Advances in Economics, Business and Management Research, volume 139
International Conference on Economics, Management and Technologies 2020 (ICEMT 2020)

Analysis of Investment Appeal for the Food Industry of Crimea

Tatiana Lomachenko[1], Remzi Ablaev[2,*], Alim Ablaev[2], Stanislav Roshchupkin[2]

[1]*Department of Economics, Finance, and Accounting Sevastopol Affiliate of the Plekhanov Russian Economic University, Sevastopol 299053, Russia*
[2]*Sevastopol State University, Sevastopol 299053, Russia*
[*]*Corresponding author. Email: Ablaev.expert@mail.ru*

ABSTRACT
This research seeks to develop a generalized investment appeal indicator for a food company and for the food industry of a region by the example of Crimea. The latter is further called the rating of investment appeal for a region. Being of interest to management scholars and practitioners, the formulated indicators are calculated using the database of the main financial and activity indicators for Crimean food companies (2015-2019).
Keywords: *principle component analysis, investment appeal, food industry*

1. INTRODUCTION

A significant increase in the complexity of somewhat chaotic changes in food production and consumption that we observe today resulted from intense economic, scientific, technical, and demographic development of modern civilization and its environmental consequences, such as global pollution and depletion of the natural resources [1, 2]. Wide application of innovative methods of molecular chemistry and physics, genetic engineering technologies, nanotechnologies, and other contemporary advances of fundamental sciences in the food industry insures the rapid increase in the number of available consumer food choices, such as functional, dietary, organic, genetically modified, and other products [3, 4]. To sustain and increase the innovative level of food industry, significant amount of investment is required [5, 6, 7]. Thus, it is vital to develop a generalized investment appeal indicator both for a food company and for the food industry in order to provide an investor with a practical tool to rank companies and regions by their investment appeal.

1.1. Materials and Methods

1.1.1. Sample for analysis

A total of 13 randomly selected Crimean food companies were analyzed using information provided by the Ukrainian State Statistics Committee. Historical statistical data on the six major efficiency indicators for these companies (the number of customers, net assets, sales volume, balance profit, budget payments and costs) was extracted from this database for further analysis.

1.1.2. Calculating the generalized investment appeal indicator

The generalized investment appeal indicator was obtained using the Principal Component Analysis (PCA) in the Open Source Software – GRETL – by calculating the first principle component based on the six initial efficiency indicators of the sample. That is, the PCA was applied in order to provide a generalization of initial company efficiency indicators into one aggregated indicator in order to obtain a possibility to compare or rank various food companies by the level of their investment appeal.

1.1.3. Analyzing dynamics of the investment appeal indicator for the food industry

Trend analysis (one of the econometrics methods) was used to estimate the dynamics of the general investment appeal indicator (rating) for the food industry. The latter was obtained by calculating Eigen values for the first principle components corresponding to investment appeal indicators for each year. That is, the trend analysis was used to analyze and project dynamics of the suggested aggregated investment appeal indicator (rating) for the region.

2. RESULTS

Within this study, the goal was achieved to develop such a rating of investment appeal for a region, using econometric methods, that it would be used as a universal tool of the overall independent assessment of the current state and potential of a region's food industry. The rating also provides the key information for an investor regarding

both generalized assessment and projections of the operational efficiency of all the region's company.

There are several means to determine the rating as an integral indicator of investment appeal [7, 8, 9, 10]. One of them, used in this study, was GRETL (GNU Regression Econometrics and Time Series Library) open source econometrical software procedures application.

The rating of investment appeal for a region is calculated based on the main financial and activity indicators of most functioning food companies of Crimea, using data from 2015 to 2019.

The following individual indicators were used in calculations, names in parenthesis indicate the corresponding variable name in Gretl:

X1 - Number of customers (Client base);
X2 - Net Assets (NA);
X3 - Sales Volume (SalesVolume);
X4 - Balance Profit (BalanceProfit);
X5 - Budget Payments (BudgetPaym);
X6 - Costs (Costs).

As far as the indicators $x_1,...,x_6$ are correlated among each other in the substantial extent, the principal components method can be applied to calculate one the most significant principal component y1 (with the maximum contribution into the overall dispersion of $x_1,...,x_6$) as a linear function of the original indexes, formula (1).

The principal component y1 can be used as a generalized index of the investment appeal for a company, as far as it contains the majority of information about the company from $x_1,...,x_6$.

$$y_1(x) = w_{11}(\frac{x_1 - \bar{x}_1}{\sigma_1}) + ... + w_{61}(\frac{x_6 - \bar{x}_6}{\sigma_6}), \quad (1)$$

where $\bar{x}_j$ and σ_j — the average and standard deviation of xj; w_{j1} – coefficients of the most significant principal component ($\sum_{j=1}^{6} w_{j1}^2 = 1$); y_1 – the most significant principal component - a generalized index of the investment appeal for a company.

