PRESENTATION OF THE NATIONAL BANK OF BELGIUM'S BUSINESS CYCLE MONITOR

As from September 2019, the National Bank of Belgium (NBB) will be publishing a quarterly analysis of the economic situation in Belgium in the current quarter: the **Business Cycle Monitor (BCM)**.

The BCM includes an estimate of economic growth in the current quarter (also referred to as a nowcast), about seven to eight weeks before the first official NAI quarterly statistics are available. This cyclical analysis will be published as early as the beginning of the last month of the quarter in question (i.e. beginning of March, June, September and December) based on the latest statistical information and the indicators available up until that time. Two nowcasting models are currently being used to interpret and analyse the available information, supplemented by expert judgement on the basis of the expected changes in the expenditure components of GDP. It must be emphasised that this is an estimate by the NBB separate from, and compiled in a different manner from, the official quarterly statistics from the NAI.

An analysis of the results from past editions of the BCM, which has in fact existed as an internal production since 2015, reveals that the estimate of GDP growth can be considered as fairly accurate.

Introduction

Collecting, analysing and disseminating economic and financial data is one of the key tasks of the NBB, not least because our central bank, being a member of the Eurosystem, contributes to the formulating and implementing of monetary policy in the euro area. Preparing such policy decisions requires timely and accurate insight into economic developments. The official statistics regarding economic activity, which in Belgium are compiled by the National Accounts Institute (NAI), are nevertheless only released with a certain time lag, just as in other countries. The first NAI publication, with the so-called flash estimate for real GDP growth, is released almost thirty days after the end of the reference quarter. Moreover, these official statistics are still subject to revision, as additional information is processed.

The conflict between, on the one hand, the importance of a timely insight into the economic situation and, on the other hand, the inherent timelag in this process of compiling official statistics, has given rise to the development of a new field of research: nowcasting. In the course of the quarter, after all, quite a few cyclical indicators are already available, from which useful information can be derived about the economic situation at that time. Some hard indicators as well as survey data are published more rapidly and at a higher frequency than GDP, often on a monthly basis. More specifically, when the BCM is compiled at the beginning of the third month of the reference quarter, survey data relating to the first two months of the quarter concerned are available, in addition to specific hard indicators for the labour market, the financial markets and new motor vehicle registrations.

The Bank has two specific nowcasting models that are used to break down the information flow into a quantitative growth estimate. However, in the BCM, these nowcasts are supplemented with an in-depth analysis of the indicators and an interpretation of their impact on changes in the various expenditure components of GDP. Thanks to that process, the model-based interpretation of specific information can be adjusted or can take into account particular elements which, at the time, perhaps were not captured through the models. All in all, the BCM puts forward a prediction of GDP growth for the current quarter, rounded off to the nearest decimal, about two months before the first official NAI quarterly statistics are released.

