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EVALUATION OF REVENUE FORECAST ACCURACY OF VOIVODSHIP SELF-GOVERNMENT UNITS

Summary: In recent years' local authorities try to go beyond one-year budgeting and capital expenditure planning for a longer-term focus. These demands are met by multi--year financial forecast which was introduced by the new Public Finance Act as a new planning tool in local government units. The purpose of the article is to describe main factors which determine effective transformation of multiannual financial forecast to the tasks realized in a current financial year. The considerations given to this issue, based on theoretical considerations on the role of the MFF in financial planning in local self--governments units, focus mainly on the analysis using statistical methods to evaluate revenue forecasts accuracy of voivodship self-government units in Poland.

Keywords: local self-government units, financial planning, multiannual financial forecast, revenues of voivodship self-government units.

Introduction

The obligation introduced by the Public Finance Act of 27 August 2009 (Journal of Laws No 157 item 1240, as amended) to prepare multiannual financial forecast (MFF) significantly changes the nature of financial planning in local self-government units. The assumption was that the forecast to be produced was intended as a tool to enable the estimation of basic parameters of future budgets and thus provide the basis for a long-term assessment of unit's financial potential. The mandatory nature of the multiannual financial forecast and the position given to it by the legislative solutions calls for a particular attention to be paid to the role the aforementioned document plays in improving the effectiveness with which local self-government units employ their financial sources.

The aim of this paper is to analyse revenues of voivodship self-government units, particularly taking into consideration the accuracy of the forecasts presented within the framework of the multiannual financial forecast generated by the individual units. The considerations given to this issue, based on theoretical considerations on the role of the MFF in financial planning in local self-governments units, focus mainly on the analysis using statistical methods to evaluate revenue forecasts accuracy of voivodship self-government units in Poland on the basis of the data for the year 2013.

1. Legal and financial rules for generating multiannual financial forecast in local self-government units

The solutions for generating the multiannual financial forecast in a local self-government unit came in the wake of the Multiannual State Financial Plan created at central level and in place since 2011, and as a consequence of expanding previous regulations on drawing up multiannual investment plans [Kotlińska, 2011, s. 4]. Among the assumed advantages related to the development of the MFF the following are named:

a) pursuing a more rational management of public funds,
b) enhancing the credibility, transparency and predictability of self-government finance management,
c) adjusting financial planning in LGUs to the needs related to acquiring and efficiently using EU funds.

The resolution on multiannual financial forecast is adopted on the basis of the following regulations:

- art. 18 section 2 point 15, of the Act on Municipality Self-Government of 8 March 1990 (Journal of Laws 2001 No 142 item 1591, as amended),
- art. 12 point 11 of the Act on County Self-Government of 5 June 1998 (Journal of Laws 2001 No 142 item 1592, as amended),
- art. 18 section 20 of the Act on Voivodship Self-Government of 5 June 1998 (Journal of Laws 2001 No 142 item 1590, as amended),
- art. 226, art. 227, art. 228, art. 229 and art. 230 section 6 of the Public Finance Act of 27 August 2009 (Journal of Laws No 157 item 1240, as amended), art. 121 section 8,
- art. 122 section 2 and 3 of the Act of 27 August 2009; regulations implementing the Public Finance Act (Journal of Laws No 157 item 1241, as amended).

The requirements the multiannual financial forecast must meet including the content that is required are set out in articles 226-232 of the Public Finance Act. In the light of the legislative provisions, the following parameters should be specified in the multiannual financial forecast for the period of one budget year and for at least three subsequent years:

- current revenues and current expenditures of the local self-government unit budget, including servicing of debt, guarantees and sureties;
- property revenues, including income from the sale of property as well as property expenditure of the local self-government unit budget;
- the outturn of local self-government unit budget;
- surplus allocation or the method of financing budget deficit;
- income and outgoings of the local government unit budget, taking into account debt incurred and debt planned to be incurred;
- debt amount of the local self-government unit and the method of funding debt payment;
- clarification of adopted values.

