Research Proposal

of 41783, from seminar 5.

The effect of Traffic Management Strategies in London's economy. A synthetic control approach.

Literature review: Around 3 billion people - virtually half of the world's population - now lives in urban settlements, a number that has greatly increased during the last 20 years (Cohen, 2006). This fast urbanization has resulted in increases of congestion and pollution and related health and economic costs, especially on regions such as China and India (Gong et al., 2012; Pucher, Korattyswaropam, Mittal, & Ittyerah, 2005). Strikingly, recent research estimates that 92% of the world's population resides in areas exceeding the World Health Organization's air quality guidelines, resulting in 3 million attributable deaths to ambient air pollution in 2012 Shaddick et al. (2018). In order to minimise these costs, substantial policy initiatives aimed at improving air quality have been implemented in cities around the world.

In European cities, Traffic Management Strategies (TMS) have proven popular to improve air quality and comply with increasingly strict European regulation on the subject (Holman, Harrison, & Querol, 2015), but are usually seen as a trade-off between imposing costs to the economy and improving the natural environment (Morgenstern, Pizer, & Shih, 2002).

On the other hand, its impact in economic outputs such as economic growth, profits and employment has been a constant concern of citizens and local officials. And their concern is not unjustified. London, who has one of the most strict LEZ in the world houses more that 8 million people (ONS, 2019a), generates one third of UK's GDP (ONS, 2019b) and has a global economic and financial impact. From classic economic theory we would expect these policies to have a negative effect in the city's GDP as it involves taxes and prohibitions on movement for certain vehicles. Nevertheless, the effects of reducing congestion and pollution might offset other economic costs.

This hypothesis is based on recent research on the effect of Low Emission Zones (LEZ) on increasing mobility within the city (Kelly & Kelly, 2009), pollution reduction (Gehrsitz, 2017; Wolff, 2014), and health costs and mortality reductions (Cesaroni et al., 2012). Furthermore, increasing literature suggest that pollution concentration reduces economic output (Dechezleprêtre, May 18, 2018; Hao et al., 2018). This could happen trough various mechanisms such as increasing mortality (Xie, Dai, Dong, Hanaoka, & Masui, 2016), reducing productivity (Adhvaryu, Kala, & Nyshadham, 2014; Chang, Zivin, Gross, & Neidell, 2016; Graff Zivin & Neidell, 2012) or increasing absenteeism (Hanna & Oliva, 2015; Ransom & Pope, 1992).

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Research Questions:

Main question:

- What was the effect of the application of Traffic Management Strategies (TMS) in London's local economy?

Complementary questions:

- What are the main transmission mechanisms that drive this effect and how much they influence the final economic output?
- Which industries and professions does it affect more?
- What is the relative effect of different TMZ in London, such as the LEZ and the ULEZ and the Congestion Charge Zone?
- How can spill-over effects be studied and estimated?

Research Design: To answer the main question on the effect of London's TMS on various economic outputs I intend to use a synthetic control approach in which the individual effect of the TMS applied to each treated region can be quantified by constructing a synthetic control from all untreated regions. This method was introduced in Abadie and Gardeazabal (2003) to look at the effect of conflict in the Basque Country' macroeconomic performance and is extensively described in Abadie, Diamond, and Hainmueller (2010). Even if, to the best of my knowledge, the synthetic control method has not yet been applied to cities' TMS, previous research has used similar methods to study LEZ effects such as Wolff (2014) and Gehrsitz (2017) who apply differences-in-differences to estimate the causal effect of LEZ in air quality. Furthermore, Transport For London produces its own evaluation reports but using a standard first-difference approach and thus unable to establish causal effects (TFL, June, 2006).

The data used would be Eurostat' collection of regional statistics available for NUTS regions (from 2000 to 2017 and covering the whole of the EU) and public information on the implementation of TMS in European regions. The strength of this methodology is based on its ability to give estimates for each region on each statistic available (including non-economic variables such as pollution[1]) as long as there is a pool of untreated regions from where to construct the synthetic control. Potentially, and for large cities such as London where different TMS are in place and the NUTS regions give sufficient resolution, a study of the relative impact of different TMS in economic output is possible as well as a study on spill-over effects by comparing regions where the application differs or comparing areas that surround treated and non-treated urban areas.

[1]Local air quality data can be gathered from van Donkelaar et al. (2016), the AirBase of European air quality e-reporting, NASA's MERRA-2, CAMS or others.

