Theses for a doctoral dissertation (PhD)

METHODOLOGICAL OPTIONS FOR CONTROLLING IN THE CASE OF ENTERPRISES ENGAGED IN MIXED FOOD RETAIL TRADE FOOD RETAIL SALES IN THE NORTH GREAT PLAIN

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1. BACKGROUND, OBJECTIVES AND HYPOTHESES OF THE RESEARCH

1.1. Background to the research

The role of SMEs (small and medium-sized enterprises) in Hungary is of particular importance, as a significant part of the gross value added and turnover generated is linked to these enterprises. SMEs also employ a significant proportion of the workforce and have a high share of the competitive sector. SMEs employ around two thirds of the workforce. The development of SMEs is the subject of ongoing national and international economic analyses.

Today, it is unthinkable to run a multinational or divisional organisation without controlling activities. In my opinion, micro, small and medium enterprises cannot be competitive without the use of controlling tools/methods and cannot stay in the market in the medium and long term.

The reason for my choice of topic is that the largest share of the domestic retail turnover is represented by food retail stores. Within the Institute of Accounting and Finance at the University of Debrecen, research on food retailing has a long history. My interest in controlling, financial analysis/modelling and food retailing dates back to September 2014. In line with these topics, I have authored and co-authored several publications in the disciplines of controlling, financial analysis/modelling and food retailing. I have presented research results at more than twenty conferences. In the Controlling section of the 2017 OTDK, my paper on bankruptcy prediction in food retailing companies was awarded 1st place and in the same year the research was recognized by the OTDT with the Pro Scientia Gold Medal.

1.2. Objectives of secondary research

C1: Explore the relationship between management, information provision, decision support, corporate performance measurement, financial analysis/modelling and controlling, using national and international literature.

C2: Based on data from accounting reports and macroeconomic indicators, development of a performance measurement model for "Mixed food retail" businesses in

the North Great Plain region of Hungary, using indicators (explanatory variables) that enable managers to measure and improve financial performance.

C3: Development of a financial indicator system as a controlling/analysis tool.

1.3. Aims of my primary research

C4: To assess, through a questionnaire filled in by the managers/owners of the food retail companies in Hungary, the current perception of the company management in relation to the controlling and financial analysis methodology, using quantitative data.

C5: Explore the management's viewpoint in relation to: controlling/financial analysis activity/function, controlling/financial analysis methods, analysis tools used, financial situation, ability of the business to generate income, use of after-tax profit, resources for operations, liquidity reserves, performance, efficiency.

C6: Use the primary research to support the objective of the secondary research, which is to develop a performance evaluation model.

1.4. Hypotheses

The objectives and the methods used to test the related hypotheses are presented in Figure 1:

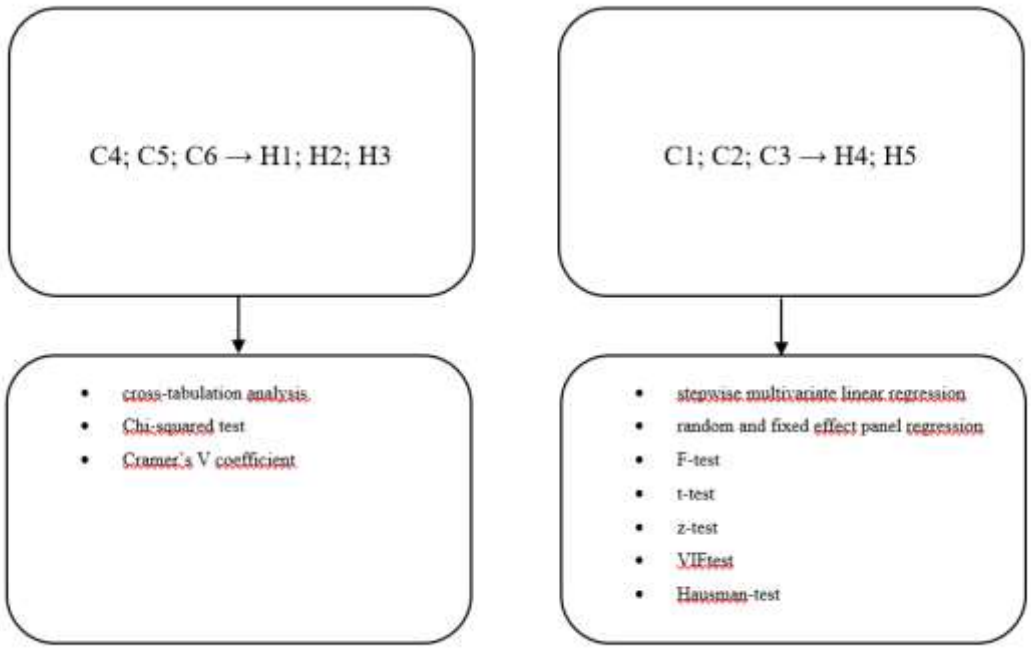

Figure 1: Objectives and methods

Source: own editing

Targets C4; C5; C6 are related to hypotheses H1; H2; H3, and I used cross-tabulation analysis, Chi-squared test and Cramer's V association coefficient as methods for generating results and hypothesis testing.

