Illustration of `SpecEval` add-in

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Moody's Analytics

Introduction

Model development process using SpecEval

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Focus on forecasting models $\Rightarrow$ most outputs visualize forecasts.

- Backtest forecasts and scenario forecasts.

Applications

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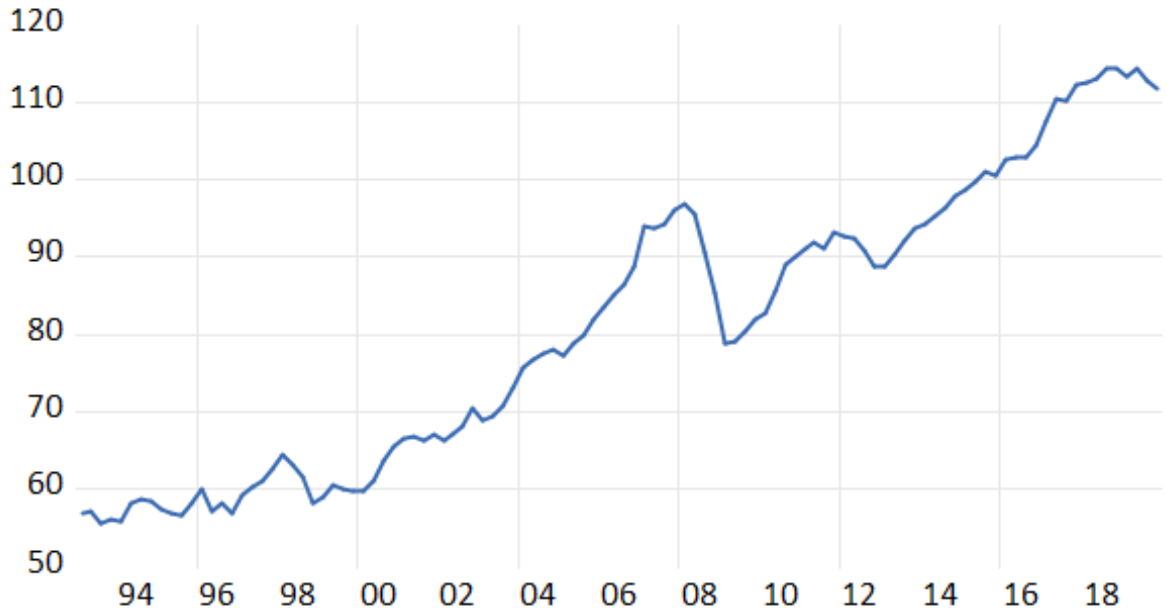
#	**Primary focus**	**Secondary focus**
1	Basic use of add-in and overview of key output objects	Iterative and interactive model development process
2	Basic use of transformations (growth)	Recursive automatic model selection
3	Advanced use of transformation (spread)	Interactive model development
4	Advanced use of transformation (log and ratio)	-
5	Unconditinal forecasts I - Exogenously produced forecasts	Use for identities
6	Unconditiona forecasts II - Systems of multiple individual equations	-
7	Custom re-estimation	-
8	Using intermediate objects	-

Basic application

Czechia IP

Standard trending macroeconomic time series.



Static regression

Consider estimating simple static regression linking growth of industrial production to growth of GDP.

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The resulting equation can be evaluated by `SpecEval` by simply calling:

```
eq_ip_static.speceval(noprompt)
```

Regression output

`SpecEval` report includes standard Eviews output with several adjustments.

Dependent Variable: DLOG(IP)
Method: Least Squares
Date: 04/05/21 Time: 19:09
Sample (adjusted): 1996Q2 2019Q4
Included observations: 95 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Std. coef.
C	-0.0021	0.0024	-0.88	0.3833	
DLOG(GDP)	1.43	0.24	5.95	0.0000	0.53

R-squared	0.275710	Mean dependent var	0.006554
Adjusted R-squared	0.267922	S.D. dependent var	0.022229
S.E. of regression	0.019020	Akaike info criterion	-5.065871
Sum squared resid	0.033642	Schwarz criterion	-5.012105
Log likelihood	242.6289	Hannan-Quinn criter.	-5.044146
F-statistic	35.40165	Durbin-Watson stat	1.420843
Prob(F-statistic)	0.000000		

Variable	Description
IP	Czechia industrial production
GDP	Czechia real GDP

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Regression variables might not be known to outside evaluators $\Rightarrow$ include variable descriptions.

