ECONOMETRIC MODELING OF FACTORS SHAPING THE FINANCIAL RESULTS OF THE SERVICES SECTOR

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Abstract. The article develops a methodology for econometric modeling of factors shaping the financial results of the service sector. The mechanism of formation of financial results is revealed through three blocks - income, costs and efficiency blocks. As a result of the research, a multifactor model of financial results, its dynamic version and an extended specification taking into account operational leverage are proposed. A system of sequential diagnostic tests for checking the adequacy of the model and rules for interpreting the results are based.

Keywords: financial performance, econometric modeling, factor analysis, panel regression, operating leverage, dynamic model, model diagnostics, services sector, profitability.

Introduction.

Financial result is the final economic indicator of the enterprise's activities, which represents the final result of management decisions. However, financial result itself is not the product of a single factor: it is formed as a result of the complex interaction of income, expenses and the efficiency of resource use. Without revealing the mechanism of this influence, it is impossible to manage financial result.

The formation of financial results in the service sector has a number of specific features. First, the industry has a high share of fixed costs, which creates strong operating leverage: a relatively small change in revenue leads to a much larger change in profit. Second, since the processes of service production and consumption coincide in time, the ability to create reserves is limited, and fluctuations in demand directly affect the result. Third, the share of labor costs is high, which makes it difficult to quickly adjust costs.

In national studies, the financial results of the service sector are mainly studied through descriptive statistical analysis: the dynamics of indicators are presented, growth rates are calculated. Econometric models that quantitatively assess the impact of factors on the result are not sufficiently developed. As a result, it is impossible to give a well-founded answer to the management question "which factor will have the greatest effect?"

The purpose of this article is to develop a methodology for econometric modeling of factors shaping the financial performance of the services sector, to justify the model specification, and to propose a system for verifying its adequacy.

Literature analysis on the topic

The tradition of modeling the impact of factors on output dates back to the work of CWCobb and PHDouglas. The production function they proposed allows us to express the impact of factors in terms of elasticity coefficients and remains the basic form for factor modeling today [1].

RMSolow introduced a technological factor into this model and created a method for decomposing output growth into factors [2]. His approach is also used in financial performance analysis: output change is decomposed into the contribution of factors and the unexplained residual.

WJBaumol substantiated the specificity of the cost structure in the service sector, showing the high share of labor costs in this sector and the limited possibilities for reducing it [9]. This conclusion should be taken into account when formulating a model specification for the service sector.

The methodology for panel data modeling is described in the fundamental works of JMWooldridge [6] and BHBaltagi [7]. The JAHausman test is the main tool for selecting the model type [5]. The RESET test proposed by JBRamsey is used to check the correctness of the model specification [8].

In the direction of dynamic modeling, M. Arellano and S. Bond developed the first-difference GMM estimator [4], and R. Blundell and S. Bond developed its improved systematic version [3]. A dynamic approach is necessary in financial performance modeling, since the current period's result is significantly dependent on the previous period's result.

S.H. Penman systematized the methodology for analyzing financial statements and isolating the factors that shape results [10]. J.F. Hair and co-authors described the statistical foundations of multivariate analysis [11].

SVBrunov assessed the relationship between resources and financial performance in the public services sector using panel models and identified the influence of factors [13]. The methodological approach used in his work is a close analogue for this study.

AA Firsova and co-authors presented the experience of modeling outcome indicators at the regional level and substantiated the principles of selecting resource and outcome variables [14]. VAPlotnikov analyzed the structural features of financial relations in the service sector [12]. VNTyutyuryukov drew attention to the problem of data comparability in modeling [15].

Research methods

The study used multivariate regression analysis, panel data methodology, dynamic modeling, and a system of diagnostic tests.

The model specification was based on the CWCobb and PHDouglas [1] function, which was modified to take into account the characteristics of the services sector: cost structure and operating leverage variables were introduced into the model.

A series of tests were used to select the model type: F-test, Hausman test [5], Breusch–Pagan LM test. The accuracy of the model specification was checked by the RESET test [8], multicollinearity by the VIF indicator, and heteroscedasticity by the modified Wald test [11].

