



Statistical Methods Use in Small Enterprises: Relation to Performance

Ksenija Dumičić

Faculty of Economics and Business, University of Zagreb, Croatia

Lea Bregar

Faculty of Economics, University of Ljubljana, Slovenia

Berislav Žmuk

Faculty of Economics and Business, University of Zagreb, Zagreb, Croatia

Abstract

Background: There are several factors that lead to an improved level of competitiveness and increased net income of enterprises. Previous studies have shown that an appropriate use of statistical methods has positive effects on the level of competitiveness and on enterprises' net income in general. **Objectives:** This study analyses the statistical methods use in Croatian small enterprises. The goal of this research is to establish whether most Croatian small enterprises use statistical methods and whether the enterprises that use statistical methods on average have greater net income than the enterprises that do not use statistical methods. **Methods/Approach:** A web survey was conducted on the sample of 631 small enterprises in Croatia in 2012. In the analysis a complex survey design was taken into account. **Results:** The results have shown that in most Croatian small enterprises statistical methods are not used. The enterprises that use statistical methods on average have greater net income than the enterprises that do not use them. **Conclusions:** The results suggest that even though the use of statistical methods in small enterprises leads to higher net income, they are not used in the majority of Croatian small enterprises. If Croatian small enterprises want to succeed on the demanding European Union's market they should consider using statistical methods in their business.

Keywords: small enterprises; statistical methods use; logistic regression; complex survey design; net income; Croatia

JEL main category: C

JEL classification: C83, L21

Paper type: Research article

Received: 12, January, 2014

Accepted: 21, May, 2014

Citation: Dumičić, K., Bregar, L., Žmuk, B. (2014). "Statistical Methods Use in Small Enterprises: Relation to Performance", Vol. 5, No. 3, 37-48.

DOI: 10.2478/bsrj-2014-0018

Acknowledgments: This work has been fully supported by Croatian Science Foundation under the project STRENGTHS (Project no. 9402).

Introduction

Enterprises, which have been described as the fundamental resources and leaders of technological, economic and social development (Škrtić, Mikić, 2011), are faced with additional consumers' demands and the growing competition (Pejić Bach, 2014). If enterprises want to succeed at the contemporary market, they must possess and develop the features which will distinguish them from other enterprises or from competitors (Renko, Delić, Škrtić, 1999). It has been long considered that the competitive advantage can be achieved primarily by using only the lowest price of the product compared to the competition (Kolaković, 2006). However, the competitive advantage can also be achieved by using differentiation in the quality of products or services in order to achieve long-term satisfaction and customer loyalty. In recent years more emphasis is placed on the quality of information.

In order to achieve and keep a competitive advantage, it is extremely important and it is necessary that an enterprise effectively conducts market research, monitors and predicts market movements, controls and continuously improves its own processes, improves the quality of its products, develops new quality products, successfully plans and forecasts sales. Statistical methods can play a very important role in the implementation of these activities. They can have significant effects on the quality of information, which forms the basis for decision-making in the enterprise especially in terms of risk and uncertainty. Therefore, the use of statistical methods can have positive impacts on the operating results of the enterprise.

Notwithstanding, relevant studies have indicated that the statistical methods use is still quite scarce. Despite the fact that there are many statistical methods the application of which is possible and appropriate in enterprises, researchers have shown that statistical methods, despite the potential benefits that might be achieved by their proper use, are applied by a very small proportion of enterprises. Hargeaves (2002) studied the level of application of statistical methods by managers. The research results indicated that only 43% of managers make decisions using statistical methods. Gremyr, Arvidsson and Johansson (2003) conducted an empirical research on a sample of enterprises and they concluded that statistical methods are very rarely used in enterprises. Gogala and Šimičević (2005) examined the practice of statistical methods use in large companies. More than one third of the observed enterprises answered that they do not use statistical methods because they simply do not need them.

