

Financial Incentives and Municipal Solid Waste Expenditures

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Abstract

Study examines the role of financial incentives in the field of municipal solid waste management. The objective is to provide evidence how can the introduction of incentives effect the related municipal expenditure using data from a sample of municipalities from the Czech Republic. Both positive and negative financial incentives in the form of PAYT and *reversed* PAYT (tax discounts) were included in the study. Results compare per capita expenditure between municipalities using incentives and those that do not. In addition, comparison of municipal expenditure before and after the introduction of the incentives is included. Depending on the specifics of the municipality, as in practice no two municipalities are equal and thus measures often tend to work slightly different, some municipalities experience immediate drop in expenditure, while in other it takes time. The participation of public and role of information campaigns here is crucial. These introduction expenditures sometimes even make waste management in total more expensive in the introductory year, but then notable savings typically begin to occur. Overall, correctly designed and introduced financial incentives have generally a large potential for improving municipal waste management both from economic and environmental perspective.

Keywords

municipal waste management, expenditures, incentives, nudging, PAYT

Introduction

Waste generation and subsequent waste management are integral parts of human consumption and societies today. The perspective on waste management is shifting in recent years towards ways to increase waste utilization and in general waste reduction. This is in accordance with the ongoing trend of circular economy promoted by the European Union and in other ways also elsewhere in the world.

One way to achieve the goals promoted by the concept of circular economy is by designing the products in a way that little to no waste is created as a by-product of their consumption. The other way is to focus on processes after the waste has been generated. The best way is of course the combination of these approaches – having the products with low remaining waste and also have subsequent processes how to treat the generated waste in order to have lowest negative impact on the environment and if possible, be of further use in the production process. In addition to that, cost related to waste management are continuously increasing, whether it is cost of the transport, cost of the labor related with the waste collection and treatment or costs for the treatment itself. Increasing costs for waste treatment are becoming more and more important, as the environmental policy increases stress towards promoting more environmentally friendly ways of dealing with the waste by making the classic waste treatment option like incineration and especially landfilling more expensive and thus promoting incentives for other types of waste treatment.

While many researches focus on technical aspects like what to do with the generated waste, we are more interested in ways of reducing the waste generation right at the source by trying to change the ways how people, as those who generate the waste, behave. And if the waste has already been generated, how to make people separate as much waste as possible right at the source. The reason to do so is that correct separation by the waste producers can dramatically reduce total costs of waste management. In fact, correctly separated waste is often no longer seen as a waste, but rather as a resource of certain economic value that no longer produces just costs, but also revenues (that can often even exceed the costs). The trick is that instead of paying waste professionals to separate the waste, if correctly communicated and executed, people themselves can do it as a part of their waste behavior with little to none additional costs to the overall waste management process.

However, just asking people nicely rarely works, as most of them lack necessary motivation to change their standard waste behavior consisting usually of dumping their waste into mixed residual waste bin, even though special bins for certain recyclable waste fraction are often right next to it or very close nearby. This is understandable, as such (non-separation) behavior represents the easiest way of how to deal with the waste. There are of course individuals that benefit from the sole personal feeling that they separated their waste correctly, but majority of people need more in order to do so. And this is the point where incentives can be utilized to the great extent.

In general, there are two ways how to incentivize people – positively and negatively. Negative ways are represented by, for instance additional fees, fines, restrictions and measures like that. On the other hand, positive

ways are typically represented by giving something to the people based on their performance, like a bonus, discount or some other additional advantages. The trick is that, from the perspective of the municipality as the guarantor of MSWM (municipal solid waste management) service, there might not be that much difference between the overall costs associated with either negative or positive incentives, as this greatly depends on the way how the related incentive scheme is set up and communicated to the people.

Based on the studies like [1], people tend to respond much better to the positive incentives, even though the benefits might be in fact quite marginal. The question then becomes how to design such incentives in order to make people more likely to exhibit desired behavior, basically to nudge them. Nudge theory, made widely popular by [2], suggests that if provided with the appropriately designed choices, people can be led to perform in a desired way. A typical example is setting up the desired choice as the default one and then relying on the fact that people are lazy to make adjustment to the default choice.

However, in case of waste management this is not a viable option, as the desired way is to produce less waste and to separate more, what in both cases requires some additional effort from the people. The typical situation in Czech municipalities is that each citizen pays a flat annual waste charge for the complex provision of waste management services. Such system does not provide any incentive, as it does not matter whether people separate or how much waste they generate – they still pay the same. If people do not have some internal motives, then it actually does not make sense to separate waste at all, as it is more laborious than throwing everything in the same bin. The challenge here becomes how to make people choose a less convenient solution? And the nudge theory here replies with providing them with some incentive that would ideally be strong enough to make them change their behavior, but on the other hand be of little if any costs to the municipality.

