Hypotheses Testing of Impacts of Reduced VAT Rates Application on Locally Supplied Services on their Providers in Accordance with the European Union Law[1]

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Abstract
Most of Member States, in contrast to the Czech Republic, have implemented the option of application of reduced VAT rates in the labour-intensive services into their legislation. This paper contains a hypothesis testing that is based on the assumption that the transfer of labour-intensive services from the standard to the reduced VAT rate would lead to reduction of tax liability of the suppliers of these services from the Moravian-Silesian Region. By reducing the tax liability these taxpayers would gain free funds that could be used for the development of their business. The providers of these locally supplied services are moreover supposed to decrease the average prices of their services and this could cause the consequent increase of demand and lead to subsequent growth of sales, increase number of job positions or growth of wages of existing staff too. The stated hypotheses will be accepted or rejected by application of selected methods of statistical induction: t-test, F-test and Z-test. To fulfil the main aim of the paper the method of analysis and deductive method have been used.

Keywords: Value Added Tax, VAT Rates, European Union, Locally Supplied Services, Hypothesis
JEL codes: C81, D22, H25, K34

1. Introduction

Application of VAT in the Member States of the European Union is based on Council Directive 2006/112/EC of 28 November 2006 on the common system of value added tax (hereinafter referred to as "VAT Directive"). The VAT Directive has been amended many times since its effectiveness. One of the amendments is the Council Directive 2009/47/EC of 5 May 2009 amending Directive 2006/112/EC as regards reduced rates of value added tax that allows Member States to include supply of labour-intensive local services to a reduced VAT rate on a permanent bases. This Directive entered into force on 1 June 2009.

The basis for the issuance of the Directive 2009/47/EC were conclusions of the Study on reduced VAT applied to goods and services in the Member States of the European Union (2007), (hereinafter referred to as "Copenhagen Economics Study"), which concluded that transfer of these services from the standard to the reduced VAT rates can foster economic growth, the transfer of these services from the informal economy into the legal sphere and also promote job creation.

Although the Czech Republic attempted several times to implement this Directive into the Czech VAT Act since its adoption, none of the prepared amendments to the VAT Act has been approved. The Directive has not been implemented primarily because the impact of this legislative change would not measurable.

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However, unlike the Czech Republic, most of the Member States at least partially exploited the possibility of implementation of this Directive also as one of the anti-crisis instruments. Not only due to this reason has the debate over the use of this legislative change been closed yet.

For this reason we decided to conduct the research among the suppliers of these services and confirm or refute the conclusions of the selected aspects of the Copenhagen Economics Study by using statistical methods in terms of the Moravian-Silesian Region.

The aim of this paper is to present partial results of long-term research project "Quantification of Impacts of Application of Reduced Value Added Tax Rate to Locally Supplied Services on the Suppliers of these Services".

1.1 Model and Data

The stated hypotheses will be accepted or rejected by application of the selected methods of statistical induction: t-test, F-test and Z-test. For more information about using statistic methods see Friedrich et. al (2005).

The basis for testing these hypotheses are data that are being currently gathered by the empirical research carried out among suppliers of these services in the Moravian-Silesian Region, specifically among suppliers of catering services, hairdressing services, minor repairing of bicycles, shoes and leather goods.

These data are obtained by the anonymous questionnaires which contain the actual data for the taxable period 4th calendar quarter of the 2010 or in case of month taxable period - December 2010. Furthermore, the questionnaires contain the data that are presupposed by the VAT payer in case of the transfer of these services from the standard to the reduced VAT rate. Specifically: sales excluding VAT, costs excluding VAT, output tax according to VAT rates, input tax according to VAT rates, tax liability, trade margin, number of employees and labour costs.

2. Legal Framework of the European Union and the Czech Republic at Application of VAT Rates

Member States have some freedom in determining VAT rates despite the requirement of harmonization. The change of VAT rates has a substantial and relevant influence on the revenues of the public budget and can also be reflected in the change of the price level. (Široký and Kovářová, 2010).

The legal framework for the application of VAT rates in Member States is included in the VAT Directive, in particular in Articles 93 to 130 and its relevant Annexes.

The basic rule for the application of VAT rates in Member States is:

- supplies of goods and services subject to VAT are normally subject to a standard rate of at least 15 %;
- Member States may apply one or two reduced rates of not less than 5 % to goods and services enumerated in a restricted list. (Taxation and Customs Union, 2011).

