

ADOPTION AND BENEFITS OF STATISTICAL METHODS IN ENTERPRISES: DIFFERENCES BETWEEN CROATIAN REGIONS

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ABSTRACT

This paper aims to address differences in the use of statistical methods by enterprises as one of the factors leading to the uneven level of economic development between different regions. For research purposes, a web survey was conducted on a sample of 667 Croatian enterprises in 2013. In order to better distinguish between Croatian regions, a complex sample survey design was used. The results show that the highest rates of statistical methods use among enterprises are in the Central and East region (36.96%). The conducted logistic regression analysis showed that the enterprises that use statistical methods have 63.5% greater odds of achieving positive net income than enterprises that do not. The research results point out the need for the adoption of statistical methods as a tool for achieving higher net income and for reducing economic dissimilarities between regions.

Keywords: *Complex sample survey design, Weighted stratified proportion estimator, Logistic regression, Nomenclature of Territorial Units for Statistics, Croatian enterprises, Use of statistical methods*

JEL: *C83, D63, G30, M21*

1. INTRODUCTION

There is no simple definition of the development concept (Nielsen 2011). Furthermore, there are different views on development levels. For instance, according to Sen (1999), development level increases when impediments to freedom such as hunger and tyranny are removed. This approach led to defining development level through acceptable minimum living conditions. The advanced version of this humanistic approach is an economic approach defining development level using purchasing power parities. The concept of purchasing power parities was originally used for exchange rate determination, but its use as a device in the comparison of living standards across countries prevailed (Lafrance and Schembri, 2002).

Consensus on what approach to the measurement

of development should be used has also not been reached by global institutions. For instance, the United Nations Development Programme's country classification system is based on the Human Development Index (HDI), which was introduced in 1990 (UNDP 1990). The HDI emphasizes three dimensions as being basic for human development: a long and healthy

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life; knowledge; and access to resources for a decent standard of living (Sagar and Najam 1998). The World Bank uses its country classification system in order to ensure the return of funds which it has lent to countries (Radelet 2005). The World Bank classification system is based on gross national income (GNI) per capita, which is calculated using the World Bank Atlas method (World Bank 2014). At the same time, the International Monetary Fund in the World Economic Outlook divides countries into two groups: an advanced economies group and an emerging market and developing economies group. The classification is not based on any strict criteria but has evolved over time (International Monetary Fund 2014).

The countries' development levels are also observed via their competitiveness level. The Global Competitiveness Index is based on the following 12 pillars of competitiveness: institutions, infrastructure, macroeconomic environment, health and primary education, higher education and training, goods market efficiency, labour market efficiency, financial market development, technological readiness, market size, business sophistication, and innovation (World Economic Forum 2014). The World Competitiveness Index benchmarks the competitiveness performance of 60 countries based on 338 criteria that are grouped into 4 main factors: economic performance, government efficiency, business efficiency, and infrastructure (International Institute for Management Development 2014).

Past research concerning statistical methods in enterprises was mainly oriented on inspecting whether enterprises use them (West 1994, Ahmed and Hassan 2003, Tanco et al. 2008), or on defining the main barriers to their use (Deleryd 1998, Antony et al. 2004, Makrymichalos et al. 2005). The main reason for the scarce use of statistical methods is thought to be the insufficient familiarity of employees with statistical methods' abilities and benefits (Tanco et al., 2008). Some efforts in additional statistical methods training for employees have been done (Vere-Jones 1995, Dransfield, Fisher and Vogel 1999, Wild and Pfannkuch, 1999, Grigg and Walls, 2007). Unfortunately, the aversion of employees is too high to change their attitudes towards statistical methods and to achieve better results in the short run (Hahn and Hoerl, 1998, Deleryd, Garvare and Klefsjö, 1999, Rungasamy, Antony and Ghosh, 2002, Makrymichalos et al., 2005). Some research has been done on the impact of statistical methods on small enterprise performance (Dumičić, Bregar and Žmuk 2014, Žmuk 2015). Furthermore, the importance of the use of statistical methods is recognized and introduced in some quality management, accounting and auditing standards (Žmuk 2012).

