

Let D be the disutility of one day in hell. Let d be your one-day discount rate. Let p equal the probability of losing the bet on a given day. This probability is actually a function of your day in hell. On day N ,

$$p = (0.5)^N$$

If you're stuck in hell forever, your expected disutility is

$$D + dD + d^2D + d^3D + \dots = \frac{D}{1 - d}$$

Suppose one day you take the bet. There is a p chance you'll lose and end up in hell forever. The other $(1 - p)$ of the time you would win, escaping hell. We could create a parameter for the value of not being in hell, but this is unnecessary, because D can be defined as the difference between hell and non-hell. Therefore, we can treat non-hell as having a value of zero (i.e., no disutility). Thus, your expected disutility of taking the bet is

$$p \frac{D}{1 - d}$$

If you decide to wait until tomorrow, you experience D now, and then your chance of losing the bet tomorrow is $0.5p$ (because your chance of losing halves every day you wait). So today's expected disutility of taking the bet tomorrow is

$$D + d \cdot 0.5p \frac{D}{1 - d}$$

So you'll prefer betting today over betting tomorrow if

$$p \frac{D}{1 - d} < D + d \cdot 0.5p \frac{D}{1 - d}$$

(You want the strategy with the lower expected disutility, which is why you want today if its value is smaller.) This reduces to

$$p < \frac{1 - d}{1 - 0.5d}$$

And given the definition of p as a function of N , we get the following condition for taking the bet on day N instead of the following day:

$$(0.5)^N > \frac{1 - d}{1 - 0.5d}$$

But you might wonder why I only compare betting today to betting tomorrow; why shouldn't we consider betting sometime in farther in the future? Well, it turns out that if you prefer betting today over betting tomorrow, you also must prefer betting tomorrow over betting the day after tomorrow, and so on for all

future days. To see this, note that the expected disutility of betting the day after tomorrow is

$$D + dD + d^2 \cdot 0.25p \frac{D}{1-i-d}$$

(The 0.25 appears because your chance of losing two days from now is a quarter of the chance of losing today.) Therefore, you'll prefer betting tomorrow over betting the day after tomorrow if

$$D + d \cdot 0.5p \frac{D}{1-i-d} < D + dD + d^2 \cdot 0.25p \frac{D}{1-i-d}$$

This reduces to

$$p \frac{D}{1-i-d} < 2D + d \cdot 0.5p \frac{D}{1-i-d}$$

But if betting today is better than betting tomorrow, a stronger condition that this one is already met, from above:

$$p \frac{D}{1-i-d} < D + d \cdot 0.5p \frac{D}{1-i-d}$$

Thus, preferring betting today over betting tomorrow implies preferring betting tomorrow over betting the day after, ad in...nitum.