According to the VAT Directive, Member States could include a limited range of goods and services into the reduced VAT rate. (Taxation and Customs Union, 2011). These exceptions were granted during the negotiations preceding the adoption of the VAT rates Directive of 1992 and in the Acts of Accession to the European Union. Overall, such exceptions prevent a coherent system of VAT rates in the European Union from being applied. (Platteeuw and De Silva, 2011)

Currently the standard VAT rate in the Czech Republic is 20 %, the reduced VAT rate 10 %. The increase of the reduced VAT rate to 14 % since the beginning of 2012 and unification of both of

the rates to one rate of 17.5 % since 2013 has been adopted. There has been discussed unification of rates to one rate of 19 % with exception of books, newspaper and pharmaceutical products which should have been applied reduced rate of 10 %. This proposal was discussed during budget preparation and finally was not approved.

2.1 Labour Intensive Local Services and VAT Rates in the European Union

As mentioned above, most of Member States at least partially apply the reduced or super reduced VAT rate to some of these services.

Specifically: 13 of Member States apply reduced VAT rate to the restaurant and catering services (including one of them who applies the super reduced rate), 8 Member States to hairdressing services and 8 to minor repairing of shoes and leather goods and bicycles. (Taxation and Customs Union, 2011).

3. Empirical Research and Determination of the Number of Respondents

The data collecting began in April 2011. The data are obtained from using anonymous questionnaires which are gathered among the providers of these services by a student of Masters program from Faculty of Economics of VSB – Technical University Ostrava.

As mentioned above, the main point of the research is the tax liability of the VAT payers and its changes.

Before starting the very research it was necessary to determine the sample size (number of respondents) in such a way to get results to at least average reliability and accuracy. In cases where the research is conducted at institutions within the region it is recommended the sample size from 200 to 500 respondents. (Sudman, 1976).

For this reason we temporary set to obtain from the respondents 250 completed questionnaires for the purposes of our empirical research. Then we found out from the data that we obtained from the Czech Statistical Office the real size of the population, i.e. the number of providers of selected services broken up by individual subgroups (see Table 1). From this data we calculated the percentage shares of the subgroups in relation to the overall size of the population and initially set the number of respondents of 250.

Table 1: The calculations to determine the sample size

Population	13 472	100 %	250 questionnaires (100 %)
Restaurant Services	8 658	64.27 %	161
Hairdressing Services	4 515	33.51 %	84
Minor repairing of shoes and leather goods	122	0.91 %	2
Minor repairing of bicycles	177	1.31 %	3

Source: authors´ calculations according to data from the Czech Statistical Office

For the analysis of the subgroups of the population is necessary to make further adjustments in the last two subgroups. The data in Table 1 show that according to these calculations the sample size of the subgroup “minor repairing of shoes and leather goods” would be only two respondents and only three respondents for the subgroup “minor repairing of bicycles”. Such a set of number of respondents does not have sufficient statistical power.

In case of fulfillment of condition of Moivre-Laplace theorem on the convergence of binomial distribution there will be provided sufficient predicative ability.

According to Newbold et al. (2009) is a good rule for us that the normal distribution provides a good approximation for the binomial distribution when

$$nP(1-P) > 9 \quad (1)$$

Substituting the value p=0,5 to relation (1) it is found that the condition of the Moivre-Laplace Theorem is true if there were collected data from at least 36 minor repairing of shoes and leather goods and 36 minor repairing of bicycles.

n0,5(1-0,5) > 9
36>9

Based on the application of relation (1) there is expanded the sample size up to 317 respondents. This step will allow analyzing not only the population as a complex but also its subgroups (i.e. restaurant services, hairdressing services, minor repairing of shoes and leather goods and minor repairing of bicycles).

Table 2: Population and sample size according to the subgroups

Population	Sample size (number of respondents)
Restaurant Services	161
Hairdressing Services	84
Minor repairing of shoes and leather goods	36
Minor repairing of bicycles	36
Total	317

Source: authors´ calculations according to data from the Czech Statistical Office

After the adjustments the sample size is sufficiently representative for the subsequent analysis.

Questionnaires from 132 random respondents have been collected until now. The following calculations are made from these questionnaires. Thus the output of this paper is the presentation of the results of the partial surveys.

After receiving all questionnaires the final evaluation and comparison with results of interim research, which are contained in this paper, will be made.

