1. **Case 2 alternative 1**

It is correct that, for a high beta project, you should discount all cash flows at a high rate. Thus, the higher the risk of the cash outflows, the less you should worry about them because, the higher the discount rate, the closer the present value of these cash flows is to zero. This result does make sense. It is better to have a series of payments that are high when the market is booming and low when it is slumping (i.e., a high beta) than the reverse.

The beta of an investment is independent of the sign of the cash flows. If an investment has a high beta for anyone paying out the cash flows, it must have a high beta for anyone receiving them. If the sign of the cash flows affected the discount rate, each asset would have one value for the buyer and one for the seller, which is clearly an impossible situation.

2. a. The real issue is the degree of risk relative to the investor’s portfolio. If German investors hold a stock portfolio comprised largely of German equities, then they are likely to find that U.S. pharmaceutical stocks are less highly correlated with their portfolios than they are with U.S. stocks, and will therefore have lower betas. This suggests that German investors might require a lower return for investing in U.S. pharmaceutical companies than U.S. investors require. That does not necessarily imply that they should move their R&D and production facilities to the U.S. however. First, there might be extra costs involved in managing the business in a foreign country. Also, R&D that simply serves a German parent company may be more highly correlated with the German market.

b. The answer here depends on the reason that German investors keep much of their money at home. If there are high costs for shareholders to invest overseas, then the German company may well provide its shareholders with a service by providing them with cheap international diversification.

b. Not necessarily. The German company needs to be remunerated only for the risk it is taking relative to its German portfolio. If the German company holds a portfolio comprised primarily of U.S. holdings, then 13% is the appropriate rate.
3. a. Since the risk of a dry hole is unlikely to be market-related, we can use the same discount rate as for producing wells. Thus, using the Security Market Line:

\[ r_{\text{nominal}} = 0.06 + (0.9) \times (0.08) = 0.132 = 13.2\% \]

We know that:

\[ (1 + r_{\text{nominal}}) = (1 + r_{\text{real}}) \times (1 + r_{\text{inflation}}) \]

Therefore:

\[ r_{\text{real}} = \frac{1.132}{1.04} - 1 = 0.0885 = 8.85\% \]

b. \[ NPV_1 = -10\text{million} + \sum_{t=1}^{10} \frac{3\text{million}}{1.2885^t} = -10\text{million} + [(3\text{million}) \times (3.1914)] \]

\[ NPV_1 = -$425,800 \]

\[ NPV_2 = -10\text{million} + \sum_{t=1}^{15} \frac{2\text{million}}{1.2885^t} = -10\text{million} + [(2\text{million}) \times (3.3888)] \]

\[ NPV_2 = -$3,222,300 \]

c. Expected income from Well 1: \[ [(0.2 \times 0) + (0.8 \times 3 \text{ million})] = $2.4 \text{ million} \]

Expected income from Well 2: \[ [(0.2 \times 0) + (0.8 \times 2 \text{ million})] = $1.6 \text{ million} \]

Discounting at 8.85 percent gives.

\[ NPV_1 = -10\text{million} + \sum_{t=1}^{10} \frac{2.4\text{million}}{1.0885^t} = -10\text{million} + [(2.4\text{million}) \times (6.4602)] \]

\[ NPV_1 = $5,504,600 \]

\[ NPV_2 = -10\text{million} + \sum_{t=1}^{15} \frac{1.6\text{million}}{1.0885^t} = -10\text{million} + [(1.6\text{million}) \times (8.1326)] \]

\[ NPV_2 = $3,012,100 \]

d. For Well 1, one can certainly find a discount rate (and hence a "fudge factor") that, when applied to cash flows of $3 million per year for 10 years, will yield the correct NPV of $5,504,600. Similarly, for Well 2, one can find the appropriate discount rate. However, these two "fudge factors" will be different. Specifically, Well 2 will have a smaller "fudge factor" because its cash flows are more distant. With more distant cash flows, a smaller addition to the discount rate has a larger impact on present value.