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NEW EVIDENCE ON BUSINESS TENDENCY SURVEY RESPONSES DURING COVID-19: AN ENTROPY AND DISSIMILARITY APPROACH

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Abstract: This article extends earlier research on the dynamics of expectations and assessments reported in business tendency surveys of Polish manufacturing firms. Using entropy-based and dissimilarity measures, the study examines whether the post-pandemic period conforms to standard business-cycle classifications. The empirical analysis shows that survey response distributions in the post-pandemic period do not align clearly with either expansionary or contractionary regimes. Elevated entropy and dissimilarity measures indicate persistent heterogeneity, and both expected and observed changes exhibit patterns that are inconsistent with those typically associated with economic expansion or recession phases.

Keywords: business tendency surveys; expectations; entropy; dissimilarity measures; business cycle; uncertainty

JEL classification: C82, D22, D84, E32

INTRODUCTION

This article revisits the study by Tomczyk [2023], which examined how the COVID-19 pandemic affected the dynamics of expectations and assessments reported in business tendency surveys of Polish manufacturing firms. It demonstrated that the statistical properties and concentration of survey responses, assessed using entropy and dissimilarity measures, did not correspond clearly to either expansionary or contractionary phases of the business cycle, suggesting that the pandemic period generated a distinct pattern in expectation dynamics. Using the same methodological framework, the present article extends this analysis to a

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subsequent period and a new macroeconomic environment, providing further evidence on survey response dynamics using entropy-based and dissimilarity metrics.

Entropy and dissimilarity measures, particularly the Kullback–Leibler divergence, are most commonly applied to the analysis of high-frequency financial data, where they are used to detect instability [Ishizaki, Inoue 2024] or to evaluate the performance of alternative methods for identifying anomalies in financial time series [Fan et al. 2025]. For Poland, Wędrowska [2011] employed this measure to analyse changes in household expenditure structures over time. Pawelec [2021] used a related concept—a measure of distance between structures—to study similarities and differences between the structures of household expenditures in Poland. By contrast, very few studies apply entropy, dissimilarity, or divergence measures to assess information content and uncertainty in business tendency surveys. An early contribution is Tomczyk [2011], who used entropy and dissimilarity measures to evaluate the informational content of Polish business tendency survey data by comparing expectations with subsequent realizations across multiple variables, ownership sectors, and firm-size groups. More recently, Tomczyk and Kowalczyk [2023] employed entropy-based methods as one of the methods of measuring the degree of consensus among survey respondents. To the best of my knowledge, no further entropy-based evidence on the dynamics of business survey responses for Poland or other European Union countries has been published since then.

The contribution of this study lies in demonstrating how entropy and dissimilarity based measures reveal atypical expectation and assessment patterns in business tendency surveys.

The remainder of the article is organized as follows. The paper begins by describing the data and the methodological framework, followed by a presentation of the empirical results. The subsequent section discusses the findings, and the paper concludes with a summary and an outline of possible directions for further research.

DATA AND METHODS

The data on assessments and expectations concerning major economic variables has been obtained from the monthly business tendency surveys in manufacturing conducted by the Research Institute for Economic Development (henceforth RIED) of SGH Warsaw School of Economics. The variables selected from the questionnaire are those that can be compared with aggregated Statistics Poland data, allowing survey-based expectations to be quantified for further analysis, that is, level of production, prices of goods produced, employment, financial standing, and the general economic situation. Each variable is assessed by respondents with respect to both recently observed changes and expectations for the next 3–4 months. For both assessments and expectations, respondents provide only qualitative information, reporting whether a given variable has increased, remained unchanged, or decreased. On this basis, balance statistics are calculated as the difference between the shares of respondents expecting (or observing) an increase and those expecting (or observing) a decrease in a given variable. A detailed account of the research methodology employed in RIED business tendency surveys is provided on the website [RIED, 2026]. The results are discussed in regular bulletins covering the specific sectors included in the surveys [Walczyk, 2026].

Following Tomczyk [2022], the following business-cycle phases are identified since 2009:

- expansion phase of October 2009 – June 2012;
- contraction phase of July 2012 – December 2012;
- expansion phase of January 2013 – February 2020;
- pandemic phase:[1] March 2020 – March 2022.