4. Hypotheses Testing

At the beginning of the research we have formulated these following working hypotheses that transfer of labour-intensive locally supplied services from the standard to the reduced VAT rate will lead to:

1. decreasing of tax liability more than 60 % of the VAT payers,
2. decreasing of prices of these services more than 60 % of the cases,
3. formation of free funds more than 60 % of the cases,
4. development of investment activities (purchase of new equipment) more than 60 % of the cases,
5. positive effect on employees (training, increasing of wages, benefits) more than 60 %
6. positive influence on increasing of employment (creation of vacancies) more than 60 % of the cases.

The testing of the above mentioned hypotheses is based on groups of methods to test hypotheses about the relative frequency (the formula was adopted from Barrow, 2010).

It uses this type of test:

$$z = \frac{p - \pi}{\sqrt{\frac{\pi(1-\pi)}{n}}} \qquad (2)$$

where:

n - sample size, p – relative frequency, π - expected frequency formulated in the null hypothesis.

The significance level is usually between 1 to 10 %. That is why we used the significance level in the high $\alpha = 5\ \%$. (Barrow, 2010).

4.1 Test of the First Null Hypothesis

H_0: Transfer of labour-intensive locally supplied services from the standard to the reduced VAT rate causes decreasing of the tax liability in at least 60 % of the VAT payers. ($Z = p_0$)

H_1: Transfer of labour-intensive locally supplied services from the standard to the reduced VAT rate will cause decreasing of the tax liability in more than 60 % of the VAT payers. ($Z < p_0$)

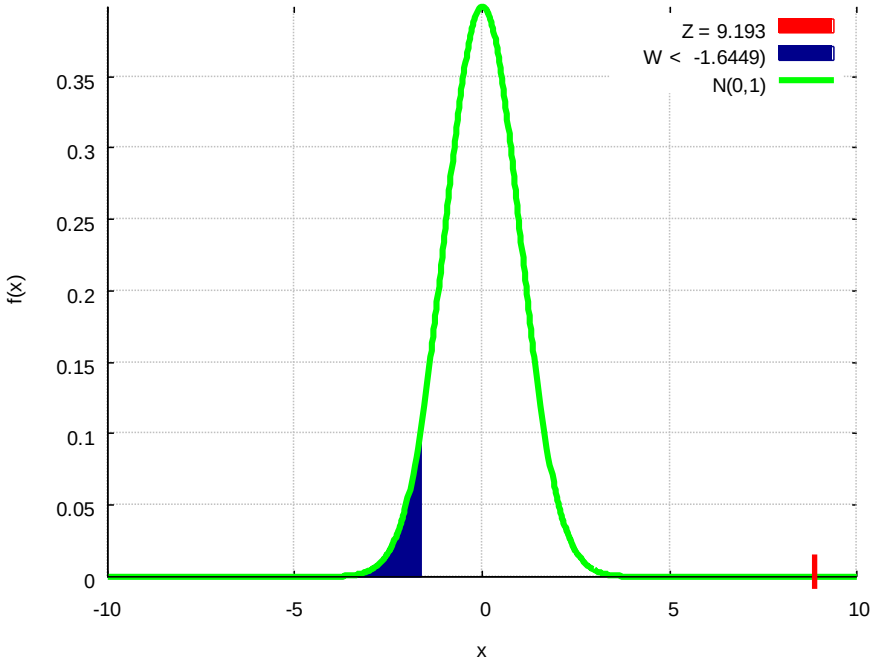
Table 3: The tax liability of the labour-intensive services suppliers would decrease

N	M	p = M/N	π	Z	W
132	131	0.992	0.60	9.193	-∞; -1.6449

Source: authors' own source

The value of the test criterion will be found from inserting the values from Table 3 into equation (2) $\frac{0.992-0.6}{\sqrt{\frac{0.6(1-0.6)}{132}}} = 9.193$

Figure 1: Critical region of the first H_0 at 5 % significance level



Source: authors´ own source with using program Maxima

Based on the graphic visualization of the testing results shown in the Figure 1 and calculated in Table 3 there is accepted of hypotheses H_0. The value of the test criterion Z doesn´t lies in the critical region.

This result means that the transfer of labour intensive services from standard to the reduced VAT rate will lead to decreasing of the tax liability for more than 60 % of the respondents. The conclusion from this testing of this hypothesis is very favourable because the large decreasing of the tax liability may lead to the rise of free funds of the VAT payers that can be used for their economic development (for more information see section 4.3).

