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# Analysis of the Correlation Between Factors Supporting Micro-Entrepreneurship in the Area of the Silesian Voivodeship in Poland

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***Abstract:***

***Purpose:*** *The article aims to identify the factors that enable the survival of micro-enterprises in times of economic instability and to examine the strength of the relationship between selected factors.*
***Design/methodology/approach:*** *In 2021–2024, micro-enterprises registered in the Silesian Voivodeship in Poland were surveyed. A research sample of 271 micro-enterprises was selected. Research methods such as interviews and surveys were used. A questionnaire was used as the tool.*
***Findings:*** *Entrepreneurs respond in different ways to the difficult situation their micro-enterprises faced after the pandemic and during the war in Ukraine. This depends on a number of factors, such as a number of years the company has been on the market, the degree of specialization in the domain handled, flexibility in re-branding, ability to obtain external financial and non-financial support, etc. These factors mean that the condition of the micro-enterprises studied is not homogeneous. Data analysis resulted in determining the strength of links between selected factors that could have had an impact on the viability of a micro-enterprise in a dynamically changing environment.*
***Practical implications:*** *Due to the small research sample, the study results cannot be generalized and treated as a picture of the condition of all companies in the Silesian Voivodeship in Poland. Further studies, based on a larger research sample, would provide a more comprehensive picture.*
***Originality/value:*** *The negative impact of the 2019 global pandemic has greatly affected micro-enterprises. The military conflict in Ukraine in early 2022 has destabilized global markets. Rising inflation in Poland became even more pronounced after the outbreak of war. Many micro-enterprises faced a difficult situation. Gaining knowledge about the impact of constraints related to the economic situation on the operation of micro-enterprises has become essential in order to develop mechanisms to mitigate negative effects on entrepreneurship based on micro-enterprises.*

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***JEL codes:*** *C1, F5.*

***Paper type:*** *Research article.*

## 1. Introduction

In 2021-2024, 271 micro-enterprises registered in the Silesian Voivodeship were surveyed. The surveys have been carried out as regards the impact of external factors of the pandemic period on the functioning of those entities in the market (Michalski, 2022) and then the impact of the next two years on destabilized global markets caused by the war in Ukraine (Michalski, 2023).

Further surveys carried out among micro-entrepreneurs allowed to collect further data. The surveys also took into account the internal aspects of micro-enterprises, such as experience, experience in the market, methods of financing activity, ability to use aid funds, and individual feelings related to difficulties resulting from the situation in the markets.

Data analysis resulted in determining the strength of links between selected factors that could have had an impact on the viability of a micro-enterprise in a dynamically changing environment.

## 2. Literature Review

### 2.1 Micro-Enterprises in an Unstable Market Situation in Europe

The war in Ukraine has become one of the most important geopolitical events in recent years. Its effects are experienced by micro-entrepreneurs in European countries, including those that are geographically distant from Ukraine. Although the war often creates new opportunities for economies, the dominant impact of the conflict on the functioning of micro-enterprises is highly adverse.

The identification and analysis of the most dominant external and internal conditions was made by micro-entrepreneurs, mainly at the time of deciding to set up a company (Alvear Montoya, Hernández Fernández, and Portillo Medina, 2022).

After the emergence of completely different circumstances, entrepreneurs had to carry out such an analysis once again. Micro-enterprises had to adapt their functioning to the new conditions, and those were related mainly to a significant rise in the prices of energy and raw materials (Mc Kinsey & Company, 2022).

As a result of the sanctions imposed on Russia and their consequences, the supply of gas by that country to European countries has been significantly reduced. As a consequence, the prices of energy reached such high levels that for many small companies, there was a drastic rise in operating costs (European Commission, 2023).

The predominant number of micro-enterprises has lower financial resources and a weaker negotiating position than large corporations, as a result of which they were unable to protect themselves against those rises, which often led to a decrease in profitability and, in extreme cases, to the cessation of activity.

Micro-enterprises from European countries often rely on local and regional suppliers, but many of them also use raw materials or components imported from Ukraine, Russia or Belarus. The war has led to the disruption or slowdown of many supply chains, which made it difficult to carry out ongoing activity, particularly where alternative sources are more expensive or difficult to obtain (OECD, 2023).

Many entrepreneurs faced the need to search for new suppliers. This process was expensive and time-consuming, and for many companies it resulted in delays in production, a rise in the costs of transport, or ultimately, the complete cessation of activity. The crisis highlighted globalization of the modern economy and the level of dependency of small companies on geopolitical stability (OECD, 2023).

Inflation, driven by the rise in the costs of energy and food, reduced consumer purchasing power in European countries. As a result, the demand for goods and services not considered essential has decreased, which has directly affected the micro-enterprises sector. Many small companies recorded a significant decline in revenue and had to reduce or suspend activity (IMF, 2023; Eurostat, 2023).

An additional factor weakening the micro-enterprises sector is the uncertainty related to the region's economic future. Concerns linked to the further escalation of the conflict and the prolonged energy crisis make entrepreneurs reduce investments and give up development.

The conflict also had an impact on the labor market. Some workers from Ukraine returned to their homeland, which intensified staff shortages in certain sectors, such as construction, agriculture and services (Bank Gospodarstwa Krajowego, 2023). On the other hand, the influx of war refugees created a potential source of labor force, although their integration required linguistic, training, and organizational support, which could be challenging for small companies (Polish Economic Institute, 2023).

Despite the difficulties, the crisis caused by the war also created some opportunities. Micro-enterprises that were able to quickly adapt to the new reality – e.g., by digitizing services, diversifying supply sources or developing the e-commerce offer – had a chance to survive and even increase their competitiveness. Also, micro-

enterprises from the IT or logistics sector noticed an increase in demand for their products and services (Business Europe, 2023).

