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The Cost of Transportation : Spatial Analysis of US Fuel Prices

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Abstract

The geography of fuel prices has several implications, from a significant impact on accessibility patterns to issues of territorial equity and transportation governance. In this paper, we study its spatio-temporal patterns at a high resolution. We construct a dataset collecting daily oil prices for two months, on a significant proportion of US gaz facilities, using a specifically-designed large scale data crawling technology. The implementation of a web-application for interactive spatio-temporal data exploration guide further statistical investigations, namely that oil price exhibit patterns that are strongly non-stationary in space and time. The behavior of spatial autocorrelation suggests the use of specific spatial econometric methods to study the role of explanatory variables that are either geographical or temporal. We study the influence of socio-economic variables, by using complementary methods: Geographically Weighted Regression to take into account spatial non-stationarity, and Multi-level modeling to condition both at the state and county level. The former yields an optimal spatial range roughly corresponding to stationarity scale, and significant influence of variables such as population density or median income, but is less accurate around administrative borders. On the other hand, multi-level modeling reveals a strong state fixed effect, and also a non-negligible county effect. Through the combination of such methods, we unveil the superposition of a governance process with a local socio-economical spatial process. Results are furthermore consistent across the different dates. We discuss one important application that is the elaboration of locally parametrized car-regulation policies.

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Keywords: Fuel Price, Data Crawling, Spatial Analysis, Geographically Weighted Regression, Multi-level Modeling

1. Introduction

C : (Juste) j'ai pas trop eu le temps de regarder la biblio mais c'est bizarre j'ai l'impression qu'il n'y a quasiment personne qui a fait ce qu'on veut faire, je dois mal chercher ?

Rietveld et al. (2001) : impact of cross-border fuel differences and implications for gradual spatial taxing in the Netherlands

Rietveld and van Woudenberg (2005) : statistical models to explain fuel price differences across European countries

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Macharis et al. (2010) : models the impact of spatial fuel price variation on patterns of inter-modality
Gregg et al. (2009) : spatial distribution of emissions, at the scale of the state (quite far from the subject)
Combes and Lafourcade (2005) : determination of accurate transportation costs for France

2. Materials

2.1. Large scale Data collections

C : (Juste) trouver un moyen de dcrire la collecte des donnes sans dire qu'on l'a fait effectivement : architecture uniquement ?

2.2. Dataset

C : (Juste) pointer vers le dataset produit par un Chinois () anonyme sur dataverse

3. Results

3.1. Spatio-temporal Patterns of Prices

3.2. Spatial Autocorrelation

3.3. Geographically Weighted Regression

3.4. Multi-level Regression

4. Discussion

4.1. On the complementarity on Spatial Analysis methods

4.2. Towards localized car-regulation policies

5. Conclusion

Acknowledgements

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