What are the Socio-Economic Impacts of Low Emission Zones?

EnergyEcolab has been awarded a grant by La Caixa Foundation, aimed at supporting social research projects that provide insights about the current and emerging social challenges through innovative approaches. The project, entitled "The Socio-Economic Impacts of Low Emission Zones (LEZs)", will contribute to the debate regarding two global questions of key socio-economic relevance: the design of environmental policies and the future of cities. This topic is anchored on the European Green Deal strategy to achieve climate neutrality by 2050 in line with the European Commission's objective to reach "100 Climate-Neutral Cities by 2030 – by and for citizens".

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Road transport is a leading source of greenhouse gases and local air pollutants, particularly in urban areas where most of the congestion occurs. The health, economic, and societal costs of local air pollution are substantial, ranging from decreased life expectancy and increased infant mortality to far-reaching economic implications such as job losses, decreased consumer spending, and overall welfare costs. This has led governments across the world to implement new pieces of legislation to tackle urban air pollution. Spain is no exception. Its new Law on Climate Change and Energy Transition, currently debated in Parliament, includes targets for electric vehicles, bans on the sale of cars running on diesel or petrol, and the obligation for medium and large cities to create Low Emission Zones (LEZs). Despite the widespread use of such policies, rigorous evidence on their effectiveness remains limited, making it difficult for policy-makers to make informed choices on how to better design them.

In this project, **we seek to dig deep into the socio-economic effects of LEZs. While their positive direct impacts on air quality in the restricted zones have already been documented, little is known about their broader and long-lasting impacts**, particularly when they interact with other policy instrument such as subsidy for low or zero-emission vehicles and gasoline taxes. Our project will focus on these long-lasting

impacts by exploring the effects of LEZs on the vehicle fleet composition, the shift in the habit of using of shared-mobility options, and broader socio-economic impacts in the restricted areas. We will also explore the distributional implications of these policies.

Spain provides a unique laboratory to investigate these issues. Pressure of legal actions from the European Commission regarding the air quality in Madrid, led to the creation of a LEZ, Madrid Central. Access to high-frequency and hyper-local data will allow us to analyse the socio-economic impacts of Madrid Central through the lens of state-of-the-art econometric techniques. The results will contribute to the on-going debate concerning the best courses of action to address environmental challenges in many cities across the world.

Objectives, Hypothesis and Methods

In this study, we aim to use rich data collected since the announcements of Madrid Central to empirically evaluate an array of questions. To what extent does urban access regulation based on the vehicles' emission rates directly shifts the vehicle composition fleet towards cleaner cars? Does this regulation create the habit of using the shared-mobility options? How do LEZs policies interact with other existing policies such as purchasing subsidies and gasoline taxes? What is the impact of these policies on global and local pollution, both in restricted and non-restricted areas? Are there other socio-economic impacts in the restricted areas?

