Business confidence indicators across (similar) surveys

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Abstract

Business survey indicators are widely used to monitor and forecast in the short term the business outlook. The main surveys are collected by different organisations, such as national statistical offices, private research entities and central banks. In Italy, the Italian National Institute of Statistics (Istat) collects monthly survey indicators, as part of the European Commission survey programme and business survey data are also gathered by the Bank of Italy, using a distinct sample.
This study evaluates the similarities and differences between two similar business survey indicators, collected by Istat and the Bank of Italy, on employment expectations and the general economic conditions. We compare the cyclical properties and ability of the two indicators to forecast key macroeconomic variables such as industrial production and employment. In addition to the standard indicators (balances between positive and negative judgements), we explore the usefulness of the single-tail components (i.e. positive and negative judgements) to track the business cycle. We find that the series of the two surveys has a significant and similar predictive power, and, with a few exceptions, it is not possible to exclude one of the indicators completely; the optimal strategy for nowcasting is therefore to use both, as in a forecast combination.

Keywords: Business survey data, forecasting accuracy, VAR models, nowcasting, macroeconomic uncertainty.

JEL Classification: C32, E32.

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1. Introduction[3]

Business confidence indicators, which are widely used by policymakers to track economic outlook and forecasting, are collected by different organisations such as national statistical offices, private research entities and central banks. In Italy, the official business confidence indicators are collected by the Italian National Institute of Statistics (Istat), in the context of the European Commission (EC) business survey programme. Since 1999, some of these indicators have also been collected by the Bank of Italy (BoI), within the Survey on Inflation and Growth Expectations (SIGE).

This study aims to compare the most similar business confidence indicators gathered by Istat and the BoI, namely the sentiment indicator on the general economic situation and the expectations of employment in the next three months. These two indicators are produced through the aggregation of qualitative data through the so-called "balance," given by the difference between positive and negative answers provided by firms.

We checked all the business survey indicators available in the two surveys. We ended up focussing only on those two, which refer to the same economic phenomenon and have a similar quantitative assessment. For example, we do not consider the indicator regarding the price expectations, despite the similar wording of the question, because Istat collects qualitative information (in the form of a balance given by the difference between positive and negative judgements). At the same time, the BoI asks for the expected percentage change in the price.

The novelty of this study is the comparison of forecasting power between indicators capturing the same economic phenomenon from two similar business surveys. To the best of our knowledge, this is new in the literature. More in detail, after a discussion of the statistical characteristics and properties of the two indicators (Istat and BoI), we assess their forecast performance using multivariate models. We also explore the potential usefulness of positive and negative judgements, individually considered, to track the business cycle. Indeed, an increase in positive answers from respondents could be associated with an expansionary business cycle phase; quite the opposite, an increase in negative judgements of the firms is expected to be associated with a worsening in macroeconomic conditions; these

3 The authors would like to thank all the participants in the Bank of Italy Lunch Seminar held on 18 November 2017, and the participants in the CFE ERCIM Conference held on 15-17 December 2017 in London for their valuable suggestions.

tail components may provide a cleaner signal at certain phases of the business cycle, but by losing observations, the signal may also be more unstable; therefore, the question of its usefulness in forecasting is empirical. Finally, we consider the possibility of using these business surveys to track macroeconomic uncertainty, following the approach proposed by Bachmann *et al.* (2013).

Many studies have attempted to analyse the forecasting performance of business confidence survey indicators (*i.e.* Hansson *et al*., 2003, Lemmens *et al*., 2005; Abberger, 2006; Claveria *et al.*, 2007; Cesaroni *et al*., 2011; Frale and Monteforte, 2011; Girardi *et. al*., 2016). The ability of business survey indicators coming from the BoI survey on Inflation and Growth Expectations (SIGE) to forecast business cycle evolution and to lead turning points has been discussed in Cesaroni and Iezzi (2017), while the ability of Istat business surveys indicators to predict business cycle has also been analysed in Bruno and Lupi, (2004), Cesaroni (2011) and Bruno *et al*. (2019). In particular, Cesaroni and Iezzi (2017) use Harding and Pagan's (2002) methodology to detect the business cycle turning points of eight SIGE indicators[4]; they find that both the general economic situation and employment expectations indicators can lead their reference series (GDP and employment) turning points. Analogously, Bruno and Malgarini (2002) analyse Istat business confidence indicators turning points using the Bry-Boschan algorithm.

Business survey data were also used to build a measure of economic uncertainty by Bachmann *et al*. (2013), who introduced a measure of macroeconomic uncertainty given by the variance of a linear combination of positive and negative judgements reported from surveys. In their findings, positive innovations to sectoral uncertainty have prolonged negative implications for sectoral economic activity in the same way as adverse sectoral business confidence shocks.

The paper is structured as follows: Section 2 describes the time series considered in the analysis, as well as their use to track macroeconomic uncertainty. Paragraph 3 focusses on the possible sources of the differences between alternative business survey indicators. Paragraph 4 deals with the statistical characteristics of the Istat and SIGE surveys and provides a nowcasting exercise, while Paragraph 5 concludes this paper.

4 Namely, inflation expectations, expectations about firms own selling prices, employment expectations, three months investment conditions, three years expectations on investment conditions, expectations on the general economic situation, and probability of economy improvement in the next three months.

2. Data

The time series that we are going to analyse are indicators of the general economic situation (SITGEN) and firms' employment expectations (EMPL_EXP). These indicators were collected from both the BoI and Istat surveys. The BoI business survey indicators come from the Survey on Inflation and Growth Expectations (SIGE), which started in 1999, and the results are available on the Bank of Italy's website[5]. The Istat survey data come from the business survey on manufacturing firms, which started in the 1980s[6]; the time series are available on the Istat database website (I.Stat). The similarity of the indicators collected in these two Italian surveys calls for a comparison of their cyclical properties to detect the differences in their predictive ability.

Concerning the data frequency, while Istat collects these indicators on a monthly basis, the SIGE survey is conducted on a quarterly basis. In the Istat survey, firms are interviewed using mixed techniques, including Computer-Assisted Telephone Interviews (CATI) and responses via fax/mail. In the BoI survey, 5 per cent of firms were contacted by telephone and 95 per cent via the web.

Since Istat confidence indicators are available at a monthly frequency while BoI business confidence indicators are collected on a quarterly basis, to make a full and fair comparison in terms of predictive accuracy, we transformed the Istat indicators from monthly to quarterly frequency. In more detail, we constructed the quarterly time series of the Istat business survey indicators taking as representative of the quarter the value of the month in which the survey of the Bank of Italy indicator was collected.

In both business tendency surveys, respondents had three reply options for each question: up, same, down, or above normal, normal, and below normal. To convert the number of answers to each of the three reply options into percentages, the information was transformed into a balance given by the frequency of positive judgements (P) minus the frequency of negative judgements (N):

$$B = 100\ (P–N).$$

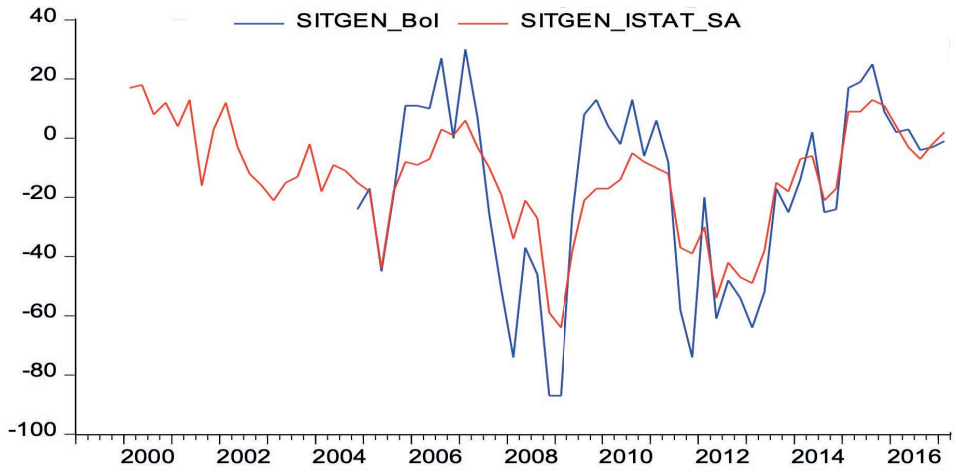
5 https://www.bancaditalia.it/pubblicazioni/indagine-inflazione/index.html?com.dotmarketing.htmlpage.language=1.

