

Economics 673: Applied Nonparametric Econometrics

Department of Economics, Finance and Legal Studies

University of Alabama

Fall 2020

Midterm

1. Suppose that instead of the density itself, $\hat{f}(x) = \frac{1}{nh} \sum_{i=1}^n k\left(\frac{x_i - x}{h}\right)$, we are interested in its derivative, $\hat{f}'(x) = \partial \hat{f}(x) / \partial x$. Derive the estimator $\hat{f}'(x)$ assuming the kernel is Gaussian. Why can we not use a uniform kernel here?

2. Consider the case of a conditional density of a scalar y on a q -vector x (i.e., $f(y|x) = f(y, x)/f(x)$). Give the kernel density estimator $\hat{f}(y|x)$. Now, suppose the q th element of x is not a relevant predictor of y . As $n \rightarrow \infty$, what will happen to the vector of bandwidths for the q -vector x ? Show this result on your conditional density estimator $\hat{f}(y|x)$.

3. Below is the kernel estimated density (Gaussian kernel with the Silverman (1986) rule-of-thumb bandwidth) of average yearly snowfall (in inches) in Buffalo, New York. Considering the figure, what do you expect to be the outcome of a test for (a) that the correctly specified density is Gaussian and (b) the density is symmetric. In each of these settings, explain how you would impose the null hypothesis in a bootstrap procedure.

