How Many Days Are in a Year?

Philip J. Rushing

The answer is not as simple as it would seem. The typical reply is 365, though if we like to be more technical we can note that every fourth year is a "leap year" with 366 days, so that on average each year has 365.25 days. A borrower calculating a mortgage payment might well respond "Who cares?" since the number of days in a year should be irrelevant to the computation. A banker trying to maximize revenue, however, might answer "360 *and* 365."

I came upon this issue recently while applying for a commercial real estate loan. A mortgage payment is the product of the original loan principal times a mortgage constant (K), defined as

$$K = \frac{i(1+i)^n}{(1+i)^n - 1} \qquad (1)$$

where i is the periodic (usually monthly) interest rate and n is the total number of periods (usually months).

Generally accepted business practice determines a monthly interest rate by dividing the nominal annual rate by 12 (the implicit assumption is that a year, regardless of how many days it contains, is 12 months long). Thus, if the annual rate is 10% and the term is 20 years, then i in the above equation is .10/12, or .00833333, and since there are 240 months in 20 years, n is 240. Substituting these i and n values into equation (1) yields a mortgage constant of .00965022. On a $1,000,000 loan, the monthly payment would be

$1,000,000 x .00965022 = **$9,650.22**.

I was puzzled to find that the bank's computed payment on my recent loan was significantly greater than the payment I had calculated with the technique described above. I can allow for a bit of rounding error, but the difference in question clearly exceeded the acceptable limits. On inquiry, I was told that my calculator and I were assuming 365 days in a year, while the bank computes a daily interest rate based on 360. That response left me even more puzzled, since it should not matter how many days we assume are in a year; indeed, equation (1) incorporates no assumption regarding the number of days in a year.

For example, assume a 260-day "year." We can multiply the daily interest rate of .10/260 = .00038462 by the 260/12 = 21.66 days in each month to compute a .00833333 monthly rate. It should come as no surprise that this "monthly" rate equals the rate computed when we made no assumption regarding the number of days in a year. If payments are computed on a monthly basis, then it does not matter how many days we assume are in a year as long as we treat consistently the numbers of days in a month and months in the year.

Consistency is the key. Consider how the loan payment would be computed under what I am told is "standard banking practice." First, assume 360 days in a year. The daily interest rate is thus .10/360 = .00027778. To get a monthly rate, however, assume a 365-day year. The result is .00027778 multiplied by the 365/12 = 30.4167 days in a month, for a total of .00844914, which exceeds .00833333. Substituting this i value into equation (1) yields a mortgage constant of .00974247 and a resulting payment that is higher by $92.25 per month than that which was previously computed;

.00974247 x $1,000,000 = **$9,742.47**.

The present value of this increase in monthly payments is $9,559.37! Of course, the annual percentage rate is no longer 10%; it has been increased surreptitiously to 10.138968%.

An informal survey indicates that some, but not all, lenders use the "360 *and* 365" procedure. At least one major accounting firm suggests that its S&L clients use this approach as a "revenue enhancement procedure." Since truth in lending laws do not apply to commercial real estate loans, *caveat mutuatur* (let the borrower beware).

Dr. Rushing is an Adjunct Professor of Finance at the University of Illinois and an active real estate investor.

Office of Real Estate Research
University of Illinois at Urbana-Champaign
304-D David Kinley Hall
1407 W. Gregory Drive
Urbana, Illinois 61801

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