

USING INDEXES IN THE COMPLEX ANALYSIS OF SALES TURNOVER

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Abstract: In the current economic context, the importance of the sales turnover measure has increased considerably, given the difficulties associated with the increase of the market share and with getting new clients. In what follows we will try to analyze the complex relation between the evolution of price and the evolution of the quantities sold and its impact upon the evolution of the sales. This relation is complex since the two factors are interdependent, which means that one cannot plan a significant intervention upon one of the fore-mentioned factors without considering the impact upon the other factor or the response of the other factor to the planned intervention. We will use indexes to describe this correlation, as indexes offer the possibility to forecast the desired level of sales turnover, to indicate the possible limits of evolution for quantity, inflation rate and other measures.

JEL classification: D22, D24

Key words: index of quantities, index of prices, index of value, sales turnover, index of inflation

1. INTRODUCTION

Usually, the sales turnover can be expressed as the product between quantity (q) and price (p , the selling price net of value added tax). The quantity represents usually the number of units sold (how many units of product the company has sold), but sometimes it can also stand for the quantity sold (for example, kilograms or tons of paint sold). The price is expressed in lei per unit sold or in lei per unit measure of sales (lei per kilogram, for example). When the company produces and or sells several types of products, the overall sales turnover (ST) can be expressed as:

$$ST = \sum_{i=1}^n q_i p_i$$

Where:

q_i – the number of units sold/the quantity sold of product i ;

p_i – the selling price of product i , net of value added tax (VAT).

The study of the evolution of sales turnover can be made either by external clients, which may be interested in investing/cooperating with the respective company or for managerial purposes (to find out why the results set through the 2010 strategy

differed from the actual results obtained in 2010 and to identify the factors and causes for underachieving or overachieving). Sometimes, even overachieving is dangerous, especially if it stresses the resources and troubles the basic equilibrium at the company level.

The use of indexes in the prospective analysis of the sales turnover offers some important advantages such as:

- The reference value of any index is equal to one, which makes easy to understand both the upwards evolutions (represented by an index with a value higher than one) as well as the downwards evolutions (represented by an index with a value less than one);
- The use of indexes allows for the concurrent analysis of the modification intervened in the level of the factors who influence the evolution of sales turnover, even if we are still determining the contribution of a specific factor (quantity, price or other) at a time;
- The quantitative factor of evolution, represented by its index of evolution stands for a multiplier/demultiplier of the action induced by the qualitative factor;

The use of indexes allows the management to perform simulations regarding possible evolutions of the sales turnover and the specific contribution of each factor (quantity, price or other).

2. OBJECTIVES

The index analysis of sales turnover is a technique that allows in-depth insights upon the evolution of sales turnover and it can be used both for the retrospective analysis as well as for prospective studies regarding the ways and limits of evolution of the two factors, respectively quantity and price of different products. For the purpose of our analysis we are using the index of quantities (I_q), the index of prices (I_p), the index of value (I_v – the same with the index of sales) and the inflation index (I_{infl}).

The technique is based on the chain substitution method, studying the influence of each factor at a time, but compared to the traditional approach has the advantage of considering the evolution of quantity when studying the contribution of price. When studying the influence of the price modification the model relates to the base level of sales, revealing the evolution of quantities as well as the contribution of the evolution of prices.

The index of quantities expresses the evolution of quantities and acts like a multiplier/demultiplier of the evolution of prices. Nevertheless, the evolution of quantities cannot reverse/overthrow the evolution induced by the prices, as shown by the relation no. 4 below.

3. METHODOLOGY

The overall evolution of the sales turnover can be explained by the mean of the influences exerted by the number of units sold (q_i) and of the selling price (p_i), according to the following system of factors (see figure 1 below):