Figure 1: The process behind the Business Cycle Monitor
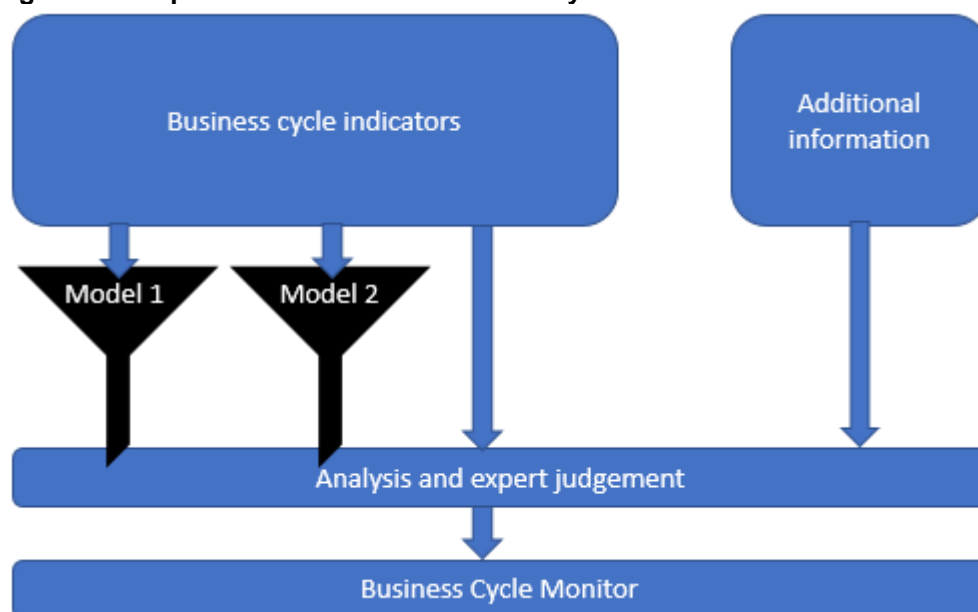
An analysis of the results of the last BCMs, that were only disseminated internally before September 2019, shows that, based on the relatively short evaluation sample of four years, the BCM estimate constitutes a useful instrument for business cycle analysis and provides a fairly good forecast of real GDP growth, as it is later revealed in the official statistics compiled by the NAI. Nevertheless, the BCM publication reader needs to keep in mind the clear distinction between the forecasts and the official statistics. The NAI statistics are in fact based on specific accounting identities and their compilation must take account of the European directives as laid down by Eurostat, which is not the case for the BCM nowcast. The latter serves only as a short- term forecast and, as is quite usual for projections, also carries a degree of uncertainty.

This article presents the NBB's nowcasting procedure. It then focuses on the details of the models used and the role of the experts' interpretation. Lastly, this article provides an oversight of the accuracy of the BCM estimate.

1. Oversight of the NBB's nowcasting procedure

1.1 Available cyclical indicators

The NBB currently uses two different nowcasting models to track the actual economic situation on a regular basis. In the first instance, various business cycle indicators are collected, hard data, financial data as well as survey data, that are published promptly and released on a frequent basis, usually monthly.

The survey data offer as an advantage that, in principle, they will not be revised and, above all, will be released very quickly. One example is the opinion surveys among business leaders and consumers that the NBB conducts each month and the results of which are published before the end of the month in question. So, survey data of this kind are also often the first indicator of macroeconomic developments.

The survey data reflect above all the sentiment among stakeholders in the economy, but only the so-called hard data provide a genuine overview, for example, of the number of unemployed job-seekers, turnover according to VAT statistics or retail sales. Although these hard data are therefore generally more closely aligned with GDP, they have the disadvantage of only being released at a later point in time. Another disadvantage is that certain hard data can still be revised in subsequent data publications.

Also, daily financial data can be used as input, like stock market indices and exchange rates, interest rates and oil prices and other commodity prices.

Finally, certain cyclical indicators from the main neighboring countries and from the euro area can also have predictive power for Belgian economic growth. For example, surveys conducted among purchasing managers in the manufacturing industry in several key partner countries for Belgium can be indicative for foreign demand for Belgian goods.

Due to the different publication dates of indicators, the dataset will change constantly in the course of a quarter: it will in fact get increasingly bigger as more information is being released.[1] In each quarter, the BCM will be compiled at a fixed time, namely at the beginning of the last month of the quarter concerned. It thus (only) takes account of indicators that are already available at that moment in time.

1.2 A brief introduction to the two nowcasting models

So, on balance, there are a lot of data available before the first official GDP release, which in Belgium is scheduled around one month after the end of the reference quarter. The nowcasting models are designed to interpret the constant flow of data in a structured manner and then infer from the data the relevant signal for the business cycle.

