Essential issues of developing improved methods of scoring commercial offers during the procurement procedure

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One of the procurement procedure stages is the commercial offers evaluation and selection of the best of them. This process is strictly regulated and must be conducted with great care because this is the stage in the most direct impact on the direct supplier choice. And the incorrect calculations presence, for example, can cause not the best offer choice and, as a consequence, the other supplier choice, which may lead to financial loss and become the subject of litigation in the future.

There are sufficient commercial bids scoring methods because this is the stage in currently developed. But two of them are the most widely used. The first method is a method presented in "Methodological recommendations for scoring of tender bids and suppliers qualification participating in the orders placing contests for goods supply for state needs" according to the Ministry of Economy of the Russian Federation letter dated June 2, 2000 №AS-751/4-605 (hereinafter - the methodology of the Ministry of Economy of the Russian Federation). According to the methodological recommendations each natural indicator of particular supplier commercial bid on valued criterion gets a mark on a ten point scale. With this purpose commercial bids indicators for certain criteria are ranked for all suppliers. The worst indicator is assigned one point, the better - ten points, and interpolation method using in the 1 - 10 points range allows to determine these indicators score for other suppliers. Later after score of all suppliers commercial indicators for all criteria a total commercial bids score is determined by summing the scores for each criterion with regard to their weighting coefficients. The winner is the supplier who has received the highest total score for his commercial bid.

The second method is the method presented in the «Practical Guide to contract procedures for European Union external actions» developed on the basis of EU and EDF Financial Regulations, hereinafter - the methodology of the EDF EU. This method is similar to the Ministry of Economy of the Russian Federation methodology. It also provides the need to develop criteria for commercial bids evaluation with the specific weight coefficient definition for the each criterion, the need of scoring for each supplier commercial bids for each criterion, as well as the need to determine the total commercial bids score.

The principle difference of this method from Ministry of economy of the Russian Federation method are other formulas for scoring supplier indicator which represent the ratio of the corresponding indicators. This method does not automatically assigns one point to the worst indicator value but provides calculation of scoring natural indicator under specific formulas. The rest of the calculation algorithm and the formulas used are similar to algorithm and formulas of the Ministry of economy of the Russian Federation methodology.

Analysis of the each methodology mathematical apparatus reveals their specific features. Thus according to both methods the maximum score for the best indicator among all suppliers commercial bids is 10. According the Ministry of Economy of the Russian Federation procedure 10 points set automatically to the best indicator among all suppliers commercial bids. Following the EDF EU the same procedure 10 points is automatically calculated for the best indicator by the corresponding formula. The main difference lies in exhibiting the minimum points amount. Thus, according to the Ministry of Economy of Russian Federation methodology 1 point automatically exhibiting to the worst commercial bids indicator of all suppliers. Following EDF EU procedure the minimum score for the worst indicator can be determined using any value in 0 to 10 points range when calculating according to respective formula.

Thus, according to the Ministry of Economy of the Russian Federation methodology regardless of the actual commercial bids indicators values 1 to 10 scores range will always be linearly distributed over the difference range between the best and worst natural indicators values by evaluated criterion among all suppliers commercial bids. Following the EU EDF procedure there are no commercial bids values which can be evaluated with minimum rating of 1 point. And evaluated point calculation is determined by the corresponding formula, expressed by the corresponding values ratio. Due to the formula hyperbolic dependence 0 to 10 points score will be distributed hyperbolically over a range of difference between the best and worst natural indicators of criteria of all suppliers commercial bids. In this case the hyperbole bending slope will be determined by how close are the best and the worst commercial bids indicators natural values for certain criteria.

Let's consider a graphical representation of exhibited commercial bids indicators score dependencies from these indicators actual values of for these methods in the following Fig. 1 and 2. In this case scoring commercial bids indicators will be on the vertical axis, and commercial bids price indicators - on the horizontal axis.