Important thing then becomes the design of the incentive. According to the nudge theory, people should not be forced into some behavior, but rather should voluntarily prefer to behave in a desired way, but still be able choose otherwise. The trick is then to make choices in such manner that the people would prefer the choice desired by the planner. When considering waste behavior of the people, a more convenient option is not to separate waste, especially in case of a flat fee. But if the separation of the waste provides people with benefits, it often suddenly becomes much a more appealing choice to them. It then depends on the choice architect what is the nature of the incentives that are provided. The goal here is to make people think that by performing the desired behavior they are being better off than in case of the opposite.

Considering the specific incentives, a typical negative incentive program in waste management is PAYT (Pay-as-you-throw), when people pay additional price for generating more waste, respectively people pay based on how much waste they generate. This system is currently not very common in the Czech Republic, but it quite widely used in multiple European countries. A lot of literature has been written about PAYT programs, including general overview [3], remarks on how to properly design a PAYT program [4] or overview of PAYT implementation studies [5]. [6-7] provide additional material on using nudging in waste management.

However, as it is often mentioned that traditional PAYT can lead to undesired behavior and can distort behavior of the people. In order to avoid additional charge, they sometime choose inappropriate ways how deal with their waste, like illegal dumping, individual burning, etc. instead of initially projected self-control in the form of trying to reduce own waste generation. Studies such as [8], [9] or [10] examine more closely the motives behind people's decision to separate waste from psychological perspective. Potential drawbacks of shifting an intrinsic motive to separate waste based on one's belief to purely economically motivated behavior when people separate primarily because it pays off in some way is discussed as well. Results of such programs are then mixed – depending on the country or on the mentality of the people, sometimes such system works excellently, while in other cases they have been abandoned due to the problems that arose once they were introduced.

Country specific experiences of using PAYT provide, for instance [11] for Sweden, [12] for Netherlands, [13] for Spain, [14] for Japan, [15] for USA, or [16] for France. Studies [17-18] dealing with this issue are available also for the Czech Republic.

In our sample PAYT system takes typically a simplified form. Instead of being charged relatively precisely according to the weight of the collected waste, households are being charged per each waste bin that it decides to have, thus household with more bins pays more while having the same collection frequency. Or sometimes the household can choose a less frequent residual waste collection, for instance biweekly instead of weekly collection. An alternative is a system where people get a certain amount of stickers or tags and they put it on the waste bin only if they want the waste company to collect it. Once they run out of stickers, they have to purchase additional ones in order to make the waste company collect their waste again. Additional advantage of such system is also for the municipality, as it can pay the waste company only for the true amount of waste bins that were collected, instead of a common approach when municipalities pay a flat fee per capita to the waste management company or it is exclusively up to the waste company how much emptied bins or collected waste it reports and then invoices to the municipality.

Positive incentive programs in waste management exist as well, although in practice are much less frequent. Contrary to regular PAYT they provide people with some form of reward upon exhibiting desired behavior, for instance more waste separation. These positive incentive programs are sometimes referred to in

general as feebates [19]. Observation that people prefer rewards to penalties was made by [1], who also observed that people tend also to prefer community-based rewards and local taxation rebates instead individual rewards. However, in my opinion this depends on the culture and habits of the people. While mentioned preferences might work in UK, where the study was conducted, in case of the Czech Republic from which we have the data individual, or let us say household assigned rewards are preferred to the community-based. It even seems that people like to compete between them in order to qualify for a higher reward. As long as they compete fairly, this should actually not be seen as a negative, on contrary, as the result would be typically even higher waste separation rate and likely less residual waste.

Such competition is offered in practice by a (positive) incentive that we call *reversed* PAYT. It represents in practice a discount that lets people to pay lower waste management charges depending on the amount of waste they separate. People do not pay for the waste they generate but instead get discount from the standard fee based on the amount of waste they separate, thus the nickname reversed payt. Technically it might be seen also as a form of tax rebate, as waste charges are more or less a form of taxation. This incentive program is slowly gaining its popularity in the Czech Republic, as will be shown later. Compared to the standard PAYT, it provides several advantages like no motivation for unwanted behavior such as illegal dumping and waste burning. But it also has some disadvantages, as it does not directly motivates people to reduce their overall waste generation, as it rewards higher separation and not lower overall waste generation. Further details about this incentive system, together with its environmental performance in the Czech Republic, are available in [20].

