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RESEARCH ARTICLE

Socio-economic impacts of waste management policy in Slovakia: Comparative analysis among municipalities

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Abstract – The paper investigates fiscal aspects of waste management policy and waste management at the communal level in the Slovak Republic. For this purpose, cross-sectional data on the municipal level averaged over five years (2017 - 2022) were used. The results reveal a significant fiscal gap between municipal waste management revenues and expenses, which are indirectly transferred to the consumers (households), and will worsen their financial situation and the related public welfare. The econometric modelling comprising quantitative and qualitative variables (ANCOVA) model was used to determine the factors significantly impacting waste management expenses. The results suggest that introducing the policy of waste prevention through a higher share of separated waste is associated with a significant increase in waste management expenses. This study contributes to the understanding of the impacts of financial incentives on waste management at the municipal level, revealing an unintended externality that points to a consequence leading to an increase in the financial burden on consumers in the form of additional costs. It is a counter-productive aspect of the policy, which should not cause a decline in public welfare and discourage consumers from waste separation. The results also suggest that current policies to promote separate collection may also inadvertently increase costs for municipalities, affecting their fiscal planning and efficiency, particularly at the environmental level. Further research is recommended in this area to gather more evidence and provide recommendations on the future implementation of waste management policy at the municipal level. For a more successful closure of the investigated issues in waste management, it is necessary to examine and minimize the revealed externalities, thereby ensuring a long-term sustainable waste management policy.

Keywords – waste management, municipality, externality, waste management policy, public welfare and Slovak Republic.

JEL classification**:** H23, H72, H76

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1. INTRODUCTION

Waste is now considered valuable (Ladychenko et al., 2020). Waste may be considered as raw material or renewable source of energy, which can be used or extracted in the most economical and ecological way (Wachira, 2022). The long-term goal of the EU waste policy is to transform Europe into a resource-efficient society with the maximum level of waste recycling, reduction of waste, and using waste as a valuable resource where possible (Zębek & Žilinskienė, 2021; Zecca, Pronti & Chioatto, 2023; Lacko, Hajduová, & Markovič, 2023; Velea et al., 2022). The EU Waste Hierarchy establishes a priority order among waste management actions: first of all 'Prevention', then 'Preparing for re-use', 'Recycling', 'Recovery' and lastly 'Disposal' (D'Inverno, 2024). According to Lansink (2018), it has become a strategic pillar of European waste management legislation since 2008.

The Waste Framework Directive establishes a structure for harmonizing waste management across EU Member States to reduce waste production and enhance waste management and disposal processes. Slovak Republic has closely aligned the goals and objectives of the EU waste policy into the national framework of strategic documents and plans.

Among such supporting documents, we can include the Waste Management Program of the Slovak Republic for the

years 2016 - 2020. It´s aim is to increase the recovery rate of waste with a view of preparing it for re-use and recycling and to promote waste prevention (Mihaliková, Lachytová, 2020). In addition to the regulation of program documents in waste management and measures to prevent the creation of waste or the rights and obligations of legal entities and natural persons in the prevention of waste creation and their management, this law also regulates the municipal waste management and the competence of state administration bodies and municipalities in matters of the state administration of waste management, as well as responsibility for breach of obligations in the area of waste management. It also supplements Act No. 329/2018 Coll. on fees for waste disposal and on amendments to Act no. 587/2004 Coll. on Environmental Fund, which regulates the payment of fees for waste disposal at a landfill and a tailings pond.

However, implementing the documents mentioned above, especially the goals and objectives, is accompanied by steep cost hikes hindering the enforcement of the waste management policy (Petrariu et al., 2022; Alam et al., 2022). Hence, the paper undertakes this topic to determine the causes and consequences of such policy failures. The paper's objective is to evaluate the financial framework applied in communal waste management on the municipal level. The attention is primarily devoted to fiscal relations (commitments) related to waste management on a local level. In this concept, the paper aims at the evaluation of cash flow related to waste management expenses and receipts in the short term (five-year span) in a selected municipalities. Furthermore, the effects of national legislation (particularly Act No. 329/2018 Coll. on fees for waste disposal) on municipal waste disposal prices are investigated through econometric modelling. The paper would significantly contribute to the topic of waste management on the municipal level, mirroring governmental waste policy applications and fiscal impact on municipalities.