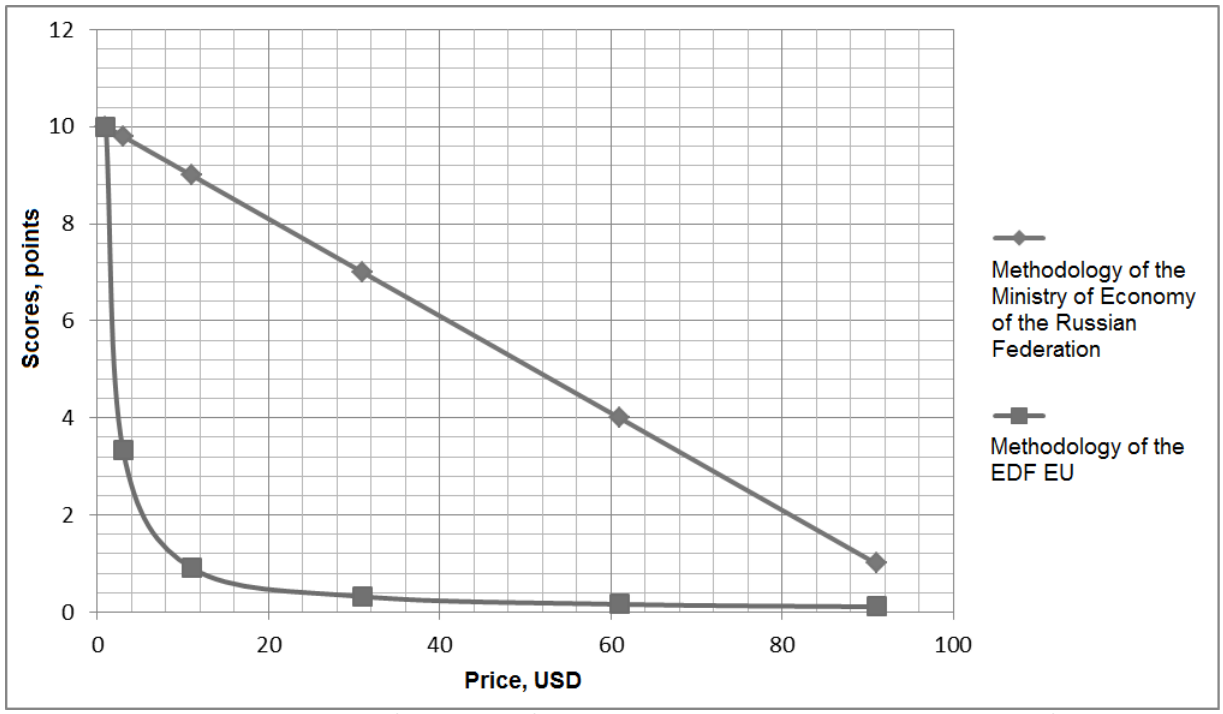

Figure 1: Graphical representation for the cases of commercial bids values indicators very large scatter for «The Price» criterion.

This graph analysis shows that in cases of commercial bids values indicators very large scatter for the individual criteria the so-called "proportionality effect" of the scores distribution is fully manifested. This effect shows the linearity of the scores distribution using the Ministry of Economy of the Russian Federation procedure, which is the positive characteristic, and hyperbolic scores distribution using the EDF EU procedure that it is the negative characteristic, since only linear interpolation is consistent with the commercial bids fair business assessment.

