

EE431: Economics of financial market and institutions

Semester 2/2017

Assignment 1 (due Tuesday 13th, 2018 at the BE office; before 3 pm.)

Instruction: Use PVF and PVIFA table in your calculation. Attempt only even numbered questions. Please answer question 12 in a separate paper.

Solution to questions assigned in your homework.

2. A 2-year government bond with its face value of \$1,000 offers the holder \$100 as the coupon payment which is given out to the investor at the end of each year. Suppose that the current market price is \$1,000, consider the following problems.

2.1) What is the coupon rate of this 2-year bond?

Coupon rate =10% (=100/1000)

2.2) What is the yield to maturity of this bond?

As price is equal to face value, yield to maturity must be equal to coupon rate.

2.3) The below table represents the investors' survey over that outlook of market interest next year. Calculate the 1-year expected rate of return on the 2-year bond purchased today. Suppose that you can sell off this bond after you've collected bond's coupon next year.

| | | | |
|-------------|-----|-----|-----|
| Rate | 8% | 10% | 12% |
| Probability | 1/2 | 1/4 | 1/4 |

Under the three cases, current yield is equal to 10%.

- When market interest rate drops to 8%, future price will be 1018.519. Hence, we earn a 1.8% of capital gain.
- When market interest rate remains at 10%, there will no gain/loss because future price would remain constant at 1,000.
- When market interest rate increases to 12%, future price will be 982.1429. That is we have -1.7% of capital loss

| | | | |
|--|-------|--------|-------|
| Interest rate by scenarios | 8% | 10% | 12% |
| Probability | 1/2 | 1/4 | 1/4 |
| Return = capital gain/loss + current yield | 11.8% | 10.00% | 8.21% |

$$\text{Expected rate of return} = \frac{1}{2} * (11.8\%) + \frac{1}{4} * (10.00\%) + \frac{1}{4} * (8.21\%)$$

Your expected return is the weighted average return under the three scenarios of future market interest rate.

4. Consider two zero-coupon bonds with remaining time to maturity of 10 years. The first one is issued by a private company named “The face”. The second one is issued by the Thai government. Each bond has its yield to maturity of 6% and 3%, respectively. Suppose that the face value of each of the two bonds is \$1,000. (Don’t get surprised why the two domestic bonds have their face value in USD. This is an example of what is called foreign-currency denominated bond. That is, a domestic entity promises investors to repay coupon and principal amount in

terms of foreign currency. In this example, the payment is made in US dollar.) From the information, consider the following problems.

4.1) calculate the current price of each of the two bonds.

At the initial level of YTM (6% and 3%), price of the two bonds are $1000 \cdot PVF(6\%, 10) = 558.39$ (The face) and $1000 \cdot PVF(3\%, 10) = 744.09$ (Government bond)

4.2) using the exact bond pricing formula, calculate the percentage change in price of the two bonds if market interest unexpectedly increases by 1% right after the investor had purchased the two bonds.

After the increase in yield to 7% and 4% for each of the two bonds, new price should be $1000 \cdot PVF(7\%, 10) = 508.35$ (The face) and $1000 \cdot PVF(4\%, 10) = 675.56$ (Government bond)

In terms of its percentage change, price of the two bonds drop by 8.96% ($= (508.35 - 558.39) / 558.39$) and 9.2% ($= (675.56 - 744.09) / 744.09$).

4.3) compare the percentage change in prices implied by the duration concept. How big is the approximation error? Would the approximate error be bigger under the high-yield bond than the low-yield bond, or vice versa?

In both cases, Macaulay Duration of the two discount bonds is 10 year. However, Modified duration of government bond is 9.70 ($= 10 / (1.03)$); meanwhile, modified duration of "the Face" is 9.43 ($= 10 / (1.06)$). The figures implies that % change in price of "The face" bond is smaller than that of government bond. This follows the convexity relationship.

Consistent with what has been discussed in class, modified duration typically overestimate the size of downside risk of bond returns. (Compare the approximate % change in price the answer provided in 4.2)

6. (CFA/Level 1) A 6% coupon bond paying interest annually has a modified duration of 10 years, sells for \$800, and is priced at a yield to maturity of 8%. If the YTM increases to 9%, what is the predicted change in price using the duration concept?

$$\begin{aligned} dp/p &= - \text{ModD} * (\text{change in } r) = \\ &= - (10) * (0.09 - 0.08) \\ &= - (10)*(0.01) = -0.1 \end{aligned}$$

That is, price would drop by 10% when interest rate increases by 1%.

