




The importance of municipal tax policy in shaping forest tax revenues in Poland

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Abstract

Motivation: The subject of interest presented in this study is the problem of forest tax and the respective municipal revenues in the context of the principle of financial independence. It is manifested in the ability of implementing own tax policy, i.e. exerting purposeful influence on the structural elements of taxes by the local authorities aimed at using their functions in an optimal manner. Forest tax as a typical local tax may contribute towards implementing this principle in practice.

Aim: The study presents the legal structure of forest tax, primarily in the context of the powers granted to municipalities in terms of fiscal power. The main objective of the study is to assess the impact of tax policy implemented by municipalities on the amount and importance of forest tax revenues in the financing structure.

Results: Comparing to other revenue categories, the fiscal efficiency of tax and its importance in the municipal financing structure remain small (approx. 0.15% of total revenues) and they depend directly on the tax base. It is a derivative of the forest area being the tax base and the structure considered in terms of statutory exemptions and the method of determining the tax rate. Municipal tax policy regarding the forest tax is characterised by a very small activity. A more liberal tax policy is usually associated with a lower tax im-



portance in a municipality, which demonstrates its fiscal stance. Generally, this policy has a marginal impact on the importance of forest tax in the structure of municipal finance.

Keywords: local self-government; tax system; local taxes; forest tax; tax policy
JEL: H20; H30; H71; K34

1. Introduction

The most important type of revenues collected by the local self-government units takes the form of tax revenue. This approach is justified by the theory of local finance, and also results from the legal acts of the highest rank. The *Constitution of the Republic of Poland* (1997), in Art. 168, provides that “the local self-government units are entitled to define the amount of taxes and local fees within the scope specified in the Act”, whereas the *European charter of local self-government* (Council of Europe, 1985), in Art. 9 par. 3, stipulates that “at least part of the financial resources of local communities should come from local fees and taxes, the amount of which these communities are entitled to determine, to the extent specified by the Act”.

Tax sources of revenues for the local self-government units, even though all based on using the tax instrument, do not constitute a homogeneous category. They differ, e.g., in the scope of the so-called fiscal power, i.e. the possibility for local authorities to shape basic elements of tax structure, such as: the subject, object and basis of taxation, tax rate as well as tax exemptions and reliefs. The particular significance of this category in the revenue structure of the local self-government finance system means that their importance in the financing structure and the scope of the fiscal power determines the actual financial independence of the local self-local government units.

It is manifested in the possibility of implementing own tax policy, which can be defined as the local authorities’ deliberate shaping the structural elements of taxes in order to use their functions (fiscal, stimulating) in an optimal manner and in accordance with the economic and social interest of the local self-government unit. Tax policy can take an active form, consisting in taking advantage of the entitlements and powers held by the local authorities, as well as a passive one, limited only to applying the solutions specified by the legislator (Felis, 2018, pp. 146–147). Tax reduction policy is described in the source literature as expansive, liberal and sometimes populist if the reductions apply to natural persons alone, or as stimulating in the case of tax reductions for economic entities. The policy promoting high taxes is sometimes referred to as restrictive or fiscal (Swianiewicz, 2004, p. 257).

The Polish system of local finance has been developed in such a way that only local taxes and shares in revenue taxes constituting the state budget revenue are important among the tax sources of financing for the local self-government units. Fiscal power was granted to the local self-governments by the legislator only in terms of local taxes. They remain the source of revenues for the low-

est level of the local self-government, i.e. municipalities, including cities with county rights.

Forest tax represents one of the typical local taxes, the total revenues from which support municipal budgets. The study presents the legal structure of forest tax, primarily in the context of fiscal powers granted to municipalities. The main purpose of the paper is to assess the impact of tax policy implemented by municipalities on the amount and importance of forest tax revenues in the structure of municipal finance.

2. Literature review

Tax policy carried out by municipalities is the subject of many scientific studies taking the form of monographs, chapters in monographs, articles in scientific journals or conference materials. These studies address the municipal tax policy either in general (Felis, 2018; Filipiak, 2015) or implemented in relation to specific taxes (Felis, 2015). Similarly, the effects of municipal tax policy are subject to extensive analyses (Kogut-Jaworska, 2017; Śmiechowicz & Kozak, 2016) focusing on its specific goal (Korolewska, 2014) or a certain area of municipal activity (Dziuba, 2015). Attempts were also made to explain the differences in the tax policy carried out by the municipalities (Dziuba, 2016; Swianiewicz & Łukomska, 2016). These numerous research works also refer to the problem of forest tax as one of the local taxes.

