The Predictive Content of Business Survey Indicators: evidence from SIGE

Tatiana Cesaroni*

Stefano Iezzi*

July 2015

Abstract

Business surveys indicators represent an important tool in economic analysis and forecasting practices. While there is wide consensus on the coincident properties of such data, there is mixed evidence on their ability to predict macroeconomic developments in the short term. In this study we extend the previous research on business surveys predictive content by examining the leading properties of the main business survey indicators coming from the Italian Survey on Inflation and Growth Expectations (SIGE).

To this end we provide a complete characterization of the business cycle properties of survey data (volatility, stationarity, turning points etc.) and we compare them with National Accounts reference series. We further analyze the forecast ability of the SIGE indicators to detect turning points using both discrete and continuous dynamic single equation models against their benchmark (B)ARIMA models. Overall the results indicate that SIGE business indicators are able to early detect turning points of their corresponding national account reference series. These findings are very important from a policy making point of view.

Keywords: Business cycle, Business survey data, Turning points, cyclical analysis, Forecast accuracy, Macroeconomic forecasts.

JEL classification: C32 E32

*Bank of Italy, Economics and Statistics Department.

We would like to thank Francesco Zollino, Leandro D'Aurizio, Luigi Cannari, Riccardo De Bonis, Giovanni D'Alessio, Nicola Branzoli and all the participants to the Bank of Italy lunch seminar held on May 28, 2015 for their comments and suggestions. Any error or mistake remains the author's sole responsibility.

1. Introduction

Business survey data are widely used in short term policy analysis since they furnish timely information on the overall economic activity as well as on the key macroeconomic series evolution. Their prompt availability with respect to national accounts data (that are published with a delay of roughly 2 months) allows detecting possible changes in the business cycle phases and to prevent possible slowdowns. Besides they are used for economic surveillance purposes as early warning indicators of economic crises given their ability to capture *"firms' sentiment"*.

While there is wide consensus on the coincident properties of business survey data, in the last twenty years the literature has provided discordant results concerning their ability to forecast the economic activity in the short term.

Bergstrom (1995) analyzes the relationship between industrial production growth rate and business tendency survey (BTS) for Sweden using autoregressive distributed lag models. In its findings the specifications including BTS indicators improve the forecasting performance of the models. Bruno and Lupi (2004) detect business cycle turning points using European commission survey data into VAR models and find a predictive power of such qualitative indicators. Lemmens *et al.* (2005) analyze the predictive content of Production Expectations data for twelve European Union countries using both univariate and multivariate Granger Causality tests. In their findings production expectations display a predictive content only in 7 EU countries when using univariate Granger test whereas in a multivariate test context the leading properties are confirmed for all the groups of countries. Abberger (2007) assesses the ability of employment expectations to forecast employment from National Accounts (NA) data using smoothing techniques, Probit models and ECM and concludes that employment expectations are leading indicators of the current employment dynamics. Analogously Claveria *et al.* (2007) analyze the predictive power of a wide set of business and consumer survey variables coming from European Commission survey for several European countries and conclude that only for a limited number of models using information from surveys the forecast performance in terms of the Root Mean Square Error (RMSE) is higher with respect to their benchmarks. More recently Cesaroni (2011) analyzes the cyclical behavior of four Italian business survey indicators (i.e. inventories, industrial orders book level, degree of plants utilization and confidence climate index) coming from the European Commission joint harmonized survey using both time and frequency domain methods and concludes that business tendency surveys are able to predict economic activity evolution especially at highest business cycle frequencies. Cesaroni *et al.* (2011) inspect the business cycle stylized facts for the three main euro area countries (namely Italy, France and Germany) and find that the GDP business cycle characteristics (such as amplitude, duration and steepness) are very similar to those found in their corresponding qualitative

business survey data. Such findings show that business surveys are suitable in to capturing the business cycle evolution.

In this paper we evaluate the predictive content of all the relevant information coming from the Italian Survey on Inflation and Growth Expectations (SIGE) conducted by Bank of Italy since 1999 on a sample of roughly 1,000 firms of industrial and services sectors. The survey has been designed in order to provide information on a wide range of business cycle indicators and is aimed to furnish a timely outlook on the Italian economy evolution. The analyzed data-set includes 8 business survey indicators with quarterly frequency available from 1999 or 2004 and a number of reference series coming from NA data (i.e. GDP, inflation, gross fixed investments and the number of employees). To test the predictive content of the survey indicators we use the following approach:

- First we evaluate the leading properties of the SIGE indicators by analyzing their co-movements with respect to their reference National Accounts series through cross correlations analysis.
- Second we analyze their business cycle characteristics (i.e. duration, turning points) and we compare them with the business cycle chronology of Italian National Accounts reference series, also in terms of synchronization.
- Third we assess the survey indicators predictive content with respect to their National Account reference series in terms of RMS(F)E using discrete and continuous univariate dynamic models.

We extend the previous research on survey data predictive content by providing further evidence coming from SIGE business indicators. As bi-product we provide a full characterization of the SIGE indicators cyclical chronology with respect to the reference Italian National Accounts.

The paper is structured as follow. Section 2 introduces the SIGE business survey data, Section 3 provides a description of their main econometric and statistical properties (i.e. stationarity, volatility) and their co-movements with the corresponding NA time series. Section 4 analyzes the business cycle properties of survey data in terms of turning points detection and phases characteristics (i.e. average duration, synchronicity) by making a comparison with respect to their national accounts reference series. Section 5 introduces the forecasting models. Section 6 reports a forecast performance exercise. Conclusions follow.

2. Data set description

Business Survey data are taken from the quarterly Bank of Italy Survey of Inflation and Growth Expectations. The survey is conducted in January, April, July and September on a sample of roughly 1,000 firms of manufacturing and services sectors with more than 50 employees. Data

are available from 1999Q4. Respondents are asked to report opinions concerning the short term evolution on some key macroeconomic variables such as inflation and business cycle, and more specific questions concerning their own business activity. The indicators coming from the survey are represented in form of balances that are the weighted[1] difference between the percentages of positive and negative answers reported by the firms.

In our analysis we focus on 8 business survey indicators namely, expectations on inflation, firms' selling prices, number of employees, conditions for investment, 3 month and 3 year firms' business condition, Italy's general economic situation and probability of improvement in Italy's general economic situation. These indicators are chosen on the basis of their economic relevance, time series length availability and the possibility to compare them with macroeconomic data.[2] More in detail we consider:

- Inflation expectations (INFL_EXP). This indicator captures the twelve months firms' expectations of harmonized price consumption index. The indicator is quantitative because the respondents provide a numerical value of inflation in the next twelve months.
- Expectations on firms' own selling prices (D_PREZ). This question asks firms to answer about 12 months expectations on future prices of its own products. The variable is qualitative in the form of a balance and can potentially furnish information on the future inflation. [3]
- Expectations on number of employees (OCC_TOT_EXP). This indicator captures the three months firms' expectations on own employment developments in the next three months. The indicator is a balance because takes into account the difference between positive and negative answers.
- Expectations on investment conditions (SIT_INV). Firms are asked to answer on their current investments conditions with respect to the past three months.
- 3 month firms' business condition expectations (SIT_IMP_3M). This question asks firms to answer about their operating business conditions in the next three months. The indicator is a balance since it's given by the number of positive answers minus the number of negative answers.
- 3 year firm business condition expectations (SIT_IMP_3Y). In this question firms are asked to answer in their operating business conditions in the next three years. The indicator is a balance since it's given by the number of positive answers minus the number of negative answers.

[1] Weights are the inverse of sample probability of inclusion.
[2] Survey indicators are usually referred to industry and services sectors.
[3] While most survey microdata are weighted with the inverse of sample probability of inclusion this variable is weighted considering also the number of employees.

- Expectations on Italy's general economic situation (SIT_GEN). This is a qualitative question, in which firms are asked to answer about the expected Italy's economic situation in the next three months. The indicator is expected to be leading with respect to business cycle.
- Probability of improvement of the economy in the next three months (PROMIG). This question ask firms to indicate a probability that the economy will improve in the next three months. The indicator takes values between 0 and 100.

Among National Accounts data we consider inflation (INFL), employment (EMPL), Investments (INV) and Gross Domestic Product (GDP). All the series are produced by the Italian National Institute of Statistics and span from 1996Q1 to 2014Q4. The data are available on quarterly basis, are seasonally adjusted and are used to make a comparison with SIGE indicators business cycle properties. For GDP and investments we use chained values with base 2010.

The dynamic of most of the variables measuring economic activity, such as production or employment, includes a trend component which needs to be excluded in order to extract the business cycle. This should not be the case with business survey indicators, since the questionnaire is designed to elicit answers concerning short run increases and decreases of a given indicator. Nonetheless, seasonal factors and irregular variability also could affect responses.[4]

See Appendix 3 for a detailed description of all variables and formulation of survey questions.

3 Stationary properties, volatility and cross correlation

As a preliminary data analysis we graphically compare the survey indicators with their corresponding reference economic series (see figures1-8 in Appendix 2). Business cycle from NA data is extracted using quarterly growth rates. Figures 1 and 2 compare the growth rate of harmonized CPI with the inflation expectations 12 months ahead (INFL_EXP) and the expectations on firm' own prices in the next 12 months (D_PREZ). Inflation expectations appears to be contemporaneous with respect to the reference series. This is probably due to the fact that the question is formulated providing an anchoring to the current inflation.[5] The graphical analysis seems to suggest that the expectations formulated by the operators follow adaptive rather than rational schemes. Indeed, the agents do not seem to be forward looking when answering on expectations on the future inflation dynamics. Firms own prices (D_PREZ) instead seems to display

[4] Currently business survey data published in the Bank of Italy Statistical Bulletin are not seasonally adjusted.