6 In Italy, manufacturing business survey data started to be collected by ISAE institutes during the 1980s within the joint harmonised programme of the European Commission. Currently, data are collected by Istat.

Balance is generally used as a proxy for business cycle evolution; if the number of positive judgements is greater than the number of negative judgements, we expect to approximate a positive business cycle phase.

We show, in Figure 2.1, the expectations on the general economic situation from BoI (SIT_GEN_BoI) and expectations on the general economic situation from Istat (SIT_GEN_ISTAT); Figure 2.2 also compares the employment expectations from BoI (EMP_EXP_BoI) and employment expectations from Istat seasonally adjusted (EMPL_EXP _ISTAT_sa). The sample considered spans from 2004Q4 (that is, the date on which SIT_GEN_BoI and EMP_ EXP_BoI indicators started to be collected) to 2017Q1.

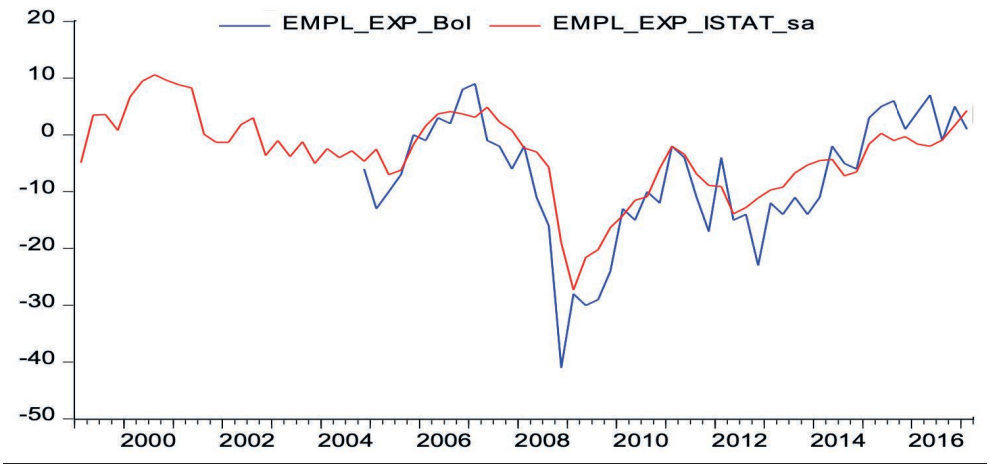
Figure 2.1 - The general economic situation expectations in the Istat and SIGE surveys. Years 2000-2016



Source: Authors' processing

As expected, the time series extracted by the two surveys are quite similar. However, there are some differences in the dynamics that can arise from various factors such as the sample, the exact timing in which the interview is conducted, the seasonal adjustment procedure and the questionnaire design.

Figure 2.2 - The employment expectations in the Istat and SIGE surveys. Years 2000-2016



Source: Authors' processing

2.1 Macroeconomic uncertainty and business confidence indicators

Often, information from business survey data is used to assess the uncertainty surrounding the economic environment. Indeed, their timeliness makes them suitable to evaluate changes in macroeconomic evolution and to track elements of uncertainty in the qualitative judgements directly coming from firms' management.

To compare and detect other possible differences in the uncertainty signal coming from BoI and Istat surveys, we also try to estimate a measure of the uncertainty on the macroeconomic environment, using the answers to the general economic situation question. More in detail, following Bachmann *et al.* (2013), we use an uncertainty measure based on the following formula:

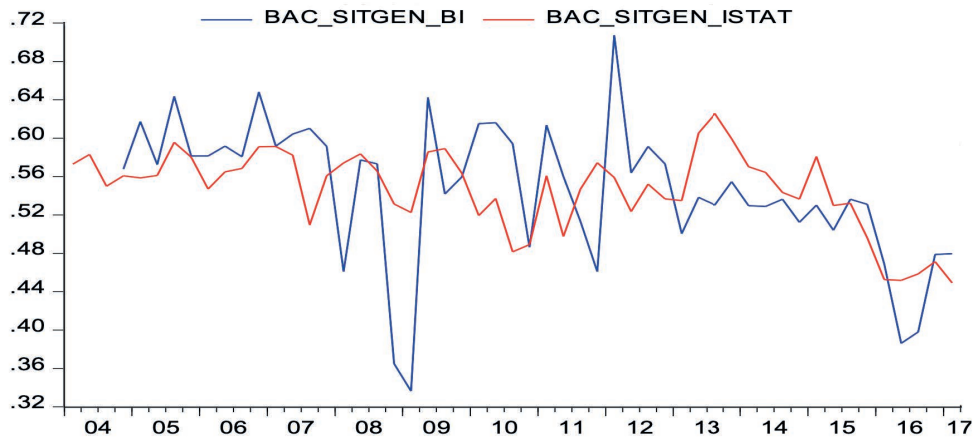
$$U_t = sqrt\{[frac_t(Increase) + frac_t(Decrease)] - [frac_t(Increase) - frac_t(Decrease)]\}^2$$

where U_t is the uncertainty given by the cross-sectional standard deviation of the survey responses. More in detail, $frac_t$ (*Increase*) represents the fraction of respondents that indicates an increase, quantified with +1, $frac_t$ (*Decrease*) represents the fraction of respondents that suggests a decrease of the survey indicators, and it is quantified with -1.

Figure 2.3 compares the Bachmann index calculated for the general economic situation question both in BoI and Istat surveys.

Looking at Figure 2.3, we see that the Bachmann (2013) index on macroeconomic uncertainty calculated using the SIGE data seems to display a higher variability concerning the corresponding Istat index.

Figure 2.3 - The Bachman index computed from BoI and Istat surveys. Sample 2004-2017



Source: Authors' processing

3. Possible sources of heterogeneity between the two surveys

In this paragraph, we focus on the sources of the differences between the indicators extracted from the two surveys, regarding the sample selection, the aggregation procedures of microdata, the seasonality treatment and the frequency.

3.1 The sample

The sample design and the structure of the sample selected can have a non-negligible influence on the results. There is heterogeneity in the population, concerning size or other characteristics; the use of stratification-based sampling methods is recommended. To give an idea of the differences in the sample structure of Istat and BoI business survey, Table 3.1 reports the stratification structure of the sample by economic sectors in both surveys. However, in this paper, we will only consider the survey conducted on the industrial sector, excluding construction firms, as this is the sector for which the two surveys (on the general economic situation and the employment expectations) are most consistent.

Table 3.1 Istat *vs.* Bank of Italy manufacturing firms' samples

	Istat sample	Bank of Italy sample
Industry excluding construction	4,100	410
Services	2,000	420
Construction	500	210

Source: Authors' processing

Looking at the Table, we can see that the Istat Survey on manufacturing firms is based on a sample of roughly 4,100 firms from the industrial sector interviewed each month. Furthermore, Istat conducts a survey on 2000 firms from the services sector and a survey on roughly 500 firms from the construction sector. The three surveys are undertaken separately, and there is no common stratification of firms among these three sectors[7]. Bank of Italy considers instead a smaller sample of roughly 1,000 firms interviewed on a quarterly basis, stratified on the basis of industry, services and construction

7 In the Istat manufacturing survey, firms are stratified according to value added and number of employees.

sectors. The main difference in the sample of the two surveys is that while Istat considers all firms with more than 5 employees, the firms considered in the Bank of Italy SIGE survey are larger, with more than 50 employees[8].