Bergquist and Albing (2006) pointed out that statistical methods do not have the place they deserve in decision-making. Their research shows that only 2.7% of the enterprises that use statistical methods use the methods in decision-making in crucial processes. Grigg and Walls (2007) divided statistical methods into two groups: the basic and the advanced statistical methods. According to their research basic statistical methods are used by approximately a half of enterprises. Advanced statistical methods are far less used in enterprises – only around one fifth of the enterprises use them. Šimičević (2007) also made a distinction between the basic and the advanced statistical methods. The results of her research conducted in large enterprises show that 51% of the enterprises used only basic statistical methods, 25% of the enterprises, in addition to basic, applied advanced statistical methods as well, and 24% of the enterprises did not apply statistical methods. Based on those findings we declare our research prepositions (RPs):

RP₁: Most Croatian small enterprises do not use statistical methods.

RP₂: The enterprises that use statistical methods on average have better performance measured in terms of greater net income compared to the enterprises that do not use statistical methods.

In order to check the validity of the research propositions, an original empirical research was conducted on the representative sample of Croatian small enterprises. It is expected that the lack of statistical methods use in enterprises in general is also valid for the small ones. If the empirical research results confirm the second research proposition, a significant increase of statistical methods use in small enterprises is expected. Thus this article has an indirect aim of popularizing statistical methods use.

The paper consists of four parts. After the introduction, the research methodology is presented, including the sample description and the research instrument. The data analysis and main research findings are provided in the third part. Finally, research results are discussed and directions for future research are given.

Research methodology

Sample description

The target population consists of small Croatian enterprises that are registered in the Court Register of the Republic of Croatia as limited liability enterprises in accordance with the Companies Act (Official Gazette, 152/11) and that are subject to the submission of annual financial statements in accordance with the Accounting Act (Official Gazette, 109/07). Pursuant to the Accounting Act (Official Gazette, 109/07, Art. 3) small enterprises are those enterprises that fulfil at least two of the three criteria: the amount of their total assets is lower than 32,500,000 HRK (Croatian kuna, the Croatian monetary unit); the amount of revenue is lower than 65,000,000 HRK; and the average number of employees during the financial year is less than 50.

According to the Croatian Company Directory of the Croatian Chamber of Economy (Croatian Chamber of Economy, 2013), which is an integrated database containing all registered business entities in the Republic of Croatia and which has been used as the sampling frame, there were 87,805 such enterprises at the beginning of the survey (in October 2012). It has to be emphasized that an in-depth analysis of the enterprises' structure has shown that there were 30,449 enterprises with the annual average number of employees being zero and that 59,157 enterprises had not provided an e-mail address. The enterprises with the annual average number of employees being zero are not going to be considered because those enterprises are mostly shell companies, i.e. without any business activity. Whether the enterprises have an e-mail address or not is a very important fact for this survey because the enterprises are contacted by e-mail. The e-mail, sent to the enterprises, was an invitation to participate in the survey. The invitation e-mail also contained a unique hyperlink to the on-line survey which was hosted on the University of Zagreb Computing Centre servers. The on-line survey was made in the LimeSurvey system (University Computing Centre, 2013). Consequently, the enterprises that did not provide an e-mail did not have the opportunity to participate in the survey. This one could lead to a coverage error if enterprises that do not have e-mails are systematically different from those that do have an e-mail. For the purpose of this paper it is assumed that there is no statistically significant difference between enterprises with and without e-mails. For that reason the target population contained 57,356 enterprises, but the surveyed population contained 24,618 enterprises. The target population is defined by subtracting the number of enterprises with the annual average number of employees being zero from the total number of small enterprises. On the other hand, the surveyed population is obtained by subtracting the number of enterprises with the annual average number of employees being zero and enterprises without an e-mail from the overall number of

small enterprises. Table 1 presents the number of small enterprises in Croatia at the beginning of October 2012.