More in-depth research covering the local tax policy was presented in the study by Łukomska & Swianiewicz (2015), in which the authors described tax policy diversification in Polish municipalities, attempted to identify the factors explaining this diversification and to determine the motives and mechanisms of making the policy oriented decisions regarding local taxes.

Against this broad background, the literature addressing solely the forest tax and tax policy implemented by municipalities in its scope looks rather modest. It can be assumed that the reason lies in its low fiscal efficiency and minor importance in the structure of municipal finance. The authors of these few studies discuss the issues of forest tax legal structure (Potocki, 2016) and its importance in the municipal financing structure (Milewska, 2017; Polna 2018).

The above-mentioned studies highlight great significance of these problems, but also the evident scarcity of research in this area and the need to arouse greater interest of Polish scientists in the issues related to local taxes. As Felis (2018) points out, “multidimensional research addressing local taxes will bring us closer towards defining the normative model of the local tax system (collection), extremely important for the local policy and the local socio-economic development”.

3. Methods

The study is divided into two main parts, resulting directly from the purpose of the article. In terms of the first of them, concerning the legal structure of forest tax, the realisation of the adopted goal required using the method for analysing legal acts referring to the discussed problem. In the second part, covering the importance of tax in municipal finance and the scale of the implemented tax policy, the statistical methods of data analysis were used, predominantly basic descriptive statistics of the variables under study. In order to classify municipalities in accordance with the selected criteria, a taxonomic method of grouping objects (k-means method) was also applied. The reports on the implementation of local self-government budgets published by the Ministry of Finance (2014–2020) and the data provided by the Local Data Bank of the Statistics Poland (2020) were the source of figures necessary to conduct the respective analyses. The research timeframe, in the empirical part, refers to the years 2013–2019, whereas the subjective scope covers all municipalities (including cities with county rights) functioning in Poland in the analysed period.

4. The construction of forest tax in Poland

Forest tax was introduced in the Polish public finance system on January 1st, 1992. Originally, its structure was specified in Chapter 9 (Articles 60–66) of the *Act on forest* (1991). At the beginning of 2003, a separate *Act on forest tax* (2020) entered into force, which changed the structure of forest tax to a large extent and adjusted it to the provisions on taxation of other real estate, in connection with the amendments to the *Act on agricultural tax* (1984) and the *Act on local taxes and fees* (1991) (which regulated the property tax). The currently binding Act has been amended many times, but in most cases these changes did not have any significant impact on the tax structure and the fiscal powers held by municipalities.

The Act provides that forests are the subject of taxation, i.e. forest land classified as such in the register of land and buildings, with the exception of forests used for economic activity other than forestry activities. The subjects of the tax are as follows: natural persons, legal persons, organizational units, including companies without corporate status being: forest owners, owners of self-owned forests, perpetual forest users, owners of the forests constituting the property of the State Treasury or of the local self-government units. The forest area presented in hectares and resulting from the records in the land and buildings register constitutes the tax basis. Therefore, the legislator resigned from the previously used, complicated system of conversion hectares, which resulted in a great simplification comparing to the previous regulations on the tax base.

The forest tax rate is the monetary equivalent of 0.22 m³ of timber per 1 ha of forest, calculated in accordance with the average selling price of timber obtained by forest districts for the first three quarters of the year preced-

ing the tax year, determined on the basis of a communication by the President of the Statistics Poland. In the case of protection forests and the forests included in nature reserves and national parks, the rate is reduced by 50%. An important entitlement of the municipalities, which allows them to conduct their own tax policy to a limited extent, is the possibility of reducing, following a resolution of the municipal council, the amount constituting the average selling price of timber, adopted as the basis for calculating forest tax in the municipality. Thus, the municipality has an indirect influence on the tax rate.

