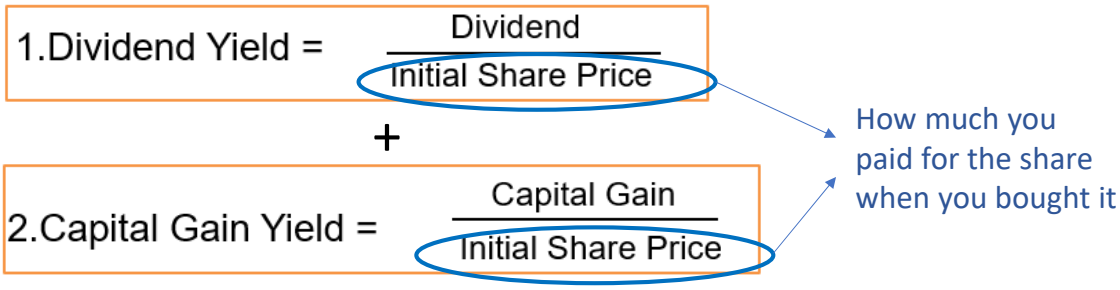
FIN2704/X
Week 4

Return

Total percentage return =



Real rate of return

- What was the return in terms of the increase in purchasing power relative to initial investment purchasing power?
- Inflation rate
  - Example: https://www.mas.gov.sg/news/monetary-policy-statements/2020/mas-monetary-policy-statement-14oct20

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Return

Historical return:

- From **past** data (t-1, t-2, t-3,…, t-n)

Prospective return:

- Predicting **future** return
- No crystal ball to predict the future!
  - Historical returns are often utilized to predict future returns
  - Some adjustments needed

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Return

Expected returns:

- Returns that take into account **uncertainties** that are present in different scenarios

$$\hat{r} = \sum_{i=1}^{n} r_i P_i$$

Risk

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Risk

- **Uncertainty** associated with future possible outcomes
- How do measure uncertainty?
  - Variance: σ^2
  - Standard deviation: $\sigma = \sqrt{Variance} = \sqrt{\sigma^2}$

$$\sigma = \sqrt{\sum_{i=1}^{n} (r_i - \hat{r})^2 \, P_i}$$

If we **know** the future possible returns and the probability of each possible return

$$\text{Estimated } \sigma = \sqrt{\frac{\sum_{t=1}^{n} \left(r_t - \bar{r}_{Avg}\right)^2}{n-1}}$$

If we use historical (past) data

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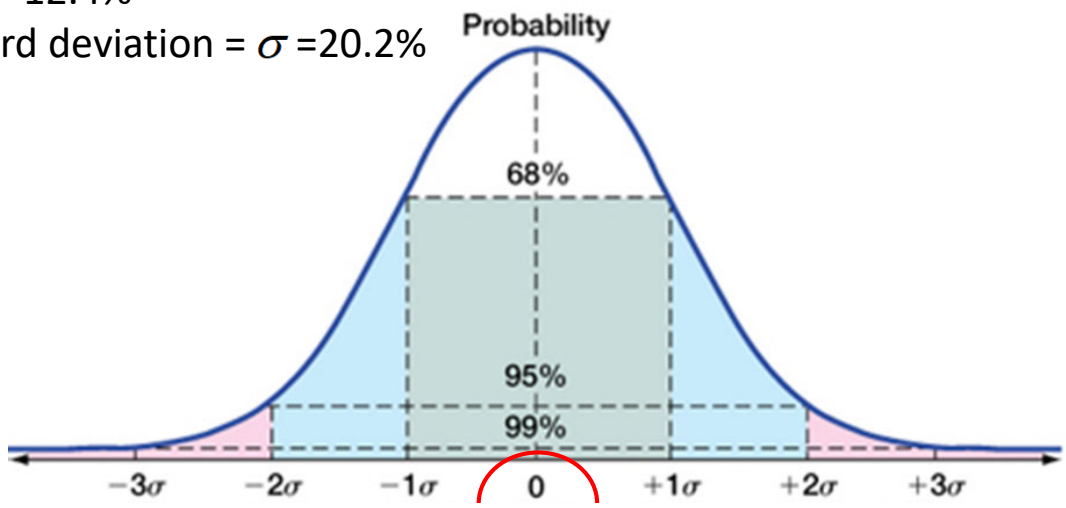
Normal Distribution

Mean = 12.4%

Standard deviation = σ =20.2%



-20.2% +20.2%

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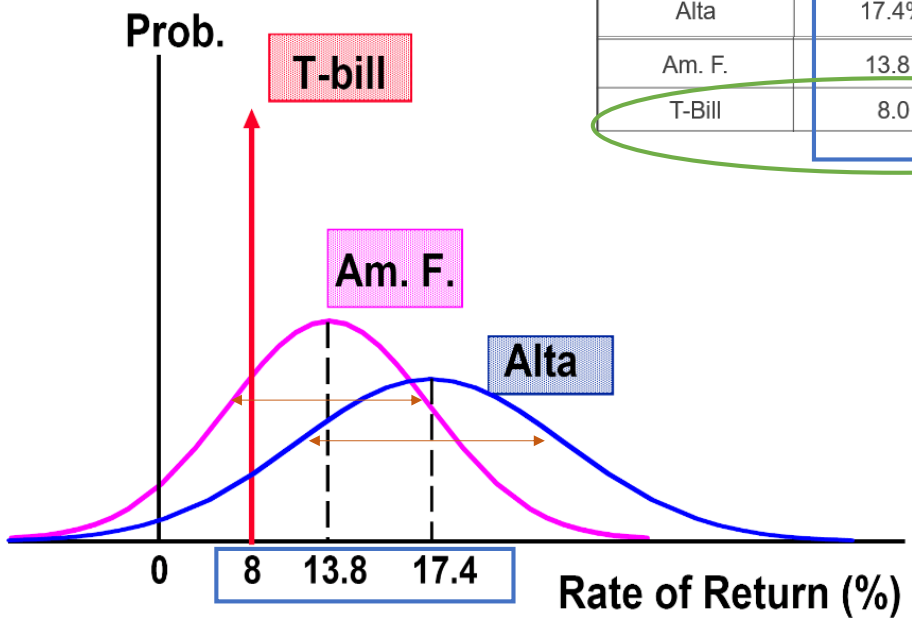
Example (slides 34 -45)