The dynamic model was estimated using the systematic GMM method [3]; the accuracy of the instruments was checked using the Hansen test, and the absence of second-order autocorrelation in the residuals was checked using the Arellano–Bond test [4].

The database consists of regional panel data for the period 2019–2024, and the source was official data from the Statistics Agency [19].

Results and discussion

Empirical modeling of financial results of service sector enterprises is one of the important areas of economic analysis, which serves to determine the profitability, efficiency and financial stability of enterprises. In this approach, economic processes are represented using mathematical and econometric models based on real statistical and financial data. The main goal of empirical modeling is to identify factors affecting financial results and to scientifically manage the level of their influence.

The first stage of empirical modeling begins with the formation of a database of enterprises. At this stage, indicators such as income, net profit, expenses, assets, employment levels, and investments of service enterprises are collected. The data is usually compiled in the form of a panel covering several years, which allows for analysis across time and objects. This stage ensures the reliability and accuracy of the empirical model.

At the next stage, a key indicator representing financial results is selected. Most often, net profit, profitability (ROA, ROE) or revenue growth rate is taken as the result variable. This indicator reflects the overall result of the enterprise's efficiency. At the same time, variables such as investment volume, labor resources, fixed assets, the level of digital technologies and the volume of services are selected as factors affecting it.

The most widely used method in empirical modeling is regression analysis. This method is used to determine the relationship between financial performance and the factors that influence it. For example, the model determines how an increase in investment affects profit or how much an increase in labor productivity increases income. The panel regression model is especially important, as it allows you to simultaneously take into account changes over time and across enterprises.

In the process of empirical modeling, the quality indicators of the model are also important. In particular, the coefficient of determination (R^2) indicates the explanatory power of the model. If R^2 is high, then the model can explain a large part of the financial results. At the same time, the statistical significance of the model parameters is assessed using t-statistics and p-values.

The results of empirical modeling allow us to determine which factors play a significant role in the financial performance of service enterprises. Typically, in the service sector, labor productivity and the level of digitalization appear as the most important factors, while investment acts as a conditional factor. The employment rate, however, does not always have a positive effect, since excess labor can reduce productivity.

In general, empirical modeling of the financial performance of service sector enterprises is an important tool for deepening economic analysis, scientifically substantiating management decisions, and identifying areas for improving enterprise efficiency. This approach assesses the real economic situation of enterprises and creates a solid scientific basis for developing development strategies.

The essence of empirical modeling of the financial results of an enterprise is to transform the risks, control mechanisms and audit results that arise in the process of forming financial indicators into quantitative variables and analyze them using econometric models. While in traditional approaches, financial results are assessed mainly on the basis of reporting data, in this approach, the quality of internal control affecting profit, profitability and cash flows, the results of audit tests and identified shortcomings are put at the center of empirical analysis. As a result, not only the final appearance of financial results, but also their relationship to the causes of their occurrence and the quality of management are scientifically substantiated.

The essence of this empirical modeling is to systematically link internal control and audit indicators (for example, the coverage of accounts, the effectiveness of control tests, the percentage of material defects, the speed of

corrective actions and the financial impact) with financial results. In this case, an empirical database is formed based on the chain "report line → risk → control → audit test → financial impact", and cause-and-effect relationships are determined using regression, panel or dynamic econometric models. This approach allows you to quantitatively measure the real contribution of internal control and audit to managing the financial results of the enterprise, determine the economic efficiency achieved by reducing risks, and make management decisions on a scientific basis.

In econometric modeling, the selection of variables should be based on the theoretical foundations of the study. The main variables (for example, the implementation of IFRS, the quality of financial reporting, the internal control system) represent the cause-and-effect relationships established in the conceptual model. Statistical justification allows you to check the existence of these theoretical relationships in real data. In this way, the model is built not randomly, but based on scientific logic. When the selection of variables is not based on statistical criteria, the model may encounter misspecification errors. Statistical justification (correlation analysis, descriptive statistics, multicollinearity testing) helps to eliminate insignificant or repetitive variables. As a result, the regression coefficients are estimated stably and reliably.

