × 3 70%

(7) : - -

(8) : - -

(9) : 가

(10) :

$$(11) : \begin{aligned} &= \quad \times (\quad - \quad) \times 60\% \\ &= \quad \times \quad (20\%) \end{aligned}$$

$$(12), (20) : \quad = (\quad + \quad + \quad) - (\quad + \quad + \quad)$$

$$(13) : \quad (5) \times$$

$$(14) : \quad (5) \times \quad (9)$$

$$(15) : \quad (6) \times 10$$

$$(16) : \quad (7) \times 10 \quad (10)$$

$$(17) : \quad (8) \times 10 \quad (11)$$

$$(18) : \quad \times \{ (\quad + \quad) - 0.5 \cdot (\quad + \quad + \quad) \};$$

, , ,
가

$$(20) : \quad (19) \div \quad (8)$$

$$(22) : \quad (20) - \quad (21)$$

가

가

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가

가

가

가

가

가 ,

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가

(sensitivity analysis)

가 .

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< -3>

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가 .

asset share

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가

10%

(

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68.7%

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10%

90%

,

10%

가

54.2%

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가

20%

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(+)

3

7

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가

가가

가

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가

가

가

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가

가

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< - 3> 가

| (1) | | | | 10% | | 70% 80% | | 10% 가 | | | |
|-----|--------|--------|--------|--------|--------|---------|--------|--------|--------|--------|--------|
| | (20) | (21) | (22) | (20) | (22) | (20) | (22) | (20) | (22) | (20) | (22) |
| 1 | 1045 | 2364 | - 1319 | 1018 | - 1346 | 1018 | - 1346 | 689 | - 1675 | 636 | - 1728 |
| 2 | 3617 | 4894 | - 1277 | 3555 | - 1339 | 3558 | - 1336 | 3041 | - 1853 | 2925 | - 1969 |
| 3 | 6987 | 7604 | - 617 | 6865 | - 739 | 6883 | - 721 | 6176 | - 1428 | 5965 | - 1639 |
| 4 | 10614 | 10505 | 109 | 10394 | - 111 | 10449 | - 56 | 9474 | - 1031 | 9122 | - 1383 |
| 5 | 14633 | 13614 | 1019 | 14257 | 643 | 14378 | 764 | 13025 | - 589 | 12456 | - 1158 |
| 6 | 18931 | 16943 | 1988 | 18352 | 1409 | 18563 | 1620 | 16753 | - 190 | 15907 | - 1036 |
| 7 | 23483 | 20508 | 2975 | 22685 | 2177 | 23004 | 2496 | 20779 | 271 | 19648 | - 860 |
| 8 | 28416 | 24328 | 4088 | 27361 | 3033 | 27817 | 3489 | 25167 | 839 | 23716 | - 612 |
| 9 | 33873 | 28422 | 5451 | 32482 | 4060 | 33130 | 4708 | 29949 | 1527 | 28093 | - 329 |
| 10 | 39657 | 32813 | 6844 | 37916 | 5103 | 38775 | 5962 | 35123 | 2310 | 32859 | 46 |
| 11 | 45744 | 37523 | 8221 | 43635 | 6112 | 44727 | 7204 | 40629 | 3106 | 37949 | 426 |
| 12 | 52360 | 42576 | 9784 | 49814 | 7238 | 51190 | 8614 | 46592 | 4016 | 43424 | 843 |
| 13 | 59562 | 48004 | 11558 | 56498 | 8494 | 58218 | 10214 | 53054 | 5050 | 49317 | 1313 |
| 14 | 67413 | 53841 | 13572 | 63736 | 9895 | 65872 | 12031 | 60069 | 6228 | 55666 | 1825 |
| 15 | 75985 | 60124 | 15861 | 71584 | 11460 | 74222 | 14098 | 67692 | 7568 | 62516 | 2392 |
| 16 | 85073 | 66896 | 18177 | 79915 | 13019 | 83099 | 16203 | 75872 | 8976 | 69908 | 3012 |
| 17 | 94968 | 74209 | 20759 | 88936 | 14727 | 92762 | 18553 | 84760 | 10551 | 77900 | 3691 |
| 18 | 105755 | 82118 | 23637 | 98718 | 16600 | 103299 | 21181 | 94431 | 12313 | 86557 | 4439 |
| 19 | 117532 | 90691 | 26841 | 109342 | 18651 | 114808 | 24117 | 104971 | 14280 | 95949 | 5258 |
| 20 | 130412 | 100000 | 30412 | 120898 | 20898 | 127398 | 27398 | 116477 | 16477 | 106160 | 6160 |

26)

3.1,

0.7,

4.5

26)

가 , , .
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2.