[5] For SIGE data it has been showed that anchoring involves the benefit of reducing the uncertainty in the formulation of expectations (expanding the set of knowledge on which they are based), with the consequent reduction of the standard error of the estimates of the average value, without generating a significant bias in the estimate of expectations (Banca d'Italia, 2013).

a leading profile with respect to inflation although in some subsamples seem to be out-of-phase. More in detail, the D_PREZ series seems to be counter-cyclical before 2008 and becomes quite pro-cyclical afterwards. This change of pattern might be explained by the fact that after the financial crisis agents became more aware of ECB inflation target policy and started to formulate their expectations on own prices looking at monetary policy announcements.

Insert Figure 1 and 2

A first inspection to the dynamics of inflation seems to indicate a volatility break in 2007 in correspondence with the beginnings of the crisis. The volatility of inflation, together with the amplitude and length of its cycle, significantly increased after that date. Inflation expectations experiments a similar change in its pattern while D_PREZ seems to display similar characteristics before and after 2007.

Figures 3 and 4 compare the firms' current investment conditions (SIT_INV) and firms expectations on its own employment in the next three months (OCC_TOT_EXP) with their reference national accounts series (namely, gross fixed investments growth and employment growth).

Insert Figure 3 and 4

Looking at investment conditions we can note that the series, although more volatile with respect to investments, are able to depict the investments business cycle with a certain lead. The employment expectations are also able to describe the dynamics of employment in the whole sample.

Insert Figure 5,6,7 and 8

Figures 5, 6, 7 and 8 report a comparison between SIT_IMP_3M, SIT_IMP_3Y, SIT_GEN and PROMIG with the GDP yearly growth rate. A first look at the pictures seems to indicate that all the indicators are able to predict the 2009 downturn of business cycle due to the economic crisis at least 2 quarters before. The three month expectations on the firm business situation (SIT_IMP_3M) seem to show a higher volatility with respect to GDP growth rate, while the three year expectations (SIT_IMP_3Y) seems to have a greater leading behavior with respect to SIT_IMP_3M.

Since Business cycle analysis and measurement requires low frequency removal from the data, we analyze SIGE indicators stationarity properties. Although business survey data, being built as balances[6], are expected to be stationary, in specific subsamples they might display a local stochastic trends. To inspect the presence of possible unit roots Table 1 reports the Augmented

[6] Given the existence of upper and lower bounds values for survey indicators built as balances we expect a bounded stationary behavior in the long run.

Dickey Fuller (ADF), GLS and Phillips Perron (PP) tests. In the case of ADF the number of lags is chosen on the basis of the Schwartz information criterion while PP doesn't requires lag structure investigation in the data being non parametric. Since the ADF and Phillips Perron (PP) test display a low small sample power[7], given a more powerful GLS test developed by Elliot, Rotemberg and Stock (1996) is also performed.

Insert table 1

Looking at the results reported in Table 1 we can notice that the ADF, PP and GLS tests provide discordant conclusions for OCC_TOT_EXP, SIT_INV, SIT_IMP_3M and SIT_IMP_3Y. Inflation expectations (INFL_EXP) and firms' expectations on its future prices (D_PREZ) are found to be stationary in all cases although at different significance levels. Overall for some survey indicators the tests seems to indicate mixed evidence on the stationarity in the sample considered.

To further analyze the stylized facts of SIGE indicators and to compare them with NA data Table 2 reports the cyclical volatility of NA series and the business surveys volatility in the whole sample (1999-2014) and two different subsamples (1999-2007 and 2008-2014). The break point should account for possible changes in the series volatility due to the economic and financial crisis.

Insert table 2

Looking at the results we can notice that as expected the volatility has increased for all national accounts series starting from the 2007 crisis. For inflation in the seven year sample after the crisis volatility has roughly increased 3-4 times with respect to the volatility in the first subsample. An analogous evidence can be found in the inflation expectation behavior (INFL_EXP) while firms' expectations on its future prices indicator (D_PREZ) shows a quite stable variability in the two subsamples confirming the graphical analysis evidence. Inflation expectation displays a similar volatility pattern with respect to inflation rate. GDP, investments and employment growth also show a volatility increase in the second subsample. In the case of GDP the volatility doubles shifting from 0.012 to 0.025 in 2007-2014 sample. Looking at investments we notice that their relative volatility with respect to GDP has increased after the 2007 crisis. For the remaining business survey indicators the comparison between the two subsamples has not been possible due to the shorter data availability.

Overall the evidence coming from the four National Accounts reference series seems to suggest that the Great Moderation hypothesis is over. Such preliminary evidence seems also to

[7] The ADF and PP tests are asymptotically equivalent but may also give different results in finite samples due to the different ways in which they correct for serial correlation in the test regression.

indicate that changes in the series occurred after the crisis could be structural rather than due to transitory shocks. However such intuition should be investigated in further detail. [8]

To inspect the leading and lagging general properties of SIGE indicators Table 3 reports the cross-correlations between each survey indicator and the reference NA series at all leads and lags from t-4 to t+4 over the period 2004-2014.

Insert Table 3

The results concerning inflation suggest that the contemporary correlation compared to the inflation expectations (INFL_EXP) is higher (0.91) than that compared to firms' own prices survey indicator (D_PREZ, 0.29). Inflation expectation have no leading power[9] whereas expectations on firms' own prices are leading in 2-3 quarters. The expectations on employments in the next three months (OCC_TOT_EXP) are leading in 1-2 quarters with a very high correlation equal to 0.84. Investment business conditions (SIT_INV) seems to be leading in two quarters (0.72) with respect to national accounts investments although firms are asked to answer on their situation about the past three months.

Survey indicators cross correlations with respect to GDP exhibit slightly different behavior namely:

- SIT_IMP_3M is pro-cyclical and leads business cycle in one-two quarters ahead with a correlation of 0.78
- SIT_IMP_3Y is counter-cyclical and leads business cycle in 4 quarters with a correlation of 0.83.
- SIT_GEN is pro-cyclical and leads business cycle two quarters ahead with a correlation of 0.74.
- PROMIG is pro-cyclical and leads business cycle two quarters ahead with a cross correlation of 0.70.

4. Turning points analysis

Another important tool to assess the business cycle properties and the predictive content of survey indicators is the turning points inspection. In what follows we evaluate the ability of the business survey data to early detect the turning points of the reference series (namely, the points corresponding to an inversion of the pattern of the series) using the Harding Pagan (2002) dating

[8] This evidence is in line with Keating and Valcarcel (2012) findings. The authors show that in several countries the financial crisis has removed great moderation. Clark (2009) quite the opposite concludes that the financial crisis would have determined a bad temporary shock as opposed to structural changes in the economy.

[9] On this result also see Tartaglia Polcini (2010).

algorithm.

The procedure is a non-parametric method that detects the turning points of a series on the basis of rules concerning the characteristics of the identified local maxima and minima of the series (i.e. requiring an alternation between peaks and troughs, a minimum distance between consecutive peaks and troughs, a minimum duration of an identified complete cycle). The algorithm can be considered an extension for quarterly data of the Bry Boschan (1971) method originally used by the NBER on macroeconomic monthly series to date to US business cycle. Although in the beginnings this method was thought to deal with a "*classical business cycle"* definition[10] *à la* Burns and Mitchell (1946) and thus considering the series in their absolute levels in the algorithm, in practice, the current dating procedures consider the so called *"growth cycle"* definition (Mintz, 1969). Growth cycles are based on the deviations of the original series from its trend. In such setting the trend component of a series is extracted with the usual time series detrending methods (i.e. polynomial trend, statistical filters, moving averages, unobserved component models, etc.) in order to apply the dating procedure directly on the cyclical component. Clearly the final results of the dating procedure strongly depend both on the choice of the business cycle definition and on the detrending method used in the case of a growth cycle setting.[11] Another possibility to remove the long run component from the data is to consider the quarterly growth rates of the reference series *(growth rate cycle).* [12] The result is comparable with that we obtain by filtering out the series but there may be some differences in terms of phase shifts and turning points.

In dealing with National Accounts data we use a *"growth cycle"* definition based on *quarterly growth rates.*[13] In this way we ensure a full comparison of the results with those obtained with forecasting models that we introduce in paragraph 5 of the paper in which we model yearly growth rates evolution of the series. Quite the opposite, for the business survey indicators, given their cyclical pattern, the turning points have been directly identified on the levels of the indicators.[14]

Insert table 4

Looking at the results reported in table 4 we can notice that the timing of business cycle peaks and trough of inflation, identified by the survey inflation expectations (INFL_EXP), is

[10] The classical business cycle definition considers slowdowns and increases in the absolute levels of the economic activity.

[11] The choice of the detrending method by removing trend components from the data also implies some a priori on the true business cycles length and in this sense can introduce some distorsions in the dating algorithm.

[12] Although the quarterly growth rates of a series are able to detect trend components in the data produce a cyclical component that contains highest business cycle frequencies with respect to detrended series obtained with moving averages.

[13] The definition of growth rate cycle that we adopt is based on a simple quarterly growth rate and is different from that used from ECRI (usually invoked in the literature) in which the growth rate is normalized with the previous six months cumulated growth rate of the series.

