Economic Commentary

The Business Survey's new indicator of economic activity - an early temperature gauge of the Swedish economy

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Summary

This Economic Commentary[1] presents a new indicator of economic activity based on the Riksbank's Business Survey. The Business Survey collects information about the Swedish business sector for use in the Riksbank's policy work. The new indicator of economic activity is a summarising measure of this information and aims to provide early signals on the development of the economy. The indicator correlates with GDP growth and has good predictive power for growth one quarter ahead. The commentary also examines the fact that GDP data are regularly revised. The results show that the indicator provides reliable signals for both the first and latest published GDP growth figures. It gives a similar picture of economic activity as other survey-based economic measures, which supports the interpretation that the Business Survey indicator can be used to estimate the state of the economy. Overall, the Business Survey and the information summarised in the indicator are deemed to provide both early and reliable insights into cyclical fluctuations of the economy.

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[1] Economic Commentaries are brief analyses of issues with relevance for the Riksbank. They may be written by individual members of the Executive Board or by employees at the Riksbank. Employees' commentaries are approved by their head of department, while Executive Board members are themselves responsible for the content of the commentaries they write.

Important to have timely data on the development of the economy

It is important for decision-makers to have access to timely information on economic conditions. Official statistics are published with some delay, so it is important to be able to capture signals about economic developments in other ways. A common method is to use different types of survey data. Like many other central banks[3] , the Riksbank therefore conducts a Business Survey with the aim of supplementing the official statistics with qualitative data collected directly from the business sector. The Business Survey provides the Riksbank with information on the current state of the economy via questions concerning companies' production, sales, employment and profitability. It also provides indications of the movement in the economy by highlighting the expectations of companies and how they plan to act based on these expectations. The results are made available one to two months before official statistics on, for example, GDP growth, which means that they can be used at an early stage to support the Riksbank's analyses.

To obtain an overall picture of the information provided by the companies, the Riksbank has produced an indicator of economic activity.[4] It will be published in the Riksbank's Business Survey Report and will primarily serve as a summarising measure of the companies' responses. This Commentary presents an analysis that examines whether the Business Survey indicator can also be used as a measure for estimating actual developments in economic activity. The analysis covers how well the Business Survey indicator reflects GDP growth and how useful the indicator is as a predictor of GDP growth. In addition, the indicator is compared with other indicators that are based on survey data from the business sector. Unlike other company-oriented surveys, the sample for the Riksbank's survey is concentrated to a few companies that dominate their industries. It is therefore interesting to examine how the Business Survey indicator relates to other survey-based measures that have a much larger sample size. Such a comparison tells us something about the accuracy of the survey and also how reliable the Business Survey indicator is in relation to other available indicators.

The Business Survey collects information through in-depth interviews

Since 2007, economists at the Riksbank have been meeting with company representatives to discuss their company's current situation and how the situation is expected to change going forward. The advantage of gathering information through dialogue is that the interviewer can ask follow-up questions on the basis of these assessments. The respondent's qualitative descriptions are complemented by quantitative answers to a set of core questions to be answered during the interview. In this way, the Busi-

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[3] For example, Bank of Canada, Bank of England, Federal Reserve and Norges Bank.

[4] The Riksbank has previously published an indicator of economic activity based on the Business Survey. It weighted eight questions using so-called Winkler weights, where the weight was based on how well each series could predict GDP growth. See Hokkanen, Melin & Nilsson (2012).

ness Survey provides an in-depth picture of the current situation in the business sector while collecting measurable data that shows how the situation changes over time.[5]

During a survey round, the Riksbank meets between 40 and 50 of the larger companies from the most important sectors of the Swedish economy. Despite a somewhat limited sample size, previous evaluations of the Business Survey have shown that the time series of quantitative responses are well aligned with official statistics on each question.[6] This can be explained by the fact that the Swedish business sector is dominated by a relatively small number of players, which means that a smaller sample can cover a large part of the business sector.