Targets C1; C2; C3 are related to hypotheses H4; H5, and I used stepwise multivariate linear regression, random and fixed effect panel regression, F test, t test, z test, VIF test and Hausman test to generate results and test hypotheses.

According to BÖCSKEI (2021), the information content of reports has become more valuable due to the digitalisation process, and the expectations of reporting will increase. ZÉMAN (2019) points out that time-driven and dynamic analysis of the increased amount of data related to accounting activities can contribute to increased efficiency. Related to the above, KOLEVA - TRAJOVSZKA (2016) argues that financial statements and information derived from financial statements can provide a realistic picture for market participants and owners. The main focus in the development of the hypotheses was on corporate efficiency and financial performance measurement, with particular attention to the data/information content derived from financial statements.

Primary research hypotheses

Hypotheses related to the questionnaire survey

Block 1 Global hypothesis

H1: There is a significant correlation between the business profit generated by the enterprise, the provision of sufficient resources for the operation of the enterprise, investments, developments, dividend payments and the performance of accounting tasks, controlling activities/functions, and the existence of a suitable tool/method for measuring financial performance among the food retail enterprises surveyed in Hungary.

Block 2 Global hypothesis

H2: The availability of liquidity reserves in the event of a turnover shortfall in the sector is influenced by the business performance and the use of external sources of finance among the food retailers surveyed in Hungary.

Block 3 hypothesis

H3: The need for external resources for the operation of the enterprise (external resources are short-term liabilities that are not immediately due, such as supplier credit) is explained by the fact that the operating profit generated by the enterprise does not provide sufficient resources for the operation of the enterprise, investments, improvements, dividend payments among the food retail enterprises surveyed in Hungary.

Secondary research hypotheses

Cross-sectional modelling hypothesis

H4: Based on cross-sectional data for the time interval 2015-2019, a multivariate linear regression function can be derived using financial ratios calculated from the reports of the food retail businesses under study as independent variables for the given year, which can be used to estimate the result of the business activity of the analysed enterprises as a dependent variable with high accuracy and significance among food retail businesses in the North Great Plain.

Panel modelling hypothesis

H5: Based on panel data for the period 2015-2019, a multivariate linear regression function can be defined using financial ratios and macroeconomic indicators as independent variables, calculated on the basis of the reports of the food retailing enterprises under study, which can be used to estimate and predict the results of the business operations of the analysed enterprises as a dependent variable with high accuracy and significance. The random-effects regression model is capable of predicting with high accuracy and significance the business performance of food retail companies in the North Great Plain, instead of using a fixed-effects regression model for food retail businesses in the North Great Plain.

2. DATABASE AND DESCRIPTION OF THE METHODS USED

2.1. Tools used for data analysis

The five main tools used for analysis and data management are IBM SPSS Statistics version 26 and Stata version 13, MS Excel spreadsheet software and Google's cloud-based Sheets and Spreadsheets service.

2.2. Data used in the research

Primary research

In the scope of primary research, data was collected through a questionnaire survey. After the questionnaire had been compiled, a pilot test was carried out with the controlling and company managers of food retail businesses in the Northern Great Plain region. Following the testing, the questionnaire was finalised after incorporating comments from company and controlling managers.

The questionnaire contained the following question blocks:

- General questions concerning the enterprise,
- General questions related to controlling,
- Questions related to financial controlling, efficiency and performance measurement,
- Questions related to the Covid-19 pandemic

The questionnaire used both open and closed questions (23 questions in total) and a Likert scale. As background variables I used the county where the enterprise is located, the net turnover of sales and the average statistical number of employees.

The questionnaire was sent out to food retail businesses in Hungary with TEÁOR 4711 (Hungarian NACE). The questionnaire was sent out by the DE Informatics Service Centre on three occasions between January and March 2021. The spectrum of the primary survey is national. The questionnaire was completed by 247 enterprises, with responses from all counties of the country, the vast majority of enterprises being SMEs (96%), with large enterprises accounting for only 4% of the sample. The set of respondents does not reflect

the statistical characteristics of the population, and therefore the sample cannot be considered representative.

Secondary research

The database for the secondary research was purchased from Opten Informatikai Ltd. It contains balance sheet and profit and loss account data of food retailing enterprises classified as TEÁOR 4711, which are located in the North Great Plain region, were established before 1st January 2015 and had a closed financial year with at least one year of accounts in the period 2015-2019. A total of 972 accounts were included in the survey over the indicated time period (2015 - 165, 2016 - 175, 2017 - 194, 2018 - 243, 2019 - 195).

During the preparation and verification of the database and the calculation of the financial indicators, I encountered several problems:

- every year, there have been businesses that ended the current financial year without any revenue,
- balance sheet and profit and loss account figures were not consistent,
- businesses prepared a cost of sales type of statement one year and a total cost type statement the next (overwhelmingly total cost type of profit and loss accounts),
- result of the calculation of financial ratios with "#ZÉRÓOSZTÓ!" (incomplete or "0" value in the numerator, e.g. when calculating the turnover rate indicators on the balance sheet lines Inventory, Receivables, Current liabilities),
- "outlier" data.

