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A Primer in Cross-testing

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Cross-testing is a method that can be used to meet nondiscrimination rules. This article introduces basic concepts used in cross-testing and illustrates why cross-testing works. The formula for an E-BAR will be determined and used to explain some of the assumptions used in testing.

Let's start with an example: Harley Worthett (age 60) deposited \$10,000 in a five-year CD guaranteed to pay 5%. Suppose his assistant, Shirley U. Jest (age 25), invested only \$2,000 in a GIC that will earn the same 5% for the next 40 years. What will be the end result of their financial endeavors? We'll keep it simple and assume interest is paid only at the end of the year.

We'll begin with Harley. To determine his balance next year, simply multiply the amount deposited by the interest rate:

$$\$10,000 * 1.05 = \$10,500.$$

In another year his balance will be:

$$\$10,500 * 1.05 = \$11,025.$$

The results after five years are illustrated in the table below.

Year	Beginning Balance	Interest	Ending Balance
1	\$10,000	1.05	\$10,500
2	\$10,500	1.05	\$11,025
3	\$11,025	1.05	\$11,576
4	\$11,576	1.05	\$12,155
5	\$12,155	1.05	\$12,763

Notice that the ending balance after any given year is simply the original beginning balance multiplied by 1.05 for each year. Thus, the balance at year five could have been determined by the following formula:

$$\$10,000 * (1.05)^5 = \$12,763$$

or in a more general form:

$$\text{Original Amount} * (1 + i)^x = \text{future value,}$$

where i = interest rate (i.e., .05) and x = the number of years to be considered.



Using this formula, one can easily determine what Shirley's ending balance will be:

$$\$2,000 * (1.05)^{40} = \$14,080$$

How about that! Shirley had 1/5 the investment but came out ahead of Harley. This illustration works because Shirley would have her money invested for a lot longer period of time than Harley. Hopefully, it also illustrates the basic concept of *why* cross-testing works. Simply substitute "NHCE" for Shirley, and "HCE" for Harley, provide the NHCE with 1/5 the contribution of the HCE and demonstrate the NHCE actually "does better" at retirement than the HCE! Cross-testing works if, under the nondiscrimination rules, you have enough NHCEs who do as well as or better than the HCEs.

Testing for Nondiscrimination

There are two basic ways to test a defined contribution plan for nondiscrimination—on an allocation basis [Treas. Reg. §1.401(a)(4)-2] or on the basis of equivalent benefits [Treas. Reg. §1.401(a)(4)-8(b)]. Testing on an allocation basis is the easiest because it is simply an individual's contribution divided by his or her compensation. However, it's not much use (unless one is restructuring) if the goal is to provide some or all of the HCEs with a larger percentage of pay than the NHCEs. Therefore, this article will focus its attention on some of the aspects of testing allocations on an equivalent benefits basis.

There are three basic parts of the regulations pertaining to testing defined contribution plans on the basis of equivalent benefits (or cross-testing):

- Treas. Reg. §1.401(a)(4)-8(b)(1)—This section deals with the gateway minimum rules which went into effect for plan years beginning January 1, 2002. For purposes of this article, it is assumed the plan has met these requirements.
- Treas. Reg. §1.401(a)(4)-8(b)(2)—This section deals with the determination of equivalent accrual rates, which is the emphasis of this article.
- Treas. Reg. §1.401(a)(4)-8(b)(3)—This section deals with target benefit plans. It is quite possible these plans are nearly extinct—if not, they are certainly on the endangered species list. As such, these animals will not be discussed in this article.

Step 1: Calculating the Future Value of a Contribution

In the initial example, Harley deposited \$10,000 and Shirley deposited \$2,000, and the formula $\text{original amount} * (1 + i)^x = \text{future value}$, where x represents years to age 65, was developed to indicate how much each would have at age 65. This step is actually the first step of what Treas. Reg. §1.401(a)(4)-8(b)(2)(ii)(B) refers to as *normalization*. The dictionary definition of *normalize* is “to change; make different; cause a transformation.” Thus, one is changing or converting the contribution into a benefit. Again, in Step 1, the process is simply calculating what the future value of a contribution will be. One could refer to this amount as the **lump sum** at retirement.

Step 2: Converting the Future Value to a Benefit

This step is even easier than the first. Simply divide the future value by an Annuity Purchase Rate (APR) from one of the permissible Mortality Tables [Treas. Reg. §1.401(a)(4)-12 Definitions—*Standard Mortality Tables*]. One could refer to this result as the **benefit** at retirement. Since the annuity factor represents a monthly annuity, this

result would produce a *monthly* benefit. Since both the contribution and compensation are annual figures, it is necessary to multiply the result by 12 to produce an annual benefit.

Question: The regulations list a number of different mortality tables that one can use in testing. Which is the most useful to use for nondiscrimination testing purposes?

Answer: As a general rule, it doesn't matter. Generally all participants in the testing group have the same retirement age, and therefore all will have the same APR factor. Thus, in Step 2, you are merely dividing by a constant. (That being said, if the plan *imputes permitted disparity*, a larger value for the APR may make just enough of a difference to help a plan pass testing.)

Step 3: Determining the Equivalent Accrual Rate

Simply take the benefit determined in Step 2 and divide by the individual's 414(s) compensation. This result is commonly referred to as the E-BAR (Equivalent Benefit Accrual Rate). By the way, the regulations never use the term E-BAR!

