Can the Business Tendency Survey Predict the Economic Indicators in Czechia?

Veronika Ptáčková[1] | *University of Economics, Prague, Czech Republic*
Jakub Fischer | *University of Economics, Prague, Czech Republic*

Abstract

In uncertain times, it is crucial to have some statistics, which can help with the prediction of future development in the national economy. Business Tendency Survey is one of the most essential and favourite tools for predictions in economic statistics. The article aims to determine which confidence indicators help predict the Czech economic development and which base of the confidence indicators is the best for making predictions. Using the Granger causality test, we prove the Business Tendency Survey indicators are beneficial for predictions. The economic sentiment indicator and the confidence indicator for industry predict the gross value added better than the gross domestic product. The long-term average is a slightly better base than the base indices. The predictions are most accurate in the horizon of two quarters. Individual composite indicator for the industry well predicts both the industrial production index (for the next month) and the gross value added in the industry (for the next quarter).

Keywords

Business Tendency Survey, prediction ability, gross domestic product, business cycle, base indices

JEL code

C10, C22

INTRODUCTION

The development of the economy in the European Union is a frequently discussed issue. The Business Tendency Survey is one of the standard data sources used. The European Commission coordinates its methodology. Thanks to this, we obtain harmonised qualitative data across all European countries. The weighting scheme (during the construction of the indicators) and the base are disputable parts of the calculation. The European Commission uses the long-term average (over the period 1990–2018). For countries where the European Commission has missing values, the period starts at the earliest available data point onwards to 2018. Every January, the European Commission recalculates the indicators. They have to add the values from the ending year (i.e. in January 2020, the European Commission

[1] University of Economics, Prague, Faculty of Informatics and Statistics, W. Churchill Sq. 4, 130 67 Prague, Czech Republic. Also Czech Statistical Office, Na padesátém 81, 100 82 Prague 10, Czech Republic. Corresponding author: e-mail: veronika.ptackova@vse.cz, phone: (+420)224095435.

is going to review the European Sentiment Indicator so that it will be based on a simple average stretching from 1990 to 2019). However, some countries have a different base. We had a simple average of 2005 in the Czech Republic by the end of 2019. From the beginning of 2020, the Czech Statistical Office uses the long-term average. In Italy, they use the simple average of 2010, while the simple average of 2015 is used in Germany and Slovakia (Ptáčková, Štěpánek, Hanzal, 2019; Czech Statistical Office, 2020).

The Business Tendency Survey has two forms of publishing the results: (i) base indices, and (ii) balance, respectively. This paper has two aims. The first is to verify which economic indicators are best predicted by business cycle surveys. We will compare predictions of gross domestic product, gross value added, the industrial production index and gross value added in industry. The second objective will be the base of the BTS indicators. Does the base affect the results? If so, which base is best for predictions in the Czech economy?

We divided the article into three chapters. The literature review is the first one. The second one consists of methodology and data, while the last part allows readers to become informed about the most relevant results of the calculation. After that, we discuss the recommendation of the base used.

1 LITERATURE REVIEW

The Business Tendency Survey (BTS) is a popular tool for predictions of the economy. The question is posed as to what this survey forecasts. The respondent should evaluate the current situation and changes in the ensuing three (or six) months (for example, the development of the national economy, financial situation or employment). Businessmen or consumers choose (typically) from three options: "decrease", "stable" or "growth". The Business Tendency Survey is a rich and reliable source for quick estimates of the results of the national economy - both as a whole and in individual sectors. Unfortunately, they are rarely used in practice (Marek, Hronová, Hindls, 2019).

1.1 Predictions of the economic indicators

The Business Tendency Survey is an essential and favourite tool for the predictions of the economic variables – Gross Domestic Product (GDP), Gross Value Added (GVA) or business cycle. Modugno, Soybilgen, Yazgan (2016) created a model re-estimation. The model has good results during a global economic crisis, but it worsens after the crisis.

Sorić and Marković (2010) discuss the fact that indicators calculated from the Business Tendency Survey responses are leading indicators for macroeconomics variables. However, they have to predict the selected variables. Balances which analysts estimate from Business Tendency Survey are an essential tool for the forecasting of and support for policy decisions (Cesaroni and Iezzi, 2015). Hainisch and Scheufele (2017) warned that data revisions could affect the quality of the survey data and the forecasting.