Table 1

Number of small enterprises in Croatia, October 2012

Activities (strata)	Overall	Without employees on average	Without an e-mail	Target population	Surveyed population
Industrial	22,794	7,630	15,057	15,164	6,769
Trade	25,310	7,957	17,016	17,353	7,186
Services	37,292	13,922	25,350	23,370	10,091
Other	2,409	940	1,734	1,469	572
Total	87,805	30,449	59,157	57,356	24,618

Source: Croatian Chamber of Economy, Authors' calculation

The enterprises were stratified according to the enterprises' main economic activity. The National Classification of Economic Activities (NACE) from 2007 identifies a total of 21 areas of activity (Official Gazette, 58/07). Since that is a significantly large number of activity areas, and since there is a very different number of enterprises operating in a particular activity area (in some areas there are only a few or even no enterprises), these areas are grouped into four independent and non-overlapping (mutually exclusive) groups or strata. So, the first stratum consists of industrial enterprises and enterprises whose main activity, according to NACE from 2007, is mining and quarrying, manufacturing, gas supply, electricity and water exploitation en, or construction (areas B, C, D, E, F). The second stratum consists of commercial enterprises or enterprises whose main activity, according to NACE 2007, belongs to the retail or wholesale trade (area G). The third stratum includes enterprises engaged in accommodation and catering services, transport, storage and communications, financial intermediation, real estate and renting, business services, education, enterprises engaged in health care and other services (areas H, I, J, K, L, M, N, O, P, Q, S). These enterprises are commonly named service industry enterprises. The fourth stratum includes remaining areas or other enterprises whose main activity is agriculture, forestry, fisheries, arts, entertainment or recreation and enterprises engaged in activities of households as employers and other sectors (areas A, R, T, U).

Since this was a web survey, there was no need to do geographic clustering of enterprises (elements) to reduce survey costs. Also, enterprises could be easily identified on the available frame. So, in this survey, cluster sampling was not used.

The survey data collection lasted from Thursday, October 10, 2012, to Sunday, February 17, 2013. The invitation e-mail was sent to all enterprises that were included based on the definition of the surveyed population. The reminder for participation in the survey was sent twice. At the end of the data collection period, 631 enterprises participated in the survey resulting in a response rate of 2.56%. Table 2 provides the distribution of sample sizes and response rates by strata.

In the analysis of weights only a nonresponse adjustment factor ($w_{nr,h}$) is going to be used, and thus the final weight is going to be equal to this factor ($w_{final,h} = w_{nr,h}$). The sample selection weight ($w_{sel,h}$) is not used because all 24,618 small enterprises were invited to participate in the survey. Also, it is concluded that the post stratification factor ($w_{ps,h}$) does not have to be included in the analysis.

Table 2
Sample sizes, response rate and weight analysis

Activities (strata)	Surveyed population, N_h , N	Responses, final sample sizes, n_h , n	Response rate, r_{ratei} , in %	Nonresponse adjustment factor, $w_{nr,h}$
Industrial	6,769	164	2.42	41.2744
Trade	7,186	134	1.86	53.6269
Service	10,091	313	3.10	32.2396
Others	572	20	3.50	28.6000
Total	24,618	631	2.56	-

Source: Authors' calculation

The post stratification adjustments have already been included through nonresponse adjustments which are based on the known population counts. So, there is no particular reason for introducing more nonresponse adjustments. The nonresponse adjustment factors that are going to be used in the analysis are shown in Table 2 and were calculated as: $w_{nr,h} = 1/r_{rateh} = 1/(n_h/N_h) = N_h/n_h$.

Research instrument

There are two key variables developed for the purpose of this paper. The first key variable includes data on statistical methods use. This variable is in the data set named *UsageC* and it is a binary variable that is equal to 1, if the observed enterprise uses statistical methods, or 0, if the observed enterprise does not use statistical methods. The second key variable is data on enterprises' net incomes. This variable is named *Income* and it is a numerical variable which contains data on net income of Croatian small enterprises in HRK for 2011. This key analysis variable has 20 missing cases in total, i.e. there are no data for 3.17% of enterprises in the sample. The reason for the missing data is that those 20 enterprises had not existed or had not done any business in 2011. This rate of missing data is considered very low, and because of that it will not require any additional weighting or imputation. The first key analysis variable *UsageC* has no missing cases.