On the other hand, micro-enterprises that operate peripherally or in small markets can try to improve logistics operations, facilitating the cooperation of partners in supply chains by implementing various types of information technologies (Dyczkowska, Olkiewicz, Chamier-Gliszczyński, and Królikowski, 2023).

Many EU Member States and European institutions implemented financial support programs for companies most affected by the consequences of the war (EY Europe, 2023), including subsidies for energy bills, state-guaranteed loans, and funds for digitization and green transition (European Commission, 2023).

Currently, micro-enterprises in Europe are facing an extremely difficult period. The war in Ukraine highlighted their vulnerability to external shocks and the dependence of even local businesses on global processes. Therefore, it is necessary to build more resilient business models.

Further support from the home countries and the European Union will be essential for the survival of the micro-enterprises sector and its future development. In the long term, the reconstruction of Ukraine may also provide a boost for companies offering construction, consulting, and technology services (World Bank, 2023).

### 2.2 Micro-Enterprises in an Unstable Market Situation in Poland

Micro-enterprises, as entities pursuing business activity, employ several (up to nine) people during the year and their annual revenue do not exceed EUR 2 million during the fiscal year. The value of EUR in relation to PLN is determined according to the exchange rates of the National Bank of Poland. Micro-enterprises also include sole proprietorships. For them, the annual revenue threshold is set at EUR 1.2 million (Nawrocki, 2023).

Where micro-enterprises employ family members, there may be cases of links between micro-enterprises and the household of the family involved in the business. This implies a number of correlations, such as capital opportunities determined by the family's wealth, etc., (Lahiri and Daramola, 2023). Micro-enterprises often base their existence on cooperation with larger entities.

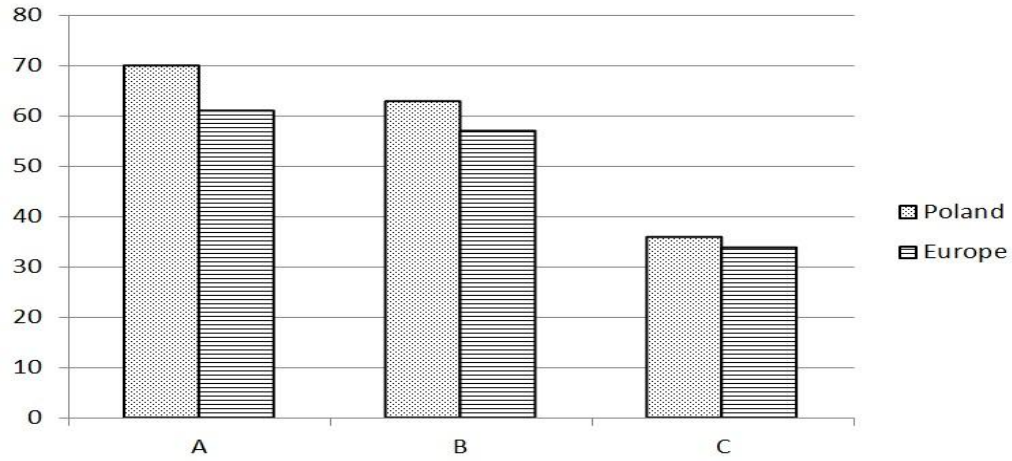
The period of the coronavirus pandemic in 2019-2022 and then Russia's armed aggression against Ukraine affected many spheres of human functioning, including pursuing business activity. The period of 2019-2022 was associated with strong restrictions in Poland, largely regarding the mobility of human and material resources, which adversely affected the condition of micro-enterprises. The coronavirus pandemic resulted in many adverse changes in the global economy (Sawicka, Aslan, and Della Corte, 2022).

Micro-enterprises were particularly exposed to the effects of the pandemic, such as restrictions on movement, financial constraints, organizational challenges or logistical difficulties (Erdiaw-Kwasie, Abunyewah, Yusif, and Arhin, 2023). On the other hand, the war in Ukraine also caused an energy crisis, which manifested itself in the high prices of energy utilities. This resulted in a rise in the operating costs of enterprises, including micro-entrepreneurs.

In addition, the decrease in real household incomes at that time resulted in an outflow of customers from enterprises (Senderowicz, 2023; Machniewski, 2023). The number of micro-enterprises in the Silesian Voivodeship at the end of 2022 decreased compared to the situation in the same period of 2021. At the end of 2022, the Silesian Voivodeship had 245,793 registered micro-enterprises, employing a total of 507,266 people (Statistics Poland, 2023). The year before, the number of registered entities was 256,888, while the number of people employed in those companies was 501,693 (Statistics Poland, 2022).

Figure 1 shows a comparison of what percentage of micro-enterprises in Poland and Europe has been affected by such consequences of destabilizing economies as a rise in the prices of goods and services (A), rise in the operating costs and the related need to amend the business strategy (B), and disruptions in supply chains (C).

***Figure 1.*** *Comparison of micro-enterprises in Poland and Europe in terms of the consequences of destabilization in the global economy: A – the percentage of micro-enterprises that were forced to increase the prices of products and services, B – the percentage of micro-enterprises that experienced a rise in the operating costs and were forced to modify their business strategies, C – the percentage of micro-enterprises that felt the effects of disruptions in supply chains.*




***Source:*** *Own elaboration based on British Polish Chamber of Commerce, (2022).*

Inflation, which affects the economy both in micro- and macroeconomic terms, means that at its high level, effective cost management by micro-enterprises may become a very difficult task (Olszowy, 2024).