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- Often interested in longer forecasts, not just one-step ahead $\Rightarrow$ use multi-step dynamic forecasts.
- We want to know how well would given model work in different historical situations $\Rightarrow$ use coefficients estimated on historically available data (recursive forecasts).

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`SpecEval` **allows inclusion of multiple horizons and choice of in-sample or out-of-sample forecasting.**

Forecast performance: How to convey information?

Two basic ways of conveying forecast performance information:

- **Numerical**: Summary statistic like RMSE.
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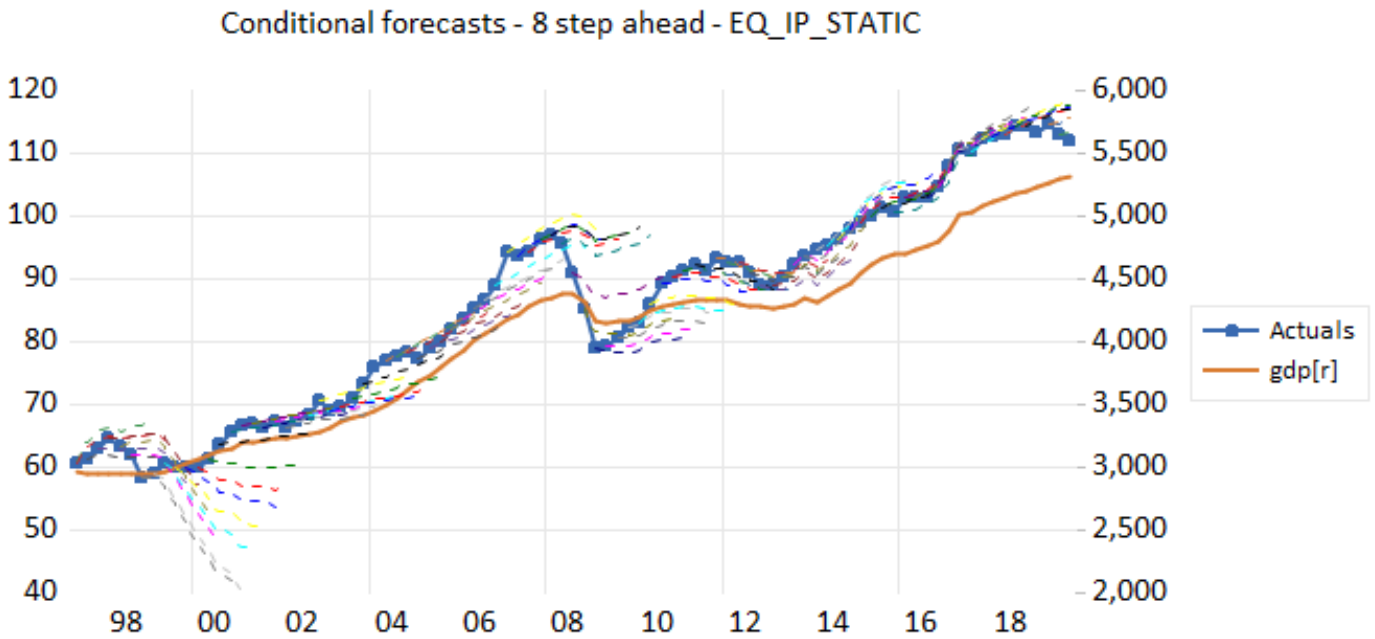
`SpecEval` **includes both types of information.**

Forecast performance: Graphical info

Forecasts problematic in beginning of sample and also during Great Recession.

- IP fell substantially more than GDP during Great recession.



Forecast performance: Numerical info

Static equation is overall worse than ARMA benchmark.

- Likely related to large forecast errors in beginning of sample.