Price will decline from \$800 to \$720. Hence, price would decrease by \$80.

8. (CFA/Level 1) A bond with *annual* coupon payments has a coupon rate of 8%, yield to maturity of 10%, and Macaulay duration of 9 years. What is the bond's modified duration?

$$\text{Modified duration} = \text{MacD} / (1+r) = 9 / (1+0.1) = 9 / 1.1 = 8.18$$

10. (CFA/level 1) Which bond has the longest duration? (Choose the best answer, and explain why?)
- 8-year maturity, 6% coupon.
 - 8-year maturity, 11% coupon.
 - 15-year maturity, 6% coupon.
 - 15-year maturity, 11% coupon.

Let's assume that the coupon is equal to yield, so each type of the bond is getting sold at par. This is to allow us to continue doing this problem.

First, note that Modified duration increase with the lowered yield. Thus, based on the pairwise comparison, you will find that duration of "a" is longer than duration of "b". At the same time, duration of "c" is longer duration of "d".

Second, modified duration increases with time to maturity. From the first point mentioned above, this implies that "c" would have longer modified duration than "a" because MacD of "c" is larger than MacD of "a".

So, the answer is "c" that is the longest modified duration.

12. True/False/Uncertain: Why, or why not?

- a) A financial adviser has just given you the following advice: "Long-term bonds are a great investment because their interest rate is over 20%." Is the financial adviser necessarily right?

The statement is not necessarily right. If the investor is not planning to hold the long-term bond until maturity, long-term bond is subjected to high interest rate risk. If the market interest rate rises in the future, the price of long-term bond will drop, and hence causing a negative return on bond investment.

- b) True or False or Uncertain: With a discount bond, the return on the bond is equal to the rate of capital gain.

If you interpret the Discount bond as zero-coupon bond, the answer is true; zero-coupon bond is not offering investors a coupon payment. However, if you interpret the discount bond as a bond that gets sold at discount, the answer may be false. Using the latter interpretation, any coupon bonds can be sold at discounted, depending on market conditions. The return on coupon bond include both current yield and capital gain. Thus, the statement will be false if the discount bond is coupon bond.

- c) True or False: Investors would normally receive a higher rate of return on bond investment when market interest rates have been on the rising trend.

If we are experiencing an upward trend of market interest rate, bond investment will be subjected to negative rate of return; price of bond will drop under the rising trend of market interest rate. Therefore, investor will in fact receive lower rate of return on bond investment under the given scenario.

- d) True or False: Bond with longer term to maturity is always having more interest-rate risk.

Mostly true, but not always. Note that interest rate risk can be approximate by the modified duration. Modified duration depends on MacD and the initial level of interest rate. One might be able to find that some examples in which long-term bond may have lower MacD than another bond with short maturity.