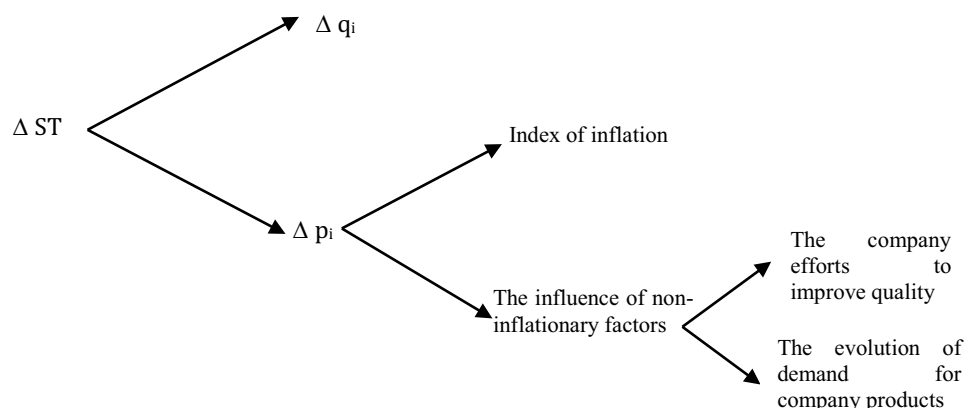


Figure no. 1. The system of factors that explain the evolution of sales turnover

In order to exemplify the methodology we are using the data from table no.1 regarding the ALFA Company, which activates in the retail sector and sells 3 products, respectively A, B and C.

Table no. 1. The prospective evolution of ALFA sales 2012/2011

| Products | The quantities sold | | The selling prices, net of VAT | |
|----------|---------------------|-----------------|--------------------------------|-----------------|
| | 2011 | 2012 (forecast) | 2011 | 2012 (forecast) |
| A | 13.000 | 14.000 | 7,8 | 8,2 |
| B | 11.000 | 12.500 | 6,7 | 7,2 |
| C | 15.000 | 13.800 | 5,5 | 5,2 |

The inflation rate is supposed to be 3% for the period.

The analysis of the sales turnover will start with establishing the evolution of the total sales turnover:

$$\Delta ST = ST_1 - ST_0 = \sum_{i=1}^n q_{i1}p_{i1} - \sum_{i=1}^n q_{i0}p_{i0} = 276.560 - 257.600 = 18.960 \text{ lei}$$

$$\Delta ST\% = \frac{\Delta ST}{ST_0} \times 100 = \frac{ST_1 - ST_0}{ST_0} \times 100 = I_{ST} - 100 = 7,36\%$$

Where:

q_{i0} – the number of units (or the quantity) sold from the product i during the base period.

p_{i0} – the selling price of the product i during the base period;

$ST_0 = \sum_{i=1}^n q_{i0}p_{i0}$ – the base level of the sales turnover;

$ST_1 = \sum_{i=1}^n q_{i1}p_{i1}$ – the effective/forecasted level of the sales turnover;

I_{ST} – the index of sales turnover (index of value).

This means that based on the market studies the company forecast an increase of 18.960 lei, or 7,36% in its sales from 2012 compared to 2011.

This evolution can be corrected (determining the real terms increase or decrease) taking into account the evolution of the general consumer prices, with the index of external consumer goods' prices (I_{ep}).

$$\Delta ST\%_{real\ terms} = \left(\frac{I_{ST}}{I_{ep}} - 1 \right) \times 100 = 4,23\%$$

Where:

- I_{ST} – the index of value, or the index of sales turnover;
- I_{ep} – the index of external prices (the index of inflation).

In our case the real terms (non-inflationary) increase in the level of sales turnover is 4,23%, lower than the nominal terms increase of 7,36%.

We can notice that a company registers a real increase of its sales turnover if the index of the nominal sales is higher than the index of the inflation ($I_v > I_{ep}$).

The contribution of the evolution of the quantities sold can be expressed as follows:

$$\begin{aligned} a. \Delta_{ST}^q &= \sum_{i=1}^n q_{i1}p_{i0} - \sum_{i=1}^n q_{i0}p_{i0} = \sum_{i=1}^n q_{i0}p_{i0} \left(\frac{\sum_{i=1}^n q_{i1}p_{i0}}{\sum_{i=1}^n q_{i0}p_{i0}} - 1 \right) = \\ &= ST_0(I_q - 1) = 257600(1,0436 - 1) = 11250 \text{ lei} \end{aligned} \quad (1)$$

Where:

I_q – the index of quantity sold, or

$$I_q = \frac{\sum_{i=1}^n q_{i1}p_{i0}}{\sum_{i=1}^n q_{i0}p_{i0}} = 1,0436$$

Another development of the relation (1) can be:

$$\Delta_{ST}^q = \sum_{i=1}^n q_{i1}p_{i0} - \sum_{i=1}^n q_{i0}p_{i0} = \sum_{i=1}^n (q_{i1} - q_{i0})p_{i0} \quad (2)$$

