Week 12: Risk Management

• Financial constraints provide rationale for corporate risk management
  ◦ If firms’ net worth matters, then firms are as if risk averse
  ◦ Collateral constraints link financing and risk management
  ◦ More constrained firms hedge less and often completely abstain

• Readings: Rampini/Viswanathan (2010), Collateral, risk management, and the distribution of debt capacity

• See also: Tirole (2006), Section 5.4

Corporate Risk Management

• Why should firms hedge?
  ◦ Firms are risk neutral, why hedge?
  ◦ Financial constraints make firms risk averse
    • Firms’ value function concave in net worth

• Financing vs. risk management trade-off
  ◦ Limited enforcement: Need to collateralize promises to financier and counterparties
  ◦ Collateral constraints link financing and risk management
  ◦ More constrained firms hedge less as financing needs dominate hedging concerns

• Relatedly for households: Financing vs. insurance trade-off
  ◦ “The poor can’t afford insurance”
Risk Management à la Rampini/Viswanathan (2010, 2013)

- Environment (as in Class 9 (pages 76-81) but here with uncertainty)
  - Time 0, 1, & 2; uncertainty: state \( j \in J \) at time 1 - probability \( p_j \); e.g., \( J = \{H, L\} \)
  - Two types of agents, owner/borrower and investor/lender

- Preferences
  - Borrower is risk neutral, impatient \( \beta \), and subject to limited liability
  - Lender is risk neutral and discounts at \( R^{-1} \in (\beta, 1) \)

- Endowments
  - Borrower has limited funds \( w > 0 \) at time 0; lender has deep pockets

- Technology
  - Capital \( k \) invested at time 0 yields stochastic payoff ("cash flow") in state \( j \) at time 1
    \[ A_j f(k) \]
  - Capital \( k' \) invested at time 1 yields deterministic payoff \( A f(k') \) at time 2
  - Strict concavity \( f_k(k) > 0; f_{kk}(k) < 0 \); also: \( \lim_{k \to 0} f_k(k) = +\infty \); \( \lim_{k \to \infty} f_k(k) = 0 \)
  - Capital is durable and depreciates at rate \( \delta \); capital \( k(1 - \delta) \) remains next period

- Collateral constraints: Need to collateralize all promises to pay with tangible assets
  - Can pledge up to fraction \( \theta < 1 \) of value of depreciated capital

Firms are Effectively Risk Averse about Net Worth

- Firm’s problem at time 1 (given net worth \( w_j \) in state \( j \)) (working backwards)
  \[
  \max_{\{d_1, d_2, k', b'\}} d_1 + \beta d_2
  \]
  subject to budget constraints and collateral constraint
  \[
  w_j + b' \geq d_1 + k'
  \]
  \[
  A f(k') + k'(1 - \delta) \geq d_2 + Rb'
  \]
  \[
  \theta k'(1 - \delta) \geq Rb'
  \]
  and limited liability \( d_1, d_2 \geq 0 \)

- First-order conditions (multipliers \( \mu, \mu', \) and \( \lambda \))
  \[
  1 \leq \mu, \quad \beta = \mu', \quad \mu = \mu' A f_k(k') \quad + \quad (1 - \delta) + \lambda \theta (1 - \delta), \quad \mu = \mu' R + \lambda R
  \]

- Optimal investment/capital \( k' \) solves
  \[
  \mu = \beta \frac{A f_k(k') + (1 - \delta)(1 - \delta)}{\theta}
  \]
  - Dividend paying firm: If \( \mu = 1 \), then \( k' = \bar{k} \) which requires at least net worth \( \bar{w} = \bar{\theta} \bar{k} \)
  - Constrained firm: If \( w < \bar{w}, k' = w/\theta \) and \( \mu = \beta[A f_k(w/\theta) + (1 - \theta)(1 - \delta)]/\theta \)
  - Marginal value of net worth is \( \mu \)
  - Value function \( v(w) \) is concave (for \( w < \bar{w} \)): \( d\mu/dw = \beta A f_k(w/\theta)/\theta^2 < 0 \)
Corporate Risk Management Problem