The given list should be treated as the minimum set of information that is to be included in the MFF, which leaves rather broad possibilities to local self-government bodies in terms of its clarification or expansion. However, what remains unchanged is the basic assumption that the document should provide for realistic forecast which will then be applied in management and creditworthiness assessment, and consequently in determining investment potential and programming the basic size of future budgets [Szczubiał, 2010, s. 24].

An important part of the MFF is debt calculation (made for the term the commitment has been made and is intended to be made) which replaces debt forecast that used to be prepared in the form of additional information to the draft budget resolution. This issue is particularly relevant in the light of the changes of debt limits that have been in force since 2014 (Public Finance Act of 27 August 2009). In this situation, under the forecasts generated in 2011-2013, a certain dualism was recorded consisting in estimating debt ratios pursuant to article 169 and 170 of the Public Finance Act of 30 June 2005 (Journal of Laws No 249 item 2104, as amended) and concurrently in taking into account individual debt ratios; however, in the years 2011-2013 the ratios were only for information purposes, having no impact on the budget resolutions structure.

The implementing body is responsible for preparing the multiannual financial forecast also having the initiative to introduce possible changes to the adopted content. The MFF draft resolution is then presented to the decision-making body of the local self-government unit and submitted to the regional Audit Office for

its opinion not later than the draft budget resolution that is until 15 November of the year concerned. Thus the multiannual financial forecast is adopted by the resolution of the decision-making body, which is separate from the budget resolution.

2. Revenue sources of voivodship self-government units

In the light of the presented situation regarding the essence and relevance of the multiannual financial forecast for financial planning in local self-government units the special role of the future revenues forecast should be emphasized. Realistic and credible estimation of potential revenues over subsequent years defines the possibilities with respect to the performance of local and regional tasks and thus constitutes the absolute starting point for a long-term planning in a given self-government unit. Within the framework of this paper, the consideration will, for the most part, be given to revenue forecast in self-government units of voivodships. Although this issue has been widely discussed in the literature concerned with the local government finance, yet considering the aim of the paper and the method of presenting the research results it appears indispensable to at least signal basic revenue sources.

Budget revenues of voivodship self-government units, not unlike those of powiats and gminas, are based on three basic sources:

1) Own revenues:
   a) 1,60% share in revenues from personal income tax from taxpayers of this tax residing in the voivodship,
   b) 14,75% share in revenues from corporate income tax from taxpayers of this tax having their registered office in the voivodship,
   c) revenues from the voivodship's property,
   d) the remaining revenues include revenues collected by voivodship budgetary units and payments from voivodship budgetary entities; legacies, bequest and donations to the voivodship; income from pecuniary penalties and fines set out in separate regulations; 5% of revenues received in favor of the state budget in connection with implementing government administration tasks as well as other tasks requested by statutes, unless provided otherwise; interests on loans granted by voivodship, unless provided otherwise; interests on overdue amounts receivable in the area of voivodship's revenue; interests on funds deposited in voivodship's bank accounts, unless provided otherwise; subsidies from the budgets of other local self-government units; other revenues due to voivodship under separate regulations.

2) General subvention which includes:
   a) Equalization component consisting of the basic and supplementary amount. Voivodships receive the basic amount of the equalization component of the general subvention if the tax income ratio per capita in the voivodship is below the state average. The supplementary amount of the equalization component is granted to the voivodships with the population of fewer than 3 million.
   b) Educational component which is divided among individual local self-government units on the basis of an algorithm that is determined annually in the Regulation of the Minister of National Education concerning the method of dividing the educational component of the general subvention for local self-government units.
   c) Regional component determined as the total amount of payments made by voivodships where the tax income ratio per capita exceeded 120% of the state average. The collected amount is divided among the voivodships, taking into account the criteria for unemployment rate, voivodship road surface, GDP, ongoing expenditures on regional carriage of passengers by rail and planned revenues from the equalization component and the amounts which are part of the regional component of the general subvention, reduced by the planned payment into the budget.
3) Targeted subsidies from the state budget for the tasks within the scope of the government administration performed by the voivodship under separate regulations or for funding voivodship's own tasks.

