Using BREL to nowcast the Belgian business cycle : the role of survey data

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Introduction

The design of appropriate macroeconomic – and, in particular, fiscal and monetary – policies requires accurate knowledge of ongoing cyclical developments. However, national accounts data that can inform policy-makers typically come with some delays. The first, so-called "flash" estimates for real quarterly GDP growth usually only become available long after the reference quarter has ended. For the EU countries, the official Eurostat data on quarterly GDP are released some seven weeks after the end of that quarter, while earlier publications by certain national statistical institutes – such as for the UK, Spain and Belgium – still take about one month. In addition, these flash GDP estimates are prone to subsequent revisions.

However, in the course of the reference quarter, several indicators are published that contain information on the current state of the economy. These indicators include both "hard" and "soft" data usually with a monthly frequency. The former range from important production or business statistics, such as industrial production or turnover according to VAT returns, that are used for the compilation of the Belgian national accounts, to specific information on certain expenditure categories such as car sales or building starts. The latter pertain to data contained in various business cycle surveys that are mostly also available on a monthly basis. The surveys provide synthetic indicators of business or consumer confidence but the actual survey questions contain more detailed information on specific issues including demand expectations, hiring intentions, saving capacity or even investment plans.

Short-term business cycle analysis or forecasting then boils down to extracting the relevant information from those hard and soft monthly – or higher-frequency – data. Golinelli and Parigi (2007) show that models using this information generate better forecasts of GDP for shorter horizons than those that do not take account of the information that becomes available in the course of the reference quarter.

Central banks and international organisations alike now routinely use specific models for this purpose. These models generally take into account a mixture of hard and soft data. While hard data, such as industrial production, are typically more closely related to GDP, survey-based data present two important advantages. First, they usually become available earlier. Second, while hard data may be revised in subsequent data releases, this is in principle not the case for survey results.

This article focuses on the role of survey data in predicting Belgian economic developments in the short run. We use and briefly present the BREL nowcasting platform that uses **BR**idge equations with predictors selected on the basis of an **EL**astic net procedure and is one of the National Bank of Belgium's forecasting tools (Piette, 2014). The remainder of the article is organised as follows. Section 1 briefly reviews the literature. The second section gives a concise overview of the existing infra-annual surveys on the economic situation in Belgium that may be used for short-term economic forecasting. Section 3 introduces the model and section 4 assesses the relevance of survey data, in particular, for short-term GDP projections taking into account the specific data release calendar. This latter analysis is repeated in section 5 for other important

macroeconomic aggregates and in section 6 for the euro area GDP. The final section presents the conclusions.

1. Short-term forecasting models and predictor selection : a brief review of the literature

While estimating and analysing short-term economic fluctuations has always been high on the agenda of policy-making institutions, the literature on nowcasting and short-term economic forecasting has grown substantially in recent years. Different approaches are followed.

One distinction is between the so-called partial and joint models. The former class of models consists of single-equation approaches that typically aim at estimating quarterly GDP growth using a set of predictors that mostly include monthly or higher-frequency data. As the explanatory variables need to be aggregated to a quarterly frequency and are usually only partially available, missing observations are forecast using satellite models. These partial approaches have a long tradition in central banks and international organisations and are usually referred to as "bridge models".

Joint models are multivariate dynamic models, in which the dependent variable and the set of independent variables that are used as predictors are essentially estimated jointly with a view to making full use of the joint dynamics of the variables considered. Practical applications mostly take the form of dynamic factor models and, to a much lesser extent, vector autoregressive (VAR) models. Central banks increasingly use such models in addition to bridge models to make short-term projections. As regards Belgium, the earliest example of a dynamic factor model that was used by the National Bank of Belgium was developed by Van Nieuwenhuyze (2006) and this Belgian model was also included in Barhoumi *et al.* (2008). The model was used in conjunction with and as a cross-check for other short-term forecasting tools in a cross-country comparison exercise for the euro area. More recently, a joint dynamic factor model for Belgium and the euro area was constructed by de Antonio (2014). This model is now being used, together with BREL, referred to in section 3, as well as other tools, in the context of the National Bank of Belgium's analyses and forecasts of short-term economic developments.

Apart from the technical aspects, the key difference between the joint and partial approaches is of a conceptual nature. Joint models are better suited to assess the specific impact of each new piece of information (Bańbura *et al.*, 2013). New data for any of the predictors can be easily compared to the value forecast by the model and the impact of the "news" or "surprise" component of the data release on the dependent variable can then be quantified. As such, these models help to interpret the data flow. Results are often presented as a timeline of forecast updates linked to data releases. Partial models, on the other hand, typically offer more simplicity and flexibility and, in that connection, can be tailored more easily to the specific data release calendar, as we do in this article.

In principle, both approaches can be combined to the extent that factors summarising large datasets can be part of bridge equations. The "bridging with factors" approach was pioneered by Giannone *et al.* (2008). Barhoumi *et al.* (2008), as well as Angelini *et al.* (2011), show that it can help to improve the forecast accuracy for predicting euro area GDP or that of individual euro area countries compared to traditional bridge models.

In all models, the selection of appropriate predictors is key. Clearly, including those indicators that are the most likely to provide advance information on real GDP or other macro aggregates, in other words those with the highest predictive power, is quintessential. On the other hand, incorporating less informative indicators entails an excess volatility that could affect the model's predictive accuracy. When dealing with numerous potential predictors, it is therefore worthwhile to resort to selection procedures that strike an appropriate balance between informative content and selectivity. To this end, in the BREL framework, we follow the approach suggested by Bai and Ng (2008), which consists in using the elasticnet regression in order to identify the most relevant indicators, and latter refined by Bessec (2013) in order to account for the fact that the potential predictors are not released simultaneously.

This selection algorithm, which will be discussed in greater detail in section 3, reveals the importance of survey data in forecasting. Bessec (2013) shows that survey indicators, like financial variables, are more likely to be picked up by the selection algorithm when the forecast is made for longer horizons, for which hard indicators – such as industrial production data – have not yet been released. Bańbura and Rünstler (2011) also put forward that property of survey indicators, showing that, due to the publication lags of hard indicators, they contribute to a larger extent to the earlier forecasts. Their contribution is nevertheless reduced when more informative predictors, in particular those that pertain to real activity, can be taken into account. The benefits from the timeliness of survey indicators were also investigated by de Antonio (2014) who, using Belgian data, also emphasised their intrinsic predictive quality. In other words, survey data keep some

informative content with regard to the prediction, even when publication lags are neutralised. Finally, another finding in the literature is that it is worthwhile to also use the disaggregated survey results, based upon the replies to individual questions, rather than just the synthetic indicators (e.g. Bec and Mogliani, 2013).

2. Existing survey data on the business cycle in Belgium

The National Bank of Belgium has a long tradition of conducting business cycle surveys. Two monthly surveys in particular, regarding business (or producer) and consumer sentiment, provide highly relevant and timely information on the cyclical conditions in the Belgian economy. In the context of the Joint Harmonised EU Programme of Business and Consumer Surveys, both of these surveys are harmonised at the European level, as regards the minimum set of questions, the possible replies, as well as the aggregation of these replies into a summary indicator per question. While the European Commission calculates composite sentiment indicators according to a harmonised methodology, in order to facilitate international comparisons, participating national institutions are free to summarise survey information into own synthetic indicators, and, in principle, to add additional survey questions.

Apart from the aforementioned business and consumer sentiment survey, the National Bank of Belgium also conducts other surveys, including the Bank Lending Survey, a survey on production capacity utilisation and another on investment plans in the manufacturing industry as well as a series of *ad-hoc* surveys. However, all of these surveys have a lower frequency (mostly quarterly or twice-yearly) and, hence, are somewhat less suited for now-casting or short-term economic projections. In addition, investment plans indicated in the replies to the investment survey tend to significantly overestimate actual investment.

The remainder of this section briefly discusses the exact contents of the business and consumer sentiment surveys. We focus on the detailed questions that may provide an input for BREL. The reader is referred to the Bank's website [1] and De Greef and Van Nieuwenhuyze (2009) for a more extensive discussion on the surveys as well as more information on the exact definition of the Bank's synthetic indicators in particular.

The business sentiment survey was launched in 1954 at the request of several professional federations. It is conducted on a monthly basis for a representative panel of about 6 000 businesses. Four different industries are covered (manufacturing, business-related services, construction and trade) and results are published at the industry level. The survey is actually also conducted for a fifth industry – civil engineering and roadworks – but the replies for that industry are not taken into account in the global sentiment indicator, as its developments are thought to be less cyclical (given that they are more dependent on government activity).

The survey questions [2] generally focus on sales or activity, (total and export) orders, prices and employment and, for each of these topics, address three different dimensions: a factual reporting of current developments, the respondent's appreciation of these developments and the respondent's expectations for the future. Only three qualitative replies can be given for each question: one positive, one neutral and one negative. The aggregation procedure is the balance approach: the average reply for each question is simply the difference between the percentages of positive and negative replies. Only about half of the questions are taken into account for the construction of the National Bank of Belgium's synthetic indicator of business sentiment.

In the early 1970s, a specific consumer sentiment survey was also introduced. Unlike its business sentiment counterpart, this survey is not organised using a fixed panel of respondents. Each month, a different sample of 1 600 households are interviewed. Apart from respondent identification questions (sex, age, employment situation, income and education level), a total of 17 questions are asked about the economic conditions and unemployment level, the respondent's own financial situation and capacity to save, price developments and major expenditure (such as purchases of cars, furniture and other durables as well as construction or renovation of dwellings). Questions relate to past developments, the (assessment of) the current situation and the outlook for the next twelve months. Replies are again qualitative with the exception of the two questions on past and future price developments, for which an inflation rate is asked. Only four questions are used in the construction of the National Bank's consumer sentiment indicator. All of these are forward-looking and pertain to the respondent's outlook, over the next twelve months, for the general economic situation, the unemployment level, his or her household's own financial position and capacity to save.