The actual performance of either PAYT or reversed PAYT then depends on the societal factors and the attitude of the people. The more people would try to go around the system, such as doing illegal dumping, the less appropriate regular PAYT would be, while on the other hand described reversed PAYT would prevent this. But as the reversed PAYT does not directly lead to the reduction in waste generation overall, we might actually end up with relative decent waste separation rates, but overall still high residual waste generation. Nevertheless, both types of incentives tend to lead to better results than scenarios without any incentives.

Theoretically, a combination of both regular PAYT and reversed PAYT might be a further step. In such scheme a designated waste producing unit somehow has to pay for additional waste it produces but at the same is also rewarded for higher waste separation rates. But important thing here is to create such system that would both require people to pay some additional fees for more generated waste but still not motivate people to perform unwanted behavior. This is more of a suggestion for the future research than an actual proposal.

In our paper we work we 3 types of municipalities depending on their usage of financial incentives in the field of MWSM. The first, obvious, and most common group consists of municipalities without any incentives. In the Czech context these municipalities mostly use flat per capita waste management charges. Such system can be seen on one hand as just, because everyone pays the same, but on the other hand does not provide any incentive to change one waste related behavior, because there is practically no effect if one behaves more or less environmentally friendly with respect to waste management habits. The second group of municipalities then uses some form of traditional PAYT, while the third group uses reversed PAYT incentive program.

In our analysis we use municipal solid waste expenditure (MSWE) instead of possibly more obvious quantity of generated municipal solid waste for several reasons. The most important is that data about MSWE are in case of the Czech Republic much more available compared to the waste data. Ministry of Finance of the Czech Republic runs an information portal MONITOR that provides quite detailed data about municipal budgets for all municipalities in the Czech Republic, which are obliged to regularly report their financial data to this information system. Even though there might be occasionally some issues with this data, let us say that it is a relatively reliable and easy-to-access source of information on Czech municipalities. On the other hand, data on generated municipal waste are not published anywhere and Ministry of Environment of the Czech Republic in recent years does not provide them even upon request for scientific purposes. Published data are usually available only at regional or national level, and thus unusable for analyses at the municipal level. However, based on our older analyses of the relationship between generated waste and MSWE, we conclude that there is a very strong correlation between generated municipal waste quantities and the related municipal costs. Moreover, when looking at the issue of MSW from the municipality's perspective, MSWE is probably more important to the municipal managers than the actual waste quantities. The preference of economic aspect when dealing with waste management over environmental aspects can be very well illustrated in the fact that the cheapest and the least environmentally friendly waste treatment option of landfilling is still very popular in the Czech Republic simply because it is the cheapest waste treatment option.

Importance of economic aspects when considering waste management as a public service becomes actually the dominant question. The issue is that in case of public sector, public managers are dealing with the public money and thus have to focus primarily on the economic side and often less on the other aspects like quality or effectiveness. The reason is simple – once they are held accountable for their choices, it is much easier the defend the choice that cost the least amount of money than the choice that provided the best quality of output for the money, even though it was not the cheapest available option. Thus it can become very tricky, even impossible for the public manager to defend a more environmental solution against a more economic one. The

same goes for the cases where reduction of costs is possible. Such cases are often preferred before those that improve the qualitative aspects. But in case of MSWM if the reduction of costs is accompanied by reduction of generated waste or increase in the waste separation, it sure is a step forward regardless of one's perspective.

An optimal situation from the municipality's perspective in the field of waste management would be the one where maximum waste gets separated, which would result also in minimum residual waste generated and subsequently also in low MSWE. Positive impact on the environment would in such case act as a cherry on top.

We build upon assumption that environmental impact of financial incentives is clearly positive, as more waste gets separated and overall less waste is being generated. But our question in this paper is more pragmatic – whether using incentives provides an economic benefit to the municipality as well? Important thing to consider here is that incentives have their costs too, therefore we examine this issue primarily from the financial perspective using municipal financial data.

In addition to that, more municipalities are being pressed towards exploring new solutions how to improve their MSWM, whether by their citizens (environmental perspective), their own budget (economic perspective), or both. In this time people are simply becoming more interested in the state of the environment and are constantly exposed to many environmental campaigns focused on, among other areas, waste management. Pursuance of environmental concept of circular economy by the European Union further strengthens these tendencies together with providing financial sources for these purposes.

The objective of our paper is thus to provide an evidence of how financial incentives can be used in order to achieve reduction in overall municipal waste management costs together with promoting and strengthening environmental awareness of people. All this can be achieved by correctly setting up the incentive program together with MSWM system without necessarily needing a lot of additional resources. Such finding can be of great benefit to many municipalities looking for ways how to improve their waste management.

