Lecture XXVII: A Numerica Example – Commercial Nebraska Farms

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Overview of Nebraska Debt/Equit

- The average return on assets for these farms over this time period was 10.09 % with a standard deviation of 2.38 %.
- The average interest rate over this period was 6.91 %.
- The average debt to asset position for these farms is 17.50 %. Thus, the implied rate of return on equity for these farms is

$$\bar{r}_E = \frac{0.1009 - 0.0691 \times 0.1750}{1 - 0.1750} = 0.1077$$
$$\sigma_E^2 = (0.0238)^2 \frac{1}{(1 - 0.1750)^2} = 0.000830 \Rightarrow \sigma_E = 0.0288 \quad (1)$$

- Given that relatively little debt is used by the farms in aggregate, the leveraging effect of debt has little impact on either farm return or risk.

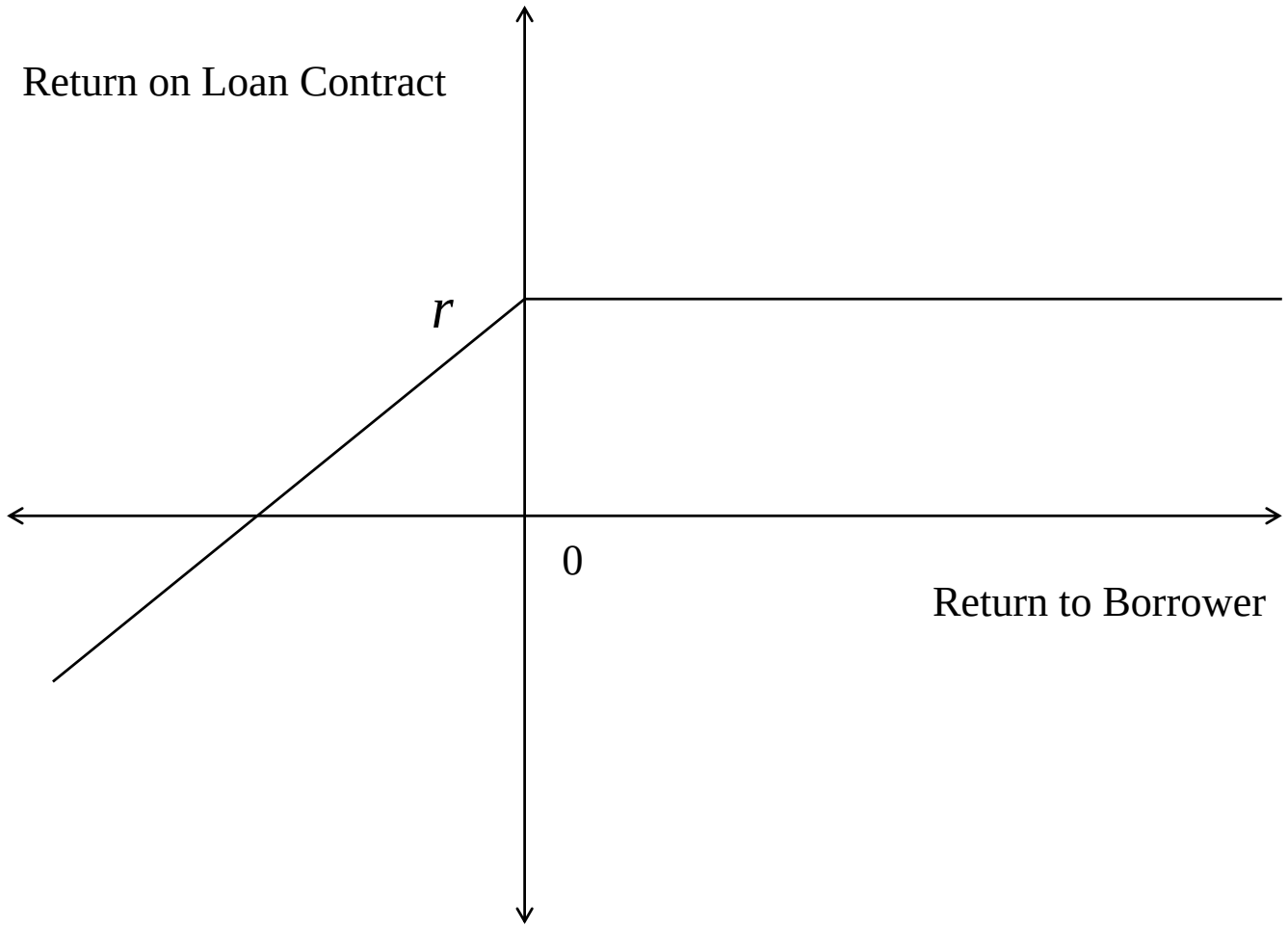
Changes in Debt Level

Debt to Asset	Mean Return to Equity	Std. Dev. of r_E	Probability of Equity Loss
17.5	0.1077	0.0288	0.0001
20.0	0.1089	0.0297	0.0001
25.0	0.1115	0.0317	0.0002
30.0	0.1146	0.0340	0.0004
35.0	0.1181	0.0366	0.0006
40.0	0.1222	0.0396	0.0010
45.0	0.1270	0.0432	0.0016
50.0	0.1328	0.0475	0.0026
55.0	0.1398	0.0528	0.0041
60.0	0.1487	0.0594	0.0062

Increasing Debt-to-Asset Ratio

- Moving from the observed debt to asset ratio to a debt to asset ratio of 40.0 % increases the expected rate of return to equity to 12.22 %, but also increases the standard deviation of this return to 3.96 %.
- These changes imply an increased probability of equity loss ($\mathrm{P}\left[r_E \leq 0\right]$) from 0.01 % to 0.10 %.
- We could extend the formulation to compute the probability of bankruptcy by computing the probability that the rate of return on equity is less than -1.00 (i.e., $\mathrm{P}\left[r_E \leq -1.00\right]$).

Payoff Function for Debt



Critical Rate of Return

- Returning to a question we asked earlier in the semester – what rate of return on assets is low enough to eliminate the operator's equity?

$$\begin{aligned} r_E &= \frac{r_A - \delta K}{1 - \delta} = -1.0 \\ \Rightarrow r_A^* &= -1 + \delta\left(1 + K\right) \end{aligned} \quad . \tag{2}$$

- In this case $r_A^* = -0.5724$.
- Next question, how likely is this event?

$$z = \frac{-0.5724 - 0.1009}{0.0238} = \frac{-67.326}{0.0238} = -28.2882. \tag{3}$$

Not very likely.

- Increasing the debt to asset position to 60.0 % increases the expected rate of return to equity to 14.87 % with an associated increase in the standard deviation of the return of equity to 5.94 %.

- The risk balancing model developed by Collins 1985 does not address several parts of the credit problem.
  - The model addresses profitability and the leveraging of risk.
  - It does not address liquidity – an important issue when most of the return to equity is from capital (land) appreciation.
- Creditors develop credit worthiness on three aspects: Profitability, Liquidity, and Solvency.