[14] In a growth cycle perspective, a turning point occurs in a series when the deviation-from-trend series reached a local maximum (Peak) or a local minimum (Trough). Growth cycle peaks (end of expansion) occur when activity is furthest above its trend level. Growth cycle troughs (end of contraction/recession) occur when activity is furthest below its trend level.

synchronous for the 2008Q3 downturn and for the 2011Q4 upturn. The D_PREZ indicator, quite the opposite, appears to be not very synchronized and seems to fails in detecting the 2007Q3 inflation downturn with a lead. The employment expectations (OCC_TOT_EXP) are able to detect the 2009Q3 downturn and 2011Q3 upturn with a lead while the other turning points of employment are detected with a lag. The SIT_INV indicator signals the 2009Q2 trough with a lead of two quarters and the 2012Q3 trough with a lead of three quarters. Looking at GDP turning points we can notice that the timing in signaling the 2009Q1 recession is good for all the SIGE business cycle indicators. More in detail SIT_GEN, PROMIG and SIT_IMP_3M detect a downturn in correspondence of 2008Q4 showing an ability to predict the minimum of the business cycle recession (2009Q1) one quarter before.

Insert table 5

Table 5 reports a complete analysis of the business survey turning points with respect to the reference series.[15] More in detail for each indicator the number of leads/lags in quarters, the number of possible extra cycles with respect to the reference series as well as the average lead or lag on the whole sample analyzed are displayed in the table that documents six main results of interest:

- D_PREZ misses two turning points while INFL_EXP displays one extra cycle, compared to the inflation rate. The average lead of the two survey indicators equals to 3.3 quarters for D_PREZ and only 0.2 quarters for INFL_EXP. These findings confirms that the inflation expectations are rather staggered and are not able to early capture (signal) the inflation dynamics.
- Regarding employment, the corresponding survey variable (OCC_TOT_EXP) misses one cycle and the average lead is 2.3 quarters.
- Regarding investments, the corresponding survey variable misses no turning point and the average lead of its turning points is equal to 2 quarters.
- Concerning GDP, survey variables don't miss any turning points (except the first peak for SIT_IMP_3Y) and only PROMIG seems to display one extra cycle.
- The average lead for GDP upturns and downturns of the survey turning points (except from PROMIG) spans from 0.8 for SIT_IMP_3M to 4.3 quarters for SIT_IMP_3Y showing a substantial ability of the indicators to early detect changes in the status of economic activity (expansions/recessions).

Overall the analysis shows that the survey indicators are more effective in detecting the beginning of recessions rather than that of an expansion.[16] This can be due to the fact that from a

[15] The turning points reported in the table are detected on the common sample.

[16] Costa and Iezzi (2013) find proof that short-term firms' expectations coming from survey data are generally pessimistic, while 3 years firms' expectations are more optimistic. This results supports to a certain extent the evidence that the beginnings of recessions are more easily detected by business survey indicators.

psychological point of view, the economic operators could be more willing to signal a negative economic evolution that can be perceived as dangerous for them and the whole collectivity while they use more caution in signaling an economic recovery situation (*glass-half empty behavior*).

In order to further describe the business cycle characteristics of SIGE indicators, in table 6 we report their average duration in quarters compared to the NA reference series. The results show that the average length of contractionary phases is higher than that of expansionary phases for almost all the survey indicators except for D_PREZ, OCC_TOT_EXP and SIT_IMP_3M.

Insert Table 6

Concerning the NA reference series we find that, in the sample analyzed (2004-2014) expansions last shorter than recession periods especially for inflation and employment data. This finding is in contrast with empirical evidence reported in the literature for industrialized countries coming from NBER and CEPR business cycle chronology based on a classical business cycle for which recessions are considered rare episodes interposing expansions. However, in interpreting such results, we have to take into account that the period considered in the analysis is relatively short and includes two severe recession episodes (2009 and 2012).

To gain further insights on the co-movements among series we also measure the degree of concordance between SIGE indicators and NA reference cycles using the concordance indicator. The index measures the proportion of time that two series x_t and y_t are in the same phase (business cycles synchronization).

$$CI = T^{-1}\left[\sum_{t=1}^{T} S_{xt}S_{yt} + \sum_{t=1}^{T} (1 - S_{xt})(1 - S_{yt})\right]$$

where T is the number of observations, S_{xt} is a binary variable that takes value 1 if the series x is in expansion and 0 otherwise. *CI=1* indicates that the two cycle are in the same phase 100% of times. The results for sample 2004-2014 are reported in table 7.

Insert Table 7

The results show a high level of concordance for almost all the series. In particular, we find that short term business survey indicators (SIT_GEN, PROMIG and SIT_IMP_3M) are highly synchronized with GDP expansions/recessions at 1-2 quarter lag, while 3 year firms' business

condition expectations (SIT_IMP_3Y) is highly synchronized at 4 quarter lag. Moreover, employment and investment survey indicators are synchronized at 2 quarter lag with their corresponding reference NA series. Regarding the consumer price index, inflation expectation is found to be highly contemporaneously synchronized with inflation, while firms' own prices are insignificantly synchronized with the reference series especially at short time lags.

5. Forecasting Models

A final purpose of the paper is to see how and whether the SIGE business survey signals can help in predicting the NA series dynamics into structural models. To obtain a reliable quantitative forecast evaluation of business surveys, it is important to know not only their ability to improve the forecast of the variable pattern at a given horizon, but also their ability to predict the probability that a turning point will occur at a certain date in the future. Indeed, from a policy making perspective, the knowledge of the beginnings of an expansion/recession, is equally as important as to know the exact magnitude of such a change. In order to address this issues and fully assess the survey variables predictive content we thus use a double strategy; first we assess the forecast ability of SIGE indicators to predict expansion and recessions through Binary Autoregressive Models (**Discrete approach)**, secondly we assess the ability of SIGE indicators to improve the prediction of NA series dynamics through univariate dynamic models **(Continuous approach).**

The forecasting exercise is based on the following steps. For each NA series an autoregressive benchmark model is estimated and compared with an augmented model including also survey data, selected on the basis of in-sample fitting and out-of-sample forecasting performance. The models are estimated on the fixed sample 2004Q4-2011Q1. Finally the forecast performance is evaluated from 1 to 4 step forecasts ahead (for example: for step 1 the out of sample will be 2012Q2-2014Q2. The models are then compared in terms of relative RM(F)SE at any step.

5.1 Binary approach

With the discrete approach, the various SIGE survey variables are examined as predictors of the probability of a expansion/recession through a binary autoregressive model.[17] In binary time series analysis, the dependent variable y_t, *t=1,2,…,T*, is a realization of a stochastic process that only takes on values one and zero.[18] In expansion forecasting, the value of an observable binary

[17] The binary autoregressive models have been found very useful in modelling the U.S. or German business cycle expansion periods, (see Chauvet and Potter, 2005; Dueker, 2005; Kauppi and Saikkonen, 2008).

[18] In other words, conditional on the information set Ω_{t-1}, y_t has a Bernoulli distribution: $y_t|\Omega_{t-1} \sim B(p_t)$.

expansion indicator will depend on the state of the economy in the following way:

$$y_t = \begin{cases} 1, & if\ the\ economy\ is\ in\ an\ expansionary\ state\ at\ time\ t \\ 0, & if\ the\ economy\ is\ in\ a\ recessionary\ state\ at\ time\ t \end{cases}$$

Let $E_{t-1}(\ \ )$ and $P_{t-1}(\ \ )$ denote the conditional expectation and conditional probability given the information set Ω_{t-1}, respectively. In the logit model the conditional probability that y_t takes the value 1 can be written as:

$$p_t = E_{t-1}(y_t) = P_{t-1}(y_t = 1) = F(\pi_t)$$

where π_t is a linear function of variables included in the information set Ω_{t-1} and $F(\ \ )$ is the logistic cumulative distribution function. The dynamic binary autoregressive model of order p implies that:

$$\pi_t = \alpha_0 + \alpha_1 y_{t-1} + \cdots + \alpha_p y_{t-p} + \boldsymbol{x}_{t-k}\boldsymbol{\beta}$$

where $\boldsymbol{x}_{t-k}$ are the SIGE business survey binary indicators representing the expansion/recession periods.

5.2 Continuous approach

Since our goal is to forecast changes in the economic fluctuations, we use a baseline model in which we consider the lagged values of the dependent variable together with the survey indicators. The survey indicator, being qualitative (so called soft data) is usually included in the models together with past values of the dependent variable. The general specification of each single dynamic equation model is:

$$\Delta^4 y_t = \alpha + \beta \Delta^4 y_{t-h} + \gamma x_{t-k} + \delta D_{Y,m} + \varepsilon_t$$

where y_t is the log of the reference national account series, $\Delta^4 = 1 - L^4$ is the quarterly growth rate, x_t is the SIGE business survey indicator and $D_{Y,m}$ is a dummy variable.

6. First empirical results from forecast exercises

In this section we report the forecasting exercises for inflation, employment, investments and GDP and using binary and continuous models. For inflation we consider INFL_EXP and D_PREZ. For GDP we consider four single equation models that separately evaluate the predictive content of SIT_IMP_3M, SIT_IMP_3Y, SIT_GEN and PROMIG. For each equation we generate recursively from one to four step ahead out of sample value static forecasts[19] and we compare the results with

[19] More in detail, the forecast of the first observation in the period 1997Q3 was obtained with parameter estimates using data up to 1997Q2. Subsequent forecasts were calculated by re-estimating each model with the new data point and then forecasting the next observation.

those obtained with the corresponding benchmark autoregressive models. To estimate our forecasting models, we use the period 2005Q2-2011Q1 as estimation sample and 2011Q2-2014Q4 to analyze the out of sample forecasting properties of the series. In the out of sample exercise we use recursive schemes. The econometric specifications are selected using a general to specific approach. Forecasting exercise results for binary models (BARIMA) are reported in Table 8a to Table 8d.