The main goal of modeling is to determine not only the relationship, but also the cause-and-effect relationship. Through the correct selection of variables and statistical justification, independent, mediating and reinforcing (moderating) factors are clearly distinguished. This allows empirically proving the impact of the introduction of IFRS on the quality of financial reporting and management effectiveness. Statistical justification when choosing key variables allows you to identify problems such as endogeneity, multicollinearity and autocorrelation in advance. For example, it is necessary to take into account the two-way relationship between the introduction of IFRS and the quality of reporting. Instruments are selected through statistical tests or appropriate estimation methods (FE, GMM) are used.

Reasonably selected variables allow for a clear and logical interpretation of the model results. The economic meaning of each coefficient is clear, and their positive or negative effects are consistent with theoretical expectations. This is important when justifying the results in the dissertation defense.

Variable selection algorithm

Stage 1: Conceptual definition of the model

Dependent and independent variables:

Yi=f(X1i,X2i,X3i,…,Xki) (1)

Here:

Y- quality of financial reporting,

X1- IFRS adoption,

X2- audit quality,

X3- disclosure

Step 2: Converting the theoretical model into a regression model

Yi=b0+b1X1i+b2X2i+⋯+bkXki+ei (2)

At this stage, all theoretical variables are entered into the model, but no reduction is yet done.

Stage 3: Measurement (operationalization) In index form:

Index=∑wjZij (3)

For example, disclosure index, audit quality index

-stage: Panel adaptation

Panel model:

Yit=b0+b1X1it+⋯+bkXkit+eit (4)

The requirement is that there should be information for all iii and ttt

Step 5: Descriptive statistics

Average:

X¯=1/n ∑i=1nXi (5)

Standard deviation

$$\sigma = 2\sqrt{\frac{1}{n} - 1 \sum(Xi - X)} \quad (6)$$

Filter:

σ≈0variable is output

Step 6: Correlation analysis

$$rxy=\sum(xi-\bar{x})(yi-\bar{y}) \,/\, 2\sqrt{\frac{1}{n} - 1 \sum(Xi - X) \sum(Yi - Y)} \quad (7)$$

Criteria:

|r|>0.8→ risk of multicollinearity

Step 7: Multicollinearity (VIF)

VIFj=1 /1−Rj2 (8)

Criteria:

VIF>10→ problem

VIF>5→ precaution

Final model with selected variables:

Yit=b0+b1IFRSit+b2AQit+b3DISCit+eit (9)

This algorithm ensures the selection of the optimal model through the chain of theoretical basis → empirical verification → statistical filter → econometric validation. The selection of key variables for modeling and their statistical justification is a decisive factor in ensuring the theoretical consistency, empirical reliability of the research, and the scientific significance of its results.

The variable selection algorithm is implemented step by step. First, the main objective and question of the research is clearly defined. For example, to determine the impact of the introduction of IFRS on the quality of financial reporting and management effectiveness. At this stage, it is determined at the conceptual level which variables are dependent and which are independent.

In the second stage, a list of initial variables is formed based on the theoretical and conceptual model. An extensive list of variables is created based on institutional, agency, stakeholder and signaling theories. For example: IFRS adoption, disclosure level, financial reporting quality, internal control, audit quality, etc. At this stage, no variables outside the model are introduced.

In the third step, check the measurement capability, h For each variable, a real or estimated data source is identified (financial statements, audit reports, statistical data). Variables that cannot be measured or have subjective assessments are excluded or indexed.

In the fourth stage, adapt to organizational and time constraints For panel data, the variables selected must be available for all enterprises and years. Variables for which data are missing are excluded or replaced by proxies.

In the fifth step, an initial screening is performed through descriptive statistics. The mean, standard deviation, minimum and maximum are analyzed. Variables with very small variance or saturated with extreme values are removed from the model or transformed (logarithmization, normalization).

In the sixth step, correlation analysis, o Pairwise correlations between variables are calculated. Variables with very high correlations ($|r| > 0.8$) are identified and one of the meaningfully repetitive indicators is eliminated.

