Factors Influencing the Effectiveness of Municipal Waste Management Expenses.Are municipal decisions effective? Case study in the Czech Republic

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Keywords:municipal solid waste, waste management plan, waste management strategy, municipal expenditures, public services

Abstract: The paper presents several models estimating current municipal solid waste expenditures(MSWE) using linked open data of the Czech Statistical Office and the Ministry of Finance. The South Moravian Region of the Czech Republic with over 650 municipalities has been chosen as the sample in our initial research. We developed two sets of models estimated MSWE.The first set of modelsis using data ofthe age structure of the municipal population and their economic activity, or housing structure.The second set of models estimated the level of per capita MSWE. It is using data ofthe population, the area and housing structure.Acquired results can support municipality decision makers regarding MSW collection fee differentiation. The current situation in Czech municipalities is that there exists one flat fee for any permanent municipal resident. Attempts of waste legislation of Czech Republic to increase MSW collection fees became politically impassable. In many municipalities this results in the necessity to subsidize MSWM from their municipal budget. More differentiation in fees can result in higher efficiency in terms of charging more those who statistically cause more MSWE, while on the other hand charging less that who cause less MSWE. This knowledge will support municipal decisions more

effective.A differentiated charging scheme might be perceived by people as more “fair” even though the overall payments collected by the municipality will increase.

Introduction

Municipal solid waste (MSW) generation and treatment represents an important socioeconomic issue of the Czech Republic and it becomes even more important in the effectiveness of municipal waste management expenses. Together with increasing population it might seriously threaten the sustainable development of current society of the Czech Republic. MSW can contain basically anything, as it consists of whatever citizens dispose of. Although there has been notable progress in past years in terms of increased availability of MSW recycling options at the Czech Republic (MoE 2015), remaining MSW still represents a significant mass that has to be dealt with. The municipality government is the most important public authority, which is responsible for dealing with MSW.

Municipal solid waste management (MSWM) is a kind of public service that is today often perceived as something automatic, or something that is somehow taken care of with little to no participation by the municipal population. But as with any kind of public services, there are expenditures connected with it that need to be at first raised (usually from taxes or fees), or subsidized from other municipal revenues(Soukopová&Struk2012), (Struk 2015). But even before that, it is more than appropriate to have some idea of how much resources should be raised in order to cover these municipal solid waste expenditures (MSWE).

This raises a question of how to determine how high these MSWE will be? In practice this is determined primarily by the amount of generated MSW that can, due to the typically very high correlation with MSWE, be often used as a proxy for MSWE (Soukopová&Malý2013). Available literature offers substantial evidence of approaches for estimating MSW, but usually does not pay much attention to the MSWE. Beigl et al. (2008) desribed in their review of 45 MSW modeling approaches. These approaches are mainly based on identifying important factors of waste generation and their correlations with the

amount of generatedMSW(Daskalopoulos et al. 2008), regression models (Hockett et al. 1995), various other econometric approaches (Beigl et al. 2004), (Johnstone&Labonne2004), mathematical modeling(Benítez et al. 2008), or methods like system dynamics (Dyson& Chang2005) that are able to overcome data scarcity that happens often when predicting future MSW generation. In case of the Czech Republic the prediction model for MSW generation and treatment has been created as well (Hřebíčeket al. 2013), (Kalina et al. 2014).

Besides these, other approaches focused directly at estimating MSWE like Callan& Thomas(2001), which estimated and compared cost functions for MSW disposal and MSW recycling with possible extension into a municipal decision support tool based on various parameters. The second approach Soukopová&Struk(2012) decomposed the process of MSWM into individual steps and created a model that calculates theoretical “minimal value” of MSWM by inputting individual municipality parameters.

The aim of this paper is to use the available historical data from selected region in the Czech Republic and through the method of linear regression examine which sociodemographic parameters can be utilizes in estimating MSWE. Subsequently, presented methods can be utilized in other areas of municipal expenditure and can serve as a tool for estimating either total or relative expenditures in given area.They canalso identify the effects of various examined parameters on the expenditures. These proposed methods are not limited to be used just in the conditions of the Czech Republic. Moreover, in this paper we specifically use available public linked open data (http://publicdata.eu/) and thus can be used basically by anyone. Although the exact cost relations might be different in other countries, identified trends should be comparable. Furthermore, we are aware that in the case of MSWE there exists some other relevant factors such as the MSW collection frequency, MSW company ownership, MSW collecting company charging scheme, a presence of competition collecting companies at market, an availability of recycling facilities for population region or an amount of population of cottages used for recreation, etc., but data on these

parameters are generally not publicly available or not available at all at some central level and thus we do not use it similarly as (Soukopová&Malý2013).