Bergström (1995) found the relationship between the industrial production growth rate and the Swedish indicators from the Business Tendency Survey. Österholm (2013) confirmed this conclusion. The survey data help with the Swedish short-term forecast of GDP growth. The author informs that it has essential informational value. Martinsen, Ravazzolo and Wulfsberg (2014) predicted GDP growth for the selected regions and sectors. They used a factor model approach for these predictions. Zeman, Lojka and Obst (2016) analysed the possibilities of using confidence indicators for the development of the q-o-q GVA changes by using Vector Autoregressive Models and co-integration analysis. In Czech data, they discovered no relationship between the questions and confidence indicator of the industries (except for the manufacturing industry where they identified significant short-term relationship).

Bruno and Lupi (2004) focused on the business cycle turning points and the prediction ability of these indicators. According to Cesaroni and Iezzi (2015), analysts should use an accurate indicator calculated from the selected question (e.g. the number of employees, the company's expectation about the economic

development or investments) for short-term predictions. But the indicators help with the policy decisions and improve the forecasts, too. Lehmann and Weyh (2016) analysed only employment expectations. They confirmed that these results help with employment growth forecasting. Abberger (2005) calculates that responses to capacity assessment are essential for the evaluation of investment.

Białowolski (2014) changes the approach of the construction confidence indicator. He warns that this concept should be tested for a particular country. But they confirmed that we could use indicators for forecasting the main macroeconomic variables. Marek, Hronová and Hindls (2019) have shown that views on developments in industry and construction with a time lag assist with the predictions of the quarterly gross value added of the national economy. The confidence indicator in trade and services was not significant. The authors argue that the respondents in the mentioned sectors have a different view of the assessment and prediction of their business development. At the same time, they remind of the dominance of manufacturing industries in the Czech economy.

1.2 Relationship of industrial production index and gross value added in industry

The monthly industrial production index (IPI) is the first approximation of the development of gross value added in the industry as the IPI for the last month of the given quarter is released around 20 days before the estimate of gross value added for individual CZ-NACE sections. There are several methodological differences between IPI and gross value added.[2] Based on the empirical analysis of the coherence of indicators, Fischer et al. (2014) note that the IPI is much closer to the development of industrial enterprises' sales at the level of individual CZ-NACE subsections than the gross value added in these subsections. However, at the level of the whole industry (sections B+C+D) the IPI is strongly correlated with the development of revenues from industrial activity, total production (gross output) of industry and the gross value added of the industry as well (Fischer et al., 2014).

2 DATA AND METHODOLOGY

2.1 Business Tendency Survey

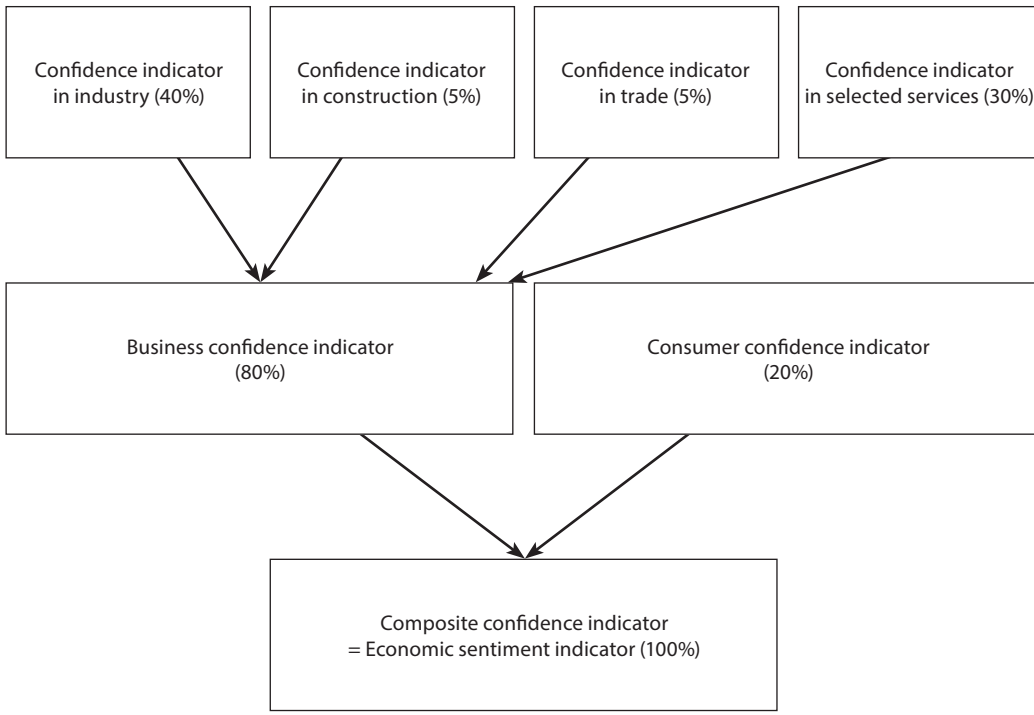
The Business Tendency Survey defines confidence indicators, which are useful for the economic sentiment indicator construction (see Figure 1).