The differences in the two samples also depend on the importance of revenues of firms with more than 5 employees on the total revenues. To deeply inspect this aspect, using Istat survey microdata, it would be possible to construct a business confidence indicator taking only the larger firms, as the Bank of Italy survey does. In this way, the universe between the two indicators can be more comparable. However, since Istat microdata are not public, we leave this aspect for future research.

3.2 Seasonality treatment

Another difference between the two surveys analysed concerns the seasonal treatment of the data. The impact of seasonal adjustment in forecasting models has been widely studied. Proietti (2012) finds that the larger the seasonal components, the larger will be the estimation error for the seasonally adjusted series, which in turn will yield a less reliable cycle estimate. Fok *et al*. (2006) analyse the ability of TRAMO SEATS and CENSUS X-12 ARIMA algorithms to detect seasonality in the data and find that the methods seem to have a similar performance. More related to the empirical application of this paper, Mazzi and Savio (2005) investigated the possible existence of stochastic trends and seasonal unit roots in business tendency surveys. They concluded that the series were not affected by seasonality and thus they should not be "treated" to remove seasonality.

Istat considers a seasonally adjustment procedure for business survey data results based on a Tramo-Seats algorithm[9]. Quite the opposite, the Bank of Italy survey indicators coming from SIGE are not seasonally adjusted; in Section 4, using the Tramo-Seats algorithm, we also do not find evidence of seasonality in the time series of SIGE considered in this paper. Furthermore, the BoI survey considers raw data when computing statistics of SIGE to prevent cyclical frequency leakages due to the seasonal adjustment procedure.

8 The weighting procedure used to expand the survey results to the universe can also potentially have an impact on the aggregate results.

9 The standard seasonality procedures are included in the EC manual.

3.3 Question design

The questionnaire design, namely how a question is formulated, can also have an impact on the reliability of the answers and thus on the uncertainty surrounding the business survey indicators. As concerns the indicators here examined, there are some differences in the wording of the questions between the two business surveys. In SIT_GEN_BoI, the respondents are asked to assess Italy's general economic situation compared to three months ago, while in SIT_GEN_ISTAT, they are asked to evaluate the general tendency of the Italian economy, abstracting from sectoral and firms' developments in the next three months. For the question concerning employment EMPL_EXP, the wording of the questions is identical in the two surveys. In both of them, the respondents are asked to assess the number of employees in firms in the next three months. The exact formulation of the questions can be found in the Appendix.

Concerning the general economic situation indicator, while Istat asks the respondents to provide an expectation of the general economic situation in the next three months, abstracting from the situation of their own business, the BoI survey asks the respondents to judge the general economic situation in the current quarter, without specifying to disregard their business situation. This difference in the wording of the questions and of the reference period can induce a different information set on which firms formulate their expectations and provide a mismatch in the signal coming from the indicator across the two surveys.

However, the paper of Cesaroni and Iezzi (2017) on the ability of SIGE data to detect business cycle turning points and to forecast the business cycle showed that even if the general economic situation question is based on the current situation, the resulting indicator has leading properties on the business cycle. This may be because respondents are not able to correctly distinguish between the current and the future situation in the very short term. When looking at the present situation, firms may also consider elements concerning the very near future and vice versa, given the very short time horizon (3 months).

Quite the opposite, the formulation of the two questions about the employment expectation is virtually the same in both BoI and Istat surveys.

4. Empirical analyses

This section deals with the statistical properties of business survey time series considered in the forecasting application. Sub paragraph 4.1 explores the statistical properties of the two survey indicators considered (employment expectation, general economic situation), regarding the seasonality, the stochastic trends and the unconditional cross-correlations with their reference series, namely the industrial production, the industrial value added and the employment. Sub paragraph 4.2 reports the results of a forecast performance exercise, while sub paragraph 4.3 reports the predictive accuracy results.

4.1 Preliminary data analysis

The first characteristic of the survey indicators that we explore regards the eventual seasonality of SIGE indicators, given that they are reported in their raw form and are not treated. To detect possible seasonal patterns in these series, we report the results of the Tramo-Seats algorithm on SIT_GEN_BoI and EMP_EXP_BoI indicators.

Table 4.1 Estimated model by TRAMO-SEATS

	SIT_GEN_BoI	EMPL_EXP_BoI
SARIMA Model (P, D, Q) (p, d, q)	(1,0,0) (0,0,0)	(0,0,0) (0,0,0)

Source: Authors' processing

The first row of the table reports the SARIMA models (P, D, Q) (p, d, q) identified by TRAMO-SEATS, where (P, D, Q) are the order of AR component, of integration and Q and MA component of the non-seasonal model, while p, d, q are the corresponding parameters components of the seasonal component.

Looking at the results, we can notice that for the series SIT_GEN, there are no seasonal roots. Analogously, looking at the identified SARIMA model for employment expectations, we can see that there are no seasonally significant components identified by the algorithm as well.

Based on such empirical evidence, in what follows, we consider the not seasonally adjusted business survey series from the SIGE survey.

As preliminary data analysis, we also conducted a unit root test on both Istat and Bank of Italy indicators. Although the data analysed are expected to be stationary by construction, since they are built as a balance between positive and negative answers of respondents, in empirical samples, they might display a stochastic trend. This is because the upper and lower bounds for the values of those variables do not eliminate the possibility of local non-stationary data trends. The Augmented Dickey Fuller (ADF) tests for unit roots were implemented to identify possible non-stationary behaviours in the Business Survey variables.

Since the low power of the ADF test, a more powerful GLS test developed by Elliot, Rotemberg and Stock (1996) was also performed. The number of lags was chosen based on the Schwartz information criterion. The results are reported in Table 4.2.

Table 4.2 - Unit root tests (a)

	ADF	GLS
Sitgen_BI	-2.80(***)	-2.82(*)
Sitgen_SA_ISTAT	-2.49(***)	-2.27(*)
Sitgen_NSA_ISTAT	-2.55(***)	-2.41(**)
Empl_Exp_BI	-3.26(**)	-3.29(*)
Empl_exp_sa_ISTAT	-2.28(***)	-2.24
Empl_exp_nsa_ISTAT	-1.75(***)	-1.51(***)

Source: Authors' processing
(a) The sample goes from 2004 q1 to 2017q1; test with trend and intercept.
*: rejection of the unit root hypothesis at 1% level; **: rejection of the unit root hypothesis at 5% level; ***: rejection of the unit root hypothesis at 10% level.

We can reject the null hypothesis of a unit root; therefore, we treat the time series as stationary.

Finally, to analyse the link between survey indicators and the reference business cycle, the following Tables (4.3*a*, 4.3*b*, and 4.3*c*) report the cross-correlations with the reference business cycle indicators (industrial production, value-added and employment in the industrial sector) for the business survey data from BoI and Istat surveys. The value added is considered an alternative to the production index to track the business cycle of the industrial sector.

We did not consider the GDP as a reference indicator. However, it is usually the primary variable used to track the business cycle, since we focus on the survey of industrial firms.

As for survey indicators, we consider both the balance (difference between positive and negative answers provided by firms) and the components, namely the positive and the negative answers. The rationale for investigating the positive and negative answers in isolation is that the components of the balance may have a larger informative content than their difference, depending on the specific stage of the business cycle. For example, the negative (or positive) answer could have an ability to anticipate troughs (or peaks) or to display a different variability.