Investment	$\hat{r}$	σ
Alta	17.4%	20%
Am. F.	13.8	18.8
T-Bill	8.0	0



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Risk

Coefficient Variation (CV)

- Relative variability

$$CV = \frac{Standard\ Deviation}{Mean} = \frac{\sigma}{\hat{r}}$$

Recall:

- Standard deviation: σ

Portfolio

- A set of assets held by an investor
  - Assets i (1, 2, …, n)
- Expected portfolio return: $\hat{r}_p = \sum_{i=1}^{n} w_i \hat{r}_i$
- Portfolio standard deviation (2 assets):

$$\sigma_p = \sqrt{w_1^2\sigma_1^2 + (1-w_1)^2\sigma_2^2 + 2w_1(1-w_1)Corr(R_1,R_2)\sigma_1\sigma_2}$$

$$= \sqrt{w_1^2\sigma_1^2 + (1-w_1)^2\sigma_2^2 + 2w_1(1-w_1)\rho_{12}\sigma_1\sigma_2}$$

  - **Correlation** = $Corr(R_1,R_2) = \rho_{12}$
  - **Covariance** = $Cov_{1,2} = Corr(R_1,R_2)*\sigma_1*\sigma_2 = \rho_{12}*\sigma_1*\sigma_2$

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Portfolio standard deviation

$$\sigma_p = \sqrt{w_1^2\sigma_1^2 + (1-w_1)^2\sigma_2^2 + 2w_1(1-w_1)Corr(R_1,R_2)\sigma_1\sigma_2}$$

$$= \sqrt{w_1^2\sigma_1^2 + (1-w_1)^2\sigma_2^2 + 2w_1(1-w_1)\rho_{12}\sigma_1\sigma_2}$$

Any correlation less than 1 would have some diversification benefit.

- This benefit increases as the correlation is smaller (or better yet, negative)

Total risk

Total Risk = Company-Specific Risk + Market Risk

Notes:

- We can diversify away some of total risk (i.e., the unsystematic component)
  - But you cannot diversify away systematic risk
- While market risk affects all firms in the market, that does not mean that every firm is affected by the market in the same way
  - Depends on the firm's exposure to the market

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Other notes

- Slides 5 – 6: Some examples of portfolios and securities investors can invest in
  - S&P500, small stocks, world portfolio – examples of stock portfolio
  - Corporate bonds, T-bill – examples of bonds

  There are many more portfolios and securities that investors can consider for investment
- Example on slides 59-60:
  - Step 1: You're given the probability distribution of the possible returns on 2 stocks. Use the formula on slide 16 to calculate the expected return of each stock.
  - Step 2: Use the expected returns from step 1 to calculate the portfolio covariance using formula from slide 56.

$$Cov_{i,j} = \sum_{s=1}^{S} \Pr(s) * \left(R_{i,s} - \mathrm{E}(R_i)\right) * \left(R_{j,s} - \mathrm{E}(R_j)\right)$$

Other notes (cont.)

Example on slides 51 – 52:

		Estimated Return		
Economy	Prob.	Alta	Repo	Port.
Recession	0.10	-22.0%	28.0%	3.0%
Below avg.	0.20	-2.0	14.7	6.4
Average	0.40	20.0	0.0	10.0
Above avg.	0.20	35.0	-10.0	12.5
Boom	0.10	50.0	-20.0	15.0

50% weight of Alta & 50% weight of Repo (Refer to **slide 51** for the weightage)

$$\hat{r}_p = (3.0\%)0.10 + (6.4\%)0.20 + (10.0\%)0.40 + (12.5\%)0.20 + (15.0\%)0.10 = 9.6\%.$$

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Week 4
List of topics

Note:

You are responsible for all materials covered in the pre-recorded videos posted on LumiNUS, unless they are marked "not examinable". This list only serves to help you in your revisions.

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Week 4 topics

Returns

- Historical or prospective
- Dollar term or percentage term
- Nominal return or real rate of return

- For stocks or bonds, return comes from:
  - Dividend or interest payment, and
  - Capital gain/loss

- Expected return
- Arithmetic average return

Week 4 topics (cont.)

Risk

- Variance and standard deviation
  - Coefficient of Variation
- Stand-alone risk

Risk & Return:

- Risk aversion
- Risk premium

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Week 4 topics (Cont.)

Portfolio

- Portfolio return
- Portfolio risk
  - Covariance
  - Correlation coefficient

- Total risk = unsystematic risk + systematic risk
  - Diversifiable vs. undiversifiable risks

- Arithmetic mean (self study)
- Geometric mean (self study)