In order to limit the negative effects of inflation (e.g., stopping the rapid rise in prices), the Polish legislation introduced a number of solutions. They include the so-called anti-inflation shield, consisting of a temporary reduction or abolition of VAT on, among others, energy utilities. As another form of assistance to households, subsidies for coal or electricity have been established.

However, for some companies existing in Poland, the assistance offered turned out to be insufficient (Kochaniak, Ulman, and Zajkowski, 2023).

## 3. Research Methodology

The analysis of the strength of the relationship between the factors affecting the viability of a micro-enterprise in a dynamic environment has been based on two groups of data.

The first one consists of data obtained in 2020-2022 from 132 micro-entrepreneurs, and some of those data were used for analyses carried out in two previous articles (Michalski, 2022; 2023), discussing the condition of micro-enterprises during the pandemic and then during the market instability caused by the war in Ukraine.

The second set of data is information obtained in the period from 2023 to mid-2024 from 139 micro-entrepreneurs. Among these 139 surveyed entities, there were 64 micro-enterprises, which had already been surveyed before, in 2020-2022. The re-survey of those entities was aimed at providing random insight into the condition of those micro-enterprises, which already function in a much more stable market situation.

A questionnaire and a face-to-face interview were used as the survey method, while the form was the survey tool.

Table 1 contains some issues and questions from the questionnaire, as well as sample responses from one of the respondents. The issues in the table were reduced to the topics that have been selected for the purpose of a correlation analysis.

***Table 1.*** *List of selected issues about which micro-entrepreneurs were asked*

| **Question No.** | **Issue/question** | **Versions of responses** | **Respondent's responses** |
|---|---|---|---|
| 1 | Sector in which a micro-enterprise operates | Service | * |
| | | Production/Industrial | |
| | | Agricultural | |

| | | | | |
|---|---|---|---|---|
| 2 | Field in which a micro-enterprise operates | | *(to be entered by the respondent)* | spring winding |
| 3 | Owner's age | | Up to 20 years | |
| | | | 21–30 years | |
| | | | 31–40 years | |
| | | | Above 40 years | * |
| 4 | Is a micro-enterprise the only source of income | | Yes | * |
| | | | No | |
| 5 | Number of employees, not counting the owner | | 0 | |
| | | | 1 | |
| | | | 2 | |
| | | | 3 | * |
| | | | 4 | |
| | | | 5 | |
| | | | 6 | |
| | | | 7 | |
| | | | 8 | |
| | | | 9 | |
| 6 | Number of years in the market | | Less than 1 year | |
| | | | 2–5 years | |
| | | | 6–10 years | |
| | | | 11–20 years | |
| | | | Over 20 years | * |
| 7 | Range of the company's impact | | Local | |
| | | | Regional | * |
| | | | National | |
| | | | International | |
| 8 | Sources of financing of the entity before the pandemic | Equity | | * |
| | | external sources | Government | * |
| | | | EU funds | |
| | | | Other | |
| 9 | Did the entrepreneur make use of non-financial support in 2020–2022 | | Training | |
| | | | Consultancy | |
| | | | Business incubators | |
| 10 | Did the company apply for financial support for companies affected by the pandemic | | Yes | * |
| | | | No | |
| 11 | Did the company use the facilities for the payment of taxes during the pandemic | | Yes | * |
| | | | No | |
| 12 | Did the entrepreneur change his sector of operation in 2020–2022 | | Yes | |
| | | | No | * |
| 13 | Did the pandemic situation force the closure of the business | | Yes | |
| | | | | * |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | No | | | | | | |
| 14 | What were the main nuisances for a micro-enterprise in 2020–2022 | | **0** | **1** | **2** | **3** | **4** | **5** |
| | | Lack of available raw materials | | | | | * | |
| | | Impossibility of direct distribution | | | | | | * |
| | | Impossibility to perform work in a place designated by the principal | | * | | | | |
| | | Rise in the prices of materials | | | | | * | |
| 15 | What was the general, subjective feeling about the impact of the pandemic on the functioning of the company, and how this impact translated into the quality of life of the employee/employees in specific areas of life | | **0** | **1** | **2** | **3** | **4** | **5** |
| | | Sense of uncertainty | | | | | | |
| | | Uncertainty about the existence of family members | | | | | | |
| | | Concern about the fate of employees | | | | | | |
| | | Lack of external support | | | | | | |
| | | Sense of lack of freedom | | | | | | |
| | | Impact on relationships with family members | | | | | | |
| 16 | What were the main nuisances of running an enterprise during a period of high inflation (2022–2024) | | **0** | **1** | **2** | **3** | **4** | **5** |
| | | High prices of materials | | | | | | |
| | | High prices of fuel | | | | | | |
| | | High prices of utilities | | | | | | |
| | | Raising salaries for employees | | | | | | |
| | | Reduced interest of customers | | | | | | |
| | | Lack of cooperation with existing entities | | | | | | |
| | | Late payments | | | | | | |
| 17 | Did an enterprise increase competitiveness in 2022–2024 by: | | **0** | **1** | **2** | **3** | **4** | **5** |
| | | Increasing the quality of products/services offered | | | | | | |
| | | Expanding the product range | | | | | | |
| | | Advertising and marketing activities | | | | | | |
| | | Using promotions | | | | | | |
| | | Determining prices lower than those of competitors | | | | | | |
| | | Implementing other distribution routes | | | | | | |
| | | Introducing technological innovation | | | | | | |
| 18 | Were any works that generated alternative income taken up in 2022–2024 | Yes | | | | | | |
| | | No | | | | | | |

