Practitioner’s view to nowcasting and forecasting at the Bank of Finland

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Thanks to Eleanora Granziera, Petteri Juvonen, Annika Lindblad, Mikko Sariola and Tomi Kortela for providing material for this presentation.
My background

- Head of Forecasting 2014-2018 (Nov)
- Previously worked mainly on macroeconomic research (monetary policy, fiscal policy, labour markets)
- Worked intensively on the development of Bank of Finland’s quarterly forecasting model Aino (also as a user)
- Strong believer of structural modelling
- No experience on hands-on-development of nowcasting models
Outline

- Modelling and forecasting at the BoF – brief history
- Some examples from practical forecasting context
- Nowcasting at the Bank of Finland
  - Finnish GDP
  - Euro Area GDP
- Conclusions
Modelling and forecasting at the BoF – a brief history

- 1969: First large macroeconomic model for the Bank of Finland
- 1972-1998 Series of large traditional econometric models developed (BOF1…BOF5) for scenario and forecasting purposes
- 1988 – Switch to model based forecasting
- 2000-2004 – First GE model Aino developed and used in forecasting
- 2010 - 2016 Aino 2.0 (extension with the banking sector)
- 2016 - 2019 Aino 3.0 (extension with the housing sector)

+ nowcasting models
Extra-ordinarily difficult time for modelling and forecasting

- Global financial crisis
- European debt crisis
- Finland specific “shocks” to export sector
- Working age population growth stalled
GDP – forecast errors during 2004-2016

- 2012-2015 large and repetitive forecast errors

- Why we missed it?
  - European debt crises
  - Series of negative shocks
  - Euro area economy started to recover in 2013

Dec 2014: Factors behind prolonged recession increasingly domestic in origin

GDP, historical shock decomposition

External factors and financial markets no longer the source of slower growth

Slower growth due to domestic supply and demand factors

Source: Bank of Finland calculations, projections based on structural SVAR model
Ex-post evaluation by structural model (Aino 2.0): export growth

- Weak productivity growth and lack of external demand explains major part of the 2012-2015 prolonged recession

- External factors explain also the upswing

- But productivity growth has remained below its historical trend
Forecasting and nowcasting

- Inevitably, we have very little, if any, information about the future (shocks).

- Therefore, a good forecast is (also) about making a good judgement of the future (shocks) and the current state of the economy

- When forecast is primarily based on DSGE model, separate nowcasting model(s) perhaps even more important

- Since 2014 we have invested more on nowcasting
Challenges to nowcasting

- Large change in the average Finnish GDP growth rate, 1995-2008 1 %, 2011-2015 0,1 %, QoQ,

- Our dynamic factor model produced forecasts with a positive mean error, large bias also in some bridge models

- Estimating forecasting model in (log) levels could help to reduce the upward bias

- When estimating a factor model, the series are either differenced or log-differenced to make sure they are stationary, Giannone et al. (2008), Banbura et al (2012)

- When estimating a VAR, non-stationarity is not a problem
Illustration: Comparing VARs, 4 quarter ahead forecasts

- Mean errors at different forecast horizons ‘06-15
  - 0M – 5M
  - Log levels: 0.08 – 0.21
  - Diff-logs: 0.05 – 0.31
  - All-diffs: 0.13 – 0.50
  - Factor m: 0.19 – 0.43
  - Bridge m: 0.33 – 0.38
Nowcasting Finnish GDP using a large BVAR

- BVAR specified on log-levels
- Over 40 variables: Confidence indicators, labor market variables, volume indices, price indices…
- ”Minnesota type” shrinkage priors to deal with over parameterization as in Giannone et al. (2015)
- Mixed frequency problem solved with time aggregation of monthly data and monthly forecasts. We use both monthly VAR and quarterly VAR
- Schorfheide and Song (2015) specify VAR on monthly frequency and treat monthly GDP as unobserved variable
Analyzing data releases in real time

- Nowcast is updated always when new data is released
- News analysis as in Banbura et al. (2013): only unexpected component in the data releases changes the nowcast
  - Model gives forecasts for all the variables in the model
  - Data release – model forecast = ”news”
  - Less weight for noisy variables
Going public: Automatization and visualization

