# *CHOOSING TO DIET: THE IMPACT AND COST-EFFECTIVENESS OF CHINA'S VEHICLE OWNERSHIP RESTRICTIONS*

Antung Liu, Indiana University O'Neill School of Public and Environmental Affairs, USA, aaliu@indiana.edu
Rubal Dua, King Abdullah Petroleum Studies and Research Center (KAPSARC), KSA, rubal.dua@kapsarc.org
Wei-min Hu, National Chengchi University, Taiwan, weiminhu@nccu.edu.tw
Arthur Lin Ku, Indiana University O'Neill School of Public and Environmental Affairs, USA, alku@iu.edu

## Overview

The transportation sector is the fourth largest emitter of greenhouse gases (GHGs), linked to rising global temperatures. Passenger cars that run on petroleum-based fuels account for about 40% of all transportation emissions. The global expansion of the passenger car fleet has been a main driver of petroleum-based fuel consumption and GHG emissions. Pollution, congestion, and accidents are some of the local externalities associated with rising passenger car use.

Voluntary efforts by countries have emerged as one of the main pathways for addressing these externalities. One of the voluntary efforts being undertaken in China, the world's largest GHG emitter, is vehicle ownership restrictions (VOR), which sets a limit on the number of new license plates issued each year. Since VOR limits the growth of car fleet size, it has the potential to assist China in significantly reducing its carbon emissions. Understanding the impact and cost-effectiveness of VOR policies in limiting car fleet size, fuel consumption, and GHG emissions is crucial for both understanding the scope of China's voluntary efforts and informing policymakers in other parts of the world who are considering the adoption of similar policies.

## Methods

We apply synthetic control, regression discontinuity, and dynamic panel analysis techniques on new car registrations and usage data in Chinese cities. In particular, we use regression discontinuity and synthetic control techniques to quantify the impacts of ownership restrictions on new car sales as well as fuel consumption rate for the new car fleet. We next estimate the effect of vehicle ownership restrictions on the average annual kilometers travelled per car for new cars. To examine this possibility, we used dynamic panel analysis technique to estimate the dependence of annual kilometers travelled per car on the total number of cars in the city.

## Results

We find that ownership restrictions in Chinese cities have had large impacts. In particular, between 2011 and 2015, ownership restrictions decreased new car sales in cities implementing them by about 72%, while decreasing gasoline consumption and tailpipe-GHG emissions by about 50%. In absolute terms, 5.3 million new car purchases and 7 million metric tonnes per year of tailpipe-GHG emissions were avoided by 2015 as a result of these ownership restricitons. To put things in perspective, the total annual car sales in Japan, the third largest automotive market in the world, were lower than 5.3 million, while thirty countries worldwide had total annual carbon dioxide emissions from fuel combustion below 7 million metric tonnes. Cost-effectiveness evaluation suggests these large impacts occur at a very high cost, comparable to the price of gasoline in China, though within the range of estimates on the cost of externalities avoided.

## Conclusions

The findings hold relevance for policymakers worldwide who might be considering restrictions on car sales for addressing automobile-related externalities. The results have implications for future oil demand, because China, also the world's largest consumer of gasoline, has taken voluntary measures to slow its demand growth. Furthermore, our results are important because they illustrate a strategy of China, the world's largest producer of GHG emissions, to decrease its future emissions growth. Our analysis can also support studies that examine whether China will meet its Paris Agreement pledges.