***Source:*** *Author's calculations.*

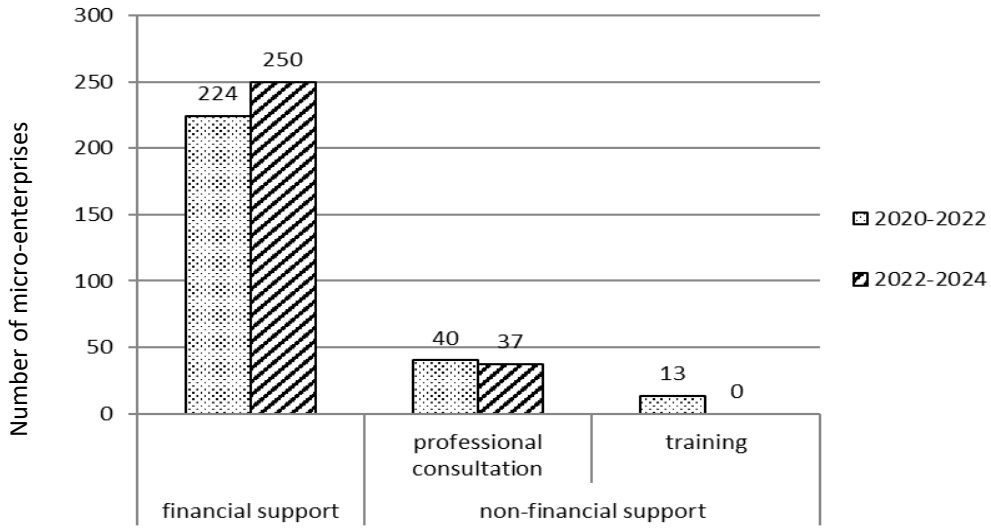
## 4. Research Results and Discussion

The surveyed micro-entrepreneurs responded in various ways both to unfavorable external factors related to the pandemic and to the unstable situation in the markets (among others, a rise in the prices of raw materials, products, utilities or their unavailability, the difficult performance of ordered work in the field, or reduced interest of customers, and obtaining payments with delay) and to forms of aid.

Those responses were conditioned by the personal psycho-physical predispositions of company owners related to age, experience, sense of responsibility for family and colleagues, possibility of obtaining alternative income, awareness of possibilities of using external aid, etc. Of the 271 micro-enterprises surveyed, 83% (224 companies) made use of state financial aid in the period 2020-2022. In 2022-2024, the number of companies making use of such forms of aid increased to 250, which accounts for 92% of all respondents.

In 2020-2022, the share of companies using at least one non-financial form of aid was as follows: 1% (3 entities) when it comes to training and 15% of respondents (40 companies) – consulting. In 2022–2024, 13% of respondents (37 entities) made use of non-financial aid (consulting). The issues presented above are illustrated in Figure 2.

***Figure 2.*** *Use of financial and non-financial external support in the period 2020-2022 and 2022-2024.*




***Source:*** *Author's calculations.*

### 4.1 Statistical Survey Methodology

The results of a research experiment analyzing the impact of the pandemic on the financial condition of companies (responses to questionnaire questions) have been described using qualitative and dichotomous features ("Yes" or "No" responses).

Consequently, the results of the experiment for two selected features can be presented in the form of a two-way table, whose rows and columns correspond to the "Yes" and "No" categories of responses to the question asked. Statistical analysis of the results will include the use of the following statistical inference techniques:

- Cramer's $V$ coefficient,
- Statistical test of independence $\chi^2$,
- Fisher's statistical test (the so-called exact test),
- McNemar's statistical test.

#### *4.1.1 Cramer's V coefficient*

The Cramer's $V$ coefficient is a measure of the strength of correlation between two qualitative variables. It takes values in the range [0,1] and is defined in the following manner:

$$V = \sqrt{\frac{\chi^2}{n \cdot \min(r-1, c-1)}}, \tag{1}$$

where $r$ and $c$ mean, respectively, the number of rows and columns of a contingency table created for the surveyed features. Since the considered features are dichotomous, the number of variants (categories) of each of them is 2, as a consequence of the analysis carried out $r = c = 2$. The chi-squared statistic (measure) on the right side of the above formula is defined as follows:

$$\chi^2 = \sum_{i=1}^{r} \sum_{j=1}^{c} \frac{\left(n_{i,j} - \overline{n_{i,j}}\right)^2}{\overline{n_{i,j}}}, \tag{2}$$

where $n_{i,j}$ are the observed counts occurring in the contingency table (obtained in the survey), and $\overline{n_{i,j}}$ are the corresponding expected counts (i.e. those that correspond to the independence of the surveyed features).

The higher the value of Cramer's V coefficient, the stronger the correlation between the surveyed qualitative features. A value of V above 0.5 corresponds to a strong correlation.

#### *4.1.2 Test of independence $\chi^2$*

The test of independence is based on the statistic $\chi^2$ (defined above), and, being a test statistic a verification of the null hypothesis on the independence of the surveyed

features. The higher the value of the test statistic, the more likely the rejection of this hypothesis. The null hypothesis is rejected if the value of the test statistic, calculated based on the results of the contingency table, exceeds the critical value $\chi 2_{(r-1)(c-1),1-\alpha}$ , which means the quantile of the order $1-\alpha$ of the distribution $\chi^2$ with $(r-1)(c-1)$ degrees of freedom ($\alpha$ is the level of significance of the test).

### *4.1.3 Fisher's statistical test*

Fisher's exact statistical test is used to check the null hypothesis, stating that the dichotomous features for which a random sample is presented in the form of a two-way table are independent. Basically, the Fisher's exact test is used for small table counts, based on the exact distribution of the observed table counts, which is a hypergeometric distribution. The probability of obtaining a combination of counts $A$ ("Yes-Yes"), $B$ ("Yes-No"), $C$ ("No-Yes") and $D$ ("No-No") is then

$$p_{ABCD} = \frac{\binom{A+C}{A}\binom{B+D}{B}}{\binom{n}{A+B}}, \tag{3}$$

where $n = A + B + C + D$ is the count of the entire table.