- The composite confidence indicator (economic sentiment indicator) is calculated as the weighted average of seasonally adjusted confidence indicators in the industry, trade, construction and in the selected service and consumer confidence indicator.
- The business confidence indicator is calculated as the weighted average of seasonally adjusted confidence indicators in industry, construction, trade and selected services:
  - The confidence indicator in the industry is calculated as the simple average of seasonally adjusted balances of three questions (the assessment of total demand, assessment of stocks of final production – with an inverted sign – and the expected development of production activity).
  - The confidence indicator for construction is calculated as the simple average of the assessment of total demand and the expected development of employment.
  - The confidence indicator in trade is calculated as the simple average of the assessment of the economic situation, the evaluation of stocks (with an inverted sign) and the expected development of the economic situation.
  - The confidence indicator in selected services is calculated as the simple average of the assessment of the economic situation, the assessment of demand and expected demand.
- The consumer confidence indicator is calculated as the simple average of the expected financial situation of consumers, the expected total economic situation, expected total unemployment (with an inverted sign) and savings expected in 12 months (Czech Statistical Office, 2019).

[2] See ECB (2016).

Figure 1 summarizes previous information about the Economic sentiment indicator construction. One can see the weights of the individual confidence indicator in brackets. The European Commission defines mentioned weighting scheme.

Figure 1 Weighing system for the construction of composite confidence indicator (in %)



Source: Czech Statistical Office (2019)

2.2 Granger causality test

We can use the Granger causality test to determine whether a concrete time series is beneficial for the forecasting of another one. The main idea of this test is: if the variable X is causal for variable Y in the Granger way, we can say that the information from variable X is essential for accurate predictions of variable Y (Wang, 2019).

The test uses two stationary time series (X_t and Y_t). The time series Y_t is correlated with lagged values of X_t. The test helps with the understanding of how the change in the one time series impact the changes in the second time series – it does not matter which one is causation and which one is a consequence (Hušek, 2007). The null hypothesis means that variable X does not influence variable Y in the Granger way. Formula (1) describes the restricted regression model:

$$Y_t = \propto_0 + \sum_{i=1}^{m} \propto_i Y_{t-i} + \mu_t , \tag{1}$$

where Y_t and Y_{t-i} are two continuous observations of the time-series in times t and t-i, respectively, α_0 and α_i are coefficients of the toughness of the dependency between Y_t and Y_{t-i} and μ_t is a non-systematic (white-noise) component of the model.

The next equation is different than the first one. There are lagged values of the time series X used as an explanatory variable. This Formula (2) is an unrestricted regression model:

$$Y_t = \propto_0 + \sum_{i=1}^{m} \propto_i Y_{t-i} + \sum_{j=1}^{m} \beta_j X_{t-j} + \mu_t , \tag{2}$$

where X_t and Y_t are values of the time series X and Y in the time t, the α_0 is a linear constant (we have to estimate this value), μ_t is the white noise sequence, α_i and β_j are coefficients of the variables X_t and Y_t and m is the number of lagged terms (Wang, 2019). Granger causality test uses the past values of both time series – X_t and Y_t. It is important to mention again that we use the known (past) values of the economic indicators and differently lagged values of the Business Tendency Survey indicators.

The test compares the unrestricted model and restricted model. The analysis is focused on data from January 2003 until December 2018 for all sectors (industry, construction, trade, and selected services, respectively) and consumers in the Czech Republic. All the computations were performed using the R language and environment for statistical computing and graphics (R Core Team, 2014).

We consider the following economic indicators:

- economic sentiment indicator (qualitative data, BTS, base indices = base in 2005, 2010, 2015, long-term average),
- business confidence indicator (qualitative data, BTS, base indices = base in 2005, 2010, 2015, long-term average),
- the individual confidence indicator in the industry (qualitative data, BTS, base indices = base in 2005, 2010, 2015, long-term average),
- gross domestic product (quantitative data, national accounts),
- gross value added (quantitative data, national accounts),
- industrial production index (quantitative data, short-term statistics, base indices = base in 2005, 2010),
- gross value added in the industry (quantitative data, national accounts, base indices = base in 2005, 2010).

