Stranded to be?
Diesel Ban in Cities and Used Car Markets

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Agenda

Introduction

French context

Data and empirical strategy

Results

Conclusion

Introduction

Diesel Vehicles and Air Pollution in Cities

- Decades of diesel promotion in Europe stopped with the increased public awareness on air pollution in cities,
- Road transport, a major contributor to air pollution :
  - $\sim$60% of NO_x and $\sim$30% of PM_{10},
  - 4.2M deaths/year due to air pollution (WHO),
  - 48,000 early deaths per year in France,
  - About 18% of COVID-19 deaths in France could be due to long term exposure to air pollution.
- Many cities are implementing policies to restrict city access to the most pollutant cars.

Paper motivations & findings

Research question :

- Do car owners anticipate the implementation of driving restrictions in their city ?

Summary :

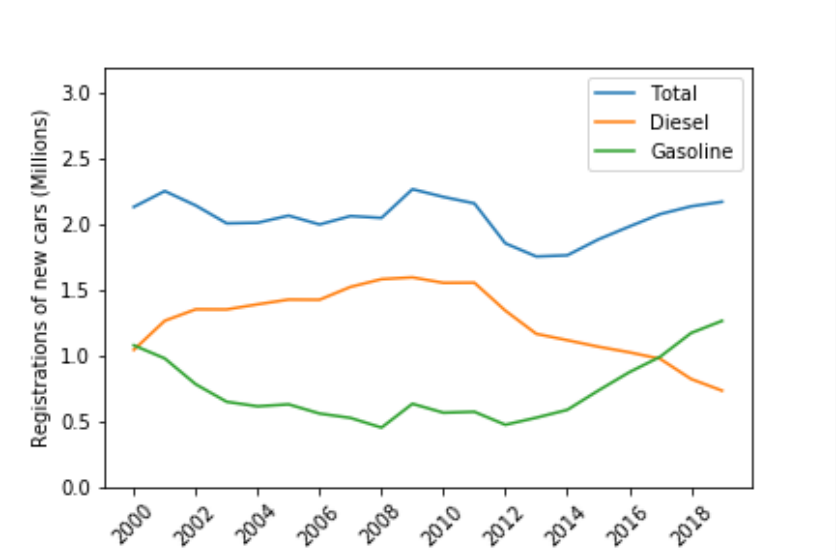
- Analysis of price determinants in the French used-cars market
- Diesel and old vehicles face a significant maluses in cities implementing Low Emission Zones

Related literature :

- Assessment of urban policies toward air pollution
- Consumer behavior in car markets