Research on the impact that the adoption of statistical methods in enterprises has on a country's development level has been neglected and little work has been done in this field. For this reason, the main aim of this paper is to investigate whether there is impact from the use of statistical methods in enterprises on the different development levels of regions within a country. The research is based on enterprises in Croatia and its regions. The research questions that are expected to be answered are: "In which Croatian region do enterprises use statistical methods the most?" and "Which region benefits the most from the use of statistical methods measured through enterprises' net income?" According to these research questions two research hypotheses were set. The first research hypothesis is that the share of the enterprises that use statistical methods is the highest in the most developed region. The second research hypothesis is that there is no statistically significant difference in the impact of the use of statistical methods on the likelihood of achieving positive net income for enterprises in different Croatian regions.

After the introduction, in the second part of the paper, the regional stratification of Croatia is presented and the most developed region is identified. The third part describes the characteristics of the conducted survey. The main research results are provided and discussed in the fourth part. The fifth and final part contains conclusions and recommendations for further research.

2. REGIONS IN CROATIA

2.1. Regional stratification of Croatia

In general, a distinction between administrative and non-administrative regional stratifications can be made. The main administrative stratification in Croatia is based on the so-called counties. Counties can be observed as political, administrative and self-managed institutions with a thousand-year-old tradition in Croatia (Vrbošić 1992). Because of its importance, the capital city Zagreb is also seen as a separate county. Thus, there are 21 counties in Croatia. The list of counties in Croatia is given in Table 1.

As opposed to administrative stratifications there are also non-administrative regional stratifications. The non-administrative regional stratifications are based mainly on the geographical position of a certain area, as well as different parameters such as population size, average income, and others that can be taken into account. Since Croatia is a European Union member state, the Nomenclature of Territorial Units for Statistics (NUTS) has recently become the main

Table 1: Stratification of Croatian regions according to the Nomenclature of Territorial Units for Statistics – Level 2 and 3 and their competitive position

NUTS-2 regions	Counties (NUTS-3 regions)	Gross domestic product per capita, 2011, in €	Regional competitiveness index rank, in 2013	Number of enterprises, October 2012
Adriatic region	County of Dubrovnik-Neretva	9,807	10	3,140
	County of Istria	12,991	3	8,393
	County of Lika-Senj	8,081	17	528
	County of Primorje-Gorski kotar	12,724	5	8,186
	County of Split-Dalmatia	8,072	9	10,311
	County of Šibenik-Knin	7,930	14	1,762
	County of Zadar	8,302	6	2,706
North-Western region	City of Zagreb	18,503	1	30,367
	County of Zagreb	7,786	7	5,538
	County of Koprivnica-Križevci	8,524	8	1,103
	County of Krapina-Zagorje	6,300	12	1,348
	County of Međimurje	8,459	4	2,138
	County of Varaždin	8,285	2	2,452
Central and Eastern region	County of Bjelovar-Bilogora	7,062	15	1,209
	County of Slavonski Brod-Posavina	5,882	16	1,263
	County of Karlovac	7,709	13	1,590
	County of Osijek-Baranja	8,271	11	3,494
	County of Požega-Slavonia	6,281	21	507
	County of Sisak-Moslavina	8,214	19	1,429
	County of Virovitica-Podravina	6,333	18	658
	County of Vukovar-Sirmium	6,217	20	1,291

Source: Croatian Chamber of Economy 2012, Croatian Bureau of Statistics 2014, National Competitiveness Council 2014.

non-administrative regional stratification in Croatia. NUTS uses population size as the base for stratification (Eurostat 2011). Also, NUTS recognizes three different levels of stratification. At the first level, NUTS strata (NUTS-1) include a population of between 3 and 7 million. At the second level, NUTS strata include a population of between 800 thousand and 3 million. The third level of NUTS strata is the most detailed. Each third level NUTS stratum has between 150 and 800 thousand people (Eurostat 2011).

