

Indebtedness of small and medium-sized wineries in Slovakia

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Abstract: Many companies depend on debt sources; they use them to finance their needs. Bank loans are the main debt sources to which companies have access. However, financing only with this source is associated with many risks. The paper's main goal is to assess and quantify the indebtedness of wineries in Slovakia for 2013–2021 through individual debt ratios. The influence of financial leverage on return on equity (*ROE*) was tested. The data were drawn from the Register of Financial Statements. From the point of view of the total debt ratio, wineries show values higher than 65%. The presence of short-term debts, especially short-term liabilities, prevailed. The average share of equity reached a very low value of 11%. The average share of bank loans on financing operating activities was very low at the level of 8.53%. The return on assets (*ROA*) was lower than the cost of debt in most wineries, which means that increasing indebtedness had a negative effect on *ROE*.

Keywords: bank loans; debt indicators; financial resilience; vineyard economics; wine industry

According to Ladvenicová et al. (2022), Slovakia has a long tradition of grape cultivation and wine production. Despite that, grape production in Slovakia (as well as in the Czech Republic) has been below the European Union's and global averages (Verter and Hasíková 2019). However, the focus of wine production in this country has been on quality rather than quantity (Králíková et al. 2021) – active winemakers [whose organisational structure is characterised by a wine-growing association established in the latter half of the 18th century (Slámová and Belčáková 2020)] producing varietal and quality wines with protected geographical indication and wines with designation of origin (Zeleňáková et al. 2019). Slovakia has six wine-growing regions, which

provide favourable conditions for viticulture and offer a diverse range of wine varieties (Regecová et al. 2022).

The winery industry in Slovakia presents several opportunities for growth and development (Kučerová 2014). Wineries also need to adapt to changing market conditions (e.g. the COVID-19 pandemic had a significant impact on the global wine sector, including Slovakia), as mentioned by Synák (2023). The winery industry can benefit by adopting sustainable business development practices, which involve considering environmental, social, and economic aspects – wineries can enhance their reputation, attract environmentally conscious consumers, and contribute to the overall sustainability of the industry (Coros et al. 2019). In ad-

dition, wine tourism also plays a key role in promoting wineries in Slovakia (Mazurek 2022) and represents a significant opportunity for the winery industry (Šťastná et al. 2020), e.g. the establishment of wine routes can increase tourist visitations and promote the wine industry (Pijet-Migoń and Królikowska 2020).

Literature review. The key problems faced by wineries in Slovakia can be attributed to numerous factors. One of the challenges is the strong competitive pressures on production in traditional wine regions, which makes the transformation process more difficult (Novotná and Novotný 2019). The competitiveness of Central and Eastern European wines (including those from Slovakia) lies in producing wines that reflect their culture and indigenous varietals. However, obstacles such as difficulties in contract enforcement and fragmented land ownership can hinder the production of distinguished wines at competitive prices (Marks 2011). According to Tancik and Seljak (2017), another problem is the occurrence of pests and diseases in vineyards [e.g. mycobiota can affect the quality and safety of wines (Felšöciová et al. 2015)]. To address these problems, wineries in Slovakia can consider implementing strategies that focus on creating value and differentiation in a competitive market (Thomas et al. 2013) and effective pest management strategies. Collaboration and knowledge exchange within the wine cluster can contribute to the development of knowledge and information networks (Morrison and Rabelotti 2009). Moreover, quality control is a key challenge faced by winemakers to produce wines with properties tailored to specific markets (Lee, et al. 2021).

To understand the financial leverage of wineries in Slovakia, it is essential to consider various factors that impact their financial performance (Simón-Elorz and Valero 2022). Bui (2020) pointed out that while financial leverage can bring potential benefits, it also introduces financial risk. According to Chadha and Sharma (2015), higher levels of financial leverage can negatively impact a firm's profitability. Danso et al. (2020) found no significant relationship between financial leverage and firm performance. This suggests that the impact of financial leverage on firm performance may vary depending on other factors. Simón-Elorz and Valero (2022) further state that financial indicators, such as liquidity and leverage, play a crucial role in resilience and performance during periods of financial crisis. Apart from that, the financial resilience and performance of wineries is a topic of interest during challenging times such as the COVID-19 lockdown, as it directly impacts their operations and sustainability

(Arimany-Serrat et al. 2023). Other significant factors of financial performance are the availability of financial resources and the ability to manage financial risk (Ključnikov et al. 2016), stable production and overall profitability (Ignjatijević, et al. 2022). In addition to financial factors, the strategic resources and human capital of wineries are essential for achieving competitive advantages and sustainable performance, especially in uncertain times (Martín-Hidalgo and Pérez-Luño 2021). The financial leverage of wineries is also influenced by their capital structure determinants (Viviani 2008), and ownership structure can influence the level of financial leverage (Margaritis and Psillaki 2010).

To evaluate the influence of financial leverage on return on equity (*ROE*), it is essential to consider the relationship between these variables. Financial leverage, often measured by the debt-to-equity ratio, can impact a firm's *ROE*. According to Campbell et al. (2008), the effects of leverage on financial distress risk are significant, indicating that leverage plays a crucial role in a firm's financial health. Relation of indebtedness and profitability was discussed also in the papers of Mijic and Jaksic (2017), Oriskóová (2017), Quiraque et al. (2022), Sukma et al. (2022), Tekic et al. (2022), Gobbi et al. (2023), Khwankawin et al. (2023), and Nussaika et al. (2023).

Gobbi et al. (2023) applied multivariate regressions with panel data using effects on a sample 270 public traded companies. Size and indebtedness positively correlated with return on assets (*ROA*) and *ROE*. Oriskóová (2017) analysed the relationship between profitability and indebtedness using various indicators. The advantage of debt financing is a better development of the *ROE*. Quiraque et al. (2022) analysed the influence of capital structure on the profitability of 106 public companies in the Brazilian market. The increase in indebtedness reduces *ROA* and *ROE*. Sukma et al. (2022) determined and analysed the effect of the debt ratio, long-term debt to equity, and firm size on profitability measured by *ROE*. The result of this research was that long-term debt has a positive effect on profitability. Long-term debt and debt ratio partially have a significant effect on *ROE*, while firm size does not significantly affect *ROE*. Khwankawin et al. (2023) discussed the effect of the debt-to-equity ratio on *ROA*. The results showed that the debt-to-equity ratio had a significant effect on *ROA*. Nussaika et al. (2023) empirically examined the effect of the degree of financial leverage (*DFL*) on the firm's profitability of twenty companies in Sri Lanka. *DFL* had a statistically significant and positive relationship with *ROA*, and *DFL*

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had a significant impact on the financial performance of companies. Mijic and Jaksic (2017) in their paper presented an analysis of the efficiency of the indebtedness of companies in the Republic of Serbia. The research results indicated that debt was negatively correlated with the level of profitability, which shows a weak ability of companies to improve their performance through additional debt. Tekic et al. (2022) used panel regression analysis; the influence of different determinants (liquidity, financial leverage, indebtedness, tangibility and others) on profitability, measured by the rate of return assets, was examined. It was noted that indebtedness had the greatest impact on companies. It had a negative impact on profitability, which can be explained by the fact that the level of indebtedness of these companies was high, and additional borrowing should be avoided in the future.