Most of the data from transmission mechanisms is directly available in Eurostat such as GDP, GVA per sector, unemployment, science and technology statistics (trademarks and patents), business outputs and demographics[2]. Furthermore, the UK has more detailed data allowing for a deeper analysis of transmission mechanisms (such as the Office of National Statistics' data on productivity.)

The model also makes assumptions that can be questioned such that the non-interference between units (Rosenbaum, 2007) and that the differences between cites with and without LEZ are not significant, apart from the environmental policy and independent of the application of the policy[3].

Potential impact and relevance of the study: This research can provide a concrete answer to an already pressing question for local authorities, academics and the broad public. The study results can be used to have a better understanding of the policy's effects by providing specific estimates for London's TMS effect in the economy accounting for the heterogeneity of implementation formulas, spill-over effects and transmission mechanisms.

Furthermore, it could also promote further research looking at the potential effect of TMS in developing urban settlements in low and middle income countries, where the costs of pollution appear to be higher and policy advice is much needed.

Limitations: Limitations of the results are derived from assumptions of the model. In the best case scenario I can claim the overall effect but the mechanisms' effect is missing for lack of more sectorial and micro data regarding businesses. Furthermore, even though an intuition on the ranges of effect size can be extracted from London's example, the results can only be interpreted for this specific case study.

[2]There is a vast amount of regional economic, demographic and environmental data at this geographical definition. Even if the information mentioned is enough to achieve the research aim of this proposal, I am confident that further data can be found that further increases the research ability to understand the transmission mechanisms at play. A summary of the potential variables can be found in the Appendix.

[3]This could be sorted in different ways, such as comparing policy-treated areas with control areas that were treated in later periods (Neumark & Kolko, 2010). Also, for major statistics such as regional GDP, data from non-european cities could be gathered to increase the pool of controls, reinforce, and test the argument of exogeneity of the treatment.

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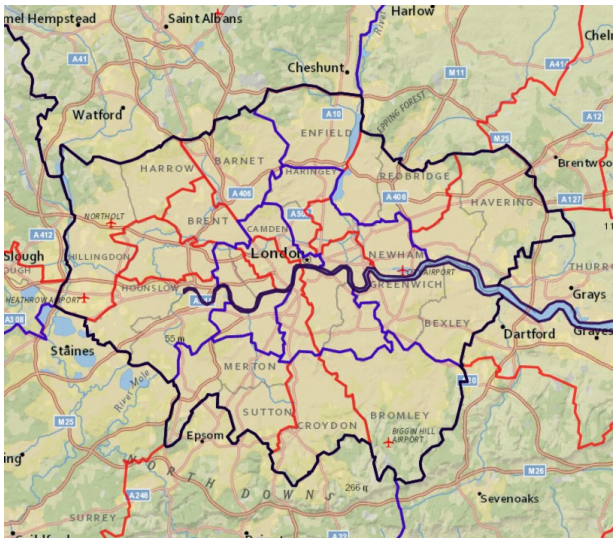
Appendices

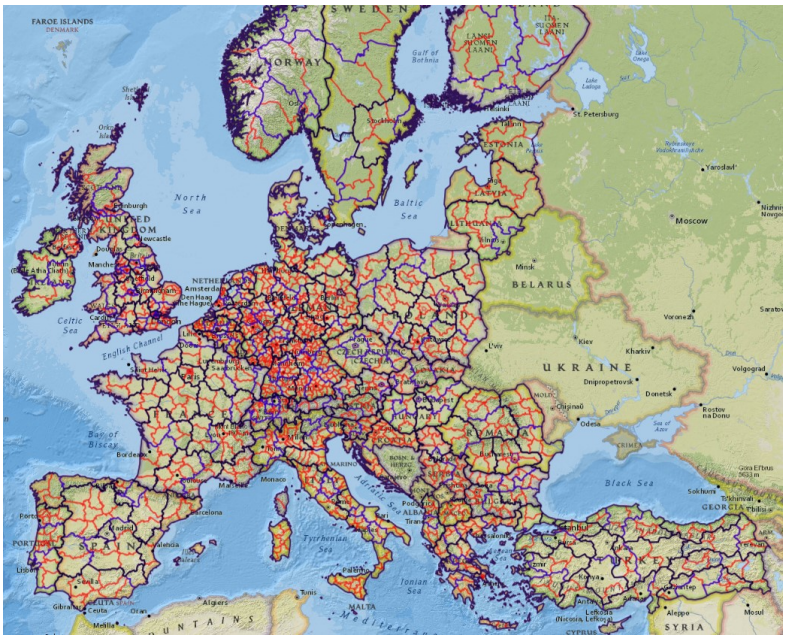
(a) Madrid (1 NUTS1)

(b) Paris (4 NUTS3)

(c) Budapest (1 NUTS1)



(d) London (22 NUTS3, 1 NUTS1)



(e) Main coverage of NUTS 3 zones

Figure 1: Main coverage, with examples, NUTS zones across Europe.
Source: Eurostat and own work.

