

TS Module 8: Non-stationary time series basics HW

(The attached PDF file has better formatting.)

*Homework assignment: Stationarity through differencing and logarithms*

- Automobile liability claim severities have a geometric trend of +8% per annum.
- The average claim severity in year  $t$  is the average claim severity in year  $t-1$  adjusted for the geometric trend, plus or minus a random error term.
  - Assume the error term is added to the logarithm of the average claim severities.
  - $\Rightarrow$  The average claim severities are multiplied by a random error term.

- A. Is the time series of average claim severities stationary?
- B. Is the first difference of this time series stationary?
- C. Is the second difference of this time series stationary?
- D. Is the logarithm of this time series stationary?
- E. What transformation makes the time series stationary?

*[NEAS: Note the pattern of each time series. An increasing trend is not stationary. A constant value makes a stationary time series.]*

<i>Period</i>	<i>Time Series</i>	<i>First Differences</i>	<i>Second Differences</i>	<i>Logarithms</i>	<i>First Differences of Logarithms</i>
1	1,000.000			6.9078	
2	1,080.000	80.000		6.9847	0.0770
3	1,166.400	86.400	6.400	7.0617	0.0770
4	1,259.712	93.312	6.912	7.1386	0.0770
5	1,360.489	100.777	7.465	7.2156	0.0770
6	1,469.328	108.839	8.062	7.2926	0.0770
7	1,586.874	117.546	8.707	7.3695	0.0770