The Act also provides for a number of tax exemptions of both objective and subjective nature. The first of them refers to forests with tree stands up to 40 years old, the forests individually entered in the register of monuments and ecological areas. In turn, the catalogue of tax-exempt entities originally listed 5 groups of entities (universities, schools and educational institutions, The Polish Academy of Sciences institutions, entities running sheltered employment or professional activity establishments, research and development units) and in the following years another 4 were added (entrepreneurs with the research and development centre status, National Real Estate Resources, federations of entities within the higher education and science system, as well as the Łukasiewicz Centre and the institutes operating within the Łukasiewicz Research Network).

An important provision shaping the financial independence of municipalities is the possibility of the municipal council to introduce, by way of a resolution, also other exemptions than those specified in the Act, however, of a subjective nature alone. According to the constitutional provision (*Constitution...*, 1997, Art. 217) subjective exemptions may take place exclusively on the basis of the Act.

The remaining provisions of the Act concern the moment of establishing and expiry of the tax obligation, the obligations related to the submission of tax declarations and information on forests as well as tax payment deadlines. To a large extent, the solutions in these areas duplicate the previous provisions of the *Act on forest* (1991).

Additional fiscal powers are vested in the municipal executive body (head of the municipality, mayor or city president), which results from the fact that he/she performs the function of the tax authority regarding the forest tax. Pursuant to the *Tax ordinance* (1997, Art. 67a), the tax authority has powers consisting in the possibility of releasing the payer from the obligation to pay tax, deferring the tax payment deadline or dividing it into instalments, postponing or spreading the payment of tax arrears into instalments including the interest for delayed payment, cancellation of all or part of tax arrears, the interest for late payment or the prolongation fee. The application of these instruments is performed at the taxpayer's request and the general method of determining the conditions for their application, such as an important interest of the taxpayer or the public interest, offers an extensive freedom in making discretionary decisions. According to many interpretations and decisions issued by adminis-

trative courts, the use of these tools should be justified only in random cases, independent of the taxpayer's behaviour (Gomułowicz & Małecki, 2013, p. 362).

5. The importance of forest tax in the structure of municipal financing in Poland

In the catalogue of financing sources for the local self-government units, forest tax is present only in the structure of municipal revenues (also including cities with county rights which, in the political system sense, represent municipalities), that remain the only beneficiaries of these revenues. The revenues collected on this account are included in public statistics and budget reporting as tax revenues, and in a broader sense — in the municipal own revenues.

The importance of forest tax in municipal finance, in the analysed period of 2013–2019 is insignificant. Based on aggregated data for the entire sector, it can be noticed that in 2019 the discussed tax was responsible for slightly less than PLN 300 million, which amounts to 0.39% of tax revenues (including also shares in PIT and CIT), 0.26% of own and as little as 0.13% of total revenues (Table 1). Similar correlations were also recorded in the previous years showing that, throughout the analysed period, tax revenues in all municipalities amounted to PLN 2.09 billion, which accounted for 0.15% of their total revenue, 0.29% of their own revenue and 0.43% of their tax revenues.

The analysis of descriptive statistics shows a large diversification in the importance of forest tax in the municipal sector. Its highest share in tax revenues at the level of 32% (11.8% of total revenues) was recorded in 2016 in Lutowska municipality, and when taking into account the aggregated data for the years 2013–2019, this indicator was the highest in Płaska municipality (25.5 %) (Table 2). High share levels (above 10%) for the entire period were recorded in 35 municipalities. On the other hand, in sixteen municipalities, in none of the analysed years, were the revenues from forest tax collected, so the minimum recorded level of their share in tax revenues was 0%. The median value of the respective share was 0.9%, while the values of the first and third quartiles were 0.9% and 0.2%, respectively. It is worth noting that the standard deviation of the share (2.3%) exceeds its arithmetic mean (1.6%), which also confirms the large diversification (coefficient of variation over 143%) of the examined feature. These statistics did not change much in each of the analysed years.

The substantive analysis covering the legal structure of forest tax leads to the conclusion that the diversification in the amount of tax revenues and its importance in the structure of financing may primarily result from:

- diversification of the tax base, i.e. the area of forests within the municipality and their structure, considered from the perspective of statutory exemptions,
- the scope of using tax policy tools by municipalities, affecting the level of tax revenues.