A new indicator of economic activity

The companies' responses to eleven of the Survey's central questions form the basis of the Riksbank's new indicator of economic activity. The questions concern companies' perception of the economic situation, new orders, production/sales, employment, access to external financing, profitability and investment plans (see Table 1). The method chosen to summarise companies' responses to these questions is principal component analysis. By identifying dominant patterns and relationships between a set of variables, principal component analysis can filter out noise and extract common movements from a dataset.[7] The method is considered to be an efficient way of summarising information and is particularly advantageous when the dataset is based on survey data as changes in individual series cannot always be assumed to be relevant to, in this case, the overall perception of the companies.[8] The analysis generates a number of underlying variables - principal components - where the first principal component explains most of the variation in the dataset. In this way, the method can reduce the problem of several of the included series being highly correlated with each other (multicollinearity) while preserving as much of the variation in the data as possible. The first principle component constitutes the Business Survey indicator[9] and it is therefore advantageous to use the indicator in different types of analyses instead of the individual questions.

The Business Survey is conducted three times a year (February, May and September) and therefore the series have first been interpolated to quarterly data (for quarter four).[10] The series are weighted by company size and are seasonally adjusted in the

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[5] The respondents' quantitative responses are coded as "1" for "better" or "increase", "0" for "unchanged" or "normal", and "-1" for "worse" or "decrease". The net figures for each question and survey round are weighted by company size (number of employees) and form a point in each question's time series.

[6] Frohm & Tibblin (2015)

[7] For a more detailed description of principal component analysis, see, for example, Jolliffe (2002).

[8] Stock & Watson (2006).

[9] The Business Survey indicator explains 57 per cent of the variation in the dataset. This means that the information extracted and summarised in the indicator retains 57% of the original variation between the variables included in the indicator.

[10] Until 2016, the interviews for quarter one were conducted in December and January. Between 2017 and 2019, the interviews were conducted in February, May and October/November. For these years, the third quarter has been interpolated.

sense that respondents are asked to provide seasonally adjusted responses. The Business Survey indicator is then calculated using principal component analysis, from 2008 quarter 3 to the latest survey period.[11] The Business Survey indicator has been standardised to a mean of zero and a standard deviation of one, which means that a negative value indicates that the situation is worse than normal and a positive value that it is better than normal.

Table 1. Series included in the Business Survey indicator

Question	Horizon
Economic situation	Now
Economic situation	Six months ahead
Production/sales	Previous three months
Production/sales	Next three months
New orders	Previous three months
New orders	Next three months
Employment	Previous three months
Employment	Next three months
Investment plans	Six months ahead
Access to external financing	Previous three months
Profitability	Now

The robustness of the Business Survey indicator over time

The answers to the Business Survey questions are never revised, but the Business Survey indicator is re-estimated after each survey round. The weights given to the variables in the indicator by the principal component analysis may therefore vary depending on when the estimate is carried out. To examine the extent to which the indicator is revised when the dataset is updated with new observations after a completed survey, it has been estimated in real time for each quarter from 2013 to 2023 (see Figure 4 in the Appendix). It is natural that the indicator is revised more in the beginning as new information is added to a smaller dataset, but as the figure shows, the revisions become smaller as the dataset becomes more comprehensive. Although the weights vary slightly among the first estimates, the real-time estimates show that the indicator is a robust summarising measure of the companies' responses that is not particularly sensitive to new information.

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[11] In the early years, questions were added/removed. From the third quarter of 2008, series of the questions included in the Business Survey indicator are available.

The Business Survey indicator provides a similar picture of economic activity as other measures

Figure 1 illustrates how the Business Survey indicator relates to four already available survey-based economic measures: The National Institute of Economic Research's (NIER) Economic Tendency Survey, its confidence indicator for the total business sector (BS confidence indicator), the purchasing managers' index (PMI) for the service sector and the PMI for the manufacturing industry.[12] These indicators are also based on data from the business sector (with the exception of the NIER's Economic Tendency Survey, which targets both companies and households) but are based on a much larger sample. [13] It therefore enhances the credibility of the Business Survey that the information summarised in the Business Survey indicator gives a similar picture of economic activity as those measures.

