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NEW APPROACHES TO TESTING ECONOMIC VULNERABILITIES BY THE ECONOMETRICAL MODELING OF THE REPORTED FINANCIAL ELEMENTS

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Abstract:
The analysis of economic vulnerabilities is a key element in building medium and long-term economic development strategies. Through the study, we aim to objectively assess the trend vulnerabilities that affect the economic development of a company and the conceptualization of an econometric model for identifying these vulnerabilities with the transposition of the results on the prudential behaviour segment in the elaboration of the economic development strategies of the Romanian companies. The study was conducted on the basis of the analysis of the dynamics revenue and expenditure accounts for a period of 5 years. The companies analysed are among the top 15 largest firms in Suceava County on turnover. The research is bivalent, with the theoretical part focused on the study of the specialized literature, and the empirical part oriented towards the analysis of data sets, systematisation of consolidated databases, statistical databases testing and econometric modelling. The resulting model is based on dynamic analysis and extrapolations made through the Econometric Model through Forecast features at 95% confidence intervals, providing users of financial statements with a pragmatic tool for early vulnerability assessment and ex-ante adjustment of medium and long term development strategies of companies.

Key words: vulnerability, financial statements, econometric model, financial analysis, forecasts.

JEL classification: M41

1. INTRODUCTION

The concept of vulnerability on the economic development segment of companies in a particular region have undergone perceptual changes as companies' financial independence was more engaged in the global macroeconomic context and in relations with the actors in the economic environment in which they operate. Considering the macroeconomic climate dominated by monetary instability and high exchange rate volatility in relation to frequent fiscal policy changes in Romania, the degree of uncertainty of economic agents in addressing medium and long-term strategies has increased and, at the same time, has attracted an atypical behaviour (specific to the periods before economic crises) in terms of conquering new commercial markets and fructification of the competitive advantage. These aspects revealed by the dynamic analysis of financial information reported by the 15 largest companies in Suceava County have generated a problem that research seeks to channel towards a conceptual model to identify commercial uncertainty and financial vulnerabilities faced by economic agents in the region. Thus, the following objectives were set in the research:

Objective 1 - Benchmarking of financial performance in relation to resource costs in order to establish the syncopes of evolution on the forecasts of financial results of economic agents;

Objective 2 - Assessment in relation to identified syncopes of causal conditions materialized in financial risk components for economic agents;

Objective 3 - Testing following the econometric modelling of financial standing in the presence and absence of identified risk.

The purpose of the study is to validate the conceptualized econometric instrument by testing the model results on the companies in the sample presented.

2. LITERATURE REVIEW

At present, the concept of durable and sustainable economy is increasingly promoted both in specialized studies (Jänicke, 2012, Socoliuc et al., 2018) and among actors in the goods and services market. The ability of companies to cope with challenges and fluctuations, to maintain their position on the market and to show efficiency, more or less, guarantees their success and performance. However, depending on the geographical location and the characteristics of the region in which they operate, the economic and social efficiency of the entities may be affected by various factors of influence (Hahmet al., 2013, Zhao et al., 2018).

During the economic crisis, more phenomenon such as unemployment, inflation, inequality in income distribution have grown, being very visible in developed countries and in world macro-regional relations. (Bostan and Grosu, 2010). These have accentuated the instability and vulnerability of the economic system since then.

Many European countries have suffered from the 2009 crisis, with considerable macroeconomic turbulence being recorded in peripheral countries, while the main EU countries (such as Germany) have seen relatively high growth rates. As a result, in recent years the volatility of economic growth rates in the European Union countries has increased (Hafner, 2018). The EU's own goal has always been to create a common economy and to unify it at Union level. In this sense, it is essential to understand the mechanism that may lead to a possible decline, in order to take preventive measures (Maziarz, 2019). State measures are not always in favour of businesses, and the challenges they face only accentuate their instability and vulnerability.

Tax vulnerability is linked to vulnerability to crises in general. The IMF (1998) argues that vulnerability depends on: the extent of economic imbalances in terms of stocks and flows; asset price imbalances, including the exchange rate; the magnitude of distortions in the financial sector and structural rigidities; and the credibility of policies. Tax vulnerability can be considered as a component of the global vulnerability stemming from the design and implementation of fiscal policy. Allen et al. (2002) adopts a more precise definition, namely the risk of liquidity or solvency situations being breached and a crisis occurring.