In the analyses the complex survey design, design effects (*Deff*), including weights and stratification, were incorporated. The Jackknife Repeated Replication method (Rust, Rao, 1996, Heeringa, West, Berglund, 2010) was utilized for variance estimation, which accounted for the random sampling weights and the stratification. The weight variable is named *weight* in the data set. The weights have not been normalized. The stratum variable, which contains the sampling error code for strata, is called *StrataC*. The variable *StrataC* contains values 1, 2, 3, and 4. Each value is coded for a different stratum or a different kind of enterprise. So, code 1 presents industrial enterprises, code 2 trade enterprises, code 3 service industry enterprises, and code 4 other enterprises.

Results

Use of statistical methods in small enterprises

First, the research preposition that most Croatian small enterprises do not use statistical methods will be researched and tested. This research preposition can also be considered as the assumption that more than 50%, in terms of percentages, or more than 0.50, in terms of proportions; of Croatian small enterprises do not use statistical methods. In order to obtain data for this analysis, enterprises were asked if they use statistical methods in their business. Overall, 631 enterprises answered this question.

Table 3

Use of statistical methods in Croatian small enterprises, n=631

Use of statistical methods in day-to-day business	N	Sum of Weights	Proportion	Std. Error of Proportion	95% CI for Proportion		95% CI for Sum		Deff
Users	215	24618	0.3454	0.0195	0.3072	0.3836	7563	9445	1.0548
Non-Users	416	24618	0.6546	0.0195	0.6164	0.6928	15173	17055	

Source: Authors' calculation

According to the data in Table 3, 215 enterprises have stated that they use statistical methods, and 416 enterprises that they do not use them. It could be easily concluded that approximately 1/3 of the enterprises (34.54%) use statistical methods, and 2/3 (65.46%) do not use them. Table 3 also provides a 95% confidence interval for the proportions. According to the 95% interval, it is expected that from 30.72% to 38.36% of Croatian small enterprises use statistical methods. On the other side, the second 95% confidence interval for proportion shows that it could be expected that from 61.64% to 69.28% of Croatian small enterprises do not use statistical methods. Both 95% intervals indicate that, at the significance level $\alpha = 0.05$, more than 50% or 0.50 of Croatian small enterprises do not use statistical methods. Consequently, the first research preposition of the paper can be accepted.

Table 3 also provides Deff. The value of Deff of 1.0548 indicates that the stratification and the weights, which were accounted for in the analysis, did not result in an improved level of precision for this estimate. On the contrary, the variance for this estimate is 1.0548 times or 5.48% higher than it would be for the variance of simple random sampling for the same sample size (631 enterprises). According to the value of Deff, the effective sample size, or the sample size of simple random sampling that would result with the same level of precision, is 599 enterprises.

The general conclusion is that most Croatian small enterprises do not use statistical methods, but a further analysis was performed to check if that is valid for all different kinds of enterprises. So, the enterprises were observed separately according to their main activity.

Table 4 shows the results of the analysis of the statistical methods use in Croatian small enterprises according to their main activity. The 95% confidence intervals and the empirical z-value suggest that, at the significance level $\alpha = 0.05$, the same conclusion as for all small enterprises in general, can be made for small industrial enterprises (CI 95% = 0.6178, 0.7602; $p < 0.0001$), trade (CI 95% = 0.5212, 0.6877; $p = 0.0069$), service industry (CI 95% = 0.6120, 0.7170; $p < 0.0001$) and other (CI 95% = 0.4935, 0.9065; $p = 0.0287$) small enterprises. The value of the Rao-Scott F-statistic for the overall test of the null hypothesis that enterprises' activities and the statistical methods use are not associated is 1.0871 (num df = 2.83, den df = 1774.19, $p = 0.3514$). Consequently, at the significance level $\alpha = 0.05$, the null hypothesis that enterprises' activities and the statistical methods use are not associated may not be rejected. Also, it has been shown that all Deffs for used estimates are less than 1 indicating that, compared to the simple random sampling for the same sample size; the higher levels of precision for subpopulation estimates are achieved.