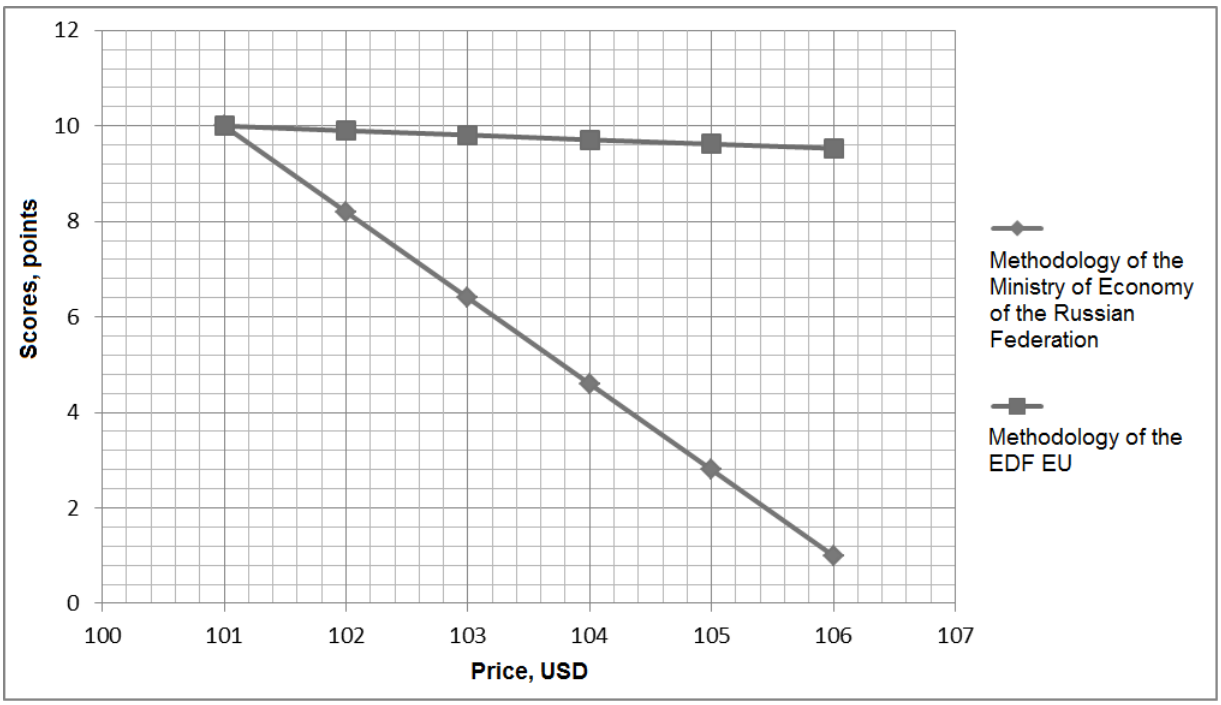

Figure 2: Graphical representation for the cases of commercial bids values indicators very slight scatter for «The Price» criterion.

This graph analysis shows that in cases of commercial bids values indicators very slight scatter for the individual criteria the so-called "sensitivity effect" of the scores distribution is fully manifested. This effect shows the full scale count from 1 to 10 using the Ministry of Economy of the Russian Federation procedure (this distribution can be called "hypersensitive"), which is its negative characteristic, and slightly different estimates exhibiting using the EDF EU procedure (this distribution can be called "normal"), which is its positive characteristic. Hypersensitive distribution is the Ministry of Economy of the Russian Federation method negative characteristic because it does not take into account the actual price difference scale.

Thus, for example, in the case of existing of two suppliers and commercial bids price difference is 1 USD with the "Price" criterion weighting factor more than 0.5 the score of the participant with the lowest price will be 10 points and the score of the participant with the highest price will be 1 point that does not take into account the actual price difference scale. In this case the second supplier may have absolutely the best performance for all the remaining criteria: for example, offering more technically advanced equipment, delivering equipment from the warehouse, giving a lifetime warranty on all equipment, free spare parts supplying, free maintenance. And he will not be recognized as the procurement procedure winner even if "the issue price" is only 1 USD. Thus only the normal sensitivity distribution meets the principles of the most advantageous offer choosing.

Developing improved method of scoring commercial offers

Based on the foregoing, each of the methods has both advantages and disadvantages. It is logically in this situation to develop a method that would combine only positive features of considered examining methods: linear score distribution and normal sensitivity to variation range of commercial bids indicators actual values for the individual criteria. This improved method will be based on the same algorithm which are both considered methods. The only change will be the change in the mathematical apparatus calculation of the scoring j-th index for the i-th supplier. This method will combine both considered methods mathematical apparatus.