The solution to the above problems, and thus the creation of a set of enterprises that can be included in the modelling, was achieved in the following way:

The date of enterprises

- not realising any revenue in the current financial year-,
- -with inconsistent data-,
- -cost of sales type profit and loss account,

- with a result "#ZÉRÓOSZTÓ!" for the calculation of financial indicators,

have been deleted.

- -outliers and extreme outliers are filtered and deleted based on a "boxplot" diagram (minimum, maximum, median values of each set of variables are defined, based on the definition of lower, upper and interquartile ranges)

For the modelling, the following macroeconomic indicators affecting the performance of the sector were selected:

- EUR/USD MNB annual average exchange rate in HUF (HUF),
- 5 year average BIRS (average over the year) (coefficient),
- Annual net household income per capita (in thousands of HUF),
- Employment rate (reference year) (coefficient).

In order to meet the requirements of each statistical method, cross-sectional and panel databases were created in the secondary research when generating the input data.

2.3. Methods used in the secondary research

Scientific literature processing methods

In the scope of the literature review, both domestic and international books and journals related to the field of controlling and financial analysis were reviewed in parallel with an independent review of the literature.

The first step of the literature search was a preliminary orientation. In this phase, a comprehensive body of knowledge related to the discipline of controlling was acquired in relation to the emergence, history of development and basic philosophy of controlling.

The second phase of the literature search was a targeted orientation, in which I examined the relationship between controlling and management, decision-making and information provision, and reviewed the literature on corporate performance measurement, financial performance measurement and financial modelling.

In the third phase of the literature review, a sector-specific literature review was carried out on SMEs and food retailing.

Multivariate stepwise linear regression

Regression is a common tool for analysing the correlation between variables. It basically examines how a particular variable, called the outcome variable (dependent variable), depends on one or more so-called explanatory (independent) variables (HUNYADI - VITA, 2008a).

In the literature, several types of regression methods are identified as methods related to the disciplines using quantitative studies: linear, non-linear, logistic, panel, stepwise, univariate, multivariate regression, etc. The form of the correlation between the variables (e.g. linear, non-linear, logistic) and the number of explanatory variables in the relationship should be a key consideration when choosing the appropriate method.

I used stepwise multivariate linear regression in the modelling because I assumed a linear relationship between the dependent and independent variables, and the reduction of the set of independent variables was necessary because of multicollinearity between the variables and the need to eliminate variables that were not explanatory for the modelling. The objective is to create a linear function that can be used to predict the value of the dependent variable (Y) by knowing the value of the independent variables (X_n). In stepwise regression, the location of the variables in the model is uncertain, if the inclusion of a new variable in the model significantly reduces the variance of the existing variable, the variable previously included in the model is excluded.

Multivariate regression can be written in the following form:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 \ldots \beta_n X_n + \varepsilon$$

where

-y is the dependent or outcome variable,

-β_0 is a regression constant, at this point the regression line intersects the y-axis, the regression is the result if the variables X_1 ...X_n are "0",

-X_1 ...X_n independent or explanatory variables,

-β_1 ...β_n are constants of the independent or explanatory variables, and give the slope of the regression line, and hence the effect of a unit change in the dependent variable on the model,

-ε is the error factor

The parameter estimation is aided by the method of least squares, which determines the parameters such that the squared difference between the actual and the estimated parameter-fitted models, i.e. the sum of squares of the differences, is minimised. This procedure does not require the variable "Y" to be normally distributed. The strength of the relationship between the dependent and independent variables is characterised by the coefficient of determination (R^2), which can vary between 0 and 1. The total sum of squared deviations of "Y" is the ratio explained by "X_n ". If the linear regression parameter "β_n " is equal to zero, then the coefficient R^2 is also zero, i.e. there is no correlation between the variables. The significance level of R^2 is tested using the F test. The accuracy of the prediction is determined after calculating the standard error of the estimate based on the squared standard deviation of the true "Y" values and the squared standard deviation of the estimated "$\tilde{Y}$" values (SAJTOS – MITEV, 2007).

There are three main types of stepwise regression techniques:

- "forward selection",
- "backward elimination",
- "stepwise regression".

The idea behind each of the methods is to look at the possible variables one by one and decide one by one whether the variable is needed in the model being built. In order to decide whether the inclusion of a variable in the model leads to a significant improvement compared to the one before, an F-test is required (PÖDÖR, 2016).

The value of the regression function "$\tilde{Y}$" is referred to as the regression. Given the value of the regression, the deviation from the value "Y" for a given condition "X" is ε (error) = Y - $\tilde{Y}$ (HAJDÚ, 2001).