Methods and Material

In this study we utilize available data on municipal expenditure from a selected period of 2010-2014 together with the data on the presence of financial incentives related to MSWM. Our sample includes 534 municipalities from South Moravia Region in the Czech Republic. The whole region includes 673 municipalities. We include in our analysis those municipalities that we were able to contact (primarily by using direct telephone call, as response rate to the initial e-mail questionnaire was very low), and acquire relevant information about the presence of a waste management related financial incentive in the municipality for the whole covered period. This process provided us with data from 535 municipalities, but later for the final sample we dropped one municipality as it did not report MSWE in the structure relevant for our analysis, unlike the rest of the sample.

In order to identify whether the municipalities with the incentives differ from those that have none, we employ basic statistical methods. Due to the limited availability of the additional data related to the issue it is not necessary to employ more sophisticated quantitative methods.

For the analysis of aggregated data we use average values of MSWE calculated per capita separately for each year covered in our dataset. Using per capita values is a necessity as we are dealing with largely heterogeneous sample of municipalities from the perspective of size. Per capita values provide us with an adequate measure for comparison between the municipalities. In order to calculate these values we used publicly available data on municipal population from Czech Statistical Office (CZSO) and municipal budget data available from MONITOR – a web service run by the Czech Ministry of Finance and providing various kinds of data about public finance in the Czech Republic. In order to have more relevant results we use current expenditure on MSW data without including any expenditure on investments like the infrastructure, repairs or small fixed assets, even though in some occasional cases of small municipalities it is likely that they did not provide such differentiation and reported only aggregated expenditure. But based on our experience, this is a rather marginal issue. Following Table 1 shows basic descriptive statistics about our dataset.

Table 1: Descriptive statistics of sample of municipalities from the South Moravia Region, 2010-2014

		2010	2011	2012	2013	2014
Population	Min	34	33	33	36	35
	2 nd quartile	270	270	272	274	274
	Median	549	556	560	568	576
	4 th quartile	1 025	1 032	1 043	1 056	1 065
	Max	34 078	34 073	33 964	33 805	33 761
MSWE p.c. (CZK/year)	Min	112	116	178	170	267
	2 nd quartile	500	507	539	540	553
	Median	603	613	627	631	649
	4 th quartile	714	724	751	753	782
	Max	3 791	3 679	3 823	3 546	3 417

Source: own calculation using CZSO and MONITOR

From the provided descriptive statistics one can already see that municipalities in our sample are very fragmented (and same is true also for the rest of the Czech Republic). On one hand this provides a lot of data for the analysis, but on the other hand the collection of the data from individual municipalities becomes quite time-consuming, if such data are not directly available in some centralized database. Other practical drawback of such fragmentation is that many small municipalities struggle with all the requirements that they are supposed to fulfill according to the law while having very limited staff to do so. But that is another issue.

Provided Table 1 also shows that MSWE per capita values in our sample are actually not that different, as 50% of the municipalities have these costs between 500 and 783 CZK. On the other hand, size of the municipalities varies much more, as the middle 50% of them spans from 270 to 1065 people.

Within our sample of municipalities we distinguish three types of municipalities depending on the presence of waste related financial incentives. First and largest group of municipalities are those that do not provide any kind of incentive. This group of municipalities can be, loosely speaking, seen as a control group.

Second and third types of municipalities include those that utilize financial incentives in their MSWM, but the difference between them is whether they use positive (reversed PAYT/tax rebates) or negative (regular PAYT) incentives. Table 2 provides an overview of the presence of waste management incentive programs in our sample of municipalities.

Table 2: Utilization of financial incentives in the sample of municipalities, 534 municipalities, 2010-14

	2010	2011	2012	2013	2014
No incentives	529	529	526	522	519
PAYT	4	4	4	4	4
Tax rebates/reversed PAYT	1	1	4	8	11