Replies to the survey questions are part of the dataset that is used in our estimations. For the business sentiment survey, we consider all questions, irrespective of whether they are taken into account for the National Bank of Belgium's

(1) http://www.nbb.be/pub/stats/surveys/opinions.htm?l=en
(2) The specific questions are included in Annex Table 1 that describes our dataset.

composite indicator of business sentiment or not. We also include the survey replies for the civil engineering and roadworks industry; while activity and sentiment in this industry may be less related to the "private-sector" business cycle, GDP also reflects government (consumption and) investment and, hence, these survey replies may contain information on GDP developments. For the consumer sentiment survey, we restrict our analysis to the four questions that are used in the synthetic consumer sentiment indicator. In both cases, we only put replies to individual questions and not the synthetic indicators in the dataset.

3. Forecasting GDP using BREL

3.1 Model description

The National Bank of Belgium uses different models and approaches to produce short-term economic projections. This paper is anchored to the recently created BREL model (Piette, 2014). It relies on standard bridge models that relate a quarterly macroeconomic aggregate (Y_t), e.g. real GDP growth compared to the previous quarter[1], to a set of monthly predictors that are converted to a quarterly frequency ($X^{Q}_{i,t}$). In its most general form, it is specified as an autoregressive-distributed lag model (ADL):

$$Y_{t+h} = \mu + \sum_{j=1}^{p} \rho_j Y_{t-j} + \sum_{i=1}^{n} \sum_{j=0}^{q} \beta_{i,j} X^{Q}_{i,t-j} + \varepsilon_t$$

where p is the number of autoregressive terms, n is the number of predictors, and q the number of lagged explanatory variables included in the equation. The parameters of the equation, i.e. the constant μ, the autoregressive parameters ρ_j and the coefficients $\beta_{i,j}$, can be estimated by means of a simple ordinary least-square regression. The lead parameter (h) can be either equal to 0, for predicting the value of Y in the current quarter, or to an integer equal to 1 or more for the subsequent periods.

One particular and well-known problem when using such bridge models in real time, e.g. in a policy environment, is the ragged-edge nature of the dataset of predictors. Typically, forecasts for the current quarter need to be made when only part of the monthly predictors ($X_{i,m}$) for that quarter are available. This is the case, for instance, when in mid-February an estimate of GDP growth in the first quarter is already required: at the very best, only monthly values for January will be available for some predictors. Hence, the model needs to be complemented by a tool that provides forecasts for these missing observations for the monthly predictors in order to aggregate them to quarterly numbers.

To this end, monthly predictor series are prolonged, where necessary, using a satellite model, which takes the form of a simple univariate autoregressive process:

$$X_{i,m} = \Phi_0 + \sum_{j=1}^{l} \Phi_j X_{i,m-j} + \eta_m$$

where l stands for the number of autoregressive parameters[2].

The predictors are chosen among a large set of hard and soft data that can be considered as business cycle indicators. The selection procedure is based upon an algorithm that uses the elastic-net regression approach pioneered by Zou and Hastie (2005) and applied in the context of short-term forecasting using a large set of indicators by Bai and Ng (2008). This statistical technique makes it possible to find the most relevant explanatory variables and rank them according to their predictive power from an unrestricted linear regression model that can include a very wide set of variables[3]. To the best of our knowledge, a similar procedure has only been applied to bridge models by Bulligan *et al.* (2012). Furthermore, we apply this selection algorithm following the approach suggested by Bessec (2013) in order to take into account the ragged data edges. To this end, the dataset is transformed so as to accurately reflect the situation in terms of data availability at the time the forecast is made. In practice, if observations of potential predictors for certain months at the end of the dataset are missing, the corresponding observations in previous quarters are replaced by their estimates based upon the aforementioned autoregressive models. Altering the dataset in this manner before running the elastic-net regression ensures that the selection is not purely based upon in-sample explanatory power when all observations are available (which may not help the forecaster when they are not) but essentially also takes account of the goodness of the fit of the autoregressive models used to generate missing observations.

This technical modification is required to duly reflect the data release calendar. As soft data are typically available earlier but are likely to be less closely correlated with the dependent variable, it avoids a selection bias towards hard data in particular: their typically higher in-sample

(1) Adjusted for seasonal and calendar effects.

(2) As a general rule, for every monthly predictor considered, we select the number of lags that minimises the autoregressive model's Schwartz information criterion, with a maximum of 12 lags.

(3) As opposed to standard regression models, the number of explanatory variables in the elastic-net regression can even be higher than the number of observations.

predictive power overstates their usefulness in a real-time forecasting environment.

3.2 Dataset and data release calendar

Our dataset covers a period spanning from the first quarter of 1995 to the last quarter of 2012 and comprises a broad range of indicators of different types. The annex table offers a detailed overview. Apart from the balances taken from the replies to the individual questions in the aforementioned producer and consumer sentiment surveys conducted by the National Bank of Belgium (type : SURVEY), we consider three other data types :

– HARD : this category includes various hard data such as industrial production indices constructed by Statistics Belgium and turnover statistics reported in VAT declarations, as well as new car registrations, several labour market statistics (among which the work volume of temporary workers is thought to reflect cyclical changes quite quickly) and permits for new buildings ;

– FINANCIAL : this category brings together a limited set of financial data, including Belgian and European stock market indices, short- and long-term interest rates, oil and other commodity prices, the EUR/USD exchange rate, as well as the gold price ;

– INTERNATIONAL : this category comprises both survey and hard data pertaining to the external environment. We include the EC's confidence indicators for the euro area and Belgium's main trading partners (Germany, France and the Netherlands), as well as certain industrial production and trade indices, also for advanced and emerging economies.

We specifically exclude certain hard data from the dataset as they are typically revised often and/or to a large extent. Hence, the initial vintage may give wrong information on the business cycle. This is the case, in particular, for the monthly statistics on Belgian imports and exports.

In the econometric estimations, all indicators with the exception of those that can take zero or negative values (e.g. survey indicators) are expressed in natural logs. Those for which a unit root was detected are included in first differences so as to make them stationary. Moreover, like GDP growth, all predictors are adjusted for seasonal effects and, wherever necessary, also for differences in the number of working days.

For the GDP estimates that are discussed in the remainder of this section and in the subsequent section, the full dataset is used. We did not take the synthetic Belgian producer and consumer sentiment survey indicators into account as those are simply linear combinations of the balances of the replies to individual survey questions. However, the estimates for other macroeconomic aggregates – discussed in section 5 – are carried out on a restricted dataset. A pre-selection is made to focus only on the indicators that we deem relevant for the variable to be estimated. In the case of value added in the manufacturing industry, for instance, we obviously do not include indicators from the producer sentiment survey or turnover statistics that pertain to industries other than manufacturing and we also exclude data on new building permits and certain financial indicators. All indicators in the INTERNATIONAL group, on the other hand, are kept in the dataset as external developments are actually likely to influence manufacturing activity in Belgium. We do exclude these latter indicators for the estimates of other aggregates such as value added in construction and the services sector as the direct impact of international developments on these aggregates is likely to be more limited.

For each of the macroeconomic variables considered, GDP or the other aggregates, six different estimates are made to take into account data availability at different points in time. We consider, in particular, six stylised "data availability scenarios" that replicate in a simplified manner the standard data release calendar in Belgium and, hence, the actual dataset that can be used in real time by the forecasters. Broadly speaking, survey data pertaining to a given month are generally available at the latest towards the end of that month and the same holds for all financial data considered here. Certain "early" hard data (e.g. on the labour market situation or pertaining to new car registrations) typically become available in the following month. However, the majority of the hard data are only released in the month after that. This adds up to the six different data scenarios that are detailed in Table 1 and range from the beginning of the quarter considered (no data on that quarter are available) to two months after the end of the quarter considered (a first vintage of all data relative to that quarter is available). In this way, our estimation framework takes due account of the different release dates for the different data types.

Scenario 5 generally corresponds to the situation in which the first flash estimates of GDP growth are produced by statistical agencies and by the National Accounts Institute in particular. These flash estimates have to be made before certain source data, notably the most relevant hard data, for the final month of the quarter are available, which may partly explain the rather frequent and sometimes significant revisions to these first quarterly estimates.

TABLE 1 DATA AVAILABILITY SCENARIOS FOR FORECASTING QUARTER Q

	Survey and financial data until	"Early" hard data[1] until	Hard data until
Scenario 1: 3 months before the end of Q	3rd month of Q – 1	2nd month of Q – 1	1st month of Q – 1
Scenario 2: 2 months before the end of Q	1st month of Q	3rd month of Q – 1	2nd month of Q – 1
Scenario 3: 1 month before the end of Q	2nd month of Q	1st month of Q	3rd month of Q – 1
Scenario 4: end of Q	3rd month of Q	2nd month of Q	1st month of Q
Scenario 5: 1 month after the end of Q	1st month of Q + 1	3rd month of Q	2nd month of Q
Scenario 6: 2 months after the end of Q	2nd month of Q + 1	1st month of Q + 1	3rd month of Q

(1) Including, in particular, data on the labour market and new car registrations.

It is important to stress that our estimates take account of the current data vintage. We could not reconstruct series on the basis of the first data vintages, either for the dependent variable(s) or for those indicators – in particular certain hard indicators – for which some data points are likely to have been revised since their first release.