In the seventh step, multicollinearity check (VIF) rA regression model is constructed and the VIF (Variance Inflation Factor) is calculated. Variables with a VIF > 10 (or > 5 in a stricter criterion) are removed from the model or re-constructed. This step ensures model stability.

Control variables are selected. Variables that may affect the underlying relationship but are not the focus of the study are identified (firm size, sector, leverage, profitability). Controls serve to “clean up” the model.

Table 1

Variable selection algorithm for modeling service sector management

Stage	Content of the action	Main question	Method used	Result
1	Determining the purpose of the research	What is being assessed?	Scientific problem analysis	Dependent and independent variables are defined
2	Fitting to the theoretical model	Which variables are logically necessary?	Conceptual model	Initial variable list
3	Checking the measurement capability	Is there information?	Data source analysis	The variables to be measured are selected
4	Check panel compatibility	Is it available in all units/years?	Data screening	Those who are not qualified will be removed.
5	Descriptive statistics	Is the dispersion sufficient?	Mean, SD, Min–Max	Stable variables are left
6	Correlation analysis	Is there a repetition?	Pearson/Spearman	High correlations are detected
7	Multicollinearity test	Is the model stable?	VIF test	Variables with VIF>5(10) are removed
8	Selection of control variables	Which ones are "cleansers"?	Theoretical + empirical choice	Control variables are defined
9	Separation of mediators/moderators	Is there a mediator/amplifier?	Conceptual compatibility	Interaction/mediation is being prepared.
10	Initial regression	Is it appropriate?	OLS/FE/RE	Specification is defined
11	Endogeneity test	Is there a two-way connection?	IV, Hausman, GMM	A sustainable valuation method is chosen
12	Final model approval	Is the model scientifically sound?	Robust tests	Final regression model

In the ninth stage, the mediator and moderator are separated, a If the conceptual model contains mediating or reinforcing factors (e.g., internal control system), they are identified separately and prepared for interaction or mediation models.

In the tenth step, the initial regression and specification test, b The regression model is estimated. The signs and statistical significance of the

coefficients are compared with theoretical expectations. If necessary, the number of variables is optimized. In the first step, endogeneity and stability are checked, and the probability of endogeneity in the main independent variables is assessed. If available, instruments are selected or methods such as GMM/2SLS are used. In the second step, the final model is validated, only theoretically and statistically sound variables are retained, and the final regression model is formed. This model serves as the basis for drawing empirical conclusions.

The above table provides a systematic and step-by-step justification for the process of selecting variables in econometric modeling. The algorithm combines theoretical validity and statistical reliability, reducing model specification errors. As a result, the selected variables allow for empirically accurate identification of the causal relationships between IFRS, auditing, and management effectiveness.

Conclusion and suggestions

The research led to the following conclusions.

1. Financial performance is formed by the interaction of three blocks - income, expenses and efficiency; including the efficiency block as an independent factor in the model allows us to separately assess the impact of management quality.

2. The strong operating leverage of the services sector should be taken into account in the model specification through an interaction term; this justifies different management strategies for regions with high and low fixed cost shares.

3. The financial result is inertial in nature, therefore a dynamic model specification is necessary; the inertia coefficient indicates the degree of stability of the result.

4. Short-term and long-term impact coefficients should be distinguished; the long-term coefficient is more important in justifying management decisions.

5. Model adequacy testing involves seven consecutive tests; interpreting the results without tests is a methodological error.

Practical suggestions:

1. Transition from descriptive statistics to multifactor econometric modeling in the analysis of financial results in the service sector and use the model results to justify management decisions.

2. Introduce the practice of separate accounting for fixed and variable costs within management accounting in service enterprises; this will allow for the correct calculation of operating leverage.

3. Define a differentiated strategy focused on increasing volume for regions and businesses with high levels of operating leverage, and on operating at margin for those with low levels.

4. When publishing the results of the econometric analysis, cite the results of all diagnostic tests; this allows for an assessment of the reliability of the results.

5. Introduce the practice of comparing factor elasticities based on model results and directing management resources to factors with the highest elasticity.

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