Source: own data

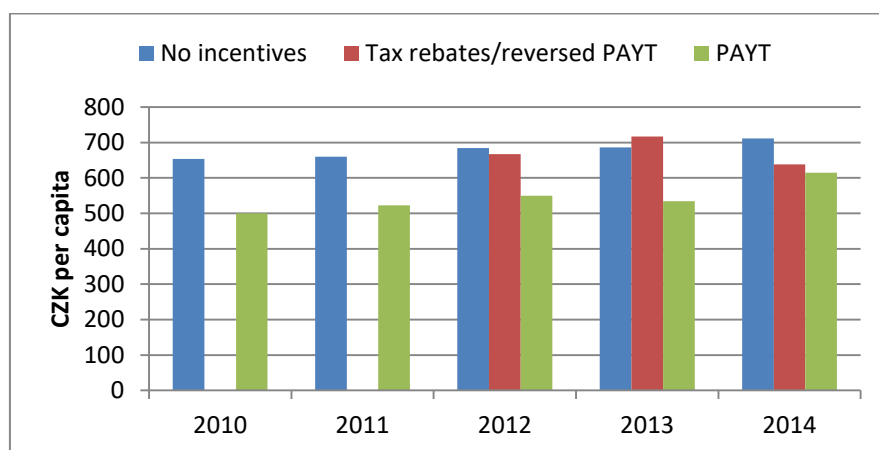
From Table 2 we can see that financial are not very popular within the analyzed sample of municipalities. But there is an increasing trend, as more and more municipalities learn about the available options for financial incentives, or see examples in municipalities that have adopted such financial incentives earlier. Even though we do not have more recent data, based on estimations, in the regions we have focused on there are currently several dozens of municipalities that have already introduced some forms of financial incentives after our collection of the data.

On the other hand, low popularity of financial incentives provides us with the possibility of a more detailed analysis of individual cases of municipalities that introduced waste related financial incentives during the analyzed period. Therefore we provide a closer look and comments on the development of MSWE in all 10 municipalities that introduced reversed PAYT during our analyzed period. This allows us to better understand what kind of effects on the municipal budgets such measure can have.

Results and Discussion

In this chapter we provide results of the analysis of MSWE based on whether the municipality uses some form of financial incentives related to MSWM. Following Figure 1 show the development of MSWE per capita in our sample with respect to the utilization of the financial incentives.

Figure 1: Municipal solid waste expenditures per capita and financial incentives, 534 municipalities, 2010-14



Source: own construction

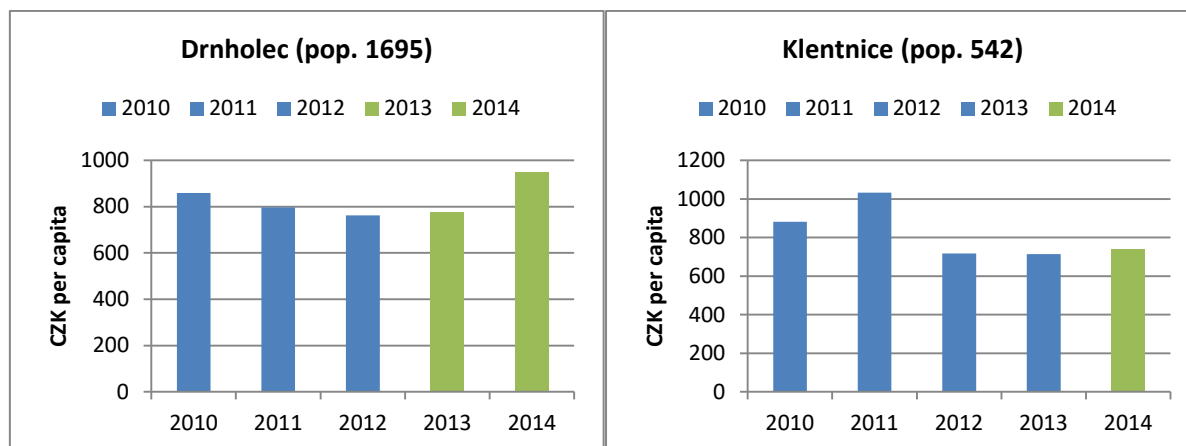
Provided results show that there is a slow tendency for MSWE increase in case of municipalities without any waste related financial incentives. Within analyzed 5-year period average MSWE per capita in these municipalities increased by almost 9%.

Municipalities using some form of PAYT seem to be doing much better in this respect, having per capita MSWE approximately 20% lower. This is likely a natural consequence of using PAYT incentive program, as people simply generate less MSW, resulting logically in lower MSWE. Between years 2012-13 this value even decreased. However, there is a notable increase of MSWE in the following year 2014. But in our opinion this might be caused by some additional factors present in the MSWM, like the preparation for biowaste collection by the municipalities that occurred during the same period or some other aspects that were unable to separate from the overall MSWE. The thing here is that municipalities sometime do not correctly differentiate between various types of expenditure, and the municipal staff in order to reduce their workload simply reports the expenditures under the most common account, making it difficult to create detailed ex-post analyses of the municipal expenditure. Also there could have been a one-time increase in the MSWE related to some improvement in MSWE that was not accounted as capital investment, for instance purchase of bins for biowaste collection, but without direct access to municipality's books we cannot reliably verify this suggestion.