Finally, since BoI indicators are not seasonally adjusted, due to the absence of statistically relevant seasonal patterns, to have a fair comparison with Istat survey indicators, in the analysis, we consider both Istat seasonally and not seasonally adjusted data. The common sample considered is 2004q4 -2017q1.

Table 4.3*a* - Cross-correlations of survey indicators (balances) with their reference series

	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4
Industrial production yoy growth rate									
Sitgen_BI	0.46	0.58	0.70	0.65	0.46	0.22	-0.01	-0.18	-0.26
Sitgen_SA_ISTAT	0.18	0.40	0.61	0.69	0.62	0.46	0.25	0.06	-0.07
Sitgen_nsa_ISTAT	0.20	0.40	0.61	0.69	0.63	0.46	0.25	0.06	-0.08
Industrial value added yoy growth rate									
Sitgen_BI	0.43	0.57	0.67	0.62	0.44	0.21	-0.02	-0.16	-0.25
Sitgen_SA_ISTAT	0.16	0.37	0.57	0.64	0.59	0.44	0.23	0.07	-0.07
Sitgen_nsa_ISTAT	0.16	0.37	0.57	0.64	0.59	0.44	0.23	0.06	-0.07
Employment yoy growth rate									
Empl_exp_BI (a)	0.67	0.81	0.87	0.84	0.75	0.60	0.42	0.24	0.07
Empl_exp_sa_ISTAT	0.58	0.75	0.86	0.90	0.83	0.70	0.52	0.36	0.21
Empl_exp_nsa_ISTAT	0.56	0.72	0.82	0.83	0.77	0.64	0.50	0.36	0.24

Source: Authors' processing
(a) Sample from 2004q4.

Looking at the results reported in Table 4.1*a*, we can notice that, considering industrial production as the reference cycle, the general economic situation (SITGEN) indicators coming from Istat, both seasonally and not seasonally adjusted, show a higher contemporary correlation (0.62-0.63) than the BoI SITGEN indicator (0.46). Quite the opposite, the SIT_GEN_BoI indicator shows a higher correlation two quarters before showing a leading property.

Also considering the value added as reference business cycle, BoI balance (SITGEN_BoI) provides a higher correlation two quarters before therefore and in the sample analysed, seems to show a higher leading behaviour for the Istat indicator (SITGEN_I). Quite the opposite, the Istat indicator displays a higher contemporary correlation (0.59) than the BoI one (0.44).

An interesting result coming from this analysis concerns the ability of SITGEN_BoI to lead the business cycle, regardless of the wording of the question provided to firms, which does not explicitly state the expectation for the next three months, as in the analogous Istat question. One explanation for this finding can be related to the fact that, since in BoI the question on the general economic situation is not explicitly required to abstract from their business financial situation, this latter information is probably included in the information set that firms use to formulate their judgement on the General Economic Situation.

Looking at the cross-correlation between the employment cycle and the employment expectations (EMPL_EXP), we notice that the seasonally adjusted and not seasonally adjusted Istat indicators display a higher contemporary correlation (0.83 and 0.77, respectively) with respect to the corresponding BoI indicator (0.75). Both series are found to be leading the employment business cycle. However, while EMPL_EXP_BoI is leading two quarters ahead (0.87), EMPL_EXP_ISTAT is leading one quarter ahead.

Overall, we notice that seasonally adjustment of the Istat data does not seem to have a significant impact on the correlation properties with the reference cycle.

Tables 4.3*b*, 4.3*c* and 4.3*d* report the cross-correlations of positive, negative and stationarity judgements separately with real economic activity (industrial production and value added) and employment growth rate reference cycles for both SIGE and Istat surveys. For Istat, as for SIGE, we can only consider raw time series, as the Istat seasonal adjusted data are only available for the balances.

As expected, (Table 4.3b), the positive answers to the question on the general economic situation are procyclical and seem to have a leading power of two quarters concerning both the value added and the industrial production reference cycle. The correlation in t-2 is higher considering the BoI indicator. Quite the opposite, the Istat indicator seems to have a higher contemporary correlation with the BoI SITGEN indicator. Employment expectations judgments seem to have a leading power in t-2 that is similar in both survey indicators.

The negative judgements, both on the general economic situation and on the employment expectations (Table 4.3*c*), show a larger correlation with

Table 4.3*b* - Cross-correlations of survey indicators (positive judgments) with their reference cycle (a)

	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4
Industrial production yoy growth rate									
Sitgen_BI	0.43	0.49	0.56	0.50	0.35	0.17	-0.03	-0.17	-0.22
Sitgen_nsa_ISTAT	0.23	0.32	0.44	0.47	0.43	0.34	0.20	0.10	0.02
Industrial value added yoy growth rate									
Sitgen_BI	0.38	0.47	0.54	0.48	0.34	0.16	-0.04	0.16	-0.21
Sitgen_nsa_ISTAT	0.17	0.28	0.40	0.43	0.40	0.32	0.19	0.11	0.04
Employment yoy growth rate									
Occtot_BI	0.65	0.77	0.81	0.79	0.72	0.62	0.48	0.34	0.21
Empl_nsa_ISTAT	0.68	0.78	0.80	0.77	0.66	0.54	0.42	0.29	0.19

Source: Authors' processing

(a) Sample from 2004 q4 to 2017q1; not seasonally adjusted data.

Table 4.3*c* - Cross-correlations of survey indicators (negative judgments) with industrial production growth (yearly) (a)

	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4
Industrial production yoy growth rate									
Sitgen_BI	-0.45	-0.58	-0.71	-0.67	-0.48	-0.23	0.01	0.17	0.26
Sitgen_ISTAT	-0.17	-0.40	-0.63	-0.72	-0.66	-0.48	-0.25	-0.04	0.11
Industrial value added yoy growth rate									
Sitgen_BI	-0.42	-0.57	-0.68	-0.63	-0.45	-0.22	0.01	0.15	0.25
Sitgen_ISTAT	-0.14	-0.38	-0.60	-0.68	-0.62	-0.45	-0.23	-0.05	0.11
Employment yoy growth rate									
Empl_exp_BI	-0.50	-0.62	-0.68	-0.65	-0.56	-0.42	-0.25	-0.09	0.08
Empl_exp_nsa_ISTAT	-0.42	-0.61	-0.73	-0.77	-0.74	-0.63	-0.50	-0.37	-0.24

Source: Authors' processing

(a) Sample from 2004 q4 to 2017q1; not seasonally adjusted data.

the reference cycle concerning the positive judgments and, in some cases, also for the balances. SITGEN_BoI is confirmed, especially leading in two quarters for both industrial production (-0.71) and value added (-0.68) reference cycles. SITGEN_ISTAT seems instead to be leading one quarter ahead concerning both industrial production (-0.72) and value added (-0.68).

Looking at the correlation with the employment business cycle, EMPL_EXP from Istat displays the highest correlation with the employment growth rate in t-1 (-0.77). Quite the opposite, EMPL_EXP from SIGE displays the highest correlation in t-2 (-0.68).

To assess the possible impact of the time aggregation method on the cyclical properties of the data, the following table reports a sensitivity analysis of cross-correlations concerning time aggregation from monthly to quarterly

frequency. Indeed, as explained before, the original frequency of Istat survey data is monthly while that of BoI indicators is quarterly; therefore, for the Istat quarterly data, we consider both the value of the month in which the BoI survey is carried out (*Sitgen_nsa_ISTAT and Empl_exp_nsa_ISTAT*) and the quarterly average of three months (*Sitgen_nsa_ISTAT_mean, Empl_exp_nsa_ISTAT_mean*).