The indebtedness of wineries in Slovakia is a complex issue that requires a comprehensive understanding of financial literacy, environmental sustainability, and business performance. Financial literacy plays a crucial role in the management of wineries' finances (Belás et al. 2016). Environmental sustainability is a critical aspect that influences the performance of wineries (Knight et al. 2018). Wineries in Slovakia may benefit from investing in sustainable practices to enhance their overall performance and potentially mitigate indebtedness. Wineries are motivated to adopt environmentally sustainable practices due to strategic, internal, and external drivers (Karagiannis and Metaxas 2020). Furthermore, the impact of high land prices on the viability of winery projects is a relevant consideration for understanding the financial challenges faced by wineries (Santos et al. 2021). The social implications of high land prices leading to more wineries being owned by capital-rich wine conglomerates underscore the financial pressures that independent wineries may encounter.

The economic and financial challenges faced by wineries in European Union countries and globally are multifaceted and influenced by various factors (Stawska and Jabłońska 2021). The wine industry has encountered significant disruptions, such as the economic crisis, changing consumer preferences, and events like the COVID-19 pandemic and geopolitical events, such as Brexit (Curtis and Slocum 2021; Kaye et al. 2021). These challenges have prompted strategic responses from wineries to ensure their sustainability and competitiveness in the global market. One crucial finding from the literature is the significance of resilience in addressing economic challenges. Research has underscored the impact of regional resilience el-

ements on the performance of clustered firms during crisis periods (Schmidt et al. 2022). By integrating sustainability into their practices, wineries can not only mitigate environmental impacts but also enhance their long-term economic sustainability. Additionally, the literature stresses the necessity of innovation and diversification to effectively tackle economic challenges (Marbach et al. 2023).

The main goal of the paper is to evaluate and measure the indebtedness of wineries in Slovakia by available disclosed data for the period from 2013 to 2021 using individual debt ratios and to propose solutions to improve the situation of high indebtedness of wineries in Slovakia.

Based on the available disclosed data, the following hypotheses were established:

H_{0A} : The researched wineries have the same average indebtedness according to the debt indicators, regardless of the winery size.

H_{0B} : The researched wineries have the same average indebtedness according to the debt indicators, regardless of the area of operation.

H_{0A} was established in accordance with the research of La Rocca et al. (2009), who found a positive correlation between firm size and debt, suggesting that larger firms tend to have higher leverage ratios. This finding supports the idea that winery size may impact debt indicators. Ramadan and Ramandan (2015) highlighted the same opinion that larger firms typically rely more on debt financing than equity. Lehenchuk et al. (2022) and Marco-Lajara et al. (2022) also offered valuable insights into the relationship between the size of agricultural companies and their debt indicators.

The relationship between winery area and debt indicators was addressed by Marco-Lajara et al. (2023), who researched wineries belonging to a wine-growing territory.

MATERIAL AND METHODS

The source for processing was data from wineries operating in Slovakia. Wineries were micro, small and medium-sized companies that kept accounts using the double-entry method. The total number of winemakers (grape growers + wine producers) and wine traders increased by 57% (from 651 to 1 022) during the period under review. In 2021, grape growers and wine producers represented 73%, while wine traders represented 27% of the total in Slovakia (Figure 1.).

Data were sourced from the Financial Statements of 107 companies for the period from 2013 to 2021. 107

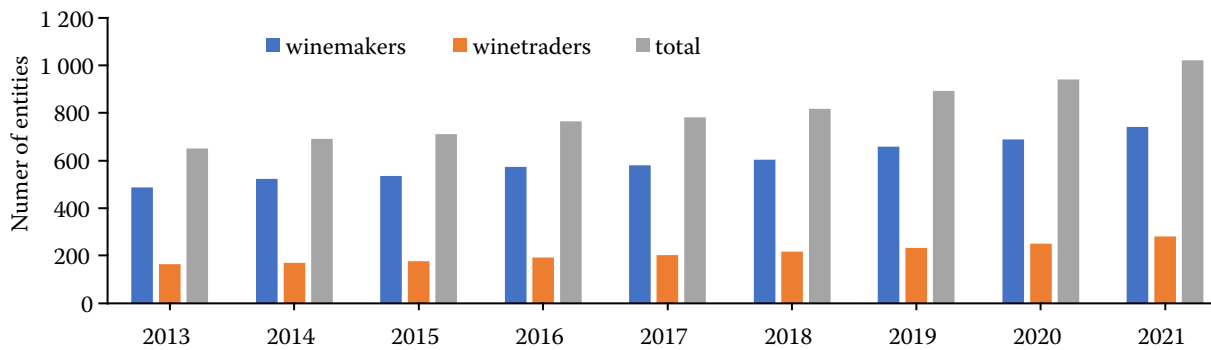


Figure 1. Number of winemakers and wine traders in Slovakia

Source: Authors' own elaboration

companies were selected from the Register of Grape and Wine Growers, focusing on wineries that:

- i) were active throughout the entire analysed period from 2013 to 2021,
- ii) were grape growers and wine producers, not wine traders,
- iii) had disclosed data.

Data were prepared and processed by Microsoft Office 365 and statistically analysed by Jamovi 2.5.6. Reliability analysis and linear regression with variance inflation factor (VIF) were used to identify the reliability of the data and to explain the model and multicollinearity between variables. Pearson's correlation heatmap was used to identify possible correlations between the debt ratio variables. The various dependencies were identified by non-parametric one-way ANOVA (Kruskal-Wallis test), which, together with the paired samples contingency tables, identified dependencies between variables and evaluated hypotheses.

The concept of indebtedness represented the use of debt sources to finance the needs of the company. Indebtedness is one of the important indicators for evaluating the financial health of companies. The following debt indicators were included:

$$\text{total debt ratio} = \frac{\text{total debt}}{\text{total capital}} \quad (1)$$

The total debt ratio is one of the basic indicators of indebtedness; it represents the share of total debt on total capital. The threshold for accepting a certain level of debt depends on the type of company and the industry in which the company operates. Taušová et al. (2016) and Valášková and Gajdošíková (2021) recommended that the indicator should range from 30% to 60%. However, the indicator can reach 70% to 80%

in market economies. As the value of the indicator increases, the risk of creditors also increases.

For a deeper analysis, the total debt was divided into short-term and long-term indebtedness. Short-term and long-term debt ratios were quantified as follows:

$$\text{short-term debt ratio} = \frac{\text{short-term debt}}{\text{total capital}} \quad (2)$$

$$\text{long-term debt ratio} = \frac{\text{long-term debt}}{\text{total capital}} \quad (3)$$

Short-term debts include short-term liabilities, short-term bank loans, short-term reserves, and short-term financial assistance. Long-term debts include long-term liabilities, long-term bank loans and long-term reserves.

