ASSESSING THE EFFECT OF TRAVELER'S NATIONALITY ON DAILY TRAVEL TIME EXPENDITURE USING ZERO-INFLATED NEGATIVE BINOMIAL REGRESSION MODELS: RESULTS FROM THE BELGIAN NATIONAL HOUSEHOLD TRAVEL SURVEY (16-2233)

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ABSTRACT

In this paper, the effect of traveler's nationality on daily travel time expenditure is assessed using data stemming from the 2010 Belgian national household travel survey. In particular, different (zero-inflated) negative binomial models were estimated to isolate the effect of nationality, after controlling for other contributing factors such as socio-demographics, residential characteristics, transport options and temporal characteristics. The results indicate that, even if one controls for a series of other influencing factors, nationality plays a significant role in differences in travel time expenditure. This finding is especially relevant in the development of policy packages that are targeted to tackle social inequalities.

From a methodological perspective, different methodological options, i.e. two weighting schemes and two bootstrap solutions, were presented to provide sufficient support for the conclusions. In order to generalize the results in further studies, an oversampling of travelers with a different nationality is strongly recommended. Future research should focus more on the underlying psychological constructs of why ethnic and cultural differences persist, even if one accounts for other determinants.

OBJECTIVES

✳ Investigating **the effect of ethnic differences on daily travel time expenditure** within the Belgian context. The research particularly focuses on whether the total daily travel time expenditure (i.e. the travel time spent on all trips realized during the day of reporting, irrespective of the trip motive) as well as daily travel time expenditure for the most common trip motives varies by nationality.

✳ Main merits:
 1. The role of ethnic variety on travel behavior
 2. The importance of daily travel time expenditure in transportation planning

DESCRIPTIVES

✳ **Data:** Belgian National Household Travel Survey 2010 (BELDAM)

✳ Considered Nationalities: Belgian, French, Italian, Dutch, Spanish, and Moroccan. (7811 respondents in total)

Descriptive Statistics Travel Time Expenditure and Explanatory Variables

Parameter	Total	Commuting	Shopping	Leisure	Visits
Continuous explanatory variables (Pearson correlation)					
Age	0.027	-0.157	0.174	-0.044	0.063
Household size	-0.066	0.038	-0.110	-0.009	-0.015
Categorical explanatory variables (Average Expenditure in Minutes per category)					
Socio-Demographics					
Gender: Female/Male	84.5/83.7	26.3/30.4	14.2/10.7	6.2/6.3	9.9/8.0
H. Education: Yes/No	100.1/72.3	33.9/24.3	15.9/9.9	6.9/5.9	8.9/9.0
Pro. Activity: Yes/No	95.1/71.8	39.9/15.6	10.8/14.2	4.5/8.3	5.9/12.3
HH income: 0-1499€	79.1	19.6	12.5	7.8	9.4
HH income: 1500-3999€	88.3	29.4	14.2	6.4	12.0
HH income: ≥4000€	88.2	35.3	8.9	5.8	4.8
HH income: undeclared	64.7	30.4	11.4	2.5	1.2
Companion: Yes/No	88.9/77.7	28.6/28.0	15.0/9.1	4.9/8.1	9.2/8.6
Child(ren): Yes/No	87.2/82.7	28.9/28.1	11.1/13.0	5.8/6.5	6.5/10.0
Residential Characteristics					
Urban	81.5	28.0	12.4	6.1	9.5
Sub-Urban. Rural	90.0	29.3	12.5	6.7	7.7
Dwel. ownership:Yes/No	82.3/86.9	27.2/30.3	12.1/13.1	5.0/8.5	10.8/5.8
Dwel. detached: Yes/No	89.7/82.6	24.9/29.3	14.6/11.9	6.6/6.2	7.4/9.3
Transport Options and Mode Use Frequencies					
PT Season ticket:Yes/No	103.6/76.5	39.3/24.2	13.8/11.9	8.7/5.4	11.3/8.0
Driving license: Yes/No	91.7/63.1	29.2/26.1	14.3/7.3	5.6/8.2	9.7/6.9
Mob. restraints: Yes/No	59.7/88.9	23.1/29.4	10.0/12.9	6.1/6.3	9.2/8.9
Bike possession:Yes/No	92.1/66.2	31.5/21.3	12.2/13.0	6.9/4.9	9.3/8.3
Car possession: Yes/No	84.1/83.7	28.3/28.7	13.2/9.4	5.6/9.1	8.8/9.4
Freq. walking: Yes/No	86.9/74.0	26.7/34.3	13.5/8.5	7.0/3.9	9.7/6.4
Freq. cycling: Yes/No	90.3/82.4	24.5/29.4	12.8/12.3	14.2/4.2	9.9/8.7
Freq. PT use: Yes/No	93.7/76.9	37.0/22.0	11.9/12.8	7.5/5.4	6.4/10.8
Freq. car use: Yes/No	86.3/76.3	27.0/33.0	13.3/9.4	5.0/10.7	10.0/5.3
Temporal Characteristics					
Weekend: Yes/No	75.1/87.1	9.1/35.0	16.5/11.0	12.1/4.3	11.0/8.2
School holiday: Yes/No	80.5/84.7	29.9/28.1	7.9/13.3	3.3/6.8	17.1/7.4