- **Firm’s problem at time 0** (given net worth \(w\) and given time 1 value function \(v\))
  - Collateral constraint for state contingent borrowing \(b_j\)
    \[
    \theta k (1 - \delta) \geq R b_j
    \]
  - Equivalently, borrow as much as possible and hedge \(h_j \equiv \theta k (1 - \delta) - R b_j \geq 0\)
  - **Firm’s risk management problem**
    \[
    \max_{\{d_0, w_j, k, h_j\}} \quad d_0 + \beta \sum_{j \in J} p_j v(w_j)
    \]
    subject to budget constraints and **short sale constraints**, for all \(j \in J\),
    \[
    w_j \geq d_0 + \psi k + R^{-1} \sum_{j \in J} p_j h_j
    \]
    \[
    A_j f(k) + (1 - \theta) k (1 - \delta) + h_j \geq w_j
    \]
    \[
    h_j \geq 0
    \]
    and limited liability \(d_0 \geq 0\)

- First-order conditions (multipliers \(\mu_o, p_j \mu_j, \text{ and } p_j \lambda_j\))
  \[
  \phi \mu_0 = \sum_{j \in J} p_j \mu_j [A_j f(k) + (1 - \theta)(1 - \delta)], \quad \beta v_n(w_j) = \mu_j
  \]
  \[
  \mu_0 = \mu_j R + \lambda_j R
  \]

Financing vs. Risk Management Trade-off

- **Investment Euler equation** (rewriting first order condition for investment)
  \[
  1 = \sum_{j \in J} p_j \frac{\mu_j A_j f(k) + (1 - \theta)(1 - \delta)}{\varphi}
  \]
  \[
  \geq p_j \frac{\mu_j A_j f(k) + (1 - \theta)(1 - \delta)}{\varphi}
  \]
  - As net worth \(w \to 0\), capital \(k \to 0\) and marginal product \(f_k(k) \to \infty\)
  - Therefore, marginal value of net worth in state \(j\) (relative to at time 0) \(\mu_j/\mu_0 \to 0\)
  - Using first order condition for hedging
    \[
    \lambda_j/\mu_0 = R^{-1} - \mu_j/\mu_0 > 0
    \]
    so severely constrained firms do not hedge at all

- Financing risk management trade-off
  - Hedging uses up net worth which is better used to purchase additional capital
    - If firms hedge, they hedge states with low net worth due to low cash flows
Why Was This Not Previously Recognized?

  - 5 reasons provided (beyond “transactions costs”)
    - (i) market power; (ii) serial correlation of profits; (iii) aggregate risk; (iv) asymmetric information; (v) incentives
  - Fact that hedging uses up net worth is not listed
    - That said, Holmström/Tirole (2000) come close

- No financing risk management trade-off in previous models
  - Models consider risk management using frictionless markets
    - Without imposing same frictions on financing and hedging, no trade-off
  - Models have no financing in first period where firms hedge
    - Without investment which requires financing, no trade-off

- Intuitive, but dubious, conclusion: More constrained firms hedge more
  - Froot/Scharfstein/Stein (1993)
  - In practice, more constrained (and smaller) firms hedge less!

Conclusions

- Corporate risk management
  - Rationale
    - Financial constraints make firms as if risk averse
  - Trade-off between financing and risk management
    - Promises to financiers and hedging counterparties need to be collateralized
    - Severely constrained firms hedge less or not at all
      - ... both in theory and in practice
    - Such firms may be more susceptible to downturns
Week 12: Risk Management (Cont’d)

• Why is household risk management so limited?
  ◦ Laboratory: Rainfall insurance in rural Indian households
  ◦ Methodology: Randomized Controlled Trials (RCT) in field and survey
  ◦ Factors: Price, liquidity constraints(!), trust, literacy, salience ...
  ◦ New frontier in microfinance: Microinsurance (next new frontier: microleasing)

• Readings: Cole/Giné/Tobacman/Topalova/Townsend/Vickery (2013), Barriers to household risk management: Evidence from India

Rainfall Insurance in Village India à la Cole et al. (2013)

