

# CONCEPTUAL PRINCIPLES OF PRICING IN THE AERATED CONCRETE MARKET IN UKRAINE IN THE CONTEXT OF ECONOMIC CYCLICALITY

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**Abstract.** *The purpose* of the paper is to identify patterns of influence of macroeconomic and sectoral factors on the dynamics of prices of aerated concrete products during 2015–2020. The method of factor analysis was used to identify the degree of influence of a number of macroeconomic indicators and raw material prices on the pricing of aerated concrete products. Using the graphical method, the patterns of change in the growth rate of aerated concrete prices at different phases of the economic cycle during this period were identified. *Methodology.* The study is based on the identification of correlation regression relationships between the price of aerated concrete products and raw materials for their production and some macroeconomic factors, as well as on the analysis of changes in the degree of influence of relevant factors on aerated concrete prices at different phases of the economic cycle. *Research results.* The article summarizes the theoretical approaches to the classification of pricing factors, defines the time limits of the phases of economic cycles in the economy of Ukraine during 2014–2020, identifies the main factors of price formation in the aerated concrete market of Ukraine and analyses the degree of their impact on prices of aerated concrete products in 2015–2020. *Practical implications* consist of identifying a number of correlations, as well as trends in aerated concrete prices at different phases of the economic cycle, which can be used to improve pricing in the construction industry. *Value/originality.* Methodological approaches used for factor analysis of pricing of aerated concrete products can be used for timely price adjustment within the chosen pricing strategy, based on forecasts of macroeconomic development of the economy.

**Key words:** aerated concrete market, pricing, factor analysis, correlation, re-gression, economic cycle, construction volumes, inflation, consumer price index.

**JEL Classification:** E32, L16, L74

## 1. Introduction

Currently, one of the urgent issues in Ukraine is renovation and modernization of worn-out and obsolete housing stock. Investment in construction has a multiplier effect in terms of accelerating the growth of national GDP, since this industry is the most material-intensive and labour-intensive. The increase in construction is always the driving force behind the development of related industries, primarily the building materials and products industry.

In our opinion, one of the important development tendencies of the construction industry is the use of modern wall materials, namely aerated concrete. According to the Ukrainian Autoclaved Aerated Concrete Producers Association (VAAG), aerated concrete has occupied the largest share of the domestic market of constructional materials over the past 10 years; it has increased from 8% to 53%. Now not only energy-efficient private cottages but also multi-storey

residential complexes are built using this light and warm material (VAAG, 2020).

Given the current unstable development of the domestic economy and the intensifying market competition, the choice of effective pricing measures is becoming increasingly important for the successful development of the enterprise, since its profitability directly depends on the price at which the product is sold. That is why the research of the pricing process for aerated concrete products is relevant. Some theoretical aspects of this problem also need further study; in particular, the main objectives of our study are to analyse the price-forming factors of macroeconomic and sectoral level and to identify the degree of their indirect influence on the prices of aerated concrete products.

Conversely, solving the problem of effective pricing is impossible without identifying and analysing the factors influencing the price.

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## 2. Theoretical foundations of factor analysis of pricing

Pricing is a rather complex process that requires a comprehensive analysis of factors in order to predict their impact on the ability to sell goods at a price favorable to the enterprise. In today's market conditions, the methods of "mechanical" pricing only based on costs and adding profit to them or focusing on the industry leader or competitors do not take into account many important factors, thus increasing the financial risks of the enterprise. That is why the issue of a comprehensive study of the system of pricing factors is extremely important.

The analysis of literature shows that at the present stage of development of economics the issue of pricing factors has been thoroughly studied. The most universal is the primary division of pricing factors into internal (those that can be controlled by managers) and external (those that the company cannot directly influence, but can adapt to them) or according to another classification – factors of direct influence (partially controlled by the enterprise) and factors of indirect influence (not controlled by it) (Mazur, 2012).

This principle of classification, proposed by P. Kotler (Kotler, 2000) is supported by most scientists (Table 1)

To create an effective pricing strategy one should create an information base that would contain all the data about the factors influencing the price level.