METHODOLOGY

✳ **Negative Binomial Regression**
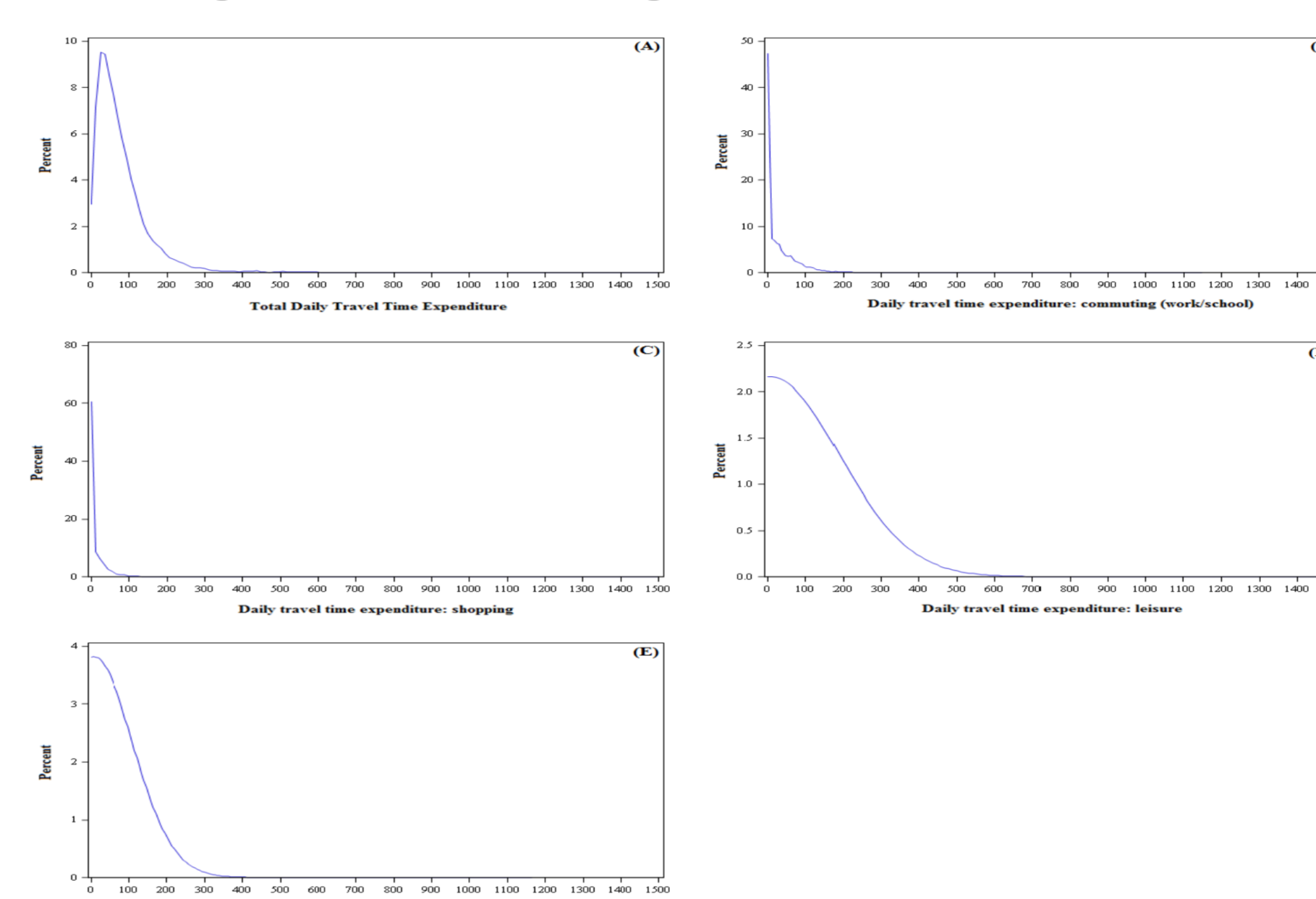
Kernel density estimates of daily travel time expenditure distributions