1.1 Public services and fiscal responsibilities of the municipalities

The system of local self-government financing is an essential precondition for their successful existence. Provazníková (2009) states that territorial self-governments provide a range of services for their residents, so the system of local self-government must be as efficient as possible. Optimization of the public finance system and, more specifically, the distribution of funds and competencies between the national, regional and local levels are also discussed in the public finance theory. According to Roubínek et al. (2015), the theory of fiscal federalism is one of the primary public finance theories, especially in the context of the increasing role of local self-governments and of the process of the reform of public administration - decentralization and deconcentration. Peková (2004) highlights that the concept of fiscal federalism is fundamentally rooted in the presence of a multi-tiered government and the ideal distribution of authority and duties among them. According to Hornyák Gregáňová et al. (2017) decentralization of the public sector also contributes to strengthening the control over public expenditure. The policy of increasing the fiscal autonomy of self-government to optimize vertical financial relations in the public sector, increases both economic efficiency and public welfare. The latter became an important goal in public administration (Mishchuk et al., 2019). The fiscal autonomy of local self-governments determines the ability to finance their activities without external assistance, for example, using the sources of the federal government (Musviyanti et al., 2022).

Świrska (2016) claims that the financial management of local self-governing bodies is essentially a process aimed at optimally executing public duties that satisfy the requirements of the local community. Vavrek et al. (2020) emphasize that the financial management of local self-governments is a key aspect of their operation. It guides the appropriate allocation of resources within each local self-governing unit, the effective execution of duties, and also guarantees sustained socioeconomic growth within its jurisdiction. The municipal financial management is determined by a financial plan (budget) created at least two years in advance. The municipal budget is defined by the municipality's objectives and related financial operations (Andrejovska & Pulikova, 2018; Koman et al., 2022). The budget must be drawn up so that it is possible to perform all competencies of municipalities (Zikhali, Lungwengwe & Komisane, 2023). It contains budget resources and estimates of revenues needed for achieving the municipality's goals (Dusek, 2017; Liptáková & Rigová, 2021).

Current studies on waste management and its impacts on municipalities underline the importance of effective financing and management of municipal waste to progressively reduce costs and promote sustainability. A study published by Jean-Pierre & Cristian (2022) shows that increasing recycling rates and reducing landfilling can generate additional savings while improving the environment, but they add that they can also lead to increased costs that are passed on to end consumers. The OECD (2022) identifies an unintended financial burden on communities, where some policies promoting circular economy practices can place significant budgetary demands on municipal budgets and local taxpayers, even when they are beneficial to the environment. The results of another study (Blagoeva et al., 2023) point to the fact that a particular economic indicator such as GDP per capita is directly related to the amount of waste generated, where GDP growth is positively influenced by an increase in the waste burden. For this reason, environmentally sustainable management may be more difficult to implement in smaller spatial units such as municipalities and regions with higher economic growth. Kyriakis et al. (2019) highlight the challenges associated with implementing waste management policies that address both economic and social needs. They confirm that poorly designed and managed waste policies from an economic point of view can put a strain on municipal budgets, whereby the provision of social

benefits can be limited, especially in municipalities without an established recycling system and infrastructure for waste-to-energy recovery.

Municipalities are governed by rules determined by law when creating their budget. A significant milestone in local and regional self-government financing in Slovakia was in 2005 when the composition of municipal budget revenues fundamentally changed. Klimovský (2004) states that until 2005 (the implementation of fiscal decentralization), 15% of municipality revenues were generated by local taxes and fees, and an additional 25% of revenues came from taxes (road tax, personal and corporate income taxes) in Slovakia.

Papcunová et al. (2019) claim that following 2004, the subsidies supporting the self-governing operation and public transportation were terminated. This process resulted in disparities between the smallest and largest municipalities, while the others disappeared. Municipalities are obligated to fund their competencies using their own resources. The deficit created by the discontinuation of subsidies could be offset, for instance, through the proactive implementation of local taxes. Several authors, including Urbaníková (2017) and Adamišin & Tej (2012), state that local taxes and fees are an economic mechanism for territorial regulation or a social tool for specific population groups (Androniceanu & Tvaronavičienė, 2019).

One of the critical revenue sources that municipalities have are the local taxes and fees. Municipalities can exercise their power to make an independent decision on the amount of these revenues issued as General-binding Regulations (Otrusinova & Kulleova, 2019). In Slovakia, municipalities can impose eight local taxes regulated by Act no. 582/2004 Coll. on local taxes and a local fee for municipal waste and small construction waste and two local fees (Bujňáková, 2018).

1.2 The challenges of waste management system in Slovakia

Local self-governing entities within the EU hold significant power in the management of solid waste. The municipality is mandated to designate areas for the disposal of all municipal waste generated by individuals within its cadastral boundaries. It is also required to provide locations for the segregated collection of municipal waste components, including at a minimum, hazardous waste, paper, plastics, glass, metals, and biodegradable waste (Androniceanu, 2019). The municipality may charge a fee for collecting, transporting, sorting, and disposing of municipal waste from individuals under a contract. Municipal waste in EU countries constitutes several problems for small communities up to large municipalities, which force the use of new efficient organizational solutions and the need to make costly investments in infrastructure. Waste management is not only a technical problem, but the waste management activity itself affects various actors in society (Ladychenko et al., 2020). This important direction of sustainable development is aligned with the ecological aspirations of different stakeholders (Holotová et al., 2020; Mishchuk et al., 2023). Particularly, the effectiveness of waste management increases significantly in societies, as well as the different groups of customers with high responsibility for food packaging use and utilization (Cichocka et al., 2020). Further issues, as the use of effective technologies, like recycling or reverse logistics are also discussed (Zielińska, 2020; Vasanicova et al., 2022; Peng et al., 2022).

