ESTIMATES OF FUTURE INDUSTRIAL DEVELOPMENT IN THE CONTEXT OF COMPANY SIZE

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Abstract

The expected development of economic reality is a determining variable for many companies and their demand planning. Do their reflections on future market development differ depending on how big the companies are? The study focused on business cycle indicators that the Czech Statistical Office (CZSO) publishes regularly. Until 2017, the CZSO published these indicators sorted according to company size, but then it abandoned the division. This study aims to evaluate whether the size of companies affects their estimate of future demand and to use these results to point out whether the termination of the publishing of these indicators, broken down by company size, was justified. The data were evaluated with correlation and cluster analysis. The research confirms that the nature of the forecasts for different-sized companies varies in terms of examined prediction indicators. Small and medium-sized companies agree in their projections, and large companies (in general) are more pessimistic than small and medium-sized ones. The breakdown made according to the size of companies should be maintained as it is an essential signal for policymakers.

Keywords: Future demand estimates, business cycle balance, size of enterprises, information value

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Introduction

Different-sized companies are undoubtedly in different situations in relation to the market and have different resources. This is also reflected in work with estimates of future economic development. In general, if a company is "ready" for future development,

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it can benefit from it and strengthen or build a competitive advantage on the market. Future development is also an important indicator for policymakers, who provide direct financial assistance to support firms' competitiveness and growth and mitigate economic downturns (Dvouletý *et al*., 2021a). The question remains, do companies of different sizes differ in their view of future developments? Are the estimates of small companies different from those of large ones?

Change is inevitable and often unexpected. For traders, this is almost the only certainty. Good reporting allows a company to be proactive face to face with expected changes of market demand and more reactive to unexpected demand (Croxton *et al*., 2002). Therefore, companies can hold the position of those who only react to or those who expect change, actively prepare for it, predict it, or even look for it. This action aims to mitigate the consequences of fluctuations for one's economic activities and time return to normal properly (Polyviou *et al*., 2019). Equally, public institutions have to react to current market conditions and the mood of firms if they want to offer them support (Dvouletý *et al*., 2021b; Juergensen *et al*., 2020; Nguyen *et al*., 2020; Razumovskaia *et al*., 2020).

A company's future development is estimated in various ways. One of these indicators that captures these forecasts is a business cycle survey. It is a statement of company managers on the future state, which accounts for, among other things, the state of production capacities, their development or the development of orders, which traditional statistics do not take into account sufficiently (Marek *et al*., 2019). Before the end of 2017, the CZSO published business cycle surveys sorted according to company size, but the data have not been published in this breakdown since then. Yet numerous studies prove remarkable differences among firms of various sizes; *e.g.*, Dvouletý *et al*. (2021a) provide an extensive literature review. So, is there a difference between the future economic forecast or prognosis of different-sized companies? Was the termination of publishing of these data justified, or would it be beneficial to continue with this breakdown and publication?

This study aims to evaluate whether the size of companies affects their estimate of future demand and to use these results to point out whether the termination of the publishing of these indicators, broken down by company size, was justified. This aim will be fulfilled with research into whether companies are more optimistic or pessimistic in terms of their predictions and whether the size of the group is the decisive factor in determining future demand prognosis.

1. Literature Review

1.1 Importance of information in market economy

Business fluctuation affects companies on all markets. Both expansion and decline in an economy can mean significant opportunities for companies. During a recession, companies reduce costs and often attenuate R&D programmes (Srinivasan, 2004), risking the loss of long-term technological benefits. Usually, businesses do not believe in a turn of the economy and behave carefully (Bachmann, 2013). At the same time, however, production processes become more efficient during declines (Lin and Huang, 2012; Tavassoli, 2015).

The causes of these fluctuations often come from the external environment of companies, for example, political conflicts, climate changes, an obsolete structure (Pettit *et al*., 2019), an investment bubble, or an unexpected "pandemic", as shown in 2020. These fluctuations subsequently affect companies' business opportunities and make them vulnerable (Pettit *et al*., 2019). As they occur relatively often, companies should work on their resilience to them (Melnyk *et al*., 2014; Polyviou *et al*., 2019).

The ability to respond to market changes requires an understanding of the market (Jüttner *et al*., 2007; Moon *et al*., 2000), which lies in aggregating historical data and interpreting them in the context of the market on which the company operates (Moon *et al*., 2000; Mentzer *et al*., 2007). To maximise market opportunities, a company must assess its position on the market, and planning and marketing reporting are key to managing market dynamics (Lackman *et al*., 2000).

Evaluating market buying opportunities requires sales and purchasing managers to orient themselves in indicators of market development and the development of their company. Awareness of the development of the economic condition is part of the "equipment" of many managers in various positions.

According to Polyviou *et al*. (2019), companies with a unique product are the most prone to fluctuations in the economy. In addition to pricing policy and business conditions, demand prediction plays a role in optimising a company's revenue (Anderson and Carroll, 2007). Of course, companies need to know their customers and needs (Croxton *et al*., 2002) and effectively meet their expectations (Jüttner *et al*., 2007).

1.2 Predicting market demand

Marketing reporting focuses on understanding, analysing and assessing the internal and external environment (Huster, 2005). Fuld (2015) defines reporting as the management of the reporting process, the use of information and data sources. At the same time,

it provides information for chosen employees who contribute to its implementation and help build policies that ensure their competitiveness on the activity market (Lackman *et al*., 2000; Calof *et al*., 2008a). Market information has great potential for improving sales prognosis (Fildes *et al*., 2009). Experts base their assessment of these market findings on a prognosis of economic expectations, which are numerically represented with economic indicators (Lawrence *et al*., 2000).