3.3 Predictive performance

Chart 1 reports the root mean square forecast errors (RMSFE)[1] from a series of recursive forecasts produced by BREL for quarterly GDP growth in Belgium, carried out over the period from the first quarter of 2004 to the fourth quarter of 2012. The bridge equations are estimated for each of the six data scenarios described in the previous sub-section, always using the top-ranked predictors, as selected via the aforementioned procedure, for that specific data scenario using the observations from the whole sample period. In line with the benchmark approach in the literature, we measure accuracy in this paper by comparing the estimates to the current national accounts data, i.e. not to the first data release. This implies that statistical data uncertainty that exists at the time of this first data release will also be reflected in the reported forecast errors as the focus is on the capacity to predict final national accounts data.

In addition, we look at the relevance of including more predictors by sequentially increasing the number of independent variables considered in the equation, in line with the ranking, starting from the top-ranked predictor up to the predictor(s) that came in 10th place. As the selection procedure sometimes results in ties, the cut-off rank may be (and in most cases is) somewhat smaller than the actual number of predictors used in the bridge equation.

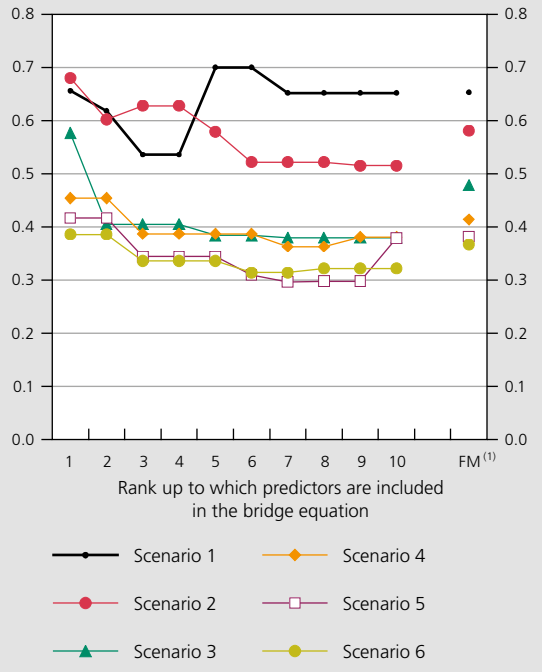
As expected, the predictive power of the bridge equations significantly improves when more data become available. Clearly, accuracy is poor when there are no

(1) For a series of forecasts for a variable Y generated over T periods, the RMSFE is defined as:

$$RMSFE = \sqrt{\frac{1}{T}\sum_{t=1}^{T}\left(\hat{Y}_t - Y_t\right)^2}$$

CHART 1 FORECAST ERRORS FOR QUARTERLY GDP GROWTH AS A FUNCTION OF THE DATA SCENARIO AND THE NUMBER OF VARIABLES INCLUDED IN THE BRIDGE MODEL

(RMSFEs in percentage points; simulations performed over the period 2004Q1-2012Q4)

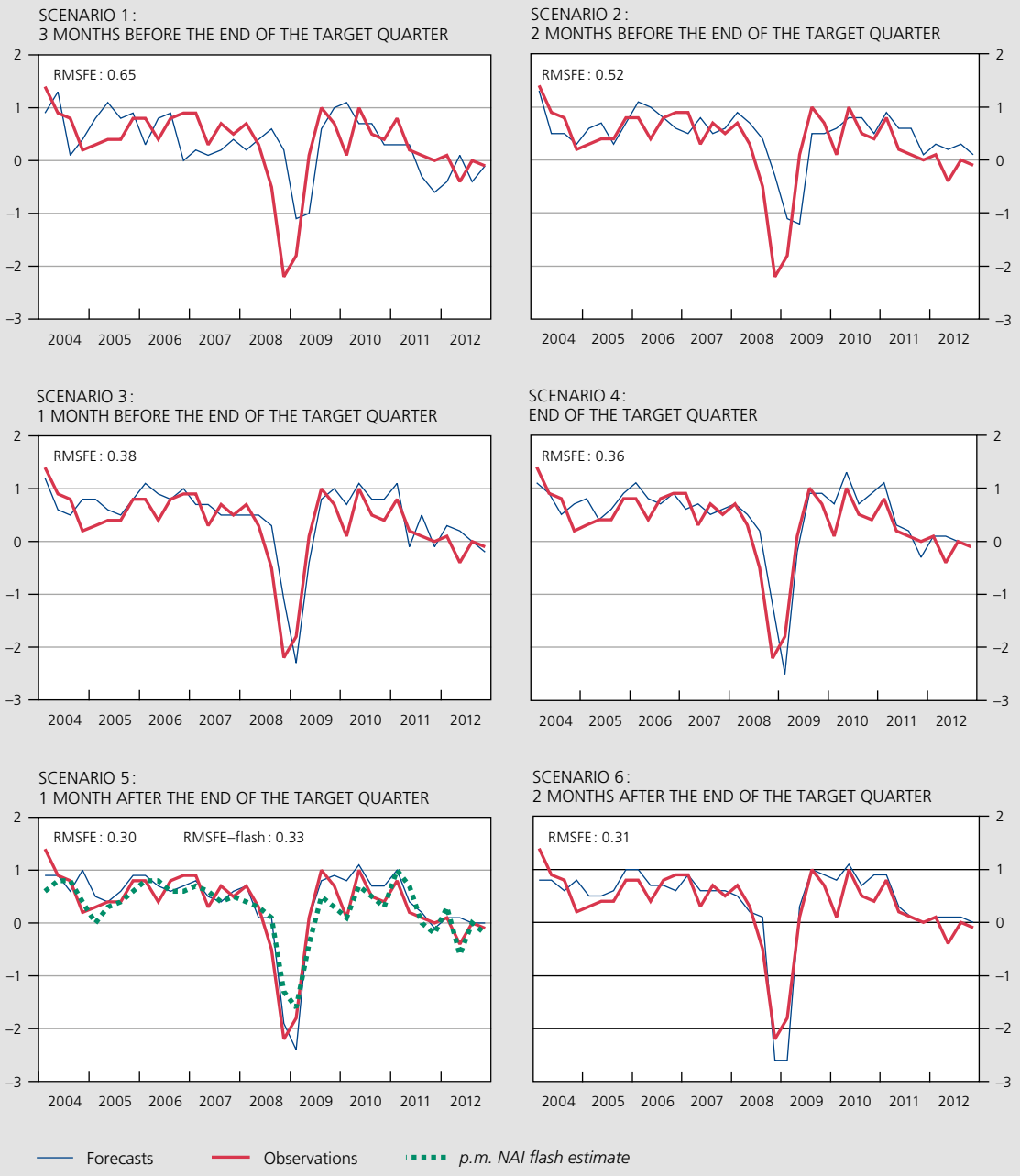


(1) FM: factor model using all available predictors.

specific data for the quarter under consideration. The RMSFE is relatively large for the earliest scenario but already drops considerably as soon as the first – survey and "early" hard – data for the quarter considered become available (scenarios 2 and 3). The accuracy of the estimates further improves by the end of the quarter under consideration, with the RMSFE in scenarios 4 to 6 falling to about half of that in the earliest estimates used here. Quite remarkably, the accuracy of the estimates in scenario 5, which corresponds to the flash estimate of the National Accounts Institute in terms of timing and data availability, is very much in line with – and actually slightly lower than – that of these first official quarterly national accounts statistics. Measured over the same period, the latter exhibit a RMSFE of around 0.33 percentage points compared to the current national accounts data, while the

CHART 2 ACCURACY OF BREL GDP FORECASTS USING PREDICTORS UP TO THE SEVENTH RANK

(percentage changes compared to the previous quarter)



Sources : NAI, NBB.

average error of the specified equation for data scenario 5 is marginally below 0.3.

Chart 1 also shows that forecasting accuracy clearly depends on the number of variables included in the bridge equations. However, accuracy gains are far from uniform and generally seem to become significantly smaller once the cut-off point for the ranking is raised to 5 or 6. At some point, they even become negative on average, suggesting that including more predictors actually worsens forecast performance. As a benchmark for our results, we also ran a factor model (FM) that makes use of all explanatory variables considered in the dataset by grouping them using the principal components method (Stock and Watson, 2002)[1]. The idea is to use the factors to capture the main "co-movements" in the business cycle that drive the monthly indicators, which are also likely to explain developments in GDP. For all data scenarios, the errors of this latter model are clearly higher than the ones for the bridge equations that use only a limited number of predictors. This confirms that selecting the appropriate predictors enhances accuracy.

Across data scenarios, the errors are on average the smallest for the model using predictors that were ranked up to seventh place. This corresponds to twelve predictors in scenario 1, eight predictors in scenarios 2 and 4, eleven predictors in scenario 3 and seven predictors in scenarios 5 and 6.[2] Chart 2 gives an overview of the goodness of fit for these specifications.

It should be stressed that, while estimates were made in a recursive manner, the selection procedure for the predictors was run over the entire 2004-2012 period. An alternative exercise that also makes the selection itself recursive not surprisingly gives somewhat less accurate results with the RMSFE only dropping to about 0.4 in scenarios 5 and 6, which nevertheless remains close to the errors made using the factor model with all predictors.