Economic sentiment indicator, the business confidence indicator, individual confidence indicators in the industry and the IPI are published monthly. That is why we recalculate these values quarterly (for comparison with the gross domestic product and gross value added). We calculate the simple average of the three-monthly values of the mentioned economic indicators. We have to adjust data (seasonally) using the X-13 Census ARIMA procedure. After that, we extract a linear trend from data. It means that all time-series were de-trended thanks to the decomposition (we get data devoid of a trend after this step). Before modelling, it is necessary to remove the seasonality (Granger, 1979). We test the stationarity of all-time series using the augmented Dickey-Fuller test. This test is based on the analysis of the first-order autoregressive process AR(1) (Box and Jenkins, 1970).

This paper follows the paper from Ptáčková, Štěpánek and Hanzal (2019). They concluded that we should use the base indices within the base given as a simple average of 2005, 2010 or 2015 years, respectively for the economic indicators prediction (in terms of achieving the tightest relations between the obtained and predicted values of the economic indicators). As in the mentioned article, the decisions will be made using only the p-values and F-statistics. We will focus only on the one-way relationship: it means that the results from the Business Tendency Survey describe/predict the values of the economic indicators (GDP, GVA, IPP).

3 RESULTS

Firstly, we focus on the relationship between economic sentiment indicator in time t and gross domestic product, gross value added, respectively, in time $t + 2$. It means that the information from the BTS

can help to predict the development of the economic indicators in the following six months. In Table 1, ESI_BI is the economic sentiment indicator in the base indices form (where the base is the simple average of the monthly results in 2005, 2010, or 2015, respectively). ESI_LTA is economic sentiment indicator in the base indices form (where the base is the simple average of the monthly results from January 2003 to December 2017).

In Table 1, ESI shows significant results for both economic indicators: gross value added and gross domestic product. But we have a better relationship between ESI and gross value added in terms of achieving the tightest relations between the obtained and predicted values of the economic indicators.

Table 1 Granger causality tests – ESI (*t*), GDP, GVA (*t* + 2)

	ESI_BI (2005, 2010, 2015)		**ESI_LTA (2003–2017)**	
	***p*-value**	**F-test**	***p*-value**	**F-test**
GDP (BI = 2005)	0.0008	12.4980	0.0003	14.5380
GDP (BI = 2010)	0.0008	12.4840	0.0003	14.5920
GVA (BI = 2005)	0.0000	31.2120	0.0000	35.7380
GVA (BI = 2010)	0.0000	31.1390	0.0000	35.5930

Source: Own construction

Secondly, we analyse the prediction ability of the business confidence indicator in time *t* and the gross domestic product or gross value added in time *t* + 1 (in the next three months). In this case, we do not have significant results for any combination (see Table 2).

Table 2 Granger causality tests – BCI (*t*), GDP, GVA (*t* + 1)

	BCI_BI (2005)		**BCI_BI (2010)**		**BCI_BI (2015)**		**BCI_LTA (2003–2017)**	
	***p*-value**	**F-test**	***p*-value**	**F-test**	***p*-value**	**F-test**	***p*-value**	**F-test**
GDP (BI = 2005)	0.3015	1.0840	0.4457	0.5895	0.3884	0.7549	0.3809	0.7793
GDP (BI = 2010)	0.2532	1.3312	0.3837	0.7703	0.3312	0.9599	0.3244	0.9876
GVA (BI = 2005)	0.3375	0.9350	0.6704	0.1830	0.5365	0.3866	0.5189	0.4210
GVA (BI = 2010)	0.3596	0.8527	0.6973	0.1528	0.5625	0.3392	0.5447	0.3711

Source: Own construction

After that, we continue in the calculation, and we focus on the next period: gross domestic product and gross value added in time *t* + 2 (in the next six months). We have better results for the long-term average. Still, we should consider the following: the business confidence indicator helps with the predictions of the key economic indicators in the following six months. We obtain similar results for this when we analyse the partial confidence indicator in the industry instead of the business confidence indicator.