French context

French context : a stock of diesel cars



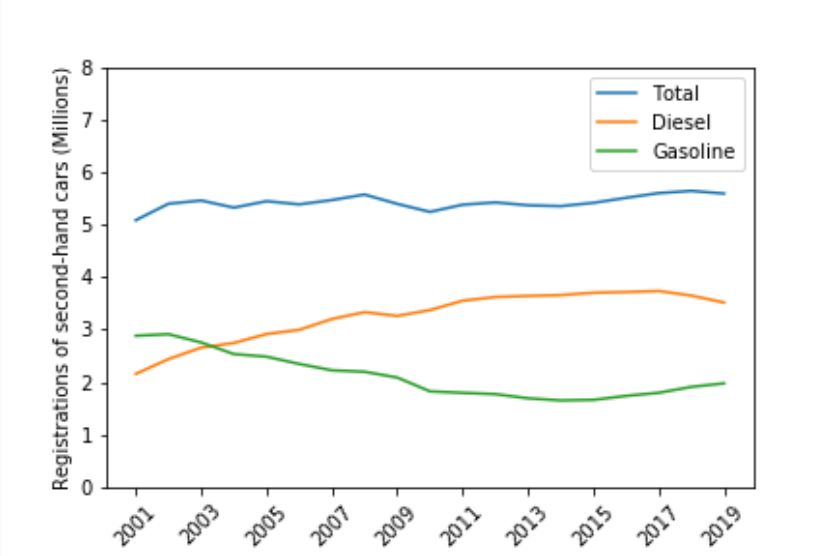
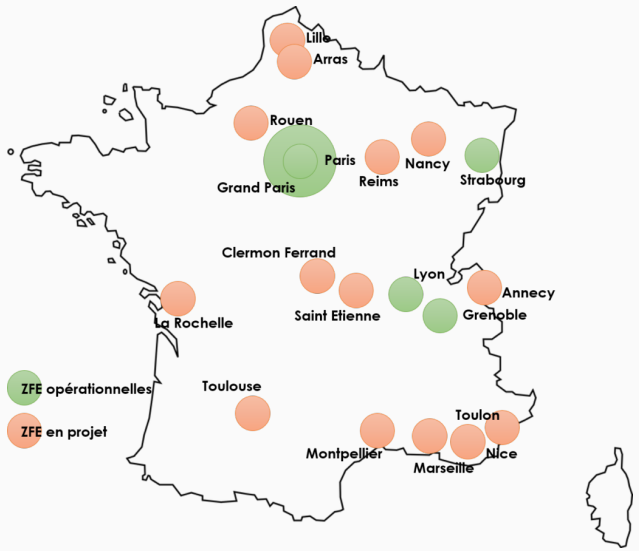
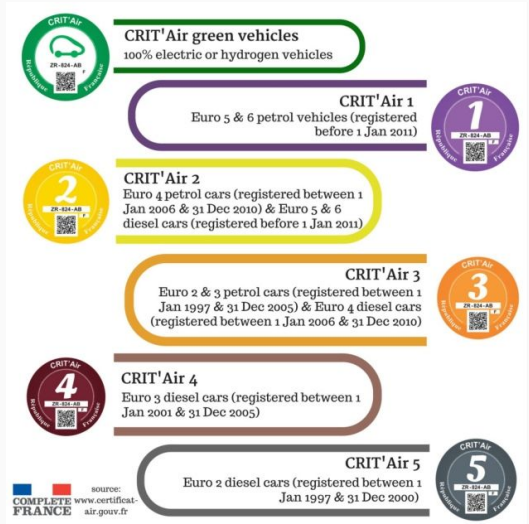


Figure 1 – Registrations of new cars (left) and used-cars (right) in France

- Diesel fashion : technical (better fuel economy than gasoline) and fiscal advantages (fuel taxes and CO_2 policies)
- Large used car market and still very dieselized.

French context : the choice of Low Emission Zones





- 2018 : 19 cities have announced the implementation of a LEZ
- 2019 : New law on mobilities, post yellow-vests crisis, in which option of introducing urban tolls was withdrawn
- November 2020 : National air council announces that effective LEZ will be mandatory in an increasing number of cities by 2025
- LEZ are driving restriction zones are based on car's pollution levels (Critair classification).
- Several cities plan a total ban of diesel by 2024-25

Data and empirical strategy

Data

Main sources :

- **$\sim$900k ads collected from an online advertizing platform in September 2020**
- **vehicles specs collected from a specialized information website**
- socio-demographic and geographic data from INSEE (population density, median revenues, urban zone types at the zipcode scale)
- air pollution data from LSCQA (at the subregion (*départements*) scale)

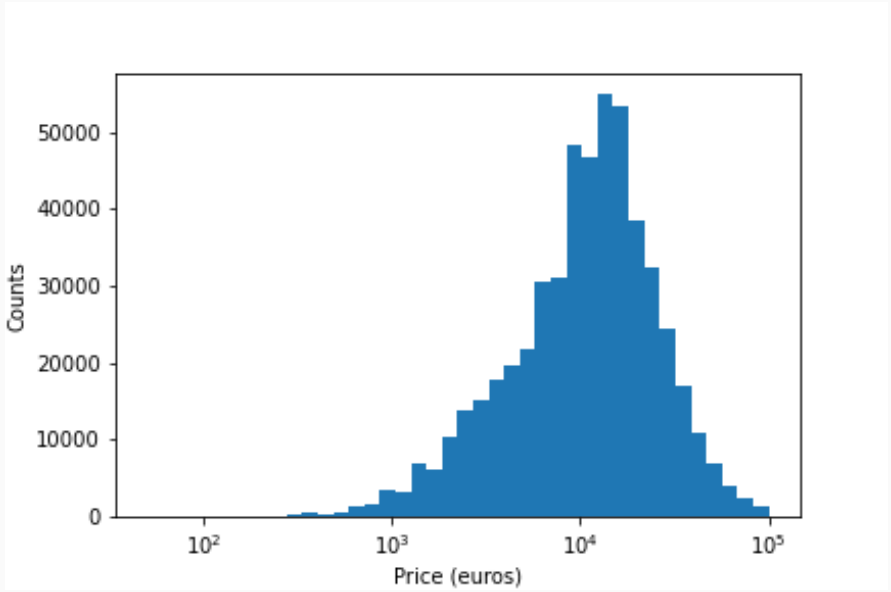
Data collection through "webscrapping" (programming a "bot" that automates data extraction from a website).