• Insurance in village India (Andhra Pradesh and Gujarat)
  ◦ Rainfall important (indeed primary) source of exogenous income risk
  ◦ “Index insurance” products pay off when there is too little/too much rain

• Methodology
  ◦ Randomized Controlled Trials (RCT) in field – treatments
    • Price: Discounts
    • Trust: Endorsements from microfinance institution, peer, or teacher
    • Liquidity constraints: Cash compensation after household visit
    • Literacy: Financial education
    • Salience: Household visit
    • Framing: Individual vs. group; religion – no effect except religion

• Noteworthy summary statistic (Table 2)
  ◦ Discount rate 0.75 per month over 3 month Monsoon season 0.43(!)

• Non-experimental evidence
  ◦ Regressions of insurance uptake on household characteristics (incl. skills)
Barriers to Rainfall Insurance in Village India

- **Price sensitivity** (Table 6) – Survey: “It is not good value”
  - Price discounts have significant effect (10% price reduction increases demand by 11%)

- **Liquidity constraints** (Table 5) – Survey: “Insufficient funds to buy insurance”
  - Cash reward significant effect on uptake ($\approx 40\%$ increase) (especially for poor)
  - Insurance demand higher for wealthy households (Tables 5/8)
  - Or reciprocity?

- **Literacy**: Financial education has negligible effect (typical finding in literature) (Table 5)

- **Salience**: Household visit has significant effect (12-17% increase) (Table 5)

- **Trust** (Tables 5/6) – Survey: “It does not pay out when I suffer a loss”
  - Survey households & households that know microfinance institution more likely to buy
  - Prior experience with insurance and “quantitative skills” increase uptake (Table 8)

- **Risk aversion has negative effect** (Table 8)

- **Ignored**: Basis risk

- Claim (in conclusions)
  - Bundling insurance and credit with state-contingent loans could help
  - Unsuccessful in field experiment in Malawi – what does our model say?

Household Risk Management

- **Households’ insurance coverage increases with wealth and age**
  - Health & long-term care insurance coverage increases with income
  - Health insurance increases with age
  - Flood insurance coverage increases with income (at state level)
  - Life insurance lapsation decreases with income – Fang/Kung (2012)

- **Explanations?**
  - Variation in cross section: Financial constraints, but also literacy, fixed costs, trust
  - Within household variation in panel data: Financial constraints!

- **Critique**: What if households use informal instead of formal insurance?
  - Townsend (1994), Risk and insurance in village India
    - Look at consumption data since households use informal insurance mechanisms
    - “… evidence that the landless are less well insured than their village neighbors in one of the three villages”
  - Blundell/Pistaferri/Preston (2008): In consumption data for U.S. households
    - “… full insurance of transitory shocks except among poor households”

- **Puzzle?** – “The poor cannot afford insurance”

  “… the near absence of derivatives markets for real estate … is a striking anomaly that cries out for explanation and for actions to change the situation.” – Shiller (2008)
Evidence on Corporate Risk Management

- **Size pattern in derivatives use**
  - Positive relation between size (and dividend yield) and hedging – Nance et al. (1993)
  - Derivatives use increases from 33% to 90% across firm size quartiles – Géczy et al. (1997)

  - Strong positive relation between net worth and hedging in panel data
  - Dramatic decline in hedging as airlines approach distress (subsequently slow recovery)

- Still confused about financing and risk management – *Wall Street Journal* [Dec 5, 2012]
  - “Forward contracts are convenient for small businesses because they generally don’t have any upfront cost, and business owners can lock in a forward contract up to a year ahead.”
  - “Certainly many small companies are still uncomfortable with hedging. Startups, which are generally strapped for resources, typically can’t afford it.”

- Financing vs. risk management trade-off reconciles seemingly contradictory statements

Conclusions

- **Household risk management**
  - Liquidity constraints, price, as well as trust, literacy, and salience as barriers
  - Most important reason for not buying insurance “insufficient funds”

- **Basic relation between financing and insurance/risk management**
  - Among Indian farmers, U.S. households, and in corporate America
    - ... more constrained are less well insured!