Predictions of industry development and predictions of the company's activities based on them fit into the scheme of marketing reporting or, more precisely, marketing information systems. The company can estimate the market better, be one step ahead of the competition (Ettorre, 1995), and create new opportunities.

Predicting market developments and demand is important for manufacturers, distributors, resellers and others (Marien, 1999). Predicting market development is one of the capabilities of a marketing-driven organisation. Understanding the future development of the environment and making a qualified estimate of demand depends on, among other things, the ability of managers to interpret and analyse historical data (Mentzer *et al*., 2007). An informed manager will provide a more accurate estimate.

Manufacturers are constantly improving demand prediction processes to get the best estimates possible. These are essential in production, transportation and decision making at all levels of the company's supply chain (Verstraete *et al*., 2020). This contributes to the following:

- ensuring sufficient sales for one's own business (Sagaert *et al*., 2018);
- profitability of the business (Moon *et al*., 2000; Croxton *et al*., 2002; Mentzer *et al*., 2007; Min and Yu, 2008);
- motivation of customers to buy (Boone *et al*., 2019);
- stronger relationship with customers and suppliers (Croxton *et al*., 2002; Hyndman and Athanasopoulos, 2018);
- ensuring product availability (Croxton *et al*., 2002; Min and Yu, 2008);
- price adjustment in proportion to market mood (Croxton *et al*., 2002; Stadtler and Kilger, 2005);
- deliveries not delayed (Moon *et al*., 2000; Min and Yu, 2008);
- taking advantage of new market opportunities (Moon *et al*., 2000; Polyviou *et al*., 2019);
- lower stocks (Moon *et al*., 2000; Min and Yu, 2008; Kerkkänen *et al*., 2009; Baardman, *et al*., 2018);
- faster production flow (Min and Yu, 2008); and
- increasing market share (Min and Yu, 2008).

In companies, predictions should be processed collectively and uniformly, and they should be coordinated (Croxton *et al*., 2002). Various departments should be involved in the process (Min and Yu, 2008), and according to Kilger and Wagner (2008), these are typically the sales, production management and marketing departments. Their common aim is to create a first-class value for the customer (Jüttner *et al*., 2007). Calof *et al*. (2008b) extend the statements about cooperation in prognosis within the company even further to external partners and competitors.

1.3 Estimates of future economic development

General expectations are based on estimates of the development of the industry environment (Mentzer *et al*., 2007). Macroeconomic indicators include a leading context, for example, currently changing global economic conditions. Companies monitor the development of their national markets to understand the development and future expectations of economic indicators (Sagaert *et al*., 2018). At the same time, companies, or rather their managers, are interested in future consumption or changes in inflation. They want to hear whether consumption will be higher or lower and discuss whether and when turning points of economic development will appear (García-Ferrer and Bujosa, 2000).

Data for demand planning/estimation must be selected systematically as part of the strategic preparation of the demand management process. After the company sets the goal of this effort, it must choose the range of predictions, the time span and selected data sources, compare different approaches of predictions and choose the prediction method (Croxton *et al*., 2002). The use of specific indicators is related to the time horizon for which companies plan (Kilger and Wagner, 2008).

Regarding the indicators of the market situation, information can be included at several levels: economic development, development of the sector and development of own branches up to business partners' and the company's performance. There are many indicators that managers can use along the same line as the above mentioned "scale" (Mentzer *et al*., 2007). Information on economic development is provided by supranational and national statistical offices (Calof *et al.*, 2008b). The field is often processed by trade unions and organisations (Povolná, 2019), and microeconomic information is part of internal company data.

Sagaert *et al*. (2018) have proven that leading indicators can improve final predictions in terms of accuracy and insights. They also recommend using the human aspect (human estimation), which can contribute significant value in identifying suitable groups of indicators which are selected for statistical models. For instance, Marien

(1999) provides a rather thorough overview of indicators that can enter the company's planning across different levels of decision making. Indicators reduce uncertainty about trends and prevent confusion for economic operators in interpreting future directions of change (Drehmann and Juselius, 2014).

Short-term expected development of the economy is the subject of business cycle surveys, which belong under the Joint Harmonized EU Programme of Business and Consumer Surveys. The surveys are conducted monthly in the following areas: industry, construction, trade, services and financial services (for more details, see OECD methodology, 2017). The complete results of the Business and Consumer Survey are published two working days before the end of each month, which is much earlier than GDP (OECD, 2017). The advantage of these data is that they are readily available, not revised and include few errors (Hansson *et al*., 2005).

Business cycle indicators are qualitative, based on expressing the future using general answers. The survey uses simple questionnaires that the management can complete very quickly (CZSO, 2015). Composite and sectoral indicators are also aggregated from business cycle survey data. The principles of these business surveys are high frequency, timeliness and continuous harmonisation (OECD, 2017). The Czech Statistical Office provides data for business cycle surveys in the Czech Republic through regular collection, the methodology of which is subject to the procedures given by the OECD (see above).

The indicators show different tendencies of companies' attitudes to the development of the economic situation. They can help companies make decisions, but only if they become part of the information portfolio (Povolná, 2019).

Business cycle indicators were published in the Czech Republic by the CZSO until 2017 for individual sectors of the economy and broken down into groups according to the size of companies. This information described the attitudes of companies of different sizes, which often operate on different principles and play different roles within the economy. Since 2018, the breakdown of indicators concerning the size of companies has not been published.

1.4 Size of enterprises

The size of enterprises is described as an important differentiation factor in many respects (*e.g.*, Srinivasan, 2004; Nollet *et al*., 2012), including the ability to predict future demand. Obviously, the larger the company, the more likely it will have staff who specialise in predicting future development. The smaller the company, the more likely the estimates will be one of the many activities of one or a few people (Dollinger

and Kolchin, 1985; Pearson and Ellram, 1995; Gadde and Håkansson, 2001; Belt *et al*., 2010).