According to NUTS-1, Croatia is stratified into just one stratum because there are around 4.2 million inhabitants in Croatia. NUTS-2 stratified Croatia into three strata: an Adriatic region; a North-Western region; and a Central and Eastern region (Letinić and Štavlić 2011). It has to be emphasized that the NUTS-2 stratification was valid until 1 January 2013. After that date, the new NUTS-2 stratification of Croatia was presented. In the new NUTS-2 stratification the North-Western region and the Central and Eastern region were merged into the new Continental region. As a result, the number of strata was reduced from 3 to 2 (Official Gazette 2012). Despite this fact, in this paper, the NUTS-2 stratification that resulted in 3 strata is observed primarily because all of the research data come

from the period before this change was announced. The most detailed, the NUTS-3 stratification, resulted in stratification into counties.

2.2 Economic development levels of regions in Croatia

This paper analyzes the development levels of Croatia and its regions defined by NUTS levels using the following three development variables: gross domestic product per capita (GDPpc), competitive rank and number of enterprises.

The variable GDPpc presents development level as the level of the citizens' welfare. It is assumed that the higher the value of GDPpc, the higher the citizens' welfare level is, i.e. the higher their development level. The variable GDPpc is observed for the year 2011 for two reasons. The first reason for using data from that year is that more recent data for GDPpc were not available for counties or NUTS-3 strata. The second reason for using GDPpc data from 2011 is that a population census was conducted that year and the most precise number of citizens was obtained (Croatian Bureau of Statistics 2011). According to the data, GDPpc

in Croatia in 2011 was €10,325 (Croatian Bureau of Statistics 2014). The most developed NUTS-2 region based on this variable was the North-Western region, with a GDPpc of €12,966 in 2011. The Adriatic region had a GDPpc of €9,941 in 2011, whereas the least developed region was the Central and Eastern region, with a GDPpc of only €7,216 in 2011 (Croatian Bureau of Statistics 2014). Table 1 provides data for GDPpc by NUTS-3 strata or by county. The City of Zagreb definitely had the highest GDPpc with €18,503 in 2011. Because the City of Zagreb includes almost one fifth of the population of Croatia (Croatian Bureau of Statistics 2013), this county accounts for the fact that the North-Western region is the most developed NUTS-2 region in Croatia. In the Adriatic region, the highest value of GDPpc was in the County of Istria, with a GDPpc of €12,991, and the County of Primorje-Gorski kotar, with a GDPpc of €12,724 in 2011. The differences in GDPpc values between counties in a NUTS-2 region are the least present in the Central and Eastern region. This region includes the County of Slavonski Brod-Posavina, which had the lowest GDPpc among all counties. In 2011, the County of Slavonski Brod-Posavina had GDPpc of only €5,882 (Croatian Bureau of Statistics 2014). According to Mikulić, Lovrinčević and Galić Nagyszombatycan (2013) a regional convergence process is absent in Croatia. In order to reduce differences in economic development levels between Croatian regions, they suggest using structural funds for improvement in overall regional investment attractiveness.

The National Competitiveness Council has been publishing the Regional Competitiveness Index since 2007. Because of three-year cycles, three publications have been published so far. The most recent Regional Competitiveness Index is from 2013. The Regional Competitiveness Index is based on a survey which is conducted based on the methodology of the World Economic Forum and the Institute for Development Management (National Competitiveness Council 2014). The survey was conducted primarily at the NUTS-3 level, which enabled horizontal analysis of differences between counties. Based on the survey, a very wide range of different indicators was used. Overall, 116 statistical indicators and 68 perceptual indicators were formed. Those indicators were grouped into so-called competitiveness pillars, forming 17 at the ground level. The ranks of counties according to the Regional Competitiveness Index in 2013 are given in Table 1.