Tax policies can be well received tools in shaping a healthy economy and fostering an increase in business welfare. Unfortunately, however, they are often seen as "traps" by which the state wishes to induce the economy in one direction or another (Ivanyna, 2017). Therefore, the use of an appropriate fiscal rule helps rationalize fiscal consolidation efforts by promoting an environment conducive to economic growth and, implicitly, business performance (Díaz-Roldán et al., 2018).

An analysis of the interaction between tax rules and fiscal space (Nerlich & Reuter, 2016) shows that countries with a higher fiscal space tend to have higher discretionary spending, but this effect is significantly reduced if there are tax rules. However, this link between fiscal space and discretionary spending/revenue seems to exist only in good economic times, not during crises. In addition, the study supports the hypothesis that discretionary spending and incomes are moving along with the economic cycle, i.e. in the context of economic growth, discretionary spending is higher (lower) and discretionary revenue is lower.

In his study, Malesios et al. (2018), assessing the relationship between social, environmental, operational and performance practices with financial performance, tried to establish a relationship between the sustainability and financial performance of IMMs in economic development. This was defined by the turnover and business growth indicators. The results have shown that there is a positive correlation between the sustainability elements (standardized business processes, health and safety practices etc.) and financial performance (the turnover) as it has been

found that various sustainability and economic indicators can influence the performance of companies.

According to Burde, "financial instability is characterized by the time in a risk situation that measures the level of financial instability an entity is facing and reflects the different funding situations that it encounters." Therefore, the vulnerability is expressed by the risk ratio and the generalized risk-taking time that measures the level of instability facing a society is taken into account. This introduces the term optimization, which refers to the idea of testing the possibility of using of results for estimating financial vulnerability (Burde, 2018).

Other studies (Hahm et al., 2013, Al-Mamun & Mazumder, 2015) have shown that the entities that tend to have low incomes or assets with low liquidities are identified as being financially vulnerable, the balance sheet high effect manifesting itself through the inability to cope with financial stress and financial crisis.

In this respect, the study aims to show that vulnerability can be assessed and quantified, eventually providing the opportunity to prudently manage future business development strategies.

3. METHODOLOGY

In order to assess the vulnerabilities in the economic development of the companies, based on the objectives presented in the introductory section, we developed an econometric model for identifying the financial syncopes. This model is based on the comparison of company revenue trends in relation to expenditures incurred to achieve this revenue. In fact, we quantified the evolution of expenditures made to produce 1,000 monetary income units, thus gaining a dynamic picture of their evolution on the structure of income and expenditure accounts, a picture where spending maximization symbolizes vulnerability areas and revenue maximization symbolizes security areas. The equilibrium point is the optimal level wanted by top management and is assimilated to the area of maximum economic productivity and high profitability respectively. Mathematically, the model can be defined by the minimum - maximum functions as follows:

$$max(p) = \lim_{n\to\infty}\left(1+\frac{1}{v}\right)^n - \lim_{n\to\infty}\left(1-\frac{1}{c}\right)^n \quad (1)$$

Where

n - the number of profit centers existing at the company level;

v - the unit value of profitability through the function of maximizing revenue (goodwill items);

c - the unit value of the surplus cost under the conditions of rational use of resources (badwill elements).

The presented model identifies the security and vulnerability areas through its spatial component based on the dynamic change in the items of income and expense accounted for in the income and expenditure accounts in the monthly balances of the economic agents.

To achieve the model, the revenue and expenditure indicators collected for the period 2013-2017 for the top 15 enterprises in Suceava County have been transformed into relative growth rates on the mobile environments model. These shares were compared for income and expense accounts, with a revenue evolution table reported on the expenditure table. This picture was classified according to the CAEN activity codes of the top 15 enterprises, thus observing that the specific weight of the Manufacturing Industry (B) in the total sample is 5, of the Wholesale and retail trade; repair of motor vehicles and motorcycles (G) sector in the total sample is 8, and the Constructions (F) and Transport and storage (H) sectors have specific small residual weights in the total sample. Therefore, the evolution averages were grouped by sectors of activity, resulting in the model dependent variable, the dynamics of the evolution of the manufacturing sector (B_dep) in relation to

the regressor Wholesale and retail trade (G_reg). The F_ind (Constructions) and H_ind (Transport) variables are instrumental variables.