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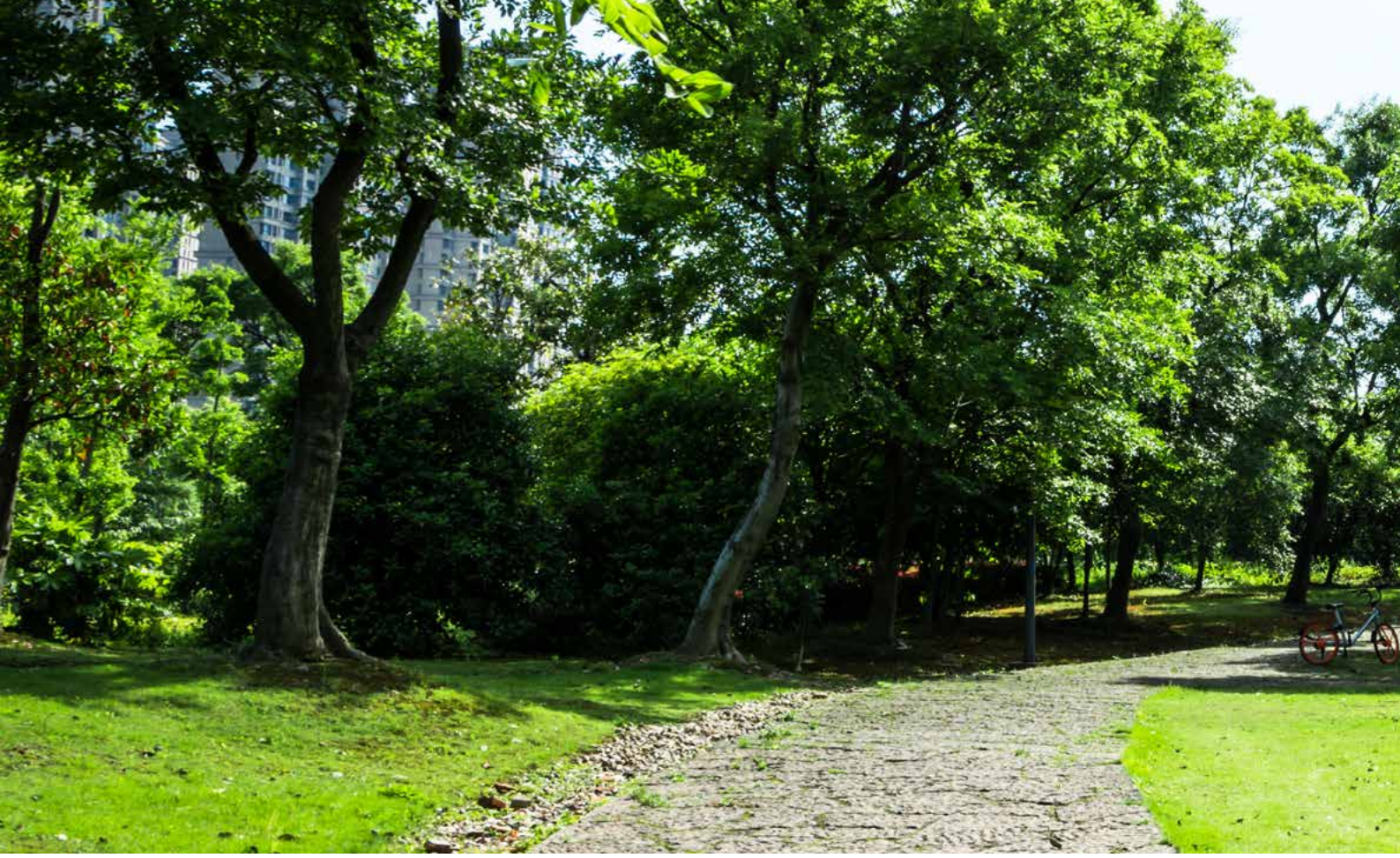
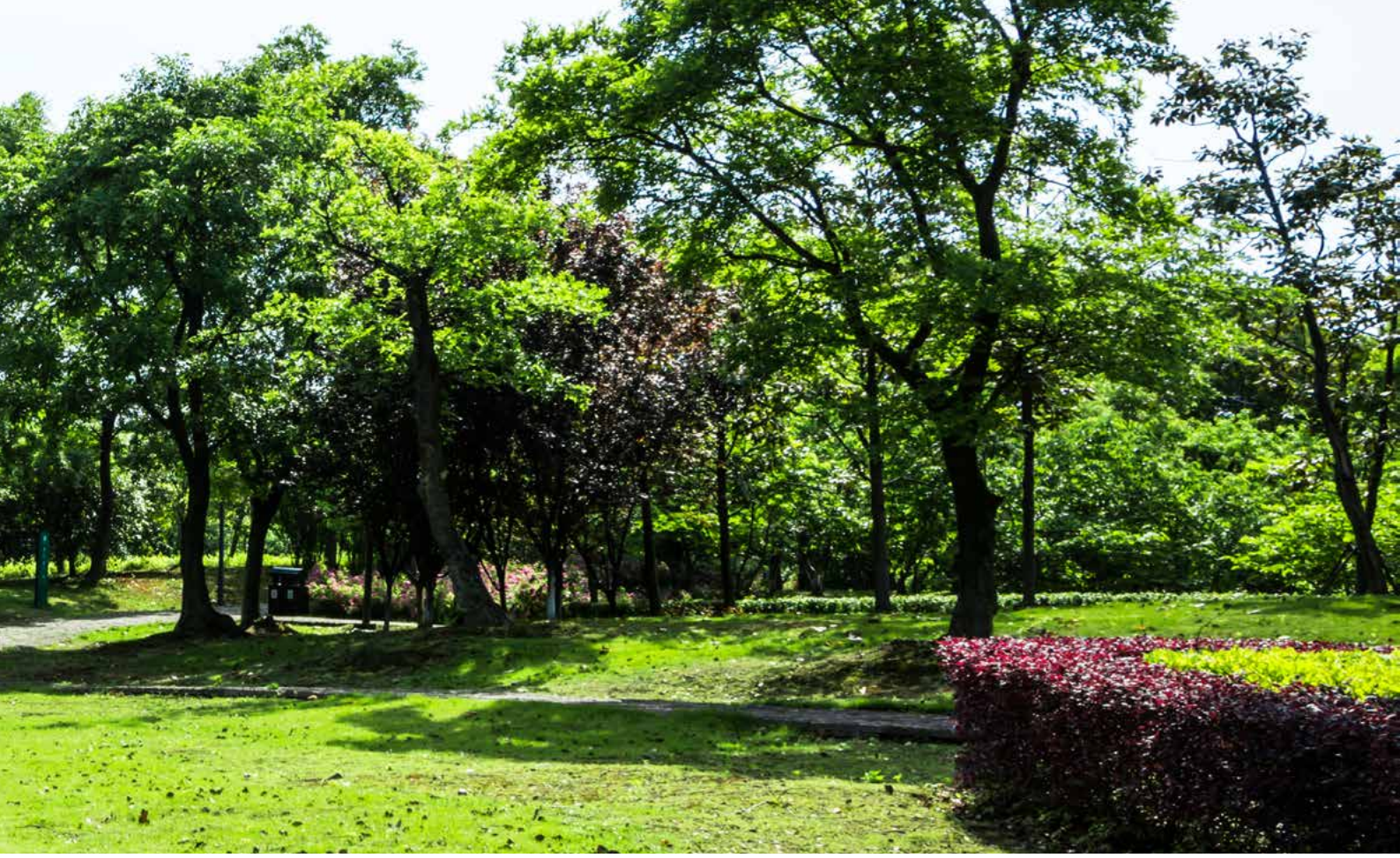


