Univariate Distributions-Distributional Forms.

- A need to understand distributions to make econometrics work!
- With distributions we can test an empirical relationship. We can examine general questions to see, for example, if a significant proportion of Californians earned over $700 in 1979.
- Examine 4 distributions that will take us from the theoretical to the applied. From distributions that can be applied to most forms of data, to one specific to small samples.
- Normal Distribution: $Y \sim N(\mu, \sigma^2)$, or a standardized normal distribution: $Z \sim N(0,1)$.
- Properties:
  1. symmetric around mean value μ.
  2. PDF of distribution is highest at μ and 'tails-off' at extremeties.
  3. $\mu \pm \sigma = 68\%$ of distribution; $\mu \pm 2\sigma = 95\%$ of distribution; $\mu \pm 3\sigma = 99.7\%$ of distribution.
  4. Described by 2 moments: μ and σ^2.
- For a continuous variable Y, deviations from the mean are expressed as:

$$f(Y) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left\{ -\frac{1}{2}\left(\frac{Y-\mu}{\sigma}\right)^2 \right\}$$

- How to read Z - standard normal distribution tables.
- Chi-squared distribution: For any $Z = \frac{Y-\mu}{\sigma}$, such that $Z \sim N(0,1)$, then $Z^2 \sim \chi^2_{(1)}$. If Z_k^2, then $\sim \chi^2_{(k)}$.
- Properties:
  1. χ^2 takes positive values $0 \to \infty$.
  2. χ^2 is a skewed distribution. As k increases it approximated a normal.
  3. Expected value is k; variance $2k$.
- F-distribution: tests the relationship between 2 independent squared random variables. $F = \frac{\sigma_n^2}{\sigma_m^2}$, but using the sample variances: $F = \frac{S_n^2}{S_m^2}$.
- Properties:
  1. F-distribution is skewed and positive.
  2. F approaches normal as k_1, k_2 the degrees of freedom parameters $0 \to \infty$.

- Students t-distribution: invented by William Gosset,(published as Student) "Probable Error of a Mean", (1908).
- Dealing with the sampling distribution of the mean: $\overline{X} \sim N(\mu, \frac{\sigma^2}{n})$. If σ^2 not known use sample variance: S^2.
- $t = \frac{\overline{X}-\mu}{S/\sqrt{n}}$.
- Properties:
  1. t is symmetric about 0.
  2. Variance is $\frac{k}{k-2}$, so defined for $k > 2$.
  3. As $k \rightarrow \infty$, t approximates 0.