Institution: LONDON BUSINESS SCHOOL

Unit of Assessment: 17 – Business and Management studies

Title of case study: Nowcasting real-time estimates of GDP

Period when the underpinning research was undertaken: 2008-2013

Details of staff conducting the underpinning research from the submitting unit:

Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Lucrezia Reichlin	Professor of Economics	From 01/09/2008

Period when the claimed impact occurred: Since 2014

Is this case study continued from a case study submitted in 2014? Y

1. Summary of the impact

Officials and policy makers around the world have used the research described in this case study to derive more accurate **real-time estimates of national GDP**, often months before official figures are available. These help firms and consumers make decisions about spending and investment.

"**I cannot value enough** how useful the London Business School model has been for us," says Dr Till Strohsal, an economist with the German government's Federal Ministry for Economic Affairs and Energy.

Called Nowcasting, the technique has also been used at the Federal Reserve Bank of New York since 2016.

2. Underpinning research

Quarterly GDP figures – critical to track economic activity and to plan investment decisions – usually come with a significant time lag, which means they are out-of-date by the time they are published. Reichlin and her co-authors have developed and applied a formal statistical framework that **produces reliable 'real-time' projections** of GDP.

The process is called nowcasting and is based on a model that reads data as it is produced, on everything from unemployment statistics to consumer surveys.

The nowcast model - described in [3.1] [3.2] [3.6] - uses all of these data, plus any other potentially relevant information, to extract a signal about the state of the economy.

The estimation procedure exploits the strong co-movement of these data series, which means their behaviour **can be captured by few factors**.

In this way, the model copes with the 'curse of dimensionality' (large numbers of correlated series) because it depends on a more limited number of representative parameters. The model assigns weights to the various data sources and optimally exploits the dynamic relationships among them. The nowcast can be interpreted as that component of GDP growth which is **highly correlated** with all of the input data series. It disregards idiosyncratic information such as the weather, but it captures common signals given by all macroeconomic data releases including surveys.

More specifically, nowcasting uses a factor model written in the state form, with a Kalman filter used to **solve problems** of missing data due to the non-synchronicity of data release and other

problems. The research shows convergence properties of the maximum likelihood estimator for the factors and the Kalman filter; it also demonstrates robustness to model misspecification. It explains why the techniques work for the "big data" empirical situation faced by the nowcaster.

This research is a development of ideas in [3.3], as well as other work by Reichlin's team.

The nowcasting method **applies comprehensive technical solutions** to address issues that plague other models of GDP, including varying publication lags ("jagged edged" data), mixed-frequency data, and missing input data. As a result, the model computes a joint forecast of predictors and the target series and, at each release, the calculation of the surprise component of the published data release (this is the "news"). The revision of the now-cast of quarterly GDP growth can then be described as the product of the weight of each series (estimated using historical data) and the news for each release. This gives a **transparent means to read and exploit** the flow of data releases.

The research described here and Reichlin's contributions are summarised in two survey papers [3.4] [3.5]. The surveys are an essential component of the research programme because they **promote the work to stakeholders and end-users**, and so set up subsequent impact of the research.

3. References to the research

[3.1] Doz, Giannone, and **Reichlin**. A quasi-maximum likelihood approach for large, approximate dynamic factor models. *Review of Economics and Statistics* 94(4), Nov. 2012, pp. 1014–1024. DOI: https://doi.org/10.1162/REST_a_00225

[3.2] Doz, Giannone, and **Reichlin**. A two-step estimator for large approximate dynamic factor models based on Kalman filtering. *Journal of Econometrics* 164(1), Sep. 2011, pp. 188–205. DOI: https://doi.org/10.1016/j.jeconom.2011.02.012

[3.3] Forni, Giannone, Lippi, and **Reichlin**. Opening the black box: structural factor models with large cross sections. *Econometric Theory* 25(5), Oct. 2009, pp. 1319–1347. DOI: https://doi.org/10.1017/S026646660809052X

[3.4] Banbura, Giannone, Modugno, and **Reichlin**. Nowcasting and the real time data flow. *Handbook of Econometrics of Forecasting*, v. 2A, ed. by Elliott and Timmermann. Elsevier (2013). DOI: https://doi.org/10.1016/B978-0-444-53683-9.00004-9

[3.5] Banbura, Giannone, and **Reichlin**. Nowcasting. Ch. 7 of *Oxford Handbook of Economic Fore- casting*, ed. by Clements and Hendry. Oxford University Press (2011). DOI: https://doi.org/10.1093/oxfordhb/9780195398649.013.0008

[3.6] Giannone, **Reichlin**, and Small, Nowcasting: The real time informational content of macroeconomic data. *Journal of Monetary Economics* 55 (4), 665–676 (2008). DOI: https://doi.org/10.1016/j.jmoneco.2008.05.010

4. Details of the impact

Through the commercial firm Nowcasting Economics Limited, the research findings have been **applied widely in the world of business and economics**. Since 2014 several new financial institutions have used the technique. Details are commercially sensitive, but other clients include the central banks of Canada, Belgium and Slovenia. Other state agencies include the German Ministry of Economics and Energy. Many other institutions apply the method on a routine basis. For example, the influential **Federal Reserve Bank of New York** has used it since April 2016 to produce early estimates of GDP growth for the US economy. [5.1]

It estimates GDP growth for the current and subsequent quarter, based on data released over the course of each week, and publishes them every Friday at 11:15 a.m. on the Federal Reserve Bank of New York's public website. They explicitly state their efforts **"build on" the work** of Reichlin and her colleagues. [5.1]

Another **significant application** of the research is in Germany. Starting in January 2020, the Federal Ministry for Economic Affairs and Energy uses the nowcasting technique to produce and publish real-time estimates of GDP, as a guide to the **performance of the country's economy**. The Nowcasting Economics Limited team developed the relevant model in collaboration with Dr Till Strohsal, an economist with the ministry, and jointly published the results with him as a working paper in 2020. [5.2]

Dr Strohsal says: "**I cannot value enough** how useful the London Business School model has been for us. The research has definitely **had a big impact** here." [5.3]

Without nowcasting, GDP figures are typically only available 30-45 days after the close of a quarter. "Now we have a reliable forecast every day and **that's very useful for us** to understand the direction of the economy and to fulfil our institutional duties."

It helps the ministry comment on the state of the country's economic performance to the media and to senior figures in government, Strohsal says. And the ministry also includes nowcast GDP estimates in its **official monthly bulletins**. "This really was the **missing piece** of the methodologies we needed," he adds.

There are two key end-users of this information. The first is the community of economic analysts and forecasters in Germany and elsewhere. The second is the general public and business communities, who need reliable information on the state of the economy **to plan and make decisions**. It's impossible to track how this information is used, Strohsal says. "But we hope and expect that it will influence firms and consumers. We know from macroeconomic theory that reliable estimates of economic growth **are essential to guide spending and future investment**."

5. Sources to corroborate the impact

[5.1] Bok, Brandyn and Caratelli, Daniele and Giannone, Domenico and Sbordone, Argia M. and Tambalotti, Andrea, Macroeconomic Nowcasting and Forecasting with Big Data (2017-11-01). FRB of NY Staff Report No. 830. Available at SSRN: https://ssrn.com/abstract=3075844

[5.2] DP14323 Nowcasting German GDP. CEPR Working Paper. January 2020 https://cepr.org/active/publications/discussion_papers/dp.php?dpno=14323

[5.3] Testimony from Dr Till Strohsal, Federal Ministry for Economic Affairs and Energy, Berlin