Table 4.4 - Cross-correlations of survey indicators with the reference variable (yearly). Sensitivity analysis concerning the time aggregation method (a)

	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4
					Industrial production yoy growth rate				
Sitgen_BI	0.46	0.58	0.70	0.65	0.46	0.22	-0.01	-0.18	-0.26
Sitgen_nsa_ISTAT_mean	0.13	0.33	0.53	0.67	0.71	0.61	0.40	0.19	-0.03
Sitgen_nsa_ISTAT	0.20	0.40	0.61	0.69	0.63	0.46	0.25	0.06	-0.08
					Employment yoy growth rate				
Empl_exp_BI*	0.67	0.81	0.87	0.84	0.75	0.60	0.42	0.24	0.07
Empl_exp_nsa_ISTAT_mean	0.50	0.69	0.82	0.87	0.84	0.72	0.58	0.43	0.28
Empl_exp_nsa_ISTAT	0.56	0.72	0.82	0.83	0.77	0.64	0.50	0.36	0.24

Source: Authors' processing

(a) Sample from 2004 q4 to 2017q1; not seasonally adjusted data.

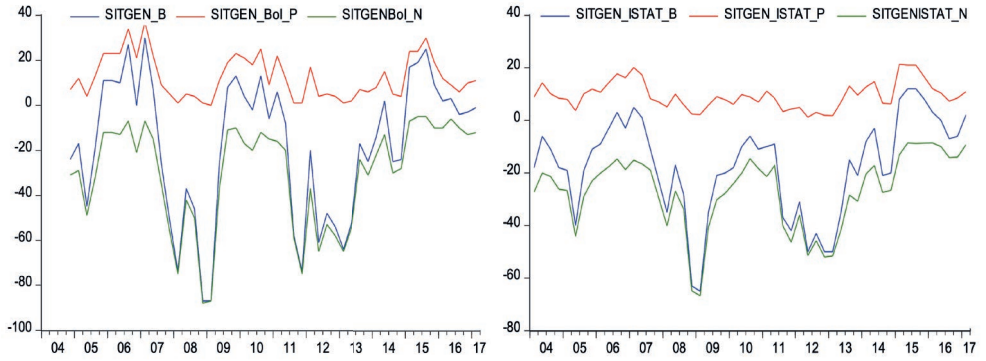
Looking at the results reported in the table, we can notice that the Istat indicator built considering the last month of the quarter (*Sitgen_nsa_ISTAT*), which is entirely consistent in timing for the alternative indicator in the SIGE survey, has a larger leading correlation concerning the indicator computed as average of the three months (variables with the suffix_mean).

Given the focus on nowcasting and forecasting of the empirical application, we choose to focus on the best indicator (taking the data of the last month of the quarter) for the Isat survey, also to have a fair comparison in terms of the informative set with SIGE[10].

To further inspect the linkages between balance, positive and negative answers dynamics, figures 4.1 and 4.2 report a comparison of positive, negative answers and the balance of the general situation and employment expectations of BoI and Istat surveys.

10 Since the BoI indicators consider only the xt information set, using a time aggregation based on xt, xt-1 and xt-2 for Istat, could penalise BoI in the statistical comparison.

Figure 4.1 - General economic situation: positive, negative responses and the balance in the BoI and the Istat surveys. Sample 2004-2017



Source: Authors' processing

Looking at the dynamics of SITGEN negative judgements, we can see that the dynamics of the overall index are mainly explained by the negative opinion component, for both the general economic situation and for employment. More specifically, during the 2009 recession, they were more negative among BoI respondents for the Istat survey; this is also true when looking at negative judgements concerning the 2012 recession. Looking at the dynamics of SITGEN positive judgements, we can also notice that between 2005 and 2007, the BoI percentage of positive answers was higher than that provided by the Istat sample firms.

Figure 4.2 - Figure 4.2 Employment expectations: positive, negative responses and the balance in the BoI and the Istat surveys. Sample 2004-2017

Source: Authors' processing

Looking at the dynamics of the employment expectations, we see (Figure 4.2) that the negative judgements are usually lower in SIGE compared to the Istat survey. Concerning the dynamics of positive judgements, we can notice that for the general economic situation question, a higher percentage of positive judgements occurred during the biennium 2005-2007. Concerning the BoI SITGEN indicator, we can see that during the years 2007-2009, the dynamics of the balances were entirely driven by the negative answers provided by firms, while the positive judgements were roughly near zero. Again, the negative judgements are structurally further down in the SIGE survey.

Overall, the results show that the cyclical dynamics of the balances are mainly driven by the negative judgments, for both the indicators considered; the negative judgments in SIGE tend to be lower than in the Istat survey. Another information coming from qualitative indicators concerns stability judgements provided by firms in business cycle analysis. However, since this variable is more related to the trend evolution of the economy and more volatile during recession episodes and since we concentrate on short-term analysis concerning business cycle evolution, in what follows, we only analyse the predictive content of the balances, the positive and the negative judgements.

4.2 The forecast performance exercise

In what follows, we use an unrestricted bivariate VAR model to compare the forecasting power of BoI and Istat business survey indicators, which takes the form:

$$\begin{bmatrix} x_t \\ y_t \end{bmatrix} = \alpha_0 + \alpha_1 \begin{bmatrix} x_{t-1} \\ y_{t-1} \end{bmatrix} + \alpha_2 \begin{bmatrix} x_{t-2} \\ y_{t-2} \end{bmatrix} + \ldots\ldots + \alpha_n \begin{bmatrix} x_{t-n} \\ y_{t-n} \end{bmatrix}$$

where $\mathbf{x}_t$ is the macroeconomic target (*i.e.* industrial production or employment) and $\mathbf{y}_t$ is its business survey indicator (namely BoI or Istat indicators). Hence, we consider two bivariate unrestricted VAR models for each survey. More in detail, we compare and analyse the out-of-sample forecast performance of SITGEN and EMPL_EXP indicators concerning their corresponding aggregate series, namely industrial production (and value added) and employment, namely the number of persons employed in the manufacturing sector. To achieve this end, we use recursive estimates.

Since the dependent variables display a stochastic trend and survey indicators are stationary, we forecast variables in year-on-year differences to remove the unit root in the time series. Given that the data are quarterly, we use the fourth differences (in logarithms). According to this notation in the model, $xt=\Delta^4 logXt=(1-L^4)logXt$, where L is the lag operator and 4 is the order of differencing.

The following Tables report the results of a forecast exercise conducted considering an estimation sample from 2004 q4 to 2012 q4 and a forecasting window equal to 16 quarters from 2013 q1 to 2016 q4. In the exercise, we compute the RMSFE in a dynamic *ex ante* forecast setting, considering recursive estimation methods.

An automatic parsimonious lag pre-selection based on a general-to-specific algorithm is used to specify the functional form of the models (see Hendry and Krolzig, 2001). More in detail, starting from an initial 6 lag model, the algorithm selects reduced form models based on lag statistical significance.

The recursive window for the out-of-sample exercise spans from 19 quarters for 1 1-step ahead forecast to 14 quarters for 4-step ahead forecasts. The lags of explanatory variables reported in the following tables are statistically significant.

Table 4.4 reports the results of 3 vector autoregressive models to forecast industrial production. Model 1 uses SIT_GEN_BoI. Models 2 and 3 use SITGEN_ISTAT both seasonally and not seasonally adjusted.