In thepaper we utilize available sociodemographic data (CZSO 2013) that are published by the Czech Statistics Office (CZSO). They are data on population (age structure), housing structure, economic status of the population. Further we use the linked open data on MSWE published by the Ministry of Financeof the Czech Republic (UFIS 2013), (MONITOR 2015).

Materials and methods

We have developed models for MSWE by specifically using linked open public data of eGoverment of the Czech Republic (Soukopová et al. 2015), (Struk 2015). We introduce the description of the used technique and the necessary description of chosen data we use in the analysis in the paper.

The Czech Republic has one of the lowest levels of MSWgeneration in the European Union (Eurostat 2015). Apart from the above-mentioned differences in definitions of the actual term “municipal waste”, the reasons for lower MSWgeneration are also closely related to the population’s purchasing power, consumer behaviour and the frequency of consumer goods replacement which is lower in the Central and Eastern European (CEE) countries than in the countries of the Western Europe.

Regression analysis

In order to develop the forecasting models we use the standard least squares regression method approach and calculate multilinear regression from available data, like (Hockett et al. 1995),(Lebersorger&Beigl2011), (Kalina et al. 2014). We assume absolute values of errorsin the first set of models and estimate total annual MSWE. The calculated coefficients could be used in scalar product operations with the actual data of given municipality in order to calculate total MSWE.

We used mostly relative data in the second set of models. These models estimate how various considered parameters affect per capita MSWE. We use mostly relative values of the parameters in regression, usually a portion of a certain parameter from the main parameter (for instance portion of people of certain

age from the whole population of the municipality). Therefore, we could estimate whether and how much givenparameters affect the level of per capita expenditure.

Used sociodemographic and economic data

We havedeveloped estimation models of MSWE based purely on linked open data. Data about expenditures was acquired from the portal ÚFIS (2013) and MONITOR (2015), which provide complete information about revenues and expenditures of any Czech municipality. We focus specifically on category of current municipal expenditures related to MSW collection, transportation and subsequent waste treatment.

Municipal sociodemographic data are published by the CZSO (2013). They are publicly downloadable with the detailed description of the methodology and what these data actually represent. We analysed and assume following data (parameters) to might have a possible effect on the level of MSWE (Struk 2015):*Population and Area covered; Age groups of population; Economic in/activity; Student status, Retired status; No. of flats in houses/condominiums; No. of flats used for recreation.*

All analysed parameters are related to the year 2011, when the national census of population and housing was done by the CZSO. We analysed the sample of population from municipalities in the South Moravian Region, which included 672 municipalities with population of 1 163508 inhabitants.

The distribution of municipality size follows rather the Poisson than normal distribution with majority of municipalities being relatively small compared to the mean of the whole sample. The several large municipalities would cause biased results of regression analysis with extremely high R^2. Therefore, we dropped 10 largest municipalities with population above 10000 inhabitants. We also dropped 3 municipalities without available MSWE data and 5 more municipalities due to a specific factor of having very large amount of recreational cottages with no permanent residents. Therefore, our final sample included 654 municipalities with average population of 930 inhabitants and covering 52% of the whole population of the South Moravia region.

Results and discussion

The Tab. 1 presents results of linear regression estimations of annual MSWE (in thousands CZK) based on data from 2011. Two sets of models are presented. For clarification we mention that presented coefficients are to be interpreted as MSWE generated by a single additional unit (person or flat) in given group, but, and we stress this, if taken into account the whole model.

Table 1 here

First set of models 1, 2in the Tab. 1 is based on age structure of the municipalities separated by decades. Due to the CZSO methodology, people under 20 years are reported in age groups 0-14 (age when students usually finish primary school) and 15-19, and thus we merge them into one group.