The multiplicative model equation is:

$$\hat{B}\_dep = + 1{,}01 * G\_reg \quad (2)$$
$$(0{,}0255)$$

n = 4, R-squared = 0,008
(standard errors in parentheses)

The above equation obtained by the least squares model in two phases (TSLS) was tested using the Gretl software program to obtain a valid highly significant model (p value < 0.0001 with the valid heteroskedasticity test, the null hypothesis confirming the absence of the phenomenon, the OLS estimates by the Hausman test being consistent and valid by the Sargan test). The statistical tests of the proposed model are presented below:

Model: TSLS, using observations 1-4
Dependent variable: B_dep
Instrumented: G_reg
Instruments: F_ind H_ind

	Coefficient	*Std. Error*	*z*	*p-value*	
G_reg	1,00707	0,0254671	39,5440	<0,00001	***

Mean dependent var	1,019471	S.D. dependent var	0,044683
Sum squared resid	0,007972	S.E. of regression	0,051548
R-squared	0,007928	Adjusted R-squared	0,007928

Hausman test -
Null hypothesis: OLS estimates are consistent
Asymptotic test statistic: Chi-square(1) = 0,239942
with p-value = 0,624248

Sargan over-identification test -
Null hypothesis: all instruments are valid
Test statistic: LM = 1,9494
with p-value = P(Chi-square(1) > 1,9494) = 0,162652

Pesaran-Taylor test for heteroskedasticity -
Null hypothesis: heteroskedasticity not present
Asymptotic test statistic: z = 0,40514
with p-value = 0,685374
Weak instrument test -
First-stage F-statistic (2, 2) = 1998,18

Forecast distribution reveals a 95% confidence interval a evolution of ± 10 units on the y-axis and a distribution on 4 quartile intervals on the x-axis, according to the graph below (see Figure 1).

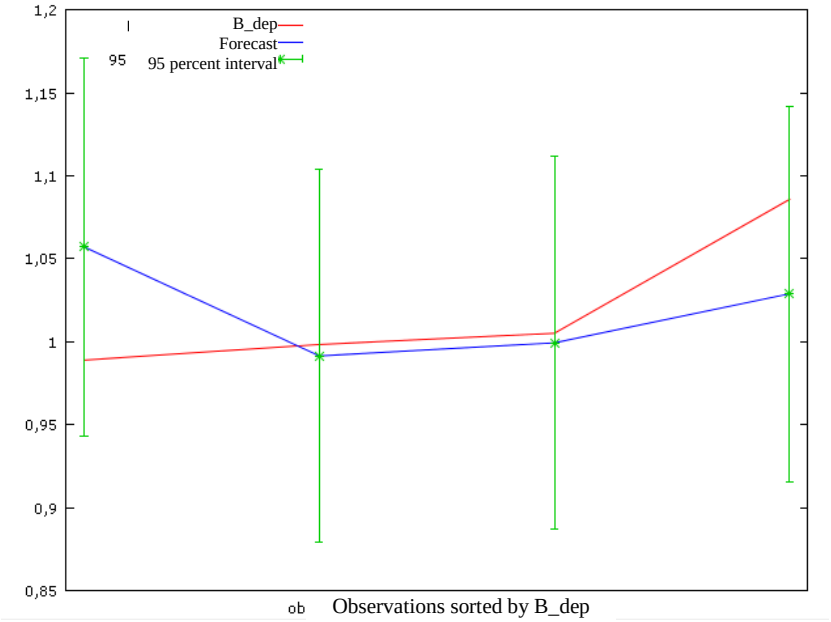

Figure 1. Predicted distribution on the 95% confidence interval of the dependent variable against the regression variable

4. RESULTS

For the practical application of the proposed model, it was defined a sample of 15 companies (the top 15 largest companies in Suceava County based on turnover), which operate in Suceava County, in the sectors: Manufacturing, Construction, Wholesale and Retail, Transport and storage. Their structure can be seen in the figure below (see figure 2).

