Three Relevant "Modeling" Examples

The May 2005 issue of the *NBER Digest* provides examples of three of the central concepts discussed in this session of the course – capturing nonlinearities and interactions, and avoiding specification bias.

The first article, "Does Poverty Cause Terrorism?", deals with the linkage between political freedom within a nation, and the level of domestic terrorism. At the top of the third column, it states: "However, the relationship between the level of political rights and terrorism is not a simple one. Countries in an intermediate range of political rights experience a greater risk of terrorism than countries either with a very high degree of political rights or than severely authoritarian countries with very low levels of political rights."

This clearly signals a nonlinear relationship, and suggests adding the square of the "political rights" variable to a model which predicts a nation's level of domestic terrorism. And indeed, this is what the author did. The second appendix to the full article reports the following regression (translated into KStat format):

Regression: log(Global Terrorism Index)

	constant	log(GDP/cap)	no rights	(no rights)^2
coefficient	something	-0.0948	0.2966	-0.0300
std error of coef	something	0.0434	0.1073	0.0127
significance	something	3.0491%	0.6422%	1.9451%
adjusted coef of determination		24%		
number of observations		154		
residual degrees of freedom		150		

The "no rights" variable takes values between 1 (great political freedom) and 7 (oppressive authoritarian regime). Note that (1) there's strong evidence that the squared variable belongs in the relationship (from the significance level of the squared term), (2) the no-rights variable relates to domestic terrorism in the form of a downward-bending "U" (since the coefficient of the squared term is negative), and (3) the "U" peaks at a no-rights level of -0.2966/(2*(-0.0300)) = 4.94 (using the –b/(2c) formula), i.e., between the extremes, as claimed in the article.

The next article, "CEO Overconfidence, Corporate Investment, and the Market's Reaction," examines the link between the personal characteristics of a CEO, and his/her propensity to invest corporate resources unwisely. It reports (in the middle of the second column): "… overconfidence among acquiring CEOs is one important explanation of merger activity. Using a dataset of large U.S. companies from 1980 to 1994 and the CEOs' personal portfolio decisions as measures of overconfidence, they find that overconfident CEOs conduct more mergers and, in particular, more value-destroying

mergers. These effects are most pronounced in firms with abundant cash or untapped debt capacity."

In other words, *the effect of* CEO overconfidence *on* overinvestment in value-destroying merger activity *depends on* the availability of ready financial resources. What we have here is an interaction, captured in the regression model by the introduction of the product of the "overconfidence" and "financial resources" variables.

Finally, the last article, "Smoking, Drinking, and Drug Use Respond to Price Changes," suggests "that legalization and taxation (of currently-illegal drugs) — the approach that characterizes the regulation of cigarettes and alcohol — may be better than the current approach."

It notes (starting at the bottom of the first column on the last page of the *Digest*): "Alcohol use and abuse cannot be correlated indisputably with the reductions in the real prices of alcoholic drinks without factoring in other elements. These include changes in the minimum legal drinking age and the redefining of blood-alcohol levels in regard to drunk driving. However, when these factors are taken into account, the 7 percent increase in the real price of beer between 1990 and 1992 attributable to the Federal excise tax hike on that beverage in 1991 explains almost 90 percent of the 4-percentage-point reduction in binge drinking in that period."

Clearly, a direct regression of "binge drinking" onto "real price of alcoholic drinks" suffers from specification bias, and fails to accurately capture the true effect of price on alcohol abuse. But, when the confounding variables – "legal drinking age" and "illegal blood-alcohol level" – are taken into account, the price effect is clearly revealed in the resulting "more complete" model.