The model 1 presents results of ordinary least square regression based solely on the age structure. Decreasing effect on MSWE is observed by 0-19 age group. This can be interpreted as that young people generally do not produce that much MSW, resulting in lower related costs. If we divide this age group into 0-14 (coefficient value ~-0.512) and 15-19 (coefficient value ~-2.481***) groups, results show that people aged 15-19 tend to have strong decreasing effect on MSWE while people under 15 have weaker, although still decreasing effect on MSWE, but in latter case the result is not significant.

Next two age groups, 20-29 and 30-39 tend to increase MSWE, which makes sense as these people generally become economically active, therefore having increased income and subsequently increased consumption (which results in MSW production).

However, next age groups, 40-49 and 50-59, seem to decrease their consumption and have little to no effect on MSWE, but results are not significant.

Interesting results are in the next age group 60-69. People in this group seem to have the strongest increasing effect on MSWE. The reason for that is unclear, although people in this age category usually

retire and thus possibly, once they retire (usually in their early 60s), suddenly have more free time and perform something like a “clean-up” and dispose of things they will not use anymore, resulting in suddenly increased MSW production.

Further split into groups 60-64 (coefficient value ~5.800***) and 65-69 (coefficient value ~1.824*) shows even more a sudden shift in waste-related behavior of people in early 60s. This finding has strong significance in all examined models and it becomes another research question for the future.

Age group 70-79 has similar results as groups 40-59. Possible interpretation here is that this group contains both retired people with decreased consumption and thus lower waste production and MSWE, but also people still economically active, together resulting in overall unclear contribution to the MSWE.

Finally, people aged 80+ have strongly decreasing and statistically significant effect on MSWE. Generally, people in this group tend to produce rather little waste, which was also confirmed by several municipal authorities.

Overall, 70+ age groups in all considered models decrease MSWE. This has been observed also by (Kalina et al. 2014). With the ongoing population ageing this might eventually lead to the gradual decrease in MSWE.

The model 2 modifies themodel 1 by splitting age group 60-69 into groups 60-64 and 65-69 and including number of economically active people (according to the CZSO methodology a person that is neither student nor retired). As was mentioned, age 64 is approximately when people retire and therefore it acts as a proxy for distinguishing between working and retired people. Compared to previous models we can see even stronger effect of age group 60-64 (coefficient value 6.006***). Second age group 65-69 has notably less increasing effect on MSWE, which supports our “early 60s clean-up” suggestion.

Concerning economic activity, it affects basically only of age groups 20-59. This makes sense as people under 20 are typically students and people over 60 typically begin to retire. Overall, the model 2 provides more accurate MSWE estimation.

Next pair of models 3 and 4 in the Tab. 1 represents a different approach to the MSWE estimation. Instead of the population parameter we use data (parameters) about housing structure containing number of flats either in a family house or in a condominium.

In the model 3 we use information about how many flats in houses and flats in condominiums are in a municipality. These data are highly correlated with population and can serve as a certain kind of proxy. Additionally we consider also number of recreational flats. The reason behind this is simple – people using recreational flats are not necessary permanent residents of a municipality (they do not show up in municipal population) but they do produce MSW and MSWE. Including the number of recreational flats therefore acts as a proxy for identifying additional population causing MSWE.

The model 3 shows that flat in a house generally causes less MSWE than a flat in a condominium. The possible explanation is that flats in condominiums are much more likely to occur in larger municipalities and not in small ones, where it is in the Czech Republic very common to have only regular family houses. This is connected with the usual observation that people in larger municipalities tend to have better income opportunities and thus consume more, and by doing that they produce more waste and implicitly cause more MSWE. The further possible explanation is that people with a house have usually much better options for storing the goods and thus "postpone" such MSW generation, which is less possible for people living in condominium, who usually lack storage space. The last parameter, the number of recreational flats with no permanent residents, has lower coefficient compared to previous two, which is in accordance with the simple fact that these residences are not permanently used for living and thus logically cause less MSWE than flats with permanent residents. All three parameters in the model 3 are statistically significant.

The model 4 extends the previous model 3 by adding significant parameters of number of retired and unemployed people. Coefficients show that each unemployed slightly increases total MSWE, while each retired does the opposite. While the decreasing effect of retired people on MSWE has basically the same

explanation as the effect of age group 65+ in the previous models, the effect of unemployed might be explained by the fact that while being unemployed people are more likely to stay at home and thus consume and subsequently generate waste at home (where it becomes actual MSW), while employed people usually spend significant portion of their time at their workplace and create waste there. This kind of waste should legally be treated as so called “business waste” for which municipality is not responsible and does not finance its treatment.