Specification	Forecast horizons (# of steps ahead) 8	24	Avg.
EQ_IP_STATIC	8.22	22.2	15.2
EQ_IP_ARMA	7.52	12.9	10.2

```
eq_ip_static.speceval(spec_list="eq_arma",
  use_names="t", graph_add_backtest="gdp[r]")
```

Large initial forecast errors: Remedy

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- Confirm there is problem with estimated coefficients $\rightarrow$ **coefficient stability**.

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eq_ip_static.speceval(exec_list="normal stability")
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- Exclude early observations $\rightarrow$ **restrict backtesting sample**.

```
eq_ip_static.speceval(tfirst_test="2000q1")
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- Exclude early observations → **restrict backtesting sample**.

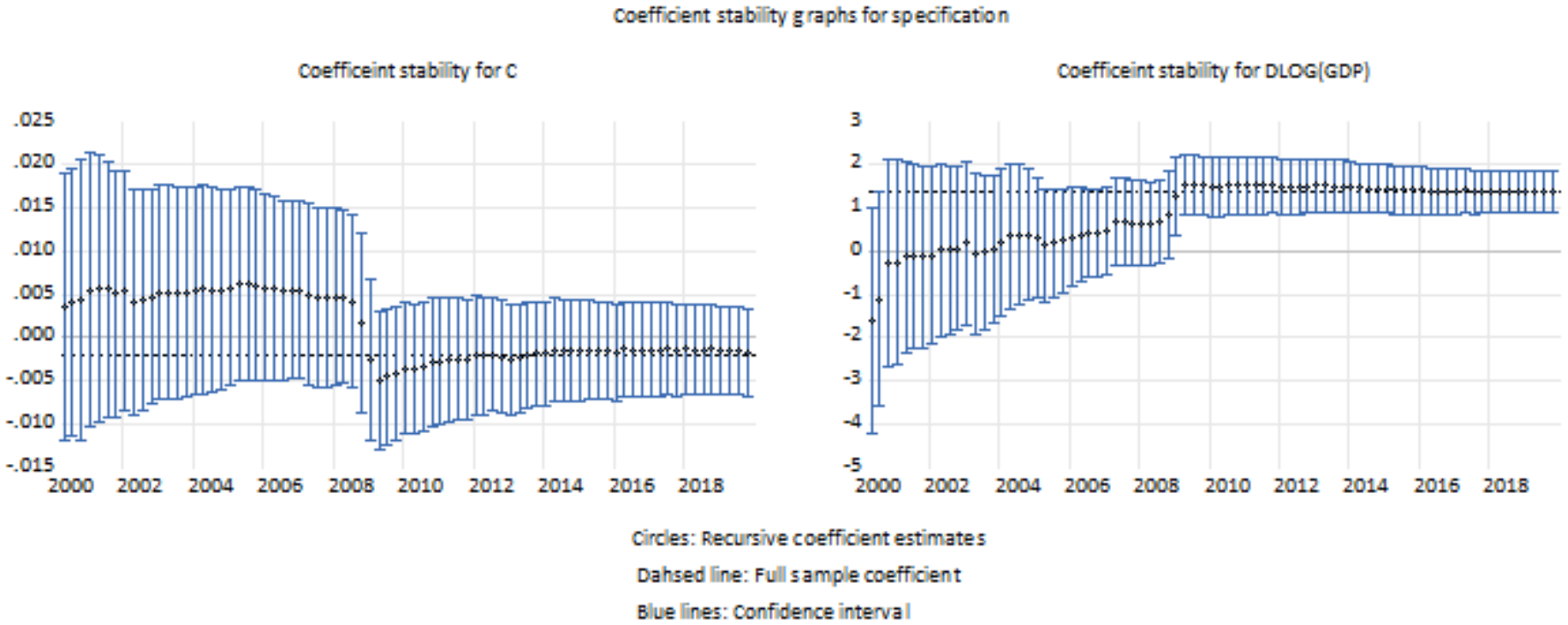
```
eq_ip_static.speceval(tfirst_test="2000q1")
```

- Use final coefficient estimates → **in-sample forecasting**.