1. Matlab scripts compiled as one .EXE-file
   - Runs on a server, pre-scheduled
   - Downloads the data from the time series database
   - Runs seasonal adjustment if needed

   - Generates updated nowcast and creates Power BI report to the web page:
     https://www.suomenpankki.fi/en/nowcast

   - **Robot economist** generates a tweet:
     https://twitter.com/SPNowCast
Data and Process Flow of BoF Nowcast system
Nowcasting Euro Area GDP

- Based on BVAR like explained earlier

- Focus on EA aggregate variables
  - A limited disturbance from idiosyncratic shocks at country level on the forecast

- A limited set of variables (9 quarterly, 22 monthly)
  - Should be able to explain why these variables change the GDP forecast
  - We may capture which sectors of the economy are contributing to the nowcast

- Also automated with Matlab, not published (yet)
Which sectors has contributed to forecast?
Why forecast has changed?
Conclusions

• Forecasting (and nowcasting) is very challenging in the current environment

• Need both structural and purely statistical approaches to forecasting

• Ex-post evaluation very important

• Publishing nowcasts in real time is “ok”.
THANK YOU!
Forecasting performances of different nowcasting models

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On solving the mixed frequency problem

- Estimate a VAR for monthly data only and a VAR for data that consists of time-aggregated monthly data and quarterly data.
- Use monthly VAR and Kalman filter to fill missing observations till the end of the latest quarter we have any observations.
- Do time-aggregation in Kalman filter and get forecast error var-cov matrix for time aggregated data. When time-aggregated data point contains forecasts, it is treaded as observed with a measurement error.
- We obtain var-cov matrix for the measurement errors from the output of the Kalman filter.
- Use quarterly VAR and Kalman filter to forecast GDP conditional on observed quarterly data and monthly data that is time-aggregated. Take into account that part of the time aggregated monthly data contains measurement errors. Feed in the var-cov matrix from step 2.
Variables used in the Euro area nowcasting model

- **Quarterly (9 variables):**
  - GDP and its components
  - Compensation per employee
  - Employment
  - Working hours

- **Monthly (22 variables):**
  - Industrial production
  - New Vehicle Registrations
  - STOXX
  - DG ECFIN, Consumer Confidence, Major Purchases at Present
  - DG ECFIN, Consumer Confidence
  - DG ECFIN, Industrial Confidence Indicator
  - DG ECFIN, Construction Confidence Indicator
  - Producer Price Index
  - FX: EUR/USD
  - New Orders, Total, Manufacturing
  - United States, Business Surveys, ISM
  - World, CPB World Trade Monitor, Total, Volume
  - Euro Area, Unemployment
  - Business Surveys, DG ECFIN, Retail Trade Confidence Indicator
  - Ifo, Business Survey, Manufacturing Industry
  - France, Business Surveys, INSEE, Industry, Manufacturing
  - Euro Area, Foreign Trade, Export
  - Euro Area, Foreign Trade, Import
  - Loans, non-financial corporation
  - Loans, households
  - Retail trade
  - Business Surveys, Markit, Composite
Key structural shocks driving the business cycle in Finland

![Graphs showing labour productivity, export share, price markup of export producing firm, and bank capital over time from 1996 to 2014.]

Juha Kilponen
Indicators point to different direction...

Sources: Markit Economics and calculations by the Bank of Finland. 30384@Euroalueen PMI

Sources: European Commission and calculations by the Bank of Finland. 30384@Teollisuuden odotukset
Nowcast is very important for policy

- In Paloviita (2017) et al. we estimated the ECB policy reaction function using the real time nowcasts and forecasts of the Eurosystem/ECB staff during 1999Q4-2014Q4.

- We found, among other things, that the ECB reacts mostly to nowcast or one quarter ahead GDP forecast and four quarters ahead inflation forecast.

- We also found out that more than 5-6 quarters ahead forecasts are increasingly more inaccurate.
  - Recall: we know very little about future (shocks...)

9/20/2019  Juha Kilponen  Suomen Pankki – Finlands Bank – Bank of Finland
References