A basic requirement of a standard linear regression model is that the explanatory variables are linearly independent of each other. Therefore, in some sources,

multicollinearity is understood as the absence of linear independence of the factor variables. In practice, this means that a factor variable can be expressed as a non-trivial linear combination of other (independent) factor variables. Multicollinearity could also be understood as a much more general phenomenon, namely the co-movement of factor variables. In empirical studies, it is often a major problem to identify multicollinearity and to find the cause of multicollinearity, since, on the one hand, the negative consequences of multicollinearity do not always occur and, on the other hand, multicollinearity can be caused by a group of variables rather than by a single variable (KOVÁCS, 2008).

The method for detecting multicollinearity is the Variance Inflation Factor (VIF), which is included in SPSS V26 and can be selected separately when performing regression analysis.

According to OYENIYI - ABIODUN (2009) and PANEKENAN - ALFA - RUMOKOY (2019), multicollinearity is accepted for multivariate linear regression models within the following limits:

$$1 < VIF < 10$$

If the VIF test result for each independent variable in the multivariate regression model is within the above relation, there is no multicollinearity present to the extent that would require the omission of additional independent variables and further iteration, although multicollinearity may be present to varying degrees in the model. In my view, within the acceptance interval for the VIF test, it is important to define categories to scale the co-movement of explanatory variables and the redundancy that M. A. GHANI - S. R. NORJAYA - M. YASIN - F. M. ALNASER (2017) summarized as follows based on the research of DIAMANTOPOULOS A. - J.A. SIGUAW (2006) AND HAIR JR. F.J. - M. SARSTEDT - L. HOPKINS - G.V. KUPPELWIESER (2014):

-1 < VIF < 3.3 - weak, negligible multicollinearity,

-3.3 < VIF < 5 - medium multicollinearity,

-5 < VIF < 10 - strong multicollinearity,

-10 < VIF - disturbing, extra strong multicollinearity.

Examining the normality of residuals is the final step in multivariate regression model building. According to the literature, a normal distribution of the estimation error is a prerequisite for multivariate regression. In addition to the independent variables included in the model, the value of the dependent variable may depend on several other factors. The residual error of the regression model is the difference between the model-estimated value of the dependent variable and the value of the actual observations.

$$\varepsilon \text{ (error)} = Y - \tilde{Y} \text{ (HAJDÚ, 2001).}$$

The difference between the actual measured and estimated coefficients of the dependent variable follows a normal distribution around the prediction, which is called homoscedasticity. Heteroscedasticity refers to the difference in the variances, in the case of linear regression, the difference in the variances of the error terms.

According to HUNYADI (2006), they assume the equality of variances of the multitudes behind different groups, categories, and variable values. This is seldom true, but it is a convenient assumption that usually simplifies the structure of the model and thus its estimation and testing. The assumption of equal variances, i.e. homoscedasticity, is not a natural assumption, but an artificial simplification. Heteroscedasticity is therefore not a mistake (as many books discuss), but an opening to reality. It can only be considered an error in the context in which, primarily for didactic reasons, the simplest possible homoscedastic model is taken as a basis.

Due to random sampling, there will be some elements under investigation with higher error rates.

One of the most common methods of testing normality and homoscedasticity is graphical representation, whereby the residue is transformed (standardized) to form Q-Q ("quantile-quantile") or P-P ("probability-probability").

The scale of the P-P method is a line corresponding to a perfect normal distribution, and the transformed residuals are scattered around it. If the point cloud roughly corresponds to the theoretical line, then the normality of the error terms is acceptable. The P-P and Q-Q methods can be used to check the existence of homoscedasticity, which requires that the variance of the residual variable be constant, i.e. independent of the values of the variables

X and Xi, respectively. If this assumption is satisfied, we can say that the model is homoscedastic. (HUNYADI - VITA, 2008b).

Multivariate linear panel regression

In a general sense, any database is a panel database in which observations can be arranged into a multidimensional structure. In the panel database, traditionally most commonly analysed, a set of individuals is observed at fixed times over a given period of time. Our observations thus consist of some properties of a given individual, changes in these properties and the time effect (BALÁZSI et. al., 2014).

In recent decades, panel econometrics has made steady progress, as has the analysis of panel data. Cross-sectional studies are usually carried out by analysing the data of the group(s) under study at a given point in time and looking for answers to the questions that arise at that point in time. According to TARNÓCZI et al. (2015), when analysing cross-sectional data over a longer period of time, it is difficult to detect individual and time effects, and therefore panel analysis, which is a cross-sectional time series analysis, is a useful approach to address this problem.

Depending on whether the elements of each group are the same or different at the time points under consideration, a distinction is made between balanced and unbalanced data panels. The panel database allows the separate analysis of the time effect and the effects of each data group.

The analysis of panel data can also be understood as collecting several observations of cross-sectional data, which belong to different points in time. Panel regression is essentially "cross-sectional time series analysis". Panel regression is not about increasing the size of the database to be analysed in order to obtain better statistical test results due to a higher degree of freedom. Panel data analysis allows the examination of economic questions that cannot be asked in cross-sectional or time-series analyses. Panel regression can also be conceived as a multilevel model. Another advantage of panel data analysis is that models with more complex behaviour can be created and tested (TARNÓCZI - FENYVES, 2017).

