Lec 5: Risk Pooling in Insurance

- If $n$ policies, each has independent probability $p$ of a claim, then the number of claims follows the binomial distribution. The standard deviation of the fraction of policies that result in a claim is

$$f(x) = P^x (1 - P)^{n-x} \frac{n!}{x!(n-x)!}$$

$$\sigma = \sqrt{p(1-p)/n}$$

- Probability that fraction of policies that result in loss will lie between $P_1$ and $P_2$, using Excel Normdist

$$\text{Normdist}(P_2, P, \sigma, 1) - \text{Normdist}(P_1, P, \sigma, 1)$$
Example

• If probability of loss is .2, I write 100 policies, then expected number of losses is 20% and the standard deviation $\sigma$ of the fraction of losses is $(.2\times0.8/100)^{.5}=.04$

• Change $n$ to 1000, get $\sigma=.013$

• Change $n$ to 10000, get $\sigma=.004$
Distribution of Fraction of Policies Resulting in Losses $P=.2$

- $n=100$
- $n=1000$
- $n=10000$