## 3. Factor analysis of prices for aerated concrete

For the factor analysis of prices for aerated concrete, we selected those factors that are subject to quantitative objective measurement (economic indicators). We divided them into 2 groups, namely:

1. Macroeconomic factors: economic growth in the country as a whole (nominal GDP growth); consumer price index; the exchange rate of USD against the hryvnia (according to the interbank foreign exchange market); the size of the average salary in Ukraine; volume of capital investments.

2. Industry factors. They characterize the conditions of management in each industry, are common to all enterprises in this industry.

Among them we have singled out: the volume of construction; prices for key raw materials for aerated concrete production (lime, cement, quartz sand, aluminium powder, gypsum) – also the cost of production directly depends on these indicators; production capacity of enterprises in the industry.

According to the results of stochastic correlation analysis, the values of correlation coefficients are obtained and presented in Table 2 (Skrypnyk, 2019).

As can be seen from the obtained coefficients, changes in average wages and inflation have the most discernible impact on aerated concrete prices, macroeconomic factors that indirectly reflect primarily changes in the cost of production of aerated concrete. The only exception was the exchange rate,

Table 1

### Overall classification of pricing factors

Authors	Internal	External
(Lytvynenko, 2010)	goals of organization and marketing, strategies for individual elements of the marketing complex, unit cost.	consumer demand, producer supply, household income, consumer behavior, the influence of the state on pricing policy, price advertising, financial system, money circulation, monetary system, participants in sales channels, competition, inflation
(Mazur, 2012)	actual costs, production capacity, method of production, image of the enterprise, etc.	macroeconomic environment, conditions of competition, characteristics of consumers, characteristics of intermediate sellers, characteristics of suppliers
(Petrunia, 2010)	current goals of the company, the level of costs of the enterprise, the pricing strategy of the enterprise.	External: state and dynamics of the market, price elasticity of demand, prices of competitors, competitive positions of the enterprise, etc.
(Beliavtsev, 2005)	types of goods, price elasticity, enterprise goals, degree of consumer satisfaction with this product, the possibility of market segmentation, the presence of qualitative differences between the company's products and competitors' products, enterprise size, degree of product differentiation, role of advertising goods, features of the production process, etc.	market structure, economic independence of the enterprise, political stability of the country-producer and the countries where the products of the enterprise are sold, the economic environment, market share, position of competitors, etc.
(Balabanova, Sardak, 2003)	mission of the enterprise, goals of the enterprise, principles of pricing, marketing goals, elements of the marketing complex, costs, personnel, image of the enterprise.	market environment, government regulation, consumers, competition, market conditions, level of demand and its elasticity, economic situation, participants
(Larina, Barylovych Skrypnyk, 2016)	Production and commercial: scale of production, production experience, commercial risks of the enterprise, conditions of sale of goods	Macroeconomic factors: inflation, exchange rates, interest rates, etc., state price regulation. Marketing factors: characteristics of markets, type of market structure, stage of the product life cycle

Table 2

**Values of correlation coefficients between aerated concrete prices and macroeconomic indicators for the period from the 1st quarter of 2015 to the 3rd quarter of 2018**

Factors Prices	Exchange rate USD, UAH / USD	Average salary, UAH	Average prices based on CPI,%	Cap. investments, million UAH	Nomin. GDP, million UAH
Small cellular B2 concrete wall blocks for laying on mortar, density of 500 kg/m <sup>3</sup>	0.59	0.88	0.87	0.57	0.70
Small cellular B2.5 concrete wall blocks for laying on mortar, density of 500 kg/m <sup>3</sup> 0.59	0.67	0.93	0.91	0.68	0.79
Average value	0.63	0.91	0.89	0.63	0.75

which, in our opinion, was due to the low share of imported raw materials in the cost of aerated concrete production.

As for the dynamics of nominal GDP and the volume of capital investment, which reflect changes in demand in the country, the impact of these factors on the prices of aerated concrete was insufficient. This confirms our previous assumption that with increasing demand for aerated concrete, producers under oligopoly do not risk raising prices, but only increase production within existing production capacity (Skrypnyk, 2019).

