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Nowcasting Finnish real economic activity using traffic loop data

Pontus Lindroos, Henri Luomaranta, and Paolo Fornaro[1]

Abstract

Statistics Finland started publishing nowcasts of the trend indicator of output (TIO), the monthly indicator of real economic activity, to answer users´ needs during the Covid-19 pandemic. The indicator was first published in April 2020, at the very beginning of the pandemic in Finland, and had a monthly release schedule until June 2021. The TIO nowcasts are produced using open-source data on truck traffic volumes at about 100 automatic measuring points in the Helsinki/Uusimaa -region and the Economic Sentiment Indicator for Finland. Estimation is done using a machine learning approach and the methodology is based on previous work done by Statistics Finland and ETLA Economic Research.

Key Words: nowcasting; flash estimates; machine learning; experimental statistics.

1. Introduction

The Covid-19 pandemic hit the world economy with unimaginable strength at the beginning of 2020. International trade, global value chains and investment schemes were shaking as uncertainty spread around the world. The uncertainty penetrated all levels of the economy, as governments, firms, and private consumers alike had to revaluate their options going forward.

The economic uncertainty brought on by the pandemic raised new challenges for central banks, policymakers and, quite frankly, anyone making economic decisions. The need for detailed and fast information on economic developments grew stronger than ever before. Although the wealth of economic information has increased significantly over the last decades, especially with new types of data and technologies being adopted, and we now have a much more detailed picture of our economy, this has not fully translated into a faster production of important economic statistics. Currently, the speed at which official economic indicators are produced is not sufficient to support decision making in times of uncertainty and rapid change.

To answer users' needs and support decision making during the Covid-19 pandemic, Statistics Finland, in collaboration with ETLA Economic Research, started publishing an early version of the trend indicator of output (TIO), the monthly indicator of real economic activity, for Finland in April 2020. Nowcasting the TIO removed the publication lag of t+18 days (flash estimate) and t+45 days (first official release) and provided practically real time estimates of economic developments. The nowcasts of TIO are based on open-source data on truck traffic volumes and estimated using a machine learning approach. The methodology is based on previous work done by Statistics Finland and ETLA Economic Research. (Fornaro & Luomaranta, 2020)

2. Background

Statistics Finland is responsible for the production and publication of numerous indicators describing the Finnish society and economy. Measurements of production and gross domestic product (GDP) are among the most closely followed indicators, with users in government, the private sector, and media among others.

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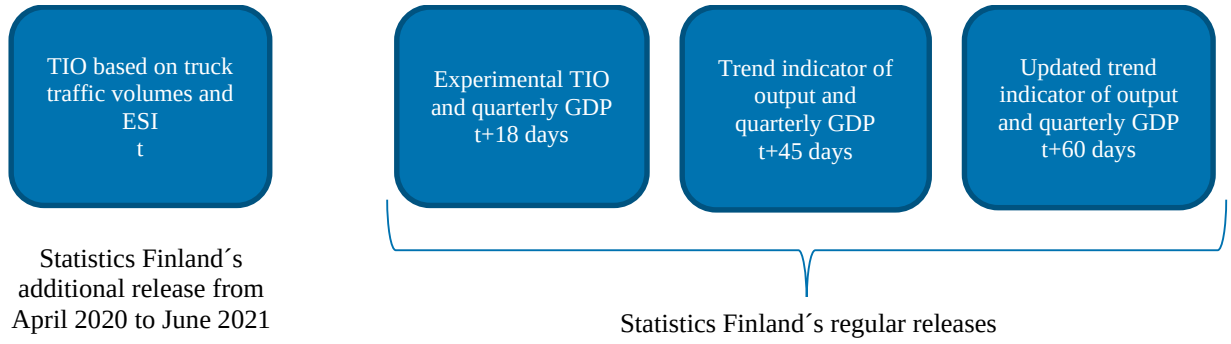
Statistics Finland´s set of economic publications includes annual, quarterly, and monthly indicators. Economic indicators are published regularly, with the first official release concerning total economy production taking place 45 days after the end of the reference period and the first update following at 60 days after the end of the reference period. The first official release at t+45 days goes under the name trend indicator of output and the indicator endeavours to measure the monthly development of the domestic economy based on preliminary data. (Statistics Finland, 2021a)