✳ **Bootstrapping**

Bootstrapping Procedure

Step 1: Determine the sample size per stratum.

To ensure maximum efficiency of inter-group (inter-stratum), the same number of observations needs to be drawn from each group.

- **Conservative approach:** *The sample size per group is defined as the smallest group size in the original sample, i.e. 36 respondents per nationality.*
- **Progressive approach:** *The sample size per group is defined as the total number of observations in the original sample divided by the number of groups, i.e. 1302 per nationality.*

Step 2: Resampling.

From each group (i.e. nationality), the required number of observations is drawn using simple random sampling with replacement. This sampling selection procedure is repeated 1000 times, so that 1000 different bootstrap samples are obtained.

Step 3: Inference per bootstrap sample.

*For each of the bootstrap samples, the different (**zero-inflated**) negative binomials are fitting using the variables that were selected following the weighting procedure.*

Step4: Final inference.

*For each parameter, the final parameter estimate is defined as the median $\mu_{1/2}$ of the 1000 parameters, and the standard error **s** is defined in an analogue way compared to standard normal confidence intervals, using the average distance to the 95% percentile bounds, and calculated using following formula;*

$$s = \frac{\frac{(\mu_{1/2} - p_{2.5})}{1.96} + \frac{(p_{97.5} - \mu_{1/2})}{1.96}}{2} = \frac{p_{97.5} - p_{2.5}}{3.92}$$

RESULTS

✳ **Significance and Direction of Effect**
 Values between brackets indicate the number of parameters (in the four models) confirming the effect

Parameter	Total	Commuting	Shopping	Leisure	Visits
Nationality: ES	– (2)	+ (3)	– (3)	– (3)	– (3)
Nationality: FR	+ (3)	+ (3)	+ (3)	– (3)	+ (3)
Nationality: IT	– (3)	+ (3)	– (3)	0	– (3)
Nationality: MA	+ (2)	0	+ (3)	– (3)	0
Nationality: NL	+ (2)	0	+ (2)	– (3)	+ (2)

✳ 0: no effect,
✳ –: negative effect,
✳ +: positive effect

✳ **Total Daily Travel Time Expenditure**

Parameter	Weighting		Cons. bootstrapping		Prog. bootstrapping	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
Intercept	3.668	0.046	3.683	0.389	3.717	0.064
Spanish	-0.057	0.027	0.016	0.212	-0.044	0.036
French	0.185	0.020	0.202	0.240	0.187	0.041
Italian	-0.133	0.021	-0.044	0.206	-0.107	0.038
Moroccan	0.073	0.029	0.082	0.240	0.020	0.039
Dutch	0.055	0.023	0.036	0.190	-0.009	0.036

CONCLUSIONS

✳ **Nationality plays an important role in explaining differences in daily travel time.**

✳ The **progressive bootstrapping approach** balances the ability to depict significant differences and simplicity of the model.

 ✳ **Differences of more significant effects** compared to the conservative bootstrapping approach which only identifies few key variables.

 ✳ **Identifies a smaller number of significant effects** than the weighting approaches.

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