



Analysis of Economic Efficiency through the Analytical Budgeting Method using Econometric Modelling

Monica Laura ZLATI*, Valentin Marian ANTOHI**

ARTICLE INFO

Article history:

Accepted March 2018

Available online May 2018

JEL Classification

M21, M10

Keywords:

Analytical budget, Econometric model, Economic performance, Optimization, Profitability.

ABSTRACT

In the literature, along with the new challenges posed by post-crisis economic hyperactivity, there were remarkable trends in economic performance and budgeting of the necessary effort to support it. In this respect, the study aims to highlight the usefulness of implementing the analytical budgeting method by developing an econometric model instrumented on a medical-social investment, including palliative services.

© 2018 EAI. All rights reserved.

1. Introduction

Managerial design implies, in terms of performance, the rational and intelligent use of potentially available resources on well-grounded planning support (Keil, M., Rai, A., Cheney Mann, J. E., & Zhang, G. P. 2003). This planning is a sensitive tool to the conjunctural factors, some authors (Kwak, Y. H., & Anbari, F. T. 2012) oppose failure of funding programs and the impact of these failures on the business structure.

The destabilization caused may affect both the performance structure of the economic and financial indicators and the relationship with the employees, the human resources being particularly sensitive in the last period to conjunctural factors (Crosbie, T., N. Dawood and S. Dawood 2011). For this reason, companies are increasingly focusing on the implementation of ERP (Enterprise Resource Planning), by taking advantage of business opportunities and eliminate critical areas with possible negative business effects through a proactive approach and innovative management techniques (Nudurupati, S., T. Arshad and T. Turner 2007).

Continuing the line of research initiated by Nudurupati, S., T. Arshad and T. Turner, a group of Taiwanese researchers, have developed earned value management system applied in consultancy project performance theory, through which the classification of the factors and indicators that contribute to the performance evaluation of the companies is performed and they have summarized 8 performance control indicators in a warning model in situations where the risk limits are reached (H. Ping Tserng, Wen-Shyong Lin, Chien-Chung Li, Kai-Wei Weng and Denise C. Loisel 2015). The risk also occurs when the project budget is affected by delays in financing from market conjuncture causes, in the literature, some models of elimination of delays are contradicted by before - programming of the works to be performed (Shumank D., M. Asim, et al., 2017).

As far as managerial design is concerned, experts base their arguments on the importance of maximizing performance rates by limiting variation in rates across different areas of activity the company or entity carries out its business (Shin, H. and R. L. Eubank 2011).

The more varied the range of rates variations calculated by activity sectors, the more effective the managerial efficiency is, and involves an effort of individual analysis and requires an analysis of cost and schedule performance in development projects (Ahsan K, Gunawan I 2010)

2. Research Methodology

The study aims to budget the establishment of a medical-social unit focusing on the care of the elderly, including palliative services, in terms of forecasting economic performance over a 15-year horizon, starting from frustrating the competitive advantage on a niche competition market in which both the public environment, and private environment are being present.

The following economically quantifiable sections were considered for designing the model:

- the quality of the service, represented by the ratio between the value of the service and the gross added value of the consumptions needed to provide the service: $Q_s = \frac{P_s}{VAB_s}$, where: Q_s - service quality, P_s - service price, VAB_s - gross added value of the service;
- the diversity of services offered, represented by the quantum of turnover obtainable in the context of complete coverage of the needs of medical and social care in the studied field $G_s = \sum_{i=1}^n \frac{CA_{s_i}}{P_{s_i}}$ where: G_s - service range, CA - turnover for each sector of activity, P_{s_j} - the service price for each sector of activity;
- the trade margin (percentage value), represented by the difference between the sales price of the service and the cost of the sold service x 100, related to the sale price of the asset: $MC_s = \frac{(P_s - C_s)}{P_s} \times 100$, where MC_s - trade margin of service, P_s - service price, C_s - cost of service;
- the unit cost of the equipment and equipment necessary for service provision: $C_{ud} = \frac{NIV}{G_s}$, where: C_{ud} - unit cost of equipment, NIV - investment need, G_s - range of services;

Work Hypothesis:

- Under the conditions of an adequate budget, a return on the level of the identifiable competitive advantage can be ensured without ensuring that the expenditure-dependent demand surplus dependent on marketing costs;
- Maximizing performance can be achieved with forecasting year 3 under the anticipated 3-year efforts to promote services;
- Accumulated performance can be maximized by budgeting an investment policy for at least 10 years;
- Performance efficiency is dependent on information quality and budget traceability.