The post-pandemic period (April 2022–January 2026, the most recent period for which data are available) is difficult to classify *a priori* as either an expansion or contraction phase of the business cycle, as it combines opposing macroeconomic forces. On the positive side, Poland experienced a relatively resilient labour market, strong investment inflows, and effective absorption of EU funds, which supported public investment and household incomes. At the same time, these gains were at least partly offset by high inflation, tight monetary policy, supply-chain disruptions, and significant uncertainty stemming from Russia's war in Ukraine, which raised energy prices, increased fiscal pressures, and influenced business confidence indicators. It remains uncertain whether this period will ultimately be classified as an expansion or a contraction, as its assessment depends on the longer-term balance between transitory shocks and underlying macroeconomic trends.

To analyse the dynamics of respondents' expectations and assessments and compare them with earlier patterns, two sets of methods are used. First, basic descriptive statistics of balance indicators for observed and expected changes in selected RIED-surveyed economic activities are computed and compared with business-cycle phase results for 2009–2022 reported in Tomczyk [2023]. Second, entropy and dissimilarity measures are used to evaluate similarities between a priori information supplied by business tendency surveys (that is, expectations), and a posteriori information (that is, assessments). Following Wędrowska [2010], let us define structure S^n as follows:

$$S^n = [s_1, s_2, \dots, s_n]^T \in R^n , \tag{1}$$

with elements s_i ($i = 1, 2, \dots, n$) fulfilling two conditions:

[1] State of pandemic has been declared on March 14, 2020 (Regulation of the Minister of Health on the declaration of an epidemic threat in the territory of the Republic of Poland, Dz.U. of 2020, item 433). Most of the restrictions were lifted on March 28, 2022.

$$0 \leq s_i \leq 1, \tag{2}$$

$$\sum_{i=1}^{n} s_i = 1. \tag{3}$$

Structure S^n is therefore fully described by a vector of fractions (structure elements) summing to one. In the empirical part of the paper, this framework is applied to the fractions of survey respondents expecting or reporting an increase, no change, or a decrease in a given economic variable.

To evaluate information content and dissimilarity between *a priori* structures $S^n{}_p$ and *a posteriori* structures $S^n{}_q$, Shannon entropy measure (henceforth H) and Chomątowski-Sokołowski dissimilarity measure (CSD) are used as defined in Tomczyk [2023]:

$$H(S^n) = \sum_{i=1}^{n} s_i \log_2 \frac{1}{s_i} \tag{4}$$

$$CSD\left(S_q^n : S_p^n\right) = 1 - \sum_{i=1}^{n} min(\, q_i, p_i). \tag{5}$$

When entropy is defined using a base-2 logarithm as in (4), its unit of measurement is the shannon (Sh). The information content of a given structure is defined relative to the probability with which that structure is observed among all possible structures: the lower the probability of occurrence, the greater the amount of information it conveys. In business tendency surveys, higher entropy values indicate a more dispersed distribution of responses, reflecting greater heterogeneity and uncertainty among firms. Conversely, lower entropy implies a higher degree of response concentration among respondents, consistent with expectations being more closely aligned with subsequent assessments.

The Chomątowski–Sokołowski dissimilarity measure (CSD) defined in equation (5) takes values in the interval [0,1] and can be used to evaluate the extent of change between an a priori and an a posteriori response structure. In business tendency surveys, higher CSD values indicate a greater divergence between the distribution of responses in consecutive periods or between expectations and subsequent realizations, reflecting structural shifts in firms' perceptions or assessments. Lower CSD values, in turn, suggest stability and continuity in response patterns, consistent with relatively stable expectations and more predictable phases of the business cycle.

Entropy captures dispersion within a given response distribution, while the CSD measure quantifies structural divergence between expectations and realizations; jointly, they provide complementary information that balance statistics alone cannot supply.

The next section reports the results for the post-pandemic period and compares them with those obtained by Tomczyk [2023] for the 2009–2022 business cycle phases.

EMPIRICAL RESULTS

Table 1 presents the means, medians, and standard deviations of balance statistics for both observed and expected changes in selected fields of economic activity surveyed by RIED over the period from April 2022 to January 2026. Means and medians of balance statistics measure average level of optimism in each phase across assessments and expectations; standard deviation – its volatility. Also, the average percentages of “no change observed / expected” answers are calculated in each case in order to evaluate the dynamics of no-change responses, that is, “everything remains / will remain stable”. A high share of such responses may reflect difficulties in providing a definite assessment, as periods characterized by external shocks—such as the COVID-19 pandemic or the Russia–Ukraine war—introduce additional uncertainty and make it more difficult for respondents to evaluate current developments or form unambiguous expectations.