As Sedláková (2016) states, the decentralization of public administration in Slovakia after 2002 resulted in a significant broadening of competencies and responsibilities of municipalities for the development of their territories. Act No. 416/2001 Coll., which pertains to the transfer of certain responsibilities from state administration bodies to municipalities and self-governing regions, also delegated some duties related to waste management. Each municipality's waste management must comply with the Act on Waste, the Waste Management Program, and the General Municipal Ordinance. The successful implementation of these expanded responsibilities can only be achieved through suitable strategies in municipal management. In the context of Slovakia, the municipality undertakes numerous responsibilities in the area of environmental protection. These duties are regulated at the self-governing level by the Act on Municipal Establishment No. 369/1990 Coll. which in § 4 section 3 also includes competencies related to the management of municipal waste and small construction waste.

Tekeli (2021) further adds that the municipality's tasks in the environmental care framework represent a combination of self-governing powers and transfer performance of the state administration. Based on them, the municipality also performs tasks transferred to the state administration in waste management. They are regulated by Act no. 79/2015 Coll. on waste and on the amendment of specific laws, which first imposes an obligation on the municipality to manage municipal waste. The municipality can include the costs for disposal in the local fee for municipal waste and small construction waste while determining its amount based on actual costs. According to Act no. 582/2004 Coll. on local taxes and the local fee for municipal waste and small construction waste, municipalities collect fees for handling municipal waste and small construction waste from citizens and legal entities that use real estate on the municipality's territory. If the municipality ensures the recovery of this waste, the costs must be reduced by the municipality's revenue from the recovery. The revenue from the local fee for municipal waste and small construction waste will be used by the municipality exclusively for the collection, transport, recovery and disposal of municipal waste and small construction waste.

The local fee for municipal and small construction waste is mandatory and shows the defining characteristics of a fee rather than a tax. The local fee for development is regulated by Act no. 447/2015 Coll. on the local fee for development as an optional fee, but it can be considered a local tax rather

than a fee (Popovič, 2016). According to Vartašová & Červená (2019), the local fee for municipal waste and small construction waste is paid to compensate for the costs of handling municipal waste produced during the use or possession of the real estate in the municipality. The municipality determines the fee rate by the established waste collection system.

The fee is paid by a natural person who has a permanent or temporary residence in the municipality, and by a legal entity entitled to use real estate located in the municipality territory for a purpose other than business. If bulk waste collection is introduced in the municipality, the fee rate is at least €0.01 and at most €0.2 per litre, dm3 or kilogram of municipal or small construction waste. If there is no bulk collection of waste in the municipality, the rate is at least €0.02, and no more than €0.2 per person and calendar day (Act no. 582/2004 Coll. on local taxes and a local fee for municipal waste and small construction waste).

Soukupová et al., (2016); Bril & Rydygier, (2016) and Bakalár et al., (2023) claim that implementing sustainable development principles in waste management makes possible using logistics solutions. It has led to the development of a new logistics branch called the logistics of waste. The condition for applying logistics in waste management is to develop an appropriate logistics system. Logistics systems can operate at a spatial, organizational or information level. Considering the functional areas, a logistically integrated waste management system should be constructed. Functional areas stand out due to activities related to waste generation, transport of waste to disposal facilities and landfills, as well as activities involving regulation and control.

The municipality must dispose of such waste according to the rules established by law for the holder of the waste and ensure the collection and transportation of mixed municipal waste generated on its territory. The municipality should regulate all details about loading, collection, waste sorting, etc., in a generally binding regulation.

Several factors play a significant role in municipality decision-making processes, adds Soukupová et al. (2016), which also determines the efficiency and effectiveness of municipal waste management expenditure. An important aspect at the local level is income and expenditure within the waste management program of each municipality. Soukopová & Malý (2013) consider that municipal expenditures are affected by different factors: the amount of municipal waste, the price of the equipment used for municipal waste recovery or disposal, the distance to facilities where municipal waste is recovered or disposed of, transport costs, competition, and the form of waste management company ownership. Approximately two-thirds of municipal waste in Slovakia ends up in landfills. They add that despite the growth of municipal waste production per capita over the last ten years, Slovakia is still one of the best in the EU. However, it lags significantly in the quality of its processing. Waste production per inhabitant, as well as the rate of sorting, is significantly heterogeneous in Slovakia.