Let’s consider the algorithm of scoring the j-th index for the i-th supplier for improved method:

1. The better indicator of all suppliers commercial bids assigned ten points. The worst indicator of all suppliers commercial bids assigned points number calculated by the following formulas:
- when the worst index value is less than his best value Nworj <Nbesj we use the following formula:

$$B_{\min j} = 10 * \frac{N_{worj}}{N_{besj}}$$

where:

Bminj - scoring j-th index assigned to the supplier who offered the worst indicator value among all suppliers commercial bids;
Nworj - the worst evaluated j-th indicator value among all suppliers in physical units;
Nbesj - the best evaluated j-th indicator value among all suppliers in physical units.
- when the worst index value is more than his best value Nworj >Nbesj we use the following formula:

$$B_{\min j} = 10 * \frac{N_{besj}}{N_{worj}}$$

2. The other indicators scores calculated by the following formula:

$$B_{ij} = B_{\min j} + \frac{N_{ij} - N_{worj}}{N_{besj} - N_{worj}} * (10 - B_{\min j})$$

where:
Bij - scoring j-th index for the i-th supplier;
Nij - evaluated j-th indicator value for the i-th supplier in physical units;

In the rest improved method algorithm repeats the algorithm of considered methods. Let's consider a graphical representation of exhibited commercial bids indicators score dependencies from these indicators actual values for the methods in the following Fig. 3.

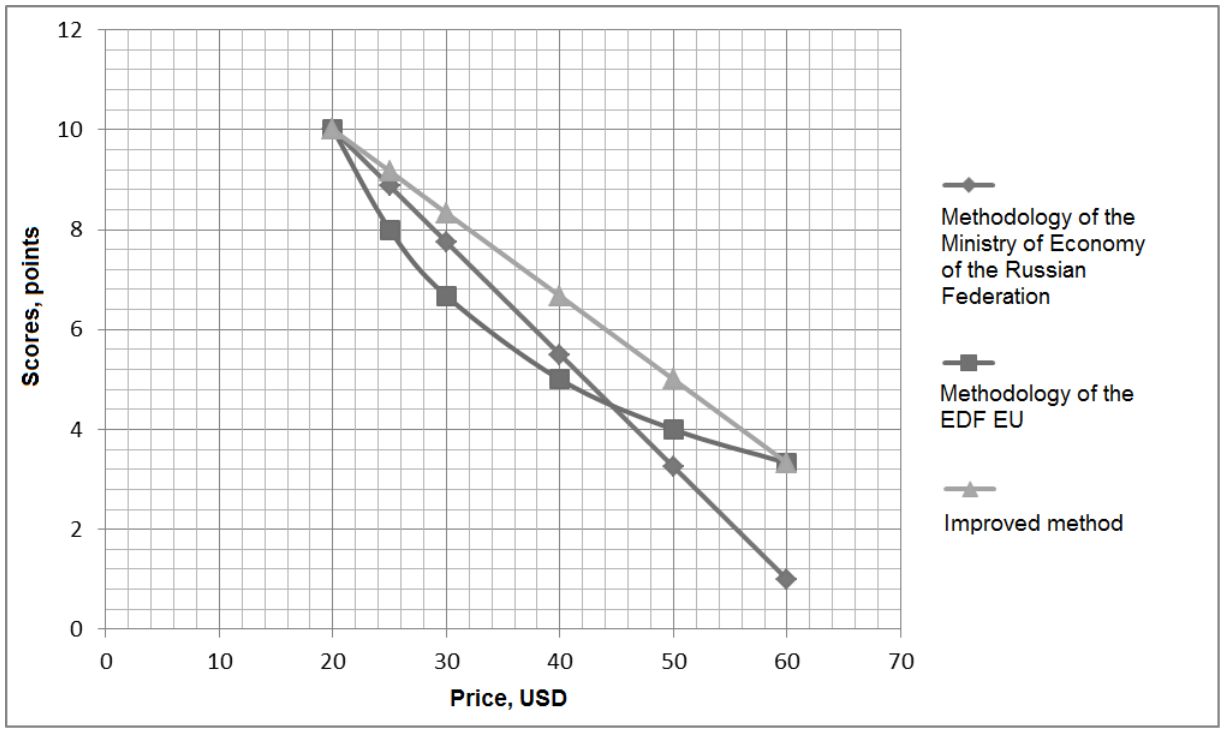

Figure 3: Graphical representation of exhibited commercial bids indicators score dependencies from these indicators actual values for all three methods.

This graph demonstrates that the Ministry of Economy of the Russian Federation method has a linear scores distribution and completely hypersensitive to variation range of commercial bids indicators actual values for the individual criteria. EDF EU method has hyperbolic (curved) scores distribution and normal sensitivity to variation range of commercial bids indicators. But improved method has a linear scores distribution and normal sensitivity to variation range of commercial bids indicators.