At the moment[2], for compiling nowcasts, the NBB uses two different models, each of which represents another model type, with its own methodology and dataset. The first one is the BREL model, that is based on **BR**idge equations in which the predictive variables are selected on the basis of an **EL**astic net procedure.[3] These *bridge* equations relate GDP growth on a quarterly basis to a series of predictive variables which have been converted into a quarterly frequency. When, as is usually the case in the nowcasting procedure, the predictive variables are not yet available for the full quarter, the missing observations must first be supplemented by means of a simple satellite model that takes the form of a univariate autoregressive process. The predictive variables are selected on the basis of the *elastic net* selection procedure from the above-mentioned dataset, containing a large number of cyclical indicators. Thanks to this statistical technique, the most relevant explanatory variables can be identified and ranked according to their predictive capacity at that specific moment in the data calendar. Finally, the number of indicators that will be used for the nowcast is determined using the regular set of statistical criteria. Besides the results of the BREL model, that is based on different variables, the BCM also contains a histogram that reflects the forecasts of multiple one-indicator bridge equations, where GDP growth is consistently related to just one single indicator. The forecasts of these one-indicator models tend to be less accurate than those of the BREL model and should therefore be interpreted with caution. Nonetheless, the histogram provides some useful insights into the distribution and skewness of the individual forecasts.

The National Bank of Belgium's second *nowcasting* model goes by the name of R2D2 and is a so-called *Dynamic Factor Model*.[4] In models of this kind, no selection procedure should be applied to limit the number of explanatory variables since they endeavor to make full use of the joint dynamics of all variables to ensure that the common signals, or factors, can be derived. Such a model not only delivers a forecast for GDP, but for all variables included. This approach makes it possible to

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[1] For a more detailed oversight of the data calendar, see Table 1 in Piette, C. and G. Langenus (2014), "Using BREL to nowcast the Belgian business cycle: the role of survey data" , NBB, *Economic Review,* June, 75-98.

[2] This is a snapshot of the models used, which may be modified, added to or even replaced in future, also because the accuracy of the BCM and the underlying mechanical nowcasts will be followed up on a regular basis.

[3] For more technical information, see Piette, C. (2016) '*Predicting Belgium's GDP using targeted bridge models*', NBB Working Paper No. 290.

[4] For more technical information, see Basselier, R., D. de Antonio Liedo and G. Langenus (2017), '*Nowcasting real economic activity in the euro area: assessing the impact of qualitative surveys',* NBB Working Paper No. 331*.*

compare additional information that becomes available for one of the explanatory variables with the figure predicted by the model. The impact of this kind of news component on the nowcast for GDP depends both on the quality of the indicator concerned (i.e. the correlation with GDP) and on the timeliness of the publication. By means of the JDemetra+ software, the model manager can track subsequent nowcasts and news components in a relatively simple and visual way, which is useful for interpretation of the results.[5]

When compiling forecasts, it is always interesting to use more than one model, since the actual model specification is unknown. In that respect, combining the two nowcasting models also offers a kind of guarantee against a big forecast error from one of the models.

1.3 The importance of expert judgement

Despite the progress made in the field of nowcasting, making model-based forecasts is still associated with some uncertainty. It is, for example, quite rare for both models to put forward exactly the same growth figure. Therefore, it often has to be decided on the basis of an experts' interpretation whether to give more weight to the result from one of the models or, in exceptional circumstances, to deviate from both of the models. In doing so, the expert takes account of the relative accuracy of both models in the past, as well as specific information that can make a model temporarily perform differently.

On the one hand, this information may concern one of the available indicators where the expert assumes that this is being wrongly interpreted by one (or both) of the models. In order to illustrate that, we refer to an example that dates back to September and October 2016. As a result of the (then) wide press coverage of announced job losses following corporate restructuring (or closure) plans, consumers' employment expectations suddenly turned a lot more pessimistic. One of the models interpreted this as an important signal and the nowcast was highly unfavourable. The underlying determinants of the labour market and the economy nevertheless remained good, which made it unlikely that growth would suddenly drop back. The model-based nowcast was therefore adjusted by temporarily ignoring that particular indicator, which in retrospect seemed to be a legitimate decision.