Table 1. Descriptive statistics for observed and expected balance statistics

Variable	Assessments				Expectations			
	mean	median	std dev	neutral	mean	median	std dev	neutral
Production	-6.02	-6.00	7.09	55.75	-0.47	1.20	9.70	52.88
Prices	22.37	15.80	16.50	62.07	27.75	21.50	16.31	60.04
Employment	-3.99	-3.80	3.83	75.03	-2.93	-3.10	3.85	72.82
Financial situation	-10.86	-10.60	6.80	64.74	-6.93	-6.60	8.48	61.37
General situation of the economy	-43.30	-35.10	16.64	47.97	-37.83	-31.10	20.10	44.96

Source: own calculations; note: std dev – standard deviation; neutral – average percentage of “no change observed / expected” answers

In line with results obtained previously, expectations remain systematically less pessimistic than assessments, a pattern already visible across all business cycle phases analysed in Tomczyk [2023]. However, unlike earlier expansions (2009–2012, 2013–2020), the post-pandemic period does not display positive mean or median balances for expectations across most questions, and the positive mean and median balances reported for prices also reflect an adverse outcome, since far more respondents expect prices to increase than to decrease. For some variables (notably prices), post-pandemic means are closer to pandemic values than to expansionary ones, despite the absence of pandemic restrictions. For another set of variables (firm’s level of production and its financial situation), post-pandemic dispersion is closer to pandemic levels than to earlier expansions, indicating persistent heterogeneity in firm responses.

As far as “no change” shares of responses is concerned, they are consistently high, confirming that response inertia is a structural feature of business tendency surveys. However, the post-pandemic period exhibits systematically higher percentage of “no change observed / expected” answers for several variables, particularly for assessments (often exceeding 60–70%). The combination of low average balances and a high incidence of “no change” responses suggests that respondents face substantial difficulty in forming clear directional views—either optimistic or pessimistic—in both expectations and assessments of recent changes.

In Table 2, summary statistics for Shannon’s entropy measure H defined by (4) are presented.

Table 2. Summary statistics for entropy measure H

Variable	Assessments			Expectations		
	spread	mean	standard deviation	spread	mean	standard deviation
Production	0.2898	1.4118	0.0652	0.2541	1.4463	0.0598
Prices	0.4504	1.1632	0.1071	0.4520	1.1444	0.0835
Employment	0.2353	1.0493	0.0654	0.3169	1.1057	0.0794
Financial situation	0.4573	1.2476	0.0952	0.3349	1.3198	0.0774
General situation of the economy	0.5335	1.1459	0.1303	0.6628	1.2500	0.1691

Source: own calculations

In the post-pandemic period, mean entropy across most questions persists at levels similar to 2009-2022, while spreads are often comparable to or higher than those observed during the pandemic. Notably, entropy does not revert to expansion-type levels, despite the absence of pandemic restrictions. This indicates that firms’ responses remain highly dispersed. Expectations and assessments show similar entropy levels, suggesting that uncertainty affects both current evaluations and predictions. Persistently high entropy signals structural rather than transitory uncertainty, consistent with overlapping shocks and an unstable information environment.

In Table 3, summary statistics for CSD measure defined by (5) are shown.

Table 3. Summary statistics for CSD

Variable	mean	median	standard deviation
Production	0.0795	0.0775	0.0452
Prices	0.0846	0.0715	0.0503
Employment	0.0487	0.0405	0.0286
Financial situation	0.0641	0.0580	0.0360
General situation of the economy	0.0957	0.0835	0.0597

Source: own calculations

In the post-pandemic period, CSD values remain elevated for most questions compared with pre-pandemic expansions and contractions, though typically below pandemic peaks. Relatively high CSD values signal greater divergence between expectations and outcomes, and suggest that survey response distributions have not reverted to their pre-2020 structure, even several years after the initial pandemic shock. The sustained dissimilarity points to lasting changes in firms' perception and reporting behaviour, rather than a temporary disturbance confined to the pandemic itself.