While analysing industry factors, we analysed the impact of the following factors on aerated concrete prices: prices in Ukraine at the end of the quarter on key raw materials used in aerated concrete production (cement brand M-400, gypsum construction grade G-4, quicklime and natural sand) and the volume of construction work.

The results of correlation analysis are showed in Table 3.

Analysis of the values of the correlation coefficients, given in Table 3, allowed us to draw the following conclusions:

A factor such as the volume of construction work, which, first of all, characterizes the change in demand for construction materials and products, has an insufficient effect on the prices of aerated concrete, which does not allow the use of this indicator for forecasting. In our opinion, this is due to seasonal changes in the volume of construction work.

Factors such as changes in prices for all types of raw materials for the production of aerated concrete have a significant impact on the prices of aerated concrete, which is due to their direct impact on the cost of its production (Skrypnyk, 2019).

#### 4. Assessment of price dynamics in the aerated concrete market of Ukraine in 2016–2020

As previously mentioned, these results were obtained for the period from the 1st quarter of 2015 to the 3rd quarter of 2018 and therefore need to be revised in the light of the data of subsequent periods.

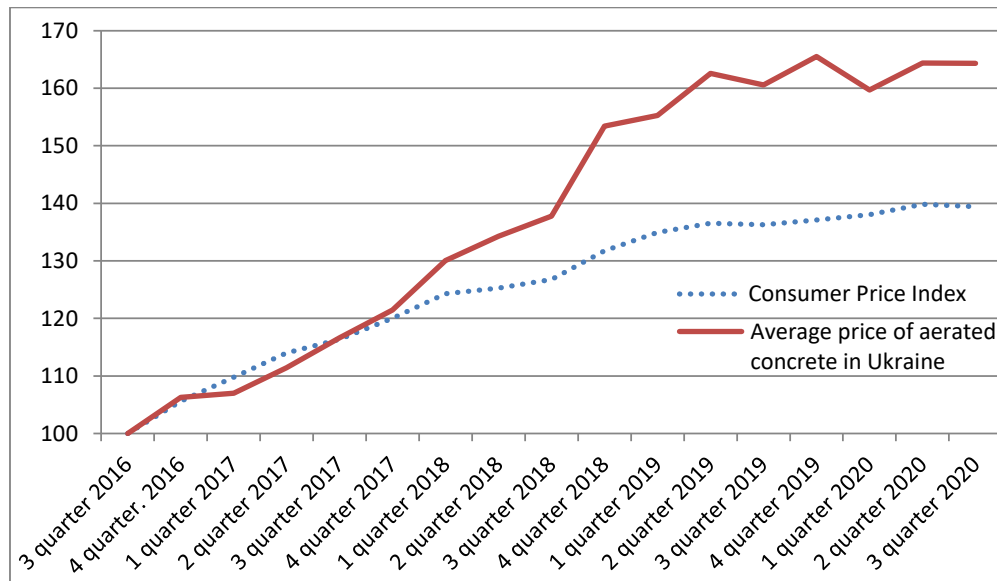
To assess the price dynamics in the aerated concrete market of Ukraine, it is first of all expedient to compare the growth rates of aerated concrete prices and the consumer price index. For that purpose, we expressed the price of aerated concrete for the 4th quarter of 2016 – 3rd quarter of 2020 as a percentage of the base price, which was the price in the 3rd quarter of 2016. Based on the consumer price index, we calculated the average consumer price with the base in the same period. The results of these calculations are shown in Figure 1.

This figure confirmed our previous studies (Skrypnyk, 2019), according to which there was a fairly high correlation between aerated concrete prices and the consumer price index in the period up to the 1st quarter of 2018 (correlation coefficient ~ 0.9). However, from the 2nd quarter of 2018, aerated concrete prices began

Table 3

**Values of correlation coefficients between aerated concrete prices and some industry indicators for the period from the 1st quarter of 2015 to the 3rd quarter of 2018**

