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ESTIMATING FUEL PRICE ELASTICITIES OF ROAD TRANSPORT DEMAND IN THE UK

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1. INTRODUCTION & MOTIVATION

The present road transport system in the UK is not functioning at its socially optimal level due to the presence of externalities. Externalities of road use exists when there are differences between marginal social costs and marginal private costs. Some examples of these externalities include congestion, air and noise pollution. According to the theory of marginal cost pricing, a road user will only consider the cost inflicted on oneself in the decision making process. Therefore, an oversupply of trips beyond socially efficient levels occur, leading to an overall deadweight welfare lost as observed in Figure 1.

Hence, in order to optimise this amount to socially efficient levels, a charge needs to be imposed on road users in order to internalise the costs he or she inflicts on others. Some suggested methods of internalising these costs include taxes, which may be levied on fuel. Thus, in order for such policies to be implemented, the local government needs to predict the response of traffic demand to changes in fuel prices, which is also known as fuel price elasticities.

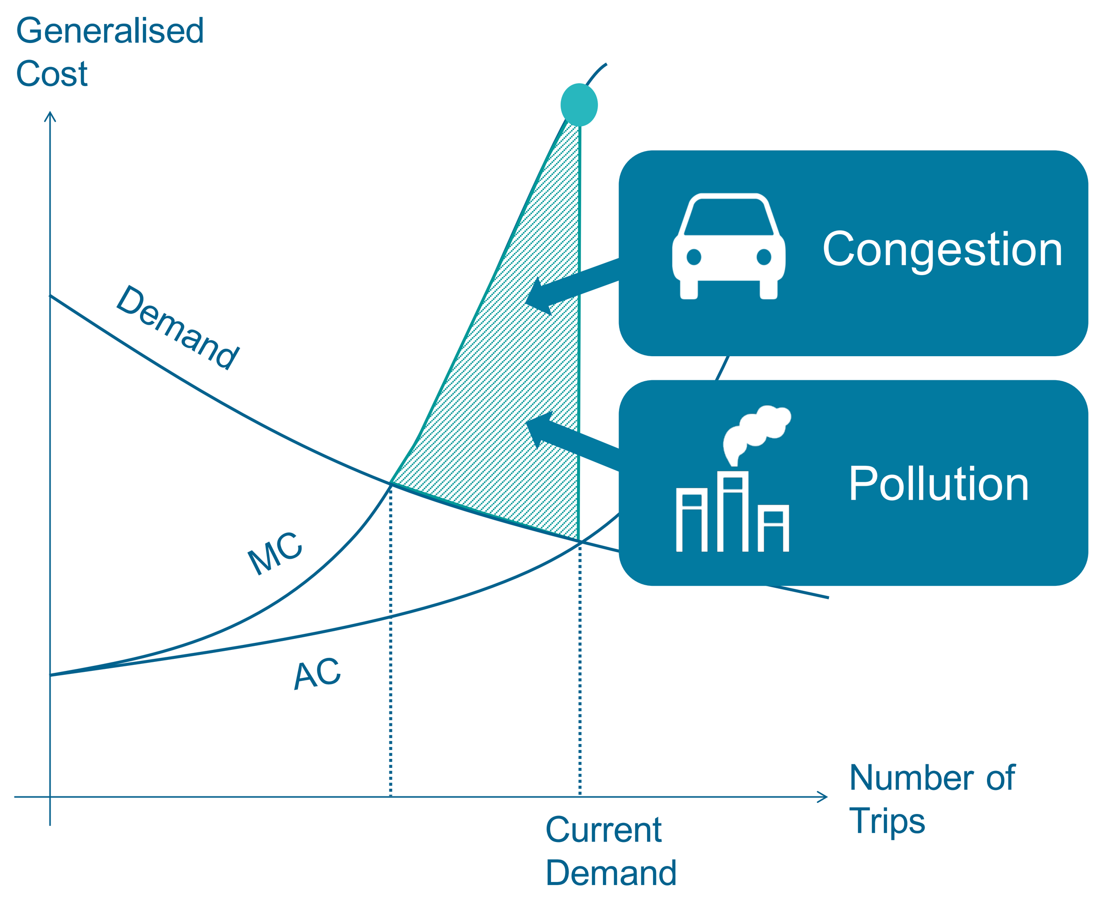


Figure 1: Deadweight welfare lost shown by the shaded region

2. DATA SETS

Panel data is utilised in this study to account for unobservable heterogeneities that may exist between the different units. Data Set A is a study on 94 different local authorities on an annual basis from 2012 to 2014, while data set B is a study on 33 different counties on a monthly basis from 2011 to 2014. Multiple estimators including instrumental variables are used in the models below to exploit the special features of panel data.