As opposed to large ones, small companies have to overcome many obstacles during their growth, such as a lack of workers' skills and limited access to financial and material resources or infrastructure (Lin *et al*., 2020). At the same time, however, small companies have the attention of state and non-state initiatives in terms of business support. Large companies can influence policy due to their economic strength. In this respect, medium-sized companies cannot achieve either (Polyviou *et al*., 2019). Considering the lower level of resources available, small firms can exploit the public support more efficiently than big ones as they associate their projects with key business activities (Criscuolo *et al*., 2019; Alecke *et al*., 2012). Without such support, they would not evolve the supported projects (Dvouletý *et al*., 2021a). The existence of small companies is dependent on innovative, proactive behaviour (Mateev and Anastasov, 2010), their ability to respond immediately to market changes (Rahmana *et al*., 2016), flexible communication, higher motivation, unique ideas; large companies, on the other hand, benefit from greater experience, resources, economies of scale, etc. (Dvouletý *et al*., 2021a).

The size of companies is characterised in various ways, mainly depending on the number of employees or annual turnover (Hariharan and Thangavel, 2016). Nováková (2019) states that according to the Confederation of Industry of the Czech Republic, a small enterprise is considered to be one with fewer than 100 employees and an annual turnover not exceeding CZK 30 million, a medium-sized enterprise has fewer than 500 employees and a turnover of less than 100 million, and the rest of the enterprises are considered large. This approach is based on the EU classification (Vochozka, 2020).

2. Methodology and Data

The study aims to evaluate whether the size of companies affects their estimates of future demand. In other words, it is a question of finding out whether firms of a certain size are more optimistic or more pessimistic in their predictions: the higher the cyclical balance, the more optimistic the firm's estimate, and the lower the cyclical balance, the more pessimistic the firm's estimate.

As explained below, the cyclical balance expresses the difference between the prediction of growth and decline in industrial demand.

The size of enterprises as an independent variable has become a significant differentiating factor, assuming that companies of different sizes have different expectations regarding the development of industrial demand.

For this study, the approach of the Czech Statistical Office was used to divide companies into size groups (Table 1), as the balances of business indicators were presented in the relevant archives. To establish hypotheses, the companies were divided into small and large with a limit of 500 employees. This division is in accordance with the EU division (Vochozka, 2020).

Table 1: Division of the companies into size groups

Size group	Number of employees
Small companies	1–99
Medium-sized companies	100–299
Medium-sized companies	300–499
Large companies	500–999
Large companies	1,000–1,999
Large companies	2,000–4,999
Large companies	5,000 and more

Source: CZSO – Business cycle survey in enterprises, 2017

The study seeks to answer the following research question:

> **Do the estimates of future industrial demand differ depending on which size group the company belongs to?**

The data from the Czech Statistical Office business cycle surveys were used to answer the research question. The estimate of future industrial demand is represented by the indicator "assessment of order book level", which is a part of the Business and Consumer Survey methodology used by the Czech Statistical Office in accordance with the Joint Harmonised EU Programme of Business and Consumer Surveys. These surveys are based on the opinions of entrepreneurs in a permanent panel of CZSO respondents, who evaluate future developments using more general terms – better, the same, worse, for the next three and six months. The evaluation is performed by summing the answers in individual variants of development. A clear expression of tendencies is the cyclical balance, which expresses the difference between the answers in the variants of increase (+) and decrease (−) in %. The higher the positive balance answer, the more optimistic the obtained answer can be considered; the lower the balance, the more the prediction can be regarded as pessimistic.

The examined data concerned the industry sector (revenues from the industrial activity of these enterprises represent more than half of the revenues of total industrial enterprises) recorded for the years 2010–2017. In the Czech Republic, the sector includes about 1,000 companies (OECD, 2017). All were available on the CZSO website and were collected as a demand prediction for the next three and six months.

The evaluated difference in estimates was how much the prediction differed in different size groups of companies, or more precisely, how much the balances differed and, thus, whether the predictions differed in their degree of optimism/pessimism.

To determine the degree of optimism/pessimism of the selected companies in the corporate environment, we assumed that company size influenced the given factor. Based on this assumption, the following hypotheses were expressed:

> **H_1: Demand predictions of companies with up to 500 employees for the next three months are expected to differ from those of companies with more than 500 employees.**
>
> **H_2: Demand predictions of companies with up to 500 employees for the next six months are expected to differ from those of companies with more than 500 employees.**

The procedure leading to confirmation or refutation of the hypotheses consisted of several phases: (1) data classification, (2) data correlation, and (3) cluster analysis.

First, the obtained data were classified based on analytical classification, which made it possible to subsequently examine the mutual relations and dependencies among the obtained data.

In the second phase of the research, the hypotheses were confirmed based on correlations between variables and nonparametric tests to compare several dependent selections. The aim was to determine whether companies have similar predictions and behave the same in the predictions. Using nonparametric tests, it was possible to decide which companies have a more pessimistic or more optimistic prediction. The positive correlation between the predictions expressed by the cyclical balance within the size groups meant that the higher one group assessed future development, the more the other size group assessed it as higher and vice versa.

The correlation coefficients were calculated using Spearman's coefficient in the SPSS Statistics software. The degree of correlation ranged from −1 to 1; the closer the value is to 1 or −1, the stronger the relationship between the variables.

The third phase of the research was to confirm the conclusions of the correlation analysis. For this, a cluster analysis was used to reveal the similarities and differences

of predictions based on the development in the observed period, or rather, to find groups of mutually similar objects. In this case, size categories were considered objects.

