IMPROVEMENT OF THE QUALITY OF REVENUE CAPACITY FORECASTING IN INTERGOVERNMENTAL TRANSFER CALCULATION[1]

The government's ability to adequately assess the revenue potential of each budget in the process of transfer allocation is a prerequisite for a successful budget equalization – both vertical and horizontal. For vertical equalization this assessment allows the government to define the gap between the future level of revenues assigned to a particular territory and the forecasted level of expenditures delegated by the State to the local level. In the process of horizontal equalization, forecasting of the revenue potential of cities and rayons helps the government to define the directions of redistribution of public resources across the local budgets so that revenue capacities of richer communities can be used to make solidarity transfers to poorer communities.

The set of instruments for revenue forecasting should be used concurrently and independently of those mechanisms that the MoF uses to stimulate the revenue efforts of local governments (*one such mechanism is the coefficient of equalization denominated as 'alpha', whose use was discussed in the previous issue of the* Budget and Fiscal Review*, p. 43).*

On the other hand, the complexity of the task of adequate forecasting should reflect the need for a uniform and universal approach, i.e. the method should be both simple and efficient. The methodology for transfer calculation applied by the Ministry of Finance in the 2001 and 2002 budgets features a number of elements that achieve this goal. The existing formula for calculating forecasted revenues is not simple but it is, however, sufficiently universal to be applied to each of the local budgets. In addition, in developing the 2002 budget, the Ministry of Finance made serious efforts to improve the existing forecasting approach in order to protect those local budgets facing potential economic declines. This note proposes options for refining the formula that would allow the government to improve the quality of revenue capacity forecasting.

What is the Essence of the Current Approach and Its Major Drawbacks?

The principles for calculating local budgets' revenue capacity are determined by Article 98 of the Budget Code. This article states that this calculation for each community must be based on the population residing in the relevant territory and the forecasted amount of the revenue basket assigned to the budget in question. The forecasted amount of the revenue basket should be defined by applying a relative fiscal capacity index calculated on the basis of actual execution of the relevant budget over the last three budget periods.

Though provisions of the Budget Code prescribe the principles for measuring the revenue potential, none of them defines the concrete form of the formula for revenue forecasting. The approach applied by the Ministry of Finance when formulating the 2001 and 2002 budgets was approved in the form of Cabinet Resolutions adopted just before the submission of the budget to the parliament. According to this approach, when calculating transfers for all the cities and rayons, a relative revenue capacity index is calculated for each of the three years on the basis of data on actual execution of basket revenues for the relevant period. The forecasted amount of revenues for the next budget period is defined by way of multiplying the anticipated national average per capita revenues for the next year by the number of population

[1] By Kateryna Mainziouk.

of the relevant territory and the average relative fiscal capacity index of this territory for the last three years.

Is it appropriate to use the simple mean value of fiscal capacity index in this case? Figures 1a and 1b below help to think about this question in the context of the measured fiscal capacity of two cities of Ukraine. The first city selected, Kamianets-Podilsky (Khmelnytska oblast), is one of those communities where the relative fiscal capacity index over three years has been declining steadily (see Figure 1a).

Two Examples of Changes in the Relative Fiscal Capacity Index over 1998-2000

Figure 1a.
Kamianets-Podilsky

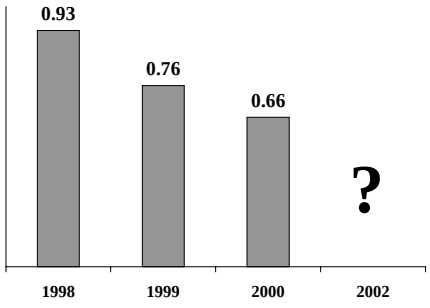
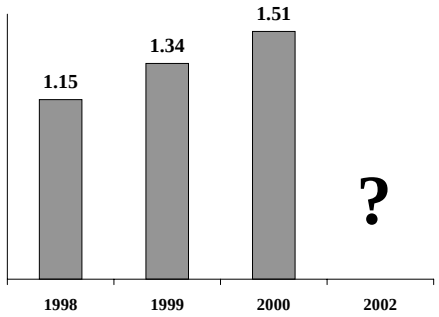


