





Formation of a Linear Functional of Cluster Value for the Innovative Development of a Region

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Abstract

Purpose: In order to create a value-oriented model of the innovation system of an industrial region, the article compiles a linear functional of the value of an innovation-industrial cluster for a region. **Design/methodology/approach:** Decomposition for this purpose of two-phase multiples of book value and revenue into fundamental variables allows us to more logically determine the reasons for the change in multipliers in the phases of rapid and stable growth of the company. This approach allows us to initially focus on the analysis of the most promising clusters. After such preparatory work, it is possible to form the value functional of the innovation and industrial cluster for the region, which linearly depends on two functions—the functions of the cluster innovative potential and innovative development. The value of this functionality should be positive in order that the function of innovative potential exceeds the function of innovative development of the cluster. This means that the company which is core of the cluster has enough innovative resources such as financial, production, labor, and others to ensure long-term stable innovative development. **Findings:** Based on empirical results, it can be argued that Nizhny Novgorod innovative-industrial cluster is more profitable to develop the direction of “Electric Power”. For this direction, the cluster has the necessary innovative potential, i.e., enough production, financial, labor, and other resources for the successful evolution of the cluster. **Originality/value:** The results of the study can be useful to financial analysts of clusters and their

companies, as well as top managers in state executive authorities for making rational decisions on the evolution of innovative-industrial clusters.

Keywords

Innovative and industrial cluster • Linear functionality of cluster values • Innovative potential • Innovative development

JEL Classification

D20 • D23 • D24

1 Introduction

In order to assess the level of economic and innovative development of territorial clusters, there is a need for tools that would really reflect on the strengthening of the cluster’s market positions at the regional, sectoral, national, and international markets. The manifestation of cluster values in the physical sphere, life, psychological, technological, economic, social, and information spheres constitute the cluster’s usefulness for the region. Formalization of its space in the form of functional cluster value for the region is a priority task of complex analysis of its development or evolution. This is necessary to create a value-oriented model of the innovation system of the industrial region.

To understand the logic of constructing analytical indicators, which will be presented below, it is first necessary to determine their practical nature. As we know, the basis of any cluster, including the innovation-industrial one, is enterprises (business), research universities (science) and local administrations (government) (Tukkel et al., 2013). The latter, as pointed out by Porter (1998), play an indirect role in the evolution of clusters. The government does not

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have the right to intervene directly in their development, therefore, it uses indirect levers of government regulation.

The economic and innovative development of territorial clusters are impossible without the necessary means that is, production, financial, human, and other resources. For this purpose, an indicator of the cluster's innovative potential should be formulated, which would reflect a market assessment of the adequacy of the indicated resources and take into account their future potential return to the investor-region. Thus, the indicator of innovative potential should characterize, first of all, the presence or absence of underestimation of the company which is the core of the cluster in the market. Such a characteristic can give spread of the market value of such a branded company.

Depending on what the investor wants to know about the company—the core of the cluster, he will use one or another multiplier. We must not forget that each of the multipliers carries additional information about the development prospects and potential of the analyzed company. Practitioners use the following main multipliers (Damodaran, 2002; Roche, 2005):

1. profit multiples (PE and PEG);
2. book value multiples (PBV);
3. revenue multipliers (PS and VS);
4. specific sector multipliers.

Although in future for analysis purposes we will use book value and revenue multiples to identify possible high yield spreads and high profit margins, nevertheless, we will need profit multipliers (PE) in order to more conveniently decompose the multiples, we need into fundamental variables.

For practical calculations, we will use the two-phase model of multipliers, characterized by a period of rapid growth and a period of stable growth. The rapid growth at the beginning of the planning horizon is due to the fact that the most promising company is chosen as the core of the cluster.

2 Materials and Method

According to the model we presented (Koshelev et al., 2016), the two-phase profit multiplier is based on the Gordon model (Brigham & Gapenski, 1993; Brigham & Houston, 2009) and an expression

$$PE = \left(1 - \frac{g}{ROE_{hg}}\right)(1+g) \left(1 - \frac{(1+g)^n}{(1+k_{s,hg})^n}\right) \frac{1}{k_{s,hg} - g} + \left(1 - \frac{g_n}{ROE_{st}}\right) \frac{(1+g)^n(1+g_n)}{(k_{s,st} - g_n)(1+k_{s,hg})^n}, \quad (1)$$

where g and g_n are the growth rates of income and dividends of the company—the core of the cluster in n years of the period of rapid growth and in the subsequent period of stable growth (%);

ROE_{hg} and ROE_{st} —return on equity in periods of rapid and stable growth (%), defined as

$$ROE = \frac{EPS}{BV}; \quad (2)$$

EPS—net profit per ordinary share (RUB);

BV—the carrying amount of one ordinary share (RUB);

$k_{s,hg}$ and $k_{s,st}$ —the cost of equity of the firm during periods of rapid and stable growth.