Critical situations

However, besides the linear scores distribution and normal sensitivity there are two critical situation in which any scoring method must also give the correct result, which will confirm the correctness of the algorithm and its mathematical apparatus.

The first situation is possible supplier fraud that allow suppliers to influence to commercial offers scores.

The customer always provides complete information in the procurement invitation including calculating method of scoring commercial bids. After the scoring mechanisms analysis any of the participants can take specific steps as legitimate as probably not legitimate for his proposal to receive the highest possible score.

The most interesting case is when the supplier involved in the procurement procedure using two companies. The first one is the primary company and the second one is the false. The false company does not aim the contract obtaining. It is used to get more score by the main company and/or to get lower scores by the other participants. This is achieved by the fact that the primary supplier wants to reduce the competitors scores for this criterion because he does not have this criterion advantage over other participants. And the primary supplier exposes the commercial bid of the false supplier with unrealistically high in the direction of improving physical indicators. This leads to increasing of commercial offers natural indicators range and participants getting lower scores due to the fact that the whole range of scores linearly distributed over the increased range of natural indicators. According to the analysis of the methods mathematical apparatus and relevant calculations, it was determined that none of the three scoring methods is not absolutely resistant to the suppliers fraud.

All three methods can lead to incorrect results, i.e. suppliers scores are reduced during such fraud.
The improved method shows correct result in the case when the largest commercial bid natural indicator of the supplier is the worst. This is because score decreasing for all participants is equal to the same amount. This fact shows that any excessive changes introduction in the range of the actual indicators values would not change the score difference. However this case is the most important because the most significant criteria are always associated with cost. And this is the case when the largest natural commercial bid indicator of the supplier is the worst and the lowest indicator is the best.

The second situation is the case if selected supplier refused to sign the contract during the procurement procedure using commercial bids scoring method. It means the possibility of different points distribution in case if selected participant's offer wouldn't be considered while the initial scoring. In this case the company with the best score which proposal is withdrawn from the calculation can have the best, worst or within the range natural indicator value. There are three different cases for each situation depending on what is withdrawn from the calculation. And depending on what value is removed from the calculation, as well as depending on the linearity or hyperbolic of calculating formulas six different cases of scoring changes are possible for each of the three methods.
Calculations analysis of these cases shows the conditions under which the places distribution will remain unchanged. Zero difference of participants score increments will be the necessary and sufficient condition for that places distribution. This will lead to the initial balance score conservation.

This material cumulative analysis shows the following. None of presented methods can not determine the winner with 100% accuracy during the rescoring of participant which took the second place at the initial scoring. However the most accurate method in this respect is the improved method of scoring commercial bids. Only this method has zero difference of participants score increments in case of the best indicator excluding when the worst index value is more than the best index value. This combination is the most important case from the six possible cases. It is because the participant who initially won has the best rate on more than 50% criteria according to their weighting coefficients. The most important criteria are always associated with the cost which means the case when the worst index value is more than the best value.

Developing an independent method of scoring commercial offers

As shown earlier, none of the three methods is not absolutely accurate in critical situations. Thus it is possible to work out a method of scoring commercial bids that would show the absolute exact result for the above two situations. These three methods analysis shows the following feature. Each method gives 10 points to the best natural indicator of the commercial offers, i.e. it depends on the initial commercial bid indicators during the procurement procedure conducting. It is possible to introduce the angle of scores distribution curve. This is the index that is determined by the coordinates of the best commercial bids points indicator. It can be demonstrated in the following Fig. 4. This graph shows three dependencies for three different procurement procedures. The best natural indicators for «The Warranty Period» criterion for each procurement procedure are 12, 24 and 36 months. We can observe a different angle of each dependency.

