E: Efficient risk sharing, part 1

Risk sharing example: **biofuels startup**

Founder's options:

1. Current salary: **$100k**
2. Startup with uncertain payoffs:

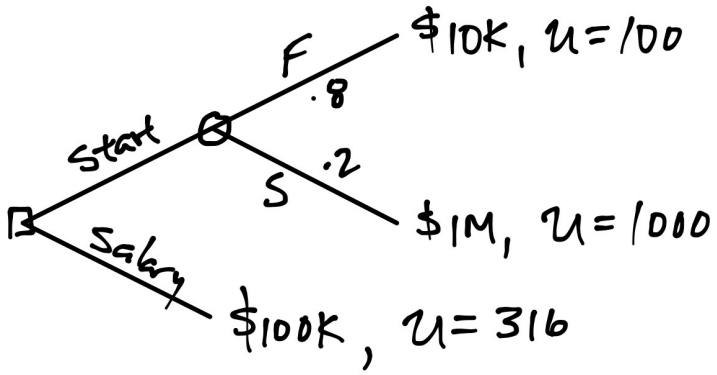
State	Probability	Payoff
Success (S):	20%	$1M
Fail (F):	80%	$10k

EV of startup: 0.8*($10k) + 0.2*($1M) = **$208k**

Founder is risk averse:

$u(c_i) = c_i^{0.5}$

Founder's tree:



Expected **utility** (EU) for startup:

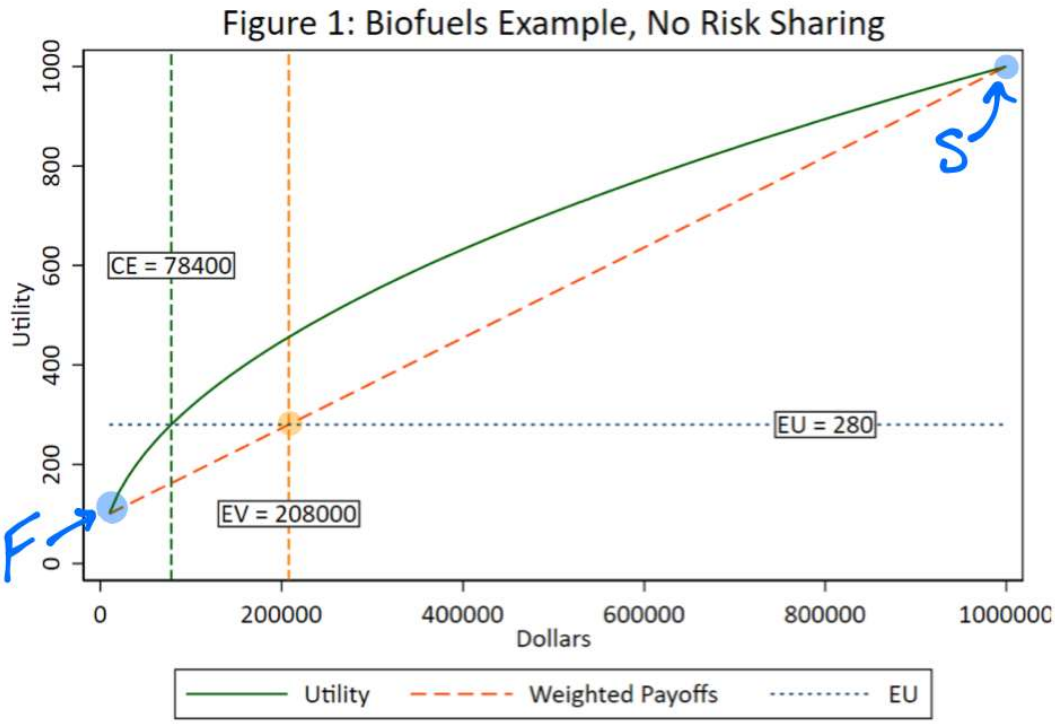
$$EU = 0.8 * 100 + 0.2 * 1000 = \mathbf{280}$$

Less than EU of salary: won't do the startup

Certainty equivalent (CE) of the startup:

$$CE^{0.5} = 280$$
$$CE = \$\mathbf{78.4k}$$

Graphing:



Gap between founder's EV and CE:

$208k - $78.4k = **$129.6**

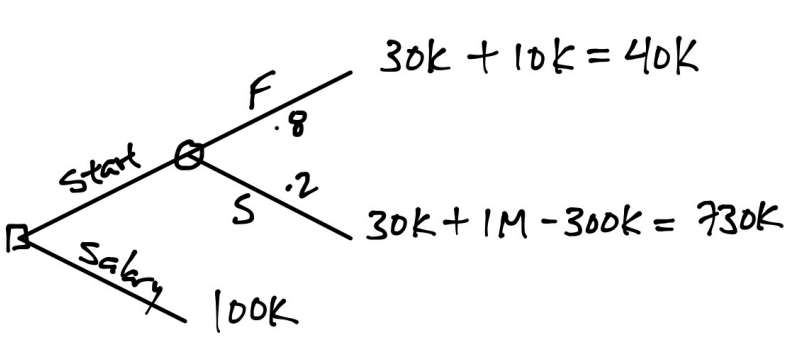
Venture Capitalist (VC):

- Risk neutral
- Doesn't have the IP to launch startup on own
- Can give insurance or incentives

Offers contract:

1. **Pays founder $30k** if tries startup
2. **Takes 30% of payoff** if startup **succeeds**

Founder's new decision:



U=200

U=854

U=316

Founder's EV and EU

EV = 0.8*(40,000) + 0.2*(730,000) = **178,000**

EU = 0.8*(200) + 0.2*(854) = **331**

EU > 316:

Satisfies the participation condition: founder accepts

How large is the founder's gain?

Certainty equivalent:

$CE^{0.5} = 331$

CE = **$109,000**

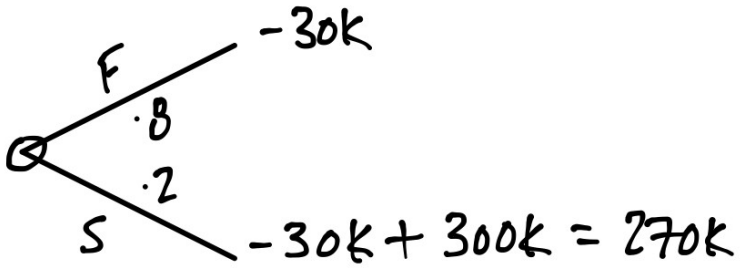
Founder better off by $9k vs salary

How much did the founder give up?

EV of startup - EV of contract:

208,000 - 178,000 = 30,000

VC's view:



EV = 0.8*(-30,000) + 0.2*(270,000) = 30,000

Overall:

- Both parties better off

- Contract produces an efficiency gain:

Founder:	$9k
VC:	$30k
Total:	$39k

Exercise on GC