The K-means algorithm and the hierarchical method were used to cluster the demand predictions. This algorithm is the most widely used clustering method in practice, and in most cases, it is effective (Wu *et al*., 2008; Jain, 2010). It is also applied to cluster demand patterns (Espinoza *et al*., 2005; Lu and Kao, 2016). K represents the division of observations into K clusters so that each observation is assigned to the cluster that has the closest diameter. The goal of K-means is to minimise the total sum of squares. A hierarchical method was also used in the clustering. This method was chosen mainly due to the small number of clustered objects and, therefore, the clarity of the output in the form of a graph. The individual steps of the cluster analysis were shown in a "dendrogram". Based on the dendrogram, a suitable number of created clusters was derived. This number is the input parameter to the K-means method. As a result, the K-means method shows a centroid for each cluster, which is a fictitious object characteristic of that cluster. In the case of time series clustering, the centroid is not a "common" multidimensional object that can be conceived as a "centre of gravity" in multidimensional space; instead, it is a functional approximation.

3. Results

Based on data from business cycle surveys from 2010 to 2017 on the prediction of demand development (order book) for the next three and six months, we examined the dependence of the business cycle balance on the size of enterprises (according to the number of employees). The data set contained the monthly values of the cyclical balance for each type of company during the monitored years.

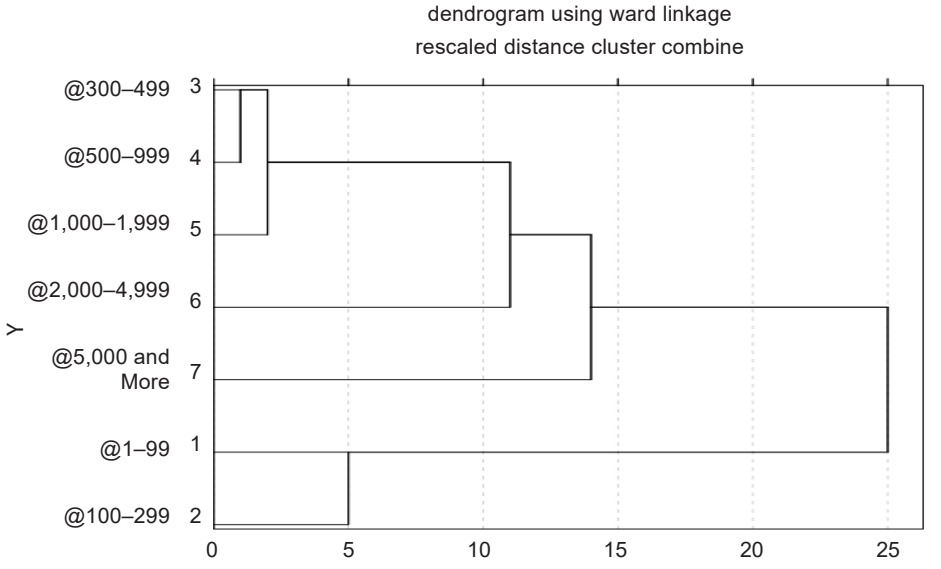
> H_1 addressed the predictions for the next three months and assumed that these would be different for smaller companies (up to 499 employees) and larger companies (more than 500 employees).

At the 1% level of significance, it turned out that the groups of the smallest companies with the number of employees 1–99 and 100–299 were strongly positively correlated (0.8683), *i.e.*, their predictions of the demand development evolved very similarly. At the same time, the two groups of companies were slightly negatively correlated (−0.20271) with the largest companies (over 5,000 employees), so the predictions were slightly in opposition. All groups with more than 300 employees were positively correlated with each other, *i.e.*, their opinions evolved similarly. The group of the largest companies showed, apart from a slight negative correlation, a positive correlation only with the group of companies sized 500–999.

The values of the correlation coefficients showed that the view of future development evolved similarly, and the opinions did not differ significantly. These conclusions were also confirmed by the nonparametric Friedman's test, where the *P*-value of 0.03 indicates differences between samples. The subsequent post hoc analysis proved that large companies with more than 5,000 employees were the only ones different from other groups. From the values of the average ranking, it is clear that these companies predict more pessimistic values of future development.

A similar result is evident from the cluster analysis (see Figure 1). The clustering objects were individual groups of companies. The variables based on which the cluster analysis was performed were the cyclical balance in individual periods. It is clear from the dendrogram in Figure 1 that two groups of medium-sized companies (300–499 and 500–999) behaved most similarly. Nevertheless, a group of slightly larger companies (1,000–1,999) was very close to them. Groups of the smallest companies (1–99 and 100–299) behaved very similarly. The group of the largest companies differed the most from other groups regarding future development.

Figure 1: Results of hierarchical cluster analysis of relations between companies and balance in individual period (dendrogram)



Source: Own construction

Cluster analysis was also conducted with the use of the K-means method. Based on the hierarchical method, the number of clusters was decided to be three. The same grouping was carried out: companies with up to 299 employees in the first cluster, companies with 300 to 4,999 employees in the second, and the largest companies in the third (see Table 2).

Table 2: Division of companies into clusters (cluster membership)

Case number	Size group	Cluster	Distance
1	1–99	1	86.087
2	100–299	1	86.087
3	300–499	2	75.699
4	500–999	2	69.946
5	1,000–1,999	2	96.724
6	2,000–4,999	2	150.968
7	5,000 and more	3	0

Source: Own calculation

Table 3 shows the basic characteristics of each cluster. The centroid (or a characteristic object of the cluster) was calculated for each cluster. A graph of the evolution of these centroids is shown in Figure 2.