Figure 1. Survey-based indicators of economic activity
Standardised units
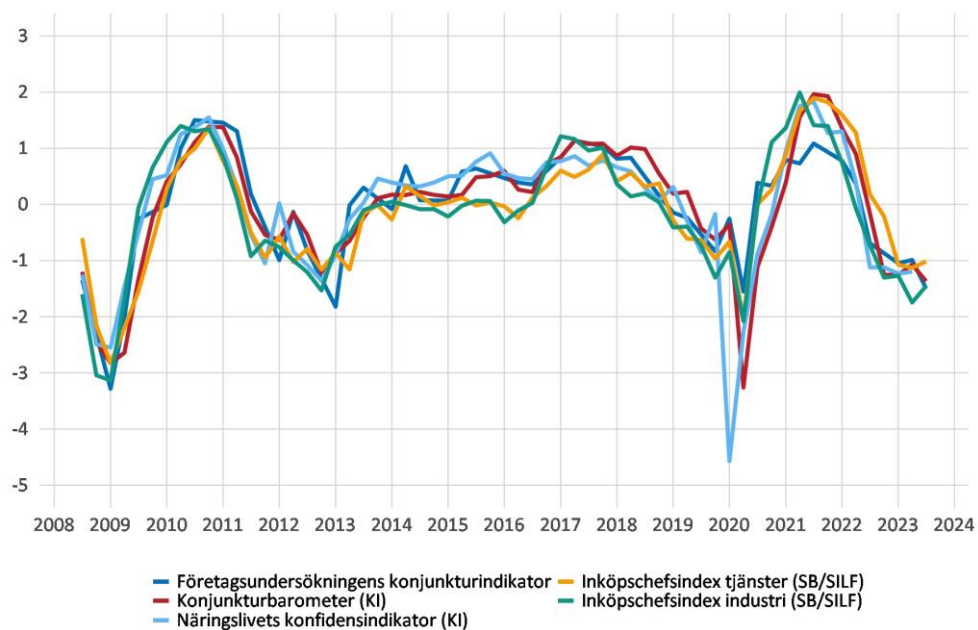
Source: NIER, the Riksbank, Statistics Sweden and Swedbank/SILF

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[12] The Economic Tendency Survey and the PMI are published on a monthly basis. Their series have been transformed into quarterly data and then standardised to a mean of zero and a standard deviation of one. The BS confidence indicator is published monthly and quarterly. The quarterly series has been used and has been standardised in the same way as the other series.

[13] The Economic Tendency Survey is based on survey data from around 6,000 companies and around 1,500 households; the BS confidence indicator is based on survey data from around 6,000 companies; and the PMI (services and industry) is based on survey data from 200 purchasing managers.

The Business Survey indicator reflects GDP growth well

As a first step to examine whether the Business Survey indicator can be used as a measure of economic activity, the correlation between the indicator and GDP growth was calculated. Statistics Sweden's (SCB) GDP time series are revised when new or better information becomes available. The first publication of a GDP outcome at a given point in time therefore differs from what subsequent publications show.[14] Even though revised GDP data provide more accurate measures of actual economic developments, there are reasons to consider real-time data as well. The first reason is that the information in the Business Survey indicator is largely based on companies' expectations and therefore data should be used that are available when these expectations are formed. The second reason is that the indicator should provide reliable early signals about the economic condition and therefore there is value in exploring whether the signals are most consistent with unrevised or revised GDP data.

The correlation analysis uses revised and unrevised data for the quarterly change in GDP and the annual change in GDP. The correlation was first calculated for the period 2008 Q3 – 2019 Q4 and then for the entire available period, 2008 Q3 – 2023 Q2. The first calculation period excludes the pandemic years in order to evaluate how the indicator correlates with GDP without the shocks from the pandemic.[15] However, it is worth examining the information value of the indicator even during the pandemic and therefore the correlation has also been calculated until 2023 Q2.