### *4.1.4 McNemar's statistical test*

McNemar's test is a statistical test used to verify the null hypothesis that the results obtained in related (dependent) samples come from a population with the same distribution. The test statistic for this test is as follows:

$$T = \frac{(B-C)^2}{B+C}, \tag{4}$$

where $B$ and $C$ mean, respectively, the numbers of the "Yes-No" and "No-Yes" combinations in a two-way table created for the surveyed dichotomous features. The null hypothesis is rejected when the calculated value of the statistic exceeds the critical value, which is the quantile $\chi 2_{1,1-\alpha}$ of the distribution $\chi^2$ with one degree of freedom.

In fact, in the analyzed data, we do not have to do with classic related (dependent) samples; however, we can treat the responses obtained to questions about the use of external sources of financing (before the pandemic) and support for affected companies (after the pandemic). However, for this reason, the results obtained with McNemar's test should be interpreted prudently.

In all the tests conducted below, the level of significance of $\alpha = 0.05$ has been assumed.

### 4.2 Statistical Analysis of Correlations between Selected Dichotomous Statistical Features

In the following analysis of the correlation of dichotomous statistical features (responses), the following features have been taken into account:

- JED: is a micro-enterprise the only source of income (Yes/No),
- ZWN: sources of financing before the pandemic – did a micro-enterprise use external funds (Yes/No),
- WSP: did the company apply for financial support for companies affected by the pandemic (Yes/No),
- UDG: did the company use the facilities in the payment of taxes (Yes/No),
- PBR: did the company have to change its sector of operation in the period 2020–2022 (Yes/No),
- ZAK: did the pandemic period lead to the cessation of activity (Yes/No).

Furthermore, the analysis was carried out with a breakdown into the time of uninterrupted operation of the company (five different periods were taken into account: 2–5, 6–10, 11–15, 16–20 and more than 20 years), as well as with a breakdown into the sector in which a micro-enterprise operates (the service sector and the production and industrial sector were distinguished here).

For each of the above-mentioned seven categories, a two-way table was presented, containing the obtained combinations of responses, and then:

- Cramer's $V$ coefficient,
- p-value of test $\chi^2$,
- p-value of Fisher's exact test,
- p-value of McNemar's test (only for ZWN vs. WSP correlation).

The obtained values of the Cramer's $V$ coefficient indicate the strength of correlations between the variables. However, due to the fact that the contingency tables have the smallest possible dimensions (2x2), they should be interpreted prudently. On the other hand, the p-values of corresponding tests are the limit values separating the "area" of rejection of the null hypothesis from the "area" of its acceptance (p-value below the significance level of 0.05 results in the rejection of the null hypothesis: then, the surveyed features significantly depend on each other).

#### (a) Companies operating in the market for 2–5 years

In the category of companies operating in the market uninterruptedly for 2–5 years, the results of the statistical analysis are presented in Tables 2a, 2b, and 2c.

***Table 2a.*** *Correlations between ZWN and WSP, UDG, PBR and ZAK for companies operating in the market for 2–5 years*

| **ZWN** | **WSP** | | **UDG** | | **PBR** | | **ZAK** | |
|---|---|---|---|---|---|---|---|---|
| | **Yes** | **No** | **Yes** | **No** | **Yes** | **No** | **Yes** | **No** |
| **Yes** | 4 | 10 | 4 | 5 | 0 | 4 | 0 | 4 |
| **No** | 0 | 11 | 0 | 14 | 2 | 19 | 0 | 21 |
| **V** | 0.3868 | | 0.5722 | | 0.1281 | | 0.0000 | |
| **chi-squared test** | 0.0032 | | 0.1016 | | 0.3841 | | 0.0371 | |
| **Fisher's test** | 0.0072 | | 0.1894 | | 0.6671 | | 0.1099 | |
| **McNemar's test** | 0.0016 | | - | | - | | - | |

***Source:*** *Author's calculations.*

***Table 2b.*** *Correlation between WSP and PBR for companies operating in the market for 2–5 years*

| **WSP** | **PBR** | |
|---|---|---|
| | **Yes** | **No** |
| **Yes** | 0 | 14 |
| **No** | 2 | 9 |
| **V** | 0.4980 | |
| **chi-squared test** | 0.0209 | |
| **Fisher's test** | 0.0421 | |

***Source:*** *Author's calculations.*

***Table 2c.*** *Correlation between JED and WSP for companies operating in the market for 2–5 years*

| **JED** | **WSP** | |
|---|---|---|
| | **Yes** | **No** |
| **Yes** | 6 | 0 |
| **No** | 8 | 11 |
| **V** | 0.3329 | |
| **chi-squared test** | 0.0003 | |
| **Fisher's test** | 0.0006 | |

***Source:*** *Author's calculations.*

The values of the Cramer's $V$ coefficients clearly indicate the existence of a significant correlation between the ZWN and WSP variables, as well as between the ZWN and UDG variables. Indeed, in the case of using external sources of financing

before the pandemic, every third company applied for aid due to the damage caused by the pandemic, and every second company made use of tax services.

For companies pursuing activity based only on their funds, none of them applied for support and the application of tax services. These conclusions are confirmed by the tests conducted: for the ZWN-WSP relation, we explicitly reject the hypothesis of independence; for the ZWN-UDG relation, the p-values are also low, although they do not allow rejecting it.

The correlation between the ZWN and PBR variables is small, which is confirmed by the coefficient $V$ and the tests conducted. None of the companies in the surveyed group has ceased their activity. The correlations between the WSP and PBR variables, as well as JED and WSP variables, are quite clear, and both tests conducted result in the rejection of hypotheses about the independence of the corresponding features.