Insert Table 8a, 8b,8c and 8d

The results show that when predicting inflation rate expansion/recessions, the best forecasting model, in terms of in-sample fitting, is the one including inflation expectation one quarter lagged ,or firm's own price expectation variation one and two quarter lagged. The two models seem to be equivalent to each other and better than the benchmark in terms of out-of-sample RMSE. Regarding employment, the forecasting model that includes the survey binary indicator one quarter lagged is slightly superior to the benchmark model. The binary model for investments does not seem to furnish an improvement in terms of forecasting content with respect to the benchmark. Finally, regarding the forecasting model for GDP we find that, with the exception of the PROMIG indicator, the other three survey binary indicators are able to add a forecasting content to the GDP autoregressive benchmark model.

Tables 9 a, b, c, d report the forecast evaluation exercise coming from the continuous dynamic models for inflation, employment, investments and GDP growth from 1 to 4 steps ahead. The forecasting exercise is carried out using recursive schemes with a forecast window of 12 quarters.

Insert Table 9a, 9b,9c and 9d

Results show that, as expected, all the indicators (except for SIT_IMP_3Y) are able to improve the forecast performance of GDP with respect to its benchmark. SIT_GEN and PROMIG are found to be significant in one lag confirming the results found from the cross correlation analysis. SIT_IMP_3M and SiT_IMP_3Yenters in 2/3 lags. For all the indicators except for PROMIG the RMS(F)E decreases when the h steps ahead forecast raise.

The results from inflation expectation model show that inflation expectation is significant at 1, 3 lag and improves the forecast errors with respect to the benchmark for inflation. Firms' own prices (DPREZ) is significant at 1 lag and seem to show a forecasting power especially one step ahead. Employment expectations model is found to improve the RMS(F)E at all-time horizons as

well as the investment expectation model.[20]

To assess if the differences between the forecast errors from the benchmark are significantly statistically different from the dynamic models, in the tables we also report the Diebold Mariano test for forecast accuracy. The null hypothesis is that the models show the same forecast accuracy.

The results show that in almost case the forecast accuracy improvement is significantly different from the benchmarks. In interpreting this result we have to take into account that with respect to other test the DM test has been found to be very conservative in shorter *h* steps.

Overall the results show that the National Accounts forecasts can be improved by introducing the SIGE business survey data into the dynamic structural models.

Main findings

In the paper we provided a complete characterization of the SIGE indicators predictive content, providing information about all their relevant cyclical features. More in detail:

- Cross correlations show that almost all indicators (with the exception of inflation expectations) are leading from 1 to 4 quarters with respect to their reference NA series.
- Turning points analysis confirms the leading properties of survey indicators. More in detail:
  - 3 month firms' business condition expectations is able to predict with an average lead of 2 quarters the troughs but it seems to be lagged with respect to peaks.
  - Overall, SIGE data seem to lead better the troughs than the peaks. The average lead of troughs is higher than that of peaks for almost series with the exception of firms own prices expectations (D_PREZ).
- Almost all business survey indicators (with the exclusion of D_PREZ) display an high coherence with NA series. In particular:
  - For the general economic situation (SIT_GEN) the concordance index is always higher than 0.75 at all lags.
  - SIT_IMP_3M and PROMIG are highly synchronized with GDP at 1-2 lags.
  - 3 year firms' business condition expectations (SIT_IMP_3Y) are highly synchronized at 4 quarter lag.
  - Employment and investment survey data are synchronized with their respect NA reference series at 2 quarter lags.
  - Inflation expectation (INFL_EXP) is highly contemporaneously synchronized with inflation while firms' own prices expectations are insignificantly synchronized.

[20] Concerning investments survey data predictive content Osterholm (2013) finds that survey data on investment goods industry can improve the forecasts of business investment growth.

- The binary approach to forecasting modelling shows that:
  - All the models including survey binary variables have a predictive power of GDP expansion/recession phases higher than the benchmark (except for PROMIG).
  - The two forecasting models for inflation expansion/recession phases including survey data on inflation expectations and own prices have a good predictive power.
  - The model for employment shows a limited predictive power, while the investment model shows no improvement with respect to the benchmark.
- The forecasting models using business surveys in levels show that:
  - At any horizon the augmented models used to forecast GDP (expect for SIT_IMP_3Y) have a significant predictive power.
  - Inflation expectation significantly improve the predictive content of the model at any horizon, while firms' own price indicator does not.
  - Both employment and investment condition indicators show a strong ability to improve the forecast accuracy with respect to the benchmark.

7. Conclusions

The literature provides mixed evidence on the predictive power of business survey data. In this paper we explore this issue considering all the relevant information available in the Italian survey on inflation and growth expectations (SIGE). More in detail, we explored the information content of short term indicators such as expectations on the number of employees in the next three months, firms' expectations on own prices and inflation, investments expectations and prospects on the general economic situation with respect to their reference series (namely employment, inflation, investments and the economic activity as whole). These series, built as balances between positive and negative answers provided by economic agents are meant to capture firms' sentiment and represent an important tool for the economy assessment in the short run.

Overall the results indicate that SIGE business indicators are able to early detect turning points of their corresponding national account reference series. However the average lead is higher for recessions that for expansions. The indicators are also able to improve the forecast accuracy of models used to predict both recession/expansion phases and growth rates dynamics of NA series. These findings confirm the strength of tendency business survey indicators as tools to support policy decisions.

References

Abberger S. (2007) Qualitative business surveys and the assessment of employment – A case study for Germany *International Journal of Forecasting 23, 249-258.*

Banca d'Italia (2013) Survey on Inflation and Growth Expectations, Supplements to the Statistical Bulletin, XXIII, no. 50, October.

Bergstrom R. (1995) The relationship between manufacturing production and different business survey series in Sweden 1968-1992. *International Journal of Forecasting, 11,* 379-393.

Bry G. and C. Boschan (1971) Cyclical analysis of Time Series: Selected procedures and Computer Programs NBER Technical paper n. 20.

Dueker M.J. (2005) Dynamic Forecasts of qualitative variables: a qual VAR model of U.S. recessions. *Journal of Business and Economic Statistics* 23, 96-104.

Giancarlo Bruno & Claudio Lupi, (2004) Forecasting industrial production and the early detection of turning points, *Empirical Economics*, Springer, vol. 29(3), pages 647-671, 09.

Cesaroni T. (2011) The cyclical behaviour of business survey data *Empirical Economics 41 (3) pp. 747-768.*

Cesaroni T., L. Maccini and M. Malgarini (2011) Business cycle stylized facts and inventories behavior: new evidence for the euro area, in *International Journal of Production Economics* vol. 133 n. 1 September p.12-24.

Chauvet M. and S. Potter (2005) Forecasting recession using the yield curve. *Journal of* Forecasting 24, 77-103.

Clark, T. E. (2009) Is the Great Moderation over? an empirical analysis." Economic Review Federal Reserve Bank of Kansas City, Q IV, 5-42.

Claveria Pons Ramos (2007) Business and Consumer expectations and Macroeconomic forecasts *International Journal of Forecasting vol. 23* pag 47-69.

Costa M. and S. Iezzi (2013) On the consistency expectations of firms' business conditions in the Bank of Italy's tendency survey.

Dueker M.J. (2005) Dynamic Forecasts of qualitative variables: a qual VAR model of U.S. recessions. *Journal of Business and Economic Statistics* 23, 96-104.

Granger C. W. J. (1969) Investigating causal relations by econometric models and cross spectral methods. *Econometrica , 37(3)* 424-43.

Harding D. and A. Pagan (2002) Dissecting the cycle: A methodological investigation *Journal of Monetary Economics* 49 (2) 365-381.

Kauppi H. and P. Saikkonen (2008) Predicting U.S. recessions with dynamic binary response models. *Review of Economics and Statistics* 90, 777-791.

Keating and Valcarcel (2012) What's so Great about the Great Moderation? A Multi-Country Investigation of Time-Varying Volatilities of Output Growth and Inflation." Working Paper Series in Theoretical and Applied Economics 201204, University of Kansas, Department of Economics.

Lemmens A. Croux C. and M. Dekimpe (2005) On the predictive content of production surveys: A pan- European Study *International Journal of Forecasting, 21 363-375.*

Osterholm P (2013) Forecasting Business Investment in the Short Term Using Survey Data NIER WP n.131.

Tartaglia Polcini R. (2010) Inflation forecasts from the Bank of Italy-Sole 24 Ore survey of expectations of inflation and growth In: Proceedings of the IFC Conference on "Initiatives to address data gaps revealed by the financial crisis", Basel, 25-26 August 2010.

Wheeler T. (2010) What can we learn from surveys of business expectations? England Quarterly Bulletin, 2010 (Q3) 190-198.

