

# 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
- Probability that fraction of policies that result in loss will lie between  $P1$  and  $P2$ , using Excel Normdist

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

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

$$Normdist(P2, P, \sigma, 1) - Normdist(P1, P, \sigma, 1)$$

# 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  $(.2*0.8/100)^{.5}=.04$
- Change  $n$  to 1000, get  $\sigma=.013$
- Change  $n$  to 10000, get  $\sigma=.004$

**Distribution of Fraction of Policies Resulting in Losses  $P=.2$**