### (b) Companies operating in the market for 6–10 years

In the category of companies operating in the market uninterruptedly for 6–10 years, the results of the statistical analysis are presented in Tables 3a, 3b, and 3c.

***Table 3a.*** *Correlations between ZWN and WSP, UDG, PBR and ZAK for companies operating in the market for 6–10 years*

| **ZWN** | **WSP** | | **UDG** | | **PBR** | | **ZAK** | |
|---|---|---|---|---|---|---|---|---|
| | **Yes** | **No** | **Yes** | **No** | **Yes** | **No** | **Yes** | **No** |
| **Yes** | 6 | 0 | 6 | 0 | 0 | 6 | 0 | 6 |
| **No** | 10 | 2 | 2 | 6 | 4 | 8 | 2 | 10 |
| **V** | 0.2506 | | 0.7502 | | 0.3779 | | 0.2506 | |
| **chi-squared test** | 0.0006 | | 0.4497 | | 0.4568 | | 0.1088 | |
| **Fisher's test** | 0.0016 | | 0.7064 | | 0.7112 | | 0.2285 | |
| **McNemar's test** | 0.0016 | | - | | - | | - | |

***Source:*** *Author's calculations.*

***Table 3b.*** *Correlation between WSP and PBR for companies operating in the market for 6–10 years*

| **WSP** | **PBR** | |
|---|---|---|
| | **Yes** | **No** |
| **Yes** | 3 | 13 |
| **No** | 1 | 1 |

| | |
|---|---|
| **V** | 0.2357 |
| **chi-squared test** | 0.0001 |
| **Fisher's test** | 0.0001 |

***Source:*** *Author's calculations.*

***Table 3c.*** *Correlation between JED and WSP for companies operating in the market for 6–10 years*

| **JED** | **WSP** | |
|---|---|---|
| | **Yes** | **No** |
| **Yes** | 10 | 0 |
| **No** | 6 | 2 |
| **V** | 0.3951 | |
| **chi-squared test** | 0.0256 | |
| **Fisher's test** | 0.0599 | |

***Source****: Author's calculations.*

It should be stressed that in the case of companies more experienced in the market and using external sources of financing, none of them resigned from applying for tax support and facilities or ceased its business activity and had to change their profile.

In the case of companies operating based only on their own financial resources, the vast majority made use of support, but only every fourth made use of tax services.

Every third of them had to change the profile of their activity. The hypotheses on the independence of features are rejected in the case of WSP-PBR and JED-WSP relations (very small p-values of corresponding tests), where 100% of companies that are the only source of income for owners applied for financial support.

### (c) Companies operating in the market for 11–15 years

In the category of companies operating in the market uninterruptedly for 11–15 years, the results of the statistical analysis are presented in Tables 4a, 4b, and 4c.

***Table 4a.*** *Correlation between ZWN and WSP, UDG, PBR and ZAK for companies operating in the market for 11–15 years*

| **ZWN** | **WSP** | | **UDG** | | **PBR** | | **ZAK** | |
|---|---|---|---|---|---|---|---|---|
| | **Yes** | **No** | **Yes** | **No** | **Yes** | **No** | **Yes** | **No** |
| **Yes** | 40 | 0 | 39 | 0 | 0 | 39 | 0 | 39 |
| **No** | 29 | 16 | 4 | 31 | 4 | 42 | 2 | 44 |
| **V** | 0.4540 | | 0.8963 | | 0.2047 | | 0.1431 | |
| **chi-squared** | 0.0000 | | 0.5083 | | 0.0000 | | 0.0000 | |

| | | | | |
|---|---|---|---|---|
| **test** | | | | |
| **Fisher's test** | 0.0000 | 0.6200 | 0.0000 | 0.0000 |
| **McNemar's test** | 0.0000 | - | - | - |

***Source:*** *Author's calculations.*

***Table 4b.*** *Correlation between WSP and PBR for companies operating in the market for 11–15 years*

| **WSP** | **PBR** | |
|---|---|---|
| | **Yes** | **No** |
| **Yes** | 3 | 66 |
| **No** | 1 | 15 |
| **V** | 0.0343 | |
| **chi-squared test** | 0.0000 | |
| **Fisher's test** | 0.0000 | |

***Source:*** *Author's calculations.*

***Table 4c.*** *Correlation between JED and WSP for companies operating in the market for 11–15 years*

| **JED** | **WSP** | |
|---|---|---|
| | **Yes** | **No** |
| **Yes** | 46 | 0 |
| **No** | 23 | 16 |
| **V** | 0.5230 | |
| **chi-squared test** | 0.0002 | |
| **Fisher's test** | 0.0003 | |

***Source:*** *Author's calculations.*

In the group of companies operating in the market for 11 to 15 years, there are quite clear correlations between the ZWN variable and the WSP, UDG, PBR and ZAK variables.

For companies using external sources of financing, 100% applied for financial support and the use of tax services. None of them had to change the profile of their activity, let alone cease it.

The "post-pandemic" crisis-affected companies relied on their existing capital, although many of them did not apply for any support (directly financial or in the form of tax services). In the analyzed group of enterprises, the correlations between the WSP-PBR and JED-WSP variables are also clear, as confirmed by the results presented in Tables 4b and 4c.

### (d) Companies operating in the market for 16–20 years

In the category of companies operating in the market uninterruptedly for 16–20 years, the results of the statistical analysis are presented in Tables 5a, 5b, and 5c.