4.2 Test of the Second Null Hypothesis

H_0: Transfer of labour-intensive locally supplied services from the standard to the reduced VAT rate cause decreasing of prices of these services in more than 60 % of the cases, ($Z = P_0$).

H_1: Transfer of labour-intensive locally supplied services from the standard to the reduced VAT rate will not cause decreasing of prices of these services in more than 60 % of the cases, ($Z < P_0$).

Table 4: Prices of the labour-intensive local services would decrease

N	M	p = M/N	π	Z	W
132	45	0.341	0.60	-6.075	-∞;-1.6449

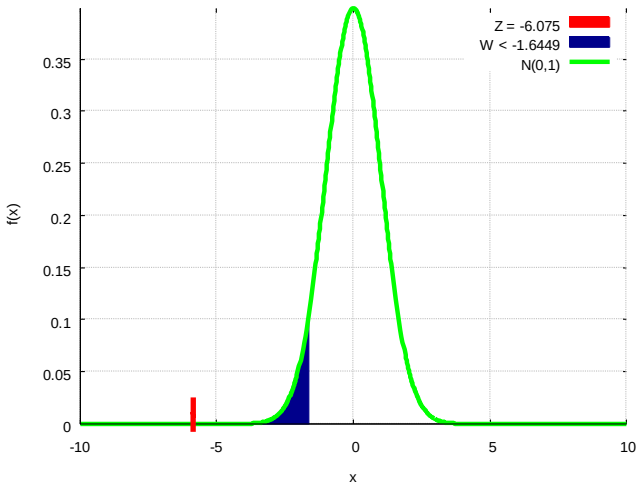
Source: authors´ own source

where:
N – number of respondents (sample size), M – number of respondents whose answer is possitive,
W – critical region

The value of the test criterion will be found from inserting the values from Table 4 into equation (2)

$$\frac{0.341-0.6}{\sqrt{\frac{0.6\,(1-0.6)}{132}}} = -6.075$$

Figure 2: Critical region of the Second H_0 at 5 % significance level



Source: authors´ own source with using program Maxima

According to the calculations in Table 4 the null hypothesis is rejected – it was refused, because the value of the test criterion lies in the critical region.

For the customers of these VAT payers it is not favourable that the decrease of the tax liability will not affect the price of the services. The fact can be explained either by low margins and interest in investing of the funds to purchase new machinery, equipment, which was also confirmed by testing the hypothesis H_4 (for more information See Section 4.3). Also the limited flexibility of downward price changes may be another reason for not changing the price of services.

4.3 Test of the Remaining Hypotheses $H_3 – H_6$

Testing of the remaining hypotheses is based on the similar principle. These hypotheses tests are presented together in one chapter because it involves the same topic – a way of using the potential available funds by the VAT payer in case of the already mentioned legislative change.

At first, the hypothesis is tested whether the available funds to the VAT payer´s would be created (hypothesis H_3). The remaining hypotheses are devoted to the ways of potential available funds usage – investing to the property, increasing of wages to the current employees or increasing of number of the VAT payer´s employees.

The 5 % level of significance still remains maintained. The alternative hypotheses are formulated as a left-sided, it also affects the critical region.

Table 5: Testing hypotheses H_3-H_6

Hypothesis	N	M	p = M/N	π	Z	W	Conclusion
3	132	117	0.886	0.60	6.707	-∞;-1.6449	$Z \notin W$, acceptance of H_0
4	132	81	0.614	0.60	0.328	-∞;-1.6449	$Z \notin W$, acceptance of H_0
5	132	41	0.311	0.60	-6.818	-∞;-1.6449	$Z \in W$, acceptance of H_1
6	132	6	0.045	0.60	-13.016	-∞;-1.6449	$Z \in W$, acceptance of H_1

Source: authors´ calculations

where:
N – sample size (number of respondents), M – number of respondents whose answer is positive,
W – critical region

On the one hand, transfer of labour-intensive locally supplied services from the standard to the reduced VAT rate causes decreasing of tax liabilities of the VAT payers and creation of free funds and the increased investments to the business. These conclusions are in accordance with the Copenhagen Economics Study.

On the other hand, the hypotheses H_5 and H_6 which were devoted to the sphere of employment, especially to the number of employees, wages, benefits and development of skills, were refuted. The respondents prefer investing into property (new machines, upgrading of equipment) to investing into the human capital.

