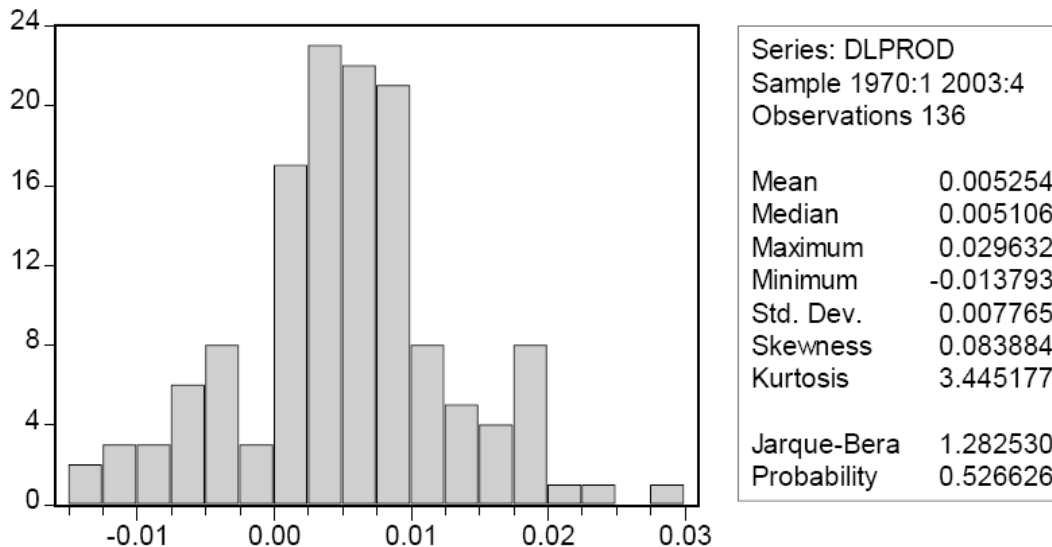


## Problem Set #7

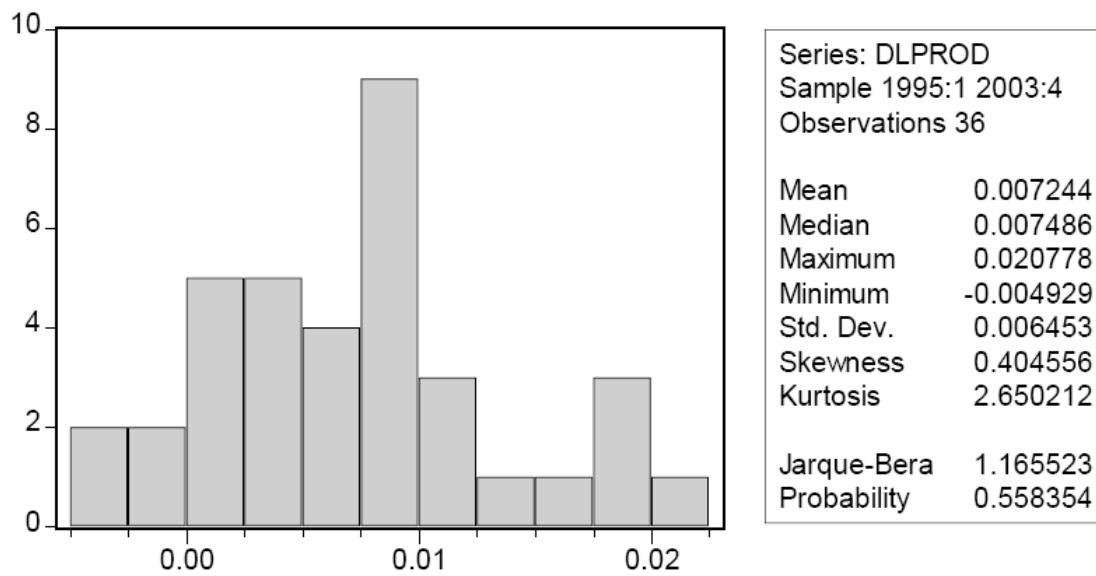
- (1) Each year, Management Accounting reports the results of a salary survey of the members of the Institute of Management Accountants (IMA). On year, the 2112 members responding had a salary distribution with a 20<sup>th</sup> percentile of \$35,1000; a median of \$50,000; and an 80<sup>th</sup> percentile of \$73,000.
  - (a) Use this information to determine the minimum sample size that could be used in next year's survey to estimate the mean salary of IMA members to within \$2000 with 98% confidence.
  - (b) Explain how you estimated the standard deviation required for the sample size calculation.
  - (c) List any assumptions you make.
  