According to the Regional Competitiveness Index, the most competitive county in 2013 was the City of Zagreb. In second place was the County of Varaždin, also from the North-Western region, whereas the

County of Istria from the Adriatic region was in third place. All top ten counties are either from the Adriatic or the North-Western regions. The best ranked county from the Central and Eastern region was the County of Osijek-Baranja, which was in 11th place. The last four counties, which are the lowest in the rankings, are from the Central and Eastern region. In general this indicates that the Central and Eastern region is the least competitive region in Croatia. This is also confirmed by regions' average ranks. The average rank of the Adriatic region is 9th, of the North-Western region 6th, and of the Central and Eastern region 17th. According to these results it can be concluded that the North-Western region is the most competitive and, consequently, the most developed region in Croatia.

The number of enterprises in a region reveals its business activity and indicates the level of prosperity the region has attained. Therefore, the present number of enterprises in the region can be viewed as an indicator of a region's development in the future. It has to be emphasized that, in the context of this paper, enterprises include only limited liability enterprises that are registered in the Court Register of the Republic of Croatia in accordance with the Companies Act (Official Gazette 2011). In October 2012, most enterprises, i.e. 30,367 (33.96%), were located in the City of Zagreb. On the other hand, the county with the fewest number of enterprises is the County of Požega-Slavonia. In October 2012 there were only 507 (0.57%) enterprises in the county. The number of enterprises in other counties is shown in Table 1. If NUTS-2 regions are observed it can be seen that the North-Western region had the largest number, or 42,946 (48.03%) enterprises in October 2012. The Adriatic region had 35,026 (39.17%) and the Central and Eastern region had 11,441 (12.80%) enterprises in October 2012. These numbers lead to the conclusion that, in the future, the North-Western region will further increase its lead in economic development relative to the other two regions.

3. RESEARCH METHODOLOGY

In order to inspect the impact that the use of statistical methods in enterprises has on regions' development levels, original primary research was conducted. The target population in the research included Croatian enterprises that are registered in the Court Register of the Republic of Croatia as limited liability enterprises (Official Gazette 2011) and that are subject to the submission of annual financial statements in accordance with the Accounting Act (Official Gazette 2007). According to the Croatian Company Directory

of the Croatian Chamber of Economy, which is an integrated database containing all registered business entities in Croatia (Croatian Chamber of Economy 2012) and which has been used as the sampling frame, there were 89,413 such enterprises at the beginning of the research. An in-depth analysis showed that overall 38,069 enterprises had no employees. It is assumed that those enterprises are shell enterprises that do not perform any business activity. For this reason, the target population was reduced to 51,314 enterprises.

The data about the use of statistical methods in enterprises were collected by a web survey. Therefore, in order to be able to participate in the survey, enterprises had to have a valid e-mail address. According to the data in Table 2, there were 59,190 enterprises overall that did not have a valid e-mail address. Because of the data collection method used, such enterprises could not participate in the survey. For this reason, there is a discrepancy between the target and the surveyed population. The size of the surveyed population was calculated by deducting the number of enterprises that did not have employees and/or did not have a valid e-mail address from the overall number of enterprises in the sampling frame. In this way, the size of the surveyed population was set at 26,186 enterprises. It has to be emphasized that it is assumed that there is no statistically significant difference in characteristics between enterprises that have and do not have a valid e-mail address. Consequently, all conclusions in this study are brought not only for the surveyed but also for the target population.

For the purpose of the study, enterprises were stratified according to their headquarters location. Three strata were recognized within this research.

Those strata are the NUTS-2 regions in Croatia. A detailed overview of the number of enterprises in NUTS-2 regions in Croatia in October 2012 is given in Table 2.

An invitation to participate in the survey was sent to all enterprises from the population surveyed in October 2012. This was possible because a web survey was conducted. The survey data collection finished in February 2013. Meanwhile, two reminders for participation in the survey were sent to the enterprises. Finally, 667 enterprises participated and filled out the survey questionnaire completely. The majority, i.e. 378 (56.67%), of the enterprises that participated in the survey have their headquarters in the North-Western region. Participation in the survey included 197 (29.54%) enterprises from the Adriatic region, and 92 (13.79%) enterprises from the Central and Eastern region.