In addition to the official production indicators and GDP releases, Statistics Finland publishes an early estimate of total economy production 18 days after the end of the reference period. The early estimate endeavours to predict the upcoming TIO release, i.e., to provide an even quicker indicator of how the domestic economy is developing on a monthly basis. The early estimate is published as one of Statistics Finland´s experimental statistics, a subsection of indicators and statistics that are undergoing development and do not yet fulfil the criteria of official statistics. The t+18 days estimate is based on monthly firm-level sales data for the 2 000 largest firms in Finland and it is produced using a combination of machine learning algorithms. (Statistics Finland, 2021)[2]

The economic indicators published by Statistics Finland form an important base for policy decisions, and updates enable continuous follow-ups and policy adjustments. Several stakeholders, including ministries and other government offices, make use of Statistics Finland´s releases in their decision-making processes. There are, however, also limitations related to the current set of economic indicators, despite their extent and widespread use. As it was proven at the beginning of 2020, the current indicators are not sufficient to navigate situations of rapid economic change. The economic disruption caused by the Covid-19 pandemic highlighted the need for more timely estimates of economic developments, a need that Statistics Finland responded to by introducing a new estimate of total production based on experimental data and methodology (from here on called truck estimate).

Figure 1 *Statistics Finland regularly publishes three updates of the monthly trend indicator of output and quarterly GDP. During Covid-19, Statistics Finland added an additional release of the TIO based on experimental data.*



3. Data and methodology

The truck estimate aims to predict the year-on-year change of the working-day adjusted monthly TIO, i.e., the first official release of total economy production published by Statistics Finland. By utilising open-source data that is updated continuously[3], the truck estimate can provide a timely estimate of economic developments, reducing the publication lag by a minimum of 18 days compared to the early experimental estimate and by 45 days compared to the first official release by national accounts. In practice, the truck estimate provides a way of estimating two missing monthly TIOs compared to the t+45 days release by national accounts.

The truck estimate is produced using a machine learning approach and the methodology is based on previous work done by Statistics Finland and ETLA Economic Research (Fornaro & Luomaranta, 2020). Although based on previous work by Fornaro and Luomaranta, the estimation process was modified and made lighter by Statistics Finland, in order to better fit the office´s available resources during the Covid-19 pandemic.

[2] Website only available in Finnish
[3] Available on the Digitraffic website maintained by Fintraffic (Digitraffic, 2021)

The truck estimate uses open-source data on truck traffic volumes at about 100 automatic measuring points (Traffic Monitoring System, TMS) in the Helsinki/Uusimaa -region (Väylä, 2021) and the Economic Sentiment Indicator (ESI) for Finland, published by Eurostat (Eurostat, 2021). The truck traffic data is updated at the end of each day, enabling nowcasting the TIO almost in real-time. For the estimation, daily data on truck traffic volumes is aggregated to monthly data at each measuring point. The ESI is, on the other hand, a monthly indicator which can be used in raw format alongside the monthly data points on truck traffic volumes. Notice that the ESI is published toward the end of the reference month, making it a less timely indicator compared to the truck traffic data. For the middle of the month estimates of TIO, we compute a forecast of the current month's ESI using a simple AR model.

With data quality in mind, Statistics Finland decided to publish the truck estimate as close to the end of the reference month as possible, enabling the truck traffic data to cover a large part of the month while still reducing the publication lag significantly.