- (2) When companies employ control charts to monitor the quality of their products, a series of small samples is typically used to determine if the process is "in control" during the period of time in which each sample is selected. Suppose a concrete-block manufacturer samples nine blocks per hour and tests the breaking strength of each. During one hour's tests the mean and standard deviation are 985.6 pounds per square inch (psi) and 22.9 psi, respectively.
  - (a) Construct a 99% confidence interval for the mean breaking strength of blocks produced during the hour in which the sample was selected.
  - (b) The process is to be considered "out of control" if the mean strength differs from 1000 psi. What would you conclude based on the confidence interval constructed in part (a)?
  
- (3) Sometimes the outcome of a jury trial defies the "commonsense" expectation of the general public. Such a verdict is more acceptable if we understand that the jury trial of an accused murderer is analogous to the statistical hypothesis-testing process. The null hypothesis in a jury trial is that the accused is innocent. The alternative hypothesis is guilt, which is accepted only when sufficient evidence exists to establish truth. If the vote of the jury is unanimous in favor of guilt, the null hypothesis of innocence is rejected and the court concludes that the accused murderer is guilty. Any vote other than a unanimous one for guilt results in a "not guilty" verdict. The court never accepts the null hypothesis: that is, the court never declares the accused "innocent." A "not guilty" verdict implies that the court could not find the defendant guilty beyond reasonable doubt.
  - (a) Define Type I and Type II errors in a murder trial.
  - (b) Which of the two errors is the more serious? Explain.
  - (c) The court does not, in general, know the value of  $\alpha$  and  $\beta$ , but ideally, both should be small. One of these probabilities is assumed to be smaller than the other in a jury trial. Which one, and why?
  - (d) The court system relies on the belief that the value of  $\alpha$  is made very small by requiring a unanimous vote before guilt is concluded. Explain why this is so.
  - (e) For a jury prejudiced against a guilty verdict as the trial begins, will the value of  $\alpha$  increase or decrease? Explain.

- (f) For a jury prejudiced against a guilty verdict as the trial begins, will the value of  $\beta$  increase or decrease? Explain.
- (4) “Take the Pepsi Challenge” was a marketing campaign used recently by the Pepsi-Cola Company. Coca-Cola drinkers participated in a blind taste test where they were asked to taste unmarked cups of Pepsi and Coke and were asked to select their favorite. In one Pepsi commercial, an announcer states that “in recent blind taste tests, more than half the Diet Coke drinkers surveyed said they preferred the taste of Diet Pepsi.” Suppose 100 Diet Coke drinkers took the Pepsi Challenge and 56 preferred the taste of Diet Pepsi. Can Pepsi be accused of false advertising? Select  $\alpha$  to minimize the probability of a Type I error. What are the consequences of the test results from Coca-Cola’s perspective?
- (5) An elevator can carry up to 3500 pounds. The manufacturer has included a safety margin of 500 pounds and lists the capacity as 3000 pounds. The building’s management seeks to avoid accidents by limiting the number of passengers in the elevator. If the weight of the passengers using the elevator is distributed  $N(155, 625)$ , what is the maximum number of passengers who can use the elevator if the odds against exceeding the rated capacity are to be less than  $3/10,000$ ?
- (6) Below are summary statistics and a histogram labor productivity growth rates (quarter-on-quarter) over the 1970q1-2003q4 period, calculated as  $\ln(x_t) - \ln(x_{t-1})$



- (a) What is the 99% confidence interval for quarterly productivity growth?
- (b) During the late 1990’s there was discussion of a New Economy, characterized by accelerated GDP growth. Over the 1995q1-2003q4 period, the growth rate was 0.7244% quarter on quarter, with standard deviation of 0.6453%. Conduct a hypothesis test that 1995q1-2003q4 growth rate was different from the of

0.4538% quarter on quarter growth rate prevailing during the 1970q1- 1994q4 period. State your assumptions.



(c) If you expressed the growth rates in annualized terms (here by multiplying the quarter-on-quarter growth rates by 4), would that change your answers?