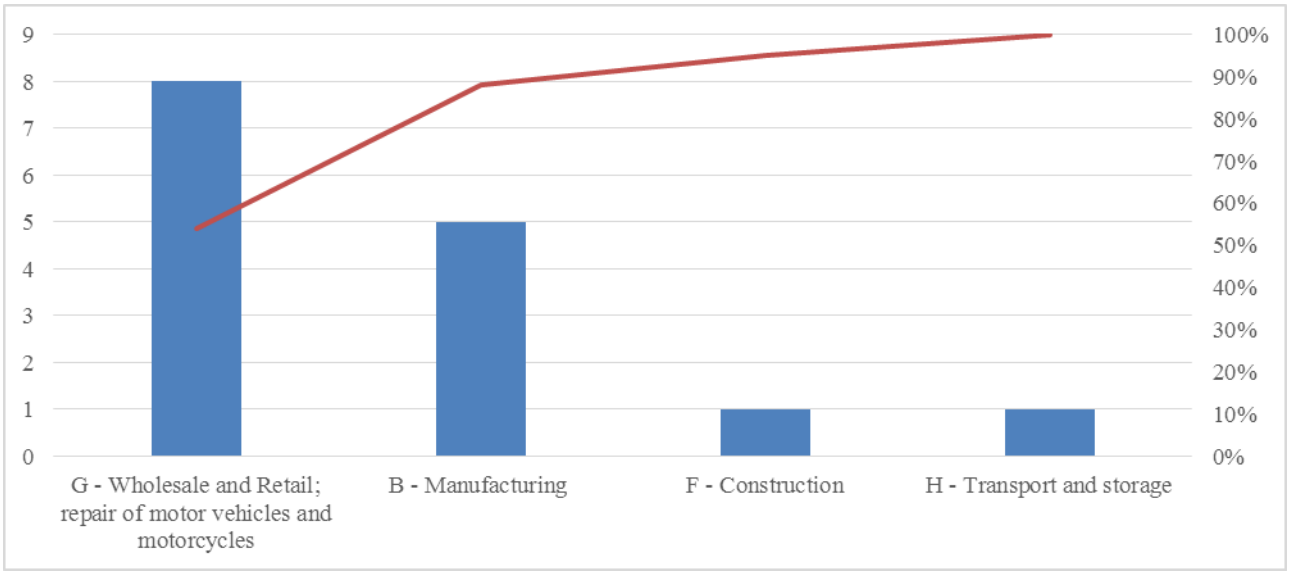

Figure 2. The specific weight of the business sectors for the top 15 enterprises in Suceava County

The distribution of the top 15 companies in Suceava County by CAEN codes shows the predisposition of the economic activity in the region towards the Wholesale and Retail Trade area, followed by the Manufacturing industry.

Data calculated on mobile averages of branch evolution indicate that the Transport and Industrial sectors show growth rates above the overall average, accumulating a standard deviation on the right-hand trend of 5%. The most favourable yearly evolutions were recorded in 2014 for the

industrial sector, 2015-2016 for the construction sector, 2017 for the trade sector and 2016 for the transport sector respectively. Global multiannual dynamics reflects the growth poles grouped at the beginning and end of the period, with the overall average (F_{GEN}=110,45%) growth of around 10% per year per sector (see Table 1).

Table 1. Evolution of turnovers by business sector for the top 15 enterprises in Suceava County

Turnover	B - The Processing Industry	F - Constructions	G - Wholesale and retail trade	H - Transport and storage	Average	Distance to the overall average
A	B	C	D	E	F=(B+C+D+E)/4	$G=F_{GEN}$-F
2017	112.56%	102.47%	118.73%	117.13%	112.72%	-2.28%
2016	104.20%	117.72%	93.78%	120.21%	108.98%	1.47%
2015	98.29%	114.17%	100.13%	113.91%	106.63%	3.82%
2014	143.37%	100.96%	99.29%	110.23%	113.46%	-3.02%
Average	114.61%	108.83%	102.98%	115.37%	110.45%	–
Distance to the overall average	-4.16%	1.62%	7.46%	-4.92%	–	–

Similarly, mobile averages on the evolution of profitability indicators were calculated. At the gross profit level, negative growth rates are observed on most sectors of activity (75%) in 2017 compared to 2016. In the Manufacturing sector the trend is passing, the dynamics of the growth being significant (24.08% compared to the previous year). In dynamics, over the entire period, Manufacturing occupies the best place from the annual profit growth perspective, with 17.48% per year. The most unfavourable situation is in the Wholesale and Retail Trade sector, where profitability dynamics fail to reach a growth rate of more than -16% per year. From the net profit point of view, it is observed that the fiscal component flattens the evolution curves by at least 10% per business sector through the fiscal policy of taxation of the relatively steady profit during the analysed period. Thus, as compared to the average gross profit growth of 3.76% per year for all sectors of activity analysed (top 15 enterprises in Suceava County), the growth rates of net profit (after tax) reflect an accumulation of 4.58% in dynamics per year in all sectors of activity (see Table 2).

Concerning from the point of view of the vulnerabilities proposed to be evaluated, the trends of evolution of the two rates of profitability are assessed, keeping constantly negative trends from the beginning to the end of the period and thus reaching a critical inflection point in 2017 when the growth value becomes subunit. This, combined with the overall turnover dynamics, signals the economic vulnerability to which the agents are exposed on an unstable macroeconomic climate characterized by inflation (the highest at EU level in 2016-2017), unstable fiscal and budgeting policy and deficit in the balance of payments.