The correlation coefficients, reported in Table 2, show that the indicator correlates strongly with the annual change in GDP but weaker with the quarterly change over the period 2008 Q3 – 2019 Q4. The correlation with the annual change in GDP is relatively high even when the period is extended to 2023 Q2. The correlation with quarterly GDP growth for the period 2008 Q3 – 2023 Q2 is much weaker, but not very different from the correlation of the other survey-based indicators with quarterly GDP growth for the same period (see Table 4 in the Appendix).

Overall, the indicator is judged to reflect GDP growth well, as illustrated in Figures 2 and 3. However, during the pandemic, there is considerable discrepancy between GDP and the indicator. GDP growth reached historically low levels, while the Business Survey indicator suggests only a cautious deterioration in the economy. This can be explained by the fact that the indicator consists of a number of forward-looking variables. For example, in the spring of 2020, a majority of the companies surveyed assessed that the economic situation would improve in six months, which softens the decline in the indicator. Compared to the financial crisis, whose impact on economic

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[14]Since May 2020, Statistics Sweden has also published a monthly GDP indicator, which is an initial compilation of the economic statistics. Here, the initial publication is the publication of the regular quarterly national accounts and not the GDP indicator.

[15] During the pandemic, there were several factors that complicated the assessment of the economy and business activity. For example, companies' production and sales opportunities were greatly affected by restrictions and the spread of infection.

activity is reflected well in the indicator, the opposite is true. A majority of the companies surveyed at that time assessed that the economic situation would deteriorate in six months' time and this contributes to the decline in the indicator for that period. However, the objective of the Business Survey, and thus the indicator, is not to identify unpredictable crises (such as a pandemic) but to reflect the trend in economic developments. It is considered to do so even during the pandemic, as it shows, like the real economy, a sudden downturn followed by a rapid recovery.
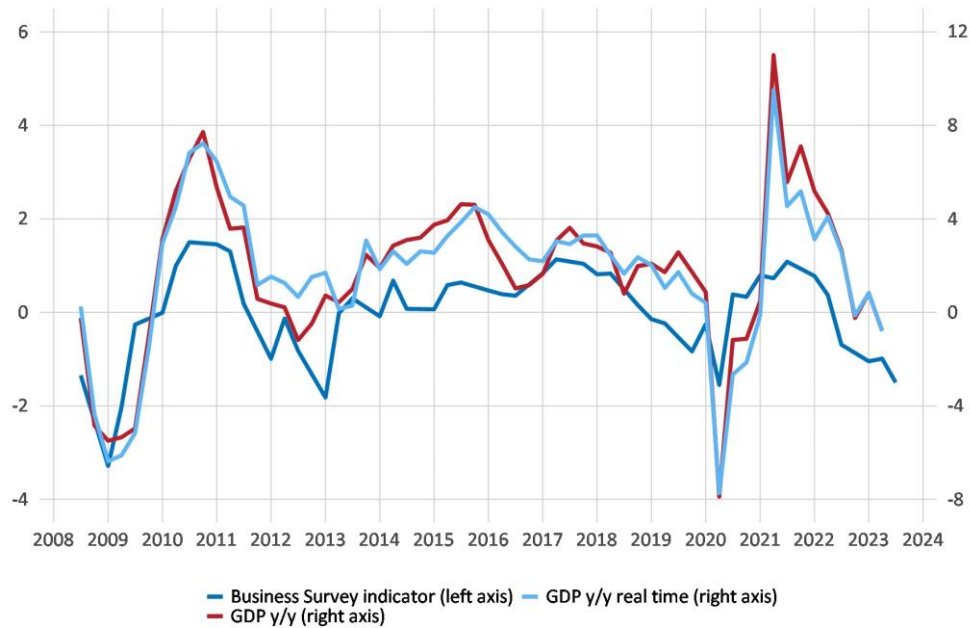
Figure 2. The Business Survey indicator and quarterly GDP change
Standardised units and quarterly change, percent
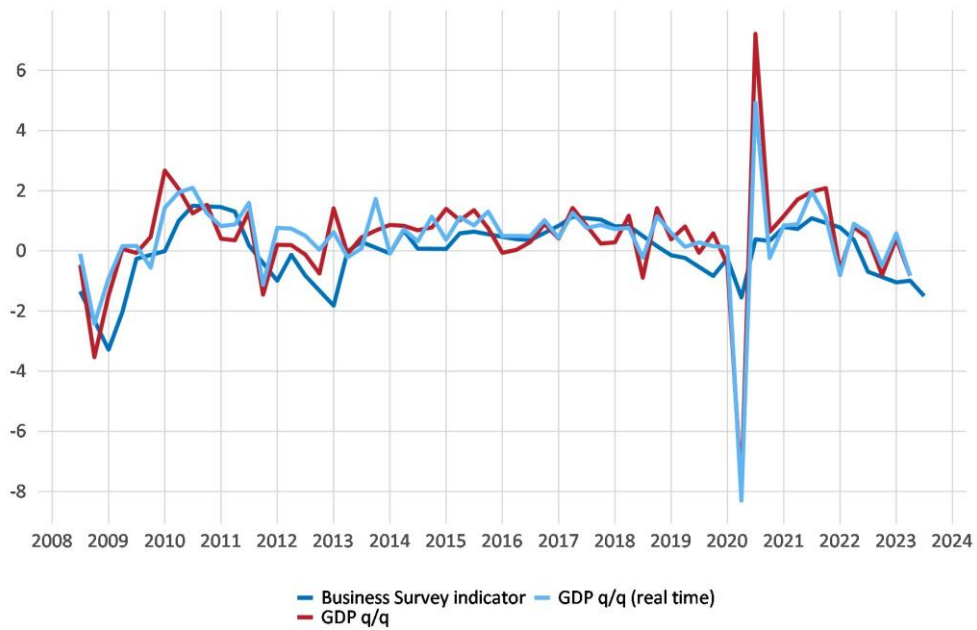
Source: The Riksbank and Statistics Sweden