4. Selection results: which predictors are important?

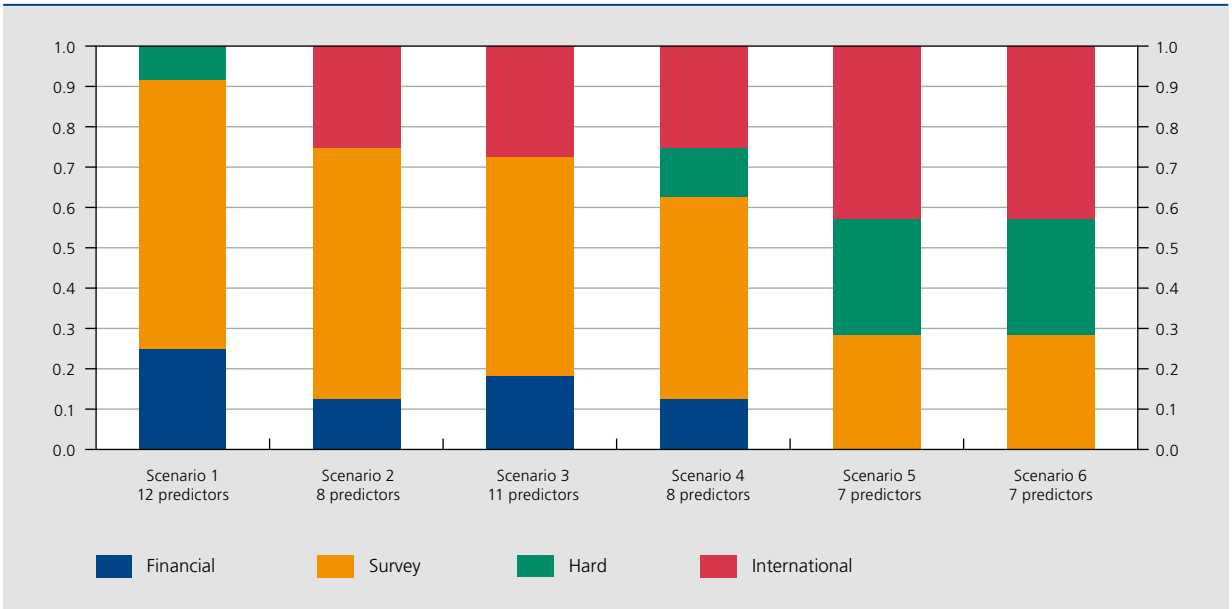
In this section, we specifically assess the importance of different types of indicators for the short-term real GDP estimates. As indicated, we distinguish between international data, hard data, financial data and survey data and will evaluate the role of the latter in particular. In line with the findings of the previous section, the model that uses predictors ranked up to the seventh place is our benchmark. As indicated, the selection algorithm is run over the entire 2004-2012 period.

(1) The factor model we used to produce the results reported in Chart 1 takes account of the non-synchronous data release in the same way as for the standard bridge model. That is, missing observations are filled in by means of the same univariate autoregressive models.

(2) As indicated above, the number of predictors used in the bridge model is most of the time larger than the ranks that appear on the x-axis of Chart 1 due to the fact that the selection procedure may sometimes result in ties and give the same rank to two – or more – predictors

CHART 3 IMPORTANCE OF DIFFERENT DATA TYPES FOR EACH DATA SCENARIO IN THE GDP ESTIMATES

(percentages, share in the number of predictors up to the seventh rank)



The empirical results are summarised in chart 3 and table 2 and are broadly in line with expectations. Clearly, the importance of each type of data strongly depends on the exact time when the estimate has to be made. Survey data are especially important for estimates before or during the target quarter (data scenarios 1 to 4), when hard data are not yet or only scarcely available. However, survey data continue to play a (more limited) role for *ex-post* estimates, even when all relevant hard data have become available.

As regards the first estimate before the start of the quarter (data scenario 1), i.e. when no specific data pertaining to that quarter are available, two-thirds (8 out of 12) of the selected predictors come from the two surveys conducted by the National Bank of Belgium. However, the top predictors are two financial indicators – the stock price index and the commodity price level in international markets – that seem to have a leading character with respect to GDP growth in the next period. Among the survey indicators, the assessment or the expectations regarding price developments seem to play an important role in this early data scenario. The assessment of activity, exports and employment expectations in trade, manufacturing and civil engineering and roadworks, as well as the indicator regarding

TABLE 2 BEST PREDICTORS FOR BELGIAN GDP GROWTH, ACCORDING TO THE DATA AVAILABILITY SCENARIO

(rankings under the seventh position are not reported; selection performed over the entire sample period)

Rank	Variable	Category	Rank	Variable	Category
Scenario 1: 3 months before the end of the target quarter					
1	Brussels All Shares Index	Financial	7	Civil engineering and roadworks: employment expectations	Survey
2	Commodity import prices in international markets, excluding energy	Financial	7	Civil engineering and roadworks: trend in number of contracts concluded	Survey
3	Business-related services: price expectations (with 1 lag)	Survey	7	Consumer survey: saving expectations of households (with 1 lag)	Survey
3	Trade: trend in prices (with 1 lag)	Survey	7	Euro Stoxx Broad Index	Financial
5	Trade: assessment of sales	Survey	7	Production in construction	Hard
5	Manufacturing: trend in export orders	Survey	7	Trade: trend in prices	Survey
Scenario 2: 2 months before the end of the target quarter					
1	Industrial production in the emerging economies	International	5	Manufacturing: demand expectations	Survey
2	Consumer survey: unemployment expectations	Survey	6	Business-related services: activity expectations	Survey
3	Commodity import prices in international markets, excluding energy	Financial	6	Civil engineering and roadworks: demand expectations	Survey
3	Industrial production in the advanced economies	International	6	Consumer survey: outlook for the financial situation of households	Survey
Scenario 3: 1 month before the end of the target quarter					
1	Manufacturing: trend in export orders	Survey	7	Industrial production in the euro area	International
2	Consumer survey: unemployment expectations	Survey	7	Manufacturing: demand expectations	Survey
2	Commodity import prices in international markets, excluding energy	Financial	7	Industrial production in the emerging economies	International
2	Industrial production in the advanced economies	International	7	Brussels All Shares Index	
5	Construction: trend in prices	Survey	7	Business-related services: general demand expectations	Survey
5	Construction: price expectations	Survey			
Scenario 4: end of the target quarter					
1	Consumer survey: unemployment expectations	Survey	3	Work volume of temporary workers	Hard
1	Industrial production in the emerging economies	International	3	Manufacturing: trend in export orders	Survey
3	Industrial production in the euro area	International	7	Commodity import prices in international markets, excluding energy	Financial
3	Manufacturing: demand expectations	Survey	7	Construction: trend in prices	Survey

TABLE 2 BEST PREDICTORS FOR BELGIAN GDP GROWTH, ACCORDING TO THE DATA AVAILABILITY SCENARIO (continued)

(rankings under the seventh position are not reported; selection performed over the entire sample period)

Rank	Variable	Category	Rank	Variable	Category
	Scenario 5: 1 month after the end of the target quarter				
1	Industrial production in the euro area	International	3	Work volume of temporary workers	Hard
1	Trade in goods in the emerging economies	International	6	Total turnover	Hard
3	Consumer survey: unemployment expectations	Survey	7	Manufacturing: demand expectations	Survey
3	Industrial production in the emerging economies	International			
	Scenario 6: 2 months after the end of the target quarter				
1	Industrial production in the euro area	International	3	Total turnover	Hard
1	Trade in goods in the euro area	International	6	Manufacturing: demand expectations	Survey
3	Trade in goods in the emerging economies	International	6	Production of intermediate goods	Hard
3	Consumer survey: unemployment expectations	Hard			

the savings expectations in the consumer survey also help to some extent in explaining future GDP developments.

Moving further along the data release calendar, survey data continue to have an important contribution to GDP estimates. In data scenarios 2 to 4, survey replies are among the most relevant predictors for the now-cast of GDP growth together with certain financial indicators and data on international developments. In the absence of hard data, they constitute the only available information directly connected to the economic developments within the period. Survey data continue to be important for the estimates when certain hard indicators, such as industrial production and VAT turnover data, are released for the first month of the quarter, as in scenario 4. This suggests that the combination of one actual observation and two autoregressive forecasts for these data does not suffice for the hard data to provide enough information on the activity developments in activity within the quarter under consideration.

Several survey data show up in a consistent manner across these three data scenarios. This is the case for the expectations on the development of unemployment in the consumer survey, which is the most relevant indicator in scenario 4, and demand indicators for the manufacturing industry (demand expectations and/or reported trend in export orders). In the former case, the statistical relationship most likely runs through private consumption (as will be shown in section 5), that accounts for about half of GDP, while the predominance of the demand indicators for the manufacturing industry may suggest that business cycle swings are more important – or show up earlier – in that industry. The latter observation is consistent with the "overweighting" of this industry in the National Bank of Belgium's synthetic indicator (De Greef and Van Nieuwenhuyze, 2009). Finally, two particular indicators from the survey results for the construction sector, as well as indicators pertaining to the assessment of or expectations regarding activity and demand in the business-related services industry also contribute to explaining some of the current-quarter variation in GDP. As regards construction, the selected indicators do not relate to developments in activity or demand, as those selected for the other industries, but to recent and expected price developments. One possible interpretation is that price developments in the construction industry might reflect general economic developments better than the respondents' assessments of actual and expected activity in that industry.

The presence of survey data on the civil engineering and roadworks industry in the earliest GDP estimates (data scenarios 1 and 2) seems to be somewhat at odds with the exclusion of this industry from the National Bank of Belgium's synthetic producer sentiment indicator. However, GDP is also to a large extent determined by government expenditure. Sentiment in this industry may be a good proxy for government expenditure and, in particular, government investment when no direct observations on this are available.