Such a construction of a two-phase multiplier PE, as well as similar constructions of the multipliers PBV and PS (or VS), have a serious drawback. It consists in accepting the condition $gDPS_{EPS}$ that it is rarely realized in practice. However, even in this approximation, by decomposing the multipliers into fundamental variables using a two-phase model, they allow us to determine important structural shifts in those internal factors of the company's activity that determine their future market prospects in the process of economic development (Damodaran, 2002).

So, the presented decomposition of the PE profit multiplier allows one to make similar calculations for the two-phase multiplier of the book value of PBV, assuming that the company uses free cash flow (Damodaran, 2002; Limitovsky, 2015) instead of its dividends:

$$PBV = \frac{EV_0}{BVC_0} = ROC_{hg}(1 - RIR_{hg})(1+g) \left(1 - \frac{(1+g)^n}{(1+k_{c,hg})^n}\right) \frac{1}{k_{c,hg} - g} + ROC_{st} (1 - RIR_{st}) \frac{(1+g)^n(1+g_n)}{(k_{c,st} - g_n)(1+k_{c,hg})^n}, \quad (3)$$

where EV_0 is the market value of the company in the current year (rubles);

BVC_0 —the book value of the total capital of the company in the current year (rubles);

ROC—return on total capital (%), defined as

$$ROC = \frac{EBIT(1 - T)}{BVC}; \tag{4}$$

EBIT—operating profit of the company (RUB);
 T—income tax rate (%);
 RIR = g/ROC—reinvestment rate;
 g—the actual growth rate of the company’s business, determined by the fundamental model (Damodaran, 2002):

$$g = RIR \cdot ROC = RIR \cdot \frac{EBIT(1 - T)}{BVC} = \frac{EBIT(1 - T) - \sum DPS}{EBIT(1 - T)} \cdot \frac{EBIT(1 - T)}{NS} \cdot \frac{NS}{BVC}, \tag{5}$$

$\sum DPS$ —the amount of annual dividends on ordinary shares (rubles);

$EBIT(1 - T)/NS$ —net operating profit margin;
 NS/BVC —the turnover of all capital.
 k_c —the value of the total capital (%).

Here, we can just observe the dependence of this PBV multiplier on the profitability of all ROC capital, its value k_c , growth rates g and g_n and the level of RIR reinvestment during periods of rapid and stable growth in the value of the company’s business.

Other things being equal, the PBV multiplier will increase as the spread on capital returns increases ($ROC - k_c$). On the contrary, this multiplier will decrease with a reduction in the profitability spread of the company. Potential investors will always be attracted by those companies that have a mismatch between the PBV multiplier and the yield spread: high PBV and low spread, as well as low PBV and high spread (Fig. 1). Getting into the area of undervaluation of the company, it can be argued that it was reasonably chosen by the core of the cluster, which allows us to continue building a positive indicator of the innovative potential of the cluster.

However, revenue multipliers are more attractive for analysis purposes for several reasons.

1. Unlike PE and PBV multiples, revenue multiples cannot take negative values, which could lead to the exclusion of such companies from further analysis.
2. Revenue is difficult to manipulate in financial statements, unlike the carrying amount used for PBV multipliers.
3. Revenue is less susceptible to annual or seasonal fluctuations as opposed to company profits.

Revenue multipliers also have a serious drawback, namely that companies can create high revenue, thereby incurring significant expenses for its creation. This problem can be solved by taking into account the size of the profit margin, as well as its dynamics over time.

VS two-phase revenue multiplier, also based on the company’s free cash flow, can be represented as