3. MODELS

20 different models are used in this study, whereby each model contains a different combination of time steps, units of traffic demand, fuel type, road type, vehicle category and presence or absence of time trends as seen in Table 1.

Criteria Present in Model	Models																			
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
Time Step - *Annual*	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■				
Time Step - *Monthly*																	■	■	■	■
Dependent Variable - *Veh/Day*		■	■	■		■	■	■		■	■	■		■	■	■	■	■	■	■
Dependent Variable - *Veh Miles/Year*	■				■				■				■							
Fuel Type - *Unleaded Petrol*	■	■	■	■	■	■	■	■									■	■		
Fuel Type - *Diesel*									■	■	■	■	■	■	■	■			■	■
Road Type - *"Major" and "Minor"*	■	■			■	■			■	■			■	■						
Road Type - *"Major" only*			■	■			■	■			■	■			■	■	■	■	■	■
Vehicle Category - *All Motor Vehicles*	■	■	■		■	■	■		■	■	■		■	■	■		■	■	■	■
Vehicle Category - *Cars and Taxis*				■				■				■				■				
Time Trend - *Present*					■	■	■	■					■	■	■	■		■		■
Time Trend - *Absent*	■	■	■	■					■	■	■	■					■		■	

Models A to P contain regressors other than fuel price

Table 1: Multiple models used in the analysis

4. RESULTS

Models Compared	Real Petrol Price, PP *(logarithmic)*	Real Diesel Price, PD *(logarithmic)*
A to I	-0.2202*** (0.0194)	-0.1639*** (0.0187)
B to J	-0.1989*** (0.0211)	-0.1637*** (0.0185)
C to K	-0.1363*** (0.0239)	-0.1154*** (0.0202)
D to L	-0.0836*** (0.0260)	-0.0692*** (0.0220)

1. Results using the fixed effects estimator with clustered standard errors shown in the parentheses
2. Individual coefficient is statistically significant at the *10%,**5% and ***1% level
3. Model stated first always denotes petrol price as the fuel regressor (i.e. A)

