STATISTICAL EVALUATION OF REGIONAL DIFFERENCES REGARDING PASSENGER CARS FLEET CONCENTRATION FROM ROMANIA, IN 2007-2012

PhD. Candidate Claudiu URSU
Piteşti University
PhD. Alina MOROŞANU
Alexandru Ioan Cuza University

Abstract

The aim of this research work is to evaluate the concentration of passenger cars fleet from Romania, by regions, in 2007–2012, to verify if there are significant regional differences in its distribution. To assess the concentration degree it is used the concentration ratio, considering the first three marks of passenger cars like importance, and for the analysis of regional differences and in time it is used the analysis of variance (ANOVA). The data are extracted from website www.drpciv.ro with the help of an application created in Visual Fox program and are processed in the statistical program R. The results showed the tendency reduction of the weight of the first three marks of cars in passenger cars fleet, simultaneously with the increasing diversification of marks, at regional level being registered significant differences.

Keywords: concentration ratio, passenger cars fleet, variance analysis, regional differences

1. Introduction

In the last years there has been an increasing attention to the study of passenger transport and passenger cars fleet from different countries (Meyer & Wessely (2009), Huo et al. (2011), Grimalab et al (2013), Propfea (2013), Rich et al. (2013)). This increasing attention may be explained by the need to establish new economic, environmental and health policies in accordance with the diversity of passenger transport demands (Singh (2006), Prelipcean, Boscoianu (2012), Kaushik & Filippini (2013)). According to the results presented in research literature, these demands may be determined by several factors. One of these factors is population density. The more people there are in a country, the greater transport demand will be. A second factor is the income

level. Bamberg et al. (2003), Luk (2003) and Wells et al. (2013) suggests that, if the income level of a country is higher, then more its inhabitants will opt for individual means of transport. A third factor identified in literature (EEA Report (2012)) is represented by urban concentration. Urban concentration is growing, both in the industrialized and the emerging countries. Considering this aspect, Poumanyvong at al. (2012) showed that changes in urbanization process appear to have a greater impact on persons transport.

In Romania, after accession to the EU in 2007, the number of passenger cars has also increased in medium and small cities and will continuously increase in the future. Information on passenger cars fleet at city or regional level is not only of great importance for improving the accuracy of national passenger cars fleet inventories, but also important for passenger cars control policies. A better understanding of passenger cars fleet characteristics at city or regional level would help policymakers to make efficient policies at both national and local levels.

In the present study we intend to achieve an evaluation of passenger cars fleet from Romania, by regions, in 2007-2012 and an analysis of its dynamic. In order to achieve the objective of the proposed research, we try to validate the following work hypotheses:

Hypothesis 1: The concentration passenger cars fleet in Romania, in the analyzed period registers a different dynamic by regions.

Hypothesis 2: In dynamic, concentration ratio by regions has values increasingly smaller from year to year, both in total and in each region.

3. Research Methodology

2.1 Observed population. Variables

The variables considered in the study are: total number of passenger cars (Cars_total), the region of Romania from which the car belong (Region) and passenger cars mark (Cars_mark). Regarding the number of cars by mark, we identified the first 3 marks representative for each region of Romania, in every year of the analyzed period of time (Table 1).

The first three marks of vehicles identified by regions and years

Table 1

Region	Order of car mark	Year
North East	DACIA, VW, OPEL	2007, 2008, 2009, 2010, 2011, 2012
South East	DACIA, DAEWOO, OPEL	2007, 2008, 2009
	DACIA, OPEL, VW	2010, 2011, 2012
South	DACIA, DAEWOO, VW	2007, 2008
	DACIA, DAEWOO, OPEL	2009, 2010, 2011, 2012
South West	DACIA, DAEWOO, VW	2007, 2008, 2009
	DACIA, OPEL, DAEWOO	2010
	DACIA, OPEL, VW	2011, 2012
West	DACIA, VW, OPEL	2007, 2008, 2009, 2010, 2011, 2012
Nort West	DACIA, VW, OPEL	2007, 2008, 2009, 2010, 2011, 2012
Center	DACIA, VW, OPEL	2007, 2008, 2009, 2010, 2011, 2012
Bucharest-Ilfov	DACIA, DAEWOO, RENAULT	2007
	DACIA, VW, RENAULT	2008, 2009, 2010, 2011
	DACIA, VW, OPEL	2012

The data are extracted from website www.drpciv.ro and represent total number of passenger cars and passenger cars by mark. The extraction of necessary data was performed using an application created in Visual Fox program. This application contains clear instructions for the identification of the total number of passenger cars in the country, in every region and in every year, by mark. We introduced the data thus obtained in a database in the statistical program R.