The respondents show the high vigilance in the sphere of recruitment. The Hypothesis H_6 was refuted too. One of the reasons may be the financial crisis which caused a worldwide drop in production. Many employers were forced due to decrease of their sales to limit their investments in the previous years, which now they are trying to rectify it.

5. Testing of the prices policy of the minor repairing of shoes and leather goods and bicycles providers

The data are collected from the four above mentioned subgroups of respondents. The last part of this paper analyzes whether there is a difference in prices policy between the providers of the minor repairing of shoes and leather goods and bicycles in case of transfer of these services from the standard to the reduced VAT rate.

As mentioned earlier, these are the partial results of this research project. Currently we have the largest part of the questionnaires in proportion to the total number in these subgroups. That is why we have chosen these two subgroups for analyzing the prices policy.

The t-test can be used for testing differences in the behaviour of price policy sphere. But there are different variations of this test. When considering which one to choose, the decision could be for example based on equality of variances test (F-test).

Table 6: Decreasing of average prices – repairing of bicycles (in %)

Number of respondents	1	2	3	4	5	6	7	8	9	10	11	12
Decreasing in %	5	0	0	10	0	5	0	0	0	10	10	0
Number of respondents	13	14	15	16	17	18	19	20	21	22	23	24
Decreasing in %	0	0	20	0	0	0	0	19	0	30	0	0
Number of respondents	25	26	27	28	29	30	31	32	33	34	35	36
Decreasing in %	0	0	14	0	0	0	0	5	0	20	0	0

Source: authors´ calculations

Table 7: Decreasing of average prices – repairing of shoes (in %)

Number of respondents	1	2	3	4	5	6	7	8	9	10	11	12
Decreasing in %	0	0	0	0	0	0	5	0	0	0	0	10
Number of respondents	13	14	15	16	17	18	19	20	21	22	23	24
Decreasing in %	0	2	0	10	5	0	0	0	0	10	10	10
Number of respondents	25	26	27	28	29	30	31	32	33			
Decreasing in %	5	0	40	13	0	0	0	0	0			

Source: authors´ calculations

5.1 F-test

As mentioned at the beginning of this chapter, before we can apply the t-test, we must determine whether the variances of the both files are identical. The F-test is going to be used for this purpose.

H_0: Decreasing of average prices of services has equal variances in both populations ($\sigma_1^2 = \sigma_2^2$).
H_1: Decreasing of average prices of services has not equal variances in both populations ($\sigma_1^2 \neq \sigma_2^2$).

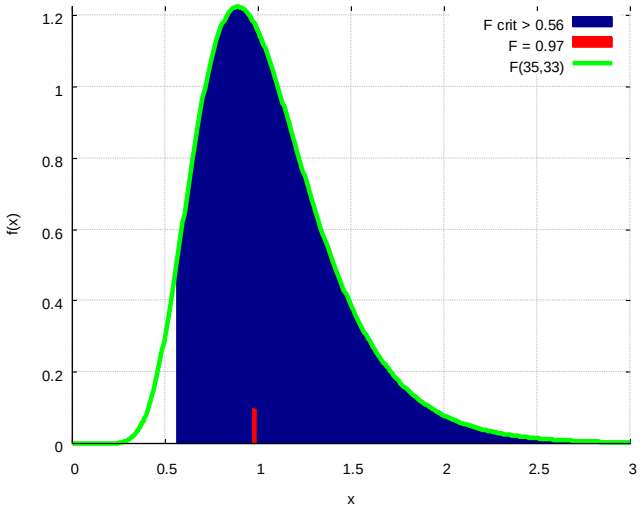
To calculate the values which are necessary to refute or accept the null hypothesis the software Microsoft Excel is used.

Table 8: Two-sample F-test for variance

	5	*0*
The mean value	4.085714286	3.75
Variance	59.49243697	61.2258065
Observation	35	32
Difference	34	31
F	0.971688907	
P(F<=f) (1)	0.465497682	
F crit (1)	0.558970948	

Source: authors´ calculations with using Microsoft Excel

Figure 3: F – distribution and F – test



Source: authors´ own source with using program Maxima

The test criterion value (F) is 0.97, the critical region takes values from 0.56 to infinity. Since the test criterion lies in the field of critical values, therefore the hypothesis H_0 is refuting at the 5% significance level. As the variances are different, further testing continues by two-sample t-test with unequal variances.