Beyond the short-run impacts on air quality in the restricted areas, we seek to disentangle their long-lasting and broader effects through changes in the vehicle fleet, the users' habits towards shared-mobility options, and further socio-economic implications in the restricted zones.

One of our hypothesis is that LEZs may influence individuals' proclivity to purchase green vehicles. To investigate this, we will use individual vehicle registration data that contains information on the characteristics of all vehicles registered in Spain from 2014 onwards. Underlying our empirical strategy is the assumption that the regulations mainly affect commuters with private cars, with different effects depending on whether they live inside or outside the LEZs. Changes in the green vehicle purchases in areas outside the restricted zones can be compared, through a differences-in-differences approach, to the changes in the green vehicle purchases by the residents in the restricted zones, before and after the introduction of LEZs.

Another hypothesis is that **LEZs can be a strong catalyst for bike-sharing and car-sharing** through several channels: a higher demand for shared-mobility to access the restricted areas induces bike- or car-sharing companies to buy more bikes or cars, and as more cars become available, this boosts the use of the shared-mobility option. In turn, through habit persistence, this can promote the use of car sharing more broadly, thus creating positive externalities beyond the restricted zones. Our empirical analysis, which aims to disentangle these three channels, will combine vehicle registration data, public transport trips data, publicly available bike sharing trip data, and car-sharing usage data. Using these data, will seek to analyse the degree of and the factors affecting the switch from private vehicles usage to bike-sharing and car-sharing since the LEZs in Madrid has been in place.

There is an increasing literature looking at how individuals react to multiple environmental instruments and how some instruments may be more salient than others,



affecting the optimal design and combination of instruments. The implementation of LEZs policies in combination with other instruments (subsidies for the purchase of low emission cars) presents a unique opportunity to evaluate these theories in the context of the car market.

Finally, **the introduction of LEZs might induce people to reduce the number of trips into the city centre, or to replace their vehicles with green alternatives**, or it may affect the composition of stores in the restricted area, or the type of people living in it. Whether these effects are present or not has important implications on the broader socio-economic impacts of LEZs, which our project also seeks to explore.

In sum, this study is intended to inform the public debate on the socio-economic consequences of urban access regulations - a hotly contested issue in Spain, and more broadly in Europe. Beyond the short-run impacts on air quality in the restricted areas, we seek to disentangle their long-lasting and broader effects through changes in the vehicle fleet, the users' habits towards shared-mobility options, and further socio-economic implications in the restricted zones. The analysis of highly detailed data regarding Madrid Central will be beneficial to other cities and countries that, subject to the new Spanish and European legislation, will soon have to implement similar urban access regulations ·