Following the analysis of the profile services market, we have found that care services have developed in Romania since the early 1990s, mainly as a non-governmental sector initiative through associations or foundations engaged in medical and social activities dedicated to a category of marginalized or insufficiently assisted persons in the medical-social system.

The econometric model of analyzing the economic efficiency of an analytical budget is as follows:

$$E_f = a_1 \times Q_s + a_2 \times G_s + a_3 \times MC_s + a_4 \times \frac{P_s}{C_{ud}}, \text{ where,}$$

- E_f - economic efficiency;
- a_i - the impact coefficients of the econometric model, $i = (1,4)$;
- Q_s - quality of service;
- G_s - range of services;
- MC_s - the trade margin of the service;
- P_s - the price of the service;
- C_{ud} - the unitary cost of endowments.

The goal is achieved in terms of maximized efficiency. This condition implies applying the limits for the determined model as follows:

$$\begin{aligned} \max_{n \rightarrow 5} (E_f)^n &= \lim_{n \rightarrow 5} (E_f)^n \\ &= a_1 \times \lim_{n \rightarrow 5} (Q_s)^n + a_2 \times \lim_{n \rightarrow 5} (G_s)^n + a_3 \times \lim_{n \rightarrow 5} (MC_s)^n \\ &+ a_4 \times \lim_{n \rightarrow 5} \left(\frac{P_s}{C_{ud}} \right)^n = a_1 \times \lim_{n \rightarrow 5} \left(\frac{P_s}{VAB_s} \right)^n + a_2 \times \lim_{n \rightarrow 5} \left(\frac{CA_s}{P_s} \right)^n + a_3 \times \lim_{n \rightarrow 5} \left(\frac{P_s - C_s}{C_{ud}} \right)^n \\ &+ a_4 \times \lim_{n \rightarrow 5} \left(\frac{P_s}{C_{ud}} \right)^n \Rightarrow \max_{n \rightarrow 5} (E_f)^n = \prod_{i=1}^n \max(E_f)_i \Leftrightarrow \lim_{n \rightarrow 5} (Q_s)^n = \prod_{i=1}^n \max(Q_s)_i \end{aligned}$$

The maximization function ensures the condition of the controlled effectiveness of the budgetary indicators and the model can be applied for the analysis of the economic efficiency of the medical investment as follows:

Table no. 1- Building the budget on capital resources

Capital sources	
Own contribution and associates	3,205,460 euro
Bank loans	0 euro
Other loans	0 euro
Total capital sources	3,205,460 euro
Start-up costs	
buildings	1,350,000 euro
enhancements	110,000 euro
Equipment's	1,576,000 euro
Administrative, legal and accounting expenses	129,800 euro
stocks	2,500 euro

Total spending on promotion and advertising	1,160 euro
Other expenses	0 euro
Unexpected expenses	1,000 euro
Circulating assets	35,000 euro
Total expenses start-up	3,205,460 euro