The total debt ratio in companies is complemented by the indicator of the degree of self-financing. If the company does not show accruals within liabilities, the sum of these two indicators is equal to one. The company is more stable if the indicator reaches higher values because the indicator contains equity invested by the owners of the company.

$$\text{degree of self-financing} = \frac{\text{equity}}{\text{total capital}} \quad (4)$$

Financial leverage is the opposite of the degree of self-financing. It represents the share of total capital on equity. The indicator expresses how many times the total capital exceeds the equity.

$$\text{financial leverage} = \frac{\text{total capital}}{\text{equity}} \quad (5)$$

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Financial leverage operates in the company as follows:

- i) positive: $ROA > \text{costs of debt} \rightarrow ROE \text{ increases,}$
- ii) negative: $ROA < \text{costs of debt} \rightarrow ROE \text{ decreases,}$
- iii) indifferent: $ROA = \text{costs of debt} \rightarrow ROE \text{ does not change.}$

The times interest earned ratio indicator refers to the coverage of the price of debt (cost interests) from earnings before interest and taxes (*EBIT*). The higher the value of the indicator, the higher the company's ability to cover the cost of debt.

$$\text{times interest earned ratio} = \frac{EBIT}{\text{cost interests}} \quad (6)$$

The relation between the most frequently used form of financing (bank loans) and the total capital is expressed by the loan burden indicator. The higher the value of the indicator, the more dependent the company is on this type of financing. The value of this indicator should not exceed 50% (Gurčík 2018; Matisková and Šebej 2012), see Equation (7).

From the input data of each winery, the mean, minimum, maximum, and median values for each debt indicator were quantified.

Factors affecting *ROE* and their influence were quantified using panel data models. These were based on data for all companies and the period included in the analysis by considering factors: *EBIT* / sales, *EBT* (earnings before taxes) / *EBIT*, *EAT* (earnings after taxes) / *EBT*, and *A* / *E* (assets / equity). All variables were used in the form of natural logarithms and, therefore, model coefficients were estimated elasticities (log-log model). To remedy any bias caused by possible heteroscedasticity or autocorrelation, robust standard errors were applied. Pooled regression model, one-way random effects model and one-way fixed effects model were considered for the conducted analysis.

The most suitable model was selected according to the results of the following methods: *F*-test for no fixed effects, which compared the pooled regression model with the fixed effect model. A low *P*-value indicated rejection of null hypothesis, and that the pooled regression model was adequate in favour of the fixed effects model. For the random effects model, the presence of individual effects was tested employing the Breusch-Pagan test for random effects, which compares the performance of pooled regression with the random effects model. In this case, the low *P*-value

indicated rejection of the null hypothesis, and that the pooled regression model was adequate in favour of the random effects model.

The decision between the fixed and random effects models was based on the test suggested by Hausman (1978). The test examines differences between coefficients estimated from the fixed effects and random effects models. The low *P*-value counts against the null hypothesis that fixed and random effects estimates do not differ substantially, and random effects estimates are consistent in favour of the alternative hypothesis to prefer the model with fixed effects and random effects estimates are not consistent. The threshold value for a decision about the hypothesis was a significance level of 0.05. When the result of the Hausman test suggested that both models were consistent, the explanatory ability of both models and the type of data were also considered.

The model was estimated in the form:

$$\begin{aligned} \ln(ROE_{it}) = & b_0 + b_1 \ln\left(\frac{EBIT}{S_{it}}\right) + b_2 \ln\left(\frac{EBT}{EBIT_{ij}}\right) + \\ & + b_3 \ln\left(\frac{EAT}{EBT_{ij}}\right) + b_4 \ln\left(\frac{A}{E_{ij}}\right) + u_{it} \end{aligned} \quad (8)$$

where: *i* – number of cross-sectional units (*i* = 1, 2, ..., *n*); *t* – number of time periods (*t* = 1, 2, ..., *T*).

The paper results include only final models with the highest prediction ability, which was evaluated as the most appropriate for the estimation of the suggested relationship based on test results described in the methodology part. The model included input data from the individually analysed wineries. Panel data model was selected to decrease the correlation between explanatory factors, which offers more reliable results concerning multicollinearity conditions than simple regression. Correlation between variables may be significant, which implies larger standard errors of estimated parameters, but it does not influence the robustness of model parameters according to post-estimation testing results. Model parameters were estimated with robust standard errors and were treated for conditions of heteroscedasticity and autocorrelation. The model was also checked for multicollinearity and estimated parameters were consistent from an econometric point of view.

$$\text{loan burden} = \frac{\text{bank loans and short-term financial assistance}}{\text{total capital}} \quad (7)$$

RESULTS

The chosen wineries that were analysed belong to micro, small, and medium-sized companies. These companies represent the driving force of our country's economy. Many of the companies cannot perform their activities effectively without liabilities. The area of Slovakia is divided into six vineyard areas: Nitra area, Small Carpathian area, Central Slovak area, Tokaj, East Slovak area, and South Slovak area. Each area is divided into regions, and in regions, vineyard villages are located in which the wineries operate. During the pandemic period, the wineries were affected by the pandemic; they had to close their shops, and there were no events, markets, or tastings where wineries could offer their products. This period was liquidating for small companies and family companies. On the contrary, the year 2021 was characterised by an above-average harvest, which was mainly influenced by the climate conditions. The area of wine production and sale in Slovakia is very complex, affected by strong competition and the import of cheap wines from abroad where most consumers look at the price, which affects the sale of Slovak wines. The state support of the sector is missing as well. At the end of 2021, there were around 692 wine producers and wine traders in Slovakia. Many winemakers conduct their business based on trade licences, and data about their economic activities and results are not disclosed. Therefore, the wineries that worked in double-entry bookkeeping and had data that was publicly available were selected for analysis.

In Table 1, the total indebtedness development of wineries is quantified. As you can see, the indebtedness reached rather high values above 65%. This means that wineries were mainly using debts for their activities. As the volume of debts grows, the need for debt repayment also grows, which impacts the liquidity of wineries. The most unfavourable years from the point of view of achieved values of indicators were the years 2014–2016 (indebtedness between 85% and 99%). For the whole period, the indebtedness increased by about 2.25%. The lowest value was zero, and the highest value of indebtedness was quantified at the level EUR 13 867 in 2016. In terms of the reported maximum value of the total debt ratio, three wineries had negative equity, incurred losses, and had the highest indebtedness values among the individual wineries during the years analysed. The average value of the file median reaches a value of 59.83%.

As shown in Table 2, on average, 34 wineries over the entire analysed period had an indebtedness of more than 80%. An average of 29 wineries were in the range 30–60% during the years under review.