The last group of municipalities including those that adopted financial incentives in the form of tax rebates, or as we call it reversed PAYT (as participants get discounts from annual municipal waste charges based on how much waste they separate) is a bit tricky. We note here that even though Figure 1 shows average MSWE for this group of municipalities only since 2012, there actually was a municipality with this kind of incentives even in prior years, as shown in Table 1. But as it was only a single municipality, we chose not to report its values and begin with 2012, once there were 4 municipalities using this type of incentive program. Results since 2012 show that in the first reported year there was practically no difference between per capita MSWE of municipalities using this incentive and municipalities without any incentives. In the following year 2013 was per capita MSWE of these municipalities even higher than those without incentives. However, in 2014 we can already see a notable drop in the average MSWE per capita values, almost comparable to those of PAYT municipalities. This initial increase in MSWE can be tracked to the fact that it usually takes some time for the people to adjust to the new system and there are also additional costs (typically related to the information campaigns) that occur in the beginning of the incentive adoption in order to provide people with sufficient information on the new system and basically teach them how it works. Another important aspect here is that the group of municipalities utilizing this type of incentive is gradually growing, and therefore in each analyzed year there were several new municipalities that had these initial increased costs. A more detailed look at the individual municipalities that adopted reversed PAYT during analyzed period (since there are only 10 such) can provide us with a better idea of the effect of adopting this incentive program.

We can differentiate these 10 municipalities into 3 groups based on how their MSWE developed once introducing reversed PAYT type of incentive. Each following Figure contains the name of the municipality, its population in 2012 (middle year from our analyzed period) and per capita MSWE in individual year. Once the municipality introduced reversed PAYT, the color of the MSWE column changes. However, we need to note here that the introduction of incentive program was not exactly at the same time in all cases, as some municipalities introduced it also in the middle of the year. In such cases we consider the year of incentive introduction as the one in which the incentive was present during the majority of the period.