PRESENT VALUE OF \$1

| P e r i o d s | RATE PER PERIOD | | | | | | | | | | | | | | | | |
|---------------------------------|-----------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| | 0.25% | 0.50% | 0.75% | 1.00% | 1.50% | 2.00% | 2.50% | 3.00% | 4.00% | 5.00% | 6.00% | 7.00% | 8.00% | 9.00% | 10.00% | 11.00% | 12.00% |
| | 1 | 0.99751 | 0.99502 | 0.99256 | 0.99010 | 0.98522 | 0.98039 | 0.97561 | 0.97087 | 0.96154 | 0.95238 | 0.94340 | 0.93458 | 0.92593 | 0.91743 | 0.90909 | 0.90090 |
| 2 | 0.99502 | 0.99007 | 0.98517 | 0.98030 | 0.97066 | 0.96117 | 0.95181 | 0.94260 | 0.92456 | 0.90703 | 0.89000 | 0.87344 | 0.85734 | 0.84168 | 0.82645 | 0.81162 | 0.79719 |
| 3 | 0.99254 | 0.98515 | 0.97783 | 0.97059 | 0.95632 | 0.94232 | 0.92860 | 0.91514 | 0.88900 | 0.86384 | 0.83962 | 0.81630 | 0.79383 | 0.77218 | 0.75131 | 0.73119 | 0.71178 |
| 4 | 0.99006 | 0.98025 | 0.97055 | 0.96098 | 0.94218 | 0.92385 | 0.90595 | 0.88849 | 0.85480 | 0.82270 | 0.79209 | 0.76290 | 0.73503 | 0.70843 | 0.68301 | 0.65873 | 0.63552 |
| 5 | 0.98759 | 0.97537 | 0.96333 | 0.95147 | 0.92826 | 0.90573 | 0.88385 | 0.86261 | 0.82193 | 0.78353 | 0.74726 | 0.71299 | 0.68058 | 0.64993 | 0.62092 | 0.59345 | 0.56743 |
| 6 | 0.98513 | 0.97052 | 0.95616 | 0.94205 | 0.91454 | 0.88797 | 0.86230 | 0.83748 | 0.79031 | 0.74622 | 0.70496 | 0.66634 | 0.63017 | 0.59627 | 0.56447 | 0.53464 | 0.50663 |
| 7 | 0.98267 | 0.96569 | 0.94904 | 0.93272 | 0.90103 | 0.87056 | 0.84127 | 0.81309 | 0.75992 | 0.71068 | 0.66506 | 0.62275 | 0.58349 | 0.54703 | 0.51316 | 0.48166 | 0.45235 |
| 8 | 0.98022 | 0.96089 | 0.94198 | 0.92348 | 0.88771 | 0.85349 | 0.82075 | 0.78941 | 0.73069 | 0.67684 | 0.62741 | 0.58201 | 0.54027 | 0.50187 | 0.46651 | 0.43393 | 0.40388 |
| 9 | 0.97778 | 0.95610 | 0.93496 | 0.91434 | 0.87459 | 0.83676 | 0.80073 | 0.76642 | 0.70259 | 0.64461 | 0.59190 | 0.54393 | 0.50025 | 0.46043 | 0.42410 | 0.39092 | 0.36061 |
| 10 | 0.97534 | 0.95135 | 0.92800 | 0.90529 | 0.86167 | 0.82035 | 0.78120 | 0.74409 | 0.67556 | 0.61391 | 0.55839 | 0.50835 | 0.46319 | 0.42241 | 0.38554 | 0.35218 | 0.32197 |
| 11 | 0.97291 | 0.94661 | 0.92109 | 0.89632 | 0.84893 | 0.80426 | 0.76214 | 0.72242 | 0.64958 | 0.58468 | 0.52679 | 0.47509 | 0.42888 | 0.38753 | 0.35049 | 0.31728 | 0.28748 |
| 12 | 0.97048 | 0.94191 | 0.91424 | 0.88745 | 0.83639 | 0.78849 | 0.74356 | 0.70138 | 0.62460 | 0.55684 | 0.49697 | 0.44401 | 0.39711 | 0.35553 | 0.31863 | 0.28584 | 0.25668 |
| 13 | 0.96806 | 0.93722 | 0.90743 | 0.87866 | 0.82403 | 0.77303 | 0.72542 | 0.68095 | 0.60057 | 0.53032 | 0.46884 | 0.41496 | 0.36770 | 0.32618 | 0.28966 | 0.25751 | 0.22917 |
| 14 | 0.96565 | 0.93256 | 0.90068 | 0.86996 | 0.81185 | 0.75788 | 0.70773 | 0.66112 | 0.57748 | 0.50507 | 0.44230 | 0.38782 | 0.34046 | 0.29925 | 0.26333 | 0.23199 | 0.20462 |
