ECO 6375-701 Prof. T. Fomby
Econometrics III Fall 2008

# EXERCISE 4

# DURATION MODELS

**Purpose:** To learn how to use **Duration Models** (and, in particular, the **Weibull Distribution**) to analyze dependent variables that represent the length of time before an "event" occurs. The SAS procedure **LIFEREG** is used to conduct the duration analysis.

Go to my website and download the file Duration.sas. This program analyses the durations of the expansions of the U.S. economy from 1854 to the present. (The "event" here is the ending of the expansion.) For the dates of the peaks and troughs of the U.S. business cycles, see the handout given to you in class that was taken from the NBER website. The variables in the Duration.sas program are **OBS** = the observation number, **MON** and **YEAR** = the month and year of the date of the trough of the business cycle (i.e. the beginning of the expansion), **DUR** = the duration of the expansion in months, **WAR** = a dummy variable that is one if the expansion occurred during a war (i.e. Civil War, World Wars I and II, Korean War, and Vietnam War) and zero otherwise, and **CENSOR** = 1 if the observation on DUR is censored and 0 otherwise (only the last observation is censored). In addition, the program creates a variable DUM = 1 if the expansion occurs in the Post-World War II period and 0 otherwise. Run the Duration.sas program and use the output to answer the following questions:

(a) Consider the first Weibull model that has no explanatory variables (other than a constant term) and that ignores the censored observation dated March 1991. What are the **predicted** $10^{th}$, $50^{th}$ , and $90^{th}$ quantiles of the durations of all U.S. economic expansions from 1854 through the expansion beginning in November of 1982. (Recall we are, at this point, not considering the current expansion because it is, as of this time, a "censored" observation.)

(b) Consider the second Weibull model that has the explanatory variable "dum". Does it appear that there is a significant difference between the durations of the Pre-World War II economy as compared to the Post-World War II economy? Explain your answer. (Again note that we are ignoring the censored expansion that began in March 1991.) What are the **predicted** $10^{th}$, $50^{th}$, and $90^{th}$ quantiles of the durations of expansions **before** World War II? What are the **predicted** $10^{th}$, $50^{th}$, and $90^{th}$ quantiles of the durations of expansions **after** World War II? (Note: For those of you who are up on your macroeconomics, economists have for some time now been interested in documenting whether the U.S. has a more "stable" and "healthy" economy since World War II because of, say, the "improved efficacy" of our monetary and fiscal policy tools.)

(c) Consider the third Weibull model that has the explanatory variables "dum" **and** "war". In addition to the Pre- and Post- World War II effect, does it appear in general that the U.S.'s participation in major wars has "helped" it sustain longer expansions? Explain your reasoning. (Again we are ignoring the censored expansion of March 1991.) What are the **predicted** $10^{th}$, $50^{th}$, and $90^{th}$ quantiles of the durations of expansions **before** World War II **during peacetime**? What are the **predicted** $10^{th}$, $50^{th}$, and $90^{th}$ quantiles of the durations of expansions **before** World War II **during wartime**? What are the **predicted** $10^{th}$, $50^{th}$, and $90^{th}$ quantiles of the durations of expansions **after** World War II **during peacetime**? What are the **predicted** $10^{th}$, $50^{th}$, and $90^{th}$ quantiles of the durations of expansions **after** World War II **during wartime**?

(d) The next three Weibull models analyzed by the Duration.sas program conduct the analysis of parts (a), (b), and (c) above, except this time using the censored observation of March 1991. Using these models answer the questions raised in parts (a), (b), and (c) above. What effect does including the censored observation have on the statistical significance of the variables "dum" and "war"? What effect does it have on the various predicted quantiles of the models?