If Response rate 1 or the minimum response rate is used (American Association for Public Opinion Research 2011), the overall survey response rate is 2.55%. The strata response rates are given in Table 3. While the strata response rates are very similar, the nonresponse adjustment factors were introduced as a part of the survey weights. The sample selection weights were not used because all of the enterprises from the surveyed population were invited to take part in the survey and so every enterprise had the same probability of being included in the sample. It was estimated that there was no need for introducing post-stratification weights. Consequently, the final weights include only nonresponse adjustment factors, which are given in Table 3 and which were calculated as a reciprocal value of strata response rates.

Table 2: Number of enterprises in Croatia, October 2012

NUTS-2 region	Overall	Without employees	Without an e-mail address	Target population	Surveyed population
Adriatic region	35,026	21,318	24,291	13,708	9,254
North-Western region	42,946	13,668	28,428	29,278	12,608
Central and Eastern region	11,411	3,083	6,471	8,328	4,324
Total	89,413	38,069	59,190	51,314	26,186

Source: Croatian Chamber of Economy 2012, Author's calculation.

Table 3: Sample sizes, response rates and weight analysis

NUTS-2 region	Surveyed population	Sample size	Response rate (%)	Nonresponse adjustment factor
Adriatic region	9,254	197	2.13	46.9746
North-Western region	12,608	378	3.00	33.3545
Central and Eastern region	4,324	92	2.13	47.0000
Total	26,186	667	2.55	-

Source: Author's calculation.

Complex survey sample design characteristics were taken into account in the analysis. In order to properly introduce the stratification and the sampling weights, the Jackknife Repeated Replication method was used as a variance estimation method (Rust and Rao 1996, Heeringa, West and Berglund, 2010). The stratification effects on the variance are additionally observed by design effects (Deff). In the analysis, strata proportions, totals and averages were estimated and logistic regression modelling was performed.

4. EMPIRICAL RESULTS AND DISCUSSION

4.1. Use of statistical methods by enterprises in Croatian regions

The first aim of the research is to estimate the rate of enterprises that use statistical methods in their business and to identify which regions have the highest percentage of enterprises that use them. According to the results given in Table 4, 35.70% of enterprises (95% CI = 0.3200, 0.3941) in Croatia use statistical methods in their business, whereas 64.30% (95% CI = 0.6059, 0.6800) do not. The results show that approximately two-thirds of enterprises in Croatia do not use statistical methods, which could be seen as a serious problem and considered one of the reasons for the low levels of competitiveness of Croatian enterprises in the world.

Table 4 provides detailed results of the proportion of enterprises that use statistical methods in the three NUTS-2 regions (strata). Despite the different numbers of enterprises that participated in the survey from the NUTS-2 regions, the results show that there is approximately the same number of enterprises that use statistical methods among the strata. More precisely,

it is estimated that 36.55% (95% CI = 0.2979, 0.4330) of enterprises in the Adriatic region, 34.66% (95% CI = 0.2984, 0.3947) of enterprises in the North-Western region and 36.96% (95% CI = 0.2702, 0.4689) of enterprises in the Central and Eastern region use statistical methods.

The value of the Rao-Scott second-order F-statistic for the overall test of the null hypothesis that the region where an enterprise has its headquarters is not associated with the use of statistical methods is 0.1346 (num df = 1.98, den df = 1317.40, $p = 0.8725$). Consequently, at the significance level $\alpha = 0.05$, the null hypothesis that the enterprises' affiliation to a region and the use of statistical methods are not associated may not be rejected. In other words, the levels of the response are not different within each region (Burke, Isik, 2009, SAS, 2014). In this way the first research hypothesis that the share of enterprises that use statistical methods is highest in the North-Western region can be rejected.

