

Problem 1

According to the World Bank, the [lending interest rate](#) in India in 2016 was 9.7 percent, which we will round to 10 percent. The lending interest rate in the United States was 3.5 percent in 2016.

Suppose there is an entrepreneur in each country that is considering taking out a loan to start their business at the given interest rates. Complete the following table for each country for an imaginary safe project and an imaginary risky project. Suppose if the risky project fails, the borrower pays back nothing.

United States	Safe	Risky
Investment Required	100	100
Project Return (% Chance)	115 (100%)	0 (50%), 200 (50%)
Bank Profits (% Chance)	3.5 (100%)	-100 (50%), 3.5 (50%)
Expected Bank Profits	3.5	-48.25
Borrower Profits (% Chance)	11.5 (100%)	0 (50%), 196.5 (50%)
Expected Borrower Profits	11.5	48.25

India	Safe	Risky
Investment Required	100	100
Project Return (% Chance)	115 (100%)	0 (50%), 200 (50%)
Bank Profits (% Chance)	10 (100%)	-100 (50%), 10 (50%)
Expected Bank Profits	10	-45
Borrower Profits (% Chance)	5 (100%)	0 (50%), 190 (50%)
Expected Borrower Profits	5	45

How much higher, as a percentage, are expected borrower profits for the safe project in the United States compared to India? How does this change for the risky project?

$$\begin{aligned} \% \text{Diff for Safe Project} &= 100 * \left(\frac{\text{Expected Borrower Profits in US for Safe Project}}{\text{Expected Borrower Profits in India for Safe Project}} - 1 \right) = \\ &= 100 * \left(\frac{11.5}{5} - 1 \right) = 130\% \end{aligned}$$

$$\% \text{Diff for Risky Project} = 100 * \left(\frac{\text{Expected Borrower Profits in US for Risky Project}}{\text{Expected Borrower Profits in India for Risky Project}} - 1 \right) =$$

$$= 100 * \left(\frac{48.25}{45} - 1 \right) = 7.2\%$$

Would a safe loan happen in each country? Would a risky loan happen in each country, why or why not? How are the Bank's expected profits impacted by the payoff of the risky project when it succeeds?

The safe loan would happen in both countries. The risky loan would happen in neither country, because the Bank wouldn't earn an expected profit. The bank's expected profits aren't impacted by the payoff of the risky project when it succeeds.

Problem 2

Suppose a bank pays depositors 5%. How high of an interest rate would a bank have to charge on a loan to break even if there is only a 25% chance of full repayment? Suppose that if a borrower defaults, they have zero liability and pay back nothing. Recall the simple formula for breakeven interest rate with no liability is given by:

$$i = \frac{100 + r}{p} - 100$$

This means $r = 5$ (5% deposit rate) and $p = 0.25$ (25% repayment rate). Therefore break even interest rate is:

$$i = \frac{(100 + 5)}{0.25} - 100 = 420 - 100 = 320$$

So the bank must charge a **320% interest rate** to break even.

Suppose we have the same set-up as the previous question, except now if a borrower defaults, they pay back 40% of the initial loan. Recall the general formula for the breakeven interest rate is given by:

$$i = \frac{100 + r - (1 - p)l}{p} - 100$$

What will the break even interest rate be?

This only change is that now $l = 50$ (50%). Therefore break even interest rate is:

$$i = \frac{(100 + 5) - (1 - 0.25)40}{0.25} - 100 = \frac{105 - 30}{0.25} = 300 - 100 = 200$$

So the bank must charge a **200% interest rate** to break even.