The value λ_1 is the maximum eigenvalue for the first principal component y_1. As far as λ_1 generalizes the majority of observations $x_1,...,x_6$, it can be considered the rating of investment appeal for a region in a given year and further used to track the dynamics of a region's investment appeal.

According to the modeling results obtained in Gretl (figure 1), the generalized indicator of investment appeal for a company (y1) for the year 2019 is determined using formula (2):

$$\begin{aligned} Y1_{2019} &= 0{,}452 \cdot ClientBase + 0{,}428 \cdot NA + \\ &+ 0{,}459 \cdot SalesVolume + 0{,}453 \cdot Costs + \\ &+ 0{,}152 \cdot BalanceProfit + 0{,}416 \cdot BudgetPayments. \end{aligned} \quad (2)$$

Principal Components Analysis

Eigenanalysis of the Correlation Matrix

Component	Eigenvalue	Proportion	Cumulative
1	4,3593	0,7265	0,7265
2	0,9329	0,1555	0,8820
3	0,3859	0,0643	0,9463
4	0,2813	0,0469	0,9932
5	0,0394	0,0066	0,9998
6	0,0013	0,0002	1,0000

Eigenvectors (component loadings)

Variable	PC1	PC2	PC3	PC4	PC5	PC6
Client_base	0,452	-0,052	0,236	0,485	-0,708	-0,019
NA	0,428	-0,063	0,684	0,105	0,576	0,044
Sales_Volume	0,459	0,001	-0,153	-0,503	-0,122	0,706
Costs	0,453	-0,161	-0,116	-0,513	-0,071	-0,698
Balance_Profit	0,152	0,982	-0,004	-0,020	0,012	-0,113
BudgetPaym	0,416	-0,062	-0,664	0,486	0,382	-0,002

Figure 1. Modeling results in Gretl using the Principal Components Method for the year 2019

The per cent of initial data $x_1,...,x_6$ embraced by y1 and included into the formula (2) is 72,65% (Proportion on figure 1).

Thus, eigenvalue $\lambda_{2019} = 4{,}3593$ can be considered the rating of investment appeal for a region in 2019.

Similar calculations were conducted using 2018data (figure 2), formula (3) was obtained:

$$Y1_{2018} = 0{,}457 \cdot ClientBase + 0{,}434 \cdot NA + \\ + 0{,}451 \cdot SalesVolume + 0{,}453 \cdot Costs + \\ + 0{,}06 \cdot BalanceProfit + 0{,}436 \cdot BudgetPayments. \quad (3)$$

The per cent of initial data $x_1,...,x_6$ embraced by y1 and included into the formula (3) is 74,49% (Proportion on figure 2).

Thus, eigenvalue $\lambda_{2018} = 4{,}4692$ can be considered the rating of investment appeal for a region in 2017.

Similar calculations were conducted using 2017 data (figure 3), formula (4) was obtained:

$$Y1_{2017} = 0{,}447 \cdot ClientBase + 0{,}446 \cdot NA + \\ + 0{,}472 \cdot SalesVolume + 0{,}469 \cdot Costs - \\ - 0{,}004 \cdot BalanceProfit + 0{,}399 \cdot BudgetPayments. \quad (4)$$

Principal Components Analysis

Eigenanalysis of the Correlation Matrix

Component	Eigenvalue	Proportion	Cumulative
1	4,4692	0,7449	0,7449
2	0,9921	0,1654	0,9102
3	0,2860	0,0477	0,9579
4	0,2130	0,0355	0,9934
5	0,0387	0,0065	0,9998
6	0,0010	0,0002	1,0000

Eigenvectors (component loadings)

Variable	PC1	PC2	PC3	PC4	PC5	PC6
Client_base	0,457	-0,051	-0,359	-0,024	0,811	0,034
NA	0,434	0,007	-0,240	0,804	-0,324	-0,056
Sales_Volume	0,451	0,014	0,553	-0,120	0,017	-0,690
costs	0,453	-0,066	0,516	-0,066	-0,063	0,718
Balance_Profit	0,060	0,996	-0,008	-0,031	0,022	0,059
BudgetPaym	0,436	-0,037	-0,492	-0,578	-0,482	-0,021

Figure 2. Modeling results in Gretl using the Principal Components Method for the year 2018