***Table 5a.*** *Correlation between ZWN and WSP, UDG, PBR and ZAK for companies operating in the market for 16–20 years*

| **ZWN** | **WSP** | | **UDG** | | **PBR** | | **ZAK** | |
|---|---|---|---|---|---|---|---|---|
| | **Yes** | **No** | **Yes** | **No** | **Yes** | **No** | **Yes** | **No** |
| **Yes** | 7 | 29 | 7 | 0 | 0 | 7 | 0 | 7 |
| **No** | 0 | 1 | 26 | 4 | 0 | 30 | 0 | 37 |
| **V** | 0.0805 | | 0.1685 | | 0.0000 | | 0.0000 | |
| **chi-squared test** | 0.0000 | | 0.0000 | | 0.0054 | | 0.0058 | |
| **Fisher's test** | 0.0000 | | 0.0000 | | 0.0114 | | 0.0121 | |
| **McNemar's test** | 0.0000 | | - | | - | | - | |

***Source:*** *Author's calculations.*

***Table 5b.*** *Correlation between WSP and PBR for companies operating in the market for 16–20 years*

| **WSP** | **PBR** | |
|---|---|---|
| | **Yes** | **No** |
| **Yes** | 0 | 36 |
| **No** | 0 | 1 |
| **V** | 0.0000 | |
| **chi-squared test** | 0.0000 | |
| **Fisher's test** | 0.0000 | |

***Source:*** *Author's calculations.*

***Table 5c.*** *Correlation between JED and WSP for companies operating in the market for 16–20 years*

| **JED** | **WSP** | |
|---|---|---|
| | **Yes** | **No** |
| **Yes** | 33 | 0 |
| **No** | 3 | 1 |
| **V** | 0.4787 | |
| **chi-squared test** | 0.1647 | |
| **Fisher's test** | 0.3575 | |

***Source:*** *Author's calculations.*

Among the companies present in the market for 16–20 years, none of them had to change the sector of operation or cease its activity. Almost all of them made use of tax services, although only 7 out of 30 used financial support. Appropriate tests (their p-values) indicate significant differences between the surveyed pairs of variables. For the surveyed group of companies, the consequence of applying for support was to maintain the profile of their existing activity (Table 5b).

### (e) Companies operating in the market for more than 20 years

In the category of companies operating in the market for more than 20 years, the results of the statistical analysis are presented in Tables 6a, 6b, and 6c.

***Table 6a.*** *Correlation between ZWN and WSP, UDG, PBR and ZAK for companies operating in the market for more than 20 years*

| **ZWN** | **WSP** | | **UDG** | | **PBR** | | **ZAK** | |
|---|---|---|---|---|---|---|---|---|
| | **Yes** | **No** | **Yes** | **No** | **Yes** | **No** | **Yes** | **No** |
| **Yes** | 52 | 0 | 52 | 0 | 0 | 52 | 0 | 52 |
| **No** | 37 | 17 | 8 | 42 | 7 | 47 | 6 | 48 |
| **V** | 0.4289 | | 0.8533 | | 0.2029 | | 0.0000 | |
| **chi-squared test** | 0.0000 | | 0.2603 | | 0.0000 | | 0.0000 | |
| **Fisher's test** | 0.0000 | | 0.0000 | | 0.0000 | | 0.0000 | |
| **McNemar's test** | 0.0000 | | - | | - | | - | |

***Source:*** *Author's calculations.*

***Table 6b.*** *Correlation between WSP and PBR for companies operating in the market for more than 20 years*

| **WSP** | **PBR** | |
|---|---|---|
| | **Yes** | **No** |
| **Yes** | 6 | 83 |
| **No** | 1 | 16 |
| **V** | 0.0137 | |
| **chi-squared test** | 0.0000 | |
| **Fisher's test** | 0.0000 | |

***Source:*** *Author's calculations.*

***Table 6c.*** *Correlation between JED and WSP for companies operating in the market for more than 20 years*

| **JED** | **WSP** |
|---|---|

| | **Yes** | **No** |
|---|---|---|
| **Yes** | 80 | 9 |
| **No** | 9 | 8 |
| **V** | 0.3695 | |
| **chi-squared test** | 1.0000 | |
| **Fisher's test** | 0.0000 | |

***Source:*** *Author's calculations.*

The chi-squared test and the so-called Fisher's exact test indicate significant differences in the "Yes-No" ratios for variable pairs in the group of companies present in the market for the longest time (Table 6a). For the ZWN-ZAK variables, they are, for example, 52 vs. 54 when compared to 6 vs. 100. In companies using external sources of financing before the pandemic, the situation is clear: none of them had to change their sector of operation or cease its activity, and all of them made use of tax services and financial support for companies affected by the pandemic.

For companies based only on their own capital, every third company did not apply for financial assistance after the pandemic, and as many as 42 out of 50 did not make use of tax services. Slightly more than 10% of such companies had to change their sector of operation, and a similar number had to cease their activity.

Observation of two-way tables for the WSP-PBR variables (Table 6b) and JED-WSP (Table 6c) variables indicates similar ratios of "Yes-No" responses for the JED and WSP variables and "opposite" (symmetric) responses for the WSP and PBR variables.

### (f) Companies from the service sector

In the category of companies operating in the service sector, the results of the statistical analysis are presented in Tables 7a, 7b, and 7c.