Figure 2: Development of MSWE per capita for Drnholec, Klentnice

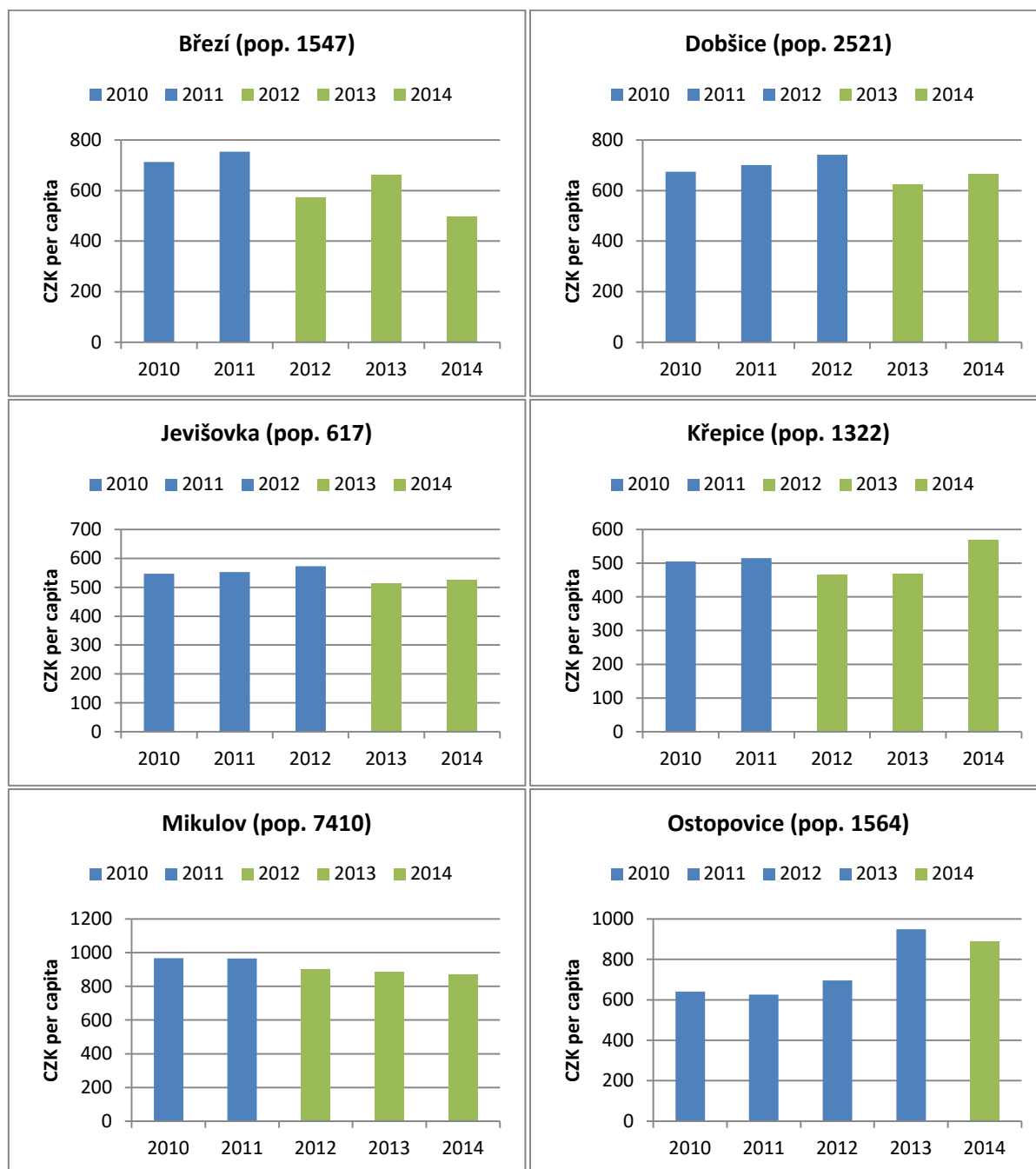


Source: own construction

Needles to mention here is one issue with such analyses, as we make here, being in the fact that each municipality is in practice a unique entity consisting of many factors that might affect the final state of MSWM. Ideally each individual municipality should be examined separately in order to distinguish between its unique characteristics and characteristics that it shares with other comparable municipalities. Thus making conclusions from very small samples should be done only with caution, as some unique characteristics of municipalities might strongly affect overall results of such small samples. However, as the sample increases and covers larger portion of the total municipalities, our conclusions from observing such larger sample become increasingly valid.

First group contains 2 municipalities shown in Figure 2 that do not show any significant difference in the MSWE once reversed PAYT was introduced. After the incentive introduction, MSWE per capita in these municipalities increased by marginal 2-3%.

Figure 3: Development of MSWE per capita for Břeží, Dobšice, Jevišovka, Křepice, Mikulov, Ostopovice



Source: own construction

This first group of municipalities shows that introducing a financial incentive might not have any significant impact on the overall level of MSWE. Actually in case of Drnolec we can observe a notable increase in MSWE in 2014. However, this is possibly caused by the preparation for the obligatory separate biowaste collection that was introduced in the Czech Republic in 2015. But we do not have sufficiently precise data in order to offset this possible factor causing increase in MSWE levels. Second municipality, Klenčice, introduced reversed PAYT in 2014, and thus there is a possibility that the positive effect of incentive program was in this specific year in the end cancelled by the increased costs for the biowaste collection. But since we do not have 2015 values, we can only speculate here. Longer dataset that will be available later could provide information whether this could possibly have been the case.

Second group of municipalities shown in Figure 3 contains 6 municipalities that show a notable decrease in MSWE after the introduction of reversed PAYT incentive program. The decrease of MSWE per capita once reversed PAYT was introduced spans from 7% to 24% with an average decrease of more than 12%.

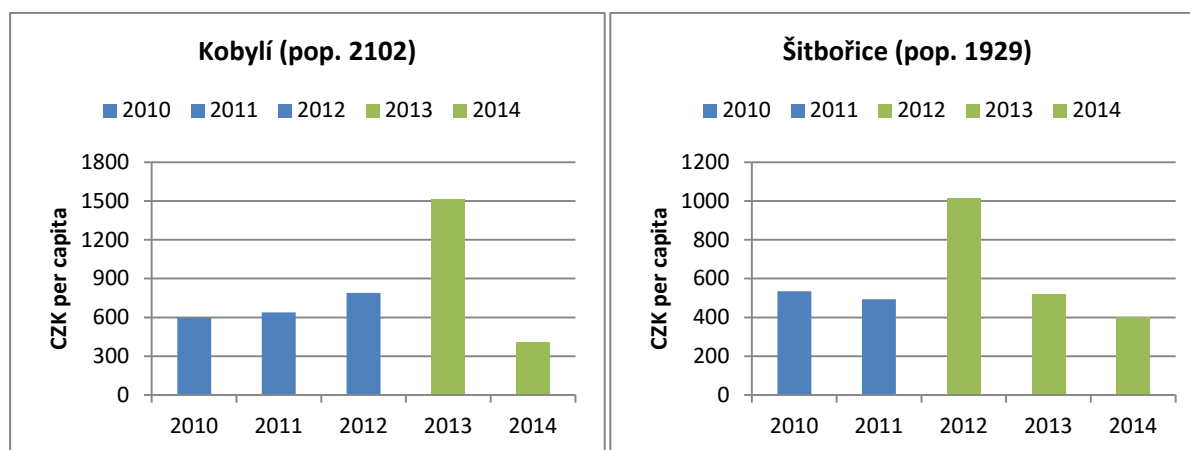
Even though there is a possibility that such drop was caused by some other factor, in our opinion the incentive program is the primary cause here, as while the data collection we have tried to drop all MSWE category that were not directly related to the everyday waste management activities.