Appendix 1 – Tables

Table 1. Unit root tests of SIGE indicators. Period: 2004Q4-2014Q4

	ADF	*GLS*	*PHILLIPS PERRON*
INFL_EXP	-4.54***	-4.36***	-2.61*
D_PREZ	-3.41*	-3.30***	-3.37*
OCC_TOT_EXP	-2.98**	-3.03***	-1.70
SIT_INV	-2.43	-2.40**	-2.49
SIT_IMP_3M	-2.58	-2.54**	-2.58
SIT_IMP_3Y♦	-2.13	-2.13**	-2.09
SIT_GEN	-2.27*	-2.75***	-2.79*
PROMIG	-3.32***	-3.37***	-3.34**

Source: Bank of Italy Survey on Inflation and Growth Expectations.
Rejection of the Unit Root hypothesis at ***1 % level, ** 5% level, * 10% level.
♦available from 2005q2

Table 2. Volatility of NA and SIGE indicators

	1999-2014	*1999-2007*	*2008-2014*
	NA indicators		
INFL	0.805	0.346	1.183
Δ^4EMPL	0.013	0.006	0.009
Δ^4INV	0.047	0.023	0.038
Δ^4GDP	0.023	0.012	0.025
	Business Survey indicators		
INFL_EXP	0.64	0.236	0.928
D_PREZ	0.589	0.479	0.585
OCC_TOT_EXP	NA	NA	9.100
SIT_INV	NA	NA	20.125
SIT_IMP_3M	NA	NA	18.887
SIT_IMP_3Y	NA	NA	13.839
SIT_GEN	NA	NA	31.558
PROMIG	NA	NA	3.442

Source: Bank of Italy Survey on Inflation and Growth Expectations and Istat.

Table 3. Cross correlations between SIGE indicators and NA reference series. Period 2004-2014.

	Lag								
	K=-4	**K=-3**	**K=-2**	**K=-1**	**K=0**	**K=1**	**K=2**	**K=3**	**K=4**
Cross correlations WRT inflation									
INFL_EXP*	-0.24	0.09	0.44	0.71	0.91	0.74	0.45	0.15	-0.18
D_PREZ*	0.38	0.43	0.43	0.40	0.29	0.07	-0.14	-0.26	-0.35
Cross correlations WRT total employment growth									
OCC_TOT_EXP	0.56	0.72	0.83	0.84	0.76	0.64	0.50	0.34	0.20
Cross correlations WRT investments growth									
SIT_INV	0.58	0.69	0.72	0.65	0.48	0.26	0.03	-0.11	-0.19
Cross correlations WRT GDP									
SIT_IMP_3M**	0.32	0.60	0.77	0.78	0.50	0.11	-0.20	-0.43	-0.50
SIT_IMP_3Y***	0.83	0.80	0.56	0.21	-0.23	-0.46	-0.53	-0.50	-0.36
SIT_GEN**	0.53	0.66	0.74	0.71	0.51	0.26	0.00	-0.17	-0.24
PROMIG**	0.31	0.54	0.70	0.67	0.41	0.09	-0.22	-0.40	-0.42

Source: Bank of Italy Survey on Inflation and Growth Expectations and Istat.
* Series are available from 2000q1 **series are available from 2004q4 ***series are available from 2005q2

Table 4 Turning points of the NA series and SIGE business survey indicators. Period 2004-2014.

	P	***T***	***P***	***T***	***P***	***T***	***P***	***T***	***P***	***T***
INFL			2003Q2			2007Q3	2008Q3	2009Q3	2011Q4	
INFL_EXP			2003Q1	2004Q4	2005Q4	2007Q2	2008Q3	2009Q4	2011Q4	
D_PREZ	2000Q2	2003Q2			2007Q2	2008Q4			2011Q2	2013Q1
Δ^4**EMPL**	2000Q4	2005Q3	2006Q2	2009Q3	2011Q3	2013Q2				
OCC_TOT_EXP			2007Q2	2008Q4	2011Q1	2012Q4				
Δ^4**INV**		2001Q3	2002Q4	2003Q4	2006Q1	2009Q2	2010Q4	2012Q3		
SIT_INV				2005Q2	2006Q3	2008Q4	2009Q3	2011Q4	2014Q2	
Δ^4**GDP**		2002Q1	2006Q4	2009Q1	2010Q4	2012Q3				

SIT_IMP_3M	2007Q1	2008Q4	2010Q4	2011Q4	2014Q2
SIT_IMP_3Y		2007Q4	2009Q4	2011Q3	
SIT_GEN	2007Q1	2008Q4	2009Q4	2011Q4	2014Q2
PROMIG	2007Q1	2008Q4	2010Q3	2012Q4	2014Q1

Source: Bank of Italy Survey on Inflation and Growth Expectations and Istat.

Table 5 Leading properties of SIGE indicators with respect to NA turning points

	Inflation									
	P	T	P	T	P	T	Number of extra cycles	Average lag		
	2003Q2	2007Q3	2008Q3	2009Q3	2011Q4			P	T	All
INFL_EXP	-1	-1	0	+1	0		+1	-0.3	0.0	-0.2
D_PREZ	-	-	-5	-3	-2		-1	-3.5	-3.0	-3.3
	Employment									
	P	T	P	T	P	T	Number of extra cycles	Average lag		
		2005Q3	2006Q2	2009Q3	2011Q3	2013Q2		P	T	All
OCC_TOT_EXP		-	-	-3	-2	-2	0	-2.0	-2.5	-2.3
	Investments									
	P	T	P	T	P	T	Number of extra cycles	Average lag		
	2006Q1	2009Q2	2010Q4	2012Q3				P	T	All
SIT_INV	+2	-2	-5	-3			0	-1.5	-2.5	-2
	GDP									
	P	T	P	T	P	T	Number of extra cycles	Average lag		
	2006Q4	2009Q1	2010Q4	2012Q3				P	T	All
SIT_IMP_3M	+1	-1	0	-3			0	0.5	-2.0	-0.8
SIT_IMP_3Y	-	-5	-4	-4			0	-4.0	-4.5	-4.3
SIT_GEN	+1	-1	-4	-3			0	-1.5	-2.0	-1.8
PROMIG	+1	-1	-1	+1			+1	0.0	0.0	0.0

Source: Bank of Italy Survey on Inflation and Growth Expectations and Istat.

Table 6 Average duration of SIGE and NA business cycle. Period: 2004q4-2014q3

	P-T	***T-P***	***P-P***	***T-T***
INFL	10.5	6.5	17.0	8.0
INFL_EXP	6.0	5.7	11.7	10.0
D_PREZ	8.3	13.0	22.0	19.5
Δ^4**EMPL**	13.0	5.5	21.5	15.5
OCC_TOT_EXP	6.5	9.0	15.0	16.0
Δ^4**INV**	9.3	9.2	19.5	17.0

SIT_INV	9.0	5.7	15.5	13.0
Δ^4**GDP**	9.1	7.4	17.5	15.0
SIT_IMP_3M	5.5	9.0	14.5	12.0
SIT_IMP_3Y	7.0	8.0	19.0	15.0
SITGEN	7.5	7.0	14.5	12.0
PROMIG	7.3	7.5	16.8	13.5

Source: Bank of Italy Survey on Inflation and Growth Expectations and Istat.

Table 7 Concordance index

	INFL		Δ^4**EMPL**	Δ^4**INV**	Δ^4**GDP**			
lag	*INFL_EXP*	*D_PREZ*	*OCC_TOT*	*SIT_INV*	*SIT_IMP_3M*	*SIT_IMP_3Y*	*SIT_GEN*	*PROMIG*
0	0.88	0.28	0.63	0.60	0.85	0.47	0.75	0.85
1	0.86	0.34	0.69	0.67	0.87	0.57	0.82	0.87
2	0.78	0.43	0.76	0.71	0.82	0.67	0.82	0.79
3	0.68	0.49	0.73	0.70	0.76	0.77	0.81	0.68
4	0.59	0.52	0.64	0.69	0.64	0.88	0.75	0.56

Source: Bank of Italy Survey on Inflation and Growth Expectations and Istat.

Table 8a. Forecasting model estimates and RMS(F)E for Inflation (INFL) – BARIMA model

	Model 0 **Benchmark**	**Model 1** **INFL_EXP**	**Model 2** **D_PREZ**
	Parameters estimates		
Intercept	-2.3514**	-3.0840**	-19.7224**
INFL t-1	4.4716**	3.5147**	21.1887**
INFL_EXP t-1		1.9445*	
D_PREZ t-1			-20.6021**
D_PREZ t-2			37.5519**
	Diagnostics		
AIC	36.6582	35.8240	29.0489
BIC	40.5218	41.6194	34.7850
	Forecasts - RMSE		
1-step dynamic forecast	0.0058	0.0015	0.0015
Relative RMSE wrt Model 0		**0.2581**	**0.2535**

Source: Bank of Italy Survey on Inflation and Growth Expectations and Istat.
All variables are binary variables indicating 1 for expansion and 0 per recession.
The unknown coefficients are estimated by the method of maximum likelihood through the Newton-Raphson iteration.
Estimation sample: 1999Q4-2011Q1. Forecasting sample: 2011Q2-2014Q4.
*: significant at 10 per cent; **: significant at 5 per cent.

Table 8b. Forecasting model estimates and RMS(F)E for Employment (EMPL) – BARIMA model

	Model 0 **Benchmark**	**Model 1** **OCC_TOT_EXP**

	Parameters estimates	
Intercept	-2.8034**	-4.1308**
EMPLt-1	4.2697**	3.8442**
OCC_TOT_EXPt-1		2.5372*
	Diagnostics	
AIC	34.7748	25.8483
BIC	38.6384	30.1503
	Forecasts - RMSE	
1-step dynamic forecast	0.1282	0.0962
Relative RMSE wrt Model 0		**0.7499**

Source: Bank of Italy Survey on Inflation and Growth Expectations and Istat.
All variables are binary variables indicating 1 for expansion and 0 per recession.
The unknown coefficients are estimated by the method of maximum likelihood through the Newton-Raphson iteration.
Estimation sample: 1999Q4-2011Q1. Forecasting sample: 2011Q2-2014Q4.
*: significant at 10 per cent; **: significant at 5 per cent.