Table 3 Granger causality tests – BCI (*t*), GDP, GVA (*t* + 2)

	BCI_BI (2005)		BCI_BI (2010)		BCI_BI (2015)		BCI_LTA (2003–2017)	
	***p*-value**	**F-test**	***p*-value**	**F-test**	***p*-value**	**F-test**	***p*-value**	**F-test**
GDP (BI = 2005)	0.0015	11.1520	0.0050	13.5870	0.0007	12.8400	0.0007	12.7230
GDP (BI = 2010)	0.0016	10.9760	0.0005	13.5940	0.0007	12.7740	0.0008	12.6480
GVA (BI = 2005)	0.0000	26.9770	0.0000	34.9110	0.0000	32.3280	0.0000	31.9390
GVA (BI = 2010)	0.0000	26.8170	0.0000	34.2760	0.0000	31.8790	0.0000	31.5140

Source: Own construction

In the next step, we try to find the best base for the individual confidence indicator in the industry (CI_BI) and industrial production index (IPI) in the time *t* + 1 (next month), …, *t* + 6 (next six months). It is essential to mention that we analyse monthly data.

Table 4 Granger causality tests – CI_BI (*t*), IPI (*t* + 1, …, *t* + 6)

	CI_BI (2005, 2010, 2015)		CI_LTA (2003–2017)	
	***p*-value**	**F-test**	***p*-value**	**F-test**
IPI (t + 1)	0.0029	9.1179	0.0029	9.1179
IPI (t + 2)	0.0050	8.0605	0.0050	8.0605
IPI (t + 3)	0.0160	5.9068	0.0160	5.9068
IPI (t + 4)	0.0649	3.4485	0.0649	3.4485
IPI (t + 5)	0.0508	3.8670	0.0508	3.8670
IPI (t + 6)	0.6281	0.2354	0.6281	0.2354

Source: Own construction

In Table 4, we have significant results (in terms of getting the tightest relations between the obtained and predicted values of the economic indicators) for these combinations: individual confidence indicator in the industry (based in 2005, 2010 and 2015) and IPI (*t* + 1), IPI (*t* + 2), individual confidence indicator in the industry (LTA) and IPI (*t* + 1), IPI (*t* + 2). The results are equal when we use different bases or long-term average for the confidence indicator.

Finally, we calculate the Granger causality tests for the individual confidence indicator in the industry (based in 2005, 2010 and 2015) and the gross value added in the industry. Table 5 describes the results of the Granger causality test. We can say that we have essential results for the combined gross value added in the industry in the time *t* + 1 (the number of the GVA in the industry is in a million Czech crowns from the national accounts – constant prices) and confidence indicator in the industry. Again, it does not matter which base we use.

Table 5 Granger causality tests – CI_BI (*t*), GVA in the industry (*t* + 1, *t* + 2, *t* + 3)

	CI_BI (2005)		CI_BI (2010)		CI_BI (2015)		CI_LTA (2003–2017)	
	***p*-value**	**F-test**	***p*-value**	**F-test**	***p*-value**	**F-test**	***p*-value**	**F-test**
GVA (t + 1)	0.0014	11.2740	0.0014	11.2740	0.0014	11.2740	0.0003	14.5400
GVA (t + 2)	0.7669	0.0887	0.7669	0.0887	0.7669	0.0887	0.7808	0.0782
GVA (t + 3)	0.7611	0.0933	0.7611	0.0933	0.7611	0.0933	0.8086	0.0592

Source: Own construction

DISCUSSION AND CONCLUSION

The Business Tendency Survey is an important data source indicating the current and future development of the national economy. A lot of analysts confirm that it works. Österholm (2013) used BTS results for the short-term forecast of GDP growth. Marek, Hronová and Hindls (2019) confirm that these results help with the predictions in the industry and construction sector.

In this paper, we focus on finding the best base for the predictions (in terms of getting the tightest relations between the obtained and predicted values of the economic indicators) of the Czech economy. By the Granger causality test, the economic sentiment indicator has significant results for the predictions of the gross domestic product and gross value added in the next six months. The business confidence indicator has the same predictive results. In both cases (economic sentiment indicator and business confidence indicator), we obtain higher *F*-values for the gross value added than for the gross domestic product. The individual confidence indicator in the industry well predicts the monthly industrial production index. The results are significant for the following month and the two months predictions, regardless of the base we used.

In conclusion, we proved that we could use the Business Tendency Survey for the predictions of economic indicators. When we talk about the gross domestic product, we can recommend using the long-term average as the base, but there is no significant difference comparing to the base indices. In this analysis, we see that the BTS is better for GVA predictions compared to GDP. Also, we can use the confidence indicator in the industry for the gross value added in the industry predictions.

In the next research, we can improve the weighting system for getting better results of the economic sentiment indicator. Furthermore, we plan to use the results from the survey-on-survey, which is currently provided in co-operation with the Czech Statistical Office.

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