Prices	Factors				
	Construction quicklime, UAH / t	Construction gypsum G-4, UAH / t	Cement M-400, UAH / t	Natural sand, UAH / t	Volumes of construction works, million UAH
Small cellular B2 concrete wall blocks for laying on mortar, density of 500 kg/m <sup>3</sup>	0.91	0.89	0.86	0.90	0.59
Small cellular B2.5 concrete wall blocks for laying on mortar, density of 500 kg/m <sup>3</sup> 0.59	0.96	0.91	0.93	0.92	0.70
Average value	0.93	0.90	0.90	0.91	0.64



**Figure 1. Comparison of the dynamics of price growth for aerated concrete and inflation in Ukraine in 1 quarter 2016 – 3 quarter 2020 as a percentage of the base values of these indicators (base – 3rd quarter of 2016)**

Source: Compiled by the author on the basis of (State Fiscal Service of Ukraine, 2020), (Inproject LLC, 2020)

to grow faster than inflation. This trend has allowed us to speculate that this may be due to the economic cyclicality that aerated concrete companies have taken into account in advance in their pricing policies. Therefore, we have analysed the dynamics of Ukraine's GDP as the main indicator for determining the phases of the economic cycles of Kitchin and Zhuglyar.

In determining the phases of the economic cycle, experts usually focus on GDP growth compared to the corresponding quarter of the previous year (because GDP has significant seasonal fluctuations). Negative GDP growth characterizes the phases of recession and depression, and positive is characteristic of recovery and upswing (respectively, the transition from negative GDP growth to positive means the beginning of the recovery phase, and from positive to negative – the beginning of the recession).

As for distinguishing between positive and negative phases of the cycle (recession from depression, and recovery from the rise), there is no single methodology for this in economics (Dubovskii, 2015). At the same time, the distinction between recession and depression is usually not a difficult task, because the transition from recession to depression begins when the rate of decline in GDP begins to decrease. Similarly, we believe that any slowdown in GDP growth during economic growth will indicate a transition from recovery to growth.

According to this concept and based on the graph of the percentage change in the quarterly GDP of Ukraine relative to the corresponding quarter of the previous year (Figure 2) in the period from 2014 to 2020 in the economy of Ukraine we have identified the following phases of the cycle:

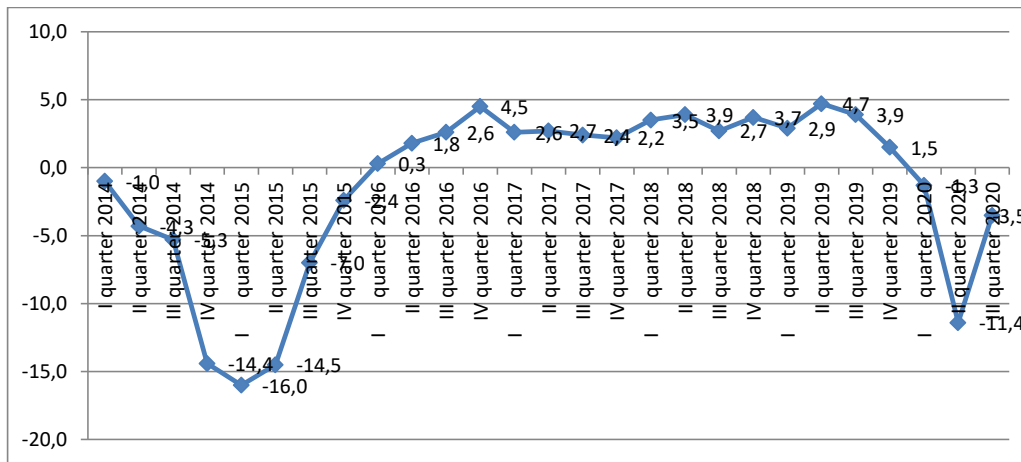
**Recession:** to Q1 2015 **Depression:** Q2 2015 – Q4 2015. **Recovery:** Q1 2016 – Q4 2016. **Rise:** Q1 2017 – Q4 2019. **Recession:** Q1 2020 – 2Q 2020. **Depression:** Q3 2020 to the present.