| 15 | 0.96324 | 0.92792 | 0.89397 | 0.86135 | 0.79985 | 0.74301 | 0.69047 | 0.64186 | 0.55526 | 0.48102 | 0.41727 | 0.36245 | 0.31524 | 0.27454 | 0.23939 | 0.20900 | 0.18270 |
| 16 | 0.96084 | 0.92330 | 0.88732 | 0.85282 | 0.78803 | 0.72845 | 0.67362 | 0.62317 | 0.53391 | 0.45811 | 0.39365 | 0.33873 | 0.29189 | 0.25187 | 0.21763 | 0.18829 | 0.16312 |
| 17 | 0.95844 | 0.91871 | 0.88071 | 0.84438 | 0.77639 | 0.71416 | 0.65720 | 0.60502 | 0.51337 | 0.43630 | 0.37136 | 0.31657 | 0.27027 | 0.23107 | 0.19784 | 0.16963 | 0.14564 |
| 18 | 0.95605 | 0.91414 | 0.87416 | 0.83602 | 0.76491 | 0.70016 | 0.64117 | 0.58739 | 0.49363 | 0.41552 | 0.35034 | 0.29586 | 0.25025 | 0.21199 | 0.17986 | 0.15282 | 0.13004 |
| 19 | 0.95367 | 0.90959 | 0.86765 | 0.82774 | 0.75361 | 0.68643 | 0.62553 | 0.57029 | 0.47464 | 0.39573 | 0.33051 | 0.27651 | 0.23171 | 0.19449 | 0.16351 | 0.13768 | 0.11611 |
| 20 | 0.95129 | 0.90506 | 0.86119 | 0.81954 | 0.74247 | 0.67297 | 0.61027 | 0.55368 | 0.45639 | 0.37689 | 0.31180 | 0.25842 | 0.21455 | 0.17843 | 0.14864 | 0.12403 | 0.10367 |
| 21 | 0.94892 | 0.90056 | 0.85478 | 0.81143 | 0.73150 | 0.65978 | 0.59539 | 0.53755 | 0.43883 | 0.35894 | 0.29416 | 0.24151 | 0.19866 | 0.16370 | 0.13513 | 0.11174 | 0.09256 |
| 22 | 0.94655 | 0.89608 | 0.84842 | 0.80340 | 0.72069 | 0.64684 | 0.58086 | 0.52189 | 0.42196 | 0.34185 | 0.27751 | 0.22571 | 0.18394 | 0.15018 | 0.12285 | 0.10067 | 0.08264 |
| 23 | 0.94419 | 0.89162 | 0.84210 | 0.79544 | 0.71004 | 0.63416 | 0.56670 | 0.50669 | 0.40573 | 0.32557 | 0.26180 | 0.21095 | 0.17032 | 0.13778 | 0.11168 | 0.09069 | 0.07379 |
| 24 | 0.94184 | 0.88719 | 0.83583 | 0.78757 | 0.69954 | 0.62172 | 0.55288 | 0.49193 | 0.39012 | 0.31007 | 0.24698 | 0.19715 | 0.15770 | 0.12640 | 0.10153 | 0.08170 | 0.06588 |
| 25 | 0.93949 | 0.88277 | 0.82961 | 0.77977 | 0.68921 | 0.60953 | 0.53939 | 0.47761 | 0.37512 | 0.29530 | 0.23300 | 0.18425 | 0.14602 | 0.11597 | 0.09230 | 0.07361 | 0.05882 |
| 30 | 0.92783 | 0.86103 | 0.79919 | 0.74192 | 0.63976 | 0.55207 | 0.47674 | 0.41199 | 0.30832 | 0.23138 | 0.17411 | 0.13137 | 0.09938 | 0.07537 | 0.05731 | 0.04368 | 0.03338 |
| 35 | 0.91632 | 0.83982 | 0.76988 | 0.70591 | 0.59387 | 0.50003 | 0.42137 | 0.35538 | 0.25342 | 0.18129 | 0.13011 | 0.09366 | 0.06763 | 0.04899 | 0.03558 | 0.02592 | 0.01894 |
| 40 | 0.90495 | 0.81914 | 0.74165 | 0.67165 | 0.55126 | 0.45289 | 0.37243 | 0.30656 | 0.20829 | 0.14205 | 0.09722 | 0.06678 | 0.04603 | 0.03184 | 0.02209 | 0.01538 | 0.01075 |
| 50 | 0.88263 | 0.77929 | 0.68825 | 0.60804 | 0.47500 | 0.37153 | 0.29094 | 0.22811 | 0.14071 | 0.08720 | 0.05429 | 0.03395 | 0.02132 | 0.01345 | 0.00852 | 0.00542 | 0.00346 |