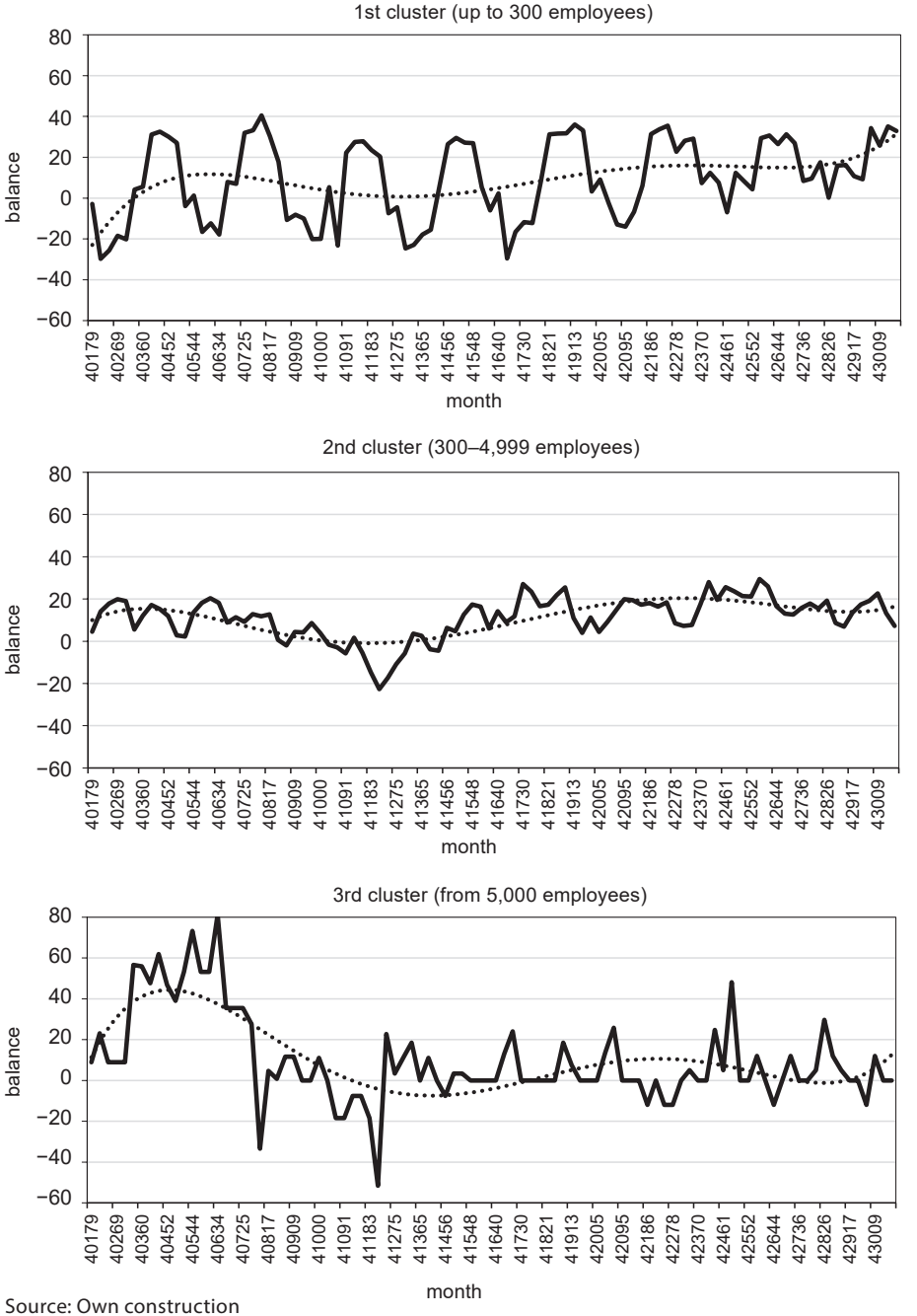
Table 3: Mean and standard deviation of individual clusters

	Cluster		
	1	**2**	**3**
Mean	9.1953	11.0502	10.1885
Standard deviation	19.4606	9.9680	21.8350

Source: Own calculation

From Figure 2 and Table 3, it is clear that the most stable and optimistic view of the development of the situation was among companies with 300–4,999 employees. Companies in the groups under 300 employees showed the least optimistic view of the development. The opinions of the companies with more than 5,000 employees were the most variable during the observed period, *i.e.*, periods with a very optimistic view were alternated by periods with a very pessimistic view of development.

Figure 2: Final centroids created by K-means method



Source: Own construction

The given results show that Hypothesis 1 can be confirmed with the correlation and cluster analysis; companies with up to 500 employees predicted the development of industrial demand in the next three months similarly, while the prediction of larger companies was different.

H_2 addressed the predictions for the next six months and assumed that these would be different for smaller companies (up to 499 employees) and larger companies (over 500 employees).

Predictions of demand development in the next six months were strongly positively correlated in the three groups of the smallest companies (1–99, 100–299, and 300–499) at the 1% level of significance (around 0.55), *i.e.*, their predictions evolved very similarly. This means that if a company has a more optimistic view in one of these groups, it is likely that the other two groups will have a more optimistic view as well.