Total indebtedness was divided into short-term and long-term due to a deeper analysis of source usage. The results of quantified indicators are shown in the following tables. Development of the short-term indebtedness is shown in Table 3. The lowest short-term indebtedness the wineries reached in 2019 at the level of 48.12%, and the highest in 2015 at the level of 76.06%. Short-term liabilities prevailed from short-term sources, and they mainly influenced the development of the

Table 1. Indebtedness development of wineries in Slovakia (in EUR)

Indicator	2013	2014	2015	2016	2017	2018	2019	2020	2021	Mean
Average	0.7713	0.8512	0.9183	0.9944	0.6681	0.7844	0.6511	0.6956	0.7938	0.7920
Min	0.0000	0.0064	0.0194	0.0203	0.0000	0.0000	0.0000	0.0000	0.0000	0.0051
Max	8.6083	7.1032	7.0763	13.8670	3.7109	4.4357	2.9238	4.0882	13.7360	7.2833
Median	0.5619	0.6536	0.6865	0.6277	0.5610	0.6531	0.5239	0.5627	0.5544	0.5983

Source: Authors' own calculation, the balance sheet of wineries

Table 2. The number of wineries from the point of view of the achieved evaluation interval of indebtedness

Interval	2013	2014	2015	2016	2017	2018	2019	2020	2021	Mean
< 0.3	32	25	15	21	25	24	26	24	31	25
0.3–0.6	23	25	30	30	31	24	33	34	28	28
0.6–0.8	18	16	15	22	21	23	17	22	24	20
> 0.8	34	41	47	34	30	36	31	27	24	34

Source: Authors' own calculation

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indicator in the wineries. The second major short-term source of funding was standard bank loans and short-term financial assistance, and short-term reserves were at about the same level. Wineries used short-term resources to cover their purchases of materials, inventory, and short-term needs. Financing through short-term resources is cheaper than financing through long-term resources, but it is riskier. The lowest minimal reached values of short-term indebtedness were EUR 0, and the maximal value was EUR 13.7115 in 2021. The number of companies included in the range of evaluation is shown in Table 4. Most wineries had a level of short-term indebtedness of less than 30%, averaging 45 wineries over the entire period under review. The level of short-term indebtedness above 80% was identified in an average of 24 wineries.

The development of long-term indebtedness of wineries for the period 2013–2021 is shown in Table 5. The average value of long-term indebtedness was at the level of 15.59%, which was 45% lower compared to the average short-term indebtedness. The companies used

long-term liabilities less than short-term liabilities. The lowest value of long-term indebtedness was quantified at the beginning of the period at the level of 9.23%. From long-term sources, the companies used mainly long-term liabilities, but also long-term bank loans. Long-term reserves formed a negligible part of the long-term resources. The minimal value of long-term indebtedness was EUR 0, and the maximal value was quantified at the level of EUR 6.2755 in 2016. This value was recorded in a winery that, in 2016, achieved a high value of other long-term liabilities compared to other years, which influenced the indicator value. The average medium value of the file was at the level of EUR 0.0158.

The development of several wineries based on long-term indebtedness is shown in Table 6. The representation of long-term debts in total winery resources averaged 30% across 86 wineries. The lowest number of wineries reached an indebtedness level above 80%.

Degree of self-financing expresses the presence of own sources of financing the company needs. The

Table 3. Development of short-term indebtedness of wineries in Slovakia (in EUR)

Indicator	2013	2014	2015	2016	2017	2018	2019	2020	2021	Mean
Average	0.6790	0.7312	0.7606	0.5443	0.5156	0.6138	0.4812	0.5286	0.6247	0.6088
Min	0.0000	0.0060	0.0189	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0028
Max	8.6083	7.1032	7.0763	5.7169	3.7055	4.2434	2.9147	4.0803	13.7115	6.3511
Median	0.3911	0.4795	0.5021	0.3721	0.3798	0.4474	0.3504	0.3568	0.2806	0.3955

Source: Authors' own calculation, the balance sheet of wineries

Table 4. Number of wineries based on a range of evaluation of short-term indebtedness

Interval	2013	2014	2015	2016	2017	2018	2019	2020	2021	Mean
< 0.3	47	41	34	43	47	43	48	47	55	45
0.3–0.6	20	21	23	27	24	22	32	30	23	25
0.6–0.8	8	12	15	15	19	17	9	12	14	13
> 0.8	32	33	35	22	17	25	18	18	15	24

Source: Authors' own calculation

Table 5. Development of long-term indebtedness of wineries (in EUR)

Indicator	2013	2014	2015	2016	2017	2018	2019	2020	2021	Mean
Average	0.0923	0.1200	0.1577	0.2039	0.1525	0.1706	0.1699	0.1670	0.1692	0.1559
Min	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Max	0.8615	1.1611	1.1229	6.2755	1.2978	1.5115	2.4377	1.8010	1.8046	2.0304
Median	0.0017	0.0036	0.0063	0.0290	0.0175	0.0156	0.0210	0.0225	0.0246	0.0158

Source: Authors' own calculation, the balance sheet of wineries

indicator should reach the highest values. In wineries, the indicator showed low values, on average, at 11.23%. In 2016, the average value of the degree of self-financing was negative, which was affected by negative values of equity. In each analysed year, the minimal value of the indicator was negative; however, in 2016, the most unfavourable value reached EUR –23.261. The highest maximal value is quantified at the level of EUR 1, as shown in Table 7. Equity in wineries consisted of share capital, other capital funds, retained earnings from previous years, and the current accounting period.

Logically, based on the quantified values of the indicator, most of the wineries will belong to the lowest range of evaluation, which was set up at 20 % for this indicator. On average, 44 wineries were in this range for the whole period. With the increase in the range, the number of wineries decreased, and the fewest wineries fell into the range above 61% (Table 8).

The opposite of the degree of self-financing is the financial leverage. Its development is shown in Ta-

ble 9. On average, over the entire period, total capital exceeded equity by 3.77 times. Minimal values of wineries reached negative values for the whole period. The average minimal value for the entire period was EUR –109.428, and the average maximal value was EUR 209.663. From the point of view of several wineries according to the range of financial leverage evaluation, the range from less than one up to three and more was set (Table 10). Total capital exceeded the equity by more than three times on average in 35 wineries.

The times interest earned ratio was expressed as *EBIT* divided by the price of debt (cost interests). Its development is shown in Table 11. Companies should reach positive values of the indicator. In wineries, the development of this indicator was affected mainly by reached loss. Many wineries do not report cost interests in profit and loss statements, and when they do, they do so with minimal value. This means the median value was at the level of 0. These two factors caused this indicator to reach negative values in 2013, 2014,

Table 6. Number of wineries based on a range of evaluations of long-term indebtedness

Interval	2013	2014	2015	2016	2017	2018	2019	2020	2021	Mean
< 0.3	93	91	84	87	86	85	86	82	84	86
0.3–0.6	11	9	12	10	12	13	13	19	16	13
0.6–0.8	2	5	8	6	6	5	5	3	4	5
> 0.8	1	2	3	4	3	4	3	3	3	3

Source: Authors' own calculation

Table 7. Development of self-financing degree of wineries in Slovakia in EUR

Indicator	2013	2014	2015	2016	2017	2018	2019	2020	2021	Mean
Average	0.1274	0.0875	0.0192	–0.2661	0.2568	0.1523	0.2731	0.2316	0.1289	0.1123
Min	–7.6083	–6.1032	–6.0763	–23.1261	–2.7109	–3.4357	–1.9238	–3.0882	–12.736	–7.4230
Max	1.0000	0.9891	0.9491	0.9241	0.9841	1.0000	1.0000	1.0000	1.0000	0.9829
Median	0.3056	0.2017	0.1732	0.2908	0.3199	0.2954	0.3474	0.3080	0.3345	0.2863

Source: own calculation, the balance sheet of wineries

Table 8. Number of wineries based on a range of evaluations of the self-financing degree

Interval	2013	2014	2015	2016	2017	2018	2019	2020	2021	Mean
< 0.2	47	52	55	41	41	44	40	39	39	44
0.21–0.4	15	16	17	27	22	22	15	21	18	19
0.41–0.6	15	11	15	15	20	22	28	22	19	19
0.61–0.8	15	14	10	15	10	8	11	12	17	12
> 0.8	15	14	10	9	14	11	13	13	14	13

Source: Authors' own calculation

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2016, 2018, and 2020 and the total average value of the indicator was –365.9. This means that in these years, the wineries were not able to cover the price of the debt from their earnings. On the contrary, some of the wineries reported a higher value of *EBIT* in comparison to the cost interests, which was shown by the high positive value of the indicator.