From the point of view of the information needs which are taken into account in the multiannual financial forecast total revenues of self-government units of voivodships can be divided into:
a) Current revenues comprising revenues from the share in corporate and personal income tax, general subvention and targeted subsidies.
b) Property revenues comprising income from property sale and from subsidies and investment funds.

Within the framework of the aforementioned primary sources of budgetary revenues of voivodship self-government units there are substantial differences with regard to the possibilities and feasibility of forecasting the revenues collected from different sources over subsequent years. The analysis of the accuracy of the forecasts in the multiannual planning constitutes therefore one of the critical requirements for a rational financial management of a particular unit.

3. Research method employed

An exceptionally important stage of the forecasting process is the forecast accuracy evaluation. The analysis and evaluation of the forecast accuracy are instrumental in choosing an appropriate forecast method for a particular forecast situation, in selecting the best available model. Ultimately they enable the measurement of the forecasting error size and the estimation of the degree of forecast uncertainty [Makridakis, Hibon, 1995]. Measuring the size of the forecasting errors also contributes to the modification and expansion of the forecasting methods employed in specific forecast situations as well as to the potential correction of the method used [Armstrong, Collopy, 1992].

The accuracy of the measurable variables of the forecast is evaluated by ex post errors, among these, absolute, relative, symmetric errors [Shcherbakov et al., 2013]. The literature recommends many forecast error measures with the research being also conducted on the properties of particular error measures [see e.g. Hyndman, Koehler, 2005; Shcherbakov et al., 2013; Makridakis, Hibon, 2000].

In view of the fact that the only available forecasts of the variables are those generated to meet the needs of local self-government units for a number of years and the realization of the forecasted variables is only for the year 2013, for the purpose of this paper, relative errors have been selected for the evaluation of the accuracy of individual forecast variables.

Relative percentage error (*PE*):

$$PE = \frac{y_t - f_t}{y_t} \cdot 100 \qquad (1)$$

where:

y_t – actual variable value at time t,

f_t – predicted variable value at time t.

Symmetric (adjusted) relative error (*sPE*):

$$sPE = \frac{y_t - f_t}{(y_t + f_t)/2} \cdot 100 \qquad (2)$$

formula designations as in (1).

In light of the fact that the only available data for evaluating the forecast accuracy pertains to the year 2013, the mean errors at the verification intervals will not be calculated and only forecasting errors in the variables in the objects under study will be calculated.

However, the cross-sectional data provides the opportunity to evaluate the mean errors in the variables in the described objects. Hence we see the modifications emerging in the *MAPE* (3) and *sMAPE* (4) formulas.

Mean absolute percentage error is given by the formula below:

$$MAPE = \frac{1}{k}\sum_{i=1}^{k}\left|\frac{y_{it}-f_{it}}{y_{it}}\right|\cdot 100 \qquad (3)$$

where:

y_{it} – actual variable value at time *t* in a *k*-th object,

f_{it} – predicted variable value at time *t* in the *k*-th object.

Symmetric (adjusted) mean absolute percentage error is given by the formula below:

$$sMAPE = \frac{1}{k}\sum_{i=1}^{k}\left|\frac{y_{it}-f_{it}}{(y_{it}+f_{it})/2}\right|\cdot 100 \qquad (4)$$

formula designations as in (3).

It should be noted that the *PE* and *MAPE* are non-normalized errors, whereas *sPE* and *sMAPE* are normalized errors on the interval respectively [-200%; 200%] and [0%; 200%]. Taking into account the symmetric errors (adjusted, although their name is contrary to their properties – see Koehler [2001]) is justified in that they are not sensitive to outliers resulting from small actual values of the predicted variable. Yet, they are sensitive to other outliers i.e. big errors in individual forecasts going beyond the interval of the mean **±3 standard deviations** [Zaluska, 2000].

4. The analysis of revenue sources of voivodship self-government units and the evaluation of the accuracy of their forecasting based on data for 2013

The conducted studies rest on a few basic assumptions:

- The number of the objects in question – sixteen voivodship self-government units.
- The object of the study − revenue forecasts of different self-government units at voivodship level.
- The scope of the information used – revenue forecasts and implementation in 2013.