Table 4.4 - Forecasting models for the industrial production using SITGEN (balances) RMSFE for dynamic forecasts (a)

	Model 1 SITGEN_BI	Model 2 SITGEN_ISTAT_SA	Model 3 SITGEN_ISTAT_NSA
Intercept	0.012(***)	0.021	0.022
Δ^4IPI t-1	0.68(***)	0.825(***)	0.83 (***)
Δ^4IPI t-3		-0.37(**)	-0.38 (***)
SIT_GEN t-1	0.001(***)	0.0015(**)	0.0014 (**)
SIT_GEN t-4		0.0001	0.0002
Normality test (residuals)	4.81 (0.09)	4.95 (0.08)	4.48 (0.11)
Heteroscedasticity test	4.06 (0.01)	1.41 (0.25)	1.00 (0.46)
AR test (residuals)	3.03 (0.05)	0.31 (0.82)	0.28 (0.84)
1-step dynamic forecast	0.019505	0.022626	0.020825
2-step dynamic forecast	0.016088	0.018894	0.021251
3-step dynamic forecast	0.019670	0.021406	0.019025
4-step dynamic forecast	0.026446	0.019970	0.022635

Source: Authors' processing

(a) The dependent variable is the year-on-year growth rate of industrial production (IPI). Estimation sample: 2005 Q1-2012 Q4. Forecasting sample: 2013 Q1-2016Q4.

*: significant at 10 per cent; **: significant at 5 per cent; ***: significant at 1 per cent; p-values in parenthesis.

The models of Table 4.4, estimated using the indicators on the general economic situation show that in terms of RMSFE model 1, based on SIGE, seems to perform better than the alternatives for 1 and 2 steps ahead; model 3 and model 2, both based on the Istat survey, are respectively better for 3 and 4 steps ahead. The diagnostics indicate no heteroscedasticity and normality for models 2 and 3. The AR test on the autocorrelation of the residuals, set on lag length from 1 to 4, shows that model 1 has no autocorrelation, models 2 and 3 have autocorrelation. The selected model 1 displays a degree of autocorrelation and heteroscedasticity in the residuals, while for the normality test, the significance is on borderline thresholds. However, the model has been selected by the general to specific algorithm, and the residuals' behaviour does not invalidate its forecast performance accuracy, but potentially only the coefficients' interpretation, which is not the focus of the paper.

We also need to inspect if the tail indicators on the general economic situation (*i.e.* positive and negative judgements) considered individually have a forecasting content. Table 4.5 shows the models to forecast industrial production using SITGEN_BoI positive judgements, and Table 4.6 focusses on the negative judgements.

Table 4.5 - Forecasting models for the industrial production using SITGEN (positive) RMSFE for dynamic forecasts

	Model 1 SITGEN_BI_P	Model 2 SITGEN_ISTAT_NSA_P
Intercept	-0.025**	-0.0165**
Δ^4IPI t-1	0.9***	1.283***
Δ^4 IPI t-2		-0.61***
Δ^4 IPI t-3	-0.31***	
SIT_GEN t-1	0.0014***	0.0018**
Normality test (residuals)	1.74 (0.42)	0.17 (0.92)
Heteroschedasticity test	0.84 (0.55)	0.62 (0.71)
AR test (residuals)	1.1 (0.37)	2.85 (0.06)
1-step dynamic forecast	0.024836	0.023498
2-steps dynamic forecast	0.023724	0.022595
3-steps dynamic forecast	0.024985	0.022485
4-steps dynamic forecast	0.027356	0.022920

Source: Authors' processing
(a) The dependent variable is the year-on-year growth rate of industrial production. Estimation sample: 2005 Q2-2012. Forecasting sample: 2013 Q1-2016 Q4.
*: significant at 10 per cent; **: significant at 5 per cent; ***: significant at 1 per cent; p-values in parenthesis.

Table 4.6 - Forecasting models for the industrial production using SITGEN (negative) RMSFE for dynamic forecasts

	Model 1 SITGEN_BI_N	Model 2 SITGEN_ISTAT_NSA_N
Intercept	0.016**	0.051
Δ^4IPI t-1	0.87***	0.786***
Δ^4 IPI t-3	-0.29***	-0.336**
SIT_GEN t-1	-0.00065**	-0.00212**
Normality test (residuals)	5.80 (0.05)	5.44 (0.06)
Heteroschedasticity test	0.99 (0.45)	0.31 (0.92)
AR test (residuals)	1.24 (0.32)	0.38 (0.76)
1-step dynamic forecast	0.025746	0.025898
2-steps dynamic forecast	0.023825	0.023562
3-steps dynamic forecast	0.025775	0.025945
4-steps dynamic forecast	0.025945	0.024879

Source: Authors' processing
(a) The dependent variable is the year-on-year growth rate of industrial production. Estimation sample: 2005 Q2-2012 Q4. Forecasting sample: 2013 Q1-2016 Q4.
*: significant at 10 per cent; **: significant at 5 per cent; ***: significant at 1 per cent; p-values in parenthesis.

Looking at the results of Table 4.5 using positive judgements on the general economic situation, we can notice that model 2 from Istat data performs slightly better than model 1 using SIGE in terms of RMSFE. Results using the negative judgements, reported in Table 4.6, show instead that model 1 in SIGE perform similarly to model 2, with marginal differences at each time horizon. All the models pass the residuals diagnostics.

In order to analyse the possible sensitivity with respect to the reference business cycle (namely industrial production *versus* value added), Table 4.7 reports the results of vector autoregressive models to forecast the manufacturing value added (instead of industrial production) by means of the general economic situation. Model 1 uses the balance of the general economic situation from BoI survey (SIT_GEN_BoI). Models 2 and 3 use SITGEN_ISTAT both seasonally and not seasonally adjusted.

Table 4.7 - Forecasting models for the industrial value added using SITGEN (balances). RMSFE for dynamic forecasts (a)

	Model 1 SITGEN_BoI	Model 2 SITGEN_ISTAT_SA	Model 3 SITGEN_ISTAT_NSA
Intercept	0.0083**	0.0111	0.0109
Δ^4VA t-1	1.26***	1.292***	1.30***
Δ^4VA t-2	-0.59***	-0.63***	
Δ^4VA t-3			-0.63***
SITGEN t-1	0.00033***	0.00041	0.00036
Normality test (residuals)	2.31 (0.31)	1.86 (0.39)	2.36 (0.31)
Heteroschedasticity test	1.31 (0.29)	0.97 (0.46)	1.04 (0.42)
AR test (residuals)	0.70 (0.57)	0.31(0.81)	0.38 (0.77)
1-step dynamic forecast	0.01778	0.015306	0.014296
2-steps dynamic forecast	0.017566	0.018794	0.019941
3-steps dynamic forecast	0.017673	0.015837	0.014954
4-steps dynamic forecast	0.020056	0.018597	0.01771

Source: Authors' processing

(a) The dependent variable is the year-on-year growth rate of the value added in the industrial sector (VA). Estimation sample: 2005 Q2-2012 Q4 Forecasting sample: 2013 Q1-2016 Q4.

*: significant at 10 per cent; **: significant at 5 per cent; ***: significant at 1 per cent; p-values in parenthesis.

Results of forecasting models reported in Table 4.7 show that while models 2 and 3 from Istat perform better 1, 3 and 4 steps ahead, model 1 from SIGE performs better in terms of RMSFE for two quarters ahead. All the models pass the usual residuals diagnostics.

Tables 4.8 and 4.9 report the results of the VAR models to forecast manufacturing value added using, respectively, the positive and the negative judgements concerning the general economic situation.

Table 4.8 - Forecasting models for the industrial value added using SITGEN (positive). RMSFE for dynamic forecasts (a)

	Model 1 SITGEN_BI_P	Model 2 SITGEN_ISTAT_NSA_P
Intercept	-0.0094**	-0.0099
Δ^4VA t-1	1.28***	1.33***
Δ^4 VA t-2	-0.60***	-0.65***
SITGEN t-1	0.54**	0.0012
Normality test (residuals)	1.61 (0.44)	2.63 (0.26)
Heteroscedasticity test	0.91 (0.50)	0.96 (0.47)
AR test (residuals)	1.18 (0.34)	0.69 (0.57)
1-step dynamic forecast	0.013847	0.014296
2-step dynamic forecast	0.018921	0.019941
3-step dynamic forecast	0.016863	0.014954
4-step dynamic forecast	0.02225	0.017710

Source: Authors' processing

(a) The dependent variable is the year-on-year growth rate of the value added in the industrial sector (VA). Estimation sample: 2005 Q2-2012 Q4. Forecasting sample: 2013 Q1-2016 Q4.