Figure 1b.
Mukacheve



What is the revenue forecast for this city for 2002 in applying the basic approach of the Ministry of Finance? Since it is based on the mean value of the index for 1998-2000, the value of revenues of this budget for the next period relative to other cities and rayons will be:

$$(0.93+0.76+0.66)/3 = 0.78.$$

A graphic illustration of this result is shown in Figure 2a. It shows that the calculated relative fiscal capacity index will be not only higher than the number for 2000 but also higher than the number for the year before that – 1999.

Results of Applying the Simple Average Value of the Relative Fiscal Capacity Index

Figure 2a.
Kamianets-Podilsky

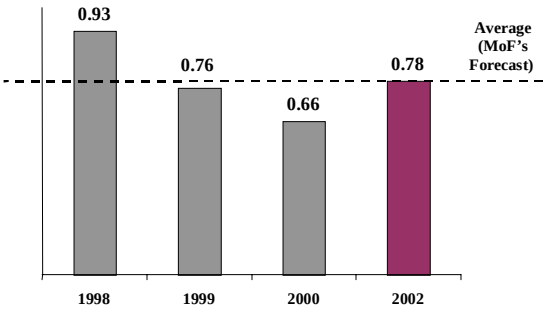
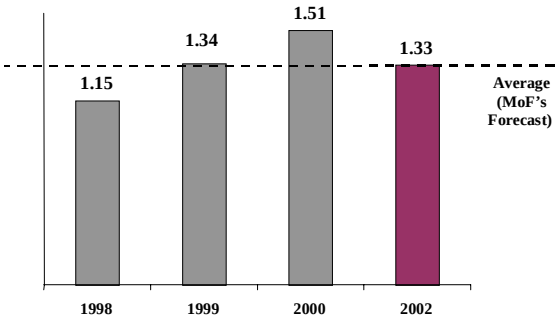


Figure 2b.
Mukacheve



For the city of Mukacheve (Zakarpatska oblast), the three years in question were rather successful (see Figure 1b). Even in 1998, the index for this city was at a higher than national average level (1.15), and in 2000 this index increased to 1.51. If the forecasted fiscal capacity index is calculated for Mukacheve based on simple mean, this index for 2002 is 1.33, which is even lower than in 1999 (see Figure 2b).

In order to improve the current approach, it is necessary to take into account, in one form or another, trends in the changes of relative fiscal capacity index of a city or rayon observed over the three years. Taking into consideration the trend allows us to forecast the further decline of revenues in 'depressive' budgets and the expected revenue growth in more economically active communities.

How to Take into Account the Trend of Revenue Change over Last Years?

Proposals of the Ministry of Finance

The draft 2002 budget submitted by the Cabinet of Ministers for the second reading features a new element dealing with the calculation of equalization transfers aimed at preventing situations like the Kamianets-Podilsky case. Forecasted revenue level for 2002 cannot exceed the actual level of basket revenue execution for 2000 by more than 65 percent. This revenue floor in the formula is captured by a new coefficient denominated as 'beta', which mechanically regulates the above-mentioned cases of 'depressive' behavior in per capita revenues.

But though the calculated revenues of 'depressive' cities and rayons can be easily adjusted mechanically by way of imposing some restrictive criteria, this approach cannot be considered an optimum way to resolve this problem for a number of reasons:

1. This approach is aimed at adjusting the consequences of the problem rather than at overcoming its causes. A mechanical restriction on the growth of revenue in particular cities fails to allow achieve the main goal – to assess adequately and take into account the real revenue potential of Ukrainian cities and rayons.
2. The choice of cities and rayons whose revenue forecasts are to be mechanically manipulated is arbitrary. The only possible way to make such an adjustment is by setting a discretionary ceiling (say, 170 or 165 percent) based on an arbitrarily chosen indicator (say, growth of revenues in calculations for 2002 relative to earlier years).
3. This approach ignores other budgets whose potential is also assessed inadequately as a result of the formula's drawbacks.