The impact of the first of these factors is quite obvious, as the forest area influences directly the amount of forest tax revenues. In order to demonstrate

the significance of this relationship, Pearson's linear correlation coefficients were calculated between the amount of revenues from forest tax and the forest area in municipalities. For the entire analysed period, the correlation coefficient was 0.98, which indicates an almost total dependence (Table 3). A similarly high correlation occurred in each of the years analysed separately. The absence of full dependence in this case indicates a slight dependence of tax revenues on other structural elements of the tax affecting its amount, i.e. the tax rate and tax exemptions, both statutory and introduced by a resolution of the municipal council.

As a result of identifying such a high degree of dependence between the forest area and the level of forest tax revenues, the question arises whether it affects the importance of this tax in the municipal finance, measured by the share of tax revenues in own revenues. In this case, the calculated correlation coefficient of aggregate data for the entire period was 0.67 which, in accordance with the norms usually adopted in statistical analyses, indicates a moderate, close to significant relationship (Ostasiewicz et al., 1999, p. 276). Similar correlations were also observed in each of the examined years. The explanation for this lower degree of dependence is the low, and frequently just marginal, share of forest tax in the structure of own revenues, which means that this share is shaped, to a greater extent, by other financing sources, influencing own revenues in a larger scale.

The structure of own revenues is determined by many factors of a demographic, social, infrastructural, economic as well as spatial, environmental and natural character. The latter group has a direct impact on the amount and structure of revenues and also on other determinants of own revenues. For example, the high share of forests in the municipal area affects directly the fiscal efficiency of the forest tax, but also reduces the tax base and the efficiency of other taxes (agricultural, real estate tax) relating to other categories of real estate. It may also have an indirect negative impact on the economic activity in a given area, the location of enterprises (lower revenues, e.g., from CIT, tax on civil law transactions, tax on means of transport) or population density (negative impact on revenues, e.g., from PIT, inheritance tax and donations, etc.).

Therefore, a hypothesis can be put forward that it is the share of forests in the total area of the municipality (the so-called forest cover) rather than the absolute forest area, which is the factor that significantly influences the forest tax in the structure of municipal financing. In order to verify this hypothesis, the correlation coefficients between the municipal forest cover indicators and the share of forest tax in their financing were calculated. The obtained coefficients, at the level of 0.57–0.61, show a positive relationship, however, of moderate significance. The forest cover indicator is highly correlated with the absolute revenues from forest tax (correlation coefficients at the level of 0.69–0.73, which means a significant relationship). Therefore, the hypothesis can be considered true, however, at the same time this analysis confirms an

extensive influence of other factors in shaping own revenues on the importance of forest tax in municipal finance.

6. Municipal tax policy in terms of the forest tax

As the analysis of the forest tax legal structure shows, using fiscal power tools in the currently binding legal order may only reduce tax revenues collected by municipalities. The analysis of municipal tax policy can therefore be carried out from the perspective of these fiscal effects resulting from using fiscal power tools.

The fiscal effects of municipal tax policy in terms of forest tax throughout the analysed period amounted to PLN 15.8 million, with annual levels ranging from PLN 1.9 (in 2014) to PLN 2.6 million (in 2016). The individual instruments of fiscal power brought about different fiscal effects. The most important one was the power to reduce the price of timber in order to determine the tax rate. Financial effects in the form of lost revenues on this account ranged from PLN 1.1 million in 2019 to PLN 1.8 million in 2015, and in the entire period of 2013–2019 amounted to PLN 10 million, which accounted for 63.7% revenues from using all instruments (Table 4). The importance of tax exemptions and cancellations of tax arrears was much lower (share of 22.9% and 12.3%, respectively), however, an upward trend was noticeable in the first category and a downward tendency in the second one. In turn, the share of the second group of tools from the *Tax ordinance* (1997) (spreading into instalments and deferring the payment deadline) was marginal in this respect (1.1%).

The importance of tax policy tools in shaping the forest tax revenues can be measured by the relationship of the fiscal effects resulting from this policy and the “potential revenues” from forest tax (PFT). This category is understood as the actual revenues increased by the fiscal effects of the tax policy. Due to the simple structure of the forest tax, it can be identified with the maximum fiscal efficiency of the tax in a particular municipality. Therefore, this category indicates the expected tax revenues if the municipalities did not take advantage of any fiscal power tool that would reduce these revenues. The amount of potential revenues depends solely on the tax base, i.e. the area of forests and their structure, considered from the perspective of the applied tax rate (either full or 50%) and the statutory exemptions.