Table no. 2 - The forecasted analysis of financial flows for the first 5 years

Initial cash balance	Year 1	Year 2	Year 3	Year 4	Year 5
Proceeds					
Proceeds from Asylum Rent (capacity 120 beds * 600 eur / month / bed)	72,000.00	372,000.00	864,000.00	864,000.00	864,000.00
Receipts for palliative services (capacity 30 beds * 2000 euro / month / patient)	60,000.00	310,000.00	600,000.00	600,000.00	720,000.00
Proceeds from the provision of medical services to third parties in the geriatric clinic	15,000.00	60,000.00	60,000.00	120,000.00	180,000.00
MTN Funding	3,205,460.00	0.00	0.00	0.00	0.00
Other receipts - settlements with Health House, Pensions, etc	0.00	0.00	120,000.00	120,000.00	120,000.00
Total	3,352,460.00	742,000.00	1,534,000.00	1,704,000.00	1,884,000.00
Payment	0.00	0.00	0.00	0.00	0.00
Capital expenditures - construction acquisition	1,100,000.00	0.00	0.00	0.00	0.00
Capital expenditures - expenditures with directional geriatric construction	250,000.00	0.00	0.00	0.00	0.00
Expenditures for Managing Financing Contract MTN Operative Mode	165,460.00	0.00	0.00	0.00	0.00
Capital expenditures - Asylum development 60 rooms with bathroom	40,000.00	0.00	0.00	0.00	0.00
Capital expenditures - Purchase and installation of external lift	35,000.00	0.00	0.00	0.00	0.00
Capital expenditures - Buying and installing an interior lift	35,000.00	0.00	0.00	0.00	0.00
Acquisition of asylum furniture	25,000.00	0.00	0.00	0.00	0.00
Purchase of equipment for cleaning and kitchen	10,000.00	0.00	0.00	0.00	0.00
Acquisition of medical equipment	1,144,540.00	0.00	0.00	0.00	0.00
Acquisition of Asian Electric Beds 120 pcs	156,000.00	0.00	0.00	0.00	0.00
Acquisition of physiotherapy room equipment	75,000.00	0.00	0.00	0.00	0.00
Legal and accounting expenses	7,500.00	66,000.00	66,000.00	66,000.00	66,000.00
Expenditure on business plan business consultancy	0.00	0.00	0.00	0.00	0.00
Expenditure on insurance	14,300.00	0.00	0.00	0.00	0.00
Staff costs	39,000.00	120,000.00	120,000.00	120,000.00	120,000.00
Acquisition of catering services	18,000.00	93,000.00	216,000.00	216,000.00	216,000.00
Acquisition of outsourced medical services related to clinical and asylum	30,000.00	120,000.00	120,000.00	120,000.00	120,000.00
Utilities	5,000.00	12,000.00	12,000.00	12,000.00	12,000.00
fuels	3,000.00	12,000.00	12,000.00	12,000.00	12,000.00
Expenses with permits, authorizations, fees, design	100,000.00	0.00	0.00	0.00	0.00
Taxes	15,000.00	60,000.00	138,000.00	180,000.00	180,000.00
Purchase of stocks	2,500.00	0.00	0.00	0.00	0.00
Expenditure on promotion and advertising	1,160.00	0.00	0.00	0.00	0.00
Circulating assets	35,000.00	0.00	0.00	0.00	0.00
Other operating expenses	3,000.00	12,000.00	12,000.00	12,000.00	12,000.00
Other financial and exceptional expenses	1,000.00	0.00	0.00	0.00	0.00
Capital repayments - related to the new credit application (MTN)	44,000.00	247,000.00	838,000.00	966,000.00	1,110,460.00
Other payments	0.00	0.00	0.00	0.00	0.00
Total Payments	3,354,460.00	742,000.00	1,534,000.00	1,704,000.00	1,848,460.00

Initial cash balance	Year 1	Year 2	Year 3	Year 4	Year 5
Net cash flow (+/-)	-2,000.00	0.00	0.00	0.00	35,540.00
Net cash flow cumulative (+/-)	53,500.00	342,000.00	1,272,000.00	1,449,000.00	1,754,540.00

Table no. 3 - The forecasted analysis of financial flows on the second horizon of forecast for 5 years

