FIN 501
Financial Economics

Risk Management in the “states” model

Professor Nolan Miller

Standard view of risk

- Consider the following choices:

A: $1000 B: Flip a coin; Heads = $0, Tails = $2000

Standard view of risk

- Consider the following choices:

  A: $1000 B: Flip a coin; Heads = $0, Tails = $2000

- These options have the same expected (average) value.

  ½ (0) + ½ (2000) = $1000

- Option B is risky, while option A is safe.

- Most people would choose A over B.

Risk aversion

- Most people, in most decisions dislike risk to some degree.
- We refer to this as being **Risk Averse**
- Risk Averse individuals must be compensated for holding risky assets rather than safe ones.
- Risk aversion accounts for why different asset classes have different average (expected) returns.

Risk Aversion and Asset Prices

- Suppose that a risky stock, like GM, has the same expected return as a safe asset, like government bonds.
- If investors dislike risk, then if the two assets have the same return, they prefer the asset with lower risk (bonds).
- Sell GM, buy bonds.
- Price of GM goes down, price of bonds goes up.
- ***Prices and returns are inversely related.***
- Result: when things stabilize, GM has a higher return than government bonds.

Risk Aversion and Asset Prices

- Higher return to GM compensates investor for holding the risky assets.
- Investors can simultaneously choose to hold both:
  - Bonds: low risk, low return
  - Stocks: high risk, high return

The “states” view of risk

- The standard approach (i.e., risky assets are random variables) provides a useful view of risk.
- Logic behind CAPM and other models.
- How do divide wealth between safe and risky assets.
- One thing it is not very good at is giving an intuition for ideas like risk management, hedging, which assets mitigate or augment the risk a firm faces, etc.
- For questions such as these, the “states” approach to risk is particularly helpful.

Risk Management

- One of the tasks of decision makers/investors is to manage risk.
- Often, this amounts to identifying situations where the investor will have high- and low-value of additional resources and finding ways to shift resources between these states.
- When do individuals have high value for additional income?
  - Recessions (low income)
  - Idiosyncratic negative shocks (health, fire damage, car crash, product failure, adverse legal judgment)
  - High-value business opportunities
- In each of these cases, investor might like to be able to shift income from states with low value of resources to high value of resources.

States

- A “state” refers to a particular situation (time, place, resources, etc.)
- Whether a state is good or bad depends on the decision maker’s objective, preferences, and resources.
- Rain may be bad for amusement parks but good for farmers.
- Examples:
  - Car crash
  - Pandemic reduces business demand
  - Bad crop conditions increase food prices
  - Etc.

What is a "high-value state"

- In high-value states of the world, a decision maker would benefit a lot from having additional (marginal) resources.
  - Car accident – money to fix car.
  - Health crisis – money for hospital bills.
  - Restaurant in pandemic – money to pay bills during shut down.
  - Firm needs money to bring product to market.
- In low-value states, the decision maker would not benefit very much from having additional resources.
  - Firm already has a lot of savings/cash available.
  - Few good opportunities to spend resources on.
- Often times, high-value = low resources and low-value = high-resources, but this is not necessarily the case.

Risk management as shifting resources between states

- Often managing risk involves using financial instruments to shift resources from good states to bad states.
- Not going to go into general theory, but let's work through a some of simple examples of how adding different assets to one's portfolio affect its risk.

Boom and Bust

- Two states of the economy next year
- Boom (good)
  - High assets
  - Additional assets have low value.
- Bust (bad)
  - Low assets
  - Additional assets have high value.
- Investor would be willing to reduce assets in Boom in order to increase in Bust.

	Boom	Bust
Prob.	0.5	0.5
Asset Value	$10,000	$5000
Value of $1	Low	High

How do various potential investments now help or harm the firm's future financial position?

XYZ: Countercyclical Stock

- Consider stock XYZ, worth $0.50 in a Boom and $1 in a Bust.
- Price is $0.75
- Would you want to buy it at price $0.75?
- Every share of XYZ reduces resources in Boom by $0.25 and increases resources in Bust by $0.25

	Boom	Bust
Prob.	0.5	0.5
Asset Value	$10,000	$5000
Value of $1	Low	High
XYZ	$0.5	$1
Price	$0.75	$0.75
Net Impact	-$0.25	+$0.25

XYZ: Countercyclical Stock

- Shifts resources from low value state (Boom) to high value state (Bust).
- This is beneficial.
- In fact, buying 10,000 shares of XYZ would equalize assets across Boom and Bust at $7,500.