The starting point for conducting the studies was establishing the level of the forecasted revenues in total as well as their structure in 2013:

Table 1. The structure of the forecasted revenues of voivodship self-government units in 2013

Specification	Total revenues (mln zł)	Current revenues		Property revenues	
		value (mln zł)	share (%)	value (mln zł)	share (%)
Dolnośląskie	1 779,3	1 098,4	61,73	680,9	38,27
Kujawsko-pomorskie	852,1	692,1	81,23	160,0	18,77
Lubelskie	1 255,5	671,8	53,51	583,7	46,49
Lubuskie	715,6	481,4	67,27	234,2	32,73
Łódzkie	856,3	641,6	74,93	214,7	25,07
Małopolskie	1 163,7	820,0	70,46	343,8	29,54
Mazowieckie	2 914,9	2 371,7	81,36	543,2	18,64
Opolskie	493,5	371,4	75,27	122,0	24,73
Podkarpackie	1 313,2	711,8	54,20	601,5	45,80
Podlaskie	632,4	368,5	58,27	263,9	41,73
Pomorskie	854,4	663,3	77,64	191,1	22,36
Śląskie	1 938,2	1 139,3	58,78	798,8	41,22
Świętokrzyskie	778,7	366,0	47,00	412,7	53,00
Warmińsko-mazurskie	1 052,7	495,2	47,04	557,5	52,96
Wielkopolskie	1 188,4	866,0	72,87	322,4	27,13
Zachodniopomorskie	841,0	545,6	64,87	295,4	35,13

Source: Own elaboration based on data from Ministry of Finance.

The presented forecasts regarding the revenues for the year 2013 show marked differences in the funds collected, which understandably is the result of different size area and revenue potential of individual voivodships. The disproportions in this respect do not yet reduce the applicability and comparability of information as seen from the perspective of the aim of this paper. What is however worth pointing out are the significant disparities regarding the structure of the forecasted revenues. The expected property revenues share exceeds 50% in some of the voivodships (świętokrzyskie and warmińsko-mazurskie), which with the very assumption makes for a very risky forecast, considering that the nature of this source of revenues is very incidental and rather difficult in terms of drawing its systematic prediction.

The primary tool for assessing the implementation of expected revenue is the accuracy evaluation of the revenues realized in total using the adjusted relative forecasting error.

Table 2. The adjusted relative forecasting error for total revenues of voivodship self-government units in 2013

Specification	Forecast	Implementation	Error
Dolnośląskie	1 779,3	1 626,4	-8,98%
Kujawsko-pomorskie	852,1	755,8	-11,97%
Lubelskie	1 255,5	1 000,0	-22,65%
Lubuskie	715,6	599,3	-17,70%
Łódzkie	856,3	751,4	-13,05%
Małopolskie	1 163,7	1 108,1	-4,90%
Mazowieckie	2 914,9	2 164,7	-29,54%
Opolskie	493,5	472,3	-4,37%
Podkarpackie	1 313,2	1 142,2	-13,93%
Podlaskie	632,4	572,8	-9,89%
Pomorskie	854,4	845,5	-1,05%
Śląskie	1 938,2	1 592,9	-19,56%
Świętokrzyskie	778,7	639,6	-19,62%
Warmińsko-mazurskie	1 052,7	886,7	-17,12%
Wielkopolskie	1 188,4	1 170,7	-1,50%
Zachodniopomorskie	841,0	792,3	-5,96%

Source: Own elaboration based on data from Ministry of Finance.