(goal)가 . ,
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 가 , 가 ,
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 가 가
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 가가 가 2/ 1,000
 가 ,

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120%

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가 .
0 .
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(
-4>).

| t | $P_{x,t}$ | ${}_tP_x$ | $D_{x,t}$ | ${}_tD_x$ | $AS_{x,t}$ | $V_{x,t}$ | $SP_{x,t}$ |
|-----|-----------|-----------|-----------|-----------|------------|-----------|------------|
| 1 | 0.72 | 0.720 | 0.652 | 0.652 | 1045 | 2364 | - 1319 |
| 2 | 0.847 | 0.610 | 0.767 | 0.500 | 3617 | 4894 | - 1277 |
| 3 | 0.836 | 0.510 | 0.757 | 0.378 | 6987 | 7604 | - 617 |
| 4 | 0.824 | 0.420 | 0.746 | 0.282 | 10614 | 10505 | 109 |
| 5 | 0.81 | 0.340 | 0.733 | 0.206 | 14633 | 13614 | 1019 |
| 6 | 0.824 | 0.280 | 0.756 | 0.156 | 18931 | 16943 | 1988 |
| 7 | 0.893 | 0.250 | 0.819 | 0.128 | 23483 | 20508 | 2975 |
| 8 | 0.92 | 0.230 | 0.844 | 0.108 | 28416 | 24328 | 4088 |
| 9 | 0.913 | 0.210 | 0.838 | 0.097 | 33873 | 28422 | 5451 |
| 10 | 0.952 | 0.200 | 0.873 | 0.081 | 39657 | 32813 | 6844 |
| 11 | 0.97 | 0.194 | 0.894 | 0.071 | 45744 | 37523 | 8221 |
| 12 | 0.969 | 0.188 | 0.893 | 0.063 | 52360 | 42576 | 9784 |
| 13 | 0.968 | 0.182 | 0.892 | 0.056 | 59562 | 48004 | 11558 |
| 14 | 0.967 | 0.176 | 0.891 | 0.050 | 67413 | 53841 | 13572 |
| 15 | 0.966 | 0.170 | 0.890 | 0.045 | 75985 | 60124 | 15861 |
| 16 | 0.982 | 0.167 | 0.905 | 0.040 | 85073 | 66896 | 18177 |
| 17 | 0.982 | 0.164 | 0.905 | 0.037 | 94968 | 74209 | 20759 |
| 18 | 0.982 | 0.161 | 0.905 | 0.033 | 105755 | 82118 | 23637 |
| 19 | 0.981 | 0.158 | 0.904 | 0.030 | 117532 | 90691 | 26841 |
| 20 | 0.981 | 0.155 | 0.904 | 0.027 | 130412 | 100000 | 30412 |

| t | $PF_{x,t}$ | 가 $PVPF_{x,t}$ | 가 $PVPT_{x,t}$ | $ASCH_{x,t}$ | $PFCH_{x,t}$ | 가 $PVPFCH_{x,t}$ |
|-----|------------|-------------------|-------------------|--------------|--------------|---------------------|
| 1 | - 1319 | - 860 | 1.304 | 1270 | 1270 | 828 |
| 2 | 747 | 374 | 1.000 | 4344 | 2981 | 1491 |
| 3 | 1049 | 397 | 0.756 | 8443 | 3662 | 1384 |
| 4 | 925 | 261 | 0.564 | 13085 | 3716 | 1048 |
| 5 | 873 | 180 | 0.412 | 18259 | 3780 | 779 |
| 6 | 617 | 96 | 0.312 | 23019 | 3662 | 571 |
| 7 | 345 | 44 | 0.256 | 26486 | 3379 | 433 |
| 8 | 457 | 49 | 0.216 | 31102 | 3280 | 354 |
| 9 | 608 | 59 | 0.194 | 37230 | 3305 | 321 |
| 10 | 336 | 27 | 0.162 | 41953 | 3170 | 257 |
| 11 | 421 | 30 | 0.142 | 47454 | 3096 | 220 |
| 12 | 588 | 37 | 0.126 | 54319 | 3090 | 195 |
| 13 | 603 | 34 | 0.112 | 61791 | 3102 | 174 |
| 14 | 617 | 31 | 0.100 | 69935 | 3105 | 155 |
| 15 | 633 | 28 | 0.090 | 78826 | 3108 | 140 |
| 16 | 362 | 14 | 0.080 | 87013 | 3058 | 122 |
| 17 | 675 | 25 | 0.074 | 97054 | 3058 | 113 |
| 18 | 701 | 23 | 0.066 | 107987 | 3058 | 101 |
| 19 | 725 | 22 | 0.060 | 120027 | 3061 | 92 |
| 20 | 725 | 20 | 0.054 | 133053 | 3061 | 83 |
| | | 891 | 6.08 | | | 8861 |

