

1. (Sensitivity Analysis) A researcher has developed a model of the following form:

$$\underbrace{\text{Output}}_{n \times 1} = \text{MODEL}(\underbrace{\text{Parameters}}_{1 \times m}),$$

where Output is an $n \times 1$ column vector, Parameters is a $1 \times m$ row vector, and MODEL is the name of the MATLAB function that computes Output as function of the parameter values. The researcher wants to check the sensitivity of her output to the parameters that she has chosen. Write a MATLAB program that computes the Jacobian for the model; i.e., an $n \times m$ matrix of derivatives shows how each parameter affects each of the output variables.

2. (Welfare Gains from Economic Growth à la Lucas, 1987) A researcher is interested in computing the welfare gains associated with economic growth. To this, she wants to compute the welfare gain or loss associated with moving from an economy where consumption grows at 3.0 percent annually to ones where consumption grows at the following percentage rates:

1.0, 2.0, 3.0, 4.0, 5.0, and 6.0.

When doing this, she assumes that utility is given by

$$\sum_{t=1}^{\infty} \beta^t \ln c_t,$$

and that initial consumption, c_1 , is the same in all economies. She measures the welfare gains in terms of the percentage of consumption in each period in the new economy that the person would be willing to give up in order to move from the benchmark situation of 3.0 percent growth. Write a MATLAB program that does this.