PPOL502-01, Spring 2016
Course Notes # 17: Measurement Error

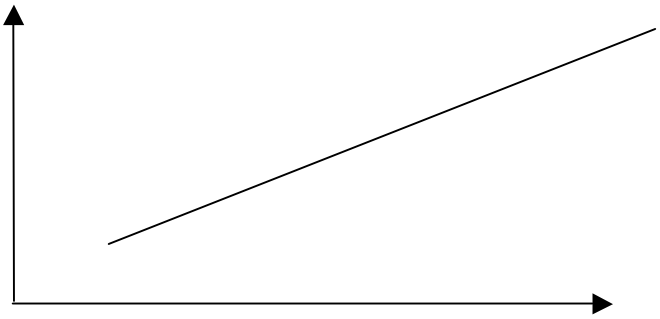
I. MEASUREMENT ERROR

- Outliers and influential observations are cases when only one or a few observations may not conform to the general pattern of the remainder of the data for some reason (including, for example, mistyping one or a few person's weights or incomes or some other survey information)

- Measurement error refers to the case when the measurement of a particular variable is consistently "off" in some way: the actual measure does not equal the "true" measure of the variable, for all cases (except by chance).

- Think of two basic cases:

Case 1: Y is measured with error



Consequences of Measurement Error in Y

(1) if measurement error is uncorrelated with the independent variables **X**, then the slope coefficients are unbiased (a good thing). This is why assumption that measurement error is uncorrelated with the independent variables **X (**sometimes referred to as classical measurement error) is so important. However, …

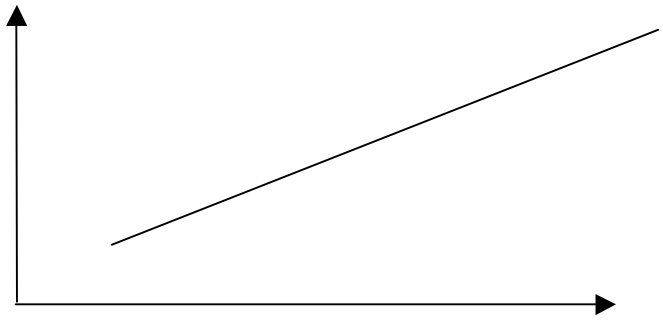
(2) the standard errors are larger than they would have been without measurement error (remember that the standard error of a coefficient estimate is a function of σ^2; with measurement error in Y, σ^2 is larger and thus the s.e.'s are larger). In other words, random errors due to inaccuracy in the process of measuring Y are absorbed into and increase the model error term. As a consequence…

(3) R-squared is reduced: when Y is "noiser", X can explain less of the variation in Y.

(4) if positive and negative errors do not tend to cancel out (i.e., measurement error is biased), then simply get a biased estimator of the intercept (not generally a big deal).

Case 2: X is measured with error

- In general, this is a much more serious case than measurement error in Y.



Consequences of measurement error in X:

(1) Biases the slope coefficient of the variable measured with error toward zero: "attenuation bias"

(2) Direction of the bias in other Xs in the model can be either upward or downward.

(3) Reduces R-squared.

(4) May increase or decrease the standard error of the slope coefficient.

You will learn about how to deal with this kind of measurement error in Quant III.