PRESENT VALUE OF ORDINARY ANNUITY
(annuity in arrears -- end of period payments)

| P e r i o d s | RATE PER PERIOD | | | | | | | | | | | | | | | | |
|---------------------------------|-----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------|---------|---------|
| | 0.25% | 0.50% | 0.75% | 1.00% | 1.50% | 2.00% | 2.50% | 3.00% | 4.00% | 5.00% | 6.00% | 7.00% | 8.00% | 9.00% | 10.00% | 11.00% | 12.00% |
| | 1 | 0.99751 | 0.99502 | 0.99256 | 0.99010 | 0.98522 | 0.98039 | 0.97561 | 0.97087 | 0.96154 | 0.95238 | 0.94340 | 0.93458 | 0.92593 | 0.91743 | 0.90909 | 0.90090 |
| 2 | 1.99252 | 1.98510 | 1.97772 | 1.97040 | 1.95588 | 1.94156 | 1.92742 | 1.91347 | 1.88609 | 1.85941 | 1.83339 | 1.80802 | 1.78326 | 1.75911 | 1.73554 | 1.71252 | 1.69005 |
| 3 | 2.98506 | 2.97025 | 2.95556 | 2.94099 | 2.91220 | 2.88388 | 2.85602 | 2.82861 | 2.77509 | 2.72325 | 2.67301 | 2.62432 | 2.57710 | 2.53129 | 2.48685 | 2.44371 | 2.40183 |
| 4 | 3.97512 | 3.95050 | 3.92611 | 3.90197 | 3.85438 | 3.80773 | 3.76197 | 3.71710 | 3.62990 | 3.54595 | 3.46511 | 3.38721 | 3.31213 | 3.23972 | 3.16987 | 3.10245 | 3.03735 |
| 5 | 4.96272 | 4.92587 | 4.88944 | 4.85343 | 4.78264 | 4.71346 | 4.64583 | 4.57971 | 4.45182 | 4.32948 | 4.21236 | 4.10020 | 3.99271 | 3.88965 | 3.79079 | 3.69590 | 3.60478 |
| 6 | 5.94785 | 5.89638 | 5.84560 | 5.79548 | 5.69719 | 5.60143 | 5.50813 | 5.41719 | 5.24214 | 5.07569 | 4.91732 | 4.76654 | 4.62288 | 4.48592 | 4.35526 | 4.23054 | 4.11141 |
| 7 | 6.93052 | 6.86207 | 6.79464 | 6.72819 | 6.59821 | 6.47199 | 6.34939 | 6.23028 | 6.00205 | 5.78637 | 5.58238 | 5.38929 | 5.20637 | 5.03295 | 4.86842 | 4.71220 | 4.56376 |
| 8 | 7.91074 | 7.82296 | 7.73661 | 7.65168 | 7.48593 | 7.32548 | 7.17014 | 7.01969 | 6.73274 | 6.46321 | 6.20979 | 5.97130 | 5.74664 | 5.53482 | 5.33493 | 5.14612 | 4.96764 |
| 9 | 8.88852 | 8.77906 | 8.67158 | 8.56602 | 8.36052 | 8.16224 | 7.97087 | 7.78611 | 7.43533 | 7.10782 | 6.80169 | 6.51523 | 6.24689 | 5.99525 | 5.75902 | 5.53705 | 5.32825 |
| 10 | 9.86386 | 9.73041 | 9.59958 | 9.47130 | 9.22218 | 8.98259 | 8.75206 | 8.53020 | 8.11090 | 7.72173 | 7.36009 | 7.02358 | 6.71008 | 6.41766 | 6.14457 | 5.88923 | 5.65022 |
| 11 | 10.83677 | 10.67703 | 10.52067 | 10.36763 | 10.07112 | 9.78685 | 9.51421 | 9.25262 | 8.76048 | 8.30641 | 7.88687 | 7.49867 | 7.13896 | 6.80519 | 6.49506 | 6.20652 | 5.93770 |
| 12 | 11.80725 | 11.61893 | 11.43491 | 11.25508 | 10.90751 | 10.57534 | 10.25776 | 9.95400 | 9.38507 | 8.86325 | 8.38384 | 7.94269 | 7.53608 | 7.16073 | 6.81369 | 6.49236 | 6.19437 |
| 13 | 12.77532 | 12.55615 | 12.34235 | 12.13374 | 11.73153 | 11.34837 | 10.98318 | 10.63496 | 9.98565 | 9.39357 | 8.85268 | 8.35765 | 7.90378 | 7.48690 | 7.10336 | 6.74987 | 6.42355 |
| 14 | 13.74096 | 13.48871 | 13.24302 | 13.00370 | 12.54338 | 12.10625 | 11.69091 | 11.29607 | 10.56312 | 9.89864 | 9.29498 | 8.74547 | 8.24424 | 7.78615 | 7.36669 | 6.98187 | 6.62817 |