The significance of survey data declines somewhat after the quarter considered has ended (data scenarios 5 and 6). Hard data on temporary work and the production of intermediate goods and, remarkably, international indicators (trade and industrial production) begin to play a more important role in explaining short-term developments in

Belgian GDP. However, even when, in principle, the full set of hard data is available for the considered quarter, *ex-post* GDP estimates continue to be anchored to certain survey results, and in particular the unemployment expectations in the consumer sentiment survey and the demand expectations in manufacturing. While hard data such as those on industrial production and turnover according to VAT data are explicitly used by the National Accounts Institute for compiling quarterly GDP figures, this suggests that the mapping from those hard data to final national accounts statistics is far from perfect and certain survey results help to deal with data gaps.

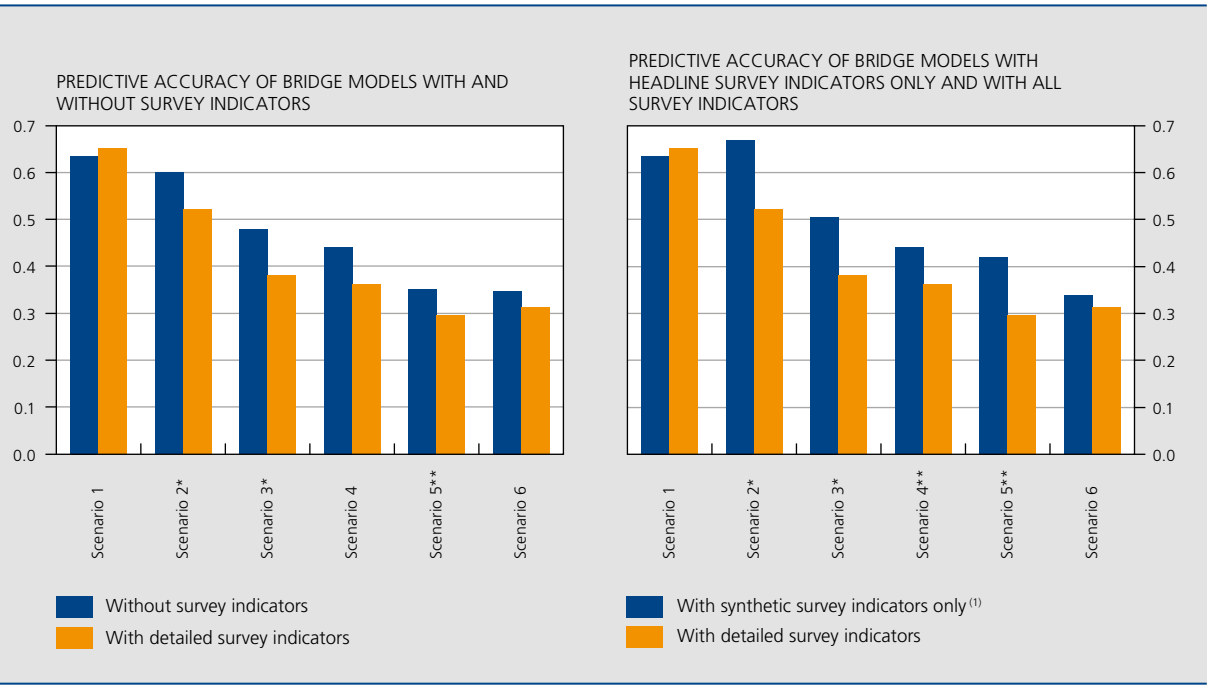
The same may be true for the number of hours worked by temporary workers, among the top 5 most relevant predictors at the time when the National Accounts Institute produces the first flash estimate of quarterly GDP (data scenario 5). Its release typically precedes by one month that of the other hard data, on production and turnover, and the predictive power for GDP is in all likelihood attributable to the fact that firms typically use temporary work as a "buffer" to absorb activity shocks. As a result, the movements exhibited by this indicator evidently constitute a good proxy for changes in economic activity. The presence of industrial production indices for the euro area and the emerging economies in the estimations for the last data scenario reflects the fact that the Belgian business cycle is determined to a large extent by external developments, notably through the trade channel.

An alternative, more synthetic gauge of the importance of survey data can be obtained by comparing the model's performance on the basis of the full dataset, as described in section 3.2, to its accuracy if no survey data are included in the dataset. As shown in Chart 4, the same pattern emerges: excluding survey data from the short-term projections would worsen forecast accuracy in all data scenarios after the start of the quarter (i.e. as soon as the first batch of survey data for that quarter become available). The difference is significant according to the Diebold-Mariano (1995) test at the 10 % significance level for scenarios 2 and 3 and at the 5 % level for scenario 5. The latter result suggests that, at the time the National Accounts Institute prepares the first flash estimate of quarterly GDP, survey data still contain very relevant information.

Finally, one can also look at the model's accuracy if only the headline survey data, i.e. the National Bank of Belgium's monthly synthetic business and consumer sentiment indicators, are taken into account. We find that using the full set of survey data again improves predictive accuracy in all scenarios from 2 to 6, with the difference

CHART 4 CONTRIBUTION OF SURVEY DATA TO SHORT-TERM GDP ESTIMATES: A SYNTHETIC VIEW

(RMSFE in percentage points; based on bridge models with the 7 top-ranked predictors; simulations performed over the period 2004Q1-2012Q4)



(1) Only using the headline consumer and producer sentiment indices.
Note: one or two stars indicate a significance level of 10 % and 5 % respectively for the Diebold-Mariano test statistic.

being statistically significant for all but the last data scenario. Clearly, restricting the dataset to headline survey indicators implies a loss of information.

5. A broader use of BREL: which predictors for other macro aggregates?

The analysis carried out in the preceding section for GDP can be easily extended to other important macroeconomic aggregates. In this section, we look at the indicator selection for three supply-side variables (value added in the manufacturing, construction and market services industries), the most important demand component, i.e. private consumption, as well as employment. As indicated previously, these estimates are made using a restricted dataset. Further details are given in the annex table. Empirical results regarding the most relevant predictors for each of the aggregates considered in this section are detailed in tables 3, 4 and 5. Due to space considerations, these tables, the content of which is similar to that of table 2, are presented in a more concise format.

5.1 Supply-side aggregates

The results obtained for value added in the manufacturing industry show a prevalence of predictors that pertain to the international environment at the different stages of the data release calendar. The indicator on industrial production in the advanced economies published by the CPB, in particular, is chosen by the selection procedure in each of the six data release scenarios. Trade volumes in the euro area and in other advanced countries also become important predictors in the later data scenarios. The fact that indicators linked to the international environment show up among the most informative to forecast value added in the Belgian manufacturing industry is not surprising. It reflects that industry's heavy involvement in international trade, which makes it relatively more dependent on external developments. The indicator on the trend in export orders, which was also selected for GDP in some data scenarios, appears to be the most relevant survey indicator for this aggregate.

When more observations for Belgium-specific hard indicators become available, the work volume of temporary workers, which is released earlier, is the first to be picked up by the selection procedure, followed by the production of intermediate goods.

As far as value added in construction is concerned, the selection procedure tends, at the beginning of the quarter, to favour indicators related to the assessment made by the respondents regarding their short-term prospects in activity (order books) or in prices. When more observations for survey data become available, four indicators stand out clearly: apart from the assessment of order books, also the trends in activity and prices from the construction survey, as well as the trend in activity from the civil engineering and roadworks survey have good predictive power. These variables remain at the top of the ranking even in the presence of observations for the hard indicators, as the latter turn out to have more limited predictive power.

As for value added in services, consumers' expectations about unemployment, employment and activity expectations in business-related services, as well as the intention of placing orders in trade businesses appear systematically at the top of the best-ranked predictors, whenever the forecast is carried out in the course of the current quarter (i.e. starting from scenario 2). However, when they are available, the turnover in services and the work volume of temporary workers are found to be the best predictors for value added in that sector.

5.2 Private consumption

The predictor selection for private consumption by and large confirms the leading properties of the unemployment expectations taken from the consumer survey. This indicator had already been singled out as one of the most relevant for GDP developments, in particular for early estimates. Among the indicators taken from the trade survey, the lagged trend in prices performs the best. Also for private consumption, the work volume of temporary workers is a key indicator in the later data scenarios. Finally, when all three monthly observations for turnover in retail trade are available, this indicator shoots up to the top of the ranking. This does not come as a surprise since the same data are used to compile private consumption in the quarterly national accounts.

5.3 Employment

As for employment in the private sector[1], the predictions rely mainly on survey indicators, even in the presence of a sufficient number of hard indicators after the end of the target quarter. The only hard indicator that is somewhat important in the list of the best predictors is the number of job-seekers in the case of the pure out-of-sample forecast (scenario 1). In our interpretation, this merely reflects

(1) We focus on salaried private-sector employment only as public-sector employment obviously exhibits a less cyclical pattern.