Table 4

Use of statistical methods in Croatian small enterprises according to main business activity

Strata	Use of statistical methods in day-to-day business	N	Sum of Weights	Proportion	Std. Error of Proportion	95% CI for Proportion		p-value	Deff
Industrial	Users	51	6769	0.3110	0.0363	0.2398	0.3822	1.0000	0.8007
	Non-Users	113	6769	0.6890	0.0363	0.6178	0.7602	0.0000	0.4077
Trade	Users	53	7186	0.3955	0.0424	0.3123	0.4788	0.9931	0.9449
	Non-Users	81	7186	0.6045	0.0424	0.5212	0.6877	0.0069	0.6641
Service	Users	105	10091	0.3355	0.0267	0.2830	0.3880	1.0000	0.6377
	Non-Users	208	10091	0.6645	0.0267	0.6120	0.7170	0.0000	0.3816
Other	Users	6	572	0.3000	0.1051	0.0935	0.5065	0.9713	0.5431
	Non-Users	14	572	0.7000	0.1051	0.4935	0.9065	0.0287	0.2349

Source: Authors' calculation

Note: * P-values are calculated for one-side test on the upper limit.

Relation between use of statistical methods and net income of small enterprises

The second aim of the paper is to examine if the use of statistical methods has positive effects on enterprises' performance measured through net income. In Table 5 the mean values of net income of Croatian small enterprises according to their main activity, and the use of statistical methods are shown. The values of net income are presented in HRK and they are related to year 2011.

According to Table 5, the average net income of Croatian small enterprises in 2011 was 185,411 HRK (95% CI = 69,592, 301,230). The highest average net income in 2011 was in the trade enterprises (mean = 364,962; 95% CI = 175,736, 554,188), and the lowest in other enterprises (mean = 1,253; 95% CI = -494,451, 496,958). In the enterprises that use statistical methods the average net income in 2011 was 213,081 HRK (95% CI = -51,890, 478,053), and in the enterprises that do not use statistical methods the average net income was 170,359 HRK (95% CI = 63,989, 276,729). It is assumed that enterprises that use statistical methods on average have greater net income than the enterprises that do not use statistical methods. But the t-test of equality of means has shown that, at the significance level $\alpha = 0.05$, the null hypothesis that the average net income in enterprises that use statistical methods is smaller or equal to the average net income in enterprises that do not use statistical methods, may not be rejected (mean difference = 42,722; $p = 0.3860$). The same decision can be made for all the strata. That way, the second research preposition of the paper could be rejected.

Table 5 provides Deffs and shows that the overall Deff of 1.0554 indicates that the stratification, which was made in the survey, and the weights, which were introduced in the analysis, did not result in an improved level of precisions for this estimate. The Deff indicates that the variance for the observed estimate (average net income) is 1.0554 times or 5.54% higher than the variance of simple random sampling for the same sample size (611 enterprises). According to the value of Deff, the effective sample size is 579 enterprises. In Table 5 Deffs for each stratum overall are also given. The first two strata, industrial and trade enterprises, have Deffs higher than 1, indicating that, compared to the simple random sampling for the same

sample size, lower levels of precision for the subpopulation estimates are achieved. On the other side, the remaining strata, service industry and other enterprises, achieved higher levels of precision for the average net income compared to the simple random sampling of the same sample size.

Table 5

Estimated mean net income values for Croatian small enterprises according to main activity and use of statistical methods, 2011, in HRK

Strata	Use of statistical methods in day-to-day business	N	Mean	Std. Error of Mean	95% CL for Mean		p-value*	Deff
Industrial	Users	51	377,864	503,317	-610,527	1,366,256	0.1923	1.0569
	Non-Users	107	-64,530	116,017	-292,359	163,300		
Total Industrial		158	78,268	179,169	-273,577	430,113		
Trade	Users	53	234,643	119,557	-138	469,425	0.8847	1.3740
	Non-Users	78	453,511	140,336	177,926	729,097		
Total Trade		131	364,962	96,359	175,736	554,188		
Service	Users	102	86,444	80,387	-71,416	244,304	0.8049	0.8253
	Non-Users	202	163,545	41,047	82,939	244,151		
Total Service		304	137,676	38,260	62,543	212,808		
Other	Users	6	261,374	241,569	-213,008	735,755	0.1738	0.7230
	Non-Users	12	-128,807	367,901	-851,274	593,660		
Total others		18	1,253	252,427	-494,451	496,958		
Total	Users	212	213,081	134,931	-51,890	478,053	0.3860	1.0554
	Non-Users	399	170,359	54,167	63,989	276,729		
Overall		611	185,411	58,978	69,592	301,230		

Source: Authors' calculation

Note: * P-values are recalculated for one-side test on the upper limit.