At the total level, i.e. at the country level, Deff is higher than 1 and is equal to 1.0352. This means that the variance for the proportion estimate is 1.0352 times or 3.52% higher than it would be for the variance of simple random sampling for the same sample size (667 enterprises). According to the value of Deff, the effective sample size, or the sample size of simple random sampling that would result in the same level of precision, is 644 enterprises. On the other hand, it must be emphasized that all Deffs at stratum levels are lower than 1. This indicates that the stratification and the weights, which were accounted for in the analysis, resulted in an improved level of precision for the proportion estimate. Consequently, the variances are lower than they would be if simple random sampling for the same strata sizes had been performed.

Table 4: Use of statistical methods in Croatian regions, n=667

NUTS-2 region	Stat. met. use	N	Sum of weights	Prop.	Std. Err. of Prop.	95% CL for Prop.		95% CL for Sum		Deff
Adriatic region	Yes	72	9254	0.3655	0.0343	0.2979	0.4330	2757	4007	0.8750
	No	125	9254	0.6345	0.0343	0.5670	0.7021	5247	6497	0.5657
North-Western region	Yes	131	12608	0.3466	0.0245	0.2984	0.3947	3763	4976	0.6671
	No	247	12608	0.6534	0.0245	0.6053	0.7016	7632	8845	0.4301
Central and Eastern region	Yes	34	4324	0.3696	0.0506	0.2702	0.4689	1168	2028	0.8114
	No	58	4324	0.6304	0.0506	0.5311	0.7298	2296	3156	0.4985
Total	Yes	237	26186	0.3570	0.0189	0.3200	0.3941	8378	10321	1.0352
	No	430	26186	0.6430	0.0189	0.6059	0.6800	15865	17808	1.0352

Source: Author's calculation.

4.2. Net income of enterprises by regions

One of the main goals of enterprises is to achieve positive net income. Positive net income is a reward for the owners and can be used for further development of the enterprise. On the other hand, it is emphasized that positive net income should not be the top priority of enterprises because an enterprise has to also have a social role in society (Doherty, Haugh and Lyon 2014). On the other hand, if an enterprise does not achieve positive net income in the long run or even in the short run, there is a possibility that the enterprise will not be able to pay out salaries to its employees. Furthermore, negative net income could lead to a situation where further enterprise's survival comes into question and the initiation of bankruptcy proceedings closing the enterprise seems to be the only and the best solution in that situation. In that case the social role of enterprises is lost as well. Therefore, positive net income has to be observed as a necessity for further continuation of business activities and the survival of the enterprise and its ability to fulfil its social role as well. Table 5 shows estimated mean net incomes in enterprises in NUTS-2 regions and throughout Croatia in 2011. Net incomes are given in Croatian currency – Hrvatska kuna (Croatian kuna - HRK).

The data from 663 Croatian enterprises were used for the purpose of estimating mean net income. The sample size was reduced because four enterprises from the sample, for unknown reasons, have not published their financial reports for 2011. In addition to observing the enterprises according to their affiliation to a NUTS-2 region, the enterprises were inspected based on whether they use statistical methods. It

has to be emphasized that in estimating mean net incomes, a complex survey design was taken into account.

According to Table 5, the mean net income of the enterprises in Croatia that use statistical methods is HRK 168,146, whereas the mean net income of Croatian enterprises that do not use statistical methods is HRK -21,874. On the other hand, at the significance level of 5%, it cannot be concluded that the mean net income of Croatian enterprises that use statistical methods (95% CI = -926,001, 1,262,294) is greater than the mean net income of the enterprises that do not (95% CI = -315,352, 271,603). The same conclusion can be made at the NUTS-2 regions level. Furthermore, only in the North-Western region is the mean net income of enterprises that use statistical methods higher than the mean net income of the enterprises that do not. What is more interesting is that only the enterprises from the Adriatic region that do not use statistical methods and the enterprises from the North-Western region that do use statistical methods have achieved positive mean net income. Those poor financial results can be explained by the global economic and financial crisis, which hit Croatia in 2008 and was still present in 2011 (Gardo and Martin 2010, European Commission 2013).