*: significant at 10 per cent; **: significant at 5 per cent; ***: significant at 1 per cent; p-values in parenthesis.

Table 4.9 - Forecasting models for the industrial value added using SITGEN (negative). RMSFE for dynamic forecasts (a)

	Model 1 SITGEN_BoI_N	Model 2 SITGEN_ISTAT_NSA_N
Intercept	0.024	0.0016
Δ^4 VA t-1	0.83***	1.36***
Δ^4 VA t-2		-0.66***
Δ^4 VA t-3	-0.32***	
SITGEN t-2	-0.00074**	
Normality test (residuals)	4.43 (0.11)	1.48 (0.48)
Heteroscedasticity test	0.61 (0.71)	1.19 (0.34)
AR test (residuals)	0.17 (0.91)	0.014 (0.99)
1-step dynamic forecast	0.016995	0.013669
2-step dynamic forecast	0.015524	0.023404
3-step dynamic forecast	0.017301	0.019034
4-step dynamic forecast	0.022018	0.019933

Source: Authors' processing

(a) The dependent variable is the year-on-year growth rate of the value added in the industrial sector (VA). Estimation sample is: 2005 Q2-2012 Q4. Forecasting sample: 2013 Q1-2016 Q4.

*: significant at 10 per cent; **: significant at 5 per cent; ***: significant at 1 per cent; p-values in parenthesis

Looking at the results of Table 4.8 using positive judgements, we can notice that the BoI model performs better in the short term (one and two steps ahead), while model 2 from Istat performs better three and four steps ahead. Quite the opposite, the results of Table 4.9 considering negative judgements on the general economic situation show that the Istat model performs better than the BoI model at 1 and 4 steps ahead. The models pass the residuals diagnostics.

Overall, the results concerning the predictive ability of the general economic situation seem to show that there is no clear pattern. Depending on the time horizon or the reference variable, one indicator may dominate over the others, but still, the differences in the RMSFE are always minor.

We now focus on the predictions for the labour market. Table 4.10 reports the results of 3 vector autoregressive models to forecast employment; Model 1 uses EMPL_EXP_BoI, while models 2 and 3 use EMPL_EXP_ISTAT, respectively, seasonally and not seasonally adjusted.

Table 4.10 - Forecasting models for employment using employment expectations (balances). RMSFE for dynamic forecasts (a)

	Model 1 EMPL_EXP_BI	Model 2 EMPL_EXP_ISTAT_SA	Model 3 EMPL_EXP_ISTAT_NSA
Intercept	-0.0033 **	-0.0028 **	-0.0027
Δ^4 empllog t-1	1.044 ***	1.052 ***	1.053 ***
EMPL_EXP t-1	-0.00016	-0.00017 **	-0.00014
Normality test (residuals)	1.42 (0.49)	0.74 (0.69)	0.96 (0.61)
Heteroscedasticity test	0.22 (0.92)	0.29 (0.88)	0.38 (0.81)
AR test (residuals)	1.37 (0.27)	1.86 (0.16)	1.82 (0.17)
1-step dynamic forecast	0.029146	0.032682	0.055628
2-step dynamic forecast	0.04388	0.040978	0.068691
3-step dynamic forecast	0.02764	0.042765	0.072859
4-step dynamic forecast	0.01536	0.034263	0.020924

Source: Authors' processing

(a) The dependent variable is the year-on-year growth rate of employment. Estimation sample: 2005 Q2-2012 Q4. Forecasting sample: 2013 Q1-2016 Q4. p-values in parentheses

*: significant at 10 per cent; **: significant at 5 per cent; ***: significant at 1 per cent; p-values in parenthesis.

Looking at the RMSFE results of Table 4.10 at various steps, one can notice that the EMPL_EXP_BoI indicator performs better at 1, 3 and 4 steps ahead, while the RMSFE of the model with the series EMPL_EXP_ISTAT_SA is lower than the alternatives 2 steps ahead. The residual test shows normality, no heteroscedasticity and no autocorrelation.

The results of the models using the positive and negative judgements on employment expectations are respectively shown in Tables 4.11 and 4.12.

Table 4.11 - Forecasting models for employment using employment expectations (positive). RMSFE for dynamic forecasts (a)

	Model 1 EMPL_EXP_BI_P	Model 2 EMPL_EXP_IS_NSA_P
Intercept	0.00825	0.0014
Δ^4 empllog t-1	1.11***	1.46***
Δ^4 empllog t-2		-0.49**
EMPL_EXP t-1	-0.00043**	-0.000
Normality test (residuals)	1.61 (0.44)	3.01(0.23)
Heteroscedasticity test	0.42 (0.82)	0.36 (0.92)
AR test (residuals)	1.31 (0.29)	0.61 (0.61)
1-step dynamic forecast	0.037624	0.087372
2-step dynamic forecast	0.03109	0.1277
3-step dynamic forecast	0.01124	0.22736
4-step dynamic forecast	0.01989	0.022375

Source: Authors' processing

(a) The dependent variable is the year-on-year growth rate of employment. Estimation sample: 2005 Q2-2012 Q4. Forecasting sample: 2013 Q1-2016 Q4. p-values in parentheses.

*: significant at 10 per cent; **: significant at 5 per cent; ***: significant at 1 per cent; p-values in parenthesis.

Table 4.12 - Forecasting models for employment using employment expectations (negative). RMSFE for dynamic forecasts (a)

	Model 1 EMPL_EXP_BoI_N	Model 2 EMPL_EXP_ISTAT_NSA_N
Intercept	-0.01189**	-0.0047
Δ^4 empllog t-1	0.9758*	1.0579***
EMPL_EXP t-1	0.00042***	0.00045**
Normality test (residuals)	3.04 (0.21)	2.75 (0.25)
Heteroscedasticity test	2.27 (0.09)	2.75 (0.98)
AR test (residuals)	0.36 (0.78)	0.11(0.17)
1-step dynamic forecast	0.021144	0.053681
2-step dynamic forecast	0.052690	0.062785
3-step dynamic forecast	0.036270	0.074971
4-step dynamic forecast	0.014980	0.014551

Source: Authors' processing

(a) The dependent variable is the year-on-year growth rate of employment. p-values in parentheses. Estimation sample: 2005 Q2-2012 Q4. Forecasting sample: 2013 Q1-2016 Q4.

*: significant at 10 per cent; **: significant at 5 per cent; ***: significant at 1 per cent; p-values in parenthesis.

Looking at the RMSFE reported in Table 4.11, we can see that model 1 using BoI employment expectations positive judgements (EMPL_EXP_BI_P) performs better at all time horizons concerning the Istat indicator. The models pass the usual residuals diagnostics. Similarly, looking at the results in terms of RMSFE reported in Table 4.12 shows that model 1 using BoI negative judgements on the general economic situation (SITGEN) performs better than model 2 using Istat data at all time horizons. Model 2 passes all the residual diagnostics at a 1% significance level, while Model 1 passes the normality test and AR test at a 1% level and the heteroscedasticity test at a 10% level.