A study by Heller & Vatn (2017) points to data from a Norwegian municipality that introduced and later abolished a differentiated fee for waste, confirming the critical role of normative motivation in sorting household waste, as well as the economic incentive, which has a decisive influence on the motivation to sort household waste. Effective use of financial resources intended for waste management in municipalities, systematic and practical selective waste collection, education in schools, the introduction of a modern method of registration and removal of waste for every household, cooperation and involvement of the municipality in various projects are some of the many effective ways that motivate each municipality to increase selective waste collection, and at the same time reduce the amount waste production itself, adds Klobučník (2021).

In the current period, reducing the amount of waste should be governed by the Waste Prevention Program of the Slovak Republic for the years 2019 - 2025, prepared by the Ministry of the Environment by § 7 of Act No. 79/2015 Coll. about waste. This program is based on the experience gained during the preparation and implementation of the previous similar program for the years 2014 - 2018, and on the ongoing evaluation of the fulfilment of its goals and measures. It also considers the current developments and trends in the field of applying the model of circular economy in the EU. The principle is the transition from a linear economic growth model to a complex, dynamic and closed model, thus aimed at the development of efficient use of resources and sustainable growth. Hence, the program stresses the main challenges of the Slovak waste management policy. Slovakia's recycling rate is one of the lowest in the European Union, which stood at 10% in 2021. This is due to several factors, including the lack of public awareness and education about recycling, the lack of infrastructure for recycling, and the lack of financial incentives (EEA, 2021).

The primary objective of Slovak WMP until 2025 is to deflect municipal waste from landfills. The critical approach is to increase the share of selected waste, which can be recovered later. For this purpose, the funding of municipal waste collection and disposal through the Extended Producer Responsibility Scheme (EPR) and levying charges on local municipal and small construction waste was adopted. (Valenčíková & Fandel, 2023) (Marišová & Fandel, 2022; Ali et al., 2023). Slovakia relies heavily on landfills to dispose of its waste. In 2021, 87% of Slovakia's municipal waste was landfilled, compared to the EU average of 27%. Landfills are not sustainable and can pollute the environment (MŽP, 2022).

Furthermore, Slovakia introduced a system of financial incentives for the municipalities to reduce waste and increase the level of selected waste. One of the main instruments, according to Act no. 587/2004 Coll. on Environmental Fund, which regulates the payment of fees

for waste disposal at landfills and tailings ponds, is the application of the principle of lower fees for a higher level of municipal waste sorting in individual municipalities. The new legal regulation of fees for the storage of mixed municipal waste is adjusted in such a way as to motivate municipalities to classify municipal waste as much as possible. It is not a new idea, as in 2015, the specialist magazine Waste mentioned the need to introduce fees for depositing waste at a landfill based on the real success of the municipal waste sorting system (Stričík, 2015).

The objective of the paper is to focus on municipal waste management. It aims to investigate the fiscal relations linked to waste management funding on municipal level. Waste management funding in the Slovak Republic is transferred to the responsibility of municipalities, which should cover the costs of municipal waste collection from the local fee for municipal and small construction waste collected from citizens.

2. MATERIALS AND METHODS

The overall scope of the paper concerns the fiscal position of the municipalities in the field of waste management. Although waste management represents just a fraction of the overall costs of municipalities, the gap between the expenses and revenues from the waste fees is substantial. There is also a significant gap between the small and larger municipalities. Hence, the paper's objective is to investigate fiscal differences among the municipalities and examine factors affecting the level of expenses on waste management. Notably, the paper investigates the current waste management policy focusing on increasing the share of separated waste on the communal waste deposed on landfilling.

According to Ordinance no.330/2018 Coll., Annex 1, regressive taxation based on the share of separated communal waste was introduced. The policy aims to incentivise the municipalities to increase the share of separated communal waste. In turn, the overall costs for disposing of the communal waste (including a higher share of separated waste) should decline. Based on this assumption, the null hypothesis might be formulated:

H_0: *Increasing the share of the separated waste on total communal waste reduces the waste expenditure paid by the municipalities.*

H_1: *Increasing the share of the separated waste on total communal waste increases the waste expenditure paid by the municipalities.*

The analysis and hypothesis verification are based on the cross-sectional data sample, which includes ninety municipalities. The data sampling was realised randomly based on the basic sample of municipalities in Slovakia. The basic sample of Slovak municipalities consists of almost three thousand units. The list of all municipalities was taken from the Slovak Statistical Office database (www.datacube.statistics.sk) and every thirtieth municipality from the list was picked up to the sample. Finally, ninety municipalities were gathered as a researched sample. After making the sample, data about municipalities were gathered, particularly the closing account of each municipality, which was analysed over the five-year period of 2017-2022. Moreover, data records about waste composition in each municipality were subsequently analysed.