The analysed relationship for the entire period shows that the municipal fiscal power reduced the potential forest tax revenues by only 0.88%. In the period under study a downward tendency of this indicator can be observed from the level of 1.1% in 2013 down to 0.63% in 2019. This trend was primarily influenced by the power to reduce the price of timber for tax purposes, which contributed to a decline in tax revenues by 0.53%. Non-statutory exemptions lowered tax revenues by 0.19% and the cancellation of tax arrears by 0.1% of the actual revenues.

The general conclusion about the minor importance of tax policy in shaping forest tax revenues, which can be drawn based on aggregated data for the entire sector, does not have to apply to all analysed entities. Therefore, the question arises whether there are any municipalities where tax policy is of greater importance and to what extent it affects tax revenues.

In order to answer this question, the descriptive statistics of the entire group were calculated regarding the fiscal effects relationship of municipal tax policy and the potential revenues from forest tax (Table 5). Some of them (range, standard deviation, coefficient of variation) of the analysed relationship suggest a large diversification of the municipal tax policy, however, it should be emphasized that the distribution of this feature is a strong right-hand asymmetry (skewness coefficient is 49.5). This means that most of the cases reach the indicator value below the median value and the average value for the entire analysed group.

The modal value equals 0% and is present in the data for the entire period in 572 cases, which means that such a number of municipalities do not use any tools of fiscal power in relation to forest tax (of which 16 municipalities also do not receive any revenues from this tax). The same modal value remains for each of the examined years, however, the number of cases is even greater (from 1040 up to 1354 cases) and shows an upward trend. In this respect, the opposite extreme groups the municipalities which tax policy reduces forest tax revenues to almost zero and results in the relationship between the fiscal effects of such a policy against the potential tax revenues close to 100%.

The quantile analysis for the data covering the period 2013–2019 shows that in 25% of units, the reduction in potential forest tax revenues due to the application of fiscal power tools did not exceed 0.001% (quartile 1) of their potential value, in 50% of units — 0.029% (median) revenues and in 75% of municipalities — 0.233% of revenues (quartile 3). More detailed conclusions can be drawn from the analysis of percentiles. It shows that only in 12% of units such reduction exceeded 1% (88th percentile), and in the case of 4% municipalities it was greater than 9% (96th percentile). The value of the following percentiles is increasing significantly, so that the value of the 99th percentile indicates that in 1% of municipalities (25 units) the scale of revenues reduction exceeds 33.4% of the actual revenues. The indicator takes the highest value in Lubin municipality (99.9%). Such percentile values confirm a strong right-hand asymmetry of the variable distribution. The same conclusions can be drawn from annual analyses, but the right-skewness of the distribution is even greater.

The analysis of budgetary data, which identified the diversity of tax importance in terms of financing structure and the application of fiscal power, raises the question about the relationship between these two features. A high positive relationship would indicate a negative impact of the forest tax policy on broader income categories (e.g. total tax revenues). However, the analysis of the correlation between these two features for the entire municipal sector does not show such a relationship.

A question arises as to how the indicated features are shaped in the municipalities divided into homogeneous groups regarding these features. The grouping was carried out using the taxonomic, non-hierarchical cluster analysis method, i.e. the k-means method based on the following variables:

- the relationship of tax policy effects in terms of the forest tax against the potential revenues from the forest tax in the entire period 2012–2018 (TP/PFT),
- the share of potential revenues from the forest tax in tax revenues (PFT/TR).

As this method requires to determine the number of clusters in advance, the analysed municipalities were initially divided into between 3 and 10 clusters (groups) aiming to maximize the distances between them (the municipalities which did not show any revenues from the forest tax in the analysed period were excluded from the analysis). Ultimately, based on the substantive analysis of the variable mean values in individual groups, it was decided that the best and most clear division is limited to 5 clusters. The result of this classification is presented in Table 6.