Principal Components Analysis

Eigenanalysis of the Correlation Matrix

Component	Eigenvalue	Proportion	Cumulative
1	4,2807	0,7134	0,7134
2	1,1715	0,1953	0,9087
3	0,3155	0,0526	0,9613
4	0,1914	0,0319	0,9932
5	0,0379	0,0063	0,9995
6	0,0029	0,0005	1,0000

Eigenvectors (component loadings)

Variable	PC1	PC2	PC3	PC4	PC5	PC6
Client_base	0,447	-0,168	-0,009	0,739	0,472	-0,050
Tour_days	0,446	-0,231	0,440	0,151	-0,725	0,069
Sales_Volume	0,472	-0,001	0,107	-0,446	0,327	0,678
costs	0,469	0,105	0,155	-0,428	0,191	-0,725
Balance_Profit	-0,004	-0,899	-0,371	-0,215	0,006	-0,084
BudgetPaym	0,399	0,314	-0,796	0,032	-0,328	0,028

Figure 3. Modeling results in Gretl using the Principal Components Method for the year 2017

The per cent of initial data $x_1,...,x_6$ embraced by y1 and included into the formula (4) is 71,34% (Proportion on fig 5).

Thus, eigenvalue $\lambda_{2017} = 4{,}2807$ can be considered the rating of investment appeal for a region in 2017. Modeling results obtained above for the Crimean Region food industry investment appeal can be summarized as follows:

2017: $Y1_{2017} = 0{,}447 \cdot ClientBase + 0{,}446 \cdot NA + + 0{,}472 \cdot SalesVolume + 0{,}469 \cdot Costs - - 0{,}004 \cdot BalanceProfit + + 0{,}399 \cdot BudgetPayments.\ \lambda_i = 4{,}2807.$

2018: $Y1_{2018} = 0{,}457 \cdot ClientBase + 0{,}434 \cdot NA + + 0{,}451 \cdot SalesVolume + 0{,}453 \cdot Costs + - 0{,}06 \cdot BalanceProfit + + 0{,}436 \cdot BudgetPayments.\ \lambda_i = 4{,}4692.$

2019: $Y1_{2019} = 0{,}452 \cdot ClientBase + 0{,}428 \cdot NA + + 0{,}459 \cdot SalesVolume + 0{,}453 \cdot Costs + + 0{,}152 \cdot BalanceProfit + + 0{,}416 \cdot BudgetPayments.\ \lambda_i = 4{,}3593.$

```
Model 1: OLS estimates using the 5 observations
Dependent variable: rating

     VARIABLE        COEFFICIENT        STDERROR       T STAT    P-VALUE

  const                  3,79850          0,121144     31,355    0,00007 ***
  index                  0,135780         0,0365262     3,717    0,03387 **

  Mean of dependent variable = 4,20584
  Standard deviation of dep. var. = 0,236848
  Sum of squared residuals = 0,040025
  Standard error of residuals = 0,115506
  Unadjusted R-squared = 0,821625
  Adjusted R-squared = 0,762167
  Degrees of freedom = 3
  Durbin-Watson statistic = 2,06425
  First-order autocorrelation coeff. = -0,328039
  Log-likelihood = 4,97453
  Akaike information criterion (AIC) = -5,94906
  Schwarz Bayesian criterion (BIC) = -6,73018
  Hannan-Quinn criterion (HQC) = -8,04552
```

Figure 4. Trend modeling results for λ_i

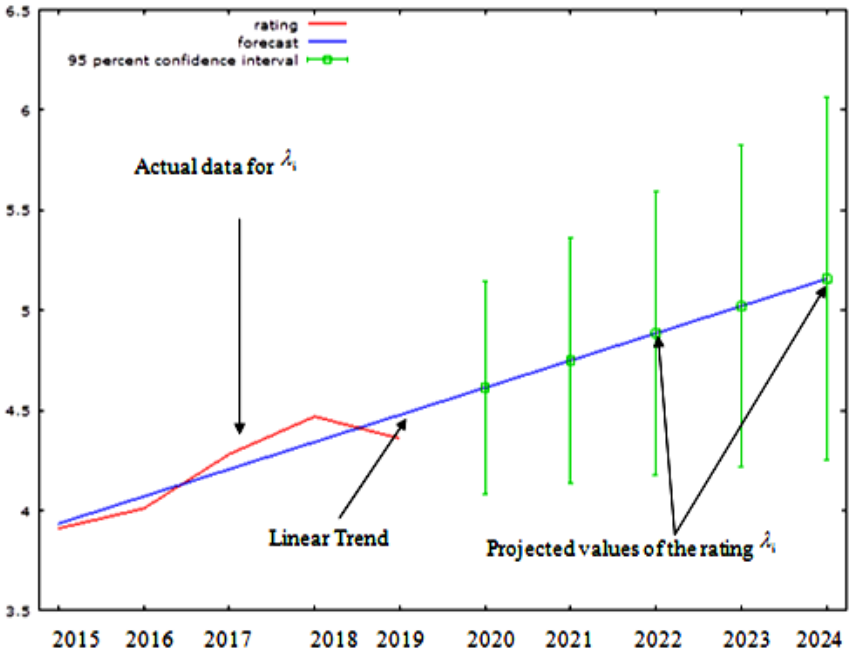

Figure 5. Dynamics and projection for λ_i (Crimea investment appeal rating)