Table 1: Potential variables to use with their source, geographic and time coverage.

Variable	Coverage	Geography	Start	End	Delta	Source
Outcomes (Y):						
GVA by Industry	UK	NUTS 3	1998	2017	1 year	ONS
Gross value added at basic prices by NACE activites	EU	NUTS 3	1995	2017	1 year	Eurostat
GDP	UK	NUTS 3	1998	2017	1 year	ONS
GDP	EU	NUTS 3	2000	2017	1 year	Eurostat
Total GDP at current prices	EU	NUTS 4 (LAU 1)	2000	2017	1 year	Eurostat
Spatial variation (X):						
Boundaries of TMS zones	EU	georeferenced	Most recent			urbanaccessregulations.eu
Boundaries of TMS zones	EU	georeferenced	Most recent			"Green-Zones" App
Boundaries of TMS zones	Germany	georeferenced	Most recent			"Umweltzone" App
Boundaries of TMS zones and details on their implementation	EU	"Described"	All	All	All	Official and legal documents
Details on TMS's implementation	Germany	"Described"	All	2017	1 year	Gehrsitz (2017) and Wolff (2014)
Transmission mechanisms (secondary Y):						
Productivity	UK	Cities	2004	2017	1 year	ONS
Employment ('000 persons) by NACE	EU	NUTS 3	1995	2017	1 year	Eurostat
Employer business demography by NACE Rev. 2	EU	NUTS 3	2008	2016	1 year	Eurostat
Employer business demography by size class	EU	NUTS 3	2008	2016	1 year	Eurostat
Business demography and high growth enterprise by NACE Rev. 2	EU	NUTS 3	2008	2016	1 year	Eurostat
Business demography by size class	EU	NUTS 3	2008	2016	1 year	Eurostat
Science and Tech statistics	EU	NUTS 3			1 year	Eurostat
Community design (CD) applications	EU	NUTS 3	2003	2016	1 year	Eurostat
Patent applications to the EPO by priority, IPC, sections and classes	EU	NUTS 3	1977	2012	1 year	Eurostat
High-tech patent applications to the EPO by priority year	EU	NUTS 3	1977	2012	1 year	Eurostat
Patent applications to the EPO by priority year	EU	NUTS 3	1977	2012	1 year	Eurostat
Business Demographics and Survival Rates	London	Borough	2002	2018	1 year	ONS
VAT enterprices by turover	London	Borough	2003	2019	1 year	ONS
Real labour productivity	UK	LEPs	2004	2017	1 year	ONS
Other variables (mostly control):						
Household income	UK	MSOA	2011	2016	2 years	ONS
Deaths (total)	EU	NUTS 3	1990	2017	1 year	Eurostat
Population change	EU	NUTS 3	2000	2018	1 year	Eurostat
Land use (to see degree of urbanization)	EU	NUTS 3	2015	2050	5 year	JRC
Electricity and Gas consumption	UK	LSOA	2016	2017	1 year	ONS
Demographic stats	EU	NUTS 3			1 year	Eurostat
Live births	EU	NUTS 3	1990	2017	1 year	Eurostat
Area (m3)	EU	NUTS 3	1990	2015	1 year	Eurostat
Population / age, sex	EU	NUTS 3	1990	2018	1 year	Eurostat
Live births / age mother	EU	NUTS 3	1990	2017	1 year	Eurostat
Fertility rate	EU	NUTS 3	1990	2017	1 year	Eurostat
Age dependency ratio by age class	EU	NUTS 3	2014	2018	1 year	Eurostat
Young age dependency ratio	EU	NUTS 6 (city)	2000	2018	1 year	Eurostat
Share of transport means to work (imperfect)	EU	NUTS 6 (city)	2001	2012	1 year	Eurostat
Cars/1000 persons (imperfect)	EU	NUTS 5	2002	2012	1 year	Eurostat
Shape files of NUTS and LAU 1 regions:						
Shape Files	EU	NUTS and LAU 1	All	All	All	Eurostat