Formally, it is observed $x_i = x_1, x_2, .., x_n$ municipalities over the $y_j = y_1, y_2, .., y_n$ regions. For the model construction, we used cross-sectional data, averaged over the five years between 2017 and 2022. As a research method, the analysis of covariance (ANCOVA) model is used.

$$E(y|x) = x'\beta = \alpha_1 D_1 + \alpha_2 D_2 + \alpha_3 D_3 + \beta_1 x_1 + \beta_2 x_2 + u_i \quad (1.0)$$

where y – "lcwfee" – the total amount of waste per capita
x_1 – "lcwexp" – the total expenditures on communal waste per capita in logarithm
x_2 – "lcwvol" – the total volume of communal waste per capita expressed as logarithm
x_3 - "lsep"- the amount of separated waste per capital level expressed as a logarithm
D_1 =1 – "sep" if the separation of additional varieties of waste is present in the municipality, 0 otherwise (e.g. batteries, small construction waste, tyres, etc.)
D_2=1 – "mrk" presence of Roma community in the municipality, 0 otherwise (e.g. ≥10%)

Then the OLS estimator can be written in several ways:

$$\hat{\beta} = (X'X)^{-1}X'y \quad (1.1)$$

Or more precisely a heteroscedasticity-robust estimator, of the OLS estimator has been used

$$\widehat{V_r}(\hat{\beta}) = (X'X)^{-1}\left(\frac{N}{N-k}\sum_i \hat{u}_i^2 x_i x_i'\right)(X'X)^{-1} \quad (1.2)$$

The research sample includes ninety statistical units (n=90). Independent variables were chosen based on their accessibility in the Slovak statistical database and previous empirical evidence about their effect on the dependent variable. Subsequent analysis was performed in the STATA program (STATA 18.0).

3. RESULTS AND DISCUSSION

Initially, the fiscal gap between the revenues and expenses from communal waste is investigated. They are expressed in euro per capita over the period 2017-2022. The gap is evaluated with the help of a two-sample -test.

Table 1 Fiscal gap

	obs	Mean1	Mean2	dif	St Err	t value	p value
lcwfee - lcwexp	89	2.892	3.309	-.417	.062	-6.7	0

Source: author's own contribution, 2024

Table 1 shows the fiscal gap between the waste expenses and revenues per capita level expressed in logarithms. Using a paired two-sample t-test with unequal variances has shown t= -6,7 has a p<0.001 (p=0.0000). Hence, a substantial gap between the revenues and expenses of communal waste management per capita may be confirmed. Is this result substantively significant? Several effect-size coefficients are used to measure the strength of the difference between means.

Table 2 Effect size based on mean comparison, unequal variances

Effect size	Estimate	[95%	conf.	interval]
Cohen's d	-0.643		-0.944	-0.341
Hedges's g	-0.640		-0.940	-0.339
Point-biserial r	-0.311		-0.433	-0.171

Source: author's own contribution, 2024

Cohen's and Hedge's values are both -0.64. Thus, the mean of the distribution of expenses for the communal waste per capita is more than half a standard deviation higher than the mean of the distribution of revenues from the communal waste per capita level. It has been suggested that Cohen's value larger than 0.50 is considered a medium effect. It is also confirmed by the point-biserial 0.31, whereas a value larger than 0.30 indicates a medium effect size.

The ANCOVA evaluation model shows that communal waste revenue per capita is a dependent variable, and the vector of independent variables comprises quantitative and qualitative variables. The effect of each independent variable is also expressed in terms of the β coefficient. All variables are expressed as logarithms.

Table 3 Results of ANCOVA model

lcwfee	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
lcwexp	.285	.244	1.17	.245	-.199	.77	
lcwvol	.467	.232	2.01	.048	.005	.929	**
lsep	.275	.125	2.21	.03	.027	.523	**
sep	-.229	.17	-1.34	.182	-.567	.109	
mrk	-.164	.097	-1.69	.094	-.357	.029	*
Constant	-1.534	.752	-2.04	.045	-3.029	-.038	**
Mean dependent var		2.892	SD dependent var			0.698	
R-squared		0.502	Number of obs			89	
F-test		25.026	Prob > F			0.000	
Akaike crit. (AIC)		137.545	Bayesian crit. (BIC)			152.477	

**** p<.01, ** p<.05, * p<.1*

Source: author's own contribution, 2024

Table 3 shows the results obtained by using the ANCOVA model. There is a highly significant relationship between communal waste expenses and five predictors. However, just three predictors became statistically significant. According to the results, fees for communal waste collection increased due to growing waste volume, waste separation, and the presence of facilities for waste processing or separation. Rising of communal waste volume and the volume of separated waste showed a statistically significant effect on waste management fees. At the same time, the presence of the Roma community can increase the amount of municipal waste fees, which was confirmed in almost every municipality with this community of inhabitants.