Figure 3. The Business Survey indicator and annual percentage change in GDP
Standardised units (left axis) and annual percentage change (right axis)

Source: The Riksbank and Statistics Sweden

Table 2. Correlation coefficients for the Business Survey indicator and GDP

	2008 Q3 – 2019 Q4	2008 Q3 – 2023 Q2
GDP q/q	0.56	0.48
GDP q/q (real time)	0.63	0.49
GDP y/y	0.81	0.74
GDP y/y (real time)	0.80	0.73

Note: Coefficients are significant with p-values less than 0.001. The time series for GDP are calendar-adjusted and seasonally adjusted.

Source: The Riksbank.

The predictive power of the Business Survey indicator is good

The next step is to evaluate the predictive power of the Business Survey indicator for unrevised and revised quarterly change in GDP. First, it is evaluated in relation to the series included in the indicator. This allows us to examine whether the indicator provides more informative signals about economic developments than the individual survey questions do. The indicator's predictive power is then compared with other survey-based indicators of economic activity. The aim is to test the indicator's ability to paint a current picture of the economy and for this reason this exercise is limited to forecasts for one and two quarters ahead.

The predictive power was tested by adding each indicator and survey question in an autoregressive model of quarterly change in GDP. First, each model has been estimated for the period 2008 Q3 to 2015 Q4 and based on this estimate, the models have generated a forecast for Q1 and Q2 2016. Subsequently, the estimation period has been extended by one quarter and new forecasts have been generated for one and two quarters ahead. The exercise has been repeated until the fourth quarter of 2022[16] and consequently the models produce a number of forecasts that can be used to evaluate their average ability to predict GDP growth. This is done by calculating the root mean square error (RMSE) and its ratio to the RMSE from an autoregressive model without an indicator/survey question. A ratio below one indicates that the model generates forecasts that deviate less from the actual GDP growth than does the autoregressive model without indicator/survey question.