On the other hand, the expert may also base his/her judgment on secondary – i.e. not included in the models' dataset – information sources. It is for example well-known that changes in regulation, benefits and taxation can generate anticipation-effects and volatility in economic agents' behavior. When, for example, it is announced that cars will be more heavily taxed from a certain date in the future, many consumers that intend to purchase a car in the near future will advance their decision to be able to enjoy the current fiscal regime. As a result, cars sales will temporarily peak and then fall again once the new fiscal rules apply. Econometric models cannot easily account for these kinds of anticipation effects or volatility as a result of changing factors and therefore tend to make forecast errors.

The interpretation by experts is based on an analysis of the effect of the cyclical indicators and possible additional information on the expected evolution of the expenditure components of GDP, such as private consumption, investment or exports. In the BCM, no attempt is made to set any exact forecasts of growth of these components, as the goal is to simply give the reader an idea of the expected direction.

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[5] The software is available on the website of the Bank and needs to be installed for that purpose together with the nowcasting plugin.

2. Assessment of the BCM

2.1 Accuracy

The BCM is only being published on the Bank's website from September 2019, while the business cycle analysis has already been released internally within the Bank for some years now. So, for a period of 18 quarters, from the first quarter of 2015 up to and including the second quarter of 2019, the extent to which the BCM provides an accurate forecast of real GDP growth on a quarterly basis can already be considered. Although that is still a relatively short assessment period, the results are currently quite good.

The accuracy of the BCM estimate is assessed by using two different benchmarks. A comparison is made with the first NAI publication, the so-called flash estimate, which is released seven to eight weeks after the BCM. As a result of various revisions, whether or not from methodological sources, the current growth figure in the national accounts nevertheless tends to deviate from this first NAI publication, as can be seen from Figure 2. The extent to which the BCM estimate is able to forecast the current statistics (even after possibly numerous revisions) is therefore also examined.

Figure 2: Real GDP growth in Belgium according to the first NAI (flash) release and the latest NAI publication[6], compared with the BCM estimate
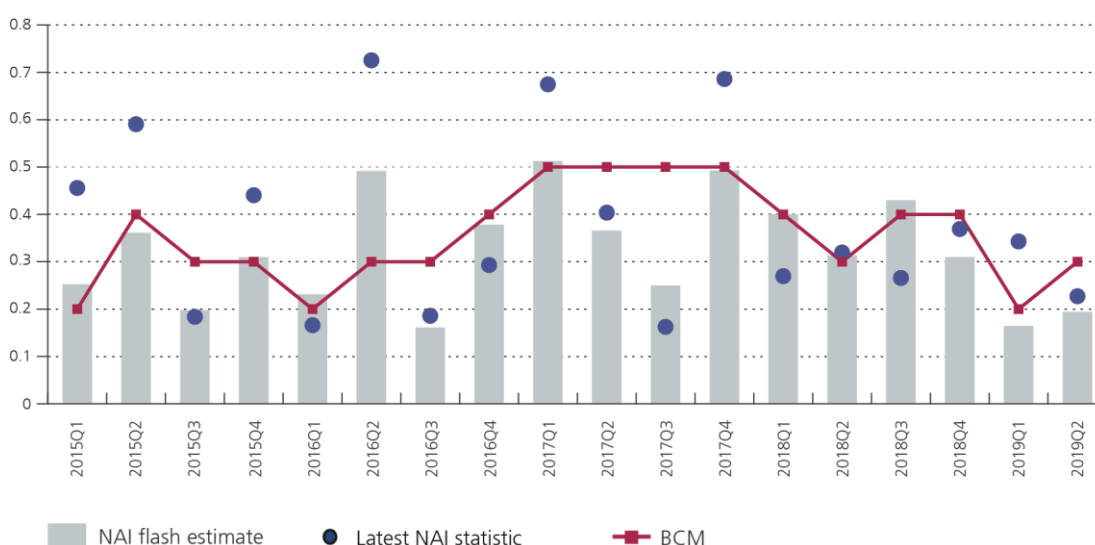
Sources: NAI, NBB.