2.2 Statistical methods used

For concentration evaluation, in literature are used concentration indices such as: concentration ratio, concentration coefficient Corrado Gini, informational energy Onicescu or Hirchman difference (Cowell (2000), Schechtman & Yitzhaki (2008), Jaba et al. (2010)). In our study we analyze the concentration of the first three marks as importance in the passenger cars fleet, by regions of Romania regions, therefore we consider categorical variables. To assess the concentration of the first three marks as importance in the passenger cars fleet, by region, was used the concentration ratio. The concentration ratio is calculated according to the relationship: $C_n = \sum_{i=1}^{n} s_i$ where $s_i = \frac{q_i}{Q}$, $Q = \sum_{i=1}^{N} q_i$ (Jaba (2002)). The distribution of concentration

ration of the first three marks as importance in the passenger cars fleet was analyzed using descriptive statistics and analysis of variance (ANOVA). To test the significance of differences between pairs it was applied HSD test (Honestly Significant Difference Test) (Abdi et al. (2009)).

3. Results

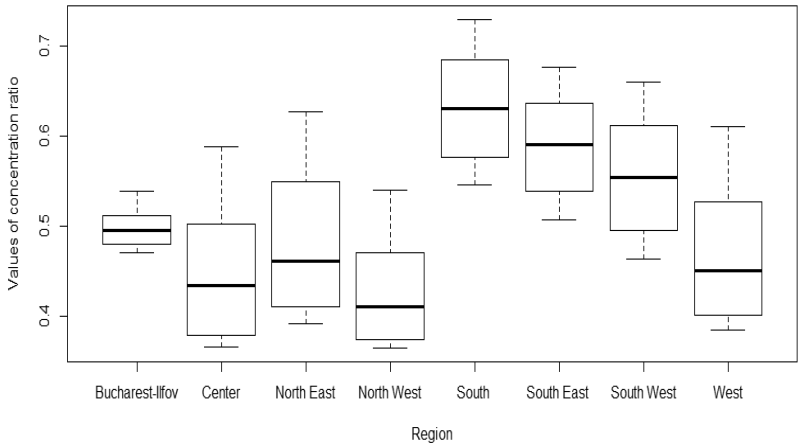
The descriptive results regarding concentration of passenger cars fleet from Romania, by regions, in the period 2007-2012 are presented in Table 1 from Appendix and in Figures 1 and 2. It is found that the distribution of annual concentration values record different levels from one region to another, for the entire period (see Figure 1). Also, the distribution of regional values of concentration ratio of the first three marks of passenger cars recorded a mean level with a reduction tendency in the period 2007-2012 (see Figure 2). The two results may indicate the existence, on the one hand, of the significant differences between the mean annual values of concentration ratio by regions, and on the other hand, the trend of diversification of cars marks.

3.1 Descriptive analysis of the distribution of annual values of the concentration ratio of passenger cars fleet

Considering the results from Table 1 of Appendix and distributions presented in Figure 1 and Figure 2, it can highlight a decrease in the value of the concentration ratio. Thus, the concentration ratio that in 2007 varied between 0.5391 (Bucharest-Ilfov Region) and 0.7305 (South Region) decreased in 2012 between 0.3638 (North West Region) and 0.5455 (South Region).