Table 8c. Forecasting model estimates and RMS(F)E for Investments (INV) – BARIMA model

	Model 0 **Benchmark**	**Model 1** **SIT_INV**
	Parameters estimates	
Intercept	-1.6740**	-19.4366**
INVt-1	20.2047**	75.2815**
INVt-4	-17.5499**	-54.4585**
SIT_INVt-2		19.4363**
SIT_INVt-3		-37.913**
	Diagnostics	
AIC	35.4651	17.7766
BIC	41.0787	24.6131
	Forecasts - RMSE	
1-step dynamic forecast	0.1182	0.1329
Relative RMSE wrt Model 0		**1.1248**

Source: Bank of Italy Survey on Inflation and Growth Expectations and Istat.
All variables are binary variables indicating 1 for expansion and 0 per recession.
The unknown coefficients are estimated by the method of maximum likelihood through the Newton-Raphson iteration.
Estimation sample: 1999Q4-2011Q1. Forecasting sample: 2011Q2-2014Q4.
*: significant at 10 per cent; **: significant at 5 per cent.

Table 8d. Forecasting model estimates and RMS(F)E for GDP – BARIMA model

	Model 0 **Benchmark**	**Model 1** **SIT_IMP_3M**	**Model 2** **SIT_IMP_3Y**	**Model 3** **SIT_GEN**	**Model 4** **PROMIG**
		Parameters estimates			
Intercept	-2.4423**	-18.6372**	-18.4317**	-3.5861**	-19.0548**
GDP t-1	4.9272**	19.1225**	18.8372**	4.32091**	2.6388
SIT_IMP_3M t-1		17.9441**			
SIT_IMP_3M t-4		-16.9253**			
SIT_IMP_3Y t-4			18.4317**		
SIT_GEN t-1				2.04145	
PROMIG t-1					19.0548**
		Diagnostics			
AIC	32.0403	20.2501	15.5027	22.8440	16.1205
BIC	35.9040	24.2468	19.2770	27.1459	20.4224
		Forecasts – RMSE			
1-step dynamic forecast	0.1100	0.0746	0.0313	0.0864	0.2230
Relative RMSE wrt Model 0		0.6782	0.2845	0.7855	2.0273

Source: Bank of Italy Survey on Inflation and Growth Expectations and Istat.
All variables are binary variables indicating 1 for expansion and 0 per recession.
The unknown coefficients are estimated by the method of maximum likelihood through the Newton-Raphson iteration.

Estimation sample: 1999Q4-2011Q1. Forecasting sample: 2011Q2-2014Q4.
*: significant at 10 per cent; **: significant at 5 per cent.

Table 9a. Forecasting model estimates and RMS(F)E for Inflation (INFL)

	Model 0	**Model 1**	**Model 2**
	Benchmark	**INFL_EXP**	**D_PREZ**
	Parameters estimates		
Intercept	1.0911**	0.7869**	0.8264***
INFL t-1	0.7695**	0.5166**	0.6885***
INFL t-2			0.2493
INFL t-3			-0.4507***
INFL t-4	-0.3105**		
INFL_EXP t-1		0.5232**	
INFL_EXP t-3		-0.4336**	
D_PREZ t-4			1.1139
2008Q1	0.5750*		
2008Q3			0.6795***
2009Q1	-0.9373**	-0.8332**	-0.9330***
	Diagnostics		
R^2	0.7598	0.7578	0.7578
Normality test	2.2104	1.3603	1.4751
Heteroschedasticity test	1.8099	1.1824	1.9622
AR test	2.0965	2.0967	0.9093
	Forecasts - RMSE		
1-step dynamic forecast	1.1519	0.73135	1.1406
2-step dynamic forecast	1.2116	0.70613	1.1322
3-step dynamic forecast	1.4068	0.85594	1.2613
4-step dynamic forecast	1.3173	0.75738	1.1368
	Test of equal accuracy wrt Model 0		
	H0: Forecast accuracy is equal		
1-step dynamic forecast		4.651**	0.174
2-step dynamic forecast		3.483**	0.990
3-step dynamic forecast		4.841**	1.485
4-step dynamic forecast		2.667**	1.437

Source: Bank of Italy Survey on Inflation and Growth Expectations and Istat.
The dependent variable (NA series) is expressed in yearly variations.
Estimation sample: 1999Q4-2011Q1. Forecasting sample: 2011Q2-2014Q4.
*: significant at 10 per cent; **: significant at 5 per cent.

Table 9b. Forecasting model estimates and RMS(F)E for Employment (EMPL)

	Model 0 **Benchmark**	**Model 1** **OCC_TOT_EXP**
Parameters estimates		
Intercept	-0.0003	0.0025 **
Δ^4EMPLt-1	-0.2919**	0.8987***
Δ^4EMPLt-2		-0.3016**
Δ^4EMPLt-3	-0.3105**	
OCC_TOT_EXPt-1		0.00035**
2006Q1	0.0120**	
Diagnostics		
R^2	0.8722	0.9240
Normality test	0.7140	0.8557
Heteroschedasticity test	0.5836	2.5558
AR test	0.6682	0.6682
Forecasts - RMSE		
1-step dynamic forecast	0.0098	0.0056
2-step dynamic forecast	0.0100	0.0058
3-step dynamic forecast	0.0098	0.0057
4-step dynamic forecast	0.0090	0.0058
Test of equal accuracy wrt Model 0 H0: Forecast accuracy is equal		
1-step dynamic forecast		3.582**
2-step dynamic forecast		8.230**
3-step dynamic forecast		6.057**
4-step dynamic forecast		3.101**

Source: Bank of Italy Survey on Inflation and Growth Expectations and Istat.
The dependent variable (NA series) is expressed in yearly variations.
Estimation sample: 1999Q4-2011Q1. Forecasting sample: 2011Q2-2014Q4.
*: significant at 10 per cent; **: significant at 5 per cent.

Table 9c. Forecasting model estimates and RMS(F)E for Investments (INV)

	Model 0 **Benchmark**	**Model 1** **SIT_INV**
Parameters estimates		
Intercept	-0.0016	0.0125**
Δ^4INVt-1	1.3914**	0.6573**
Δ^4INVt-4	-0.5400**	
SIT_INVt-1		0.0010**
SIT_INVt-4		0.0002
Diagnostics		
R^2	0.8689	0.9321
Normality test	0.2937	0.7780
Heteroschedasticity test	0.8740	0.1571
AR test	0.0584	2.0311
Forecasts - RMSE		
1-step dynamic forecast	0.0619	0.03619
2-step dynamic forecast	0.0569	0.03605
3-step dynamic forecast	0.0526	0.03543
4-step dynamic forecast	0.0433	0.03548
Test of equal accuracy wrt Model 0		
Test of equal accuracy wrt Model 0 H0: Forecast accuracy is equal		
1-step dynamic forecast		2.861**
2-step dynamic forecast		1.914*
3-step dynamic forecast		1.495
4-step dynamic forecast		1.021

Source: Bank of Italy Survey on Inflation and Growth Expectations and Istat.
The dependent variable (NA series) is expressed in yearly variations.
Estimation sample: 1999Q4-2011Q1. Forecasting sample: 2011Q2-2014Q4.
*: significant at 10 per cent; **: significant at 5 per cent.

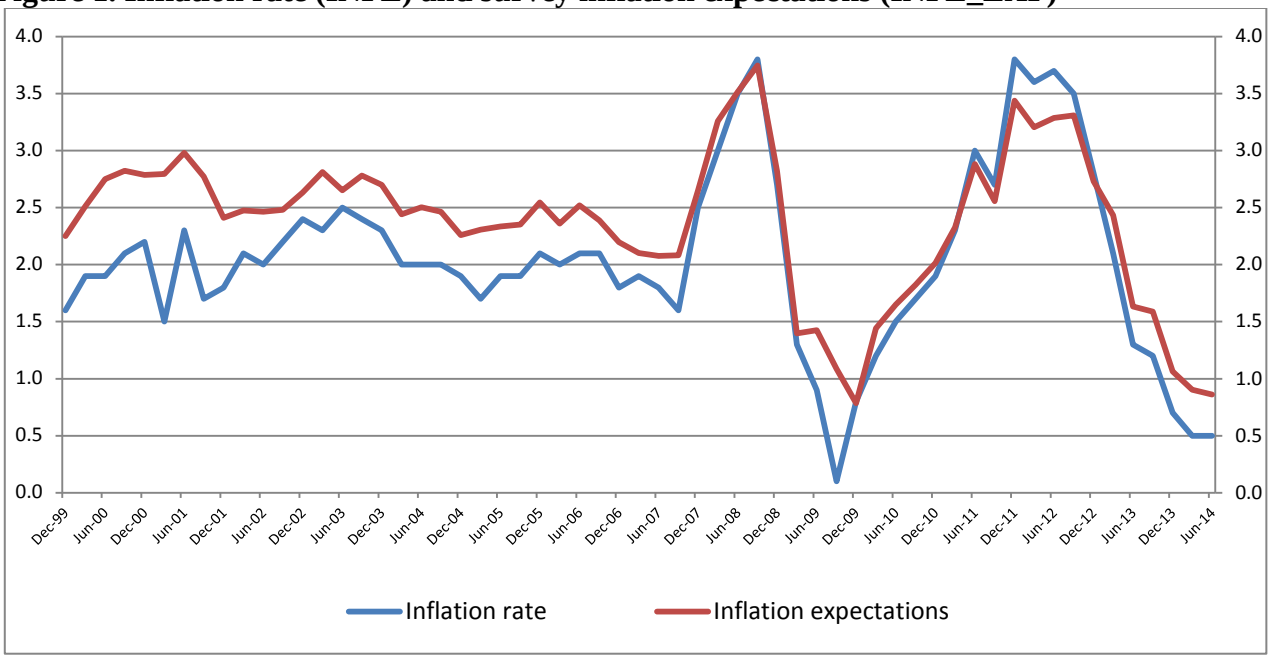
Table 9d. Forecasting model estimates and RMS(F)E for GDP