In their paper, Fornaro & Luomaranta try a variety of models and model combinations to identify the best way of estimating real economic activity based on, among other data sources, truck traffic volumes. At the beginning of the Covid-19 pandemic, resource efficiency and ease of use were high on Statistics Finland priority list when exploring new ways of answering users' needs, and therefore tests to find a single model for low latency estimation were run. For testing, Statistics Finland used the modeling syntax developed by Fornaro & Luomaranta, with the addition of the monthly ESI for Finland.

Statistics Finland evaluated the available estimation models based on their respective mean squared error (RMSE), mean error (ME), mean absolute error (MAE) and maximum absolute error (MaxE). The time period used for evaluation started in January 2006 and ended in December 2019, covering practically the whole available estimation period, and including both economically "normal" times and previous economic crises. Based on the performance tests, a single random forest model was selected for producing the truck estimate.[4]

The selected random forest model was used to estimate the whole TIO series starting in January 2006 separately for each publication. By estimating the whole series separately for each publication, changes to the official TIO, including changes to seasonal adjustment methodologies, were directly taken into account in the truck estimate.

4. Estimate performance

All in all, the truck estimate managed to capture the abrupt economic change brought on by the Covid-19 pandemic in a satisfactory way. Especially at the beginning of the pandemic, when the need for fast information was most urgent, the truck estimate managed to capture not only the direction but also the magnitude of economic developments very well. The estimate dropped of in performance when the economy started to recover, likely indicating its´ ability to depict some parts of the economy better than others, e.g., services versus manufacturing.

For all published estimates concerning 2020, the MAE between the truck estimate and the first official release of the TIO at t+45 days was 1.7 percentage points, with the truck estimate predicting the direction of economic developments correct every month. The maximum absolute error during 2020 was 3.9 percentage points and occurred in the second month of publication (April). The maximum error was partially affected by how national accounts treated the first affects of the pandemic in their t+45 TIO calculation, with the absolute error between the truck estimate and the t+60 days TIO in fact being smaller due to revisions in national accounts.

The truck estimate performed significantly worse when looking at 2021, with performance taking a significant turn for the worse when the economy started to bounce back after the pandemic. For the last three months of publication, namely March, April and May 2021, the truck estimate was unable to capture the economic recovery that took place, still predicting a year-on-year decline in the TIO. The MAE for the whole period of publication (3.1 percentage points), and especially 2021 (5.5 percentage points), was highly affected by the truck estimate predicting a small year-on-year

[4] A more detailed description of the estimation methodologies developed by Fornaro and Luomaranta is available in their 2020 publication

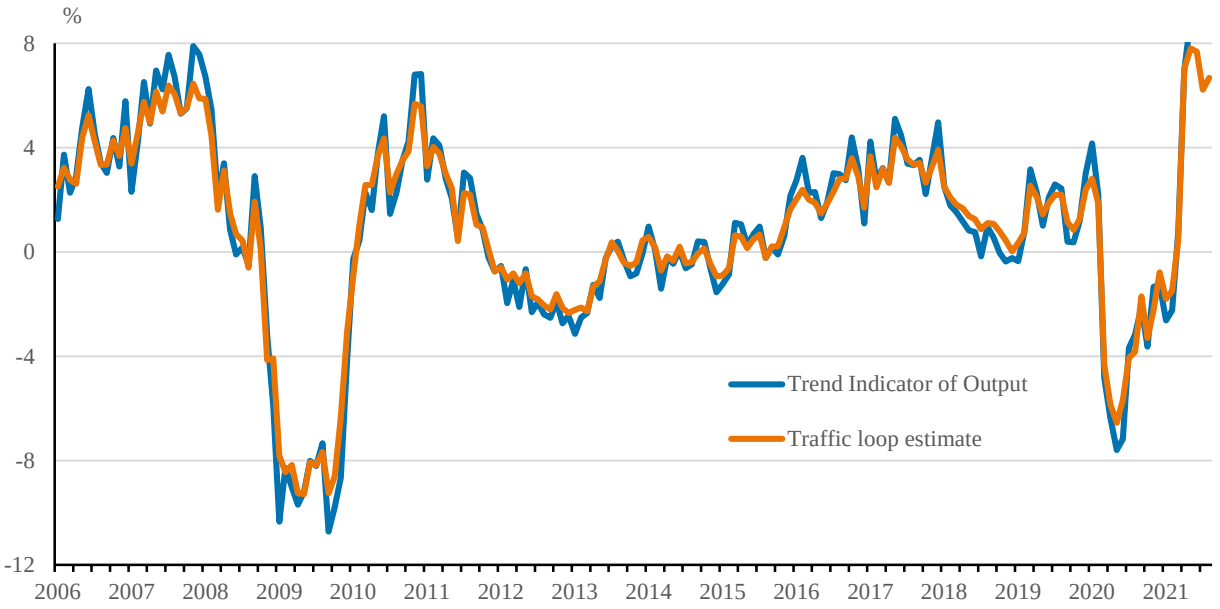
decline for April and May 2021, while the first official release of the TIO showed that production increased by 6.4 and 9.0 percentage points from 2020 to 2021, respectively.