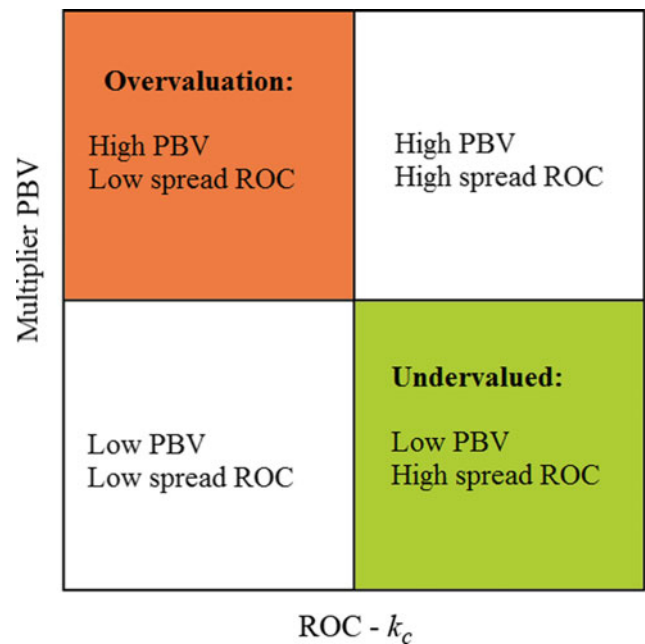


Fig. 1 Dependence of PBV multiplier and spread of total capital of the company

$$VS = \frac{EV_0}{NS_0} = \left(\frac{EBIT_0(1 - T)}{NS_0} \right)_{hg} (1 - RIR_{hg}) (1 + g) \left(1 - \frac{(1 + g)^n}{(1 + k_{c,hg})^n} \right) \frac{1}{k_{c,hg} - g} + \left(\frac{EBIT_0(1 - T)}{NS_0} \right)_{st} (1 - RIR_{st}) \frac{(1 + g)^n (1 + g_n)}{(k_{c,st} - g_n)(1 + k_{c,hg})^n}, \tag{6}$$

where NS_0 is the company’s revenue at the beginning of the phase of rapid or stable growth (%).

Like the corresponding PBV multiplier, this multiplier is determined by the following determinants: net operating profit margin $EBIT_0(1 - T)/NS_0$, growth rates g and g_n , the cost of the company’s total capital k_c and the level of its RIR reinvestments.

Potential investors, using the VS multiplier for analysis, are guided by companies with a mismatch between the multiplier f and the profit margin. So they are primarily attracted to companies with high multiples of VS and low net profit margins or net operating profit, as well as companies with low multipliers and high profit margins (Fig. 2).

Although these approaches look attractive, it is necessary to check the company’s core of the cluster for its existing brand. The value of which reflects the degree of confidence for investors and consumers of the company’s products in its activities. But since we are primarily interested in the innovation activity of the cluster, which is characterized, first of all, by its success in the company. It is necessary to compare subsequently the indicator of innovative

| | | |
|----------------------|--|--|
| Multipliers PS or VS | Overvaluation: High PS or VS Low margin profits | High PS or VS High profit margin |
| | Low PS or VS Low margin profit | Undervaluation: Low PS or VS High profit margin |
| | Profit margin | |

Fig. 2 Dependence of the revenue multiplier and the profit margin of the company

development, which is depending on the brand, with the indicator of the cluster innovative potential.

Book value multipliers (PBV) and revenue (VS) allow determining the fair market value of a branded company’s business (the core of the cluster) using the formulas:

$$EV_b = PBV \cdot BVC_0 \quad \text{or} \quad EV_b = VS \cdot NS_0 \quad (7)$$

Estimates, naturally, will turn out different, which will ultimately lead to different values of the cluster value functional for the region. However, this approach will allow obtaining a range of functional values in return for a single value that does not claim absolute fidelity.

In further calculations, the value of the brand value of the company (Damodaran, 2002; Limitovsky, 2015), which in general terms can be calculated as:

$$B = (VS_b - VS_g)NS_b, \quad (8)$$

where the index *b* means a branded company, and the index *g* means a model company.

It is also important to understand that a good brand is not always good. All such preliminary estimates only help in the end to come to the calculation of the linear functional of cluster values for the region.

After such preparatory work, it is possible to form the value functional of the innovation and industrial cluster for the region, which linearly depends on two functions:

1. Function of cluster innovation potential:

$$\Phi(S_b) = \frac{S_b}{EV_b} = \frac{EV_b - NC_b}{EV_b}, \quad (9)$$

where *S_b* is the spread of the branded company market value (rubles);

NC_b—net capital of the branded company (rubles), which is defined as

$$NC = LTL + PS + CS, \quad (10)$$

LTL, PS, CS—market values of the long-term liabilities, preferred shares and ordinary shares of the company (RUB).

2. Cluster innovative development function:

$$\Phi(B) = \frac{B}{EV_b} = \frac{(VS_b - VS_g)NS_b}{EV_b}. \quad (11)$$

The difference of these functions is a linear functional of the value of the innovation and industrial cluster for the region:

$$\Phi(S_b - B) = \Phi(S_b) - \Phi(B) = \frac{S_b}{EV_b} - \frac{B}{EV_b} = \frac{S_b - B}{EV_b} > 0. \quad (12)$$

This linear functional must be greater than zero. Then the indicator of innovative development of the analyzed cluster does not exceed the value of the indicator of its innovative potential. This means that in this case we avoid the danger of the appearance of a branded “bubble” (Limitovsky, 2009), represented by the company, which is at the same time the core of the cluster. Of course, a high share of the market value of the brand in the market value of the company or cluster is welcomed by analysts and means high confidence in the innovative activities of the company, and in its products. But if such a brand is not supported by sufficient innovative potential of the company, then this situation is regarded by analysts as an unreasonable “bubble”. This is dangerous for further prospects for the development of the company—the core of the cluster and the evolution of the most evaluated cluster.