4.3. Impact of the use of statistical methods on enterprises' net income

Because there is an evident impact from the crisis on Croatian enterprises, instead of a quantitative

Table 5: Estimated mean net income in enterprises according to NUTS-2 regions and use of statistical methods, 2011, in HRK, n=663

NUTS-2 region	Statistical methods use	N*	Mean	Std. Err. of Mean	95% CL for Mean		Deff
Adriatic region	Yes	72	-300,318	670,060	-1,616,008	1,015,374	1.2010
	No	125	70,995	72,897	-72,141	214,132	
	Total	197	-64,713	247,398	-550,490	421,064	
North-Western region	Yes	131	1,262,250	816,718	-341,411	2,865,911	0.8507
	No	245	-60,259	281,425	-612,849	492,331	
	Total	376	400,509	338,750	-264,641	1,065,659	
Central and Eastern region	Yes	33	-1,892,585	1,943,171	-5,708,084	1,922,914	1.2090
	No	57	-108,340	331,996	-760,228	543,548	
	Total	90	-762,563	734,904	-2,205,578	680,452	
Total	Yes	236	168,146	557,231	-926,001	1,262,294	0.9764
	No	427	-21,874	149,463	-315,352	271,603	
	Total	663	46,048	220,571	-387,054	479,149	

Source: Author's calculation.

* Note: Four enterprises did not publish financial reports for 2011.

estimation of the impact of the use of statistical methods on enterprises' net income, a kind of probabilistic approach is used. In other words, instead of estimating a possible change in enterprises' net income value, expressed in HRK, as a result of the use of statistical methods, the likelihood of achieving positive net income when statistical methods are used is inspected. In order to do this logistic regression modelling was used.

To estimate a high quality model, enterprises with unusual net income values in 2011 were omitted. Unusual net income values or outliers are those net incomes that were more than two standard deviations from the global estimated mean of HRK 46,048. There were 42 such enterprises, which had net incomes lower than HRK -973,132 or higher than HRK 1,302,941 in 2011. Consequently, data from 591 enterprises were used in the analysis. Out of these 591 enterprises, 194 (32.83%) use and 397 (67.17%) do not use statistical methods. In the analysis, the enterprises are also observed after their affiliation to a stratum, i.e. a region. There were 176 (29.78%) enterprises in the Adriatic region, 334 (56.51%) enterprises in the North-Western region and 81 (13.71%) enterprises in the Central and Eastern region.

In the logistic regression model, the variable *Net income* is the dependent variable. This variable is set as a binary variable. It is equal to 0 if the enterprise has achieved a negative net income and it is equal to 1 if the enterprise has achieved a positive net income in 2011. The variable *Use of statistical methods*, which is an independent variable in the logistic regression model, is also a binary variable. It is equal to 0 if the enterprise does not use statistical methods and it is equal to 1 if the enterprise uses them. In the regression model, the reference category for this variable is that an enterprise does not use statistical methods. Additionally, the analysis by stratum is made by introducing the variable *Strata*. The North-Western region is used as a reference category because the previous results have shown that this region is the most

developed. The results of the logistic regression analysis are given in Table 6.

In the logistic regression model, net income is observed taking into consideration the use of statistical methods and an enterprise's affiliation in terms of NUTS-2 region. According to the Wald Chi-Square test, the variable *Use of statistical methods* ($\chi^2(1)=3.9056$, $p = 0.0481$) is statistically significant in the model at the significance level $\alpha = 0.05$. Thus, the enterprise that uses statistical methods has 1.635 times or 63.5% (85% CI = 1.143, 2.339) greater odds of achieving positive net income than the enterprise that does not use statistical methods (holding all other factors constant).

The variable *Strata* ($\chi^2(2)=6.2955$, $p = 0.0429$), which introduced the strata into the analysis, is significant overall in the model at the significance level $\alpha = 0.05$. The individual categories of the variable *Strata*, which are introduced into the model, are individually significant at the significance level $\alpha = 0.05$ (Adriatic region, $p = 0.0169$) and $\alpha = 0.15$ (Central and Eastern region, $p = 0.1365$). The model has pointed out that enterprises in the Adriatic region and the Central and Eastern region have lower odds of achieving positive net income than those in the North-Western region. The estimated odds ratio of achieving positive net income of enterprises in the Adriatic region relative to enterprises in the North-Western region is 0.569. The estimated odds of achieving positive net income for enterprises in the Central and Eastern region are 0.626 times the odds of achieving a positive net income for enterprises in the North-Western region.