According to the β coefficient, the amount of communal waste has shown the most substantial effect, which is not surprising. However, the model shows that an increase in the share of separated waste is related to waste fee increases, which might indicate the counterproductive effect of the policy. It is true that, with the rise of the share of selected waste, landfilling fees for the municipalities decrease. Meanwhile, each component of selected waste has to be collected separately. Hence, the policy has created a negative externality, which affects the consumer's income

negatively. Finally, the presence of waste processing equipment in the municipality also seems to increase the costs of the municipalities, bearing by the inhabitants. Regarding other indicators, R-squared = 0.512, which suggests that the model explains 50% of the variance of the model. When comparing other propositions, especially multicollinearity, the mean VIF factor of the model is 1.19, which is a minimal value.

The paper found evidence of a substantial income gap between the expenses and revenues for waste management on municipal level. In most cases, revenues generated from waste management on municipal level do not cover all costs and therefore have to be subsidized by the municipality. It means that the municipalities use their own funds to cover the total costs associated with waste management.

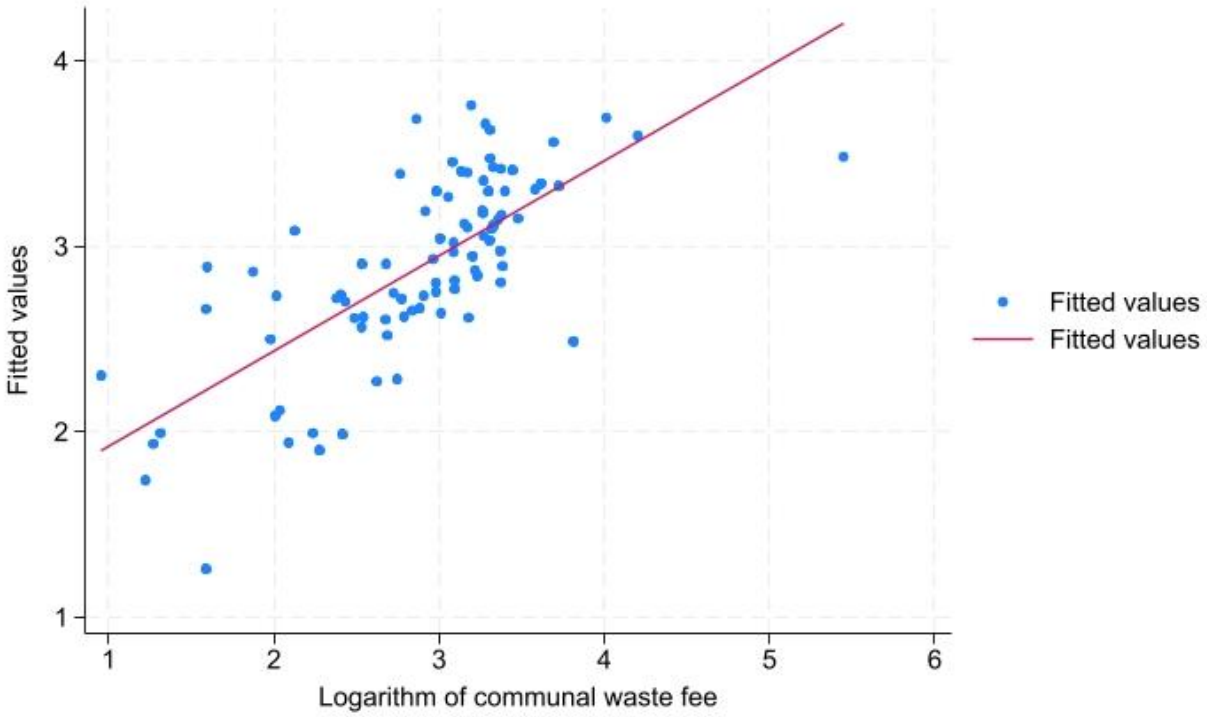

Figure 1 Visualisation of the model fit – dependent variable and predicted
Source: author's contribution, 2024

Figure 1 provides a graphical evaluation of the model fit. The plot shows a reasonable clustering pattern of the model's fitted values. Several outliers lower the model's efficiency, but overall, it provides the visual ground for the presented results. Additionally, Figure 2 shows the 'Residuals vs. Fit' plot, providing additional insights into the quality of the model. The highest concentration of the residuals is around 0, which suggests a good model fit. Moreover, the residuals appear to be scattered randomly showing no significant pattern. However, some outliers suggest possible heteroscedasticity of the model.