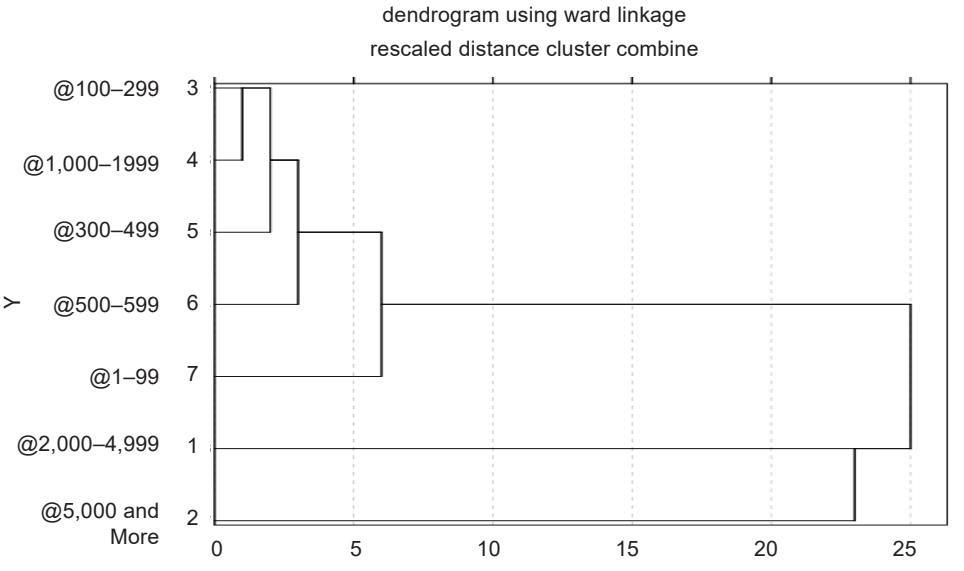
The largest companies (over 5,000 employees) showed only a weak positive correlation (0.0087) with the groups of companies of 500–999 and 1,000–1,999 employees. On the contrary, it showed a weak negative correlation with the group of companies of 2,000–4,999 employees and an even weaker negative correlation with that of 300–499 employees. These results show that the largest companies show little or no concordance with companies with a smaller number of employees.

Furthermore, whether and how companies of different sizes differed in terms of future developments was evaluated using a nonparametric Friedman test. The *P*-value of $4 \times 10 - 25$ showed significant differences between predictions. The subsequent post hoc analysis of average ranking values showed that the smallest companies (up to 99 employees) have the most pessimistic opinion on average in the given months; the large companies with more than 5,000 employees were the second. The groups of medium-sized companies (300–4,999 employees), on the other hand, had the most optimistic opinion.

The hierarchical cluster analysis provided a slightly different result (see Figure 3). Here it can be observed that the groups of small and medium-sized companies (*i.e.*, fewer than 1,999 employees) were similar. Large companies, *i.e.*, both with 2,000–4,999 and more than 5,000 employees, were significantly different.

The apparent discrepancy between the results of the nonparametric test and the results of the cluster analysis was caused by the fact that the smallest companies had the most pessimistic view of all groups in many given months, but there were months when large companies had a significantly more pessimistic view. The smallest companies joined the cluster due to an overall view of the development in the entire monitored period. In addition, it is evident from the dendrogram (see Figure 3) that if four clusters had been created, these smallest companies would have already separated and formed another cluster.

Figure 3: Results of hierarchical cluster analysis of relations between companies and balance in individual period (dendrogram)



Source: Own construction

Table 4: Division of companies into clusters

Case number	Size group	Cluster	Distance
1	1–99	1	81.241
2	100–299	1	34.291
3	300–499	1	59.392
4	500–999	1	54.663
5	1,000–1,999	1	71.707
6	2,000–4,999	2	0
7	5,000 and more	3	0

Source: Own calculation

Figure 4: Final centroids created by K-means method

Source: Own construction

The cluster analysis was also carried out using the K-means method, where the number of clusters was decided to be three based on the hierarchical method (see Table 4). The same groupings were created again, namely companies with fewer than 1,999 employees in the first cluster, companies with 2,000–4,999 employees in the second, and companies with more than 5,000 employees in the third.

Table 5 shows the basic characteristics of each cluster. The centroid (or a characteristic object of the cluster) was calculated for each cluster. A graph of the evolution of these centroids is shown in Figure 4.

Table 5: Mean and standard deviation of individual clusters

	Cluster		
	1	**2**	**3**
Mean	9.0564	17.1739	6.7270
Standard deviation	4.9571	16.0918	15.5489

Source: Own calculation

In Table 5, with the basic characteristics of individual clusters and also in the graph in Figure 5, describing the development of centroids in separate clusters, it can be observed that larger companies (2,000–4,999 employees) have the most optimistic average view of the development in the next half year. Nevertheless, these companies also have the highest standard deviation. Their predictions changed considerably over time during the observed period, from a very pessimistic to a very optimistic view. On average, the largest companies (more than 5,000 employees) have the most pessimistic views, and their views also changed significantly. The companies of the first cluster, *i.e.*, those with up to 1,999 employees, seem to be the most stable in their opinions.

The given results show that Hypothesis 2 can be confirmed thanks to correlation and cluster analysis results. Companies with up to 500 employees predicted the development of industrial demand in the next six months similarly, while the predictions of the larger companies differed.

4. Discussion

In the case of both the three-month and six-month demand prediction, it was confirmed that small and medium-sized companies estimate economic development similarly while large companies do differently. The established hypotheses:

H_1: Demand predictions of companies with up to 500 employees for the next three months are expected to differ from those of companies with more than 500 employees;

H_2: Demand predictions of companies with up to 500 employees for the next six months are expected to differ from those of companies with more than 500 employees;

can both be considered accepted.

Based on examining the relationships among data on companies' demand prediction in terms of their size, a significant correlational dependence is assumed between similar or identical demand predictions for small or medium-sized companies. More precisely, small and medium-sized companies predict economic development similarly. On the contrary, there was no statistically significant relationship between companies with more than 5,000 employees and other company size groups.

The cluster analysis found relationships between the size of the companies and the balance of the development of demand estimate (assessment of order book levels), where smaller companies reacted similarly to the prediction of industrial demand, while large companies behaved differently.

