ECON 612: MONEY AND BANKING

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MORAL HAZARD*

SOLUTIONS AND EXPLANATIONS

COLOR LEGEND

- HEADINGS
- GIVEN/PREVIOUSLY FOUND INFORMATION
- CONCEPTS YOU SHOULD ALREADY KNOW
- ANSWER
- ANNOTATIONS AND EXTRA EXPLANATIONS

* A COPY OF THE PROBLEMS IS ATTACHED AT THE END OF THIS DOCUMENT. THERE MAY BE SOME DIFFERENCES BETWEEN THIS VERSION AND THE ONE AVAILABLE ON CANVAS.

GIVEN INFORMATION

$E = \$100$ — THIS IS THE FIRM'S RETAINED EARNINGS.

$I(Sa) = \$0$ — THIS IS THE INVESTMENT REQUIRED FOR PROJECT 1 (SAFE).

$I(R) = \$30$ — THIS IS THE INVESTMENT REQUIRED FOR PROJECT 2 (RISKY).

$L = \$100$ — THIS IS THE BOND/"LOAN" THE FIRM MUST TAKE OUT AND REPAY.

$D(Sa) = \$100$ — THIS THE DIVIDEND PAID TO SHAREHOLDERS FOR PROJECT 1 (SAFE).

$D(R) = \$70$ — THIS THE DIVIDEND PAID TO SHAREHOLDERS FOR PROJECT 2 (RISKY).

$S(Sa) = \$110$ — THIS IS THE BOOM/SUCCESSFUL OUTCOME FOR PROJECT 1 (SAFE).

$P(S|Sa) = 0.5$ — THIS IS THE PROBABILITY OF PROJECT 1 (SAFE) BOOMING.

$F(Sa) = \$70$ — THIS IS THE BUST/UNSUCCESSFUL OUTCOME FOR PROJECT 1 (SAFE).

$P(F|Sa) = 0.5$ — THIS IS THE PROBABILITY OF PROJECT 1 (SAFE) BUSTING.

$S(R) = \$200$ — THIS IS THE BOOM/SUCCESSFUL OUTCOME FOR PROJECT 2 (RISKY).

$P(S|R) = 0.5$ — THIS IS THE PROBABILITY OF PROJECT 2 (RISKY) BOOMING.

$F(R) = \$5$ — THIS IS THE BUST/UNSUCCESSFUL OUTCOME FOR PROJECT 2 (RISKY).

$P(F|R) = 0.5$ — THIS IS THE PROBABILITY OF PROJECT 2 (RISKY) BUSTING.

1. **CONCLUSION**

   THE PRINCIPAL IS THE BONDHOLDERS AND THE AGENT IS THE FIRM/SHAREHOLDERS.

2. **CONCLUSION**

   PROJECT 1 IS SAFER AND PROJECT 2 IS RISKIER.

3. **FINDING $R(A|Sa)$** — THIS IS THE NET RETURN OF THE SAFE PROJECT FOR THE SHAREHOLDERS/AGENT.

$$R(A|Sa) = D(Sa) + P(S|Sa)[S(Sa) - L] + P(F|Sa)[F(Sa) - L]$$ SUBSTITUTE GIVEN VALUES

$$= 100 + 0.5(110 - 100) + 0.5(\underbrace{70 - 100}_{\text{THE BORROWER IS COVERED BY LIMITED LIABILITY, SO THE MOST THEY COULD REPAY IS } F(Sa) = \$70.})$$

$$R(A|Sa) = \$105$$

FINDING $R(A|R)$ — THIS IS THE NET RETURN OF THE RISKY PROJECT FOR THE SHAREHOLDERS/AGENT.

$$R(A|R) = D(R) + P(S|R)[S(R) - L] + P(F|R)[F(R) - L]$$ SUBSTITUTE GIVEN VALUES

$$= 70 + 0.5(200 - 100) + 0.5(\underbrace{5 - 100}_{\text{THE BORROWER IS COVERED BY LIMITED LIABILITY, SO THE MOST THEY COULD REPAY IS } F(R) = \$5.})$$

$$R(A|R) = \$120$$

CONCLUSION

SINCE $R(A|R) > R(A|Sa)$, SHAREHOLDERS PREFER RISKY.

4. **FINDING $R(P|Sa)$** — THIS IS THE NET RETURN OF THE SAFE PROJECT FOR THE BONDHOLDERS/PRINCIPAL.

$$R(P|Sa) = P(S|Sa)[S(Sa) \text{ OR } L] + P(F|Sa)[F(Sa) \text{ OR } L]$$ SUBSTITUTE GIVEN VALUES

$$= 0.5(100) + 0.5(70)$$ ← CHOOSE THE SMALLER VALUE →

$$R(P|Sa) = \$85$$

FINDING $R(P|R)$ — THIS IS THE NET RETURN OF THE RISKY PROJECT FOR THE BONDHOLDERS/PRINCIPAL.

$$R(P|R) = P(S|R)[S(R) \text{ OR } L] + P(F|R)[F(R) \text{ OR } L]$$ SUBSTITUTE GIVEN VALUES

$$= 0.5(100) + 0.5(5)$$ ← CHOOSE THE SMALLER VALUE →

R(PIR) = $52.50

CONCLUSION

SINCE R(PISa) > R(PIR), BONDHOLDERS PREFER SAFE.

5 CONCLUSION

LENDERS USE THE FOLLOWING METHODS:

- ASKING FOR COLLATERAL, WHICH INCREASES LIMITED LIABILITY.
- LIMITING THE DEBT/LOAN SIZE.
- INCREASING CAPITAL FROM THE BORROWER BY ASKING THE BORROWER TO PUT IN MORE OF THEIR OWN SHARE IN THE PROJECT.
- ESTABLISHING COVENANTS IN LOAN CONTRACTS THAT BAR CERTAIN ACTIONS BY THE BORROWER AFTER THEY RECEIVE THE LOAN.

Moral Hazard

A firm has the following options with retained earnings of $100:

Project 1: No investment

Project 2: Make $30 investment

Additionally, the firm must take out a bond of $100 and repay the bondholders. The following questions aim to show that what is in the best interest of the shareholder is not what is in the best interest of the bondholders. Use **Table 1.3** below for each of the following questions:

TABLE 1.3 Payoffs Related to Different Investment Opportunities

	State of Nature	
Strategy	Boom (with probability 0.5)	Bust (with probability 0.5)
Total firm value at $t = 1$ if no investment made and $100 dividend paid at $t = 0$	$110	$70
Total firm value at $t = 1$ if $30 investment made and $70 dividend paid at $t = 0$	$200	$5

(1) Identify the principal and agent in this problem.
(2) Identify which project is safer and which is riskier.
(3) Find which project the shareholder prefers.
(4) Find which project the bondholders prefer.
(5) How do lenders resolve this in debt contracts/bonds? List methods.