	Model 0 Benchmark	Model 1 SIT_IMP_3M	Model 2 SIT_IMP_3Y	Model 3 SIT_GEN	Model 4 PROMIG
		Parameters estimates			
Intercept	0.0002	0.0056**	-0.0208**	0.0037*	-0.0252*
Δ^4GDP t-1	1.4492**	0.5815***	0.8359**	1.0649**	1.1883**
Δ^4GDP t-2		-0.3103**		-0.3742**	-0.5138**
Δ^4GDP t-3					
Δ^4GDP t-4	-0.6526**				
SIT_IMP_3M t-1		0.00073***			
SIT_IMP_3M t-3		0.00046**			
SIT_IMP_3Y t-2			0.00052**		
SIT_GEN t-1				0.0001**	
PROMIG t-1					0.0019**
PROMIG t-2					-0.0002
2009Q1			-0.0439**	-0.0329**	
		Diagnostics			
R^2	0.8654	0.9496	0.9452	0.9462	0.9147
Normality test	5.6501	1.0641	3.2195	3.6830	5.8509
Heteroschedasticity test	5.2860**	0.45612	3.9260*	4.5484**	3.3256*
AR test	0.0053	0.35716	0.7690	0.2475	0.5139
		Forecasts – RMSE			
1-step dynamic forecast	0.0187	0.0097	0.0384	0.0117	0.0111
2-step dynamic forecast	0.0185	0.0098	0.0348	0.0110	0.0108
3-step dynamic forecast	0.0170	0.0085	0.0289	0.0100	0.0114
4-step dynamic forecast	0.0143	0.0077	0.0247	0.0095	0.0123
		Test of equal accuracy wrt Model 0			
		H0: Forecast accuracy is equal			
1-step dynamic forecast		3.974**	-11.03**	4.598**	2.930**
2-step dynamic forecast		2.398**	-25.00**	5.031**	2.453**
3-step dynamic forecast		1.812*	-45.54**	4.035**	1.931*
4-step dynamic forecast		1.812*	-4.524**	6.347**	1.737*

Source: Bank of Italy Survey on Inflation and Growth Expectations and Istat.
The dependent variable (NA series) is expressed in yearly variations.
Estimation sample: 1999Q4-2011Q1. Forecasting sample: 2011Q2-2014Q4.
*: significant at 10 per cent; **: significant at 5 per cent.

Appendix 2 – Figures

Figure 1. Inflation rate (INFL) and survey inflation expectations (INFL_EXP)



Source: Bank of Italy Survey on Inflation and Growth Expectations and Istat.

Figure 2. Inflation rate (INFL) and expectations on firms' own prices (D_PREZ)

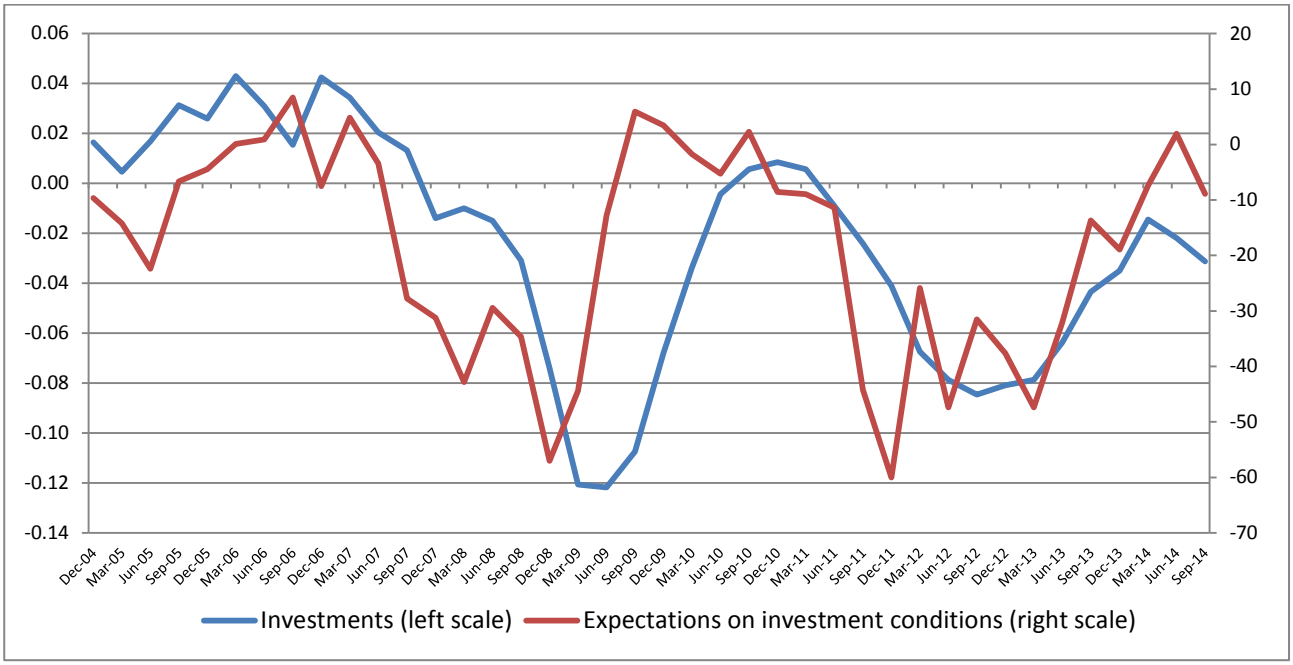
Source: Bank of Italy Survey on Inflation and Growth Expectations and Istat.

Figure 3. Employment (yearly growth rate) (EMPL) and expectations on number of employees (balance) (OCC_TOT_EXP)

Source: Bank of Italy Survey on Inflation and Growth Expectations and Istat.

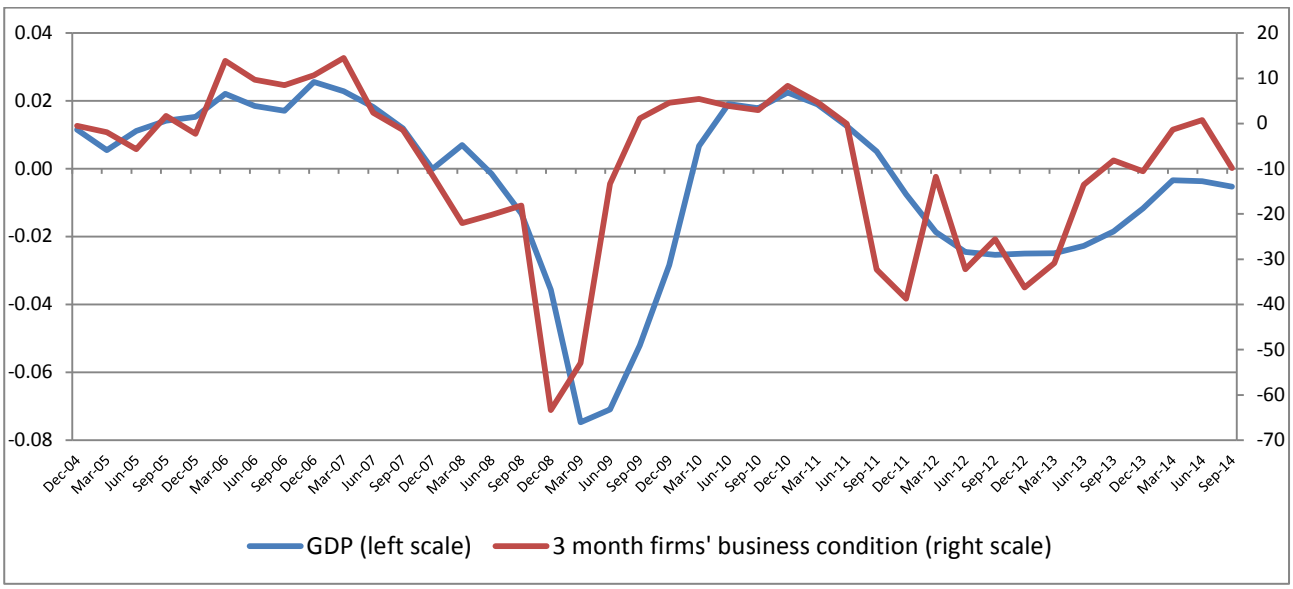
Figure 4. Investments (yearly growth rate) (INV) and expectations on investment conditions

(balance) (SIT_INV)