If the company wants to get an increase in its sales turnover it has to get a bigger than one index of the quantities ($I_q > 1$), which can be obtained by selling more of each and every product of the company, conditioned by maintaining the prices at the base level (keeping at least the level p_{i0} of the price). A possibility of increasing the sales turnover can result even if the company sells more out of some products and less from other products, but the overall increase is bigger than the overall decrease:

$$\sum_{i=1}^m \Delta q_{i1+} p_{i0} > \left| \sum_{i=1}^h \Delta q_{i1-} p_{i0} \right|$$

Where:

- Δq_{i1+} - the increase in quantity sold for certain products;
- p_{i0} - the price from the previous period of the products that register an increase of the quantity sold;
- Δq_{i1-} - the decrease in the quantity sold for the other products;
- p_{i0} - the price from the previous period of the products that register a decrease of the quantity sold.

In our example, if the company wants to ensure an increase of 11.250 lei of its sales it needs to secure a 4,36% increase in the quantities sold. Based on the company market studies, the increase is possible to obtain by securing an increase in units sold for products A and B which will more than compensate the decrease of units sold from product C.

In fact the increase in quantities sold of products A and B amounted to +17.850 lei, which more than compensated the – 6.600 lei decrease due to product C.

The influence of the evolution of the prices can be expressed as follows:

$$b. \Delta_{ST}^p = \sum_{i=1}^n q_{i1}p_{i1} - \sum_{i=1}^n q_{i1}p_{i0} = \sum_{i=1}^n q_{i1}p_{i0} \left(\frac{\sum_{i=1}^n q_{i1}p_{i1}}{\sum_{i=1}^n q_{i1}p_{i0}} - 1 \right) = \sum_{i=1}^n q_{i1}p_{i0} (I_p - 1) \quad (3)$$

The relation no.3 shows that in order to get a higher sales turnover, the company must have a greater than one index of the company prices (the average price of the company has to increase). The prices of the company should increase as a result of promoting new, better quality products, which should offer increased functionality, lower power consumption, or using eco-friendly materials or technology for their production.

The previous relation can also be developed as follows:

$$\begin{aligned}\Delta_{ST}^p &= \sum_{i=1}^n q_{i1}p_{i1} - \sum_{i=1}^n q_{i1}p_{i0} = \sum_{i=1}^n q_{i0}p_{i0} \left(\frac{\sum_{i=1}^n q_{i1}p_{i1}}{\sum_{i=1}^n q_{i0}p_{i0}} - \frac{\sum_{i=1}^n q_{i1}p_{i1}}{\sum_{i=1}^n q_{i0}p_{i0}} \right) = \\ &= ST_0(Iv - Iq) = ST_0(Iq \times Ip - Iq) = ST_0 \times Iq(Ip - 1) \quad (4) \\ &= 257600 \times 1,0436 \times 0,0286 = 7.710 \text{ lei}\end{aligned}$$

Where:

Iv – the index of value, or the index of sales turnover,

$$Iv = \frac{\sum_{i=1}^n q_{i1}p_{i1}}{\sum_{i=1}^n q_{i0}p_{i0}} = 1,0736; \quad Iv = Iq \times Ip$$

The relation no.4 offers another perspective about the influence of the prices upon the evolution of the sales turnover; respectively the prices have a positive contribution to the evolution of sales turnover if the index of value (actually the index of sales turnover) is higher than the index of quantities or if the index of prices is higher than one.

The index of quantities cannot overthrow the positive influence of prices (if the prices increase, the sales turnover will increase), because the index cannot have negative values. Rather, the index of quantities acts like a multiplier/demultiplier of the evolution induced by the prices; when the quantities have a positive influence (their index is higher than one) they will amplify the increase offered by the higher prices. When the quantities will register a decrease, they will reduce the increase given by the increase in prices. In our example, the increase in prices of 2,86% (an index of prices of 1,02868) was multiplied by the positive evolution in quantities (an index of 1,0436), leading to a 2,99% increase in sales turnover due to prices.

We can further analyze the influence of the prices upon the sales turnover if we segregate the influence of the inflation from the influence of the non-inflationary factors, such as the evolution of the demand for the company products, the efforts of improving the quality of products or of offering better after sale service and maintenance.