Initial cash balance	Year 6	Year 7	Year 8	Year 9	Year 10
Proceeds					
Proceeds from Asylum Rent (capacity 120 beds * 600 eur / month / bed)	864,000.00	864,000.00	864,000.00	864,000.00	864,000.00
Receipts for palliative services (capacity 30 beds * 2000 euro / month / patient)	720,000.00	720,000.00	720,000.00	720,000.00	720,000.00
Proceeds from the provision of medical services to third parties in the geriatric clinic	180,000.00	180,000.00	180,000.00	180,000.00	180,000.00
MTN Funding	0.00	0.00	0.00	0.00	0.00
Other receipts - settlements with Health House, Pensions, etc	120,000.00	120,000.00	120,000.00	120,000.00	120,000.00
Total	1,884,000.00	1,884,000.00	1,884,000.00	1,884,000.00	1,884,000.00
Payment	0.00	0.00	0.00	0.00	0.00
Capital expenditures - construction acquisition	0.00	0.00	0.00	0.00	0.00
Capital expenditures - expenditures with directional geriatric construction	0.00	0.00	0.00	0.00	0.00
Expenditures for Managing Financing Contract MTN Operative Mode	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00
Capital expenditures - Asylum development 60 rooms with bathroom	0.00	0.00	0.00	0.00	0.00
Capital expenditures - Purchase and installation of external lift	0.00	0.00	0.00	0.00	0.00
Capital expenditures - Buying and installing an interior lift	0.00	0.00	0.00	0.00	0.00
Acquisition of asylum furniture	0.00	0.00	0.00	0.00	0.00
Purchase of equipment for cleaning and kitchen	0.00	0.00	0.00	0.00	0.00
Acquisition of medical equipment	0.00	0.00	0.00	0.00	0.00
Acquisition of Electric Beds 120 pcs	0.00	0.00	0.00	0.00	0.00
Acquisition of physiotherapy room equipment	0.00	0.00	0.00	0.00	0.00
Legal and accounting expenses	66,000.00	66,000.00	66,000.00	66,000.00	66,000.00
Expenditure on business plan business consultancy	0.00	0.00	0.00	0.00	0.00
Expenditure on insurance	0.00	0.00	0.00	0.00	0.00
Staff costs	120,000.00	120,000.00	120,000.00	120,000.00	120,000.00
Acquisition of catering services	216,000.00	216,000.00	216,000.00	216,000.00	216,000.00
Acquisition of outsourced medical services related to clinical and asylum	120,000.00	120,000.00	120,000.00	120,000.00	120,000.00
Utilities	12,000.00	12,000.00	12,000.00	12,000.00	12,000.00
fuels	12,000.00	12,000.00	12,000.00	12,000.00	12,000.00
Expenses with permits, authorizations, fees, design	0.00	0.00	0.00	0.00	0.00
Taxes	180,000.00	180,000.00	180,000.00	180,000.00	180,000.00
Purchase of stocks	0.00	0.00	0.00	0.00	0.00
Expenditure on promotion and advertising	0.00	0.00	0.00	0.00	0.00
Circulating assets	0.00	0.00	0.00	0.00	0.00
Other operating expenses	12,000.00	12,000.00	12,000.00	12,000.00	12,000.00
Other financial and exceptional expenses	0.00	0.00	0.00	0.00	0.00
Capital repayments - related to the new credit application (MTN)	0.00	0.00	0.00	0.00	0.00
Other payments	0.00	0.00	0.00	0.00	0.00
Total Payments	738,000.00	738,000.00	738,000.00	738,000.00	738,000.00
Net cash flow (+/-)	1,146,000.00	1,146,000.00	1,146,000.00	1,146,000.00	1,146,000.00
Net cash flow cumulative (+/-)	7,449,000.00	7,449,000.00	7,449,000.00	7,449,000.00	7,449,000.00

Table no. 4 - The forecasted analysis of financial flows on the third forecast horizon of 5 years