Table 2. Evolution of profitability by business sector for the top 15 enterprises in Suceava County

Profitability before tax	B - The Processing Industry	F - Constructions	G - Wholesale and retail trade	H - Transport and storage	Average	Distance to the overall average
A	B	C	D	E	F=(B+C+D+E)/4	$G=F_{GEN}$-F
2017	124.08%	92.48%	42.02%	85.30%	85.97%	24.48%
2016	104.20%	117.72%	93.78%	120.21%	108.98%	1.47%
2015	98.29%	114.17%	100.13%	113.91%	106.63%	3.82%
2014	143.37%	100.96%	99.29%	110.23%	113.46%	-3.02%

Average	117.48%	106.33%	83.81%	107.41%	103.76%	–
Distance to the overall average	-13.72%	-2.57%	19.95%	-3.65%	–	–
Profitability after tax	**B - The Processing Industry**	**F - Constructions**	**G - Wholesale and retail trade**	**H - Transport and storage**	**Average**	**Distance to the overall average**
2017	120.84%	92.58%	59.48%	84.06%	89.24%	21.21%
2016	104.20%	117.72%	93.78%	120.21%	108.98%	1.47%
2015	98.29%	114.17%	100.13%	113.91%	106.63%	3.82%
2014	143.37%	100.96%	99.29%	110.23%	113.46%	-3.02%
Average	116.67%	106.36%	88.17%	107.10%	104.58%	–
Distance to the overall average	-12.10%	-1.78%	16.41%	-2.53%	–	–

The same trend is observed for the growth of the equity of the companies, which record the same decreasing evolution on average, with a capitalization rate of only 9% per year at the level of the analysed sample, with the indication that tendencies of trends stabilization towards the end of the period were observed for 75% of the analysed sectors (B - Manufacturing, F - Constructions, G - Trade), while for the H - Transport sector the evolution is a constantly negative one, respectively, of a decrease of branch capitalization by up to 50% in 2017 compared to the previous year. The data are presented in Table 3.

Table 3. Evolution of capitalization on business sectors for the top 15 enterprises in Suceava County

Turnover	**B - The Processing Industry**	**F - Constructions**	**G - Wholesale and retail trade**	**H - Transport and storage**	**Average**	**Distance to the overall average**
A	B	C	D	E	F=(B+C+D+E)/4	$G=F_{GEN}-F$
2017	118.24%	116.55%	110.23%	84.53%	107.39%	3.06%
2016	104.20%	117.72%	93.78%	120.21%	108.98%	1.47%
2015	98.29%	114.17%	100.13%	113.91%	106.63%	3.82%
2014	143.37%	100.96%	99.29%	110.23%	113.46%	-3.02%
Average	116.03%	112.35%	100.86%	107.22%	109.11%	–
Distance to the overall average	-6.91%	-3.24%	8.26%	1.89%	–	–

The analysis of income and expenditure developments responds to the research objective and proves to be in favour of the evolution trend of expenditures for the analysed period (see Table 4).

Table 4. Evolution of earnings and expenditure items by business sector for the top 15 enterprises in Suceava County

Incomes	**B - The Processing Industry**	**F - Constructions**	**G - Wholesale and retail trade**	**H - Transport and storage**	**Average**	**Distance to the overall average**
A	B	C	D	E	F=(B+C+D+E)/4	$G=F_{GEN}-F$
2017	112.97%	101.82%	118.70%	120.78%	113.57%	-3.12%
2016	104.20%	117.72%	93.78%	120.21%	108.98%	1.47%

2015	98.29%	114.17%	100.13%	113.91%	106.63%	3.82%
2014	143.37%	100.96%	99.29%	110.23%	113.46%	-3.02%
Average	114.71%	108.67%	102.98%	116.28%	110.66%	–
Distance to the overall average	-4.05%	1.99%	7.68%	-5.62%	–	–

Expenses	**B - The Processing Industry**	**F - Constructions**	**G - Wholesale and retail trade**	**H - Transport and storage**	**Average**	**Distance to the overall average**
2017	111.89%	102.59%	120.68%	129.01%	116.04%	-5.60%
2016	104.20%	117.72%	93.78%	120.21%	108.98%	1.47%
2015	98.29%	114.17%	100.13%	113.91%	106.63%	3.82%
2014	143.37%	100.96%	99.29%	110.23%	113.46%	-3.02%
Average	114.44%	108.86%	103.47%	118.34%	111.28%	–
Distance to the overall average	-3.16%	2.42%	7.81%	-7.06%	–	–