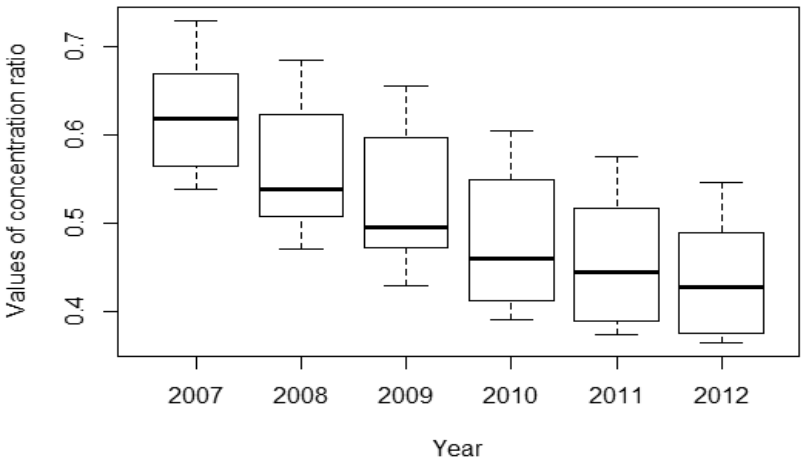
The distribution of annual values of concentration ratio of the first three marks of passenger cars by regions, in Romania, in period 2007-2012

Figure 1



The distribution of regional values of concentration ratio of the first three marks of passenger cars in Romania, by years

Figure 2



From Figure 1 and Figure 2 is observed that at regions level, the lowest values of the concentration ratio are recorded in the North-West Region, Central Region, West Region and North East Region. In the analyzed time period, the lowest values are recorded in the years 2010, 2011, 2012. These results reflect large changes of the concentration ratio values of

passenger cars fleet. The first and third quartile, also, records different annual values from one region to another. Annual values of interquartilic intervals of concentration ratio show a different dispersion, with the highest values for the Central Region, Western Region and North-East Region; the lowest value for the Bucharest-Ilfov Region, reflecting small changes in the values of the concentration ratio.

The evaluation of differences between the mean levels by region and years of concentration ratio of the first three marks of passenger cars was achieved by applying ANOVA and HSD test.

3.2 The evaluation of the significance of differences between the concentration ratio mean values

The ANOVA results from Table 2 and Table 3, show that there are significant differences between concentration ratio mean values, both region and years.

Evaluation of differences between the mean levels, by regions, of concentration ratio for the first three marks of passenger cars

Table 2

Variables	Df	Sum Square	Mean Square	F Test Value	Pr(>F)
Region	7	0.2188	0.031256	5.806	0.000109***
Residuals	40	0.2154	0.005384		

Signif. Coeff.: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Evaluation of differences between the mean levels, by years, of concentration ratio for the first three marks of passenger cars

Table 3

Variables	Df	Sum Square	Mean Square	F Test Value	Pr(>F)
Year	1	0.1911	0.19108	36.16	2.76e-07***
Residuals	46	0.2431	0.00528		

Signif. Coeff.: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

The value of F test is significant and this indicates that the mean concentration ratio from at least one region or year differs from the mean concentration ratio of other regions or years.

HDS test results are shown in Table 3 in the Appendix. From the results achieved by the HDS test (Table 3 in Appendix) is observed significant differences in 7 of 28 pairs of annual mean values by regions of the concentration ratio.

Conclusions

In the paper was realized a statistical evaluation of regional differences regarding the concentration of passenger cars fleet in Romania, in period 2007-2012. To achieve this objective, was measured the concentration level of the first three marks from passenger cars fleet and there were found differences. These differences can be explained by the action of some factors. One factor is the economic crisis. This determined a contraction of the car market sales generated by restriction of access to finance, potential buyers become more cautious. Another factor is the gradual lowering from year to year, of the budget assigned to programs for passenger car fleet renewal. Because of this, in Romania, there has been a continuous aging was of passenger cars fleet in recent years, currently reaching an average of 12 years old, compared to an average of 10 years recorded in 2008.

Study results also showed that, in dynamic it is found a decrease of the concentration level of the first three car marks. This decrease of the concentration level shows a diversification of the car marks generated by a combination of socio-economic and demographic factors.

