**An Outline**

**Statistical Distributions**

**Brigham Young University**

**June 2013**

**[Modification of presentation given at the**

**Meetings of Multinational Finance Association, Orlando 2008 &Crete 2009]**

**James B. McDonald**

**Brigham Young University**

**1. Introduction**

1. **Some families of statistical distributions**
   1. **Families  where  denotes a vector of unknown parameters** 
      1. **GB: GB1, GB2-----p.7+**





* + 1. **EGB: EGB1, EGB2**



* + 1. **SGT: ST, GT, SGED----p.17+**





* + 1. **IHS**
    2. **g- and- h distributions**
    3. **Other distributions: Extreme value, Pearson,**
    4. **Extensions: (multivariate pdfs and  )----p.28**
  1. **Properties**
     1. **Moments---GB (p. 30, 31, 32, 33, 34)**

**----SGT (p. 39,40, and 41)**

* + 1. **Cumulative distribution functions----p.49**
    2. **Gini coefficients----p. 50, 51, 52, 53**
    3. **Incomplete moments----p. 54, 55, 56**
    4. **Mixture model (potential Bayesian application): GB2 and SGT**

**p. 58 and 59**

* + 1. **Hazard functions----p. 60, 61, 62, 63, 64**
  1. **Model selection: Goodness of fit and statistical tests** 
     1. **Goodness of fit---p. 65 & 66**

**SAE**

**SSE**

****

**AIC**

* + 1. **Testing nested models----p. 69 & 70**
  1. **An example: the distribution of stock returns**

1. **Regression applications---- p.80, 87. 88, & 98**
   1. **Background**
   2. **Alternative estimators**
      1. **Estimation**

**OLS**

**LAD**

**Lp**

**M estimators**

**MLE**

**Partially adaptive or QMLE**

* + 1. **Influence functions**
    2. **Asymptotic distribution of extremum estimators: **

**Sandwich estimator of the variance**

* + 1. **Other estimators**

**Semiparametric**

**GMM**

**IV estimation**

**GIV estimation**

* 1. **A Monte Carlo comparison of alternative regression estimators—p. 98**
  2. **An application:** 
     1. **CAPM with and without normal errors**
     2. **CAPM with and without ARCH effect**

1. **Censored regression models---p. 107 & 108**
   1. **Basic Framework**
      1. **Tobit model is MLE for homoscedastic normal errors**
      2. **Tobit is biased and inconsistent with either nonnormal errors or heteroskedasticity**
   2. **Computer simulations**
2. **Qualitative response models**
   1. **Basic framework**
   2. **An application**
   3. **Related issues**
3. **Option pricing** 
   1. **The Black Scholes option pricing formula**
   2. **Background and alternative formulations**
   3. **A comparison of pricing behavior**
4. **VaR (value at risk)**
   1. **Background and definitions**
      1. **Value at Risk**
      2. **Standardized returns**
      3. **Unconditonal VaR formulation**
      4. **Conditional VaR formulation**
   2. **Models and applications**
      1. **Unconditional VaR formulation**
      2. **Conditional VaR formulation**
5. **Conclusion---p. 138, 139, 140, 141**

**HOMEWORK**

**Some fun theory**

1. The equation for the SGT pdf is in the notes. Write the equation for the GT pdf.

2. Derive the equation for the SGED as a limiting case of the SGT as q 

Hints: (a) 

(b) Stirling’s approximation for the gamma function of a large argument



(c) 

2. Using the equation for the SGED, write equations for the pdf’s of the following pdf’s:

1. GED
2. Skewed Laplace
3. Laplace
4. The normal

**Some applied work**

1. Obtain MLE the parameters for the GB2, Burr 12, Burr 3, generalized gamma, gamma, and

the lognormal

Hint: recall that the pdf of the lognormal (LN) is given by 

1. Using the results obtained in the previous problem, test the following separate hypotheses:

 GB2=Burr 3;  GB2=Burr 12;  GB2=GG;  GG=gamma;  GG=LN