Net Incomes	**B - The Processing Industry**	**F - Constructions**	**G - Wholesale and retail trade**	**H - Transport and storage**	**Average**	**Distance to the overall average**
2017	99,83%	100,49%	98,44%	98,84%	99,40%	2,25%
2016	108,58%	100,66%	102,16%	99,47%	102,72%	-2,70%
2015	100,50%	99,94%	99,23%	101,18%	100,21%	1,49%
2014	98,88%	99,79%	104,96%	101,32%	101,24%	-1,03%
Average	101,95%	100,22%	101,20%	100,20%	100,89%	–
Distance to the overall average	1,05%	-0,67%	0,31%	-0,69%	–	–

The data presented reflect an asymptotic evolution of the revenue-expenditure ratio, with the macro-stability periods being marked at the inflection point of 2016 for the Industry and Construction sectors and 2015 respectively for the Transport sector. In the Trade sector, the situation is fluctuating, unstable, indicating a high sensitivity of the enterprises in the branch to the macroeconomic conditions, this sector being the most sensitive in relation to consumer behaviour and the social policy elements promoted by public authorities. Globally compared in dynamics income-spending developments for the top 15 are found to be unitary with annual growth of less than 1% in revenue. At branch level best positioned on multi-year averages is the Industry branch, with equality between the multi-annual development averages in the Construction and Transport sector. However, the vulnerability picture is activated when we analyse the overall evolution of the revenue-expenditure ratio in annual dynamics. This is a declining one which, at the end of the period (2017), tilts the vulnerability balance for 3 out of 4 sectors of activity by increasing expenditure in addition to rising incomes.

The general trend requires managers to be cautious about economic development policies primarily by protecting their own assets in relation to labour protection (attractive remuneration), and harnessing the competitive advantage. The vulnerability picture as seen through the application of the proposed econometric model is presented in the table below (see Table 5).

Table 5. Vulnerability panel obtained by applying the model

Vulnerability	B - The Processing Industry	F - Constructions	G - Wholesale and retail trade	H - Transport and storage
Turnover	114.61%	108.83%	102.98%	115.37%
Profitability before tax	117.48%	106.33%	83.81%	107.41%
Profitability after tax	116.67%	106.36%	88.17%	107.10%
Incomes	114.71%	108.67%	102.98%	116.28%
Expenses	114.44%	108.86%	103.47%	118.34%
Net Incomes	101,95%	100,22%	101,20%	100,20%
Legend	Medium (above average)			
	High			
	Low			

The picture shows that there are threats to transport and trade companies, especially in the profitability (Trade) and accumulation of expenses (Transport) segment. The orientation towards the Manufacturing industry provides stability through the impact of the business on the market, industrial businesses in the Industrial sector aiming to capture monetary resources, both by exploiting the competitive advantage in the domestic market and by exporting. Also, profitability rates are high in this segment. The Construction sector benefits from the stability of the branch with a profitability with an average growth rate of 6.3% per year and the revenue-expenditure ratio is slightly tilted to the expense.

CONCLUSIONS

The research aimed to analyse the economic development strategies through the quantification of trends in the evolution of financial elements (income and expense accounts) for the top 15 largest enterprises in Suceava County by turnover. The proposed econometric model, based on the least squares method in two phases, surprised for the high specific weight branches in the proposed sample the correlated evolution of revenues and expenditures in 5-year dynamics. The model highlighted the vulnerabilities affecting the economic activity on its financial side in dynamics by years and by sectors of activity. The macroeconomic component has been assessed both from fiscal policy point of view, as well as from social policy and interaction with business environment policy point of view.

The objectives of the study were achieved thus the comparative evaluation of the financial performances was carried out with the table showcasing the evolution of the economic agents (see tables 1-4). At the same time, the causal conditions of the financial risk components were analysed and they were included in the vulnerability table (Table 5). By econometric modelling, the evolutions of revenues and expenditures were comparatively tested, and by applying the Forecast forecasting method, the financial standing was modelled on the evolutionary slopes of the income and expense indicators.

In conclusion, the study is a innovative one, based on trend analysis, sequential structuring of developments by sectors of activity and years, and provides users of financial information with a useful tool in establishing medium- and long-term development strategies.

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