Alternative Approaches

One of the simplest forecasting methods that takes into account the trend of earlier changes in indexes is to estimate, based on existing observations (that is, indexes of earlier years), some curve which would best describe the existing trend and than extrapolate it to the next budget period. This curve may be selected with the help of a standard least squares method and, due to modern means for statistical processing of data, this selection may be carried out quickly.

Figures 3a and 3b show how this method can work in a real life. First, let us consider an example where the trend line based on the assumption that it is a straight one. The least-squares method defines the equation for such a line and extrapolate it to future periods. For Kamianetsk-Podilsky, the trend line will have the form of a steep gradient. When extrapolating this line, we will get a forecast of the value of the fiscal capacity index at the level of 0.51, a value much closer to the real state of affairs in this community. And vice versa, the straight line trend in the fiscal capacity index of the city of Mukacheve is upward and determines a higher level of the forecasted value for the next year than in the case of calculations based on a simple mean (Figure 3b).

Results of Applying Alternative Methods for the Relative Fiscal Capacity Index Forecasting: LINEAR TREND

Figure 3a.
Kamianets-Podilsky

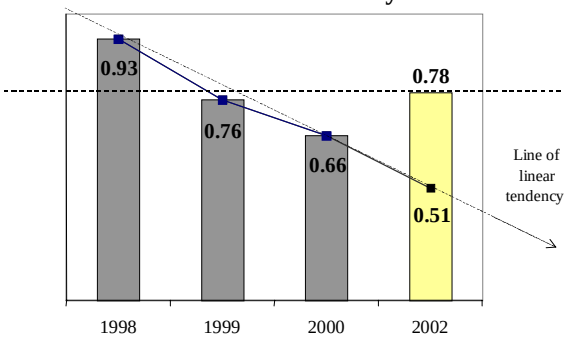
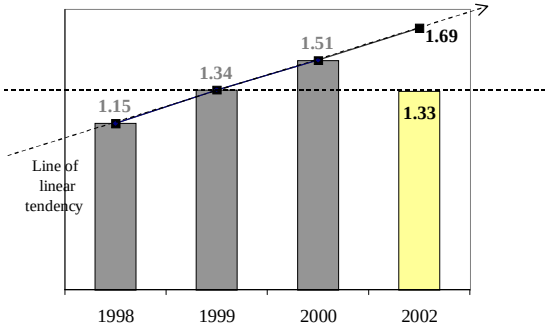


Figure 3b.
Mukacheve



However, the assumption about the form of the trend line may be more sophisticated than an ordinary straight line. For example, another approach would be based on a hypothesis that the trend line is best described by an exponential function; that is, a process where changes in numbers are not a constant but rather accelerate or decelerate with time. Figures 4a and 4b illustrate the process of forecasting based on this approach. They show that for Kamianets-Podilsky the application of the least squares method in defining a exponential trend leads to a conclusion that, though the fiscal capacity index of this city decreases, the rate of decrease tends to decelerate. Given this, it may be more reasonable to anticipate that the next year's fiscal capacity index will be lower than in earlier three years but higher than the value determined by way of linear extrapolation (0.51 versus 0.54).

Results of Applying Alternative Methods for the Relative Fiscal Capacity Index Forecasting: EXPONENTIAL DEVELOPMENT

