Problem Set 1

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Question 1

1. Citation:
   Deschênes, O., Greenstone, M., & Shapiro, J. S. (2017). Defensive Investments and the Demand for Air Quality: Evidence from the NOx Budget Program. American Economic Review, 107(10), 2958–2989.
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2. Econometric Model
   $$Y_{cst} = \gamma_1 1(NBP\ Operating)_{cst} + W'_{cst}\beta + \mu_{ct} + \eta_{st} + v_{cs} + \varepsilon_{cst} \quad (1)$$
   $$Y_{cst} = \delta NOx_{cst} + W'_{cst}\emptyset + \lambda_{ct} + \pi_{st} + \gamma_{cs} + v_{cst} \quad (2)$$

Here NBP is abbreviation for Nitrogen Oxides Budget Program. $\boldsymbol{c}$ references county, $\boldsymbol{s}$ indicates season, and $\boldsymbol{t}$ denotes year.
For equation 1, $\boldsymbol{Y_{cst}}$ are pollution emissions, ambient pollution concentrations, medication costs, hospitalization costs, and mortality rates. The parameter of interest is $\boldsymbol{\gamma_1}$, associated with the variable 1(NBP Operating)cst. This takes the value of 0.5 for all NBP states in 2003, when the market was operating in 8 states plus Washington, DC, and a value of 1 in 2004 and all subsequent years.
The matrix of weather controls, $\boldsymbol{W_{cst}}$ includes measures of precipitation, temperature, and dew point temperature (a measure of humidity). The vector $\boldsymbol{\mu_{ct}}$ is a complete set of county by year fixed effects, which account for all factors common to a county within a year. The season-by-year fixed effects, $\boldsymbol{\eta_{st}}$, control for all factors common to a season and year. The county-by-season fixed effects, $\boldsymbol{v_{cs}}$, allow for permanent differences in outcomes across county-by-seasons.
For equation 2, $\boldsymbol{Y_{cst}}$ is restricted to measures of medication purchases and mortality rates, and $1(NBP\ Operating)_{cst}$ from equation (1) is used as an instrumental variable that estimates medication purchases and mortality rates through NOx emissions.

3. Exogenous variables: $\boldsymbol{\gamma_1,\ 1(NBP\ Operating)_{cst},\ W_{cst},\ \mu_{ct},\ \eta_{st},\ v_{cs},\ \delta,\ \lambda_{ct},\ \pi_{st},\ \gamma_{cs}}$
   Endogenous variables: $\boldsymbol{Y_{cst}, NOx}$

4. The model is dynamic as it accounts for time-dependent changes. It is linear and stochastic as it is a regression model.

5. Individual's compensatory behavior may also have an effect on medication purchases, and could be included in the model if there is further study.

Question 2

1. $\Pr(Y = 1|X) = G(\beta_0 + \beta_1 * \text{Age} + \beta_2 * \text{Edu} + \beta_3 * \text{Ma} + \beta_4 * R + \beta_5 * H)$
   Y is a binary outcome where 1 = get married. *Edu* denotes year of education received, *Ma* denotes mother's age when got married, R denotes number of relationships experienced, and H references household wealth.

2. I think age, education and household wealth are key factors.

3. I think these factors – individual's age, year of education received, household wealth, number of relationships experienced, and mother's age when she got married influence a person's perception of himself/herself and marriage itself. I think other factors (such as income) can either be represented by the above factors, or influence the outcome through the above factors.

4. I can design a simple survey to have people answer questions about whether do they decide to get married, when, and why, and have them rank the factors that may influence their decision. The result of the survey may tell me whether these factors are significant in real life.