The average number of wineries over the entire period was 69, and most fell within a range of less than one for the time's interest earned ratio. These were mainly wineries which reported negative *EBIT*, but

on the other hand, there were wineries with high *EBIT*, which was reflected in the value of the indicator for more than (on average) 27 wineries in the entire period (Table 12).

The last quantified indicator of indebtedness was the indicator of loan burden. Its development is shown in Table 13. The indicator divides bank loans, short-term financial assistance and total capital. As it is shown in Table 13, the wineries did not use bank loans, their average representation was on the level of 8.53%. The minimum value of the indicator was zero

Table 9. Development of financial leverage of wineries in Slovakia in EUR

Indicator	2013	2014	2015	2016	2017	2018	2019	2020	2021	Mean
Average	7.1679	1.8395	2.3244	5.2146	1.9413	1.5280	4.2519	4.2163	5.4731	3.7730
Min	–24.999	–53.575	–55.494	–283.141	–110.926	–85.128	–107.359	–17.553	–246.677	–109.428
Max	399.091	80.411	138.066	453.255	67.7004	87.964	124.987	34.948	500.549	209.663
Median	1.4944	1.4821	1.6145	1.8856	1.9571	1.8949	1.9948	2.0378	1.9950	1.8174

Source: Authors' own calculation, the balance sheet of wineries

Table 10. Number of wineries based on a range of evaluations of financial leverage

Interval	2013	2014	2015	2016	2017	2018	2019	2020	2021	Mean
< 1	34	32	36	21	23	28	18	16	19	25
1–2	35	33	28	34	34	28	36	35	36	33
2–3	10	11	13	13	16	19	18	13	15	14
> 3	28	31	30	39	34	32	35	43	37	35

Source: Authors' own calculation

Table 11. Development of times interest earned ratio of wineries in Slovakia

Indicator	2013	2014	2015	2016	2017	2018	2019	2020	2021	Mean
Average	–151.89	–5 385.01	5.49	–929.19	1 128.82	–1 049.41	545.64	–349.92	2 892.40	–365.90
Min	–16 163	–585 398	–21 412	–185 730	–29 308	–77 189	–24 564	–39 681	–3 371	–109 202
Max	3 589.9	10 534.0	13 617.9	57 380.1	99 218.9	3 591.06	81 092.1	928.55	292 348	62 477.8
Median	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Source: Authors' own calculation, the balance sheet and the profit and loss statement of companies

Table 12. Number of wineries based on a range of evaluations of times interest earned ratio

Interval	2013	2014	2015	2016	2017	2018	2019	2020	2021	Mean
< 1	81	73	73	68	67	67	62	66	66	69
1–2	5	5	8	6	7	9	13	6	8	7
2–3	3	6	1	4	4	7	1	5	3	4
> 3	18	23	25	29	29	24	31	30	30	27

Source: Authors' own calculation

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each year, and the average maximal value was at the level of 80%.

The desired threshold for loan burden of up to 50% was achieved by the largest number of wineries during the period under review, averaging 103 wineries. On average, four wineries exceeded 50%. The calculation of the indicator shows that wineries used loans for their operations, and their usage was reasonable (Table 14).

Based on the previous calculations, the individual data were coded, and a subsequent reliability analysis was performed. The results in Table 15 show that Cronbach's alpha was 0.623 and McDonald's omega was 0.733, which can be considered sufficient given the structure of the recalculated data.

According to the results shown in Table 16 and Figure 2, the model revealed that 53 % of the variability observed in the target variables was explained by the regression model within the dependent variable 'area of operation of the winery'. Up to 65 % of the variability

observed in the target variables was explained by the regression model within the dependent variable 'size of winery'.

From the collinearity statistics shown in Table 17, the *VIF* value for predictors ranged from 1.14 to 4.35. There were a lot of different cutoffs for *VIF*. Some authors say that *VIF* should be no higher than 3, 4, 5, or even 10. Whichever cutoff is chosen, none of them shows high multicollinearity. The only higher value multicollinearity was identified in the 'total debt' variable, which was because it partly included variables 'long-term debt', 'short-term debt' and 'degree of self-financing'.

Pearson's correlation heatmap in Figure 3 showed a strong positive correlation between the total debt ratio of wineries and the short-term debt ratio at 0.79. This correlation follows from the fact that wineries finance their operations mainly with short-term resources, which are more accessible to them than short-term bank loans and short-term financial assistance.

Table 13. Development of loan burden of wineries in Slovakia in EUR

Indicator	2013	2014	2015	2016	2017	2018	2019	2020	2021	Mean
Average	0.0614	0.0723	0.0733	0.0766	0.0972	0.1036	0.0953	0.0941	0.0936	0.0853
Min	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Max	0.8923	1.0174	0.9773	0.8208	0.7715	0.7381	0.7423	0.5545	0.6854	0.8000
Median	0.0000	0.0000	0.0000	0.0000	0.0000	0.0056	0.0081	0.0001	0.0001	0.0016

Source: Authors' own calculation, the balance sheet of companies

Table 14. Number of wineries based on a range of evaluations of loan burden

Interval	2013	2014	2015	2016	2017	2018	2019	2020	2021	Mean
< 0.5	104	104	105	103	101	101	103	104	103	103
> 0.5	3	3	2	4	6	6	4	3	4	4

Source: Authors' own calculation

Table 15. Scale reliability statistics

Statistical indicator	Mean	SD	Cronbach's α	McDonald's ω
Scale	3.19	0.694	0.623	0.733

Source: Authors' own elaboration

Table 16. Model fit measures; model estimated using sample size of $N = 107$

Model	Area of operation of the winery		Size of the winery	
	R	R^2	R	R^2
1	0.608	0.534	0.707	0.657

Source: Authors' own elaboration

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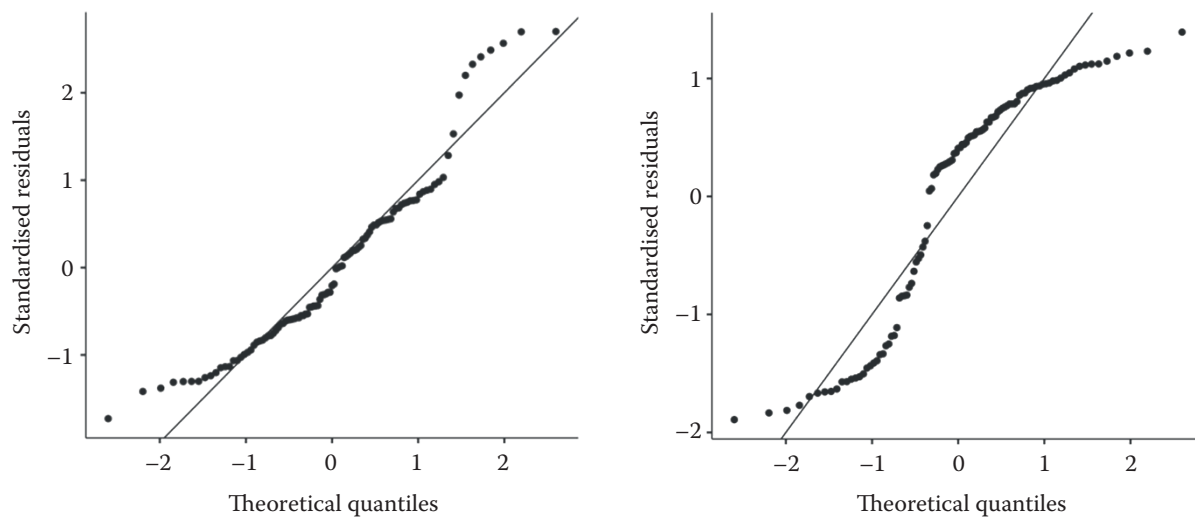