The panel regression analysis method allows the examination of the regressive relationship between the data (panel matrix) of n variables with a time series of T periods. The basic equation of the model:

$$Y_{it} = a + X_{it}\,\beta + V_i + \varepsilon_{it}\ ,\ i=1, ..., n \text{ and } t = 1, ..., T$$

where

"a" stands for the constant tag,

"β" are the coefficients of the model estimated by calculation,

"Vi + εit" represent the residual members (residuals), i.e. "V" are the residuals that are attracted to variables, which differ from unit to unit but are constant as variables (MADARAS, 2009).

Two main types of multivariate panel regression can be distinguished depending on whether the unobserved independent variable "ε" is correlated with the independent variables in the model: fixed effect and random effect models.

For the fixed-effect model, it is necessary to assume that the unobserved variable covering the variance of the error term is correlated with the explanatory variables in the model. For the random effects model, it is assumed that the latent variable is not correlated with any of the independent variables in the model.

To choose between fixed- and random-effect models, a Hausman test is required. The null hypothesis of the Hausman test is that the random-effects model gives a consistent estimate, in which case the random-effects specification should be chosen over the fixed-effects specification, otherwise the fixed-effects model specification applies. The consistency should be assessed by the significance level, "p" value, associated with the Hausman test (ELEKES 2018).

If the Hausman test indicates a $p>0.05$ the random effect panel regression model is used, in case of a $p<0.05$ the fixed effect panel regression model is used.

If the assumption of the random effect estimator is true (i.e. there is no endogeneity in the model), the estimator is both consistent and efficient, i.e. it is more favourable than the fixed effect estimator (which is also consistent but not efficient). However, if the condition is not met, the random-effects estimator is inconsistent (BEREZVAI, 2015).

2.4. Methods used in the primary research

Pearson's Chi-squared test

One of the most common methods used to examine the values (cross-combinations) of nominal or ordinal variables together is the cross-tabulation. It is used to plot the joint distribution of the association relationship between two quantitative or qualitative variables (column and row variables) in the form of a 2x2 matrix.

The contingency matrix is used as the basis for Pearson's Chi-squared test, which, in addition to the correlation between two variables, can be used to explore the causal relationship when each row and column variable is considered as dependent and independent variables. The dependent and independent variables were identified on an expert basis by examining the logical relationships between the variables.

The Chi-squared test as a statistical procedure was created by Karl Pearson (the founder of modern statistics) in 1900. The test was used both as a goodness of fit test of the fit of a statistical model to observed data along one dimension and as a means of categorising data based on contingency tables along two or more dimensions (HOWELL, 2011). In a general application of this method, a random sample of 'n' individuals in a population can be categorised into 'k' unique classes. Since Pearson's Chi-squared test is extremely robust, there are no conditions on the distribution of the data when using hypothesis testing, so the distribution does not affect the reliability of the hypothesis test (COCHRAN, 1952).

The standard Chi-squared test can be written using the following formula:

$$\chi^2 = \sum\sum (O_{ij} - E_{ij})^2 / E_{ij}$$

where

- O_{ij} is the actual frequency of the i-th row and j-th column,
- E_{ij} is the expected frequency of the i-th row and j-th column (Howell, 2011).

In SPSS V26, the independent variable is recorded in the rows and the dependent variable in the columns. The general disciplinary rule of thumb is that the frequency should be at least five in each cell of the cross-tabulation. In some cases, if the above condition is not fulfilled, the expected frequency for all cells in the cross-tabulation may be less than five, with a maximum of 20%.

In hypothesis testing, the Chi-squared test can be used to test hypotheses H0 and H1. The H0 hypothesis states that there is no relationship between the analysed dependent and independent variables, while the H1 hypothesis states that there is a relationship between the dependent variable in the rows of the cross-tabulation and the independent variable in the columns.

When using nominal variables, the Cramer coefficient V is used to measure the closeness of the association. The value of the coefficient can vary between 0 and -1, it takes the value 0 if $\chi^2 = 0$, i.e. there is no association between the two variables, and it takes the value 1 if the association between the independent variables clearly indicates the association between the independent variables (HUNYADI - VITA, 2008A).

To reject or retain the H0 hypothesis and to accept the H1 hypothesis, it is necessary to run Cramer's V test in SPSS V26 in addition to the Chi-squared test. If the significance level associated with the Cramer's V test is $p<0.05$, the H0 hypothesis should be rejected and the result of the test should be used to characterise the population analysed. The significance value is obtained by comparing the theoretical value of the Chi-squared distribution with the Chi-squared value calculated from our data. The Cramer's V test gives the probability of obtaining a Chi-squared distribution value by chance from the sample under analysis. If this probability is less than the expected maximum significance level (0.05), then the test result indicates that the test result is correct.

3. MAIN FINDINGS OF THE THESIS

The main objective of my primary research is to explore the relationship of the management of food retailers in Hungary to controlling and financial analysis using quantitative data.