In the presented cases we also see that the MSWE savings after the incentive program introduction persisted also in the following years (except for Ostopovice, where we have data only for the initial year of the incentive presence). This is an important observation, as it is often case that some measures are able to produce only temporary effect and after some time things return to their previous state. This is, for example, case of changing MSWM company, where [21-22] observed that savings resulting from such change typically diminish after several years and thus regular tenders should be pursued by the municipality in order to secure contracts with the best available prices and service quality.

As was mentioned in the previous group, also here we can see in several cases that MSWE increase in 2014. Again, in our opinion this is likely caused by the preparation of the municipalities for the upcoming introduction of separate biowaste collection, that typically includes purchasing biowaste bins or containers and related information campaigning in order to make people more familiar with the upcoming changes. Such campaigns typically include printing, distribution and designing of the flyers, creating instruction leaflets for the individual household, etc. that technically represent a one-time investments, but in practice are reported by the municipalities as current expenditure, and thus interfere with the standard current expenditures that we collected and used in the analysis.

Final third group includes 2 municipalities that provide interesting development with initial increase, followed by a comparable drop of the MSWE in the following year is presented in Figure 4. In case of these municipalities after the introduction of reversed PAYT MSWE per capita practically doubled, but in the next year dropped back to the previous level or even lower than before the incentive introduction.

Figure 4: Development of MSWE per capita for Kobyly, Šitbořice



Source: own construction

Based on our more detailed examination, both of these cases are the result of the information campaign that accompanied the introduction of the incentive program and related adjustments of the MSWM in the given municipalities. In both cases the introduction of incentive program included production of a large amount of information material in order to educate local people in this respect, including public meetings focused on this issue as well. Such activities naturally cost money and in these cases were assigned to the MSWE.

Generally in comparable cases additional costs might be related to the purchase of special bins for separated waste, although in case of Czech municipalities MSW incentive programs are usually applied with

kerbside collection using plastic sacks that do not require a costly one-time purchase. Additional initial costs can come from the purchase of a license of a software product. Such tool is often used for analyzing and reporting the results of waste separation by individual households and then assigning them with rewards based on their performance and in case of a smaller municipality with a smaller budget can become noticeable in the overall costs.

But as was mentioned, each municipality is in this aspect different, and what might become a notable costs in one, can actually be done practically costless in the other – sometimes municipality might pay substantial amount of money for creating appropriate information campaign, while in the other municipality the information channels might be already well developed and local cooperating opinion leaders can provide most of the information to the people on their own with little effort and costs required from the municipality's side.

As the detailed analysis of MSWE from individual municipalities that introduced reversed PAYT shows, MSWE generally tend to get reduced. But at it is common in practice, exception might occur, especially in cases like ours where there might be some additional individual municipal factors we are unaware of that can cause higher MSWE.

Conclusions

In this study we have examined the changes in municipal expenditure on solid waste management after introducing waste related financial incentives. Generally it is in the best interest of the municipality to have lower waste generation and higher waste separation rates, as this directly translates into the related expenditures. The question to be solved here was how to make people change their waste behavior in such manner. According to the nudge theory, if the available choices are appropriately designed and introduced to the people, they can be led to make the decision that correspondent with the desired goals. One way how to do this is to use financial incentives that make desired waste related behavior more appealing to the people. If correctly designed, subsequent savings from improved waste behavior can outweigh costs of the incentives.

In our study we have compared municipalities with regular PAYT system, reversed PAYT/tax rebate system and municipalities without any financial incentives. Municipalities with PAYT system report per capita waste expenditure lower by 20%. In case of reversed PAYT we have observed several scenarios. Majority of the municipalities that introduced this kind of incentive experienced a decrease in per capita expenditure, with some only by few percent while others by more than 15%. The results most likely depend on the individual characteristics of the municipalities, the actual process of introduction of the new incentive system in the municipality, plus the results were available only for few initial years. It is to be expected that the number should improve even more once people get more accustomed to the new system. Two municipalities even reported significant increase in the initial year of the incentive presence followed by a drop to previous or even lower expenditure levels in the next year. Such development was likely the result of the initial costly activities related with the financial incentive introduction. Still, overall results suggest that financial incentives, especially if appropriately introduced and designed, can lead both to improved environmental performance (lower waste generation or increased waste separation) and decreased municipal waste expenditure.

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