3.1 Discussion

The current times require governments to pay increased attention to environmental protection and promoting ecological activities. A recycling society that minimizes waste generation and increases its recycling level is often discussed. One of the attributes of achieving this goal is increasing the public's environmental awareness, while the first step is to start solving such tasks at the local level, e.g. municipalities. Current waste management expenses record an upward trend, while the revenues lag behind. This statement is confirmed by Ševčíková et al. (2022), who state that the amount of the fee for municipal and small construction waste does not include all the real costs related to the collection and disposal of municipal waste. The authors also state that a particular problem is the will of local governments to enter into favorable contracts with collection companies. In this case, however, the citizens must consistently check the content of the contracts that the municipalities conclude with the collection companies.

It is important to assume that the national strategy on waste, separation, processing, and waste reduction initiatives can have an important impact on the municipalities and their related economic costs. One of the latest tools for reducing waste of a specific type was the introduction of a backup system for PET bottles and cans in the Slovak Republic on January 1, 2022. Even though the municipalities appreciated the decreasing problem of pollution caused by the accumulation of plastic waste and its subsequent removal, at the same time, it increased the costs associated with the process of separation and removal.

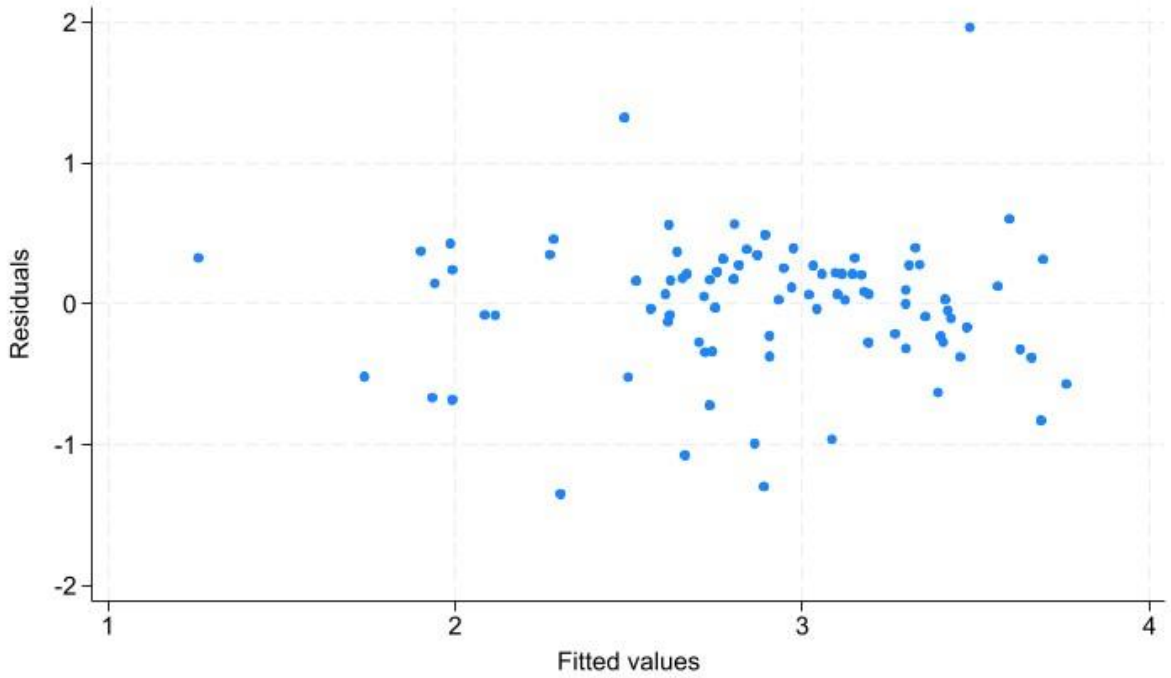

Figure 2 Visualisation of the model fit – residual variants
Source: author's contribution, 2024

Based on the recommendations we encountered, we find the introduction of selective collection of municipal waste in all municipalities in Slovakia, as well as the introduction of effective municipal waste management systems that would motivate citizens to produce less mixed communal waste and initiate separated waste collection crucial. Of course, this will subsequently be reflected in the increase in costs related to it. Another tool for more efficient management of municipal waste is to adopt legislative measures regarding the amendment of the Waste Act and, above all, the Act on Local Taxes and Fees, to enable the modification of generally binding regulations adopted by cities and municipalities in a form that will allow paying lower fees for those citizens who practice separated waste collection. It is vital to promote the importance of selective waste collection and increase awareness or introduce education programmes accessible to the public.