I used the Chi-squared test to examine the relationship between nominal variables. The test compares the observed number of cases with the expected number of cases. I tested for significant causal association between the selected variables. The test uses the Chi-squared distribution for the analysis. The Chi-squared test requires that the expected frequency in each cell in the cross-tabulation is at least five. This condition was met in the tests. The design of the dependent and independent variables was based on the causality of the questions in the questionnaire, with the independent variables in the rows of the cross-tabulation and the dependent variables in the columns. To assess the relationship between two nominal variables, I used Cramer's V coefficient, which can vary from 0 to 1. If the coefficient is 0, the variables are independent of each other, if the coefficient is 1, there is a deterministic relationship between the variables. When evaluating the relationship between variables, I decided on the basis of the significance levels. For $p < 0.05$ I decided on the existence of a causal relationship, for $p > 0.05$ I decided on the independence of the variables.

Based on the primary research, it can be concluded that there is a multidimensional system of relationships between the use of controlling and financial analysis methods and the performance of Hungarian food retailers, which will be presented in detail in the chapter on novel findings.

Summarising the results of the primary research, it can be concluded that one of the main problems of the analysed enterprises is the lack of resources. One of the reasons for the lack of resources is the access to external sources of finance and the low level of business profit generation, which is not sufficient to finance continuous and uninterrupted operations. For the majority of the enterprises surveyed (54.3%), the operating result is insufficient to finance operations, investments and developments. 71.7% of the enterprises surveyed have no external sources of finance. 42.5% of the enterprises surveyed have no liquidity reserve,

32.8% have only 3 months' liquidity reserve, 6.9% have 6 months' liquidity reserve and 17.8% have more than 6 months' liquidity reserve.

Furthermore, the analysis of the questionnaire survey shows that there is a need to develop a tool to measure financial performance in the context of food retailing in Hungary, including the North Great Plain region.

The food retailers I studied are predominantly micro, small and medium-sized enterprises, and operational planning and back-testing of the performance of their retail activities would be difficult to standardise.

In my opinion, at the managerial level, the medium and long-term strategic financial directions and existing financial structural problems can be estimated for the analysed enterprises using appropriate methods and tools. The majority (72.5%) of the surveyed companies do not apply financial analysis and/or controlling methods.

The main objective of the secondary research was to develop a performance measurement tool based on quantitative data. A multivariate regression model and a financial indicator framework were developed. Based on the statistical procedures, the practical results of the secondary research can be applied to the entire population of the region under study and are therefore recommended. The final result of the modelling is a random-effects regression model that can predict 81.6% of the business performance of food retailers in the North Great Plain.

"Random effect - RE" panel regression results (STATA)

For both the random effect and fixed effect panel regressions, it is necessary to specify the time variables and the clustering variables, which in this case are the period 2015-2019 and the Opten ID of the firms.

The results of the RE panel regression are presented in Table 1. The Corrected R^2 is 0.8156, which means that the constructed random-effects regression model can predict the operating performance of the North Great Plains firms with 81.6% accuracy.

The STATA procedure uses the Wald Chi-squared test for RE panel regression to determine whether the model applies only to the sample under consideration or to the entire

population. The Wald test result is 4015.06, p=0.00, which leads to the conclusion that the model is applicable to the whole population. All variables in the model are significant.

The random effects model for food retailers in the North Great Plain can be written in the following form:

$$ÜÜTE_{Pred} = 210.5 + (-614.9 \text{x Current Assets Ratio}) + (0.115 \text{x Net Working Capital}) + (-1230.1 \text{x Net Working Capital Ratio}) + (10306.3 \text{x ROA Margin I}) + (0.315 \text{x Annual Net Income per Capita of households})$$

Table 1: RE panel regression model summary

Name of independent variable	**Beta**	**Standard error**	**z test**	**Level of significance**	**Confidence interval (95%)**	
Current assets ratio	-614.9	109.8	-5.60	0.000	-830.2	-399,6
Net working capital	0.115	0. 003	30.90	0.000	0.108	0,122
Net working capital ratio	-1230.1	96.4	-12.7	0.000	-1419.1	-1041,09
ROA margin I.	10306.3	191.1	53.9	0.000	9931.7	10680,9
Annual net income per capita of households (thousand HUF)	0.315	0.118	2.67	0.008	0.084	0,5469
Constant	210.5	168.3	1.25	0.021	-119.3	540,5
Corrected R^2	0.8156	**Wald Chi-squared**	4015.06	**RE model significance level**	0.000	

		test result			

Dependent variable: OCT

Source: own editing

"Fixed effect - FE" panel regression result (STATA)

The results of the FE panel regression are presented in Table 2. The Corrected R^2 is 0.7874, which means that the constructed fixed-effects regression model can predict the operating performance of the North Great Plain enterprises with an accuracy of 78.74%.

The STATA procedure applies an F test to FE panel regression to determine whether the model applies only to the sample under consideration or to the entire population. The result of the F test is 291.62, p=0.00, which suggests that the model could be applied to the entire population. However, it is important to point out that the indicator for the proportion of assets in circulation is not significant in the fixed effect model (p=0.789).