Overall, looking at the results of the forecast models for industrial production, value added and employment, we can notice that Bank of Italy SIGE survey indicators, although based on a small sample of firms, seem to display a forecast performance that is broadly similar to the predictions of the industrial output. At the same time, they tend to be better for SIGE regarding employment. The latter result might seem at odds with the fact that the Istat survey is based on a larger sample; one explanation for this result can be linked to the inclusion in the Istat sample of the small firms, which could bring some noise in the answers to the questionnaire. Larger firms probably formulate more reliable expectations and judgements, putting more resources into developing their plans concerning small firms; moreover, the person answering the survey questionnaire in the small enterprise may have less

macroeconomic expertise than the person responding in the large enterprise. This interpretation concerning a limited ability of small firms to track and forecast business cycle evolution is coherent with Van Nieuwerburgh and Veldkamp's findings (2006). Another result concerns the fact that the seasonal adjustment does not seem to be so relevant, given that often the forecast accuracy of the models based on the raw Istat indicator is better than that of the models using the Istat seasonal adjusted data.

4.3 Comparing predictive accuracy

To assess if the difference in the forecasting performance among models is statistically significant, Diebold Mariano (1995) test results are also reported. The test is based on the null hypothesis that the forecast performance between two models is equal, against the alternative that it is statistically different. The test statistics is:

$$T = \frac{\bar{d}_t}{\left(cov(d_t, d_{t-1},)/T\right)^{1/2}}$$

where $\bar{d}_t = \left(e^{BoI}_{t+h/t} - e^{ISTAT}_{t+h/t}\right)$ indicates the difference between the forecasting prediction errors obtained using the BoI and Istat forecasting models and $\bar{d}_t = \frac{1}{t_0}\sum_{t_0}^{T} d_t$.

Table 4.13 reports the p-values of the Diebold Mariano test for 1, 2, 3, and 4 forecast horizons for 2 bivariate VAR models used to forecast industrial production and employment.

Table 4.13 – Results of the Diebold Mariano test (p-values)

Test of equal accuracy of the Istat forecast wrt the BoI forecast
H0: Forecast accuracy is equal

	Industrial production		Employment	
	SITGEN_BOI SITGEN_ISTAT_NSA	SITGEN_BOI SITGEN_ISTAT_SA	EMPL_EXP_BoI EMPL_EXP_ISTAT_NSA	EMPL_EXP_BoI EMPL_EXP_ISTAT_SA
1-step forecast	0.03	0.87	0.00	0.02
2-step forecast	0.87	0.38	0.00	0.15
3-step forecast	0.13	0.08	0.00	0.37
4-step forecast	0.25	0.28	0.09	0.01

Source: Bank of Italy, Survey on Inflation and Growth Expectations (SIGE), and Istat, Manufacturing business survey

The results of the Diebold Mariano test indicate that the differences in the MSFE of the VAR models based on SIGE and Istat business surveys for industrial production are, in general, not statistically significant; this is consistent with the fact that the differences between the RMSFE are minor, as noted above. In the case of the employment prediction only, there is a dominance of the SIGE indicator over the raw indicator of Istat, as already mentioned, looking at the size of the prediction errors.

Based on the previous results, it seems that both surveys, SIGE and Istat, have similar informative content, in nowcasting and short-term forecasting. It is therefore worth investigating if one model may encompass an alternative one, in the sense that its forecast captures completely the information of the alternative.

In what follows, to test the relevance of business survey indicators information, the results of an encompassing test are also shown. The idea of the encompassing test relates to the notion that one model not only fully explains what another model can explain but also provides additional information. With competing forecasts, the condition that *f1,t+1/t* encompasses *f2,t+1/t* can be stated as:

$$E\left[L\left(f/_{1,t+1/}t, y_{t+1}\right)\right] \leq min_{g(.)}E\left[L\left(f/_{1,t+1/}t, f/_{2,t+1/}t\right), y_{t+1}\right]$$

If this equation holds, then the first forecast is sufficient in the sense that there is no information in the second forecast that is useful once we have access to the first forecast[11].

Table 4.14 reports the forecast encompassing tests based on two statistics, "test a" and "test b". In "test a", the null hypothesis is that the prediction based on the SIGE survey encompasses the one based on the Istat survey. In "test b", the null hypothesis is that the prediction based on the Istat survey encompasses the one based on the SIGE survey. More in detail, the encompassing test is based on Chong and Hendry (1986), considering only forecast information and abstracting from the data-generating process and the model structure.

11 Note that the forecast encompassing depends on a standard quadratic loss function. However, as shown in Harvey et. al. (1998) the forecast evaluation results are not significatively sensitive to different loss functions.

Table 4.14 – Results of the forecast encompassing tests (p-values) (a)

		Industrial production		Employment	
		SITGEN_BOI SITGEN_ISTAT_NSA	SITGEN_BOI SITGEN_ISTAT_SA	EMPL_EXP_BoI EMPL_EXP_ISTAT_NSA	EMPL_EXP_BoI EMPL_EXP_ISTAT_SA
h=1	Test a	0.00	0.00	0.00	0.00
	Test b	0.00	0.00	0.00	0.00
h=2	Test a	0.00	0.00	0.00	0.00
	Test b	0.00	0.01	0.00	0.00
h=3	Test a	0.00	0.00	0.34	0.00
	Test b	0.00	0.00	0.00	0.00
h=4	Test a	0.04	0.06	0.02	0.40
	Test b	0.01	0.04	0.00	0.00

Source: Authors' processing

(a) Test a: the null hypothesis is that the prediction based on the SIGE survey encompasses the one based on the Istat survey; test F.
Test b: the null hypothesis is that the prediction based on the Istat survey encompasses the one based on the SIGE survey; test F.

The forecast encompassing test shows that, except for a few exceptions, the information contained in the SIGE survey may not encompass that of the Istat; therefore, both surveys are beneficial in nowcasting and short-term forecasting.

5. Conclusions and further research

In this paper, we analyse the similarities and differences between two business confidence indicators for Italy, on the expectations of the general economic situation and employment, collected by the Bank of Italy (Survey SIGE) and by Istat. To do this, we analyse the statistical properties of such data (*i.e.* seasonal components, unit roots and the cross-correlations concerning their reference cycles) and perform a forecast exercise using VAR models.

We find that the SITGEN indicator from the SIGE survey concerns its ability to lead the business cycle, similarly to the corresponding series in the Istat survey; this is not a foregone result, as the SIGE question to firms is not explicitly formulated as forward-looking, and the SIGE sample has a smaller number of firms than the Istat sample.

Regarding the predictions on employment, the SIGE indicator seems to overperform the Istat survey; the better forecast accuracy is also statistically significant for some horizons, but the predictions of the model based on SIGE do not encompass the alternative.

The forecasting exercise is mainly based on "balance", which is given by the difference between positive and negative judgments provided by firms. We also explore the predictive power of its components, namely the positive and negative judgments considered separately. We find the predictive power of the positive and negative judgments is comparable to that of balance; therefore, they can be used singularly in nowcasting and short-term forecasting. This result holds for both the BoI and the Istat indicators.

Our results provide insights for further research. To better understand the extent to which the differences in the sample structure of the SIGE and manufacturing Istat surveys affect their leading properties, an in-depth study of the relevance of small firms in business surveys can be performed. Future studies could also explore forecasting combination techniques to take full advantage of the informative content of both surveys.

Appendix

Table A1 - Istat and Bank of Italy business survey questions

Bank of Italy	SITGEN_BoI	Compared with 3 months ago, do you consider Italy's general economic situation to be: 1 Better, 2 the same, 3 Worse?
Istat	SITGEN_Istat	In the next 3 months, the general tendency of the Italian economy, abstracting from sectoral and firms' developments, will be: 1 Favourable, 2 Stationary, 3 Unfavourable.
Bank of Italy	EMPL_EXP_BoI	In the next 3 months, overall employment of your firm will be: 1 Higher, 2 Unchanged, 3 Lower.
Istat	EMPL_EXP_Istat	Your firm's total number of employees in the next 3 months will be: 1 Lower, 2 Unchanged, 3 Higher.

Source: Authors' processing

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