The Business Survey indicator has a significantly lower RMSE than most of the individual survey questions for both unrevised and revised GDP data and for both time horizons (see Table 6 in the Appendix). The individual survey questions that perform about as well as the Business Survey indicator are production/sales in the current quarter, new orders in the current quarter, investment plans and access to external financing. However, when the time horizon is extended by one quarter, the forecast errors for the models where these are included increase to a greater extent than the model for the Business Survey indicator.

Despite the fact that the Business Survey indicator is based on a much smaller sample, it performs about as well, and sometimes even better, than the other survey-based economic measures (see Table 3). The forecast exercise also shows that the Business Survey indictor functions as a relatively good predictor for GDP growth independent of GDP revisions, but provides slightly more accurate forecasts for the real-time figures. This is in line with what previous studies on the predictive power of survey-based indicators have shown.[17] The indicator can therefore be assumed to provide valuable signals on GDP growth, regardless of whether unrevised or revised data are being used.

Table 3. Forecast evaluation for quarterly change in GDP, 2016-2022, RMSE in relation to the benchmark model

	GDP q/q (real time)		GDP q/q	
	One quarter ahead	Two quarters ahead	One quarter ahead	Two quarters ahead
AR (1) without indicator	1	1	1	1
Business Survey indicator	0.69	0.74	0.71	0.73
Economic Tendency Survey (NIER)	0.67	0.75	0.76	0.76

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[16] The evaluation period is set at 2016-2022 to give the models enough observations to be estimated (2008-2015) but also enough forecasts to be evaluated. Starting the evaluation period at 2016 avoids an evaluation period centred around the pandemic and allows for a better comparison between revised and unrevised GDP.

[17] See for example Pichette & Robitaille (2017), Brander et al. (2017) and Chamberlin (2007).

	GDP q/q (real time)		GDP q/q	
Business sector confidence indicator (NIER)	0.80	0.81	0.85	0.80
PMI services (SB/SILF)	0.72	0.79	0.72	0.75
PMI industry (SB/SILF)	0.71	0.78	0.66	0.70

Note: NIER refers to data from the National Institute of Economic Research. SB/SILF refers to data from Swedbank/SILF

Source: The Riksbank.

Concluding comments

This Economic Commentary has presented a new indicator of economic activity. Using principal component analysis, eleven time series from the Riksbank's Business Survey have been weighted together into one indicator. The information summarised in the indicator provides timely signals on the state of the economy, which has been tested by means of correlation analysis and a forecasting exercise using an autoregressive model. The Business Survey indicator has also been compared with other survey-based indicators of economic activity. The results of the correlation analysis and the forecasting exercise for the different indicators do not differ significantly from each other. They are highly correlated (see Table 5 in the Appendix) and generally provide a similar picture of economic activity. However, there are some differences worth highlighting. The Business Survey indicator has both a higher correlation and a smaller forecast error than the NIER's BS confidence indicator – the indicator that most closely resembles the Business Survey indicator in terms of purpose and questions included. The NIER's Economic Tendency Survey has a higher correlation with GDP and smaller forecast errors for real-time data, but the Business Survey indicator has slightly smaller forecast errors for the most recently published GDP data. How the Business Survey indicator relates to the Economic Tendency Survey is particularly interesting as the Economic Tendency Survey is based on survey data from both companies and households. Although the Riksbank's Business Survey captures household behaviour and attitudes indirectly by asking companies about sales, it lacks the direct link to households. The relationship between the Economic Tendency Survey and the Business Survey indicator is strong with a correlation coefficient of 0.89. This reinforces the interpretation that the Business Survey indicator is a reliable measure of economic activity.

As the quantitative responses summarised in the indicator are consistent with the qualitative responses provided by the companies, the results of the analysis indicate that they are also reliable. In summary, this commentary has shown that the data collected by the Business Survey are a valuable complement to other economic activity data and that the Business Survey indicator presents these data effectively. In the quarters in which the business survey is conducted, the Business Survey indicator is published one to two months before the GDP data for the period in question, which means that it can provide an early picture of the state of the economy.