Figure 4a.
Kamianets-Podilsky

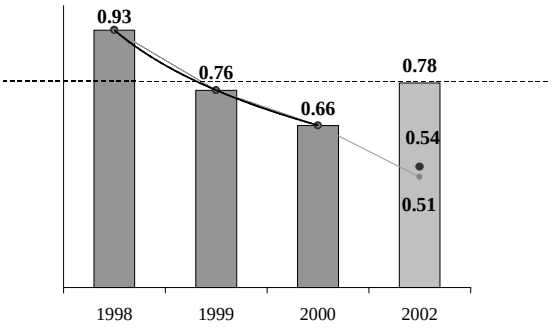
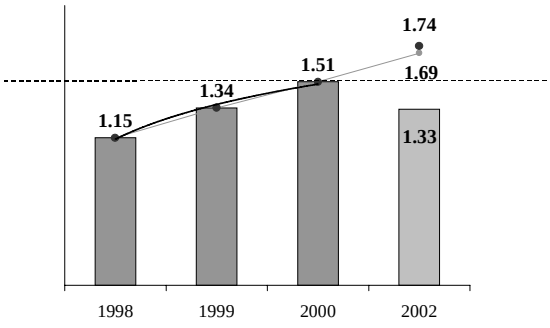


Figure 4b.
Mukacheve



On the other hand, the index of fiscal capacity of the city of Mukacheve over three years also increases at a decelerating rate. As a result, as suggested by Figure 4b, a more accurate forecast of the future fiscal capacity index is that its value will be equal to 1.69 rather than 1.74.

On page 37 of this issue of the *Fiscal and Budget Review*, there is a detailed analysis of estimated revenues of Ukrainian cities and rayons, which were used by the Ministry of Finance when formulating the draft 2002 budget. This analysis illustrates, among other things, the negative consequences of inadequate choice of the methods for forecasting the revenue capacity. Therefore, one of the most important tasks for 2003 is elaboration of more adequate methods. A wide discussion should take place when achieving this goal. Therefore, it is a high time to begin these efforts.

Application of the Least-squares Method for Defining a Trend Line

In economic forecasting, it is frequently needed to define the trend line on the basis of an existing series of values, i.e. the line that describes best the direction and form of development of some process. Obviously, any trend line is only a simplified drawing of the general trend and, hence, would differ from actual data. Conceptually, the variety of lines which can depict the dynamics of the process is infinite. Therefore, in practice it is needed to define the most adequate line.

A simple and convenient way to resolve this issue deals with identifying a trend line which least deviates from the actual values. A criterion for choosing this line is the least sum of squared deviations between the actual values and respective values of the trend line.

In other words, this method allows us to approximately present a set of statistical data in the form of some line, for example, a straight line, parabolic curve, or exponential curve, each point of which deviates from actual data the least. Upon defining this line, one can use it, among other purposes, for forecasting future values of the existing dynamic row by way of extrapolating the trend line to future periods.

Figures 1 and 2 graphically illustrate the idea of application of the least-squares method. In both figures, a set of statistical data is shown that consists of 12 monthly values of some parameter, *Y*. As one can see, the values of this parameter fluctuate considerably and do not form a straight trend line. None the less, the existing observations allow us to make an assumption about some ascending trend.

Figure 1 shows an attempt to identify a line which depicts such a trend the best (that is, the least differs from actual values). How can we quantitatively assess the overall deviation in order to minimize it? However, it is obvious that some actual values are smaller and some other are bigger than the values of the trend line. Therefore, each particular deviation should be first squared since this operation allows us to assess the size of the deviation abstracting from its sign, that is, from whether an actual value is lower or higher relative to the trend line.

There can be more than one assumption about the functional form of the line for which the least-squares method is applied. Figure 2 shows the trend line for the same process under assumption that the line is an exponential trend rather than a straight line. On this assumption, like in the first case, the "best" line is identified by way of minimizing the sum of squared deviations of each actual value from the respective point on the exponential curve.

Figure 1. Application of the least-squares method for describing the trend in the form of a straight line

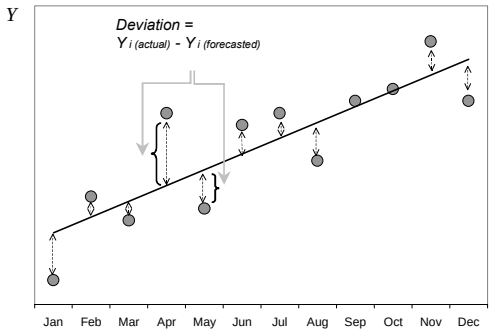


Figure 1. Application of the least-squares method for describing the trend in the form of an exponential curve