Regarding the difference in the nature of the predictions, it is evident from the results that in the shorter term, small and medium-sized companies predicted future development more optimistically than large companies. In the longer term, the optimism of small companies decreased, and large companies remained the most pessimistic.

In terms of company prognosis, it is clear that the demand estimates were affected by various macroeconomic influences. The results show that the only significant fluctuation in companies with 300–4,999 employees was the decline in the demand estimate in November 2012. At that time, the austerity tax package was passed. It is very likely that this decision strongly and negatively affected these companies' managers' views of the future development of the economy. A closer look at the course of development of the opinion of companies with 5,000 and more employees again shows the strong negative impact of introducing the austerity package in November 2012 (Vláda České republiky, 2012). An even more significant decline in this category is evident during the second quarter of 2011. When examining the possible reasons for that decline, the most likely cause was the earthquake in Japan, followed by the explosion of the Fukushima nuclear power plant, which affected fuel prices as well as industry worldwide (Brown, 2011). However, a significant positive change was seen during mid-2016, which may have been influenced by the European migration crisis solution (EP, 2017). A closer look at the development of typical opinions of companies with up

to 300 employees does not show any significant fluctuation during the period under review. The development of expectations is strongly seasonal, and very negative opinions are always manifested at the turn of the year. Still, on the other hand, the most optimistic opinions are seen during the autumn months.

In connection with the great dynamics of market changes, it is necessary to strengthen the company's competitiveness (Fabrizio and Tsolmon, 2014), which, according to some authors (Biggs, 2003; Arranz *et al*., 2019), is determined by its size. For companies to survive and build their competitive advantage, examining the external environment and obtaining the necessary resources is necessary (Dickson *et al*., 2006). Through good prediction, a company reduces its vulnerability. It increases its ability to withstand competition attacks (Calof *et al*., 2008), so it does not have to slow down or accelerate its activities unnecessarily in the context of change (Polyviou *et al.*, 2019; Melnyk *et al*., 2014). Archibugi (2015) suggests that during the economic downturn after 2008, smaller and younger companies, whose competitive strategies were based on products rather than prices, were more likely to invest in their development. Cowling *et al*. (2018) found out that after the crisis of 2008, larger firms were more affected by the downturn than smaller and younger firms; the small ones were more agile and more flexible than the larger ones. A more recent study related to COVID-19 times by Adam and Alarifi (2021) pinpointed that innovative strategies adopted by SMEs to face lockdown helped firms survive the crisis and increase their performance. The literature shows that different-sized firms use different strategies (Dvouletý *et al*., 2021a). This is, to some extent, related to the finding that small companies have a relatively more optimistic approach to future developments.

Polyviou *et al*. (2019) contribute to the discussion about coordination of the prediction process by researching the importance of an organisation's social capital and emphasise close cooperation among workplaces (geographical proximity of decision makers, flat company hierarchy, close relationships, devotion, respect), which should be complemented with deep knowledge of the company, often based on the long-term employment of its employees. Such an approach can be applied primarily to large companies where many employees provide processes with more experience. Small companies have the opportunity to associate in alliances or clusters and share certain know-how (Povolná, 2019).

Studies point out that both small and large companies improve their market knowledge through access to external knowledge provided by alliance partners (*e.g.*, Steensma *et al*., 2000; Dickson *et al*., 2006; Lohrke *et al*., 2006; Ariño *et al*., 2008; Vang Gils and Zwart, 2009). Alliances are seen as part of a company's effort to obtain the necessary resources to survive and create an advantage; satisfaction with an alliance

will be high when these resources exchanges are considered adequate (Dickson *et al*., 2006).

According to Schumacher (2011) and De Mattos *et al*. (2013), small and medium-sized enterprises (SMEs) are more likely to create a more innovative environment for creating customer value. A more optimistic view gives smaller companies better prospect for more progressive innovation, which will sustain them through the downturn (Povolná, 2019). Of course, due to limited resources, small and medium-sized enterprises are more cautious in evaluating market opportunities than large companies (Narula, 2004), and the ability to respond quickly to changes in the market environment is critical for them (Lin *et al*., 2020). Differences in the size of companies are also reflected in the possibilities of mobilising funds in favour of innovation in times of economic downturn – large companies can do this more easily; small companies then reach for local resources that they know better (Silvestri *et al*., 2018).

Juergensen *et al*. (2020) claim that policymakers determine whether entrepreneurship will thrive as they set up the measures. In terms of assessment of the public support effect, the question of firm size is not considered enough (Kersten, 2017; Dvouletý, 2021b) as it was proven that the smaller the firm, the larger the effect of public support (Criuscuolo *et al*., 2019; Alecke *et al*., 2012). OECD (2009) deems public support significant for the survival and growth of SMEs even under normal economic conditions. Politicians should structure support measures in the context of firm size (Juergensen *et al*., 2020) and the current economic situation (Nguyen *et al*., 2020; Razumovskaia *et al*., 2020). Polyviou *et al*. (2019) point out that medium-sized companies face higher requirements than small and large ones; for policymakers, they are too small to compete with large ones for attention and too large to benefit from support for small businesses.

Verstraete *et al*. (2020) point out that traditional statistical prediction methods extrapolate historical trends and seasonal fluctuations. Therefore, these cannot predict environmental macroeconomic changes in business, which usually affect demand significantly. Pettit *et al*. (2019) suggest that companies develop their processes to capture early signals of the company's emerging vulnerability (including indicators of political strength, product complexity, critical material dependency, capacity constraints) and prioritise it over rescue plans that follow after a change of market trends.