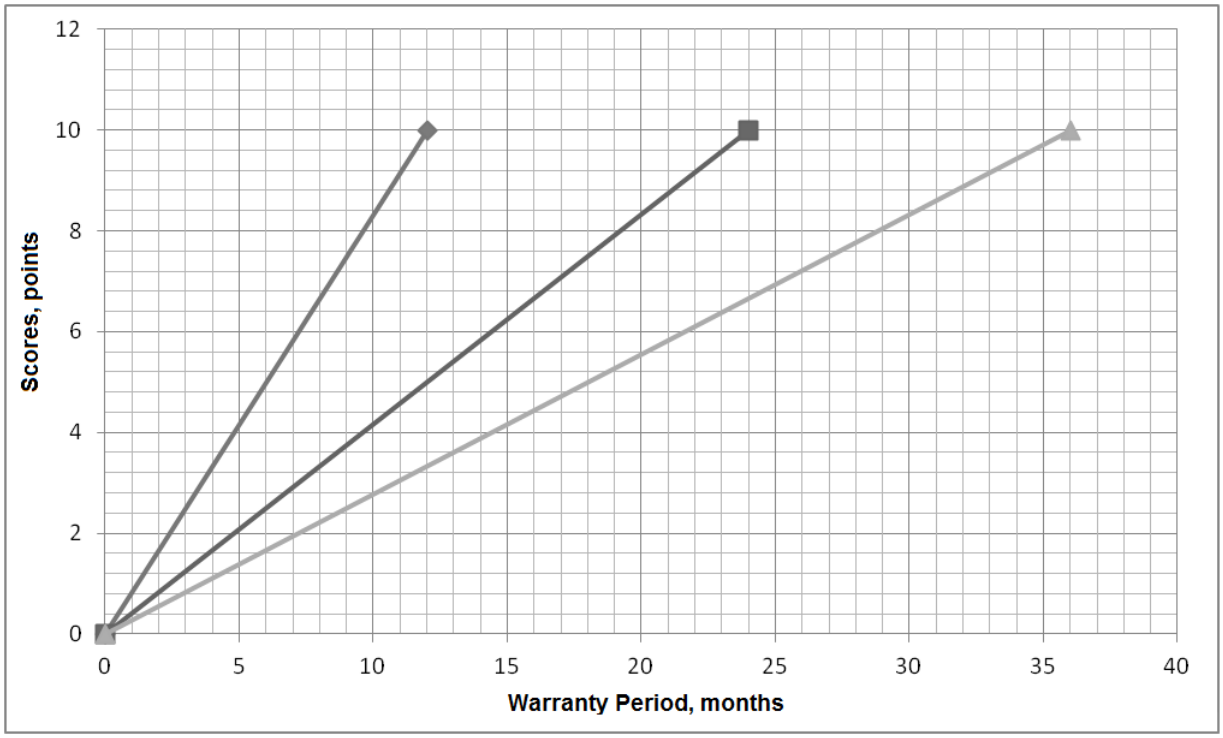

Figure 4: Graphic dependencies for three different cases of the angle of scores distribution curve.

The main reason of these three methods inadequately scoring in the situations described above is the best indicator coordinates and the angle of scores distribution curve change. In this case scores are changing correspondingly resulting in an uneven change of the other participants score. The solution is to fix the coordinates of the best indicator point and to fix the angle of scores distribution curve correspondingly. Thus it is possible to work out an independent method of scoring commercial bids. This method algorithm is following:

1. At the marketing research and documentation preparation stage procurement manager determines the best possible necessary products supply conditions from currently existing at the market. It is also necessary to determine each criterion weighting coefficients calculated based on the cost method. The weighting coefficients sum is equal to 1 and the indicators for such conditions are some kind of standard for necessary products supply. There are possible situations when the supplier will offer more favorable conditions which were not covered by the marketing research.
2. According to the developed evaluation criteria for the best possible supply conditions we fix 100 points score.
3. Commercial offers evaluation is determined in proportion to the participant natural indicator percentage change relatively to the best possible indicator which was defined during marketing research. The score may exceed 100 points and it can also be negative.
4. Received scores are summed considering weighting coefficients for each criterion.
5. After finding the final score the participants are ranked in descending order.

Common dependencies characterizing this method are as follows.