Initial cash balance	Year 11	Year 12	Year 13	Year 14	Year 15
Proceeds					
Proceeds from Asylum Rent (capacity 120 beds * 600 eur / month / bed)	864,000.00	864,000.00	864,000.00	864,000.00	864,000.00
Receipts for palliative services (capacity 30 beds * 2000 euro / month / patient)	720,000.00	720,000.00	720,000.00	720,000.00	720,000.00
Proceeds from the provision of medical services to third parties in the geriatric clinic	180,000.00	180,000.00	180,000.00	180,000.00	180,000.00
MTN Funding	0.00	0.00	0.00	0.00	0.00
Other receipts - settlements with Health House, Pensions, etc	120,000.00	120,000.00	120,000.00	120,000.00	120,000.00
Total	1,884,000.00	1,884,000.00	1,884,000.00	1,884,000.00	1,884,000.00
Payment	0.00	0.00	0.00	0.00	0.00
Capital expenditures - construction acquisition	0.00	0.00	0.00	0.00	0.00
Capital expenditures - expenditures with directional geriatric construction	0.00	0.00	0.00	0.00	0.00
Expenditures for Managing Financing Contract MTN Operative Mode	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00
Capital expenditures - Asylum development 60 rooms with bathroom	0.00	0.00	0.00	0.00	0.00
Capital expenditures - Purchase and installation of external lift	0.00	0.00	0.00	0.00	0.00
Capital expenditures - Buying and installing an interior lift	0.00	0.00	0.00	0.00	0.00
Acquisition of asylum furniture	0.00	0.00	0.00	0.00	0.00
Purchase of equipment for cleaning and kitchen	0.00	0.00	0.00	0.00	0.00
Acquisition of medical equipment	0.00	0.00	0.00	0.00	0.00
Acquisition of Electric Beds 120 pcs	0.00	0.00	0.00	0.00	0.00
Acquisition of physiotherapy room equipment	0.00	0.00	0.00	0.00	0.00
Legal and accounting expenses	66,000.00	66,000.00	66,000.00	66,000.00	66,000.00
Expenditure on business plan business consultancy	0.00	0.00	0.00	0.00	0.00
Expenditure on insurance	0.00	0.00	0.00	0.00	0.00
Staff costs	120,000.00	120,000.00	120,000.00	120,000.00	120,000.00
Acquisition of catering services	216,000.00	216,000.00	216,000.00	216,000.00	216,000.00
Acquisition of outsourced medical services related to clinical and asylum	120,000.00	120,000.00	120,000.00	120,000.00	120,000.00
Utilities	12,000.00	12,000.00	12,000.00	12,000.00	12,000.00
fuels	12,000.00	12,000.00	12,000.00	12,000.00	12,000.00
Expenses with permits, authorizations, fees, design	0.00	0.00	0.00	0.00	0.00
Taxes	180,000.00	180,000.00	180,000.00	180,000.00	180,000.00
Purchase of stocks	0.00	0.00	0.00	0.00	0.00
Expenditure on promotion and advertising	0.00	0.00	0.00	0.00	0.00
Circulating assets	0.00	0.00	0.00	0.00	0.00
Other operating expenses	12,000.00	12,000.00	12,000.00	12,000.00	12,000.00
Other financial and exceptional expenses	0.00	0.00	0.00	0.00	0.00
Capital repayments - related to the new credit application (MTN)	0.00	0.00	0.00	0.00	0.00
Other payments	0.00	0.00	0.00	0.00	0.00
Total Payment	738,000.00	738,000.00	738,000.00	738,000.00	738,000.00
Net cash flow (+/-)	1,146,000.00	1,146,000.00	1,146,000.00	1,146,000.00	1,146,000.00
Net cash flow cumulative (+/-)	7,449,000.00	7,449,000.00	7,449,000.00	7,449,000.00	7,449,000.00

The interpretation of the data presented above in terms of performance is indicative of 5-year forecast intervals a maximization towards the end of the period under the conditions of a resource-controlled imputation, the calculation of the coefficients of the model over the 15 years is presented in the table below.