The calculations show that in each of the voivodships the level of the fore-casted revenues in total is overestimated compared to the actual implementation. The mean deviation reached 12%. The smallest forecasting error was recorded in pomorskie voivodship (-1%) and wielkopolskie voivodship (-1,5%). On the oth-er hand, clearly the biggest adjusted relative forecasting error was recorded for mazowieckie voivodship (-29,5%).
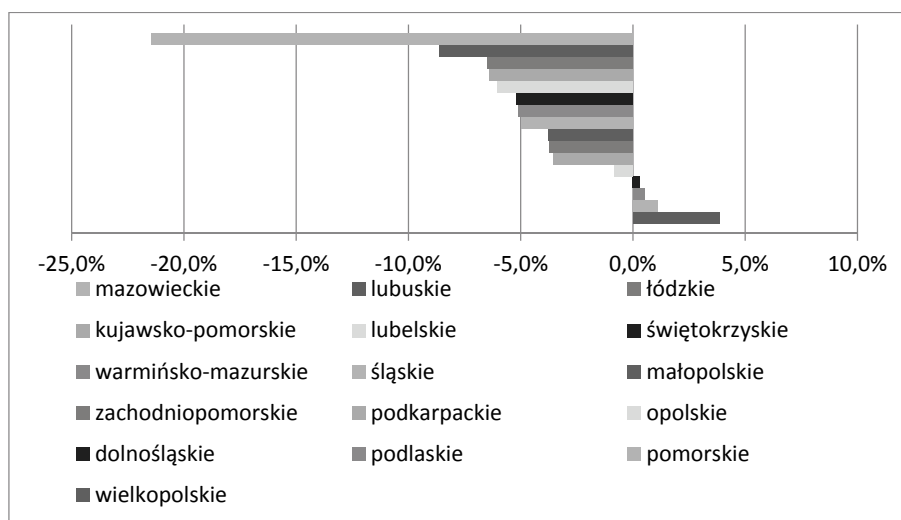
Fig. 1. Adjusted relative forecasting error for current revenues in the year 2013 (%)

Source: Own elaboration.

The overestimation of the forecast regarding the level of total revenues compared to the actual implementation in each of the voivodship under study is bad news for assessing the credibility and reliability of the generated forecasts. This finding induces one to pose a question as to the causes and nature of this situation. The starting point in this respect is the analysis of the accuracy of the generated forecast according to different revenue sources.

It is worth noting that in respect to current revenues in individual voivodships a relatively small forecasting errors were recorded varying around 10%, with the exception being mazowieckie voivodship where the error reached 21,5% because of a considerable overestimation of revenues from personal income tax share, exceeding as many as 300 million PLN. Considering the fact that this source of revenues is relatively easy to plan (its basis being the tax base of the voivodship's inhabitants) and there have been no significant changes introduced to the structure of this tax, the overestimation should be perceived as negative in terms of the quality of the generated forecast. In the remaining voivodships the situation appeared much better with some cases showing higher revenue implementation level than that of the forecast (in wielkopolskie voivodship it was higher by 3,9%). Analyzing current revenue sources according to the type, the smallest deviations between the forecast and implementation were recorded for the general subvention and the share in the revenues from corporate income tax.

Decidedly bigger deviations within the scope of the budgetary revenue realization of the voivodship self-government units refer to property revenues.
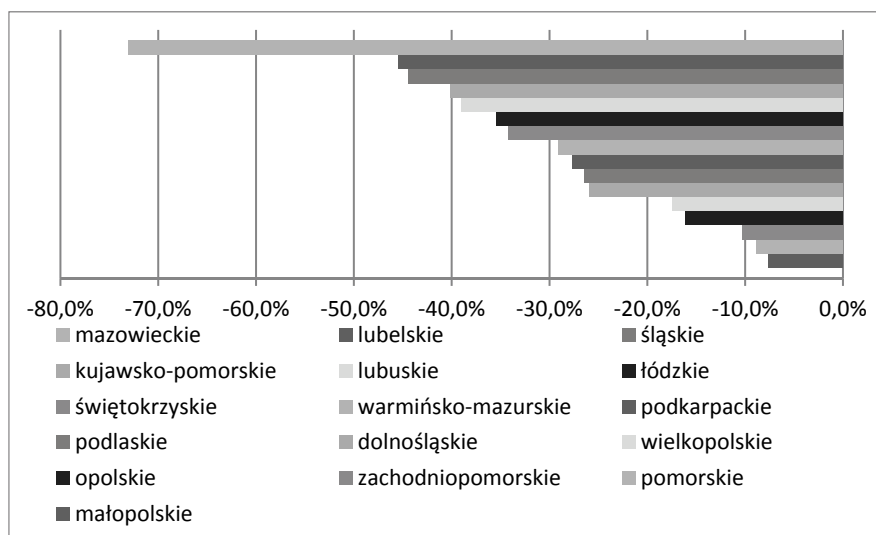