$$P_{x,t} : t \quad 1 \quad ,$$

$${}_iP_x : \quad t \quad ,$$

$$D_{x,t} : \quad t \quad 1$$

$$P_{x,t}/(1+i) , i$$

${}_tD_x$: $\frac{P}{\prod_{i=1}^t(1+ip)}$, ip
 $AS_{x,t}$: t (asset share)
 $V_{x,t}$: t (valuation)
 $SP_{x,t}$: t (,suplus)
 $PF_{x,t}$: t 1 (profit), $SP_{x,t} - SP_{x,t-1} \times (1+i)/P_{x,t}$
 $PVPF_{x,t}$: ${}_tD_x$ 가
 $PF_{x,t} \times {}_tD_x$
 $PVPT_{x,t}$: 가 1,000 2 ${}_tD_x$
가 , $(2) \times {}_tD_x$
 $ASCH_{x,t}$: 100% 가
 $[AS_{x,t-1} + PR_{x,t}] \times (1+i)/P_{x,t} - EXP_{x,t} \times (1+i/2)/P_{x,t}$
 $PFCH_{x,t}$: 100% 가
 $[PR_{x,t} \times (1+i)/P_{x,t} - EXP_{x,t} \times (1+i/2)/P_{x,t}]$
 $PVPFCH_{x,t}$: $PFCH_{x,t} \times {}_tD_x$ 가
 $PFCH_{x,t} \times {}_tD_x$
 $PR_{x,t}$: t
 $EXP_{x,t}$: t

가
가 , $PRCH_{x,t}$

$$PVPF'_{x,t} = PVPF_{x,t} + PRCH_{x,t} \times PVPFCH_{x,t} \dots\dots\dots$$

(n)

$$AS'_{x,n} = AS_{x,n} + PRCH_{x,t} \times ASCH_{x,n} \dots\dots\dots$$

$$ASCH_{x,n} : n$$

가. : 가가 가 2/ 1,000
가

가 .

$$PVPF'_x = PVPT_x ,$$

$$PVPF_x + PRCH_x \times PVPFCH_x = PVPT_x \text{ 가 } PRCH_x$$

$$PRCH_x = \frac{PVPT_x - PVPF_x}{PVPFCH_x} \text{ 가 } .$$

< -4>

$$PRCH_x = (6.08 \times 100 - 891) / 8861 = - 0.0319 \text{ 가 } .$$

$$= (1 - 0.0319) \times 3,147 = 3,047 .$$

가 2/ 1,000

$$3.2\% \quad 3,047 .$$

. : 120%

"가" 가

$$AS'_{x,n} = 1.2 \times V_{x,n} \quad ,$$

$$AS_{x,n} + PRCH_x \times ASCH_{x,n} = 1.2 \times V_{x,n}$$

$$PRCH_x = \frac{1.2 \times V_{x,n} - AS_{x,n}}{ASCH_{x,n}} \text{ 가 } .$$

< -4 >

$$PRCH_x = (120,000 - 130,412) / 133,053 = - 0.0783 \quad .$$

$$= (1 - 0.0783) \times 3,147 = 2,901 \quad .$$

120%

7.8%

2,901

가

가 가 .

. < -5 >

$$PVPF'_x = PVPT_x \quad . \quad , \quad \text{가 } 602$$

, 가 1 가 6.08

10

608

< - 5 >

| | 가 | | | | 가 |
|-----|--------------|------------|------------|------------|--------------|
| t | $PVPT_{x,t}$ | $AS_{x,t}$ | $SP_{x,t}$ | $PF_{x,t}$ | $PVPF_{x,t}$ |
| 1 | 1.304 | 945 | - 1419 | - 1419 | - 925 |
| 2 | 1.000 | 3373 | - 1521 | 657 | 329 |
| 3 | 0.756 | 6540 | - 1064 | 920 | 348 |
| 4 | 0.564 | 9887 | - 618 | 788 | 222 |
| 5 | 0.412 | 13512 | - 102 | 727 | 150 |
| 6 | 0.312 | 17322 | 379 | 516 | 80 |
| 7 | 0.256 | 21404 | 896 | 395 | 51 |
| 8 | 0.216 | 25841 | 1513 | 419 | 45 |
| 9 | 0.194 | 30687 | 2265 | 472 | 46 |
| 10 | 0.162 | 35903 | 3090 | 386 | 31 |
| 11 | 0.142 | 41439 | 3916 | 394 | 28 |
| 12 | 0.126 | 47435 | 4859 | 479 | 30 |
| 13 | 0.112 | 53936 | 5932 | 491 | 27 |
| 14 | 0.100 | 60995 | 7154 | 505 | 25 |
| 15 | 0.090 | 68669 | 8545 | 518 | 23 |
| 16 | 0.080 | 76889 | 9993 | 395 | 16 |
| 17 | 0.074 | 85822 | 11613 | 572 | 21 |
| 18 | 0.066 | 95541 | 13423 | 592 | 20 |
| 19 | 0.060 | 106136 | 15445 | 614 | 18 |
| 20 | 0.054 | 117704 | 17704 | 622 | 17 |
| | 6.08 | | | | 602 |

가 .