Table no. 5 - Calculation of Impact Indicators on Budget Financial Efficiency

<i>Year</i>	<i>Qs</i>	<i>Gs</i>	<i>MCs</i>	<i>PS/Cud</i>
<i>Year 1</i>	39.53373	2600	0.464572	0.726285
<i>Year 2</i>	2.97992	2860	0.332884	3.666008
<i>Year 3</i>	4.123656	3146	0.546284	7.529644
<i>Year 4</i>	4.580645	3461	0.566901	7.826087
<i>Year 5</i>	5.064516	3807	0.60828	8.715415
<i>Year 6</i>	5.064516	4188	0.60828	8.715415
<i>Year 7</i>	5.064516	4607	0.60828	8.715415
<i>Year 8</i>	5.064516	5068	0.60828	8.715415
<i>Year 9</i>	5.064516	5575	0.60828	8.715415
<i>Year 10</i>	5.064516	6133	0.60828	8.715415
<i>Year 11</i>	5.064516	6746	0.60828	8.715415
<i>Year 12</i>	5.064516	7421	0.60828	8.715415
<i>Year 13</i>	5.064516	8163	0.60828	8.715415
<i>Year 14</i>	5.064516	8979	0.60828	8.715415
<i>Year 15</i>	5.064516	9877	0.60828	8.715415

The efficacy model on the maximum criterion can be econometric represented by the regression equation:

$$\hat{Qs} = + 76.8 * MCs - 4.79 * PS/Cud$$

(13.2) (0.974)

n = 15, R-squared = 0.968
(standard errors in parentheses)

The model is homogeneous and representative in 97% of the studied phenomenon; the statistical tests are presented below and are obtained by the least squares method in two phases for the dependent variable QS and repressors MCs and PS/Cud

Table no. 6 - Statistical tests to determine the homogeneity of the TSLs econometric model, using observations 2-16 (n = 15)

Dependent variable: Qs
Instrumented: MCs PS/Cud
Instruments: Gs const

	Coefficient	std. error	t-ratio	p-value	
MCs	76.7610	13.2206	5.806	6.11e-05 ***	
PS/Cud	-4.78603	0.973758	-4.915	0.0003 ***	
Mean dependent var		7.128508			S.D. dependent var 8.982882
Sum squared resid		84.68323			S.E. of regression 2.552272
R-squared		0.967786			Adjusted R-squared 0.965308
F(1, 13)		67.11989			P-value(F) 1.72e-06
Log-likelihood		-16.82731			Akaike criterion 37.65461
Schwarz criterion		39.07071			Hannan-Quinn 37.63953

OLS estimation through the Hausman test is consistent for Chi-Square = 559,737 with p-value tending to 0.

Hausman test - Null hypothesis: OLS estimates are consistent

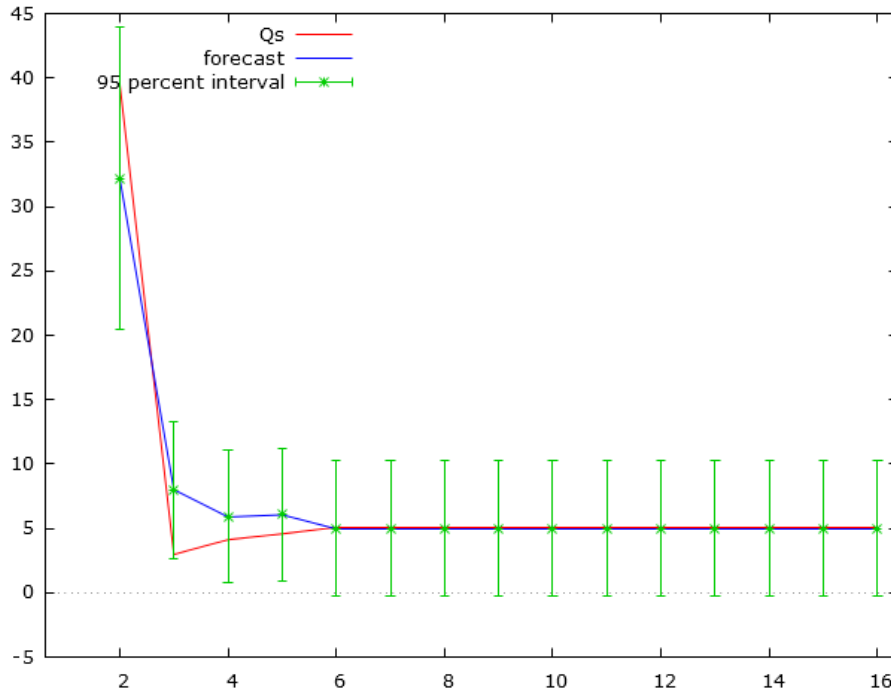
Asymptotic test statistic: Chi-square(2) = 559.737, with p-value = 2.84876e-122