Figure 2. Q-Q plots of residuals (size of the winery on the left; area of operation of the winery on the right)

Source: Authors' own elaboration

There is also a strong negative correlation between short-term debt ratio (-0.71) or total debt ratio (-0.87) and the degree of self-financing, which is obvious since the degree of self-financing decreases in direct proportion to the amount of short-term and total debt ratio.

Based on the results from the Kruskal-Wallis statistics shown in Table 18, it was possible to reject the null hypothesis H_{0A} and accept the alternative hypothesis H_{1A} because the P -value in selected debt indicators was < 0.001 . It was possible to identify that at least one of the sizes of the winery does not have the same average indebtedness according to the debt indicators.

The contingency table (Table 19) shows that micro wineries were willing to risk indebtedness, with 73 wineries showing some level of total debt ratio. All the 39 wineries with more than 75% indebtedness were micro-sized. It is also noticeable that small and medium-sized wineries most often struggled to maintain their total debt ratio at the level of 25% to 50%.

The next contingency table (Table 20) shows that several wineries preferred short-term debt to long-term debt. The contingency table again confirms that the most short-term indebted were the micro wineries, of which there were 73, with the most common level of short-term debt ratio being between 25% and 75%. Again, the fact that medium-sized wineries were not willing to take on even short-term debt was confirmed, as medium-sized wineries, in particular, struggled to maintain less than 25% short-term debt in most cases.

In the contingency Table 21, a total of 26 wineries showed a negative degree of self-financing, of which 25 were micro wineries. The analysis of the debt indicators shows that a negative self-financing rate indicates that micro wineries are in a financially difficult situation and do not have sufficient resources to finance their needs, which increases their dependence on foreign resources and can potentially increase their financial risk. On the contrary, out of a total of 20 wineries,

Table 17. Collinearity statistics

Indicator	VIF	Tolerance
Total debt	5.35	0.136
Long-term debt	2.13	0.470
Short-term debt	3.41	0.185
Degree of self-financing	4.26	0.234
Financial leverage	1.26	0.791
Times interest earned ratio	1.18	0.845
Loan burden	1.14	0.879

Source: Authors' own elaboration

Table 18. Kruskal-Wallis statistics (size of the winery)

Indicator	χ^2	df	P
Total debt	24.25	2	< 0.001
Long-term debt	2.40	2	0.301
Short-term debt	26.26	2	< 0.001
Degree of self-financing	15.62	2	< 0.001
Financial leverage	7.63	2	0.022
Times interest earned ratio	5.62	2	0.060
Loan burden	2.45	2	0.294

Source: Authors' own elaboration

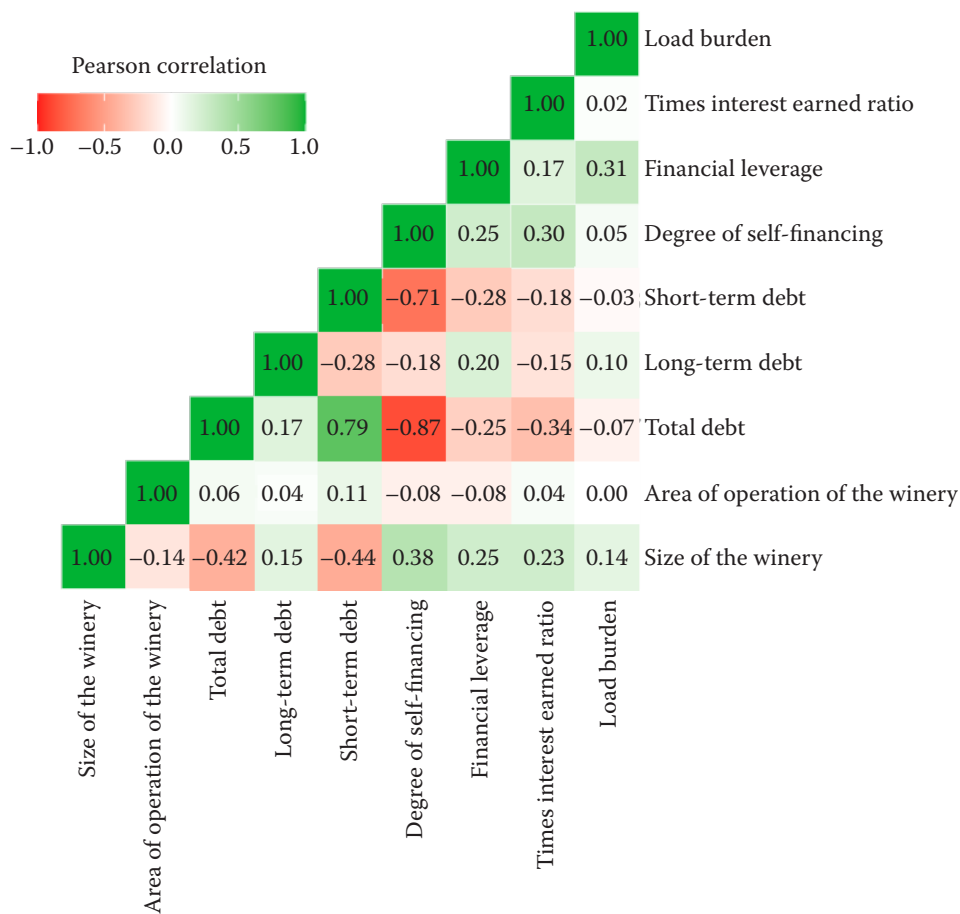


Figure 3. Pearson's correlation heatmap

Source: Authors' own elaboration

more than 50% of the small and medium wineries had the value of self-financing degree as micro wineries.

Based on the results from the Kruskal-Wallis statistics shown in Table 22, it was not possible to reject the null hypothesis H_{0B} because the P -value in selected debt indicators was not < 0.001 . It is possible to declare that the researched wineries had the same average indebtedness according to the debt indicators regardless of the area of operation of the winery.