The first-order interaction of the variables *Use of statistical methods* and *Strata* was tested in a separate model and was not significant. Therefore, the interaction terms were not included into the final model, which is given in Table 6. Consequently, it can be concluded that the decision to use or not use statistical methods and affiliation to a NUTS-2 region together do not have a statistically significant impact on achieving positive net income. This lack of impact led to the conclusion that there is no statistically significant

Table 6: Logistic regression analysis of net income in Croatian enterprises, positive vs. negative net income, n=591

Parameter	Analysis of Maximum Likelihood Estimates				Odds Ratio Estimates		
	Estimate	Stand. Error	Wald Chi-Square	Pr > ChiSq	Point Estimate	85% Wald Confidence Limits	
Intercept	1.5726	0.1632	92.8328	<.0001	-	-	-
Use of statistical methods	0.4917	0.2488	3.9056	0.0481	1.635	1.143	2.339
Strata – Adriatic region	-0.5631	0.2356	5.7105	0.0169	0.569	0.406	0.799
Strata – Central and Eastern region	-0.4688	0.3149	2.2169	0.1365	0.626	0.398	0.985

Source: Author's calculation.

Note: Reference categories for categorical predictors are: Enterprise does not use statistical methods (*Use of statistical methods*), North-Western region (*Strata*).

difference in the successfulness of the use of statistical methods in the NUTS-2 regions in Croatia. As a result, the second research hypothesis of the paper can be accepted.

5. CONCLUSION

The more developed a country is, the better a standard of living it is supposed to have. Unfortunately, there are very significant differences between countries in the level of development they have achieved. These differences are not only present at the level of countries, but at the regional level as well. Of course, Croatia is no exception.

In Croatia there are different regional stratifications. In the paper, the emphasis was on the stratification according to the NUTS system. The NUTS system recognizes different levels of stratification and the NUTS level 2 stratification was selected as the most appropriate to observe. According to the NUTS-2, there are three regions in Croatia: the Adriatic region, the North-Western region and the Central and Eastern region. If GDPpc, the regional competitiveness index rank and the number of enterprises criteria are observed, it can be concluded that the most developed region in Croatia is the North-Western region.

In order to obtain insight into statistical methods adoption in NUTS-2 regions in Croatia, a web survey was conducted. In the data analysis, a complex survey methodology was used. The results have shown that there is no statistically significant difference in statistical methods adoption between NUTS-2 regions. Hence, development level does not have any impact on an enterprise's decision to use statistical methods. On the contrary, logistic regression modelling showed that the enterprises that use statistical methods have higher odds of achieving positive net income than enterprises that do not use them. The interaction effect of the use of statistical methods and affiliation to a stratum did not have a statistically significant effect on the odds of achieving or not achieving positive net income. Based on this finding it has been concluded that there is no difference in the benefits of the use of statistical methods in enterprises in different regions. According to the results, more emphasis should be given to intensive statistical methods use in less developed regions. In this way, enterprises in less developed regions could achieve better business results and so reduce gaps in economic development. The crucial thing here is to conduct additional employee training. Only when employees become aware of the potential benefits of statistical methods will they warm to their use.

The main limitation of the research stems from the point in time at which the research was conducted, which was inappropriate. Namely, the research was conducted during the financial and economic crisis in Croatia. Because the negative crisis effects prevailed over the positive effects of the use of statistical methods, the given results have to be taken with great caution. Furthermore, instead of conducting a web survey, due to its limitations, different approaches are recommended for use in future research. A preliminary face-to-face interview survey with managers is highly recommended. In case of a very limited budget, a preliminary telephone survey could also be very useful in further improving the survey questionnaire.

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