Marek *et al*. (2019) have shown that business surveys are a rich and reliable source of input data for quick estimates of national economic performance. Not only Marek *et al*. (2019) but also Biermauer-Polly and Hölz (2016) and Ptáčková (2018) point out that business cycle survey forecasts represent the personal opinion of specific managers, which should be based on the knowledge of the company's inner situation but should

also include the relevant surroundings. As indicated above, managers also see external influences in connection with several specific macroeconomic events. The CZSO states that it is the contact with respondents and users of the business surveys. Many firms use mostly aggregated data for situation analyses in their area or for feedback evaluation.

The researched data included the period 2010–2017. After 2017, the CZSO no longer published business surveys divided according to the size of enterprises. The CZSO follows the rules of the Joint Harmonised EU Programme of BCS, which is operated by the European Commission, specifically the DG ECFIN. This caused adjustments in data collection and processing and laid down new instructions for publication (EC, 2016; Lojka *et al*., 2016). Hence, the examined data are not sorted by individual industries but only by main sectors (data for the manufacturing industry were analysed). The ownership structure of companies is not clear either, *e.g.*, in terms of being part of larger business chains, which could affect predictions. For example, for the most part, the respondents mainly get information for their estimates of the business cycle survey from their own companies' internal data (Ptáčková, 2020), while parent companies make the important decisions.

Another important fact is that companies do not stand alone in the market space as they are part of certain value chains. It is essential to distinguish between short- and long-term effects of fluctuations on inter-related firms. Juergensen *et al*. (2020) claim that in the case of the COVID-19 lockdown, companies mostly faced challenges in logistics and demand ruptures in the short term. They presume that companies may anticipate various threats and opportunities in the long term depending on the company type. Therefore, policymakers should consider whole value chains when setting up public support and prevent the effects of their steps from paralysing companies (Adam and Alarifi, 2021). Razumovskaia (2020) points out that in the case of SMEs, public support should be aimed at "open innovation", Le *et al*. (2020) propose a strengthening of supply and demand linkage, support of business and cooperation of companies and trade associations among their recommendations.

5. Conclusions

A firm's size influences the firm's future activities. The study confirms that company size does have an impact on estimates of future demand. Opinions of managers leading companies of different sizes are influenced by various events. It is a pity that it is not possible to follow the opinions and attitudes of companies of different sizes in terms of future developments during the coronavirus pandemic, from both the scientific research point of view and that of practical use of survey results by managers.

The study does not comment on whether the predictions were fulfilled or not, as this was not the goal of the study. However, based on the studies (Povolná, 2019; Dovern and Jannsen, 2017), it should be mentioned that predictions work worse in times of recession and better in times of growth. Chen and Blue (2010) proved that demand signals are some of the least accurate among production planning information, but at the same time, they are some of the most important parts of these plans. Another problem is that despite the high importance of estimating demand development, there is a lack of communication among organisational units of companies (Marien, 1999).

Given that small and medium-sized enterprises significantly contribute to a country's gross domestic product (GDP) and provide employment for many people (Dvouletý, 2019), it is in the interest of governments to support their survival and growth. The definition of small and medium-sized enterprises (SMEs) is not simple because, besides other reasons, their size may vary from sector to sector or according to the level of the particular economy considered and the time frame. There is no generally accepted definition of small and medium-sized enterprises; often, SMEs are described by numbers of employees or annual turnover (Hariharan and Thangavel, 2016).

Companies could help each other with the predictions. They can join forces themselves or get help through various platforms, such as unions and associations. In traditional fields, these functions are provided by trade unions. Specialised centres have emerged over the last decade, such as innovation centres and ones providing advice and other support for small entrepreneurs.

The impact of cyclical economic change on firms is related to how they systematically build their competitive advantage and how they can fulfil their capacities through business (Anderson and Carroll, 2007). When predicting, companies should combine different indicators from different sources and rely on their own flexibility (Min and Yu, 2008).

Small and medium-sized enterprises are not burdened with large administration within the organisation so that the managers are closer to business and do more activities at once. Thus, it is possible to infer freer judgment that does not depend on the agreement of many other company members. SMEs could therefore be more open to incentives for cooperation and business development. SMEs cannot afford to get discouraged by crises, and the state can rely on them. It can be speculated that a more positive estimate of smaller companies is related to their greater flexibility (Polyviou *et al*., 2019).

Most impulses for demand variability cannot be eliminated; however, the business processes can be adapted to them, including preparation for contingencies that may disrupt operational plans (Croxton *et al*., 2002). Thus, companies can be in a position

of those who only react to a change or those who expect the change, actively prepare for it, predict it or even look for it.

Further research directions can be found in the following areas:

The predictions should be examined in greater detail, as well as the planning of their offer. It would be appropriate to determine how the predictions fit into the demand management process in different-sized companies with selected characteristics and fields. It is necessary to define demand estimates against other factors that affect trade within the prediction model of future development. Alternatively, it should be found out what role different indicators play in synchronising supply with demand. The essence of the predictions should be supplemented with the extent to which these predictions reflect actual future developments to recommend suitable indicators to companies for their plans.

Another idea for research would be to find out how companies of different sizes behave in the event of an expected decline in economic growth to clarify how these companies could be supported or identify factors that affect the resilience of companies of different sizes in times of crisis. From the point of view of support of companies by state and non-state institutions, it would be beneficial to monitor the development of predictions from the region's perspective and link them to these activities and assess the effects of this support according to firm size and other characteristics. Further, other facts have emerged during the recent years which have significantly impacted on national economies, such as the coronavirus pandemic, changes in energy prices, or the green deal.

Considerations on the use of the examined indicators should be supplemented with a methodology on how to use the predictions and consider their inclusion in systems that support decision making, especially in smaller companies. Estimates of future development could be understood as predictions throughout the supply chain. The prediction scheme should include the company's partners and consider their roles in the chain.

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