RISK → uncertain

→ Fluctuation of return

From normal level

↓

Average

Mean of return weighted by probability

$$E(V) = \text{sum of } \text{Prob} \times \text{payoff}$$

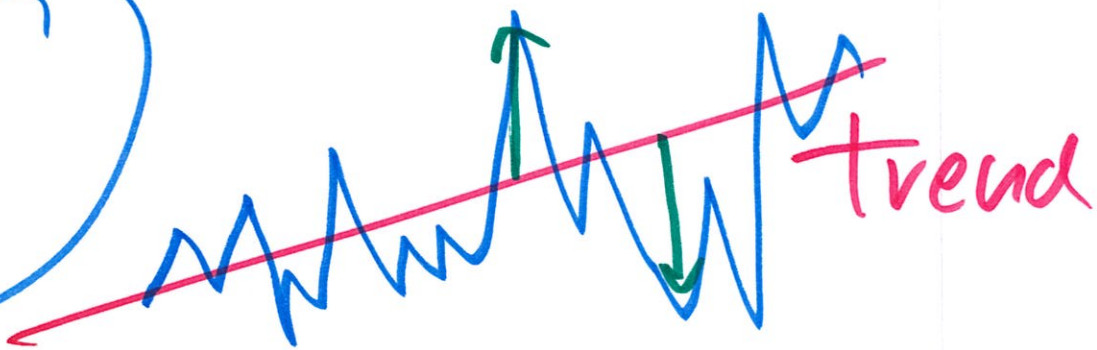
invest for 100 millions baht

possibility	Expected Payoff (0.8) Normal time (best case)	(0.2) Recession
① shopping center	180	-90
② condominium	120	110

probability

RISK ②

→ standard deviation

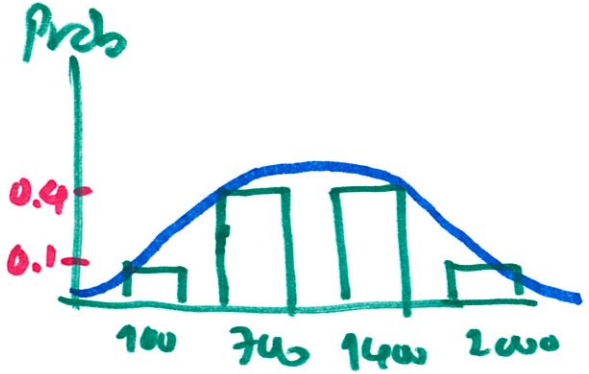


Possibility	Prob	Payoff	E(V) Prob x Payoff	(Deviation)^2 [Payoff − E(V)]^2
# 1	0.1	100	0.1 (100)	$(100 - 1050)^2 = (-950)^2$
# 2	0.4	700	0.4 (700)	$(700 - 1050)^2 = (-350)^2$
# 3	0.4	1400	0.4 (1400)	$(1400 - 1050)^2 = (+350)^2$
# 4	0.1	2000	0.1 (2000)	$(2000 - 1050)^2 = (+950)^2$

E(V) = sum (Prob x Payoff)

= 0.1(100) + 0.4(700) + 0.4 (1400) + 0.1(2000)

= 1,050



variance = sum [Prob x (Deviation)^2]

= 0.1 (902,500) + 0.4 (122,500) + 0.4 (122,500)
+ 0.1 (902,500)

= 278,500

standard deviation = $\sqrt{\text{variance}}$

= $\sqrt{278,500}$ = 528

Hedging → buy two different assets, whose prices/returns move on different direction

Probability		Payoff of possibility: GE (I)	Texaco (II)
oil price increase	1/2	100	120
oil price decrease	1/2	120	100

Strategy: Buy only ONE asset 1) calculate E(V)

① Buy GE (I) $E(V) = \frac{1}{2}(100) + \frac{1}{2}(120) = 110$

② Buy Texaco (II) $E(V) = \frac{1}{2}(120) + \frac{1}{2}(100) = 110$

Calculate variance & standard deviation

$$SD \rightarrow \sigma_{GE} = \sqrt{\frac{1}{2}(100-110)^2 + \frac{1}{2}(120-110)^2}$$

$$= \sqrt{100}$$

$$= 10$$

$$\sigma_{TEXAO} = \sqrt{\frac{1}{2}(120-110)^2 + \frac{1}{2}(100-110)^2}$$

$$= \sqrt{100}$$

$$= 10$$

Strategy → invest in both asset

Payoff table

Possibility	GE	TAXACO	Total Payoff	Prob
oil price decrease # 1	60	50	110	1/2
oil price increase # 2	50	60	110	1/2

① Calculate E(V)

$$E(V)_{\text{Hedging}} = \frac{1}{2}(110) + \frac{1}{2}(110) = 110$$

② calculate standard deviation

$$SD = \sqrt{\frac{1}{2}(110-110)^2 + \frac{1}{2}(110-110)^2} = 0$$

By hedging strategy, we must eliminate risk

→ STD = 0

spreading → Buying more than one asset

But, these assets should not be completely related → could move in the same direction or opposite direction

Payoff Table

Possibility		GE	Microsoft	total payoff	Prob
# 1	price move in the same side (increase)	60	60	120	1/4
# 2	only GE price increases	60	50	110	1/4
# 3	only MS price increases	50	60	110	1/4
# 4	prices of two aiset decrease	50	50	100	1/4

① CALCULATE E(V)

$$E(V)_{spreading} = \frac{1}{4}(120) + \frac{1}{4}(110) + \frac{1}{4}(110) + \frac{1}{4}(100)$$

$$= \frac{1}{4}(440) = 110$$

② CALCULATE STANDARD DEVIATION

$$SD = \sqrt{\frac{1}{4}(120-110)^2 + \frac{1}{4}(110-110)^2 + \frac{1}{4}(110-110)^2 + \frac{1}{4}(100-110)^2}$$

$$= \sqrt{50} = 7.1$$