5. Publication

Like the production process of the truck estimate, Statistics Finland strived to minimise the publication effort for the estimate, while at the same time reaching a wide as possible audience. In order to fulfill both goals, Statistics Finland published the first truck estimate as a blog, explaining how and why the estimate is produced and how it should be interpreted as a part of the statistical ecosystem. Later releases, i.e., from May 2020 to June 2021, were published as news articles on Statistics Finland´s website, along with a coordinated release on the website of ETLA Economic Research. (ETLA, 2021)

Statistics Finland´s release included the TIO estimate for the two missing months of the t+45 days release, along with a chart depicting the correlation of the truck estimate and the official TIO for the whole estimation period (Figure 2). The publication was timed close to the end of the latest reference month, primarily after the 25th day in order to secure data quality. The truck estimate was also included in Statistics Finland´s quarterly update of the Finnish economy[5], another publication that was added to better inform policymakers, researchers, and the public on economic developments during the Covid-19 pandemic. (Tilastokeskus, 2021b)

Figure 2 *Year-on-year changes in the official working-day adjusted trend indicator of output and the traffic estimate, January 2006 - August 2021*



Statistics Finland decided to discontinue publication of the truck estimate after the publication in June 2021. The decision was primarily motivated by the improving situation of the pandemic, by Statistics Finland´s need to refocus resources elsewhere and by the need to conduct further quality assessment of the truck estimate before deciding on its future. Statistics Finland will assess the overall success of the truck estimate during its publication span and explore alternative ways of utilising the data in other products or as an improved version.

[5] Publication only available in Finnish

6. Conclusion

The production of nowcasts of TIO, based on truck traffic volumes, is a practical example of how new technologies and data can help improve the production of official statistics by, for example, reducing publication lags. Experimental indicators can also help expand the coverage of economic indicators, leading to a better overall view of the economy. By adopting new technologies and methodologies, statistical offices can strengthen their role as crucial supporters of sustainable and reliable policymaking. By carrying out real exercises and releasing new (experimental) data to users, statistical offices can also gain important information about users needs and requirements – a crucial step in developing the supply of available information.

Statistics Finland is a trusted producer of official statistics, which means that new publications, methodologies, and data sources attract attention and therefore need to be properly communicated and assessed. In situations of economic uncertainty, reducing publication lags can bring significant benefits, but Statistics Finland is simultaneously determined to conduct proper quality assessment on all information it produces. By continuously assessing the quality of new products, data sources, and production methodologies, Statistics Finland can remain a trusted producer of official statistics while also answering the needs of a wider base of users. The adoption of data science in the production of official statistics is a key to future success, and it is crucial to remember that the adoption can be done is several small steps to improve quality and timeliness even in the short run.

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