	Boom	Bust
Prob.	0.5	0.5
Asset Value	$10,000	$5000
Value of $1	Low	High
XYZ	$0.5	$1
Price	$0.75	$0.75
Net Impact	-$0.25	+$0.25

XYZ: Countercyclical Stock

- Because of this risk reduction value, investor might even be willing to pay more than $0.75 for a share.
- Pay extra for insurance value of XYZ.

	Boom	Bust
Prob.	0.5	0.5
Asset Value	$10,000	$5000
Value of $1	Low	High
XYZ	$0.5	$1
Price	$0.75	$0.75
Net Impact	-$0.25	+$0.25

ABC: Procyclical stock

- Consider stock ABC, worth $1 in a Boom and $0.50 in a Bust.
- Price is $0.75
- Would you want to buy it at price $0.75?

	Boom	Bust
Prob.	0.5	0.5
Asset Value	$10,000	$5000
Value of $1	Low	High
ABC	$1	$0.5
Price	$0.75	$0.75
Net Impact	+$0.25	-$0.25

ABC: Procyclical stock

- At a price of $0.75, it shifts resources from Bust to Boom.
- Increases risk.
- Investment not desirable at this price.
- Price would have to be lower for the investor to buy ABC.

	Boom	Bust
Prob.	0.5	0.5
Asset Value	$10,000	$5000
Value of $1	Low	High
ABC	$1	$0.5
Price	$0.75	$0.75
Net Impact	+$0.25	-$0.25

Risk Premium

- Since prices and returns are inversely related, lower price means higher return.
- Investors would have to be given a higher return in order for them to be willing to hold ABC.
- The mechanism the market uses to offer *higher returns* is for the asset to have a *lower price.*

ABC: Procyclical Stock

- What if price is $0.6?
- At the lower price, investor gains $0.4 in Boom for every $0.1 lost in Bust.
- May be desirable, even though resources are less valuable in Boom.
- If not, price may have to fall even further to induce investors to hold ABC.
- Risky assets must have higher returns to compensate for risk.

	Boom	Bust
Prob.	0.5	0.5
Asset Value	$10,000	$5000
Value of $1	Low	High
ABC	$1	$0.5
Price	$0.6	$0.6
Net Impact	+$0.4	-$0.10

Short Sale of ABC

- Consider stock ABC, worth $1 in a Boom and $0.50 in a Bust.
- Price is $0.75
- Would you want to SELL it at price $0.75?
- Now it shifts resources from Boom to Bust.
- Same as XYZ.

	Boom	Bust
Prob.	0.5	0.5
Asset Value	$10,000	$5000
Value of $1	Low	High
ABC	-$1	-$0.5
Price	$0.75	$0.75
Net Impact	-$0.25	+$0.25

Bust Insurance

- Insurance policy pays $1 in a Bust.
- Price is $0.5.
- Would you buy it?
- Shifts resources from Boom to Bust.
- Note: works the same as buying XYZ or shorting ABC.

	Boom	Bust
Prob.	0.5	0.5
Asset Value	$10,000	$5000
Value of $1	Low	High
Insurance	$0	$1
Price	$0.5	$0.5
Net Impact	-$0.5	+$0.5

Risk management

- Risk management (e.g., insurance, hedging strategy, portfolio strategy) is about shifting resources from low-value states to high-value states.
- Assets that naturally accomplish this will be valued by investors (prices increase, returns decrease).
- Assets that do the reverse are risky for the firm to hold, and investors will require an additional risk premium to be willing to invest in them.
- Financial innovation is often about identifying particular high-value states and creating financial innovations that shift resources to those states.

Implications: asset pricing

- This view of risk helps investors/analysts think about how assets fit into overall portfolios.

- If the asset's high returns occur when the investor's marginal resource value is high, this is good.
  - Crop insurance for farmers pays when farm income is low.
  - Business insurance pays during shut down.
  - Subsidiary business lines that do well when main business does poorly (e.g., firms that offer luxury and necessity products, local BMW/Honda dealer).

- If the asset's high returns occur when the investor's marginal resource value is low, this is bad.
  - Insurance that refunds part of your premium if no loss occurs.
  - State of Illinois bonds do well when the state does well, which is when I am least likely to get fired.