The random effects model for food retailers in the North Great Plain can be written in the following form:

$$ÜÜTE_{Pred} = -427.57 + (-78.4 \text{x Current assets ratio}) + (0.088 \text{xNet working capital}) + (-884.2 \text{xNet working capital ratio}) + (10492.6 \text{x ROA margin I}) + (0.483 \text{x Annual net income per capita of households})$$

Table 2: FE panel regression model summary

Name of independent variable	**Beta**	**Standard error**	**t test**	**Level of significance**	**Confidence interval (95%)**	
Current assets ratio	-78.4	293.02	-0.27	0.789	-654.6	497,8
Net working capital	0.088	0.013	6.62	0.000	0.062	0,114
Net working capital ratio	-884.2	248.13	-3.56	0.000	-1372.2	-396,2
ROA margin I.	10492.6	290.08	36.17	0.000	9922.21	11063,1

Annual net income per capita of households (thousand HUF)	0.483	0.195	2.47	0.014	0.099	0,868
Constant	-427.57	331.54	-1.29	0.198	-1079.5	224,4
Corrected R^2	0.7874	**F test result**	291.62	**FE model significance level**	0.000	

Dependent variable: OCT

Source: own editing

Hausman test results, conclusions

Based on the coefficient of determination (FE (0.7874) <RE (0.8156) and the explanatory power of the independent variables, as well as the level of significance (for the fixed effect model, the indicator for the share of Revolving Assets is not significant at p=0.789), the random effect model clearly performs better.

I used the Hausman test to decide between random effect and fixed effect regression models. The significance level of the test is p=0.352, which makes the random effect model practically applicable. The random effect model is consistent and effective for food retailers in the North Great Plain. The fixed effect model is effective but not consistent.

Based on panel data between 2015 and 2019, using financial ratios of food retailers in the North Great Plain and macroeconomic indicators as independent variables, a multivariate linear regression function can be derived, which allows to estimate and predict the result of the business operation of the enterprises as a dependent variable with high accuracy and significance. The random-effects regression model is capable of predicting with high accuracy and significance the operating/operating results of the enterprises under study; instead, the fixed-effects regression model cannot be used.

Among the financial ratios produced from the reports used in the procedures, I suggest the use of ROA margin I, Net working capital, Net working capital ratio, Current assets ratio as key indicators, and Inventory turnover rate, Total assets turnover rate, Capital strength as key indicators. The indicators form a set of indicators that can contribute to the controlling

and financial analysis, financial planning and decision making of food retailers in the North Great Plain.

Among the macroeconomic indicators, Household Income per Capita and its change can provide planning support as the most important macroeconomic indicator of food retail risk, in my opinion.

Table 3 shows which of the findings led to the acceptance or rejection of each objective and hypothesis, and which of the new and novel findings were derived from which research findings. The table gives the sequence numbers of the objectives, hypotheses and theses, and the chapter numbers of the relevant results.

Table 3: Relationship between objectives and hypotheses, results, new and novel findings (theses)

Goal → Hypothesis	Result	New, novel findings (Thesis)
C4; C5; C6 → H1; H2; H3	4.1	1; 2; 3;
C1; C2; C3 → H4; H5	4.2; 4.3;	4; 5; 6; 7;

Source: own editing

I have achieved the objectives of the primary and secondary research, and the hypotheses have been proven by the findings.

4. NEW OR NOVEL RESULTS OF THE THESIS

1. Based on my findings, I conclude that there is a functional relationship between the performance of accounting tasks - depending on whether the activity is performed by internal or external accounting - and the sufficiency of the business result for operations, investments, improvements, dividend payments. Internal accounting can facilitate the production of operating profit to a greater extent in the case of the food retail businesses studied. There is a conditional relationship between the existence of a controlling activity/function and the use of a financial performance measurement tool/method and the sufficiency of the business result for operations, investments, improvements, dividend payments. The controlling activity/function and the financial performance measurement methods facilitate the production of business results in the food retail enterprises under study.

2. Based on my findings, I conclude that there is a functional relationship between the sufficiency of the operating result and the availability of external resources for operations, investments, improvements, dividend payments and the sufficiency of available liquidity reserves in case of a possible shortfall in turnover. Low operating profit generation does not allow for the establishment of liquidity reserves in the majority of the companies surveyed. The majority of the enterprises surveyed do not have external resources to build up liquidity reserves.

3. Based on my findings, I conclude that if the business profit generated by the enterprise provides sufficient resources for the operation of the enterprise, for investments, improvements, dividend payments, the need for external resources for its operation (external resources are short-term liabilities not immediately due, such as supplier credit) is lower in the food retail enterprises under study.

4.Based on my findings, I conclude that, using cross-sectional data for the 2015-2019 time interval, the financial ratios calculated from the reports of the food retailing enterprises under study as independent variables for the given year, a multivariate linear regression function/model can be derived that can estimate the results of the operating and business activities of the enterprises under study as a dependent variable with high accuracy and significance. Based on the cross-sectional modelling, the following financial ratios as independent variables occurred in each model in each year: ROA margin I (Operating profit / Total assets), Net working capital (Current assets - Current liabilities) Net working capital ratio (Net working capital / Total assets). Based on the global interpretation of the t-tests, these three variables have the highest added value and impact in the models in each year, so that the above financial ratios can be defined as key indicators based on the analysis.