Growth of indebtedness positively affected the ROE only if the appreciation of the total capital (which included not only equity but also liabilities) was higher than the cost of debt. As can be seen from Table 23, from average indicators (ROE , ROA and cost on debt), ROA was lower than cost on debt each year which means that ROE was decreasing

Financial leverage on average increased the ROE in 38 wineries for the whole period, as shown in Fig-

Table 19. Contingency tables (size – total debt)

Total debt	Calculation method	Size			
		micro wineries	small wineries	medium-sized wineries	total
< 0.25	count	8	6	1	15
0.25–0.50	count	11	12	5	28
0.50–0.75	count	15	8	2	25
0.75–1.00	count	25	0	0	25
1.00–1.50	count	9	0	0	9
> 1.50	count	5	0	0	5
Total	count	73	26	8	107

Source: Authors' own elaboration

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Table 20. Contingency tables (size – short-term debt)

Short-term debt	Calculation method	Size			
		micro wineries	small wineries	medium-sized wineries	total
< 0.25	count	17	18	6	41
0.25–0.50	count	19	6	2	27
0.50–0.75	count	21	2	0	23
0.75–1.00	count	7	0	0	7
> 1.00	count	9	0	0	9
Total	count	73	26	8	107

Source: Authors' own elaboration

Table 21. Contingency tables (size – degree of self-financing)

Degree of self-financing	Calculation method	Size			
		micro wineries	small wineries	medium-sized wineries	total
< –0.10	count	14	1	0	15
–0.1–0	count	11	0	0	11
0–0.25	count	22	9	1	32
0.25–0.50	count	17	9	3	29
> 0.50	count	9	7	4	20
Total	count	73	26	8	107

Source: own elaboration

Table 22. Kruskal-Wallis statistics (area of operation of the winery)

Indicator	χ^2	df	P
Total debt	2.66	5	0.753
Long-term debt	1.21	5	0.944
Short-term debt	3.08	5	0.688
Degree of self-financing	2.20	5	0.821
Financial leverage	9.59	5	0.088
Times interest earned ratio	1.27	5	0.938
Loan burden	2.59	5	0.763

Source: Authors' own elaboration

ure 4. In the Small Carpathian area, there were 13 wineries (the highest number) with a positive impact on *ROA* and the fewest wineries were in three areas: East Slovak area, Central Slovak area and Tokaj (2 wineries on average). These wineries can still get into debt, considering other factors such as liquidity, financial stability etc.

From the point of financial leverage impact on *ROE* in each winery, we can state that there is majority of the wineries in which the financial leverage decreased *ROE* (from 61 to 78 wineries) as shown in Figure 4.

On average, in 68 wineries the financial leverage decreased *ROE* for the entire period. Most of the wineries were in the Small Carpathian area (28) and a few wineries were in the Central Slovak area (3). Further indebtedness of these wineries was not appropriate, and measures should be oriented on increasing the share of equity.

Indifferent (zero) influence of the financial leverage was recorded in 2013 where in 7 wineries the value of *ROE* did not change due to the influence of financial leverage (Figure 4).

Table 23. The influence of financial leverage on ROE development in wineries

Year	ROE	Comparison	ROA	Comparison	Cost of debt
2013	−5.1613	<	−3.2024	<	0.1288
2014	0.9750	>	−0.1081	<	4.9756
2015	0.7871	>	−0.1213	<	0.0465
2016	0.1171	>	−0.3732	<	−0.0637
2017	0.0102	>	−0.0714	<	0.4260
2018	−0.1241	>	−0.1588	<	0.0450
2019	0.0474	>	0.0101	<	0.0726
2020	0.0293	>	−0.0257	<	0.0583
2021	0.5536	>	−0.0213	<	0.0355

ROE – return on equity; ROA – return on assets

Source: Authors' own calculation, balance sheet and profit and loss statement of wineries

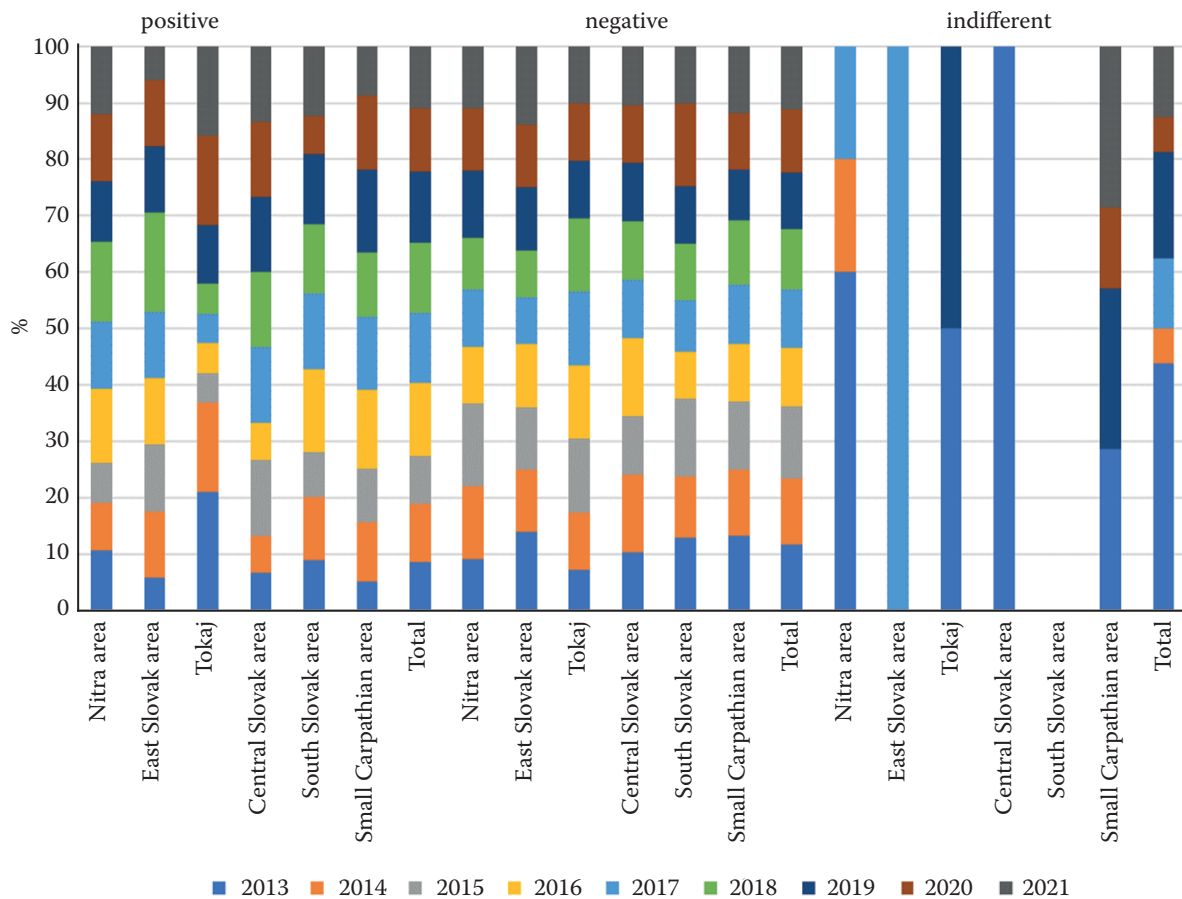


Figure 4. Number of wineries with the positive, negative and indifferent influence of financial leverage on ROE development