TABLE 3 BEST PREDICTORS FOR VALUE ADDED IN THE THREE MAIN INDUSTRIES, ACCORDING TO THE DATA AVAILABILITY SCENARIO

(predictors that appear at least once in the top seven of the ranking in one of the six scenarios; rankings under the seventh position are not reported; selection performed over the entire sample period)

	Data availability scenario					
	1	2	3	4	5	6
VALUE ADDED IN MANUFACTURING						
Financial indicators						
Import prices of energy raw materials in international market	5		7			
Commodity import prices in international market, excluding energy	1	7				
Survey indicators						
Manufacturing: trend in export orders			2	4	5	
Manufacturing: trend in the production rate				4		
Manufacturing: demand expectations			5			
Manufacturing: trend in prices (with 1 lag)	7					
Hard data						
Production of intermediate goods					6	6
Work volume of temporary workers	3		4	6		
Indicators related to the international environment						
Industrial production in the euro area				3	3	1
Industrial production in the advanced economies	3	1	1	1	1	2
Trade in goods in the advanced economies					2	2
Trade in goods in the euro area				2		2
Consumer confidence in France	6	6			6	7
Industrial production in France		4				7
Trade in goods in the emerging economies		3			6	
Industrial production in the emerging economies (with 1 lag)			3			
Industrial production in the emerging economies		2				
Consumer confidence in the euro area	2					
Lagged dependent		**5**	**5**	**7**	**4**	**5**
VALUE ADDED IN CONSTRUCTION						
Survey indicators						
Construction: assessment of order books	3	1	1	1	1	1
Construction: trend in activity			5	2	2	2
Construction: trend in prices			1	3	3	3
Civil engineering and roadworks: trend in activity				3	3	3
Construction: price expectations		3	4			
Civil engineering and roadworks: assessment of order book		5	6			
Civil engineering and roadworks: trend in prices			6			
Civil engineering and roadworks: trend in number of contracts concluded		4				
Consumer survey: unemployment expectations		5				
Civil engineering and roadworks: demand expectations		7				
Civil engineering and roadworks: trend in number of tenders (with 1 lag)		7				
Construction: assessment of order books (with 1 lag)	1					
Civil engineering and roadworks: trend in number of contracts concluded (with 1 lag)	2					
Civil engineering and roadworks: trend in amount of work to be done (with 1 lag)	4					
Civil engineering and roadworks: trend in number of tenders	4					
Construction: employment expectations (with 1 lag)	4					
Hard data						
Permits for new residential buildings (in m^2)				6	3	6
Production in construction				7	7	6
Work volume of temporary workers	4					
Lagged dependent		**1**	**3**	**3**	**3**	**3**

TABLE 3 BEST PREDICTORS FOR VALUE ADDED IN THE THREE MAIN INDUSTRIES, ACCORDING TO THE DATA AVAILABILITY SCENARIO (continued)

(predictors that appear at least once in the top seven of the ranking in one of the six scenarios; rankings under the seventh position are not reported; selection performed over the entire sample period)

	Data availability scenario					
	1	2	3	4	5	6
VALUE ADDED IN MARKET SERVICES						
Survey indicators						
Business-related services: employment expectations		2	1	1	2	3
Consumer survey: unemployment expectations	4	1	4	1	4	3
Trade: intentions of placing orders		2	1	4	4	3
Business-related services: activity expectations	6	2	3	5	6	6
Business-related services: trend in employment			7	5	6	6
Business-related services: trend in activity		6	5			
Consumer survey: outlook for financial situation of households	2	6	7			
Business-related services: general demand expectations	1		7			
Consumer survey: outlook for saving of households (with 1 lag)	2					
Business-related services: price expectations (with 1 lag)	5					
Trade: demand expectations	6					
Trade: trend in sales (with 1 lag)	6					
Hard data						
Work volume of temporary workers					1	1
Turnover in services				1	2	2
Lagged dependent		**5**	**5**	**5**		

TABLE 4 BEST PREDICTORS FOR PRIVATE CONSUMPTION, ACCORDING TO THE DATA AVAILABILITY SCENARIO

(predictors that appear at least once in the top seven of the ranking in one of the six scenarios; rankings under the seventh position are not reported; selection performed over the entire sample period)

	Data availability scenario					
	1	2	3	4	5	6
Survey indicators						
Consumer survey: unemployment expectations	2	3	3	2	3	4
Trade: trend in prices (with 1 lag)	3	2	2	3	3	5
Trade: employment expectations (with 1 lag)		6	6	5	6	7
Trade: assessment of sales			4	4	6	
Trade: assessment of the level of stocks	6	3		5	6	
Consumer survey: outlook for the financial situation of households				5	6	
Consumer survey: unemployment expectations (with 1 lag)		3	4	5		
Trade: price expectations (with 1 lag)	1					
Trade: trend in prices	3					
Trade: demand expectations (with 1 lag)	6					
Hard data						
Work volume of temporary workers					1	1
Turnover in retail trade					5	1
Registration of new private cars (with 1 lag)			6	5	6	5
Registration of new private cars		6	6	5	6	
Turnover in hotels and restaurants					6	
Turnover in hotels and restaurants (with 1 lag)	6	6				
Harmonised unemployment rate (with 1 lag)	3					
Lagged dependent		**1**	**1**	**1**	**1**	**1**

TABLE 5 BEST PREDICTORS FOR PRIVATE-SECTOR SALARIED EMPLOYMENT, ACCORDING TO THE DATA AVAILABILITY SCENARIO

(predictors that appear at least once in the top seven of the ranking in one of the six scenarios; rankings under the seventh position are not reported; selection performed over the entire sample period)

	Data availability scenario					
	1	2	3	4	5	6
Survey indicators						
Manufacturing: assessment of total order book		1	1	1	1	1
Manufacturing: employment expectations	2	3	2	2	2	2
Civil engineering and roadworks: price expectations	2		2	4	4	4
Manufacturing: demand expectations (with 1 lag)		7	5	4	4	4
Civil engineering and roadworks: trend in amount of work to be done			5	4	4	4
Trade: demand expectations			5	4	4	4
Trade: intentions of placing orders			5	4	4	4
Civil engineering and roadworks: trend in prices		3		4	4	4
Civil engineering and roadworks: trend in number of contracts concluded (with 1 lag)		7		4	4	4
Manufacturing: trend in orders from the domestic market (with 1 lag)	5		5			
Manufacturing: assessment of export order book		1				
Manufacturing: trend in orders from the domestic market	2	6				
Manufacturing: demand expectations	1					
Civil engineering and roadworks: trend in number of contracts concluded	5					
Hard data						
Production of capital goods (with 1 lag)		7				
Turnover in manufacturing (with 1 lag)		7				
Unemployed job-seekers (with 1 lag)		7				
Unemployed job-seekers	5					
Lagged dependent		**3**	**2**	**2**	**2**	**2**

a certain degree of persistence in the labour market developments since this variable can be seen as a substitute to the lagged dependent when the latter is not yet available (because, in our simulations, it is only included as of the second data scenario).

Remarkably, the selection procedure tends to choose an indicator related to developments in activity, i.e. the assessment of total order books in manufacturing, over one more directly connected to employment, i.e. employment expectations in that same industry. It can, however, be argued that there is a strong causal link between developments in activity and in employment. As the former usually precede the latter, this might explain why indicators related to activity perform better when it comes to providing early information on employment developments. Even though services contributed strongly to job creation over the sample period according to the national accounts statistics, no indicator from the survey in business-related services was included in the selection. Finally, while the unemployment expectations in the consumer survey clearly help to explain GDP and private consumption growth, they do not seem to have any predictive power for employment growth.

6. Can Belgian survey data contribute to estimating euro area GDP?

It is a widespread view that Belgian survey data, in particular the global business confidence indicator, can provide advance information on business cycle developments in the euro area as a whole. Intuitively, its strong trade connections with three of the euro area's largest economies (Germany, France and the Netherlands) and its industrial specialisation in intermediate goods may account for a leading character of the Belgian business cycle with respect to those of its main neighbours and, by extension, other European countries. This intuition was confirmed by Vanhaelen *et al.* (2000) who, using formal statistical methods, showed that turning points in the Belgian business confidence indicator lead those for the euro area.

Furthermore, compared to other business surveys carried out elsewhere in the euro area, the Belgian survey indicators have the additional advantage of being released relatively early, like the German IFO or the PMI indicators compiled by Markit Economics, which make them even more useful for real-time forecasting. For this reason, Camacho

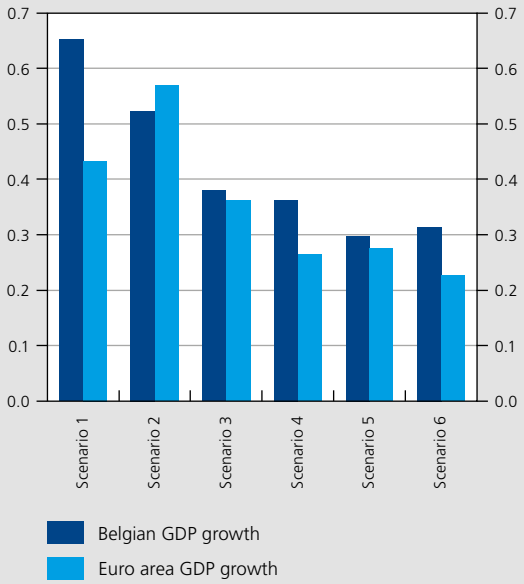
and Perez-Quiros (2010) incorporate the National Bank of Belgium's overall business confidence indicator in their short-term forecasting model for euro area GDP growth.

In this section, we use the BREL framework to investigate whether the Belgian survey data are useful for predicting euro area GDP, opting for the same approach as the one we followed for Belgian GDP. We start from a similar set of pre-selected potential indicators that includes the same variables from the various NBB surveys, along with their counterparts from the surveys in the other 17 euro area countries. In addition, the dataset also comprises some hard data, i.e. industrial production indices and unemployment rates for the euro area and the other individual euro area countries, as well as the CPB trade and production series for the main economic areas. We have also taken certain financial series into account[1]. All in all, after removal of those series with insufficient time coverage[2], the dataset we use in this exercise consists of 316 potential predictors. As for Belgian GDP, we limit the selection up to the seventh rank. Remarkably, the bridge models selected for the euro area GDP produce on average more accurate forecasts than those used for the Belgian GDP, in particular when hard data can be used, that is, starting from the fourth data scenario.