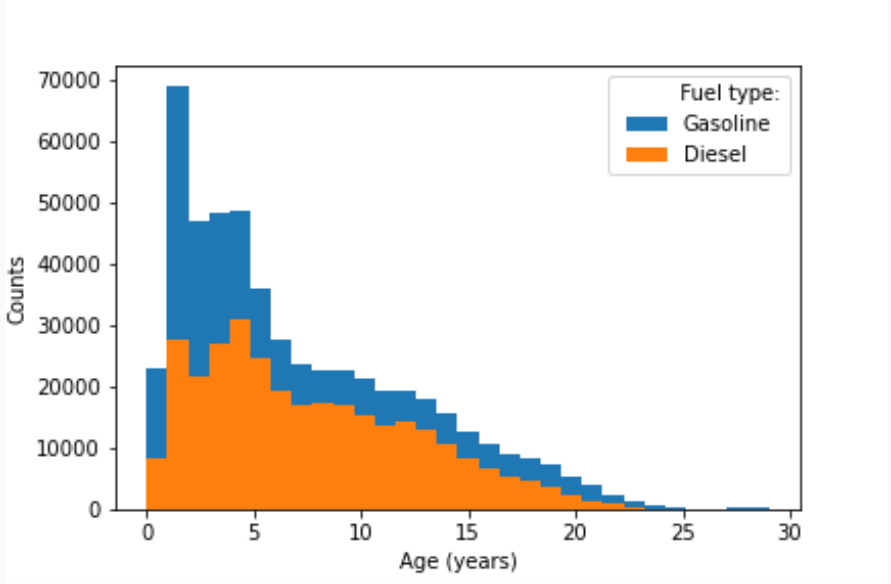
Descriptive statistics (1)

Variable	Mean	Std. deviation
Price (€)	14003	12013
Age (year)	6.9	5.6
Mileage (km)	97000	79000
Engine power (kW)	128	52
Weight (kg)	1312	298
Fuel consumption (l/km)	5.2	1.4
Trunk volume (cm^3)	391	224
Fuel type - Diesel (dummy)	58%	-
Gearbox - Manual (dummy)	71%	-
Seller - Professional (dummy)	57%	-
Total : 919,594		

Table 1 – Main descriptive statistics

Descriptive statistics (2) : price and age distributions





Econometric model

$$\log(PRICE_i) = \alpha X_i + \beta A_i + \gamma G_i + \sum_j \left[\sigma_j PROX_{ij} + \eta_{ij} PROX_{ij}.Fuel_i\right] + \epsilon_i \quad (1)$$

$$\log(PRICE_i) = \alpha X_i + \beta A_i + \gamma G_i + \sum_j \left[\sigma_j PROX_{ij} + \eta_{ij} PROX_{ij}.Age_i\right] + \epsilon_i \quad (2)$$

- X_i : vector of car characteristics
- A_i : vector of ad details
- G_i : vector of geographic controls
- $PROX_{ij} = e^{-d_{ij}/d_0}$: LEZ proximity indicator
- d_{ij} minimal distance to LEZ of type j from location of seller i. d_0 : characteristic distance