Weak instrument test - Cragg-Donald minimum eigenvalue = 1.63002

Critical values for desired TSLs maximal size, when running tests at a nominal 5% significance level:

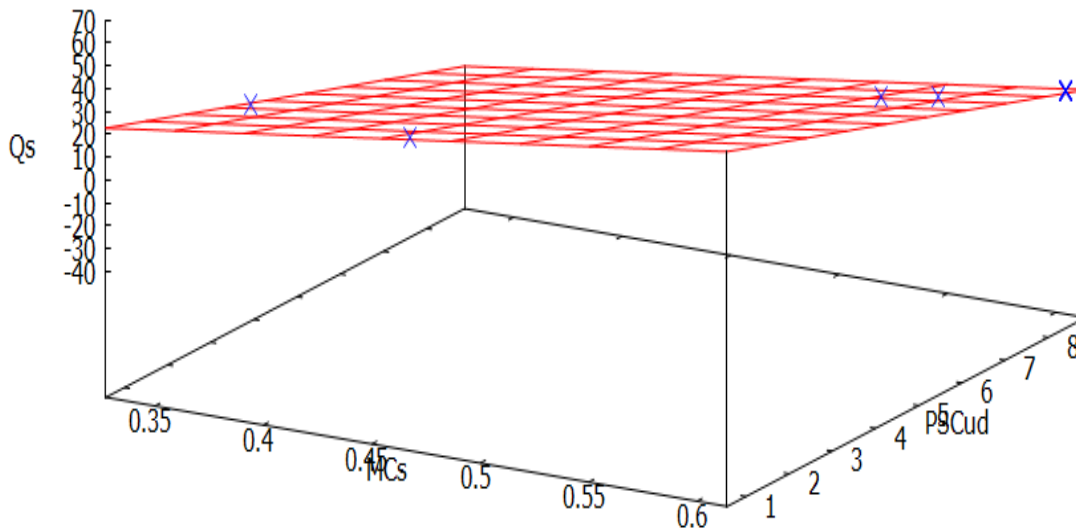
Size	10%	15%	20%	25%
Value	7.03	4.58	3.95	3.63

Figure no. 1 - Confidence Interval Forecast of 95%



The predicted forecast demonstrates the evolution of the 95% confidence interval in the range 0-10.

Figure no. 2 - The normal distribution data by Qs var.



Pesaran-Taylor test for heteroskedasticity

OLS, using observations 2-16 (n = 15)

Dependent variable: uhat^2

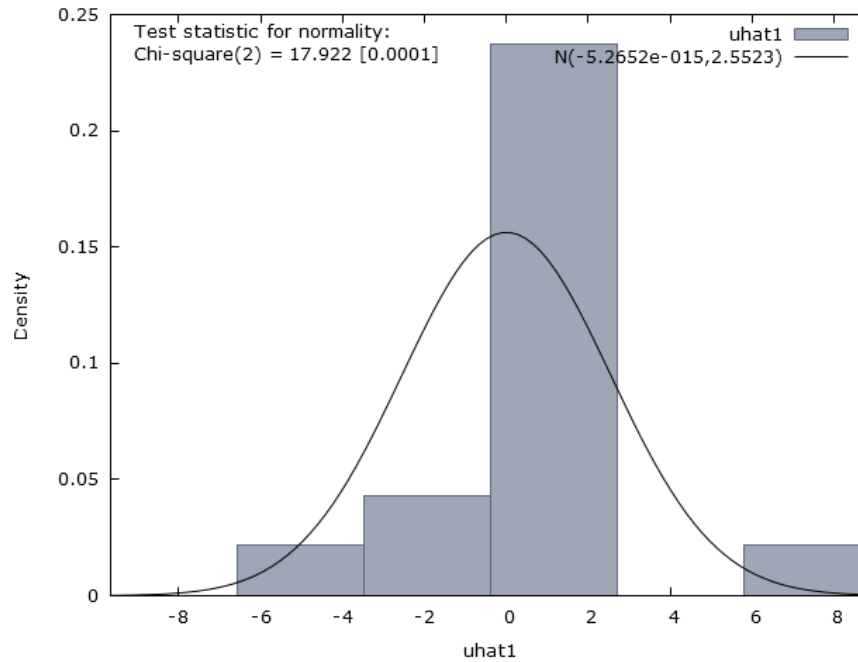
	coefficient	std. error	t-ratio	p-value
const	-7.77294	6.18120	-1.258	0.2307
yhat^2	0.230176	0.0901911	2.552	0.0241 **