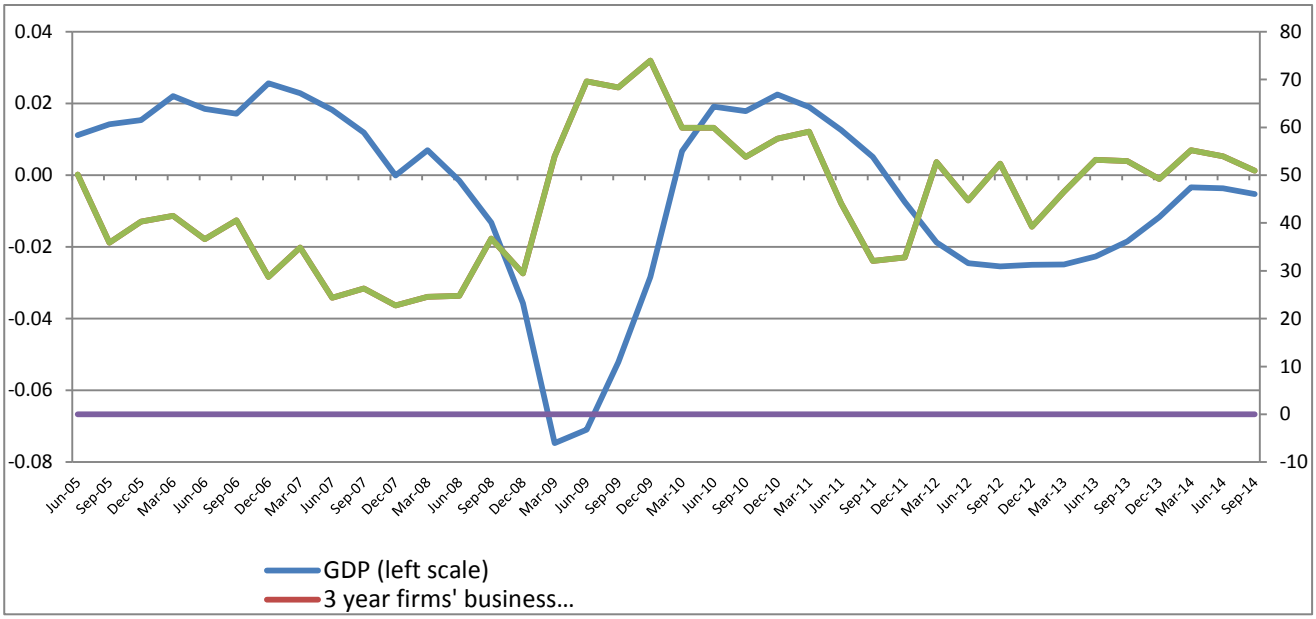
Source: Bank of Italy Survey on Inflation and Growth Expectations and Istat.

Figure 5. GDP (yearly growth rate) and 3 month firms' business condition expectations (balance) (SIT_IMP_3M)



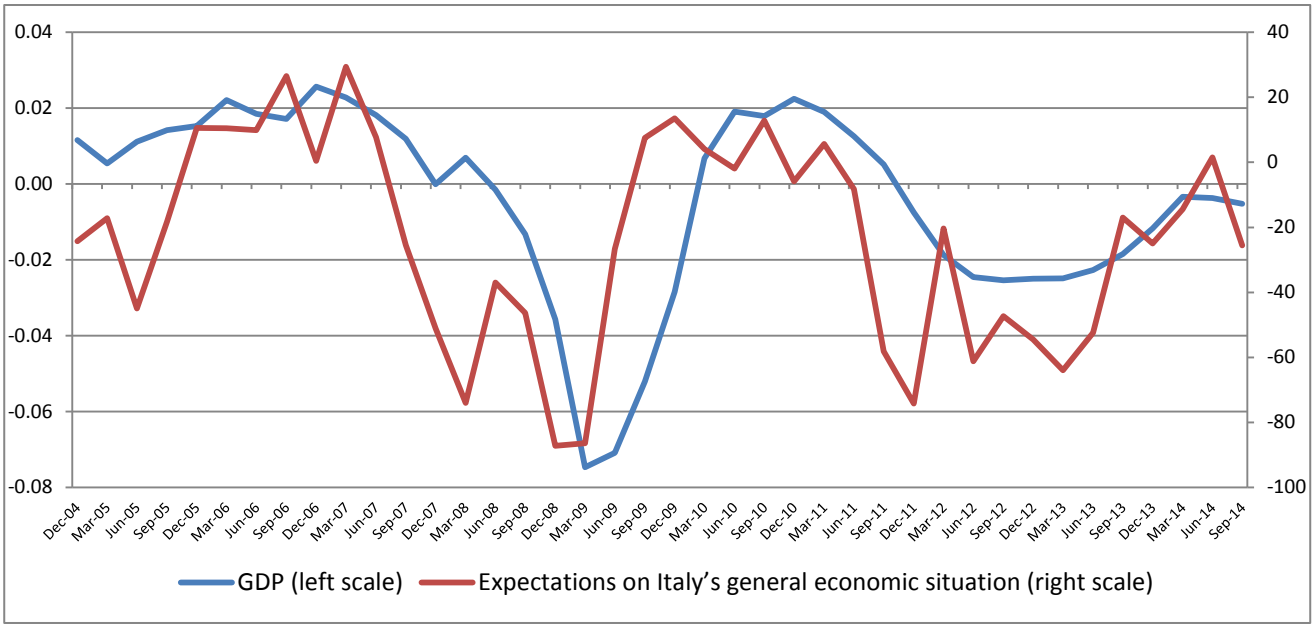
Source: Bank of Italy Survey on Inflation and Growth Expectations and Istat.

Figure 6. GDP (yearly growth rate) and 3 year firms' business condition expectations (balance) (SIT_IMP_3Y)



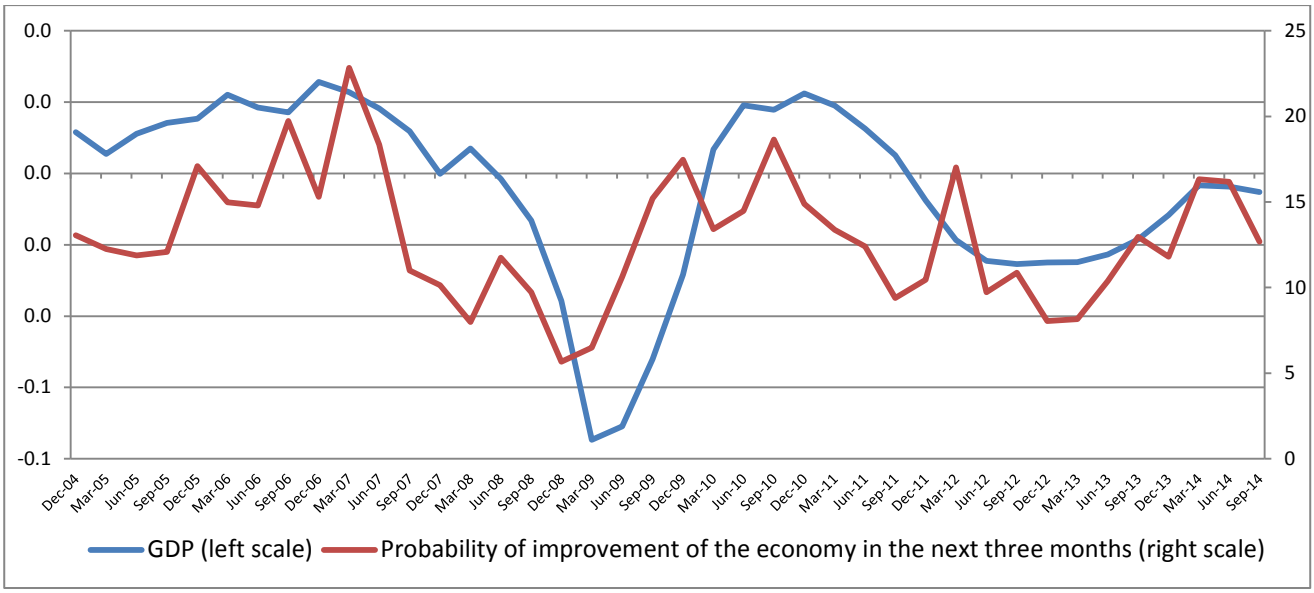
Source: Bank of Italy Survey on Inflation and Growth Expectations and Istat.

Figure 7. GDP (yearly growth rate) and expectations on Italy's general economic situation (balance) (SIT_GEN)



Source: Bank of Italy Survey on Inflation and Growth Expectations and Istat.

Figure 8. GDP (yearly growth rate) and Probability of improvement of the economy in the next three months (mean) (PROMIG)



Source: Bank of Italy Survey on Inflation and Growth Expectations and Istat.

Appendix 3 – Data description

Survey data :

- **INFL_EXP**: Inflation expectations

  "In October consumer price inflation. measured by the 12-month change in the harmonized index of consumer prices was 0.0 per cent in Italy and 0.4 per cent in the euro area. What do you think it will be in Italy in March 2015?"

- **D_PREZ**: Expectations on firms' own selling prices

  "For the next 12 months. what do you expect will be the average change in your firm's prices?"

- **OCC_TOT_EXP**: Expectations on number of employees

  "Your firm's total number of employees in the next 3 months will be Lower, Unchanged or Higher?"

- **SIT_INV**: Expectations on investment conditions

  "Compared with 3 month ago. do you think conditions for investment are Better, The same,

Worse?"

- **SIT_IMP_3M**: 3 month firms' business condition expectations
  "How do you think business conditions for your company will be in the next 3 months? Much better, Better, The same, Worse, Much worse"
- **SIT_IMP_3Y**: 3 year firm business condition expectations
  "How do you think business conditions for your company will be in the next 3 years? Much better, Better, The same, Worse, Much worse"
- **SIT_GEN**: Expectations on Italy's general economic situation
  "Compared with 3 months ago. do you consider Italy's general economic situation is Better, The same, Worse?"
- **PROMIG**: Probability of improvement of the economy in the next three months
  "What do you think is the probability of an improvement in Italy's general economic situation in the next 3 months? Zero, 1-25 per cent, 26-50 per cent, 51-75 per cent, 76-99 per cent, 100 per cent"

National accounts data:

- **HICP**: Harmonized index of consumer prices
- **EMPL**: Number of total employed population, adjusted for seasonality, total economy
- **INV**: Gross fixed investments, adjusted for seasonality, total economy
- **GDP**: Gross domestic product, adjusted for seasonality, total economy