It can be seen immediately from the chart that the BCM estimate aligns closer to the NAI flash estimate than to the latest version of the national accounts. That is logical because this latest version is often revised several times, either for methodological reasons or in response to new source information that is only released much later. The accuracy of the BCM estimate can also be more precisely determined by using statistical benchmarks to evaluate the forecast error. It should also be noted that, since the BCM estimates are always rounded off to the nearest decimal, deviations of up to 0.05 of a percentage point are in fact insignificant.

The most intuitive benchmark to evaluate the BCM's forecast error is the *mean absolute error* (MAE), which indicates by how many percentage points the BCM estimates, on average, deviate from the flash and the latest NAI statistics. With a mean absolute forecast error of only 0.07 of a percentage point compared with the NAI's flash estimate, it may be concluded that the BCM estimate is very accurate. The BCM's mean absolute forecast error is a little bit bigger when the forecast is compared against the latest NAI statistics, but it is still only very small.

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[6] The chart is based on the latest NAI publication dated 30 August 2019.

On the other hand, the relevant literature often uses the *root mean square error* (RMSE). Using RMSE ensures that major forecast errors will weigh relatively more heavily in the final figure. This yardstick equally confirms that the BCM provides a good forecast for the flash, but also that the accuracy declines when the latest NAI publication serves as a reference.

Finally, it can be established via the mean error whether there was a systematic upward or downward bias. Ideally, this measure is as close as possible to zero, which implies that the positive and negative forecast error on average cancel each other out and that there is no systematic deviation in one of the two directions. As the last line of Table 1 shows, the BCM in past editions does not exhibit a notable systematic deviation.

Table 1: Statistical measures of the accuracy of the BCM (2015Q1 to 2019Q2)

	BCM compared with flash	BCM compared with latest NAI publication	Average model estimate compared with flash
Accuracy			
Mean absolute error (MAE)	0.07	0.15	0.11
Root mean square error (RMSE)	0.10	0.18	0.14
Upward or downward bias			
Mean error	0.03	-0.02	0.08

2.2 The added value of an experts' interpretation

The BCM largely consists of the descriptive analysis, in which the experts' interpretation is explained in greater detail. It is a deliberate choice to not only hand the reader the model-based result of the nowcasts, but also an insight into the wider business cycle analysis surrounding it. Moreover, an assessment of the last 18 editions shows that this expert judgement also offers an added value to the forecast. The forecast error, measured using the mean absolute error and the root mean square error, does in fact seem to be clearly bigger if the average model estimate is assessed against the flash publication than was the case for the BCM estimate. Furthermore, the lower right-hand corner of Table 1 shows that the average model estimate is usually too optimistic for GDP growth, measured according to the first NAI publication. This upward bias fades out with the addition of the experts' interpretation.

3. Comparison with other central banks

A number of central banks in other countries, both within and outside the euro area, make use of nowcasting models as input for their business cycle analysis. However, they usually opt for publication of the mechanical result, without adding any expert judgement. One of the forerunners in that area is probably the Federal Reserve Bank of Atlanta, which has been publishing a weekly nowcast of GDP growth in the United States via its GDPNow platform since mid-2014. The Federal Reserve Bank of New York has also already been publishing a weekly nowcast in real time on its website for about three years now, along with a visual tool that gives users themselves some insight into the impact of the different cyclical indicators.

In the euro area, nowcasts are also mentioned in the publications issued by, for instance, the Banca d'Italia (on a quarterly basis in its Economic Bulletin), the Banco de España (idem) and the Banque de France (monthly).