Meeting - Raúl 01/2020

Main points:

- [ ] Possibility to increase the sample to all the UK / All germany / European Union
- [ ] Approach to "exogeneity" of the treatment
- [ ] Rationalization of "transmission mechanisms"

Possibility to increase of sample:

Given I have a decent amount of data regarding the geolocation and characterístics of LEZ and other Urban Access Regulations I thought it is a oportunity to increase the scope of the analysis:

- See the map and the DB from sources $\rightarrow$ R

Subject	Pros	Cons
Complexity		Higher computational power and more complex code (I need a set of controls for each city)
Comparative Politics (policy relevance)	I can compare between different cities and their implementations of the policies.	Need good (better if detailed) data of implementations
	I do not have the problems of high endogeneity between London zones	
Usefullness	Higher external validity and usual standard errors of coefficients.	Better analysis of the London case
Methods	I can use a wider set of methods, from Diff-in-diff to newer forms of synthetic control methods.	Hill have to do a bit more research on those.

Approach to exogeneity of the treatment and SUTVA:

I need both but the solutions of one might compromise the other...

Exogeneity:

What would make the treatment endogenous? That treatment and control are significantly different in characteristics that condition the final output.

Possible failures of exogeneity:

- Cities / countries that apply LEZ have more X than those who don't and X affect the short and medium term GDP/productivity/...
    - X: Progressive politics
    - X: Production per capita
    - X: Cyclists/Public transport systems
    - X: Less/more proportion of transport-induced pollution

How to have a strong argument of exogeneity?

- Include the X, if possible, in the Synthetic Control estimation and test for their balance.
- Comparing treated areas with control areas that were treated in later periods as Neumark and Kolko (2010)
- Argument theoretically:
    - The decition is not really optional, it mainly comes from the oblication to comply with the European Comissio regulations in air quality, thus self-selection is less likely.

How can this be tested?

- Parallel trends assumption
- Ballancing of covariates as done by Abadie et al. (2003) (for effects on GDP)

SUTVA

SUTVA requires that the response of a particular unit depends only on the treatment to which he himself was assigned, not the treatments of others around him.

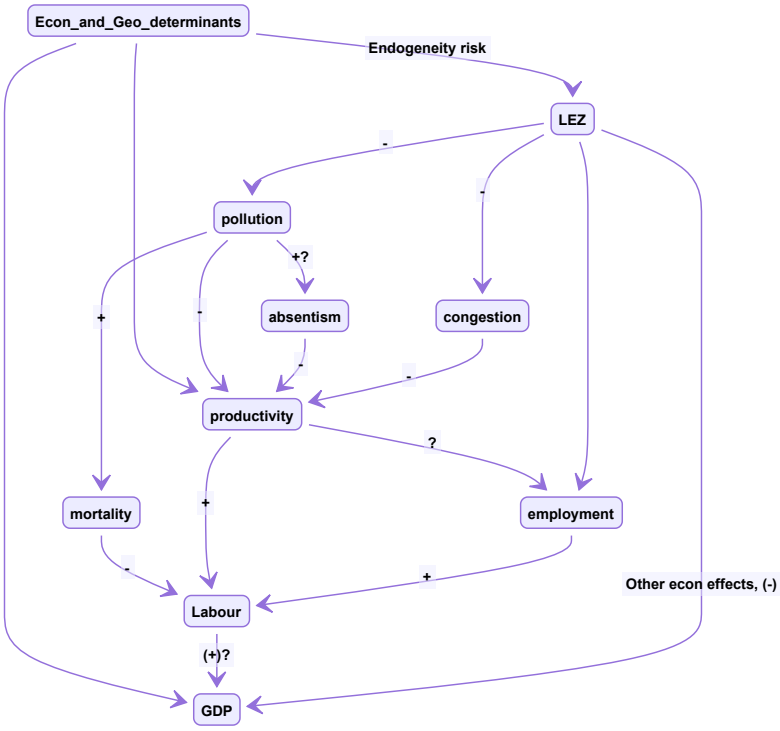
- No spillover effects $\rightarrow$ Change pool of controls to a more restrictive pool that has higher geographic/administrative/economic separation.

Possible spillover effects:

- Contagion: A LEZ in a big city makes the fleet of cars change and thus all their neighbouring cities will have part of their fleet changed.
- Displacement: If a very strong LEZ displaces busineses to "control" cities, the ATE on GDP, employment, ... would be biased.
- Signaling: The first LEZ in germany sends a strong signal that similar german cities might apply a LEZ soon and thus changes the car fleets of those control cities start to change.
- Anticipation: LEZ zones are advertised before application to give some time to change fleet so the effects might be seen before application or the timing of effects might not be perfect.

Rationalization of transmission mechanisms:

How do I shine light on this network of effects?



1. Use the same methodology, but step by step (my favorite)

1. Predict the effect of LEZ in each of them (LEZ $\rightarrow$ pollution, congestion, employment, gdp, productivity ...) $ATE_{pollution}, ATE_{congestion}, \dots .$
2. Look how the policy effects in productivity, congestion, pollution, ... affect the final effect of the policy in GDP ($ATE_i \rightarrow ATE_{LEZ}, i = pollution, congestion, \dots$)

   Something like:
   $ATE_{LEZ} = \beta_0 + \beta_1 ATE_{pollution} + \beta_2 ATE_{congestion} + \beta_3 ATE_{employment} + \dots + \epsilon$

This will summarise the effects on the labour imput of GDP, as this is the one who is more probably positively affected by the introduction of a LEZ.

2. Simplify the analysis and have "productivity" as the final output:

Posible change of the main Y, from GDP to $\frac{GDP}{Emp}$ as a proxy to productivity. I could do both.

- Pros:
  - Less complex transmission mechanisms.
- Cons:
  - Loosing the main discourse of "the effects in the economy" to "the effects in productivity", which is less interesting policy wise

If we have more time...

3. Create a macro model where my assumptions and modelling is clear (just a side idea)

> NOTE: **I am not sure** how to do this, and leaving my time series and macro notes in London makes it harder.

Model a relation of the form $Y = f(K, L, H|D, A)$ where output Y is a function of capital K, labour L and human capital H controlling for demographics D and different applications of the policy A, all fixed in the short term. In this specification K and L are functions of the application of the policy and represent the transmission mechanisms.

For example:

$$
\begin{aligned}
Y_t &= K_t^{\alpha} L_t^{\beta} H_t^{\gamma}, \\
K_t &= \theta_1 K_{t-1} + \theta_2 A_P + \theta_3 t + \theta_4 A_P * t + D\delta + \epsilon \\
L_t &= \phi_1 L_{t-1} + \phi_2 A_P + \phi_3 t + \phi_4 A_P * t + D\delta + \omega \\
H_t &= \xi_1 H_{t-1} + \xi_2 A_P + \xi_3 t + \xi_4 A_P * t + D\delta + \upsilon
\end{aligned}
$$

With A_P is the application of the policy P, and D and is a matrix of demografic controls. I (think) this might be done by doing some AR(p) model or a VAR(p) for each "transmission mechanism".