DISCUSSION

As in the pandemic phase, the post-2022 period cannot be readily interpreted using standard business-cycle classifications based solely on balance statistics. This is confirmed in recent analyses of business tendency survey data which report the absence of clear upward or downward trends, frequent shifts in the direction of cyclical movements, and low fluctuation amplitudes [Walczyk 2026]. Current Statistics Poland analyses [2026] emphasize the uncertainty associated with the impact of the war in Ukraine, inflation, and geopolitical tensions, resulting in inconsistent signals regarding the phase of the business cycle.

Traditional indicators provide weak and inconsistent signals, whereas entropy and dissimilarity measures offer a clearer characterization of the post-2022 period as atypical relative to conventional business-cycle phases. The combination of low mean balances, high entropy, and elevated dissimilarity points to an environment in which firms face sustained uncertainty rather than a clearly defined expansionary or contractionary regime. Unlike earlier downturns, this uncertainty affects both assessments and expectations to a similar extent, suggesting limitations in firms' ability to form directional forecasts.

A particularly high share of "no-change" responses may indicate economic stabilization; however, more plausible explanations include heightened uncertainty and caution (a "wait-and-see" approach) or increased heterogeneity across firms within a narrow margin, whereby small increases and decreases are reported as "no change."

Overall, the post-pandemic phase appears to represent a distinct and unsettled regime rather than a return to pre-pandemic cyclical regularities. From a policy perspective, the results suggest that standard business cycle indicators may be insufficient to classify the 2022–2026 period unambiguously as either an expansion or a contraction of the business cycle. Instead, entropy- and dissimilarity-based measures provide a complementary perspective by capturing uncertainty-driven dynamics. Consequently, incorporating indicators based on entropy and dissimilarity into the routine monitoring of business tendency surveys may improve the monitoring of uncertainty-driven slowdowns and help assess the effectiveness of stabilization policies.

CONCLUSIONS AND DIRECTIONS FOR FURTHER RESEARCH

As demonstrated in descriptive statistics, the post-pandemic period (March 2022–January 2026) departs from previous patterns in business cycle phases. Mean balances are predominantly negative or close to zero for both assessments and expectations, while the share of "no change" responses increases markedly for several questions, often exceeding levels observed in earlier phases. At the same time, dispersion remains elevated, suggesting heterogeneous firm-level assessments and expectations despite the absence of formal recessionary classification.

Entropy measures confirm systematic differences across phases. In the post-pandemic period, entropy remains high and does not return to levels typical of earlier expansions. Differences between assessments and expectations are small, suggesting broadly shared uncertainty. CSD values, although below pandemic peaks, remain elevated relative to pre-pandemic periods, indicating that response distributions have not fully reverted to their earlier structure, despite the passage of time since the pandemic shock.

In summary, the post-pandemic period cannot be clearly aligned with the expansionary or contractionary patterns observed over 2009–2022, indicating a distinct configuration. Whether this period will ultimately be classified as an expansion or a contraction remains uncertain, given the lack of a clear and consistent signal across recent business survey data.

Future research could extend the present analysis in several directions. First, objective aggregated data could be combined with respondents' subjective survey assessments to evaluate the degree of consistency between expectations and actually observed changes. The selection of questions from the RIED questionnaire allows for such comparisons, as all five variables—production, prices, employment, financial standing, and the general economic situation—have counterparts in monthly Statistics Poland data. Linking survey-based entropy indicators with observed macroeconomic outcomes could help assess their predictive content. However, establishing close analogues for the RIED variables in Statistics Poland reports may prove challenging due to differences in definitions between the two data sources.

Second, entropy and dissimilarity measures could be applied to other sectors for which survey data are available through the RIED questionnaires—namely agriculture, trade, construction, finance, and households—allowing for cross-sector comparisons of expectation dynamics. In addition, the use of survey data from other EU countries would enable future cross-country comparative analyses.

An important direction for further research concerns the potential of entropy- and dissimilarity-based indicators to improve the analysis and prediction of business-cycle dynamics. Future studies could examine whether changes in entropy or divergence measures systematically precede turning points in real economic activity, thereby providing early signals of expansions or contractions that are not captured by conventional balance statistics. Linking survey-based entropy measures with established dating procedures may help assess their dynamic properties and clarify whether dispersion and uncertainty in expectations contain predictive information about the business-cycle phases.

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