Taking the formula from the initial example:

$$\text{original amount} * (1.0)^x = \text{future value}$$

and working through the steps results in the following:

- Step 1:** $\text{contribution} * (1 + i)^x = \text{lump sum}$
- Step 2:** $12 * \text{lump sum} / \text{APR} = \text{annual benefit}$
- Step 3:** $\text{benefit} / \text{compensation} = \text{E-BAR}$

Combining these into one produces the following formula:

$$12 * \text{contribution} * (1 + i)^x / \text{APR} / \text{compensation} = \text{E-BAR}$$

Working through another example, consider 60 year-old Barbara Seville, an HCE making \$230,000. A contribution of \$46,000 (20% of pay) is made for her. What is her E-BAR?

(The APR in this example is 115.39, which is based on the 1983 IAF table at 8.5% interest.)

The E-BAR for Barbara is:

$$12 * 46,000 * (1.085)^5 / 115.39 / 230,000 = 3.128\%$$

Barbara knows just enough about the rules to know that before even considering cross-testing she must provide a minimum allocation of 5% to any of her employees. She only has one employee, Sharon Sharalike, and therefore provides her with a 5% contribution. Sharon is 43 years old and makes \$20,000 a year, so her contribution is \$1,000. (Sharon is 22 years from retirement age of 65.) Barbara asks if this contribution is sufficient to pass nondiscrimination testing. Simply plug the numbers into the formula and determine the E-BAR for Sharon:

$$12 * 1,000 * (1.085)^{22} / 115.39 / 20,000 = 3.129\%$$

What luck! Sharon has an E-BAR slightly greater than Barbara, and so this situation would pass nondiscrimination testing. Wow! Barbara received a 20% contribution which was four times the 5% contribution provided Sharon, and yet the plan was still able to pass testing. By the way, it is not how much someone receives in terms of dollars, but rather what percentage of pay he or she receives that determines if a plan passes or fails cross-testing. Sharon's compensation could have been \$33,275.21 and as long as she received 5% of pay (\$1,663.76) the results would have been the same.

Okay, maybe this outcome was not really luck. The numbers were pretty contrived to obtain these results. Note that Barbara was 60 years old and Sharon was 43 years old. There is a 17-year difference between their ages. The interest rate assumption was 8.5%, and that age difference produces the following factor: $(1.085)^{17} = 4.00226$. Thus, it is really no surprise that Barbara could receive a contribution that is four times that of Sharon. Since the minimum allocation gateway is 5%, an owner making maximum compensation will be able to receive 20% of pay ($4.00226 * 5\%$)—enough to reach the 415 limit provided there are enough employees with a 17-year age difference.

The regulations require the use of a pre-retirement interest rate between 7.5% and 8.5%. What would happen if a lower interest rate was used? Assuming the same mortality table and interest of 1983 IAF and 8.5%

Barbara:
 $12 * 46,000 * (1.075)^5 / 115.39 / 230,000 = 2.986\%$
 Sharon:
 $12 * 1,000 * (1.075)^{22} / 115.39 / 20,000 = 2.553\%$

Sharon's E-BAR is now less than Barbara's E-BAR, and this example would fail cross-testing. It is easy to see why a pre-retirement interest rate of 8.5% is typically used in testing—it normally produces better results. (If there is more than one HCE in the testing group, it is possible that a lower interest will produce better results, but I leave that to a more in-depth discussion of cross-testing.)

Let's go back and look at Barbara again. Suppose she had a calendar year plan that runs from January 1, 2008 – December 31, 2008. She was born May 1, 1948, so her attained age is 60, and in all the examples it was assumed she had five years to retirement. Barbara is actually closer to age 61 at the end of the plan year, so in testing, one could have assumed only four years to retirement.

Using attained age:
 $12 * 46,000 * (1.085)^5 / 115.39 / 230,000 = 3.128\%$
 Using age nearest:
 $12 * 46,000 * (1.085)^4 / 115.39 / 230,000 = 2.883\%$

Using "age nearest" will produce a smaller E-BAR for anyone born in the first half of the plan year. There is no rule regarding when you can use attained age or age nearest, as long as you are consistent with all employees. Therefore, if the HCE (or most of the HCEs, if there are more than one) are born in the first half of the plan year, exercising this option might be enough to enable a plan to pass nondiscrimination testing.

Conclusion

This brief article developed the formula for calculating an E-BAR, which is really the first step in cross-testing. Of course, few will actually hand-calculate those values, depending instead on the accuracy of computer software to generate those numbers. However, based on the formulas shown, it is hoped that one can understand why cross-testing works in the first place. In addition, it was proven that to maximize the owner and still provide the gateway minimum would require a difference of at least 17 years between the HCE and some of the NHCEs. This point implies that one should be able to look at some census data, and based just on ages (without even running any numbers), have a rough idea if a plan is a good candidate for cross-testing. Things get a little more complicated if there is more than one HCE, but at least it is a place to start. Finally, the article indicated why an interest rate of 8.5% is typically used instead of 7.5%, and why the age assumption (nearest vs. attained) may be helpful in testing.

Now that the formula for the E-BAR has been determined, the next step is putting this design to work under the cross-testing rules. A plan can pass the nondiscrimination requirements using either the ratio percentage test or the average benefits test. In addition, there are other possible options, such as imputing permitted disparity, restructuring or "accrued to date" testing of contributions. For now, we will consider those subjects to be "advanced topics" and fodder for future articles. ↗

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