The selection of the relevant phases of the economic cycle allowed us to identify the following trends in the dynamics of prices for aerated concrete products in Ukraine:

1. Aerated concrete prices in the analysed period in the phases of recovery and growth initially grew rapidly, outpacing inflation (from Q1 2016 to Q2 2019), but from the 3rd quarter of 2019, the growth rate of prices slowed down, and this happened at the stage of prosperity. Thus, aerated concrete producers predicted the onset of the recession and adapted their pricing policies in advance to the onset of this phase of the cycle.

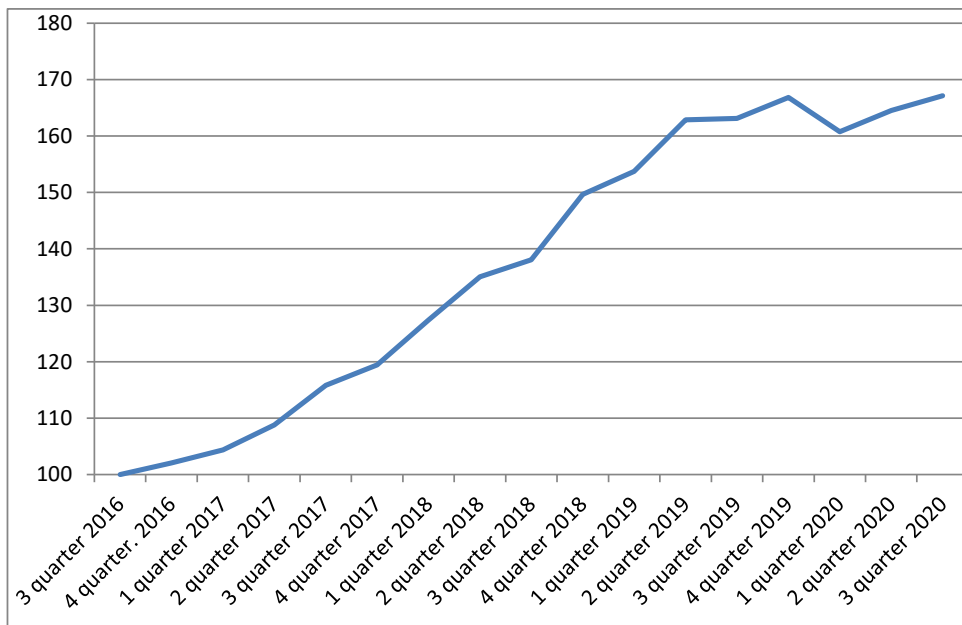
To identify the real dynamics of aerated concrete prices not related to inflation, it is advisable to consider changes in the discounted price of aerated concrete in the analysed period as a percentage of the base price with the same base (we have used the consumer price index to discount aerated concrete).

Comparing the graphs in Figure 1 and Figure 3, we can see that the dynamics of the discounted price of aerated concrete corresponds in general to the dynamics of its undiscounted price. This allows us to conclude that the rise in prices for aerated concrete is influenced not only by inflation in the economy, but also the pricing policy of manufacturers who use increasing demand for aerated concrete in the boom phase to increase profitability, thereby reducing financial risks in the next phase of economic cycle during recession.



**Figure 2. Percentage change in the quarterly GDP of Ukraine relative to the corresponding quarter of the previous year. Period – 1st quarter of 2014 – 3rd quarter of 2020**

Source: Compiled by the author on the basis of (State Fiscal Service of Ukraine, 2020), (Inproject LLC, 2020)



**Figure 3. Dynamics of the discounted price of aerated concrete for the period 3rd quarter of 2016 – 3rd quarter of 2020 as a percentage of the base price (base – 3rd quarter of 2016)**