5. Based on my findings, I conclude that based on the panel data for the period 2015-2019, a multivariate linear regression function can be derived using financial ratios and macroeconomic indicators as independent variables, which can be used to estimate and predict the results of the business operations of the investigated enterprises as a dependent variable with high accuracy and significance. The main new and novel result of the thesis is that a performance evaluation panel regression model specific to food retail enterprises operating in the North Great Plain region has been developed, which can be used to predict the results of the operating/operating activities of the enterprises under investigation. The modelling confirmed the findings of the primary research, as the financial indicators ROA Margin I, Net Working Capital, Net Working Capital Ratio, Current Assets Ratio were included as independent variables in the models based on the data of the food retail businesses under study, and the macroeconomic indicator Net Annual Income per Capita of households was included as a macroeconomic indicator. Based on the Hausman test, there is no endogeneity in the model and the error terms are uncorrelated, which makes the random effects model practical. The random effects model is consistent and effective for food retailing enterprises in the Northern Great Plain, the fixed effects model is effective but not consistent. The Adjusted R2 of the RE panel regression is 0.8156, which means that the constructed random effect regression model can predict the operating/operating performance of the Northern Plains businesses with 81.6% accuracy. Based on the Wald Chi-squared test, the RE panel regression is applicable to the entire population.

6. Based on my findings, I conclude that the analysis and interpretation of key indicators can help food retailers in the North Great Plain to achieve higher operating revenue. The following financial indicators form the basis of the developed set of indicators, which can contribute to the maximisation of operating/operating profit in the context of financial analysis and controlling activities of food retailers in the Northern Great Plains: Current Asset Ratio, Net Working Capital, Net Working Capital Ratio, ROA Margin I. Based on these key indicators, the efficiency of current asset management can be analysed at a high level of abstraction, which can be used as a basis for determining the appropriate activities in the operational activities to mitigate the given problem. I also find that the cross-sectional stepwise regression procedure has produced a number of indicators, not all of which are directly related to working capital management, but their application can provide additional information for food retailers in the Northern Great Plain. The indicators that could be used were selected despite the fact that, although they were excluded from the panel model, they had explanatory power in the cross-sectional regressions: Inventory Turnover, Total Asset Turnover, Capital Strength. I also find that the variance explained by the dependent variables dropped from the panel model is partially equal to the variance explained by the variables that remain. In practical terms, this means that the two financial ratios provide some or all of the same information. From a professional point of view, the analyst should pay attention to the similarity of the information content when assessing performance.

7. Based on my findings, I conclude that the results can be used by food retailers in the Northern Great Plain in their financial analysis, controlling and performance measurement activities. Businesses have two options, they can either substitute the relevant financial indicators and the current level of the macroeconomic indicator into the final overall model to get a forecast of the operating/operating result or they can make a decision with the support of the developed indicator system. Of course, it is also possible to use both methods in combination, and it is recommended from a professional point of view.

5. PRACTICAL APPLICABILITY OF THE FINDINGS

The key indicators that can contribute to maximise the operating profit based on financial data in the context of the financial analysis and controlling activities of food retailers in the North Great Plain have been identified:

- Current assets ratio
- Net working capital
- Net working capital ratio
- ROA margin I.

Based on the above key performance indicators, the effectiveness of working capital management can be analysed at a high level of abstraction, allowing the operational function to identify the appropriate action to mitigate the problem.

Among the macroeconomic indicators, the variable with the largest impact on the profitability of retail trade is identified, namely the annual net income per capita of households.

It is important to point out that although the independent variables in the panel regression are the financial indicators and the macroeconomic indicator detailed above, the cross-sectional stepwise regression procedure included several indicators, not all of which are related to current asset management, but their use may provide additional information for food retailers in the North Great Plain. The indicators that could be used were selected despite the fact that, although they were excluded from the panel model, they had explanatory power in the cross-sectional regressions. It is possible that the variance explained by the dependent variables dropped from the model is partially equal to the variance explained by the remaining variables. In practical terms, this means that the two financial indicators provide some or all of the same information. From a professional point of view, the analyst should pay attention to the similarity of the information content in the valuation. The financial indicator framework based on the selected financial indicators is presented in Table 4, where the first four indicators are the key indicators.

Table 4: System of indicators

	Name of the indicator
1	**ROA margin I.**
2	**Net working capital**
3	**Net working capital ratio**
4	**Current assets ratio**
5	Turnover rate of inventories
6	Turnover rate of total assets
7	Capital strength

Source: own editing

The results can be used by food retailers in the North Great Plain in their financial analysis, controlling and performance measurement activities. Businesses have two options, either to incorporate the relevant financial indicators and the current level of the macroeconomic indicator into the final overall model to forecast the operating performance or to make a decision with the support of the established indicator framework. Of course, it is also possible to use both methods in combination, and it is recommended from a professional point of view.

6. PUBLICATIONS ON THE SUBJECT OF THE THESIS

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List of publications related to the dissertation

Articles, studies (16)

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