Unadjusted R-squared = 0.333783

Test statistic: $HET_1 = |0.230176| / 0.090191 = 2.552088$,
with p-value = $2 * P(z > 2.552088) = 0.0107$

Statistical test Pesaran-Taylor test for heteroskedasticity shows that the null hypothesis is confirmed for $z > 2.55$ with p-value = 0.01 indicating the validity of the model and its homogeneity demonstrated also through the Q-Q plot below:

Figure no. 3 - Normal distribution chart of the frequency series



Results: The matrix for the econometric model presented indicates the maximum economic efficiency point in terms of maximizing QS.

Table no. 7 - The Optimum Point Matrix for Maximizing Efficient Budgeting Efficiency

E_f	Q_s	G_s	MC_s	P_s/C_{ud}
max Q_s	maxim	medium	maximum	maximum
max G_s	medium	maximum	minimum	minimum
max MC_s	maximum	minimum	maximum	maximum
max P_s/C_{ud}	maximum	minimum	maximum	maximum

3. Conclusions

The presented model is a useful novelty in calculating budget-based efficiency and is an effective tool for business optimization for managers. Medical care services are currently considered niche services and can be implemented in the context of a realistic business budget taking into account the initial financial effort that involves the creation of a complex of facilities necessary for the service for which a financial effort is required at the time 0 of the business. As such, business analysis and budgeting are needed not only to achieve the desired efficiencies but also to support business in front of credit institutions that want to get funding for starting a business.

References

1. Ahsan K, Gunawan I. 2010. "Analysis of cost and schedule performance of international development projects." *International Journal of Project Management* 68-78.
2. Crosbie, T., N. Dawood and S. Dawood. 2011. "Improving the energy performance of the built environment: The potential of virtual collaborative life cycle tools." *Automation in Construction* 20(2) 205-216.
3. H. Ping Tserng, Wen-Shyong Lin, Chien-Chung Li, Kai-Wei Weng, and Denise C. Loisel. 2015. "Research on the earned value management system applied in consultancy project performance." *Journal of Marine Science and Technology*, Vol. 23, No. 1 21-35.
4. Keil, M., Rai, A., Cheney Mann, J. E., & Zhang, G. P. 2003. "Why software projects escalate: The importance of project management constructs." *Engineering Management* 251-261.
5. Kshirsagar A. B., Konnur B. A. 2017. "Earned Value Management Tool for Controlling Project Duration and Budgeted Cost." *International Journal of Engineering Technology Science and Research* 1275-1280.
6. Kwak, Y. H., & Anbari, F. T. . 2012. "History, practices, and future of earned value management in government: Perspectives from NASA." *Project Management Journal*, 43(1) 77 - 90.
7. Nudurupati, S., T. Arshad and T. Turner. 2007. "Performance measurement in the construction industry: An action case investigating manufacturing methodologies." *Computers in Industry* 58(7) 667- 676.
8. Shin, H. and R. L. Eubank. 2011. "Unit canonical correlations and high-dimensional discriminant analysis. ." *Journal of Statistical Computation and Simulation* 81(2) 167-178.
9. Shumank D.,M. Asim, et.al. . 2017. "Earned Value based Liability Calculation Algorithm for Schedule Delays in Construction Projects." *Indian Journal of Science and Technology*, Vol 10(15) 1-10.