Table 2: Summary of results for models A to L

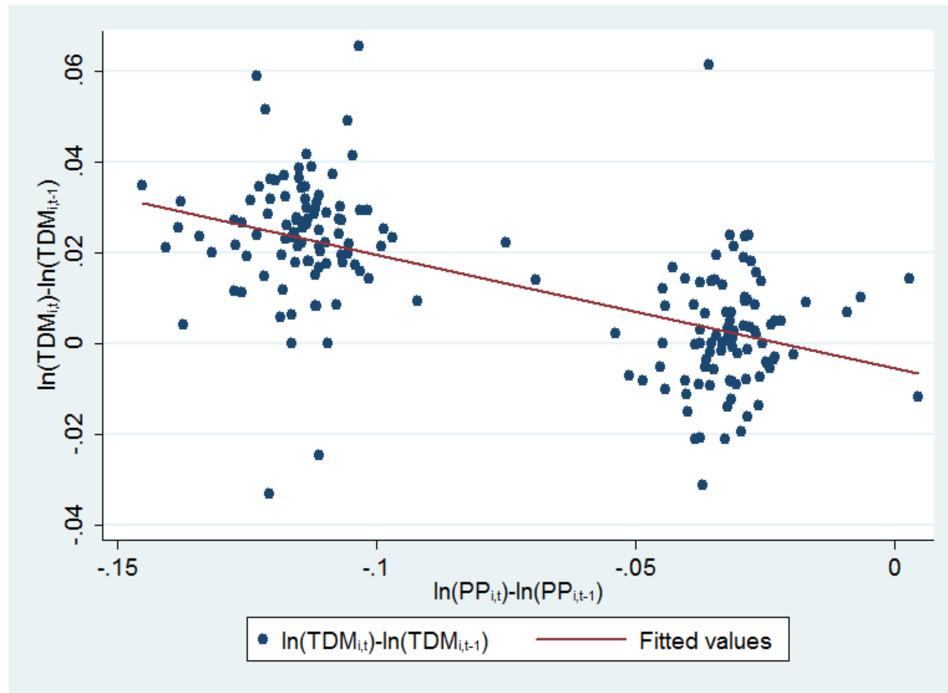
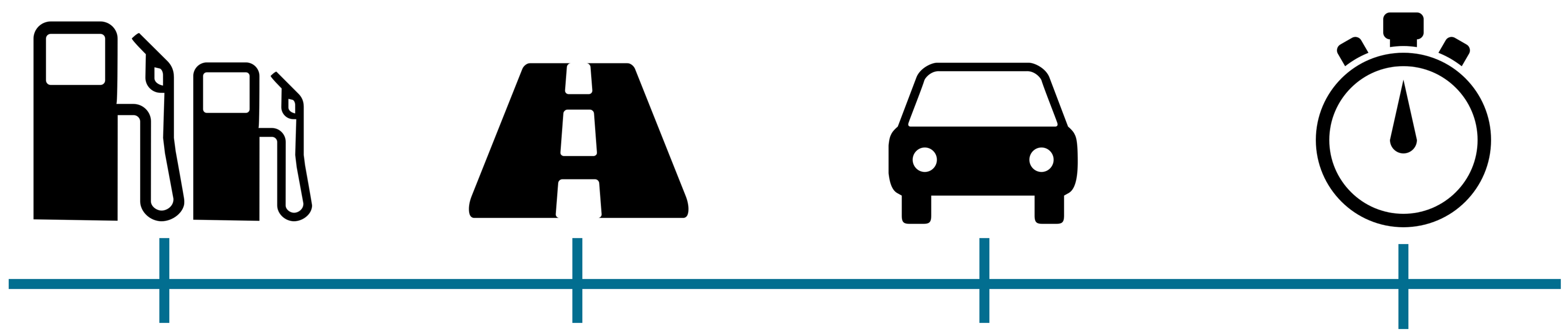


Figure 2: First difference scatter plot of Model A. TDM denotes traffic demand for Models A and I

Key results show that fuel price elasticities are negative and significant at an annual time scale. In Table 2, the fuel price elasticity of -0.2202 signifies a decrease in traffic demand by 0.2202 percent for an increase in real fuel price by 1 percent.

5. DISCUSSION



Petrol price elasticities of traffic demand are higher than that of diesel.

"Major" road traffic is less elastic to changes in fuel prices as compared to "major and minor" road traffic.

Cars and taxis are less elastic to changes in fuel prices as compared to all motor vehicles.

When the time frame of observations are reduced from annual to monthly, fuel prices appear to have an insignificant effect on demand.

6. ACKNOWLEDGEMENTS

I would like to thank Professor Daniel J. Graham for his continuous guidance and kind support throughout the project.

7. REFERENCES

Yang, H. & Huang, H. (1998) Principle of Marginal-Cost pricing: How Does it work in a General Road Network? 32 (1), 45-54.

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