According to Adamivič et al. (2023) current legislative changes, for example in the form of mandatory sorting of household kitchen waste, are pushing local governments into increasing municipal waste fees. New obligations related to the introduction of mechanical biological treatment of municipal waste prior to landfilling will have a significant impact on the costs of municipalities in the near future. The current government policy in waste management encourages municipalities to increase the share of separated components from communal waste by imposing regressive taxation for municipalities to increase waste separation. According to the findings, this policy is ineffective since each waste component is required to be collected, transferred and handled separately, which ultimately increases the costs paid by municipalities. Moreover, the EEA also underlines the complexity of this issue; recycling and waste reduction can be more expensive than traditional waste disposal methods. In particular, this can make it difficult for businesses and households to adopt sustainable waste management practices (EEA, 2022).

These findings contradict another important element that should have a positive effect in reducing the costs of municipalities for waste management. This is based on the new law on waste, the introduction of the principle of extended producer responsibility, which means that manufacturers and importers must take care of the product from the beginning until the end of the product lifecycle. It means that they are obliged to bear the financial costs associated with the collection and disposal of waste from their products and related packaging. This procedure should lead to a better system of financing selective waste collection, which will bring savings to municipalities and cities in their budgets by having the producers take over the costs. The more waste is sorted in the municipality, the less costs the municipality will spend on the disposal of other waste from the local fee. This should ensure the financing of costs for the sorted collection of collected waste in municipalities, which will subsequently be relieved of these costs. The result will be an efficient set-up sorted collection, which would be free of charge for the municipality and citizens. These claims would require further analysis of the impact of legislative and normative regulations, and related impacts on the financial resources of municipalities.

Finally, the municipality's waste processing equipment operation also increases municipal costs. Building such facilities is often subsidised by grants. However, its

operation has to be paid for by the municipality. Some share of overall waste management costs is transferred to the consumers living in the municipality. However, the households may not see the real benefits of such a pro-environmental policy. In 2022, the Ministry of the Environment of the Slovak Republic approved projects for selecting municipal waste in almost sixty municipalities for 26 million euros. The approved projects will ensure the annual sorting of another 35,000 tons of municipal waste.

Some steps related to waste management have been accomplished in the past, but many challenges of the policy remain. The lack of investment in waste management infrastructure, the lack of public awareness and education, but also the inefficient enforcement of environmental regulations still remain obstacles to successful waste management in Slovakia. (OECD, 2019; FAOLEX, 2022)

4. CONCLUSION

The paper focuses on waste management funding at the municipality level. Waste management is an essential part of the current environmental policy aiming to decrease communal waste deposited in landfills by increasing the share of separated waste components. Currently, in Slovakia, more than 50% of total communal waste is dumped in landfills, representing a severe environmental hazard. To reduce the amount of landfilling, the government provides financial incentives for the municipalities, encouraging them to increase the share of separated waste.

According to the paper's results, this policy has created an unintended externality, negatively affecting the consumer. The overall system of separated waste handling ultimately increases the cash flow spent on waste management at the municipal level. Such policies, when aiming at closing the "loop "in waste management, should review possible externalities altering the intended outcome of the policy. However, it has to be admitted that such justification needs further research, especially a more significant research sample and applying sociometric methods of research.

The OECD report on Waste Management and the Circular Economy in Selected OECD Countries describes some similar conclusions and recommendations to those in our article. It also identifies the significant fiscal challenges faced by municipalities in implementing measures to promote the circular economy. A common consensus, which can serve as a general recommendation, is the need for careful consideration and assessment of the economic impact of waste management policies in EU countries on households and municipalities. This would avoid the aforementioned and unintended additional externalities affecting their populations.

Similarly, we found consistency in the recommendation of our results and the findings in the OECD report, where we recommend municipalities to be more transparent in their waste management financing and support within public funds, which in turn could reduce the costs that are ultimately borne by the final consumers anyway. Therefore, our approaches are also applicable to municipalities outside Slovakia, especially those that are implementing similar waste collection and separation systems or are striving for their sustainability. Their application, especially through better fiscal coordination and more transparent public spending, can help them avoid negative financial impacts on municipalities themselves as well as on households.

Moreover, the research scope may be expanded significantly. In particular, in-depth consumer impact analysis has to be conducted to find out specific impacts on consumers resulting from the unintended externality (hikes of the overhead costs). This could involve surveys, interviews, or focus group discussions to understand how consumers are affected by the increased cash flow spent on waste management. In the long run, an examination of the long-term effects of waste management policies may be appropriate. This could involve tracking changes over a more extended period to observe trends and patterns. In case of further investigation of socio-economic impacts on local governments and society on a larger sample of municipalities from all regions of Slovakia, the results could be even more precise and their contribution would also point out other possible differences in waste management policies between regions on a national context.

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