The selection results reported in table 6 suggest that, at least in the early data scenarios, Belgian survey indicators do indeed provide some information on the business cycle in the euro area. The indicator regarding demand expectations in the Belgian manufacturing sector is again selected as having some predictive power, for euro area GDP growth too. It is picked up in two data scenarios, i.e. when the prediction is made one month before the end and at the end of the target quarter. The indicator on employment expectations from the Belgian manufacturing survey is also selected in one data scenario, i.e. when the forecast is made at the end of the first month of the target quarter.

CHART 5 ACCURACY OF GDP FORECASTS PRODUCED BY BREL FOR BELGIAN AND EURO AREA GDP

(RMSFEs in percentage points; based on bridge models with the 7 top-ranked predictors; simulations performed over the period 2004Q1-2012Q4)



It should be stressed, however, that, according to the results we obtained, survey data from various other countries also help to explain euro area GDP growth in the early data scenarios. In addition, Belgian or other survey data do not provide the 'best' advance information: the industrial production index and, to a lesser extent, the unemployment rate in Spain seem to be the most consistent early indicators. Finally, when hard data become available, the best predictor for euro area GDP growth appears to be industrial production in the euro area as a whole. This result is obviously in line with prior expectations.

(1) Namely the same financial indicators as those listed in Annex table 1, with the exclusion of the Belgian-specific series (i.e. the ten-year government bond yield, and the Brussels All Shares Index)

(2) We used only series with monthly observations available from January 1996 to December 2012.

TABLE 6 BEST PREDICTORS FOR EURO AREA GDP GROWTH, ACCORDING TO THE DATA AVAILABILITY SCENARIO

(rankings under the seventh position are not reported; selection performed over the entire sample period)

Rank	Variable	Category	Rank	Variable	Category
	Scenario 1: 3 months before the end of the target quarter				
1	French construction survey: employment expectations	Survey	6	Spanish trade survey: employment expectations	Survey
2	Spanish manufacturing survey: assessment of total order book	Survey	7	Finnish consumer survey: unemployment expectations	Survey
3	Euro Stoxx Broad Index	Financial	7	French construction survey: assessment of order book	Survey
3	Harmonised unemployment rate in Spain	Survey	7	French construction survey: assessment of order book (with 1 lag)	Survey
3	Portuguese manufacturing survey: assessment of total order book	Hard	7	Spanish construction survey: trend in activity (with 1 lag)	Survey
	Scenario 2: 2 months before the end of the target quarter				
1	Industrial production in Spain (with 1 lag)	Hard	4	Dutch construction survey: price expectations	Survey
2	French construction survey: employment expectations (with 1 lag)	Survey	4	Euro Stoxx Broad Index (with 1 lag)	Financial
2	Slovenian manufacturing survey: price expectations	Survey	4	Latvian manufacturing survey: employment expectations	Survey
4	Belgian manufacturing survey: employment expectations	Financial			
	Scenario 3: 1 month before the end of the target quarter				
1	Industrial production in Spain	Hard	6	Dutch manufacturing survey: employment expectations	Survey
2	Harmonised unemployment rate in Spain	Survey	6	French construction survey: employment expectations (with 1 lag)	Survey
2	Industrial production in Spain (with 1 lag)	Hard	6	Greek manufacturing survey: assessment of total order book	Survey
2	Slovenian manufacturing survey: price expectations	Hard	6	Harmonised unemployment rate in the euro area	Survey
5	Belgian manufacturing survey: demand expectations	Survey	6	Portuguese manufacturing survey: demand expectations	Survey
6	Austrian trade survey: demand expectations	Survey	6	Spanish manufacturing survey: assessment of total order book	Hard
6	Dutch construction survey: price expectations	Survey			
	Scenario 4: end of the target quarter				
1	Industrial production in Spain (with 1 lag)	Hard	6	Harmonised unemployment rate in Spain	Hard
2	Belgian manufacturing survey: demand expectations	Survey	7	French construction survey: employment expectations (with 1 lag)	Survey
2	Harmonised unemployment rate in the euro area	Hard	7	Greek manufacturing survey: assessment of total order book	Survey
2	Industrial production in Spain	Hard	7	Industrial production in the euro area	Survey
2	Trade in goods in the euro area	Hard	7	Slovenian manufacturing survey: price expectations	Hard

TABLE 6 BEST PREDICTORS FOR EURO AREA GDP GROWTH, ACCORDING TO THE DATA AVAILABILITY SCENARIO (continued)
(rankings under the seventh position are not reported; selection performed over the entire sample period)

Rank	Variable	Category	Rank	Variable	Category
	Scenario 5: 1 month after the end of the target quarter				
1	Industrial production in the euro area	Hard	4	Industrial production in Spain (with 1 lag)	Hard
2	Harmonised unemployment rate in Spain	Hard	4	Trade in goods in the emerging economies	Hard
2	Harmonised unemployment rate in the euro area	Hard	4	Trade in goods in the euro area	International
4	Industrial production in Spain	Hard			
	Scenario 6: 2 months after the end of the target quarter				
1	Industrial production in the euro area	Hard	5	Industrial production in Spain (with 1 lag)	Hard
2	Harmonised unemployment rate in the euro area	Hard	5	Trade in goods in the euro area	Hard
3	Harmonised unemployment rate in Spain	Hard	7	Greek manufacturing survey: assessment of total order book	Survey
3	Industrial production in Spain	Hard			

Conclusion

National accounts data are not available in real time. Even the earliest vintages of quarterly data are only released one month or more after the end of the quarter considered. In addition, they are often revised in subsequent vintages. Hence, policy institutions that monitor the cyclical situation of the economy need to turn to higher-frequency data. Of those, the so-called hard data pertain to actual observations that are related to parts of the production process (industrial production, turnover or value added statistics, etc.) or certain demand components (car sales, new building starts, etc.). While such monthly data are published earlier than the national accounts, they also come with significant delays and are sometimes revised. Data from specific monthly business cycle surveys are typically available at an earlier stage but may obviously be affected by the respondents' subjective assessments.

Policy institutions now routinely use tools that can extract information from these hard and survey data in order to have a timely and accurate understanding of the cyclical conditions in the economy. Different models are used with dynamic factor models and bridge models among the most popular. In this paper, we use BREL, a new nowcasting platform that is one of the National Bank of Belgium's tools for short-term projections of GDP and other macroeconomic aggregates. BREL uses an indicator selection algorithm that can take into account different scenarios of data availability. We consider, in particular, different specifications for six data scenarios for the estimates of a quarterly aggregate, ranging from the day just before the start of the quarter to two months after the end of the quarter. We consider a very broad dataset and specifically look into the importance of survey data for the projections in each of these six data scenarios.

Different conclusions can be drawn from our empirical results. First, BREL provides reasonably accurate estimates of Belgian quarterly GDP: the average error obviously declines when more information becomes available and is, already towards the end of the quarter, not very different from that of the first flash estimate by the National Accounts Institute. Second, survey data clearly help to predict Belgian GDP developments. In line with the intuition, their importance is greater in the course of the quarter that has to be estimated, i.e. when no or very few actual hard data are already available. However, even after the quarter has ended and hard data are out for most or all months in the quarter, certain survey data continue to be selected by the model as relevant predictors of GDP. This latter result suggests that they capture some of the relevant information that is not covered by the range of intra-quarter hard data, because of problems related to either their statistical quality or their exhaustiveness. Third, forecasters should go beyond the synthetic survey indicators: results for individual survey questions are shown to contribute to the GDP estimate. While the exact selection differs according to the data scenario considered, a limited number of specific survey indicators, including, in particular, indicators of demand in the manufacturing industry, as well as unemployment expectations in the

consumer survey appear to have a greater predictive power for GDP. Moreover, we also present some preliminary evidence that our results on the role of survey data for short-term projections, do not only hold for GDP but also for supply-side aggregates, private consumption and employment. Finally, we also find indications that Belgian survey data can provide some advanced information on GDP developments in the euro area, but this property is not specific to the Belgian indicators.

Our results illustrate specifically that two of the drawbacks of intra-quarter hard data, a lack of timeliness and, to a lesser extent, quality and exhaustiveness, can be addressed by making appropriate use of survey data. We show, in particular, that at the time when the first estimate of GDP is made by the National Accounts Institute, two individual survey indicators still contain relevant information in addition to that included in the then available hard data. One dimension that is not explicitly covered in this article is the importance of revisions in the hard data. While we have excluded Belgian trade figures from our dataset, as they are subject to the largest revisions, our empirical results are based upon the current and not the initial vintage of other hard data. Our initial observations suggest that, in the particular case of Belgium, these revisions tend to be rather small.