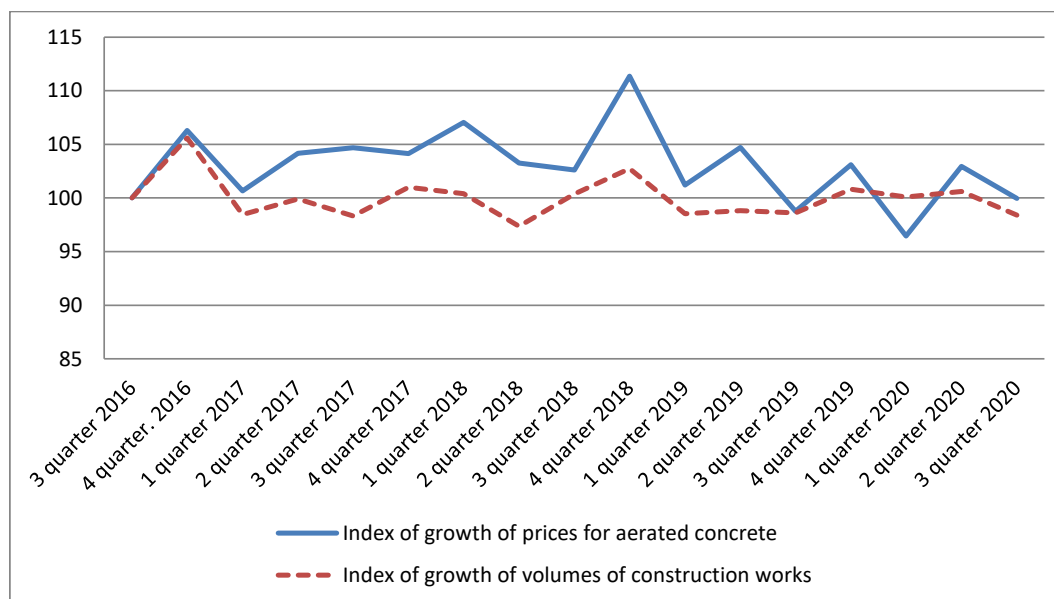
Source: Compiled by the author on the basis of (State Fiscal Service of Ukraine, 2020), (Inproject LLC, 2020)

Another probable factor influencing the prices of aerated concrete, as already mentioned, is the change in construction volumes. To determine the impact of this factor, we compare the discounted price of aerated concrete expressed as a percentage of the previous quarter and the discounted volumes of construction expressed as a percentage with the same base (we use the index of rising prices for construction works to discount it).

This figure shows that in general, the decrease in the volume of construction work is usually reflected in the discounted prices of aerated concrete. Thus, in the recovery phase and for most of the upswing

phase, this led to a decrease in aerated concrete prices, but in the final pre-recession part of the upswing phase, this led to a decrease in discounted prices (i.e. in fact real prices did not decrease, but the profitability of aerated concrete products decreased for manufacturers). At the same time, the growth of construction work usually led to an increase in the growth rate of discounted prices for aerated concrete.

It should be noted that sometimes these changes did not occur in the same quarter, but with a delay of one quarter, which confirms the existence of a stable relationship between changes in construction and the price of aerated concrete products.



**Figure 4. Comparison of the index of price growth for aerated concrete relative to the previous quarter and the index of growth of construction work relative to the previous quarter**

Source: Compiled by the author on the basis of (State Fiscal Service of Ukraine, 2020), (Inproject, 2020)

## 5. Conclusions

Analysis of the literature has shown that the price is formed under the influence of many factors, some of them are not quantifiable, which complicates the calculations when setting the price and forecasting its change. Therefore, it is important to identify key ones for timely and effective regulation of pricing and choosing the right strategy, tactics and methods of pricing.

Analysing the dynamics of prices for aerated concrete products in Ukraine in 2016–2020, we can conclude that in the positive phases the price of aerated concrete is highly sensitive to changes in the phase of the economic cycle and volume of construction work, and much less sensitive to inflation in the country. At the same time, during economic growth, the profitability of aerated concrete production increases significantly (due to the outstripping growth of aerated concrete

price compared to its production costs), while during the economic downturn it decreases slightly (because the price of aerated concrete grows much lower than its cost).

According to our research, the most influential macroeconomic factors in pricing aerated concrete products are inflation and construction volumes. The impact of these factors will be different in different phases of the economic cycle.

The patterns identified by us can be used to develop strategic and tactical decisions to regulate the price of aerated concrete products in Ukraine at the microeconomic, sectoral and macroeconomic levels. The prospect of further research is to analyse the impact of a number of other macroeconomic indicators (such as market structure, tax rates, average wages) on pricing in the construction industry.

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