ROE – return on equity

Source: Authors' own elaboration

Table 24 shows the influence of factors affecting wineries' ROE. Data were processed as a panel, which was analysed with the application of panel models. Results

estimated in various models were compared and evaluated by the *F*-test for no fixed effects, the Breusch-Pagan test for random effects and the Hausman test to se-

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Table 24. Factors affecting return on equity-random effects model

Variable	Coefficient	SE	Z	P-value	95% LL	95% UL
Constant	−0.84***	0.10	−8.25	< 0.0001	−1.04	−0.64
l_EBIT / S	0.87***	0.02	37.69	< 0.0001	0.83	0.91
$l_EBT / EBIT$	1.28***	0.06	19.80	< 0.0001	1.16	1.40
l_EAT / EBT	1.04***	0.05	21.20	< 0.0001	0.94	1.14
l_A / E	0.75***	0.04	18.91	< 0.0001	0.67	0.83

*, **, *** - significant at $\alpha = 0.1$, $\alpha = 0.05$ and $\alpha = 0.01$, respectively; LL – lower limit; UL – upper limit; *EBIT* – earnings before interest and taxes; *S* – sales; *EBT* – earnings before taxes; *EAT* – earnings after taxes; *A* – assets; *E* – equity
Source: own calculation

lect the most appropriate method. A low *P*-value of the *F*-test and Breusch-Pagan test showed the significance of individual cross-sectional effects. The result of the Hausmant test with a *P*-value of 0.16 suggests that both fixed effects and random effects models were consistent, but estimates obtained with the random effects model were more efficient. The estimated random effects model explained a significant proportion of ROE variability.

Variables were used in the form of natural logarithms, estimated coefficients can be therefore interpreted as elasticities and the influence of different factors can be directly compared based on their coefficient value. All explanatory factors significantly influenced ROE, as all their *P*-values were less than 0.0001. Elasticities can be interpreted as a percentual change in ROE caused by a 1% change in independent variable *ceteris paribus*. Based on model results it seems, that the most important factor is *EBT / EBIT*, with a coefficient of 1.28. It means that its 1% change caused a 1.28% change in ROE. The second most influencing factor was *EAT / EBT* followed by *EBIT / S*. The least important, but still significant factor was *A / E*. Its 1% change causes a 0.75% change in ROE.

DISCUSSION

Wine-growing has a long tradition in Slovakia. Many wineries, mainly small family wineries, fought for survival during the pandemic years. From year to year, the area of fruiting vineyards decreases and the aid from the state is inadequate. Based on the statement of Mács (2021) from the Guild of Winegrowers and Winemakers of Slovakia, state support for this segment should be more intensive. Only EUR 3.7 million of the EUR 20 million aid has been repaid. This aid has been repeated 2–3 times in other countries since the first wave of the COVID-19 pandemic. Currently, in the year

2024, growers can only receive subsidies for terraced vineyards, of which there are very few in Slovakia. Financial support plays an important role in agriculture and could help winegrowers to overcome the adversity of climate conditions, and rising wine prices. The EU's Common Agricultural Policy plays a significant role in providing funding and support for these initiatives, helping to enhance the competitiveness and sustainability of the Slovak viticulture sector. From this point of view, the wine sector in Slovakia is the least supported compared to neighbouring countries. The National Support Programmes for the common organised wine market in the years from 2009 to 2023 allocated EUR 17 billion to support viticulture in the EU. 87.6% of the total financial resources were received by 5 countries: Spain, France, Italy, Portugal and Romania. Slovakia only received 0.38 % support from this program. Inconsistent distribution of funds leads to systematic underfinancing of the wine sector in Slovakia (Pospíšilová 2024).

One of the critical aspects of a business operation is having sufficient capital. Wineries use to finance their needs from their equity as well as from debts which are cheaper than equity. The same opinion is shared by Cerkovskis et al. (2022) and Kontuš et al. (2022). The representation of equity in the selected sample of wineries was low, and financing by debt prevailed. In terms of debt, wineries mainly used short-term debt to finance their activities, and in particular short-term liabilities had the highest representation among short-term debt. Wineries also relied on bank loans, both short-term and long-term, but even in terms of the quantification of the loan burden indicator, their drawdown was below 50 %. Leveraging financial resources allows wineries to invest in vineyard expansion, equipment upgrades, marketing efforts, and overall business growth (Surroca et al. 2009). The degree of self-financing showed low values in the analysed set; the value of equity was most sig-

nificantly influenced by the reported results of the past years or the accounting period.

Analysing the relationship between debt and profitability has its place in corporate financial management. As stated by Horváthová et al. (2022), it is a prerequisite for competitiveness, value creation and performance of the enterprise. From the point of view of the relationship between indebtedness and profitability, the number of wineries where financial leverage reduced ROE prevails. Financial leverage as a tool to evaluate the financial health and performance of wineries was used by Grinko et al. (2022) in their research. Understanding the factors affecting capital structure is important for wineries to make decisions regarding their financial structure and leverage ratios (Viviani 2008).

Based on the statistical evaluation of the individual variables, we rejected H_{0A} and accepted the alternative hypothesis H_{1A} . It is possible to identify that at least one of the sizes of the winery does not have the same average indebtedness according to the debt indicators. It was found that the 39 micro wineries maintained an overall total debt ratio of more than 75% compared to small and medium wineries. In terms of short-term indebtedness, micro wineries were the most frequent drawers of this type of resource, with 73 wineries having short-term indebtedness levels of between 25 and 75%. Of the analysed set of wineries, a total of 26 wineries showed a negative level of self-financing, of which 25 were micro wineries. The negative equity was mainly due to the economic result of previous years.

Based on the results from the Kruskal-Wallis statistics it was not possible to reject the null hypothesis H_{0B} because the P -value in selected debt indicators was not < 0.001 . Most of the wineries operated in Nitra area, Small Carpathian area, and South Slovak area due to suitable favourable climate and soil conditions for grape growing and wine production.

CONCLUSION

Based on the results of the quantified indicators, the analysed wineries collection in Slovakia showed higher indebtedness and low value of self-financing level. Wineries should prioritize optimizing their indebtedness, meaning that short-term sources, which increase liquidity risk, should primarily be used to finance the company's needs. Long-term loans are more accessible for agricultural companies, as they have lower level of risk and are repaid across a longer period which means lower monthly instalments, they may help improve long-term financial strategy, the company may

better plan expenses if the long-term liabilities are set in advance. Wineries could negotiate better conditions for loans, e.g. lower interest rates or extended payment period. From the point of view of lower level of self-financing they may focus on the increase of equity value, e.g. apply for grants or sources from the EU aimed at support of small and medium sized companies in agriculture. Thanks to these forms of help the wineries can invest into modernisation and the production process can become more effective. Wineries should appeal for state support in form of grants, subsidies or tax reductions. They should focus on improving cash flow by quicker debit of receivables and decrease the need of short-term financing. To bridge the unfavourable situations or in periods of sale decrease, create a reserve. They should also emphasise reinvestment of reached profit into equity which could decrease dependence on external forms of financing. Wineries could prepare real financial plans for better management of indebtedness and sustainable operation. From point of view of marketing, investing into marketing campaigns, attending exhibitions, workshops, organising wine tasting and wine tours in order to attract the customers could increase the income of wineries.

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