Annex

PREDICTORS TAKEN INTO ACCOUNT IN THE SELECTION PROCEDURE

Variable	Source	Data category	Used as a potential predictor for					
			GDP	V.A. in manufacturing	V.A. in construction	V.A. in market services	private consumption	private-sector salaried employment
A. NBB's producer sentiment survey								
Manufacturing industry								
Trend in the production rate	NBB	Soft	X	X				X
Trend in orders from the domestic market	NBB	Soft	X	X				X
Trend in export orders	NBB	Soft	X	X				X
Trend in prices	NBB	Soft	X	X				X
Assessment of total order book	NBB	Soft	X	X				X
Assessment of export order book	NBB	Soft	X	X				X
Assessment of the level of stocks of finished products	NBB	Soft	X	X				X
Employment expectations	NBB	Soft	X	X				X
Demand expectations	NBB	Soft	X	X				X
Price expectations	NBB	Soft	X	X				X
Construction								
Trend in activity	NBB	Soft	X		X			X
Trend in orders	NBB	Soft	X		X			X
Trend in equipment	NBB	Soft	X		X			X
Trend in employment	NBB	Soft	X		X			X
Trend in prices	NBB	Soft	X		X			X
Demand expectations	NBB	Soft	X		X			X
Assessment of order book	NBB	Soft	X		X			X
Employment expectations	NBB	Soft	X		X			X
Price expectations	NBB	Soft	X		X			X
Trade								
Trend in sales	NBB	Soft	X			X	X	X
Trend in prices	NBB	Soft	X			X	X	X
Assessment of sales	NBB	Soft	X			X	X	X
Assessment of the level of stocks	NBB	Soft	X			X	X	X
Demand expectations	NBB	Soft	X			X	X	X
Intentions of placing orders	NBB	Soft	X			X	X	X
Employment expectations	NBB	Soft	X			X	X	X
Price expectations	NBB	Soft	X			X	X	X
Business-related services								
Trend in activity	NBB	Soft	X			X		X
Trend in employment	NBB	Soft	X			X		X
Trend in prices	NBB	Soft	X			X		X
Assessment of activity	NBB	Soft	X			X		X
Activity expectations	NBB	Soft	X			X		X
General demand expectations	NBB	Soft	X			X		X
Employment expectations	NBB	Soft	X			X		X
Price expectations	NBB	Soft	X			X		X

PREDICTORS TAKEN INTO ACCOUNT IN THE SELECTION PROCEDURE (continued 1)

Variable	Source	Data category	Used as a potential predictor for					
			GDP	V.A. in manufacturing	V.A. in construction	V.A. in market services	private consumption	private-sector salaried employment
Civil engineering and roadworks								
Trend in activity	NBB	Soft	X		X			X
Trend in number of tenders	NBB	Soft	X		X			X
Trend in number of contracts concluded	NBB	Soft	X		X			X
Trend in amount of work to be done	NBB	Soft	X		X			X
Trend in prices	NBB	Soft	X		X			X
Assessment of order book	NBB	Soft	X		X			X
Demand expectations	NBB	Soft	X		X			X
Employment expectations	NBB	Soft	X		X			X
Price expectations	NBB	Soft	X		X			X
B. NBB's consumer survey								
Economic situation in Belgium (forecasts for the next twelve months)	NBB	Soft	X		X	X	X	
Unemployment in Belgium (forecasts for the next twelve months)	NBB	Soft	X		X	X	X	X
Financial situation of households (forecasts for the next twelve months)	NBB	Soft	X		X	X	X	
Saving of households (forecasts of saving for next twelve months)	NBB	Soft	X		X	X	X	
C. Hard data								
Turnover at constant prices (based on VAT returns)								
Manufacturing	NAI (1)	Hard	X	X				X
Construction	NAI (1)	Hard	X		X			X
Retail trade	NAI (1)	Hard	X			X	X	X
Hotels and restaurants	NAI (1)	Hard	X			X	X	X
Business services	NAI (1)	Hard	X			X		X
Total services	NAI (1)	Hard	X			X		X
Total turnover	NAI (1)	Hard	X					X
Industrial production index								
Manufacturing	SB	Hard	X	X				X
Construction	SB	Hard	X		X			X
Energy	SB	Hard	X	X				X
Capital goods	SB	Hard	X	X				X
Intermediate goods	SB	Hard	X	X				X
Durable consumer goods	SB	Hard	X	X				X
Non-durable consumer goods	SB	Hard	X	X				X
Total industrial production, excluding construction	SB	Hard	X	X				X

Note: SB = Statistics Belgium.
(1) Using data from the FPS Finance, Statistics Belgium and the NBB.

PREDICTORS TAKEN INTO ACCOUNT IN THE SELECTION PROCEDURE (continued 2)

Variable	Source	Data category	Used as a potential predictor for					
			GDP	V.A. in manufacturing	V.A. in construction	V.A. in market services	private consumption	private-sector salaried employment
Registration of new private cars	SB	Early hard	X			X	X	
Work volume of temporary workers	Federgon	Early hard	X	X	X	X	X	X
Unemployed job-seekers	NEO	Early hard	X	X	X	X	X	X
Harmonised unemployment rate	EC	Early hard	X	X	X	X	X	X
Permits for new residential buildings (in m^2)	SB	Hard	X		X			
Permits for new non-residential buildings (in m^2)	SB	Hard	X		X			
D. Financial data								
Ten-year government bond yield; Belgium	Th. R.	Financial	X					
3-month Euribor	Th. R.	Financial	X					
Brussels All Shares Index	Th. R.	Financial	X					
Euro Stoxx Broad Index	Th. R.	Financial	X					
Crude Oil-Brent Dated Free on Board	Th. R.	Financial	X	X				
Import prices of energy raw materials in international market	HWWI	Financial	X	X				
Commodity import prices in international market, excluding energy	HWWI	Financial	X	X				
Exchange rate or the euro against the U.S. Dollar	Th. R.	Financial	X	X				
Spot price of gold (Standard & Poor's GSCI)	Th. R.	Financial	X					
E. International indicators								
Trade in goods (average of exports and imports of goods)								
Euro area	CPB	Hard	X	X				
Advanced economies	CPB	Hard	X	X				
Emerging economies	CPB	Hard	X	X				
Industrial production index								
Euro area	EC	Hard	X	X				
Advanced economies	CPB	Hard	X	X				
Emerging economies	CPB	Hard	X	X				
Germany	EC	Hard	X	X				
France	EC	Hard	X	X				
Industrial confidence indicator								
Euro area	EC	Soft	X	X				
Germany	EC	Soft	X	X				
France	EC	Soft	X	X				
Netherlands	EC	Soft	X	X				
Consumer confidence indicator								
Euro area	EC	Soft	X	X				
Germany	EC	Soft	X	X				
France	EC	Soft	X	X				
Netherlands	EC	Soft	X	X				

Note: SB = Statistics Belgium; Th. R. = Thomson Reuters.

Bibliography

Angelini E., G. Camba-Mendez, D. Giannone, L. Reichlin and G. Rünstler (2011), "Short-term forecasts of euro area GDP growth", *Econometrics Journal*, 14, C25–C44.

Bai J. and S. Ng (2008), "Forecasting economic time series using targeted predictors", *Journal of Econometrics*, 146, 304-317.

Bańbura M., D. Giannone, M. Modugno and L. Reichlin (2013), *Now-casting and the real-time data flow*, ECB Working Paper Series 1564.

Bańbura M. and G. Rünstler (2011), "A look into the factor model box: Publication lags and the role of hard and soft data in forecasting GDP", *International Journal of Forecasting*, 27 (2), 333–346.

Barhoumi K., S. Benk, R. Cristadoro, A. Den Reijer, A. Jakaitiene, P. Jelonek, A. Rua, G. Rünstler, K. Ruth and Ch. Van Nieuwenhuyze (2008), *Short-term forecasting of GDP using large monthly datasets – A pseudo real-time forecast evaluation exercise*, NBB Working Paper 133.

Bec F. and M. Mogliani (2013), *Nowcasting French GDP in real-time from survey opinions: information or forecast combinations?*, Banque de France, Document de travail 436.

Bessec M. (2013), "Short-term forecasts of French GDP: a dynamic factor model with targeted predictors", *Journal of Forecasting*, 32, 500–511.

Bulligan G., M. Marcellino and F. Venditti (2012), *Forecasting economic activity with higher frequency targeted predictors*, Banca d'Italia, Temi di Discussioni 847.

Camacho M. and G. Perez-Quiros (2010), "Introducing the Euro-Sting: Short-Term Indicator of Euro Area Growth", *Journal of Applied Econometrics*, 25, 663–694.

De Antonio Liedo D. (2014), *Nowcasting Belgium*, NBB Working Paper 256.

De Greef I. and Ch. Van Nieuwenhuyze (2009), "The National Bank of Belgium's new business survey indicator", *Economic Review*, NBB, 31–51, June.

Diebold, F. X. and R. S. Mariano (1995), "Comparing Predictive Accuracy", *Journal of Business & Economic Statistics*, 13 (3), 253–263.

Giannone D., L. Reichlin and D. Small (2008), "Nowcasting: the real-time informational content of macroeconomic data releases", *Journal of Monetary Economics* 55, 665–676.

Golinelli R. and G. Parigi (2007), "The use of monthly indicators to forecast quarterly GDP in the short run: an application to the G7 countries", *Journal of Forecasting*, 26 (2), 77–94.

Piette Ch. (2014), *Forecasting Belgium's GDP using Targeted Bridge Models*, mimeo.

Stock J.H. and M.W. Watson (2002), "Macroeconomic Forecasting Using Diffusion Indexes", *Journal of Business & Economic Statistics*, 20 (2), 147–162.

Vanhaelen J.-J., L. Dresse and J. De Mulder (2000), *The Belgian industrial confidence indicator: Leading indicator of economic activity in the euro area?*, NBB Working Paper 12.

Van Nieuwenhuyze Ch. (2006), *A generalised dynamic factor model for the Belgian economy – Useful business cycle indicators and GDP growth forecasts*, NBB Working Paper 80.

Zou H. and T. Hastie (2005), "Regularization and Variable Selection via the Elastic Net", *Journal of the Royal Statistical Society*, Series B, 67 (2), 301–320.