As we are dealing with a sample of municipalities with notable variance of municipality size, calculated R^2 need to be taken with a reserve, as such high R^2 values are primarily result of the presence of municipalities with high population, although we have already limited the analyzed sample of population by considering only municipalities with population under 10,000.

The Tab. 2 presents results of linear regression estimation of per capita MSWE (in CZK) based on the data from 2011.

Table 2 here

Compared to the models 1, 2, 3 and 4 in the Tab. 1, we use per capita measure and robust standard errors in order to deal with the problem of heteroskedasticity that is obviously present in the models from Tab. 1. On the other hand, this results in rather low R^2, which is primarily caused by using linked open data of the CZSO and thus omitting some important parameters. The coefficients in the Tab. 2 are to be interpreted as how considered parameters influence per capita MSWE. The total expenditures are then calculated by simple multiplication with the population count.

The model 5 shows there is something like a base level of per capita MSWE of approximately 500 CZK per capita represented by the constant. Then, with more population, the average MSWE tends to decrease slightly. On the other hand, more population has also a small geometric effect on increasing MSWE.

Municipal area has basically the same effect on MSWE, just with the opposite sign in both cases. Overall, the model 5, as well as following models 6,7 and 8, estimate lower MSWE per capita in smaller municipalities with higher population, suggesting some kind of economies of scale with more population and increased costs (probably from transportation) with increasing municipal area. The last parameter included in this model is the share of flats in condominiums (with the rest of the portion being generally flats in houses) on the total amount of flats, suggesting that with higher portion of flats in condominium average MSWE tend to increase as well. Possible interpretation is that living in a house offers generally more possibilities for dealing with the waste and thus causing subsequent reduction of MSWE, or alternatively that average flat in a house simply produces less MSW that average flat in a condominium. Although R^2 of this model is rather small, all considered coefficients are statistically significant.

The model 6 adds variable with the share of retired people in the total municipal population. The coefficient for this parameter is significant and can be interpreted as that increasing share of retired people in the municipal population also increase the average MSWE by a little. If we connect this finding with the models 1 and 2, we can see that this increasing effect on MSWE is caused primarily by the youngest group of retired people, as in the age groups 70+ is the effect rather negative. We can also see that, compared to the model 6, the constant has decreased notably. However, this is levelled back by "standard" share of retired people in the population.

The model 7 extends the model 5 by adding the parameter with the share of recreational flats on the total amount of flats in a municipality. The coefficient for this variable has increasing effect and is significant. Again, as in the models 3 and 4, this parameter can be interpreted as a proxy for the amount of people that consume, generate waste and subsequently cause additional MSWE for the municipality without showing up in the municipal population count as permanent residents.

The model 8 extends the model 7 by adding the share of people in the age group 0-14 in the municipal population. This statistically significant effect is analogous to the effects of youngest age groups

considered in the models 1 and 2 and can be interpreted as that a higher share of children among the population tends to decrease the average level of MSWE per capita. Nevertheless, even this last model has rather low explanatory power caused most likely by not including some of the relevant parameters that are not publicly available.

The presented models consist of statistically significant parameters that can, to the certain level, explain either the total or per capita MSWE for individual municipality. On the other hand, there has been most likely some omitted parameters that will be included in the next stage of our research. Nevertheless, the objective of these developed models was to show the explanation power of current linked open data and provide information about what kind of effects on MSWE considered parameters have.

Conclusions

Our paper presented several models estimating current MSWE using linked open data of the CZSO and the Ministry of Finance of the Czech Republic. The South Moravian Region of the Czech Republic with over 650 municipalities has been chosen as the sample for our initial research. We developed two sets of models estimated MSWE. The first set of modelsis using data ofthe age structure of the municipal population and their economic activity, or alternatively data with the housing structure of the municipality. Interesting finding that had high statistical significance in every model where it was used is notable increase in MSWE caused by the age group 60-69, and specifically by the subgroup 60-64. The second set of models estimated the level of per capita MSWE. We have identified that parameters such as the population, the area and housing structure have significant effects on the level of average MSWE per capita and can be used for its estimation by inputting individual municipality data. The coefficients for estimating relative levels of expenditures are in the coherence with the coefficients for estimating absolute levels of expenditures, although overall explanation power of the models estimating average MSWE is rather low.