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APPENDIX - Tables and charts

Figure 4. Estimates of the Business Survey indicator when the time horizon is extended

Standardised units
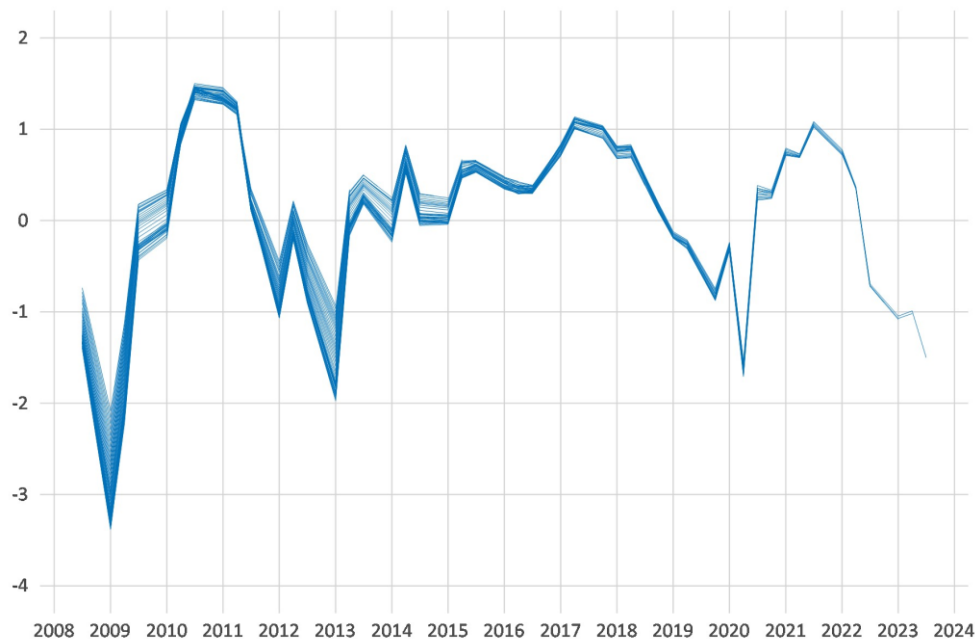
Source: The Riksbank

Table 4. Correlation coefficients, indicators of economic activity and GDP, 2008-2023

	GDP q/q	GDP q/q (real time)	GDP y/y	GDP y/y (real time)
Business Survey indicator	0.48	0.49	0.74	0.73
Economic Tendency Survey (NIER)	0.50	0.53	0.88	0.87
Business sector confidence indicator (NIER)	0.47	0.45	0.73	0.70
PMI services (SB/SILF)	0.52	0.50	0.84	0.79
PMI industry (SB/SILF)	0.55	0.49	0.71	0.66

Source: The Riksbank.

Table 5. Correlation between the Business Survey indicator and other survey-based indicators of economic activity, 2008-2023

	Correlation coefficient
Economic Tendency Survey (NIER)	0.89
Business sector confidence indicator (NIER)	0.78
PMI services (SB/SILF)	0.86
PMI industry (SB/SILF)	0.89

Source: The Riksbank.

Table 6. Forecast evaluation for quarterly change in GDP, 2016-2022, RMSE in relation to the benchmark model

	GDP q/q (real time)		GDP q/q	
	One quarter ahead	Two quarters ahead	One quarter ahead	Two quarters ahead
AR (1) without indicator	1	1	1	1
Business Survey indicator	0.69	0.74	0.71	0.73
Current economic situation	0.88	0.93	0.95	0.96
Economic situation +6m	0.96	0.93	0.96	0.89
New orders -3m	0.76	0.83	0.75	0.81
New orders +3m	0.89	0.87	0.91	0.82
Production/sales -3m	0.66	0.73	0.71	0.79
Production/sales +3m	0.87	0.84	0.92	0.80
Employment -3m	0.80	0.85	0.95	0.96
Employment +3m	0.84	0.84	0.94	0.87
Investment plans	0.72	0.82	0.81	0.87
External financing	0.78	0.85	0.73	0.75
Profitability	0.96	0.99	1.0	1.01

Source: The Riksbank.