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Appedix 1

Concentration ratio values of the first three car marks in the passenger cars fleet by regions of Romania and by years

Tabel 1

Nr. Crt.	Region	Concentration ratio values	Nr. Crt.	Region	Concentration ratio values
1.	North East 2007 2008 2009 2010 2011 2012	 0.6277 0.5499 0.4898 0.432 0.4104 0.3915	5.	West 2007 2008 2009 2010 2011 2012	 0.6112 0.527 0.4759 0.4238 0.4004 0.3835
2.	South East 2007 2008 2009 2010 2011 2012	 0.6775 0.6366 0.6123 0.5691 0.5387 0.5074	6.	North West 2007 2008 2009 2010 2011 2012	 0.5402 0.4703 0.4295 0.3900 0.3729 0.3638
3.	South 2007 2008 2009 2010 2011 2012	 0.7305 0.6855 0.6564 0.6055 0.5761 0.5455	7.	Center 2007 2008 2009 2010 2011 2012	 0.5885 0.5026 0.4672 0.3995 0.3778 0.3646
4.	South West 2007 2008 2009 2010 2011 2012	 0.6609 0.6118 0.5806 0.5285 0.4954 0.4626	8.	Bucharest-Ilfov 2007 2008 2009 2010 2011 2012	 0.5391 0.5115 0.5019 0.4877 0.4794 0.4698

Source: Own calculations

Descriptive statistics

Table 2

Region	Mean	Std. Dev.	1st Quartile	Median	3rd Quartile	Skewness	Kurtosis
North East	0.4835	0.0913	0.4158	0.4609	0.5349	0.780	-0.628
South East	0.5903	0.0635	0.5463	0.5907	0.6305	0.068	-1.232
South	0.6332	0.0699	0.5835	0.6310	0.6782	0.168	-1.344
South West	0.5566	0.0656	0.5037	0.5545	0.6040	0.083	-1.222
West	0.4703	0.0763	0.4062	0.4499	0.5142	0.923	0.544
North West	0.4278	0.0677	0.3772	0.4098	0.4601	0.978	0.073
Center	0.4500	0.0827	0.3832	0.4334	0.4938	1.053	0.140
Bucharest-Ilfov	0.4982	0.0250	0.4815	0.4948	0.5091	0.761	0.187

Differences between pairs of annual means, by regions, of concentration ratio

Table 3

Regions	Diference	Lower limit	Upper limit	Probability value
West-Center	0.02026667	-0.1151447111	0.15567804	0.9997003
Bucharest-Ilfov-Center	0.04820000	-0.0872113778	0.18361138	0.9441901
North East-Center	0.03351667	-0.1018947111	0.16892804	0.9926658
North West-Center	-0.02225000	-0.1576613778	0.11316138	0.9994460
South-Center	0.18321667	0.0478052889	0.31862804	0.0022969
South East-Center	0.14023333	0.0048219556	0.27564471	0.0377583
South West-Center	0.10660000	-0.0288113778	0.24201138	0.2181240
Bucharest-Ilfov-West	0.02793333	-0.1074780444	0.16334471	0.9976104
North East-West	0.01325000	-0.1221613778	0.14866138	0.9999829
North West-West	-0.04251667	-0.1779280444	0.09289471	0.9712150
South-West	0.16295000	0.0275386222	0.29836138	0.0091020
South East-West	0.11996667	-0.0154447111	0.25537804	0.1155348
South West-West	0.08633333	-0.0490780444	0.22174471	0.4706045
North East-Bucharest-Ilfov	-0.01468333	-0.1500947111	0.12072804	0.9999656
North West-Bucharest-Ilfov	-0.07045000	-0.2058613778	0.06496138	0.7099163
South-Bucharest-Ilfov	0.13501667	-0.0003947111	0.27042804	0.0511433
South East-Bucharest-Ilfov	0.09203333	-0.0433780444	0.22744471	0.3891442
South West-Bucharest-Ilfov	0.05840000	-0.0770113778	0.19381138	0.8614500
North West-North East	-0.05576667	-0.1911780444	0.07964471	0.8872054
South-North East	0.14970000	0.0142886222	0.28511138	0.0212604
South East-North East	0.10671667	-0.0286947111	0.24212804	0.2170057
South West-North East	0.07308333	-0.0623280444	0.20849471	0.6713961
South-North West	0.20546667	0.0700552889	0.34087804	0.0004680
South East-North West	0.16248333	0.0270719556	0.29789471	0.0093854
South West-North West	0.12885000	-0.0065613778	0.26426138	0.0722414
South East-South	-0.04298333	-0.1783947111	0.09242804	0.9694521
South West-South	-0.07661667	-0.2120280444	0.05879471	0.6181487
South West-South East	-0.03363333	-0.1690447111	0.10177804	0.9925113