If the standard errors in the table are observed closer, it can be concluded that they have high values. In the same way, if standard deviations of net incomes are observed, it can be concluded that their values compared to means values are high. For this reason the representativeness and the means use in the statistical analysis is questionable. So, an additional statistical analysis is required. Due to the very large dispersion of the small enterprises' net incomes, the net incomes have been recoded for the purpose of the analysis. If the value of the net income is between -500,000 and 0 HRK, it is coded with number 0. Therefore in this group there are enterprises that have negative values for net income. On the other hand, if the value of the enterprises' net income is between 0 and 5,000,000 HRK, it is coded with number 1. It has to be emphasized that there are overall 29 enterprises that have net income outside the stated intervals. It is assumed that these enterprises were influenced by one or more different factors that are not usually a part of their business, but they had an impact on their net income during 2011. Because of that these 29 enterprises are excluded from further analysis. As a result of the transformation, the variable net income becomes a binary variable, and consequently, the logistic regression analysis will be used. In the logistic regression model the variable *Use of statistical methods* is going to be an independent variable, and the variable *Net income* is going to be a dependent variable.

Additionally the analysis by stratum is going to be made. The results of the logistic regression analysis are given in Table 6.

Table 6

Logistic regression analysis of net income of Croatian small enterprises, positive vs. negative net income, Model 1 & Model 2

Model 1	Analysis of Maximum Likelihood Estimates				Odds Ratio Estimates		
Parameter	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	Point Estimate	90% Wald Confidence Limits	
Intercept	1.2593	0.2416	27.1601	<.0001	-	-	-
Use of statistical methods	0.4536	0.2610	3.0195	0.0823	1.574	1.025	2.418
Main activity – Industrial	0.2413	0.3230	0.5581	0.4550	1.273	0.748	2.165
Main activity – Other	-0.2283	0.6353	0.1291	0.7194	0.796	0.28	2.263
Main activity – Service	0.3513	0.2821	1.5504	0.2131	1.421	0.893	2.260
Model 2							
Parameter	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	Point Estimate	85% Wald Confidence Limits	
Intercept	1.4663	0.1343	119.193	<.0001	-	-	-
Use of statistical methods	0.4272	0.2611	2.677	0.1018	1.533	1.053	2.232

Source: Authors' calculation

Note: Reference categories for categorical predictors are: Enterprises do not use statistical methods (*Use of statistical methods*), Trade (*Main activity*).

In *Model 1* net income is observed taking into consideration the use of statistical methods and the enterprise's main activity. According to the Wald Chi-Square, the variable *Use of statistical methods* ($\chi^2(1)=3.0195$, $p = 0.0823$) is statistically significant in the model at the significance level $\alpha = 0.10$. Thus, the enterprise that uses statistical methods has 1.574 times or 57.4% (90% CI = 1.025, 2.418) greater odds of achieving positive net income than the enterprise that does not use statistical methods (holding all other factors constant). On the other side, the variable *Main activity*, which represents the strata analysis, overall is not statistically significant at any usual used level of significance ($\chi^2(3)=2.1418$, $p = 0.5435$). As a result *Model 2* has been formed without this variable. In this new model, the variable *Use of statistical methods* ($\chi^2(1)=2.677$, $p = 0.1018$) is statistically significant in the model at the significance level $\alpha = 0.15$. In ensuring statistical significance at the lower level the sample size was probably the main limiting factor. So, the enterprises that use statistical methods have 1.533 times higher odds of achieving a positive net income compared to the odds of achieving a positive net income by an enterprise that does not use statistical methods (85% CI = 1.053, 2.232). That way, the second research reposition of the paper could be accepted.