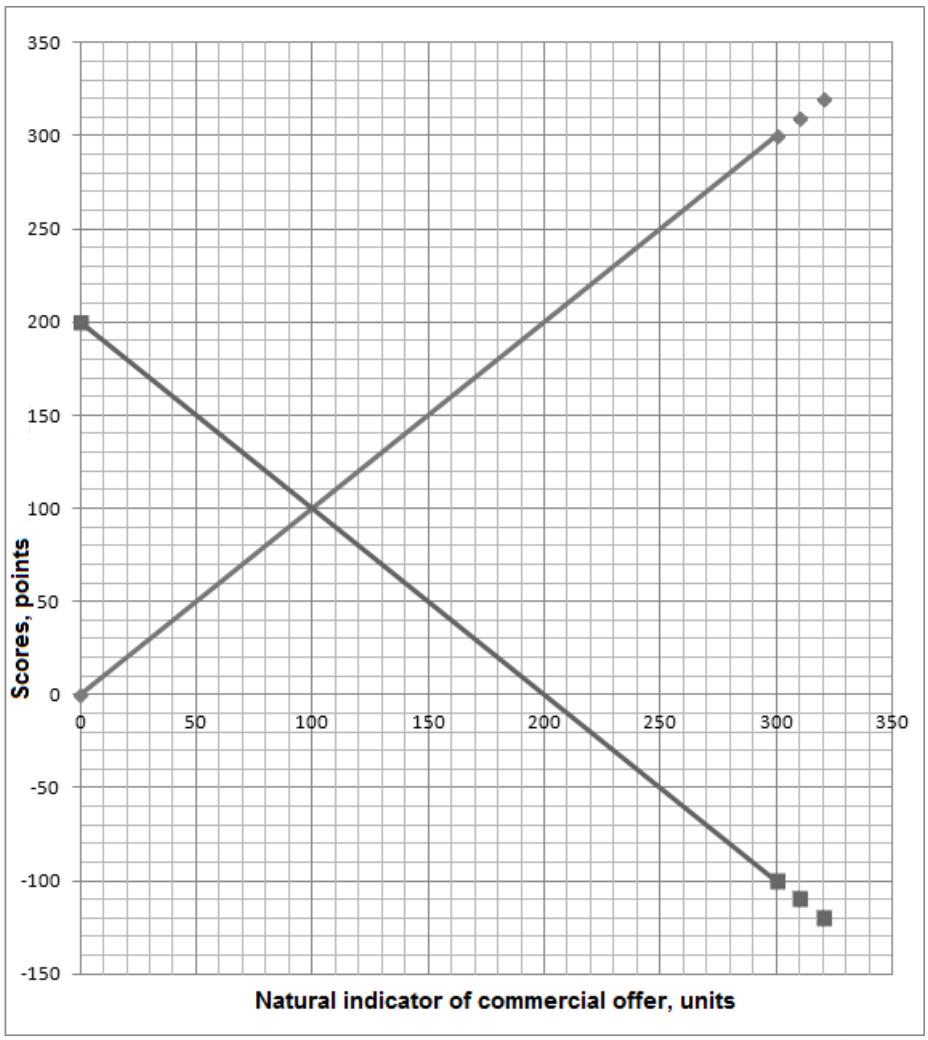

Figure 5: Graphic dependencies characterizing the independent method of scoring commercial offers.

Herewith the dependence starting from the beginning of coordinates determines the case when the greatest natural indicator of the suppliers bids is the best. And decreasing dependence defines the case where the greatest natural indicator of the suppliers bids is the worst.

If selected supplier refuses to sign the contract during the procurement procedure using scoring method that means the possibility of a different scores distribution when commercial bid of the selected participant is not taken into account. During rescoring proposed method with absolute precision determines the winner. This is the participant who took second place at the initial assessment. This is because any participant exception will not affect the other suppliers score in any form since angle of scores curve is fixed and scoring determines the same scores for the participants as at the original calculation.

There is the case of suppliers fraud the proposed method does not allow to make such fraud because regardless of the particular suppliers unrealistic high indicators presence the other suppliers will get their scores based on comparison with standard indicators identified in marketing research conducted prior to the procurement procedure.

Thus this method can be considered as one of the most perfect because it combines a number of positive characteristics:

- linear proportionality of scoring commercial bids natural indicators;
- the simplest mathematical apparatus;
- the immutability of bids scoring calculation when excluding and/or adding partic-ipants;
- impossibility of any suppliers fraud.