Results

Regression results

	Dependent variable :	
	log(Price)	
	(1 - Energy*LEZ)	(2 - Age*LEZ)
Age	−0.076*** (0.0001)	−0.075*** (0.0001)
Mileage	−0.039*** (0.0001)	−0.039*** (0.0001)
Diesel	0.010*** (0.001)	0.005*** (0.001)
Manual Gearbox	−0.123*** (0.001)	−0.123*** (0.001)
Professional Seller	0.051*** (0.001)	0.051*** (0.001)
Ad Duration	0.0002*** (0.00000)	0.0002*** (0.00000)
Engine Power	0.003*** (0.00001)	0.003*** (0.00001)
Weight	0.0003*** (0.00000)	0.0003*** (0.00000)
Fuel Consumption	−0.034*** (0.001)	−0.034*** (0.001)
Trunk volume	0.0001*** (0.00000)	0.0001*** (0.00000)
Median Revenue	0.031*** (0.002)	0.029*** (0.002)
LEZ_ongoing_20	−0.055*** (0.004)	−0.045*** (0.004)
LEZ_planned_20	−0.068*** (0.003)	−0.033*** (0.004)
LEZ_announced_20	−0.012*** (0.002)	−0.0001 (0.002)
Diesel :LEZ_ongoing_20	−0.086*** (0.004)	
Diesel :LEZ_planned_20	−0.022*** (0.004)	
Diesel :LEZ_announced_20	−0.018*** (0.002)	
Age :LEZ_ongoing_20		−0.008*** (0.0004)
Age :LEZ_planned_20		−0.007*** (0.0004)
Age :LEZ_announced_20		−0.003*** (0.0002)
Constant	9.181*** (0.005)	9.183*** (0.005)
Brand	Yes	Yes
Category	Yes	Yes
Geographic controls	Yes	Yes
Ad controls	Yes	Yes
Observations	919,594	919,594
R^2	0.905	0.905
Adjusted R^2	0.905	0.905
Residual Std. Error (df = 919507)	0.281	0.281
F Statistic (df = 86 ; 919507)	101,836.400***	101,891.400***
Note :	*p<0.1 ; **p<0.05 ; ***p<0.01	

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Results interpretation

- Clear effect of LEZ on diesel and older vehicles
- Sellers seem to anticipate the implementation of policies.
- Although we do not observe transaction prices, we could imagine that demand for diesel would drop in LEZ.
- Back of the envelop calculations :
  - Ongoing : $\sim 1100 - 1500€$
  - Planned & Announced : $\sim 300 - 400€$

Robustness checks

- Senstitivity of the characteristic distance d_0
- Placebo test by resampling
- Adding technical controls
- Adding crossed variable

Conclusion

Conclusion and future works

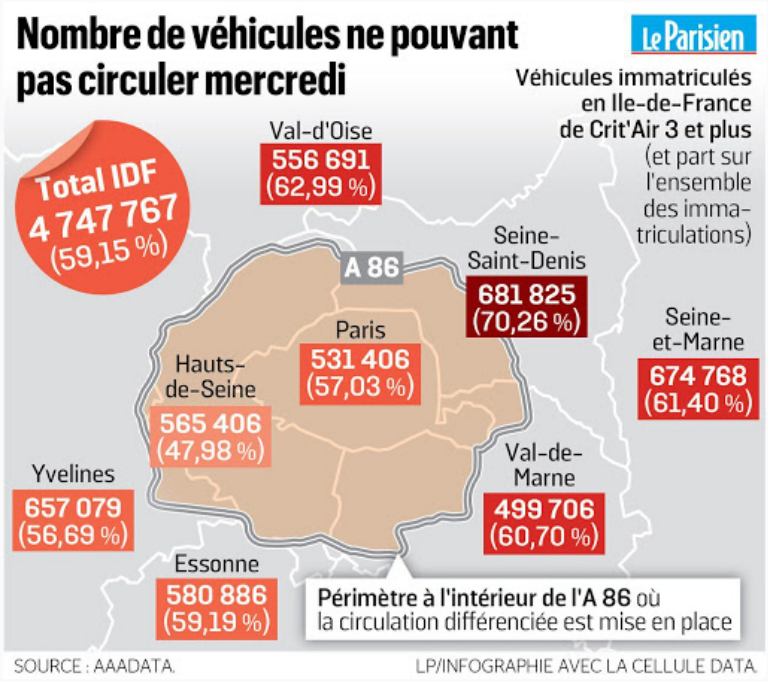
Summary :

- Sellers of cars in second-hand markets seem to anticipate driving restrictions
- This implies that LEZ could create distributional effects.

Future works :

- Get more precise estimation of the malus per town and compare to regional policies (eg scrapping schemes).
- Repeat data collection and track "diesel" malus in time
- Analyze a used-car market in an other country (eg Germany)

Question on distributive impacts



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