The influence of the inflation can be expressed as follows (by the mean of external prices index – Iep):

$$b1. \quad \Delta_{ST}^{Iep} = \sum_{i=1}^n q_{i1}p_{i0} \times Iep - \sum_{i=1}^n q_{i1}p_{i0} = \sum_{i=1}^n q_{i1}p_{i0} (Iep - 1) \quad (5)$$

We can notice that an index of external prices higher than one ($Iep > 1$) will determine an increase of the sales turnover, all other factors kept constant.

Also, here we can express the relation as follows (having in mind the correlation between the evolution of quantities and the evolution of prices):

$$\Delta_{ST}^{Iep} = \sum_{i=1}^n q_{i1}p_{i0} \times Iep - \sum_{i=1}^n q_{i1}p_{i0} =$$

$$\begin{aligned}
&= \sum_{i=1}^n q_{i0} p_{i0} \left(\frac{\sum_{i=1}^n q_{i1} p_{i0}}{\sum_{i=1}^n q_{i0} p_{i0}} \times Iep - \frac{\sum_{i=1}^n q_{i1} p_{i0}}{\sum_{i=1}^n q_{i0} p_{i0}} \right) = \sum_{i=1}^n q_{i0} p_{i0} \times Iq(Iep - 1) = \\
&= ST_0 \times Iq(Iep - 1) = 257600 \times 1,0436 \times 0,03 \quad (6) \\
&= 8064,94 \text{ lei}
\end{aligned}$$

The relation no. 6 is similar in meaning and interpretation with the relation no. 4. It shows that an increase in the general level of consumer prices (a positive index of inflation) will normally lead to an increase in the sales turnover. This increase can be multiplied by a favorable evolution of quantities (an index of quantities higher than one). The difference is represented by the fact that inflation offers only a premise for the increase in sales turnover, which can become a certainty only if the company succeeds to take to right measures and actions in order to capitalize the contribution of inflation. Of course, the efforts of the company are influenced by external factors such as the elasticity of the demand and the level of competition in the sector.

In our example, the inflation offers the company a potential of increasing the sales turnover equal to 8064 lei, respectively a growth of 3,13%. The growth potential was amplified by the positive evolution of the quantities sold, which registered an index of 1,0436.

Next, we want to find out if the company succeeds to capitalize on the impulse given by the increase in the inflation rate, calculating the influence of non-inflationary factors.

The influence of the non-inflationary factors (such as the efforts of the company to improve quality and the evolution of the demand for the company products) can be expressed as such:

$$b. 2. \Delta_{ST}^{non-inflationary} = \sum_{i=1}^n q_{i1} p_{i1} - \sum_{i=1}^n q_{i1} p_{i0} \times Iep = \sum_{i=1}^n q_{i1} p_{i0} (Ip - Iep)$$

Where:

Ip – the index of company prices;

Iep – the index of external prices (the index of inflation).

We can notice that the non-inflationary factors can contribute to the increase of the company sales turnover if the index of company prices is bigger than the index of inflation (for example if the prices of the company increased by 15% when the rate of inflation was of 10%). Such an evolution can be explained by either an increase in the demand for the company products or by the result of offering better quality products.

The relation can be further expressed, if we take into consideration the interaction between the evolution of the quantities sold and the evolution of the prices:

$$\Delta_{ST}^{non-inflationary} = \sum_{i=1}^n q_{i1} p_{i1} - \sum_{i=1}^n q_{i1} p_{i0} \times Iep = \sum_{i=1}^n q_{i0} p_{i0} (Iv - Iq \times Iep)$$

Since the index of value (the index of sales turnover) can be expressed as a product between the index of quantities sold and the index of company prices ($Iv = Iq \times Ip$), we can rewrite the precedent relation:

$$\begin{aligned}
\Delta_{ST}^{non-inflationary} &= \sum_{i=1}^n q_{i0} p_{i0} (Iv - Iq \times Iep) = ST_0 \times Iq(Ip - Iep) \quad (7) \\
&= 257600 \cdot 1,0436(1,0286 - 1,03) = -354 \text{ lei.}
\end{aligned}$$

The relation (7) shows actually that a favorable evolution of the company prices (an index of company prices higher than the index of inflation) can be amplified should the index of quantities is higher than one or reduced if the quantities sold are reduced.