Discussion and conclusion

Methodological remarks

The analyses have shown that most Croatian small enterprises do not use statistical methods. It has been shown that only 215 enterprises of 631 in the sample or 34.54% use statistical methods in their business. As a result it can be concluded that at the significance level $\alpha = 0.05$ more than 50% of Croatian small enterprises do not use statistical methods. This conclusion can be made for Croatian small enterprises in general, but also when their main activity is taken into consideration. The conducted

analyses have confirmed and proven that Croatian small enterprises have not yet recognized the advantages of the use of statistical methods.

The first analysis has shown that there was no statistically significant difference in average net income in 2011 between Croatian small enterprises that use statistical methods and those that do not use them (mean difference = 42,722, se = 144,983.38, $t = 0.29$, $p = 0.3860$). The same conclusion could be made at the stratum levels. The in-depth analysis has shown that the net incomes have high dispersion. Thus, the results of the conducted analysis should be taken with care because the analysis was based largely on the means. In order to overcome the problem of the high net income dispersion the values of net income were divided and coded into two groups. The net incomes that are between -500,000 and 0 HRK were put in the first group, and the net incomes that are between 0 and 5,000,000 HRK were put in the second group. The net incomes in the first group were then coded with 0 and the net incomes in the second group with 1. This way the logistic regression analysis was enabled. In the logistic regression analysis the dependent variable, coded the *net income*, and the independent variable, coded the *use of statistical methods* in enterprises, were used. The analysis has shown that the enterprises using statistical methods have 1.533 times higher odds of achieving a positive net income compared to the odds of achieving a positive net income by an enterprise that does not use statistical methods ($\chi^2(1)=2.677$, $p = 0.1018$, 85% CI = 1.053, 2.232).

Relation to previous findings

Previous studies have monitored statistical methods use in enterprises in general or just in large ones. Also, previous studies have not researched the impact of the statistical methods use on enterprises' net income. Therefore, the conducted research represents a significant step forward in understanding the position and the role of statistical methods in enterprises.

Practical implications

The conducted analyses in this paper have resulted in the following two main conclusions: most Croatian small enterprises do not use statistical methods, and the use of statistical methods may have a positive impact on the value of net incomes for Croatian small enterprises. If Croatian small enterprises want to succeed on the demanding European Union's market they should consider using statistical methods in their business. In order to maximize the effects of using statistical methods, small enterprises should first become acquainted with different statistical methods. In the next step, after a thorough analysis enterprises should choose which statistical methods they are going to use and make a statistical methods implementation plan. It is very important that the enterprises are aware of the fact that using statistical methods alone does not guarantee a positive net income. Statistical methods should be treated only as an assistance tool in achieving better business results.

Research limitations and further research

There are several important limitations of the conducted survey. The first limitation is the frame. The used frame contained a list of all small enterprises in Croatia, but it did not contain a list of e-mail addresses for all of them. This resulted in a large share of the Croatian small enterprises not having a chance to be involved in the survey. Another great limitation of the survey was the way in which it was conducted. Namely, in order to achieve as high a response rate as possible, this web survey used only a limited number of questions. This way it was not possible to survey all aspects

and effects of using statistical methods on an enterprise's results. Another limitation of the conducted survey is a very low response rate (2.56%). This response rate could have a significant impact on inferences. Given that situation, future surveys should use a face-to-face mode instead of a web survey mode. Future surveys should give special attention to choosing the most appropriate person in the enterprise for an interview. Future research studies should seek answers to the question why enterprises do not use statistical methods.