The conducted cluster analysis shows that the local self-government sector is dominated by the municipalities implementing a passive tax policy and in which the revenue potential of forest tax is also small (group 1 — 2,151 entities). In 6 municipalities (group 4), tax policy remains, indeed, highly liberal, but at the same time they are characterized by a very low average revenue potential in terms of the forest tax. These municipalities in which the efficiency of forest tax is relatively high (group 3) follow the most passive tax policy, resigning from the application of the fiscal power instruments. In general, the greater the importance of the forest tax in terms of financing, the less liberal tax policy is implemented. Identifying the reasons for such a distribution of the analysed features requires more in-depth research. The preliminary conclusion which can be drawn from these data is a strongly fiscal approach in tax policy. The municipalities in which the importance of the analysed tax is relatively high are not willing to give up this revenue easily. In turn, in these municipalities where the efficiency of the discussed tax is marginal, this already small revenue is given up to a greater extent due to other, non-fiscal reasons, e.g. political or social ones.

It was not possible to distinguish the group of municipalities that would be characterized by both a highly liberal tax policy and a high revenue potential of the forest tax. Thus, it can be concluded that, in the period under study, the municipal tax policy in terms of the forest tax does not affect significantly the importance of forest tax in the structure of their financing.

7. Conclusions

The discussion presented in the article allows drawing several conclusions. The legal structure of the forest tax indicates that it is a direct property tax, and the real property is the subject of taxation. It is classified as a typical lo-

cal tax, since it is permanently, indefinitely and entirely related to the budget of municipalities which are vested with the fiscal power in shaping its structure. It should be emphasized that it is small and limited only to the possibility of lowering the average price of timber, which is the basis for determining the tax rate, and the possibility of introducing non-statutory objective exemptions. Establishing the head of municipality, mayor or city president of as the tax authority should be approached positively, which gives additional competences in the field of granting reliefs based on the *Tax ordinance* (1997). The legal structure of the forest tax has been legally relatively stable since 2003, which should be assessed positively from the perspective of the tax stability principle known from the theory of finance.

Comparing to other revenue categories, the tax fiscal efficiency and its importance in the financing structure of municipalities are small (approx. 0.15% of total revenue). They depend directly on the amount of tax base, i.e. the area of forests being the taxable base, and their structure considered in terms of the statutory exemptions and the method of determining the tax rate.

The municipal tax policy in the field of forest tax is characterized by a very small activity. In the years 2013–2019, 570 municipalities, i.e. 23% of their total number, did not use any fiscal power tool, and only a few reduced their revenues significantly. The loss of forest tax revenues in the entire sector amounted to PLN 15.8 million, which was only 0.84% of their potential value. The instrument for reducing the price of timber, which influences the tax rate, was of the greatest importance in tax policy. The *Tax ordinance* (1997) tools, on the other hand, are of the least importance, which should be assessed positively due to the discretionary and sometimes questionable mode of their application.

The results of the conducted classification covering municipalities allowed detecting the regularity consisting in the presence of greater activity in the tax policy implemented by the municipalities characterised by a lower potential tax efficiency. The municipalities where the importance of this tax is relatively higher are not willing to give up this revenue. It proves the general fiscal approach to the tax policy in terms of the forest tax. An additional conclusion resulting from the conducted analysis is the marginal impact of the municipal tax policy on the forest tax importance in the structure of their financing.

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Appendix

Table 1.
Revenues from forest tax in the structure of revenues collected by municipalities and cities with county rights in the years 2013–2019

Specification	2013	2014	2015	2016	2017	2018	2019	2013–2019
	billion PLN							
total revenues (ToR)	144.26	152.81	158.23	176.21	189.72	206.93	229.06	1,396.87
own revenues (OR)	78.60	84.60	88.35	91.00	96.39	104.94	113.54	731.37
tax revenues (TR)	50.55	53.61	56.60	60.14	64.81	70.87	76.21	480.74
forest tax revenues (FT)	0.23	0.21	0.23	0.30	0.30	0.30	0.30	2.09
	%							
FT/ToR	0.16	0.14	0.15	0.17	0.16	0.15	0.13	0.15
FT/OR	0.29	0.25	0.26	0.33	0.31	0.29	0.26	0.29
FT/TR	0.45	0.39	0.41	0.49	0.46	0.43	0.39	0.43

Source: Own preparation based on Ministry of Finance (2014–2020).