3 Results

For the Nizhny Novgorod innovation and industrial cluster, it is necessary to choose the most promising direction of its evolution. At the same time, two areas are officially provided for by the Government of Russia, and the third is a pilot cluster, also potentially promising for the Nizhny Novgorod region.

1. The cluster of automotive and petrochemicals. Presented by the core company PJSC GAZ.
2. Sarov innovation cluster. Presented by the core company is Atomenergoproekt JSC.
3. Pilot cluster of electric power industry. Presented by the core company PJSC TNS Energo.

For all three companies, IFRS reporting was analyzed for a period of 7 years, i.e., from 2011 to 2017.

It is possible to solve the question in which direction the Nizhny Novgorod innovation and industrial cluster should develop by visualizing the results in a diagram characterizing the linear functional of the cluster value for the region (Fig. 3). It depicts three areas of cluster activity, i.e., automotive, nuclear power, and electric power. The horizontal axis shows the direct values of the linear functional that were obtained using the multipliers VS and PBV. At the bottom of the diagram is strategies that correspond to the activities of the cluster. Based on these results, we can conclude that the Nizhny Novgorod innovation and industrial cluster should develop the direction of “Electric Power”. In this case, the cluster has the necessary innovative potential, i.e., enough production, financial, human, and other resources for the successful development of the cluster.

4 Conclusion

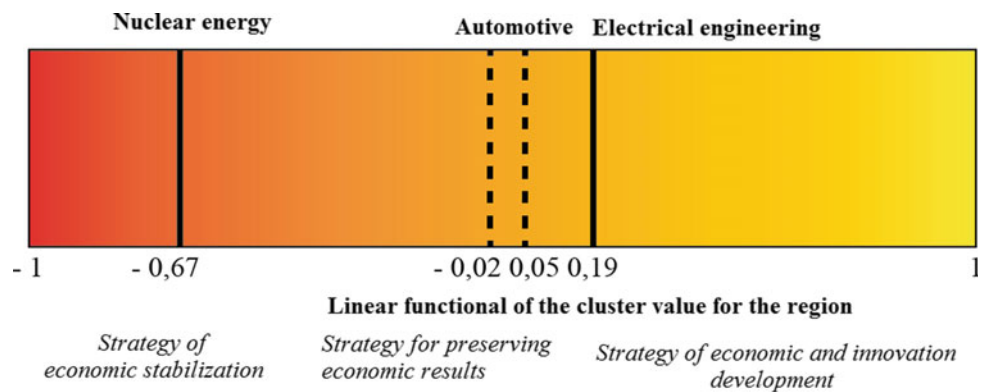
We formulate the most important conclusions obtained as a result of the study.

1. The combination of the region’s values in the sphere of life, physical, psychological, technological, economic, social sphere, and information spheres into a single system, implying their interconnection, determines the usefulness of the present or emerging cluster for the region in which it operates. Inconsistency of the development goals of the innovation-industrial cluster with the

values and usefulness of the region may lead to the destruction of the cluster as such, which will be reflected, first of all, in an unjustified increase in the debt obligations of cluster companies exceeding the acceptable level of financial stability, as well as in a direct loss of its labor and production resources.

2. For this reason, it is necessary to conduct a monetary assessment of the size and quality of the cluster brand, which will be determined primarily by the brand of the company—the core of the cluster. It is the construction of the functional as a family of the corresponding cluster value functions for the region that allows one of the most important variables to analyze and plan the brand of such companies, while avoiding the danger of branded bubbles, which will inevitably drive the cluster into the debt hole through its companies.
3. Decomposition for this purpose of two-phase multiples of book value and revenue into fundamental variables allows more logically determine the reasons for the change in multipliers in the phases of rapid and stable growth of the company. This approach allows us to initially focus on the analysis of the most promising clusters.
4. After such preparatory work, it is possible to form the functional value of the innovation and industrial cluster for the region. Linearly depending on two functions—the function of the innovation potential of the cluster and functions of innovative development of the cluster.
5. The value of this functional must be positive so that the function of innovative potential exceeds the function of innovative development of the cluster, which means that the company—the core of the cluster has enough innovative resources—financial, production, labor, and others—to ensure long-term stable innovation cluster development.
6. Based on empirical results, it can be argued that Nizhny Novgorod innovative-industrial cluster is more profitable to develop the direction of “Electric Power”. For this direction, the cluster has the necessary innovative

Fig. 3 Chart for making a decision on the development of the Nizhny Novgorod innovation and industrial cluster



potential—enough production, financial, labor, and other resources for the successful evolution of the cluster.

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