In our case, due to the fact that the company price index is lower than the inflation index (the prices of the company products registered a smaller increase compared to the general level of consumer prices). This evolution can be explained by the intense competition in the market of product C and the company has to take the appropriate measures (in what concerns marketing, promoting, commercial credit terms, price policy) in order to ensure an increase in sales. It is also possible that product C is heading toward the end of its life cycle and the company should develop plans for replacing/improving. Based on the evolutions determined for our company we can draw the diagram of sales 2012/2011 (see figure 2 below).

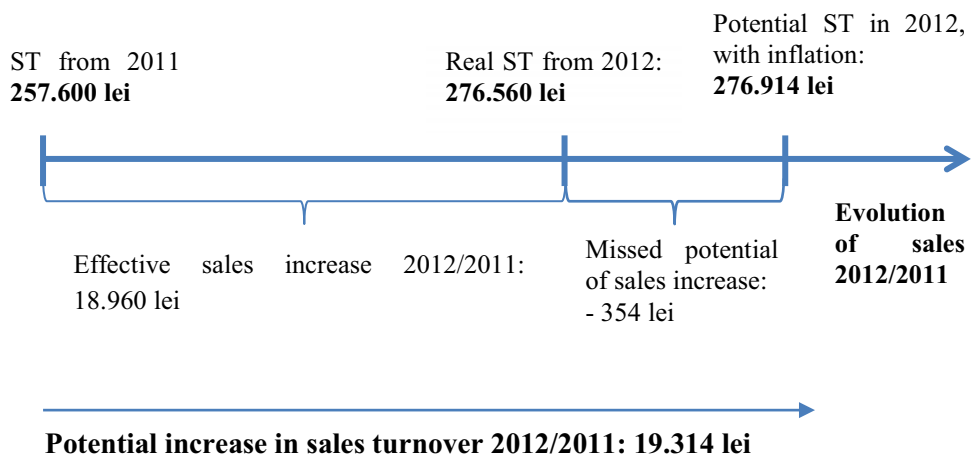


Figure no. 2. The diagram of the evolution of sales 2012/2011

Should the company managed to capitalize on the impulse offered by inflation, the diagram would have looked like in figure no. 3.

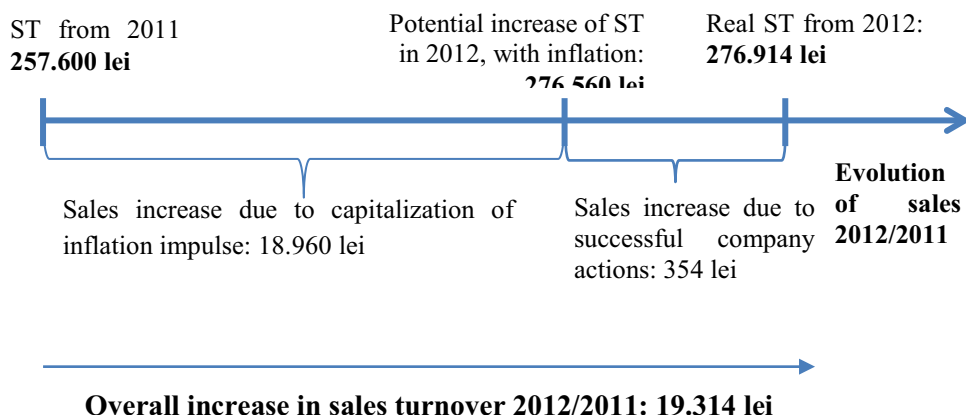


Figure no. 3. Alternative evolution of sales turnover

4. THE CORRELATION WITH THE COMMERCIAL CREDIT POLICY

Often the companies have to offer discounts in order to increase their sold quantities (leading to a higher than one index of quantity), causing in turn diminished prices (a less than one index of prices). The reason for this kind of action is the better use of the installed production or sale capacity, as the managers know that they can reduce the fixed cost component of the unit cost (and hence reduce the unit cost) by selling more units and making better use of the existing assets. Normally, this should be part of the commercial credit policy, which entails the sustainable increase in company profits, ensuring a proper use of the company productive assets as well as good relations with the company clients.

We have seen that the index of sales turnover (or index of value) can be expressed as the product between the index of quantities and the index of prices:

$$Iv = Iq \times Ip$$

The idea is to have the increase in quantity sold more than compensating the decrease in the price level ($Iq \times Ip > 1$). The situation can be represented as in figure no. 4 below.