Thus, the principal component method allows for generalization and synthesis of initial financial and activity indicators $x_1,...,x_6$ for individual companies in a certain year into a generalized indicator of a company's investment appeal y1
(most significant principal component) and also for calculation of the investment appeal rating for a region's food industry λ_1 (eigenvalue for y1.)

In order to estimate the dynamics of the calculated ratings in the given time-frame (2015-2019) and to make the projections for the period (2020-2024), the trend analysis method (one of the methods for time series analysis) was applied in Gretl.

According to the modeling results using Ordinary Least Squares method (Figure 4) the trend model of the time series of λ_i was developed, formula (5):

$$\lambda_i = 3{,}7985 + 0{,}13578 \cdot t + \varepsilon, \quad (5)$$

where t - year; ε - random error (residuals).

Model (5) was developed based on prior obtained values of λ_{2015}, λ_{2016}, λ_{2017}, λ_{2018}.

Prediction of the rating λ_i for the time frame (2020-2024) is shown on figure 5 and 6.

For 95% confidence intervals, t(3, .025) = 3,182

Obs	Prediction for λ_i (Rating)	std. error	95% confidence interval
2020	4,61318	0,167384	(4,08049, 5,14587)
2021	4,74896	0,193279	(4,13386, 5,36406)
2022	4,88474	0,222181	(4,17766, 5,59182)
2023	5,02052	0,253061	(4,21517, 5,82587)
2024	5,15630	0,285279	(4,24841, 6,06419)

Figure 6. The parameters of the projection for λ_i (Crimea investment appeal rating)

The model (5) can be considered adequate and its parameters - valid with a 5% probability of an error.

3. CONCLUSION

Overall positive dynamics of the investment appeal rating for Crimea can be indicated during the period 2015-2019, (Figure 5). The rating value is going to reach 4,61318 in 2020 and 5,15630 in 2024 according to the projections using the linear trend model (5).

Modeling results obtained in the research allow to make a conclusion that investment appeal of Crimea is going to increase 5,82% in 2020 and 18,28% in 2024 due to the positive dynamics of individual financial and activity indicators of food companies in the region.

REFERENCES

[1] Ablaev, R.R., Kokodey, T.A., Lomachenko, T.I. Dynamics of the main factors of the global food crisis in history. Journal of Audit and financial analysis. 2020. № 1. pp. 181-186. DOI: https://doi.org/10.38097/AFA.2020.79.34.025

[2] Berry, B.J.L. Long-wave Rhythms in Economic Development and Political Behaviour. Baltimore & London. 1991.

[3] Braudel, F. The Perspective of the World. Civilization and Capitalism, 15th-18th Century. University of California Press, Berkeley. 1992.

[4] Carpenter, S., et al.: Ecosystems and human well-being: scenarios. findings of the Scenarios Working Group, Millennium Ecosystem Assessment. Island Press, Washington. 2005.

[5] Erokhina, E.V. Investment image and investment attractiveness of the region – the development of opportunities. Science and Modernity. 2016. № 4. pp. 20–33.

[6] Kokodey, T.A. History of the global business environment in the polycyclic conceptual framework. Applied Econometrics and International Development. 2013. №13 (2). pp. 1-17.

[7] Mustafakulov Sh. Investment Attractiveness of Regions: Methodical Aspects of the Definition and Classification of Impacting Factors. European Scientific Journal, 2017, vol. 13, no. 10, p. 433.

[8] Smaglyukova, T.M. Methodology for comprehensive assessment of investment attractiveness of regions in view of their sectoral specialization. Problems of Modern Economics. 2007. no. 3, pp. 311-314.

[9] Trachenko, M.B., Dzhioev, V.A. Express Analysis of the Investment Appeal of Regions. Finance and Credit. 2018. vol. 24. iss. 9. pp. 2151–2165.

[10] Yakovets, Y.: The Future of Civilizations and Strategy of Civilization Partnership. Part 9 of the Global Forecast "Future of Civilizations" for 2050. Moscow, Russia: SKII. 2009.