Fig. 2. Adjusted relative forecasting error for property revenues in the year 2013 (%)

Source: Own elaboration.

For this source of revenues, the overestimation was very high in each of the voivodship reaching on average 30%. The greatest discrepancies again were found in mazowieckie voivodship, yet the presence of significant deviations in the remaining units as well attests to considerable difficulties in providing a credible forecast for property revenues. This widespread tendency may also raise concern whether the forecast overestimation is not the outcome of an attempt to artificially increase the revenues in order to meet the statutory requirements set out in the Public Finance Act regarding the debt limit.

Summary

The presented considerations on multiannual financial forecasts produced by voivodship self-government units allow for formulating several important conclusions regarding the assessment of the applicability of the forecasts for the ongoing financial management of voivodship. It is worth notice that bigger deviations within the scope of the budgetary revenue realization of the voivodship self-government units refer to property revenues. On the other hand, the smallest deviations between the forecast and implementation were recorded for the general subvention and the share in the revenues from corporate income tax, which are relatively easier for preparing forecast.

However, the generated forecasts are characterized by a low degree of accuracy. This low accuracy comes predominantly from a considerable overestimation of the forecasted revenues. The reason for the widespread nature of this phenomenon may be twofold: on the one hand one should not forget the prosaic need of local authorities to artificially overstate the revenue forecast in order to demonstrate that the planned ratio of outstanding commitments by year will be within the statutory debt limits. It is yet undeniable that the low degree of forecast accuracy bodes negatively for the assessment of credibility and reliability of the produced forecasts. This further implies that it is necessary to have in-depth analysis of the methods employed in generating the forecast as to having them critically verified and developing appropriate solutions. All this will constitute the object of further examination by the authors of this paper.

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OCENA TRAFNOŚCI PROGNOZ DOCHODÓW JEDNOSTEK SAMORZĄDU WOJEWÓDZKIEGO

Streszczenie: Wprowadzony ustawą o finansach publicznych z 27 sierpnia 2009 roku (Dz.U. Nr 157 poz. 1240 z późn. zm.) obowiązek sporządzania wieloletniej prognozy finansowej (WPF) w istotny sposób zmienia charakter planowania w jednostkach samorządu terytorialnego. Opracowywana prognoza w założeniu miała się stać narzędziem umożliwiającym oszacowanie podstawowych parametrów przyszłych budżetów, a tym samym stanowić podstawę długookresowej oceny potencjału finansowego jednostki. Obligatoryjny charakter sporządzania wieloletniej prognozy finansowej oraz ranga nadana przez rozwiązania ustawowe każe zwrócić szczególną uwagę na rolę, jaką podany dokument odgrywa w zakresie poprawy efektywności wykorzystania środków finansowych przez jednostki samorządu terytorialnego. Celem artykułu jest analiza dochodów jednostek samorządów wojewódzkich ze szczególnym uwzględnieniem oceny trafności prognoz prezentowanych w ramach wieloletniej prognozy finansowej opracowanych przez poszczególne jednostki. Prowadzone w tym zakresie rozważania, bazując na teoretycznych rozważaniach dotyczących roli WPF w zakresie planowania finansowego w jednostkach samorządowych, koncentrują się w głównej mierze na analizie z zastosowaniem metod statystycznych trafności prognoz dochodów jednostek samorządu wojewódzkiego w Polsce na podstawie danych za 2013 rok.

Słowa kluczowe: jednostki samorządu terytorialnego, planowanie finansowe, wieloletnia prognoza finansowa, dochody jednostek samorządu województwa.