Moving from GDP Flash Estimates to GDP Nowcasts

**Keywords:** Gross domestic product (GDP), economic growth, flash estimate, nowcast, monitoring economic growth and business cycle, bridge models, dynamic factor models, machine learning techniques

# Introduction

Gross domestic product (GDP) and its rate of change is considered one of the main indicators for the performance of a country’s economy. As times of crises reveal the need for policymakers to get a quick overview over the economic performance of a country – as we saw during the COVID-19 pandemic – it is important to provide them with quick and accurate GDP estimates. While Eurostat, Germany as well as many other countries publish their GDP flash estimates at t+30 days after the end of a reference quarter, Germany is also testing in a feasibility study to calculate an estimate for German GDP as early as t+10 days after the end of the reference quarter (GDP nowcast)[1]. Due to the more timely estimation this GDP nowcast is based on a less complete set of source data. It is therefore crucial to check the reliability of the GDP nowcast, as there is a trade-off between timeliness and accuracy.

# Methods

## The pillars of the German GDP nowcast at t+10 days

The official German GDP flash estimate at t+30 days is based on three pillars: an expert approach, an econometric approach and a reconciliation between experts and econometricians. While the expert approach comprises the estimates of the units within the national accounts divisions, the econometric approach are GDP estimates calculated through the implementation of purely statistical models.

In contrast, the t+10 GDP nowcast only consists of one pillar, the econometric approach. This is due to the fact, that at this early point in time less data is available and more econometric models have to be used. Therefore, the selection of the econometric model and the set of explanatory economic indicators is of great importance to outweigh the loss of data and expert knowledge.

The feasibility study on the GDP nowcast focuses on three different types of econometric modelling to deal with the lack of data that result from accelerating GDP estimation: bridge models, dynamic factor models as well as the implementation of machine learning techniques. At the time the GDP nowcast is calculated, some important official source statistics are not yet available for all relevant months of the reference quarter. Hence, this needs to be dealt with by applying appropriate econometric models and by filling the data gaps with relevant early economic indicators, from either business surveys or new digital data sources.

## Bridge Models

Bridge models are often introduced when explanatory variables (e.g. the industrial production index) have monthly frequency and are only available for one or two months of the respective quarter. As GDP is a quarterly measure, the missing values of the monthly explanatory variable need to be forecasted [2]. Commonly used methods are ARIMA-models (autoregressive integrated moving average) or ADL-models (autoregressive-distributed lag). In the case of the German GDP nowcast, in a first step, the missing monthly values of the official source statistics are forecasted using ARIMA-models that also account for the seasonality of the respective variables. In a second step, the various GDP components are estimated using the realized and forecasted values of the official source statistics and supplemented by a wide range of relevant early economic indicators. Finally, the estimates of the various GDP components are aggregated to the GDP nowcast.

## Dynamic Factor Models

Another estimation method are dynamic factor models. The premise here is that a large number of time series can be described by a relatively small number of unobserved or latent factors, which themselves evolve over time. This is especially useful for GDP estimations as economic development is reliant on many different economically relevant time series, whose co-movements can be described by some common factors [3]. Dynamic factor models can be used for news-analyses, i.e. automatic updates of the GDP estimates as soon as new data becomes available. This also allows assessing the marginal effect of new information on the GDP estimates and can be easily implemented in the time series analysis software JDemetra+.

## Machine Learning

As big data as well as artificial intelligence are slowly but surely finding their way into official statistics, the associated methods offer great potential in enhancing GDP estimates. Machine learning techniques have been explored for their use in GDP estimates by the German Council of Economic Experts as well as the Federal Ministry of Economic Affairs and Energy [4]. The Federal Statistical Office is also considering these new techniques as a third type of statistical modelling in the context of the GDP nowcast feasibility study.

# Results

The accuracy of results is probably the most important quality indicator of GDP estimates. The quality requirements for European GDP flash estimates could also serve as a suitable benchmark for the accuracy of national nowcasts [5]: First, a GDP nowcast should be an unbiased estimate of GDP growth at t+45 days, with an average revision between –0.05 and +0.05 percentage points (ppt), and no more than 66.7% of revisions in the same direction. Second, the average absolute revision of a GDP nowcast should be within 0.10 ppt compared with t+45 GDP growth estimate.

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| **Table 1: Revision Analysis** |
|   | Eurostat revision criteria | Revision to GDP estimate at t+45 |
|   |   | **GDP Nowcast (t+10)**  | **GDP flash estimate (t+30)**  |
| Mean revision | ±0,05 | 0,057 | -0,025 |
| Mean absolute revision |  0,10  | 0,153 | 0,100 |
| Share of revision | max. 66,7 % | 0,688 | 0,563 |
| Note: GDP growth rate yoy. Time horizon: 16 Quarters comprising 2016 Q1 till 2019 Q4. Econometric Modelling: Bridge Models. |

Table 1 shows the quality assessment of the German t+10 GDP nowcast using bridge models compared to the t+30 GDP flash estimate and their revisions to the GDP released at t+45 days after the end of the reference quarter. While the GDP flash estimate fulfills the three European accuracy criteria, the GDP nowcast does not. It nearly fulfills two of the three criteria. The mean revision and share of revisions in one direction are almost satisfied whereas the mean absolute revision deviates by more than 0.05 percentage points from its benchmark.

# Conclusions

The paper explains the German approach of how the t+10 GDP nowcast is produced and how this early estimate differs from the traditional t+30 GDP flash estimate. Thereby, the paper shows the performance of the three different types of statistical models (bridge models, dynamic factor models and machine learning). It gives an overview on the data availability at t+10 days after the end of the reference quarter as well as on newly available indicators (business surveys and new digital data sources such as flight transport data, electricity production, weather data or preliminary VAT returns) and their feasibility for GDP estimates. Finally, it briefly looks ahead at possible future developments regarding German national accounts estimates. For instance, the development of new early economic indicators (e.g. a new transportation index enhancing the truck toll mileage index or a project on financial transaction data) are going to play an important role in enhancing GDP estimates for Germany.

# References

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