NEIS Insight

FORECASTING

Quick Overview of Forecasting approaches in different Domains

- Central Banking

- Modern Business

- Standard Business

Recently I finished a course from the IMF for central bankers and other interested parties on *"Model Based Monetary Policy Analysis and forecasting"* and I found the approach to forecasting intriguing in comparison to one in Standard Business. I can wholeheartedly recommend that edX course for everyone not afraid of some mathematics and programming.

OVERVIEW

Here is an overview, which is enriched with modern tools coming from Data science & Machine Learning not yet widely applied in the Industry, but regularly used by modern businesses:

Domain	Central Banker	Modern Business	Standard Business
Role	Macroeconomist	Microeconomist	Microeconomist
Approach	Model (equations, parameters, variables, calibration). Structural equations with a macroeconomic motivation and theory and Reduced equations from e.g. regression of data.	Using past data and evtl. Forward oriented parameters to extrapolate future figures, using machine learning algorithms.	Direct estimation based on a holistic view from Sales, management, business controller. Also two stage directly estimating drivers and than calculating sales as a function of parameters and the drivers.
Tools	**Matlab / Octave** (Mathematical software is featuring a high-level programming language, primarily intended for numerical computations. Helps in solving linear and nonlinear problems numerically.)	**Machine Learning** through programming languages like **Python** and **R** and modules for standard machine learning algorithms.	**Spreadsheets** (e.g. **Excel**)

As I do not have the data, I cannot state in which domain we find the best forecast accuracy. The simplest tools are sometimes the best. However if you are not satisfied with the accuracy in your domain you might want to try the techniques of the other domains.

Not only could you be able to increase accuracy but also gain insights into your business model and understand sub components of it and their inter dependencies much better, if you would model it.

For modeling Excel is not enough! You need to head for Machine Learning and /or Matlab.

These insights potentially give you strategic ideas and levers for your business development.

So Forecasting is more than just figures and hitting the right one in 6 month from now. It's about understanding your business and important drivers.

TYPICAL OUTPUTS

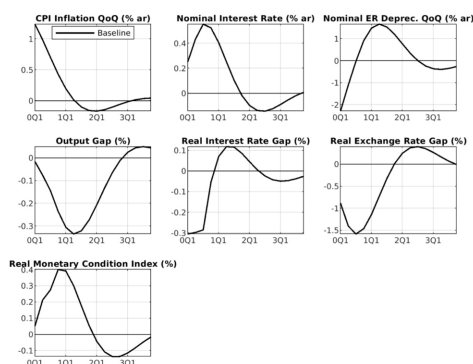### Central Banker

Modern Business

Standard Business

Here e.g. with have a cononical Quarterly Projection Model with 35 equations and 35 variables. In the first quarter we trigger an Inflationary shock and forecast for the next 4 years or 16 quarters what will happen to our economy in comparison to the baseline development without the shock.

The answer of the Central Bank to the inflation increase would be to increase the nominal interest rate in the first two quarters and than lower them down again.
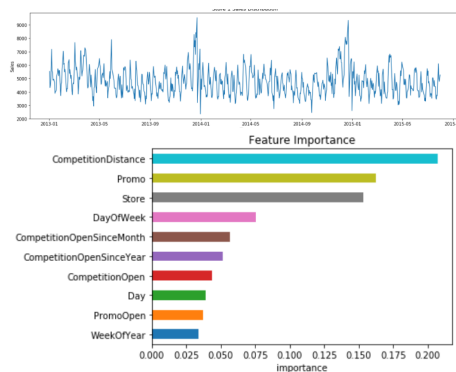
For forecasting sales with Machine Learning often Models like Linear Regression, Random Forest Regression or XGBoost are applied. But also Neural Networks might be used.

Not only you get a forecast, but also a breakdown of factors (here called features) which are important for the forecast.

In Kaggle companies like Rossmann, Walmart, Bosch, Santander offer competitions to get the best forecast against substantial awards.
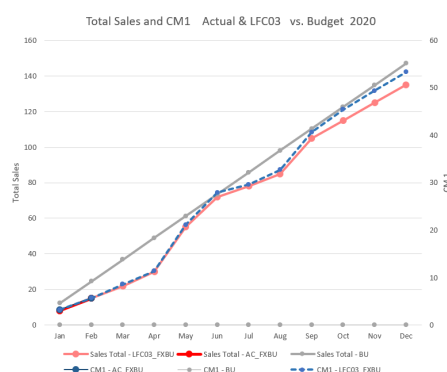
Sales forecasting is often developed on past experience and future outlook by the Sales function and the controlling function. Cost forecasts are done decentrally by cost center managers or centrally by controlling. Based on these forecasted P&L's decisions are taken and built into the next forecast.

Forecast are typically 12 month.

Business plans are typically looking 3 to 5 years into the future.

EXPERIMENT AND GAIN INSIGHT

First review if forecasting is important to You.

Analyze if you are satisfied with the accuracy and / or the insight the forecasting process delivers.

If there are shortcomings experiment with the other approaches and develop a method which suits your needs.

Of course there are some prerequisites for the modeling approaches. Machine learning needs some data. Thus for retailer or B2C companies it is suited very well. But also for B2B companies with enough data it's perfect. If your business however is selling few very large projects each

year, it will be less suited for sales forecasting.

For the Central Banker's approach you would need to able to describe your model with equations. As often that might be a challenge a hybrid solution where some dependencies can be described with equations and others are merely observed and extrapolated with machine learning regression models might be the way to go.

Go ahead and explore. Good Luck !

Have a Neis Day