# Problem Set 1

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## PROBLEM 1

**(a)**

The model of *difference-in-difference* is retrieved from the journal article "*Creative Destruction Barriers to Urban Growth and the Great Boston Fire of 1872*". The historical background of this article is that the Great Boston Fire of 1872 has been thought of generating benefits from replacing old buildings with more-valuable ones. The author formalized this intuition by showing that under the assumption of cross-plot externalities the reconstruction increase the land value in surrounding areas which encourages land owners to build even more high-quality buildings. Thus the widespread construction of new buildings brought about further positive spillover effects. The model estimated differences between burned and unburned plots after the Fire, relative to the difference between burned and unburned plots in the year when the Fire occurred.

**(b)**

Hornbeck, R., & Keniston, D. (2017). Creative destruction: Barriers to urban growth and the Great Boston Fire of 1872. *American Economic Review*, 107(6), 1365-98.

The increase in the land value in Boston after the Fire of 1872 is largely attributed to the positive externalities from investments in building. The virtuous cycle encourages land owners to tear down obsolete buildings and upgrade with new ones. This statement is true only under the condition of cross-building externalities. Because when the extension model differentiated the influence of the individual building fires with the Great Fire, there was little impact on the value of buildings. In the article, author discussed some other mechanisms including land assembly, the concentration of ownership, in which the Great Fire impact the urban growth other than the cross-building spillover effects. The results of the article implies that although the individual land owners do not optimize their investment in buildings, the obliged widespread reconstruction generated substantial economic benefits by tearing down old buildings. From the perspective of policy making, we might realize that the returns of investments when internalizing the positive spillover effects are greater than sequential investment decisions.

**(c)**

$$Y_{it} = \alpha_t + \gamma_t X_i + \beta_{1873} I_i^{Fire} \times I_t^{1873} + \beta_{1882} I_i^{Fire} \times I_t^{1882} + \beta_{1894} I_i^{Fire} \times I_t^{1894} + \varepsilon_{it}$$

The outcome variable $Y_{it}$ can be either log value of land per square foot or log value of building per square foot in plot $i$ at year $t$, depending on which question to be answered. $X_i$ indicates the plot $i$ characteristics.The indicator variable $I_i^{Fire}$ suggests whether the plot $i$ is within the burned area and the interactive variables consider the changes in the value of building/land over the time. The estimated coefficient $\beta_{1873}$ suggests

the average change from 1872 to 1873 for burned plots relative to the unburned plots which have similar characteristics $X_i$

**(d)**

In this model, the exogenous variables are $Y_{it}$, and all indicator variables, which are $I_i^{Fire}$, $I_t^{1873}$, $I_t^{1882}$ and $I_t^{1894}$. In addition, the plot characteristics $X_i$ are also determined outside the model.
In terms of endogenous variables, the fixed effect $\alpha_{it}$, $\gamma_i$, $\{\beta_{1873}, \beta_{1882}, \beta_{1894}\}$ and error term $\varepsilon_{it}$.

**(e)**

1. static
   This model calculates the system in equilibrium, and thus is time-invariant.

2. linear
   A model is said to be linear model when it satisfies the conditions where all terms in the equation is either a constant or a parameter multiplied by an independent variable. In other words, a linear model has linearity with respect to the parameters.

3. deterministic
   A deterministic model has to be fully determined by the parameter values. In this model, the estimated coefficient is determined by the exogenous observations.

**(f)**

Besides the cross-building spillover effects, the author considered other factors that may influence the urban growth and pattern. For example, the efficiency of industry will be improved by the re-location of firms. Since the approximation can generate greater benefits in some industries, the reconstruction after the Great Fire encourage firms to choose their new location. The reason for considering this problem is that the business agglomeration may alter the spatial pattern of building investments. However, I also noticed the potential changes in the residence and how it will influence the residents' intention of choosing location. As far as I am concerned, the segregation between residential areas is determined by the city productivity, which in turn depends on the average level of labor skills in the city. Residence with different skill levels have different intention to choose places to live, and this will affect the city productivity as well. Since the author has considered the effects of business agglomeration, we may think a little further about this issue.

## PROBLEM 2

**(a)**

$$\begin{aligned} Y_i = &\beta_{0i} + \beta_{1i} Own\ educ_i + \beta_{2i} Spouse\ educ_i + \beta_{3i} Own\ inc_i + \beta_{4i} Spouse\ inc_i + \beta_{5i} Age_i + \beta_{6i} Race_i \\ &+ \beta_{7i} Region_i + \beta_{8i} Own\ parents'\ inc_i + \beta_{9i} Spouse\ parents'\ inc_i + \beta_{10i} Marriage\ penalty_i + \varepsilon_i \end{aligned}$$

**(b)**

One of the potential outcome of the model can be a binary indicator, which $1 = get\ married, 0 = not\ get\ married$. We can also consider the question of when individuals decide to get married. When dependent variable equals to zero, it means that the individual will not get married. Any positive number can suggest when they get married.

**(c)**

In order to make sure the model can simulate data, we need to check whether the estimated model can predict the output successfully when we plug in the input data.

**(d)**

*Education* and *Income* for both individuals and their potential spouse are important factors. People tend to easily ignore the significance of *Marriage penalty*. I related this factors with the non-marriage-neutral tax system in the United States. Thus, this factor also seems to matter as well.

**(e)**

According to Becker(1973), individual use the market goods and time input to make optimal decision in their consumption, in order to maximize their utility. In other words, people will get married when the consumption when married is greater than singled. In terms of the important factors such as *Spouse income*, higher spouse wages increases the potential benefits from marriage, which positively influence the probability of marriage. The similar analyses can be applied to the factor of *Education*. *Marriage penalty* indicates that the Tax Reform Act of 1969 substantially decrease the tax liability of single people relative to married couples. This tax reform changed the "tax" on marriage so that individuals consider it as an important factor.

**(f)**

Firstly, I would plot the distribution of the variables and check whether they are normally distributed. According to their distribution, I decide whether to use numerical or categorical variables. In addition, I make two-dimension graphs of the dependent variable against each independent numerical variable. This is a basic approach of checking the relationship between dependent and independent variables and test whether there is a linear relation as the statistic model predicts. Later, I will do the correlation analysis in order to catch the potential relation between independent variables. Perform a correlation analysis as a quick check to see if there are possible violations of the independence assumption.

## REFERENCES

[Alm, J., & Whittington, L. A.(1999)] . For love or money? The impact of income taxes on marriage. *Economica*, 66(263), 297-316

[Hornbeck, R., & Keniston, D. (2017)] . Creative destruction: Barriers to urban growth and the Great Boston Fire of 1872. *American Economic Review*, 107(6), 1365-98.