***Table 7a.*** *Correlation between ZWN and WSP, UDG, PBR and ZAK for companies operating in the market in the service sector*

| **ZWN** | **WSP** | | **UDG** | | **PBR** | | **ZAK** | |
|---|---|---|---|---|---|---|---|---|
| | **Yes** | **No** | **Yes** | **No** | **Yes** | **No** | **Yes** | **No** |
| **Yes** | 95 | 0 | 95 | 0 | 0 | 142 | 0 | 95 |
| **No** | 112 | 44 | 43 | 102 | 16 | 93 | 10 | 146 |
| **V** | 0.3598 | | 0.6959 | | 0.2978 | | 0.1589 | |
| **chi-squared test** | 0.0000 | | 0.0001 | | 0.0000 | | 0.0000 | |

| | | | | |
|---|---|---|---|---|
| **Fisher's test** | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **McNemar's test** | 0.0000 | - | - | - |

***Source:*** *Author's calculations.*

***Table 7b.*** *Correlation between WSP and PBR for companies operating in the market in the service sector*

| **WSP** | **PBR** | |
|---|---|---|
| | **Yes** | **No** |
| **Yes** | 10 | 197 |
| **No** | 6 | 38 |
| **V** | 0.1370 | |
| **chi-squared test** | 0.0000 | |
| **Fisher's test** | 0.0000 | |

***Source:*** *Author's calculations.*

***Table 7c.*** *Correlation between JED and WSP for companies operating in the market in the service sector*

| **JED** | **WSP** | |
|---|---|---|
| | **Yes** | **No** |
| **Yes** | 159 | 10 |
| **No** | 48 | 34 |
| **V** | 0.4384 | |
| **chi-squared test** | 0.0001 | |
| **Fisher's test** | 0.0000 | |

***Source:*** *Author's calculations.*

In the service sector, companies using external sources of financing survived the pandemic with the unchanged profile of activity, making use of tax services and financial support (100%) "en route".

In the case of companies based only on their own capital, every third company did not make use of financial support, and two-thirds did not use tax services. Several percent ceased their activity and a dozen or so have had to change their sector of operation.

All tests explicitly reject the hypothesis on the independence of distributions of feature pairs. The situation is similar in the case of the contingency tables presented in Tables 7b and 7c, concerning the correlations between the WSP-PBR and JED-WSP feature pairs.

### (g) Companies from the production and industrial sector

In the category of companies operating in the production and industrial sector, the results of the statistical analysis are presented in Tables 8a, 8b, and 8c.

***Table 8a.*** *Correlation between ZWN and WSP, UDG, PBR and ZAK for companies operating in the market in the production and industrial sector*

| **ZWN** | **WSP** | | **UDG** | | **PBR** | | **ZAK** | |
|---|---|---|---|---|---|---|---|---|
| | **Yes** | **No** | **Yes** | **No** | **Yes** | **No** | **Yes** | **No** |
| **Yes** | 13 | 0 | 13 | 0 | 0 | 13 | 0 | 13 |
| **No** | 4 | 3 | 2 | 5 | 1 | 6 | 0 | 7 |
| **V** | 0.5723 | | 0.7868 | | 0.3122 | | 0.0000 | |
| **chi-squared test** | 0.0105 | | 0.0004 | | 0.1621 | | - | |
| **Fisher's test** | 0.2733 | | 0.7111 | | 0.0001 | | 0.0000 | |
| **McNemar's test** | 0.0455 | | - | | - | | - | |

***Source:*** *Author's calculations.*

***Table 8b.*** *Correlation between WSP and PBR for companies operating in the market in the production and industrial sector*

| **WSP** | **PBR** | |
|---|---|---|
| | **Yes** | **No** |
| **Yes** | 1 | 16 |
| **No** | 0 | 3 |
| **V** | 0.0975 | |
| **chi-squared test** | 0.6665 | |
| **Fisher's test** | 0.0000 | |

***Source:*** *Author's calculations.*

***Table 8c.*** *Correlation between JED and WSP for companies operating in the market in the production and industrial sector*

| **JED** | **WSP** | |
|---|---|---|
| | **Yes** | **No** |
| **Yes** | 15 | 0 |
| **No** | 2 | 3 |
| **V** | 0.7277 | |
| **chi-squared test** | 0.0011 | |
| **Fisher's test** | 0.6948 | |

***Source:*** *Author's calculations.*

Companies representing the production and industrial sector accounted for only about 7% of the surveyed enterprises. As in the service sector, all those companies previously using external sources of financing survived the pandemic with the unchanged profile of activity, additionally making use of tax services and financial support.

For companies based only on their own funds, only one had to change its sector of operation, and none of them ceased their activity.

Approximately every second company did not make use of financial support, and 2 out of 7 did not also make use of tax services. Table 8b indicates the "Yes-No" response rate asymmetry for the WSP vs. PBR variables. For the JED vs. WSP variables, we have the response rate symmetry (Table 8c).

## 5. Conclusions, Proposals, Recommendations

The functioning of enterprises includes the element of dynamically changing internal and external conditions. When the scale of the latter does not exceed the level acceptable for a micro-entrepreneur, he is able to include them in the routine of his daily activities.

However, there are periods when this factor of changes, their speed and direction, make it extremely difficult or impossible for a micro-enterprise to remain in the market. People running micro-enterprises come from various backgrounds and have different seniority and professional experience.

They are also characterized by different financial situations, financial liquidity, different opportunities to obtain alternative income, and many other personal factors.

Therefore, it is important to examine the links between individual factors that make a micro-enterprise able to survive a period of economic instability. It is also important to identify the aspects that lead to the cessation of the entity's activity.

Identifying these factors and learning the strength of the correlation between them may contribute to building a model that will enable a quick identification of areas in which the aid for a given micro-entrepreneur will be necessary. Moreover, determining the form of this aid – financial or non-financial – will make it more effective, and a micro-enterprise will survive.

The limited volume of the article necessitated the need to choose from many combinations of factors that have been correlated with each other. The selection of pairs of factors, whose correlations have been surveyed, is the author's subjective selection, and the results obtained only outline the subject matter and are a contribution to further surveys that make the recognition of the issue deeper.

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