Acquired results can also initiate discussion regarding MSW collection fee differentiation. The current typical situation in Czech municipalities is that there exists one flat fee for any permanent municipal resident, with occasional discounts for small children or old people. Attempts of waste legislation to increase MSW collection fees thus affect basically everyone in the municipality and became politically impassable. In many municipalities this results in the necessity to subsidize MSWM from their municipal budget, leaving smaller amount of resources for other expenditure areas. More differentiation in fees can result in higher efficiency in terms of charging more those who statistically cause more MSWE, while on the other hand charging less that who cause less MSWE. Such differentiated charging scheme might be perceived by people as more "fair" even though the overall payments collected by the municipality will increase.

Acknowledgements

This paper has been elaborated as one of the outcomes of specific research project no. MUNI/A/0784/2013 at Masaryk University and supported by the Czech Science Foundation under the project "Unfair competition and other economic factors influencing the efficiency of the provision of public services".

References

Beigl, P., Lebersorger, S.&Salhofer, S. (2008) Modelling municipal solid waste generation: A review.*Waste management*, 28, 200-214

Beigl, P., Wassermann, G., Schneider, F.&Salhofer, S. (2004) Forecasting municipal solid waste generation in major European cities. In: iEMSs 2004 International Congress: Complexity and Integrated Resources Management, Osnabrueck, Germany.

Benítez, S. O., Lozano-Olvera, G., Morelos, R. A.& Vega, C. A. D.(2008) Mathematical modeling to predict residential solid waste generation. *Waste Management*, 28, S7-S13

Benítez, S. O., Vega, C. A.& Marquez-Montenegro, M. Y.(2008) Household solid waste characterization by family socioeconomic profile as unit of analysis. *Resources, Conservation and Recycling*, 52, 992-999

Callan, S. J.& Thomas, J. M.(2001) Economies of scale and scope: A cost analysis of municipal solid waste services. *Land Economics*, 77, 548-560.

CZSO (2013)Otevřená data pro výsledkysčítánílidu, domů a bytů 2011 (SLDB 2011).From: http://notes.czso.cz/csu/redakce.nsf/i/otevrena_data_pro_vysledky_scitani_lidu_ domu_a_bytu_2011_(sldb_2011) (May 31, 2015)

Daskalopoulos, E., Badr, O.& Probert, S. D. (1998) Municipal solid waste: a prediction methodology for the generation rate and composition in the European Union countries and the United States of America. *Resources, Conservation and Recycling*, 24, 155-166

Dyson, B.& Chang, N.B. (2005) Forecasting municipal solid waste generation in a fast-growing urban region with system dynamics modeling. *Waste management*, 25, 669-679

Hockett, D., Lober, D. J.& Pilgrim, K. (1995) Determinants of per capita municipal solid waste generation in the Southeastern United States.*Journal of Environmental Management*, 45, 205-217

Hřebíček, J., Kalina, J.&Soukopová, J.(2013) Integrated economic model of waste management: Case study for South Moravia region. ActaUniversitatis*AgriculturaeetSilviculturaeMendelianaeBrunensis*,60, 917-922

Johnstone, N.&Labonne, J.(2004) Generation of household solid waste in OECD countries: an empirical analysis using macroeconomic data. *Land Economics*, 80, 529-538

Kalina, J., Hřebíček, J., &Bulková, G. (2014) Case study: Prognostic model of Czech municipal waste production and treatment. In: Ames, D.P., Quinn, N.W.T., &Rizzoli, A.E. Proceedings of the 7th International Congress on Environmental Modelling and Software,San Diego, 15-19 June, pp. 932-939.iEMSS, San Diego

Lebersorger, S.&Beigl, P. (2011) Municipal solid waste generation in municipalities: Quantifying impacts of household structure, commercial waste and domestic fuel. *Waste management*, 31, 1907-1915

Mazzanti, M.&Zoboli, R. (2008) Waste generation, waste disposal and policy effectiveness: evidence on decoupling from the European Union. *Resources, Conservation and Recycling*, 52, 1221-1234

MoE (2015) Plánodpadovéhohospodářství ČR (Plan of waste management of the Czech Republic). From: http://www.mzp.cz/cz/plan_odpadoveho_hospodarstvi_cr (May 31, 2015)