Table 2.
Descriptive statistics for the share of forest tax in municipal tax revenues in the years 2012–2018 (%)

Specification	2012	2013	2014	2015	2016	2017	2018	2012–2018
max.	28.53	22.75	22.72	32.05	29.60	26.20	26.57	25.51
min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
quartile 1	0.23	0.20	0.21	0.27	0.25	0.24	0.21	0.24
median	0.88	0.77	0.79	0.98	0.91	0.87	0.78	0.86
quartile 3	2.26	1.95	2.02	2.38	2.22	2.09	1.88	2.08
arithmetic mean	1.72	1.49	1.54	1.84	1.71	1.61	1.48	1.61
stand. deviation	2.46	2.13	2.17	2.67	2.52	2.32	2.21	2.32

Source: Own preparation based on Ministry of Finance (2014–2020).

Table 3.
Pearson's linear correlation coefficients between the selected features for municipalities in the years 2013–2019

Correlation relationship between:	2013	2014	2015	2016	2017	2018	2019	2013–2019
the area of forests and forest tax revenues	0.97	0.97	0.97	0.99	0.99	0.99	0.99	0.98
the area of forests and the share of forest tax revenues in own revenues	0.64	0.65	0.65	0.67	0.67	0.67	0.66	0.67
the forest cover indicator and the share of forest tax revenues in own revenues	0.57	0.58	0.58	0.61	0.60	0.61	0.60	0.60
the forest cover indicator and the forest tax revenues	0.69	0.70	0.70	0.73	0.73	0.74	0.74	0.72

Source: Own preparation based on Statistics Poland: Local Data Bank (2020).



Table 4.
Fiscal consequences of using fiscal power instruments (TP) by municipalities in terms of the forest tax in the years 2013–2019

Specification	2013	2014	2015	2016	2017	2018	2019	2013–2019
million PLN								
tax rate reduction	1.63	1.09	1.79	1.46	1.45	1.53	1.07	10.03
tax reliefs and exemptions	0.44	0.41	0.49	0.50	0.58	0.55	0.63	3.61
cancellation of tax arrears	0.38	0.35	0.31	0.25	0.21	0.26	0.18	1.95
spreading into instalments, deferring the deadline	0.03	0.02	0.04	0.04	0.01	0.02	0.01	0.17
total	2.48	1.88	2.63	2.25	2.26	2.36	1.90	15.76
in relation to potential revenues from forest tax — TP/PFT (%)								
tax rate reduction	0.71	0.52	0.77	0.49	0.49	0.50	0.36	0.53
tax reliefs and exemptions	0.19	0.19	0.21	0.17	0.19	0.18	0.21	0.19
cancellation of tax arrears	0.17	0.17	0.13	0.08	0.07	0.09	0.06	0.10
spreading into instalments, deferring the deadline	0.01	0.01	0.02	0.01	0.00	0.01	0.00	0.01
total	1.08	0.89	1.13	0.75	0.76	0.77	0.63	0.84

Source: Own preparation based on Ministry of Finance (2014–2020).

Table 5.
Descriptive statistics of the fiscal effects relationships referring to the application of fiscal power instruments to the potential revenues from forest tax (PP/PFT) in municipalities in the years 2013–2019 (%)

Specification	2013	2014	2015	2016	2017	2018	2019	2013–2019
max.	99.98	99.98	99.98	99.98	99.98	99.98	99.98	99.88
min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
quartile 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
median	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.03
quartile 3	0.25	0.25	0.21	0.13	0.10	0.08	0.06	0.23
modal value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
number of modal value cases	1040	1057	1091	1178	1251	1265	1354	572
88th percentile	1.09	1.00	0.90	0.58	0.49	0.53	0.36	0.98
96th percentile	11.34	7.11	10.33	9.74	7.40	8.52	4.12	8.97
99th percentile	44.69	38.02	42.23	37.61	36.50	32.79	26.97	34.25

Source: Own preparation based on Ministry of Finance (2014–2020).

Table 6.
The result of the grouping of municipalities and the average level of variables in each group

Group	1	2	3	4	5
number of municipalities	2151	28	192	6	86
TP/PFT (%)	0.29	39.25	0.20	83.49	13.66
PFT/TR (%)	1.11	1.41	7.67	0.40	1.76

Source: Own preparation.