5.2 T-test

To test the significance of difference in two mean values the t-test is used. In part 5.1. the used F-test reveals that variances cannot be considered identical.

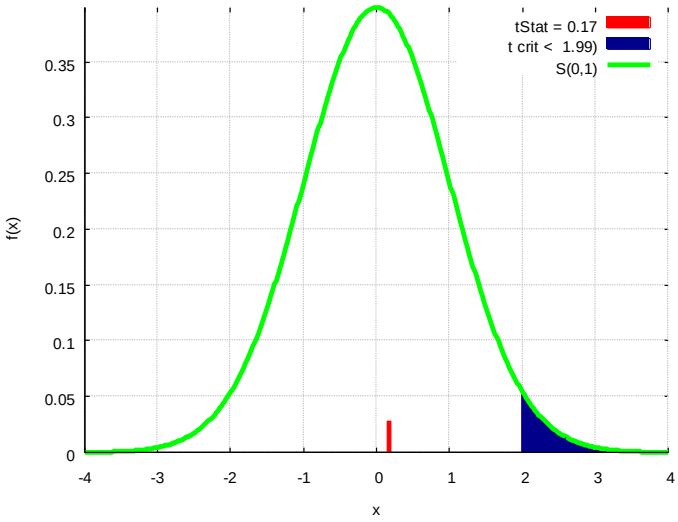
Even in this case, the calculation is done by software Microsoft Excel (data analysis tool). The null hypothesis in based on the statement that the difference of the mean values is zero (H_0: $\mu_1 - \mu_2$ =0 or that $\mu_1 = \mu_2$. Then the alternative hypothesis assumes that the mean values are not equal ($\mu_1 \neq \mu_2$).

Table 9: Two-sample t-test with the inequality of variances

	5	*0*
The mean value	4.085714286	3.75
Variance	59.49243697	61.2258065
Observation	35	32
Hypothetical difference of the mean value	0	
Difference	64	
t Stat	0.176616149	
P(T<=t) (1)	0.430183812	
t crit (1)	1.669013026	
P(T<=t) (2)	0.860367624	
t crit (2)	1.997729633	

Source: authors´ calculations with using Microsoft Excel

Figure 4: t-test



Source: authors´ own source with using program Maxima

The test criterion value (t Stat) doesn´t lie in the field of the critical region $(1.99; \infty)$. This step leads to accepting the null hypothesis. In the 5 % significance level we can conclude that differences of the mean values from the subsequent group of the minor repairing of bicycles and from the subsequent group of repairing of shoes are close to zero. Both samples come from distributions with the same mean values.

Based on the results showed in the Table 9, we accept the null hypothesis of changes equality in average prices of the provided services on the above mentioned significance level. The selected respondents, providers of bicycles repairing and providers of shoes and leather goods repairing would have similar prices policy in case of these services transfer from the standard to the reduced VAT rate.

It is worth to note the fact that some respondents would not be willing to reduce the final price of their services.

6. Conclusion

The analysis proved that hypotheses H_1, H_3 a H_4 were accepted. Transfer of labour-intensive locally supplied services from the standard to the reduced VAT rate would cause decreasing of tax liabilities of the VAT payers, creation of free funds and increasing of investments to the business. These conclusions are in accordance with the Copenhagen Economics Study.

On the other hand, the hypotheses H_2, H_5 a H_6 were refuted. Because most of the respondents answered that free funds gained from tax liability decreasing would not be used for decreasing of prices of their services, increasing the number of job positions or wages of their current employees.

The results cannot be clearly generalized. Firstly, it is necessary to take into account that Copenhagen Economics Study was created in 2007, i.e. before the global financial crisis. That is why the demand has decreased. Currently lots of providers of these services could use the free funds for labour costs and retain the current employees. However, most of them do not plan to create new job positions at the moment as it was proposed by the Copenhagen Economics Study in 2007.

The analysis does not reflex the growth of input prices, which however can be examined in subsequent research.

While writing this paper there were data from 132 respondents available. However, the whole research will include data from 317 respondents.

Although we do not have all the data for the moment, we have regarded it necessary to conduct an evaluation of current results of the research. Moreover, we would like to give information about objectives and methodological procedures used in dealing with this research project. We hope this will allow us to obtain ideas, suggestions and comments leading to the successful achievement of the objectives of the project not only from the other conference participants but last but not least from the reviewers. Furthermore, after finishing the empirical research we can compare current results with the final results.

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