Soukopová, J.&Malý, I.(2013) Competitive environment in waste management and its impact on municipal expenditures.*ActaUniversitatisAgriculturaeetSilviculturaeMendelianaeBrunensis*,61, 1113-1119

Soukopová.J.&Struk. M. (2012)Metoda "minimálníhodnoty" a jejívyužití v analýzeefektivnostiběžnýchvýdajůobcínanakládání s odpady (The method of "minimum value" and its use in the analysis of the effectiveness of the current expenditure of the municipalities on the management of waste).*Waste Forum*, 4, 162-172

Struk, M. (2015) Estimating municipal solid waste expenditures – the case of South Moravian Region. In: 19th International Conference Current Trends in Public Sector Research. Masaryk University, Brno

ÚFIS(2013)Účetní a finančníinformační system MF ČR, From:http://wwwinfo.mfcr.cz/cgi-bin/ufis/iufisusc/index.pl (May 31, 2015)

Table 1. Estimation models for expenditures on municipal solid waste. Source: (Struk 2015)

Model	(1) MSWE (kCZK)	(2) MSWE (kCZK)	(3) MSWE (kCZK)	(4) MSWE (kCZK)
0-19 yrs.	-1.091***	-1.209***		
	(0.400)	(0.393)		
20-29 yrs.	1.791***	3.662***		
	(0.551)	(0.671)		
30-39 yrs.	1.890***	4.087***		
	(0.404)	(0.610)		
40-49 yrs.	-0.567	1.615**		
	(0.542)	(0.675)		
50-59 yrs.	-0.015	1.439***		
	(0.402)	(0.556)		
60-69 yrs.	4.027***			
	(0.473)			
60-64 yrs.		6.006***		
		(0.767)		
65-69 yrs.		1.590*		
		(0.939)		
70-79 yrs.	-0.373	0.147		
	(0.672)	(0.674)		
80+ yrs.	-1.646**	-1.213		
	(0.767)	(0.763)		
Economic. active		-2.312***		
		(0.476)		
Flats in houses			1.641***	1.836***
			(0.038)	(0.155)
Flats in condos			2.150***	2.327***
			(0.050)	(0.126)
Recreational flats			0.961**	1.147**
			(0.490)	(0.492)
Unemployed				0.785**
				(0.372)
Retired				-0.467**
				(0.223)
Constant	-49.900***	-56.543***	-25.011*	-26.792**
	(11.366)	(11.299)	(12.867)	(12.839)
Adj. R^2	0.928	0.931	0.938	0.939
RSS	30644128	29237015	26330015	26057993.4
Observations	654	654	654	654
AIC	8908	8881	8816	8795

*, **, *** stand for a result valid on 10%, 5% and 1% significance level, standard errors in parentheses

Table 2. Selected factors affecting per capita expenditure on municipal solid waste

Source: (Struk 2015)

Model	(5) Ø MSWE (CZK)	(6) Ø MSWE (CZK)	(7) Ø MSWE (CZK)	(8) Ø MSWE (CZK)
Population/100	-9.367***	-8.312***	-6.513***	-6.419***
	(1.745)	(1.789)	(1.837)	(1.822)
(Population/100)^2	0.116***	0.103***	0.085***	0.083***
	(0.023)	(0.022)	(0.022)	(0.021)
Area	11.601***	11.321***	10.503***	10.324***
	(2.538)	(2.552)	(2.536)	(2.525)
Area^2	-0.170***	-0.168***	-0.155***	-0.155***
	(0.046)	(0.046)	(0.045)	(0.045)
Flats in cond. (%)	2.790***	2.905***	2.705***	2.806***
	(0.727)	(0.709)	(0.698)	(0.682)
Recreational flats (%)			1.982***	1.658***
			(0.618)	(0.616)
Retired (%)		3.884**		
		(1.676)		
0-14 yrs. (%)				-6.814**
				(2.668)
Constant	513.841***	415.756***	481.595***	587.352***
	(15.442)	(40.268)	(17.179)	(48.352)
Adj. R^2	0.075	0.084	0.097	0.107
RSS	17380248	17177728	16934026	16727395
Observations	654	654	654	654
AIC	8531	8525	8516	8510

*, **, *** stand for a result valid on 10%, 5% and 1% significance level, robust standard errors in parentheses