References

1. Bergquist, B., Albing, M. (2006), "Statistical methods: Does anyone really use them?", *Total Quality Management & Business Excellence*, Vol. 17, No. 8, pp. 961–972.
2. Croatian Chamber of Economy (2013), "Croatian Company Directory", available at: <http://www1.biznet.hr/HgkWeb/do/extlogon> (22 October 2013).
3. Gogala, Z., Šimičević, V. (2005), "Korištenje statističkih metoda u hrvatskim poduzećima" ("Usage of Statistical Methods in Croatian Large Firms"), *Zbornik Ekonomskog fakulteta u Zagrebu*, Vol. 3, No. 1, pp. 321-338.
4. Gremyr, I., Arvidsson, M., Johansson, P. (2003), "Robust Design Methodology: Status in the Swedish Manufacturing Industry", *Quality and Reliability Engineering International*, Vol. 19, No. 4, pp. 285-293.
5. Grigg, N. P., Walls, L. (2007), "Developing Statistical Thinking for Performance Improvement in the Food Industry", *International Journal of Quality & Reliability Management*, Vol. 24, No. 4, pp. 347-369.
6. Hargreaves, C. A. (2002), "Do Managers Make Decisions Using Statistics?", available at: http://www.stat.auckland.ac.nz/~iase/publications/1/10_22_ha.pdf (16 September 2013).
7. Heeringa, S. G., West, B. T., Berglund, P. A. (2010). *Applied Survey Data Analysis*, Boca Raton: Chapman & Hall/CRC.
8. Kolaković, M. (2006). *Poduzetništvo u ekonomiji znanja (Entrepreneurship in the knowledge economy)*, Zagreb: Sinergija-nakladništvo.
9. Official Gazette (2007), *Zakon o računovodstvu (The Accounting Act)*, Vol. 16, No. 109, Zagreb: Narodne novine d.d., pp. 8130-8137.
10. Official Gazette (2007), *Odluka o Nacionalnoj klasifikaciji djelatnosti 2007. - NKD 2007. (The National Classification of Economic Activities)*, Vol. 16, No. 58, Zagreb: Narodne novine d.d., pp. 4170-4186.
11. Official Gazette (2011), *Zakon o trgovačkim društvima (The Enterprises Act)*, Vol. 20, No. 152, Zagreb: Narodne novine d.d.
12. Pejić Bach, Mirjana. (2014), "Exploring Information and Communications Technology Adoption in Enterprises and its Impact on Innovation Performance of European Countries", *Ekonomický časopis*, Vol. 4, No. 2, pp. 335-362.
13. Renko, N., Delić, S., Škrtić, M. (1999). *Benchmarking u strategiji marketinga (Benchmarking in marketing strategy)*, Zagreb: Mate.
14. Rust, K. F., Rao, J. N. (1996), "Variance estimation for complex surveys using replication techniques", *Statistical Methods in Medical Research*, Vol. 5, No. 3, pp. 283-310.
15. Šimičević, V. (2007), "Istraživanje statističkih metoda i statističkog mišljenja u hrvatskoj poslovnoj praksi" ("Research of Statistical Methods and Application of Statistical Thinking in the Croatian Business Practice"), *Ekonomski pregled*, Vol. 58, No. 7-8, pp. 445-464.
16. Škrtić, M., Mikić, M. (2011). *Poduzetništvo (Entrepreneurship)*, Zagreb: Sinergija-nakladništvo.

17. University Computing Centre (2013), "LimeSurvey", available at: <http://limesurvey.srce.hr> (22 October 2013).

About the authors

Ksenija Dumičić is a Full Professor with Tenure at the Department of Statistics, Faculty of Economics & Business, University of Zagreb. Her main research fields include sampling, statistics, business statistics, sampling for social and business surveys. The author can be contacted at: kdumicic@efzg.hr

Lea Bregar Lea Bregar is an Associate Professor at University Ljubljana, Faculty of Economics, retired in 2008. As a lecturer and scholar she visited European universities (Vienna, Budapest, Warsaw, Stirling, UK) teaching undergraduate, graduate, post-graduate and doctoral courses on applied statistics and on research methodology. She is an expert on economic statistics, specialised in index numbers theory and practice and in official statistics. Her specific research interest is investigation of ICT potential for enhancing higher education, in particular in the field of statistics. The author can be contacted at: lea.bregar@ef.uni-lj.si

Berislav Žmuk is a Senior Assistant at the Department of Statistics, Faculty of Economics & Business, University of Zagreb. His main research fields include applications of statistics in business and economy, sampling and statistical quality analysis. The author can be contacted at: bzmuk@efzg.hr