| 15 | 14.70420 | 14.41662 | 14.13699 | 13.86505 | 13.34323 | 12.84926 | 12.38138 | 11.93794 | 11.11839 | 10.37966 | 9.71225 | 9.10791 | 8.55948 | 8.06069 | 7.60608 | 7.19087 | 6.81086 |
| 16 | 15.66504 | 15.33993 | 15.02431 | 14.71787 | 14.13126 | 13.57771 | 13.05500 | 12.56110 | 11.65230 | 10.83777 | 10.10590 | 9.44665 | 8.85137 | 8.31256 | 7.82371 | 7.37916 | 6.97399 |
| 17 | 16.62348 | 16.25863 | 15.90502 | 15.56225 | 14.90765 | 14.29187 | 13.71220 | 13.16612 | 12.16567 | 11.27407 | 10.47726 | 9.76322 | 9.12164 | 8.54363 | 8.02155 | 7.54879 | 7.11963 |
| 18 | 17.57953 | 17.17277 | 16.77918 | 16.39827 | 15.67256 | 14.99203 | 14.35336 | 13.75351 | 12.65930 | 11.68959 | 10.82760 | 10.05909 | 9.37189 | 8.75563 | 8.20141 | 7.70162 | 7.24967 |
| 19 | 18.53320 | 18.08236 | 17.64683 | 17.22601 | 16.42617 | 15.67846 | 14.97889 | 14.32380 | 13.13394 | 12.08532 | 11.15812 | 10.33560 | 9.60360 | 8.95011 | 8.36492 | 7.83929 | 7.36578 |
| 20 | 19.48449 | 18.98742 | 18.50802 | 18.04555 | 17.16864 | 16.35143 | 15.58916 | 14.87747 | 13.59033 | 12.46221 | 11.46992 | 10.59401 | 9.81815 | 9.12855 | 8.51356 | 7.96333 | 7.46944 |
| 21 | 20.43340 | 19.88798 | 19.36280 | 18.85698 | 17.90014 | 17.01121 | 16.18455 | 15.41502 | 14.02916 | 12.82115 | 11.76408 | 10.83553 | 10.01680 | 9.29224 | 8.64869 | 8.07507 | 7.56200 |
| 22 | 21.37995 | 20.78406 | 20.21121 | 19.66038 | 18.62082 | 17.65805 | 16.76541 | 15.93692 | 14.45112 | 13.16300 | 12.04158 | 11.06124 | 10.20074 | 9.44243 | 8.77154 | 8.17574 | 7.64465 |
| 23 | 22.32414 | 21.67568 | 21.05331 | 20.45582 | 19.33086 | 18.29220 | 17.33211 | 16.44361 | 14.85684 | 13.48857 | 12.30338 | 11.27219 | 10.37106 | 9.58021 | 8.88322 | 8.26643 | 7.71843 |
| 24 | 23.26598 | 22.56287 | 21.88915 | 21.24339 | 20.03041 | 18.91393 | 17.88499 | 16.93554 | 15.24696 | 13.79864 | 12.55036 | 11.46933 | 10.52876 | 9.70661 | 8.98474 | 8.34814 | 7.78432 |
| 25 | 24.20547 | 23.44564 | 22.71876 | 22.02316 | 20.71961 | 19.52346 | 18.42438 | 17.41315 | 15.62208 | 14.09394 | 12.78336 | 11.65358 | 10.67478 | 9.82258 | 9.07704 | 8.42174 | 7.84314 |
| 30 | 28.86787 | 27.79405 | 26.77508 | 25.80771 | 24.01584 | 22.39646 | 20.93029 | 19.60044 | 17.29203 | 15.37245 | 13.76483 | 12.40904 | 11.25778 | 10.27365 | 9.42691 | 8.69379 | 8.05518 |
| 35 | 33.47243 | 32.03537 | 30.68266 | 29.40858 | 27.07559 | 24.99862 | 23.14516 | 21.48722 | 18.66461 | 16.37419 | 14.49825 | 12.94767 | 11.65457 | 10.56682 | 9.64416 | 8.85524 | 8.17550 |
| 40 | 38.01986 | 36.17223 | 34.44694 | 32.83469 | 29.91585 | 27.35548 | 25.10278 | 23.11477 | 19.79277 | 17.15909 | 15.04630 | 13.33171 | 11.92461 | 10.75736 | 9.77905 | 8.95105 | 8.24378 |
| 50 | 46.94617 | 44.14279 | 41.56645 | 39.19612 | 34.99969 | 31.42361 | 28.36231 | 25.72976 | 21.48218 | 18.25593 | 15.76186 | 13.80075 | 12.23348 | 10.96168 | 9.91481 | 9.04165 | 8.30450 |