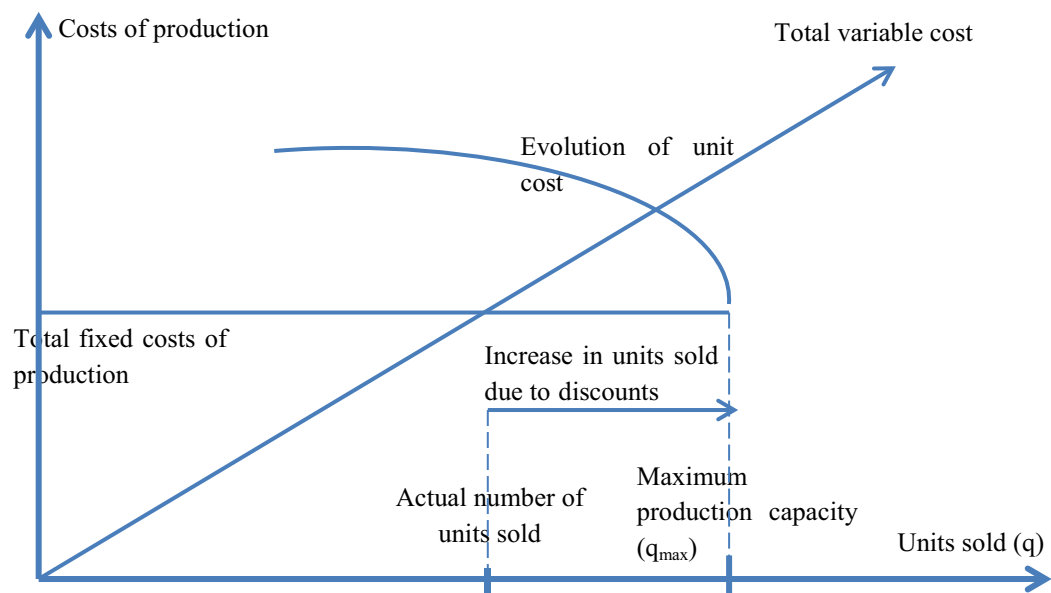


Figure no. 4. Correlation of price and quantity under production restrictions

For example, the company may offer a discount of 4% (from 10 lei to 9,6 lei) as part of its commercial credit policy with the purpose of obtaining a 10% increase in sales turnover. The managers count on the combined effect of quantity and price to obtain the envisioned increase in sales. The quantity sold will increase by 15% (for example from 10.000 units to 11.500 units), more than offsetting the decrease in price. The sales turnover will increase by 10,4% (from 100.000 lei to 110.400 lei).

The evolution of the profit will depend on the influence exerted by the 15% increase in the quantities sold upon the fixed cost component of the unit cost.

If the company is in a situation similar to that described in figure no. 3 the increase in the quantities sold will produce a significant reduction in the level of the unit cost (via the fixed cost component) which may lead to the preservation of the previous profit

margin. The profit margin may even decrease but the company profit still grows as the index of quantities compensates the slightly lower margin.

If the company operates near the maximum production capacity it has to be more careful when granting discounts, as the reduction in prices (an index of prices lower than one) cannot be easily offset by a significant increase in the quantity sold. For instance, a 2% price discount will have to be compensated by a minimum 2,04% increase in the quantities sold. The profit will also increase more difficultly as the margin is likely to decrease.

5. CONCLUSIONS

The use of indexes in the analysis of the sales turnover evolution offers interesting approaches to the managerial action in order to reach the planned level of company sales. The indexes are important since they allow us to make good use of the statistical instruments such as the complement against one; respectively what decrease can a factor sustain if we increase the other factor (factors) by 20% for example. In the same time, the index method always refers to the base level of sales turnover, allowing us to evaluate the modification induced by the contributing factors.

Often, when a company plans to increase its number of units sold it has to take into consideration the effect of this action upon the prices, which tend to decrease as a result of granting discounts and other sale or after service facilities. The model allows us to study the correlated evolution of quantity-oriented actions and of price-oriented actions and even to take inflation into consideration such as we can observe and manage the overall real increase of sales turnover.

The use of indexes allows simulations and different scenarios that can lead to the attainment of the planned evolution of sales turnover according to the concurrent modification of quantity, price, inflation rate and non-inflationary factors.

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