```
eq_ip_static.speceval(oos="f")
```

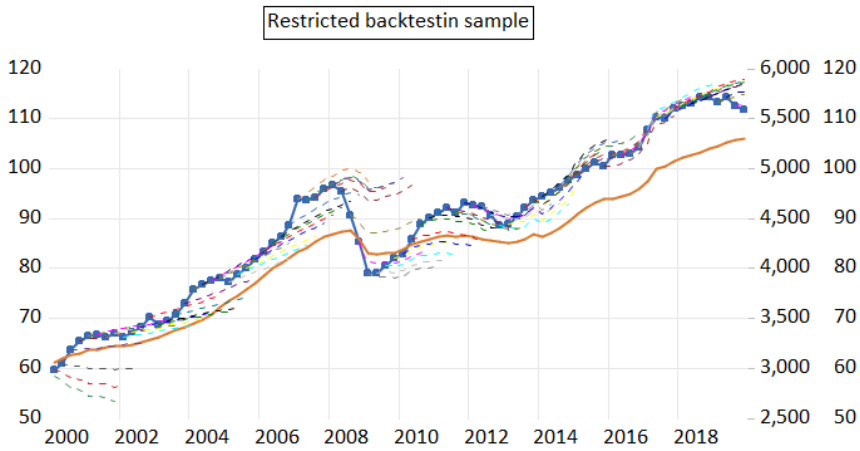
Coefficient stability

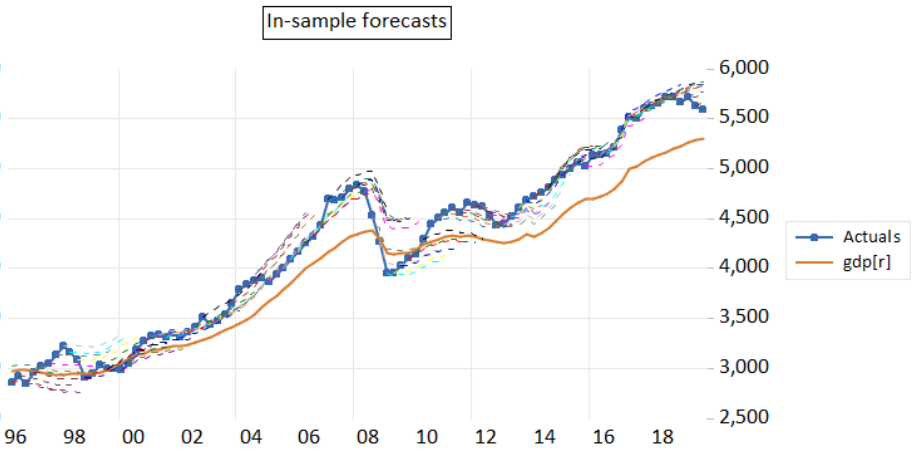
Coefficient on GDP in beginning of sample is negative.



Adjusted forecasting

Both adjustments change the conclusions about performance of static equation.





Specification	Forecast horizons 8	24	Avg.
EQ_IP_STATIC	6.79	14.5	10.6
EQ_IP_ARMA	8.18	13.8	11.0

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EQ_IP_STATIC	4.36	5.55	4.96
EQ_IP_ARMA	6.70	9.25	7.98

Setting horizons

`SpecEval` allows user to easily set the horizons for either of the outputs.

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Consider evaluating static regression with and without constant for multiple horizons:

```
eq_ip_static.speceval(spec_list="eq_ip_static*",
   horizons_forecast="1 2 4 8 16 40 80",
   horizons_graph="4 8 40", alias="with without")
```

	Forecast horizons (# of steps ahead)							
Specification	1	2	4	8	16	40	80	Avg.
with	1.56	2.77	4.84	8.22	13.7	37.7	103	24.6
without	1.51	2.59	4.38	7.44	13.5	39.9	104	24.7

Great Recession forecasts: Remedy

The forecast summary graph showed that the decline during Great Recession was smaller than in reality $\rightarrow$ include interaction with recession dummy.

$$dlog(IP_t) = \beta_0 + \beta_1 dlog(GDP_t) + \beta_2 D_t^{recession} dlog(GDP_t) \qquad (2)$$

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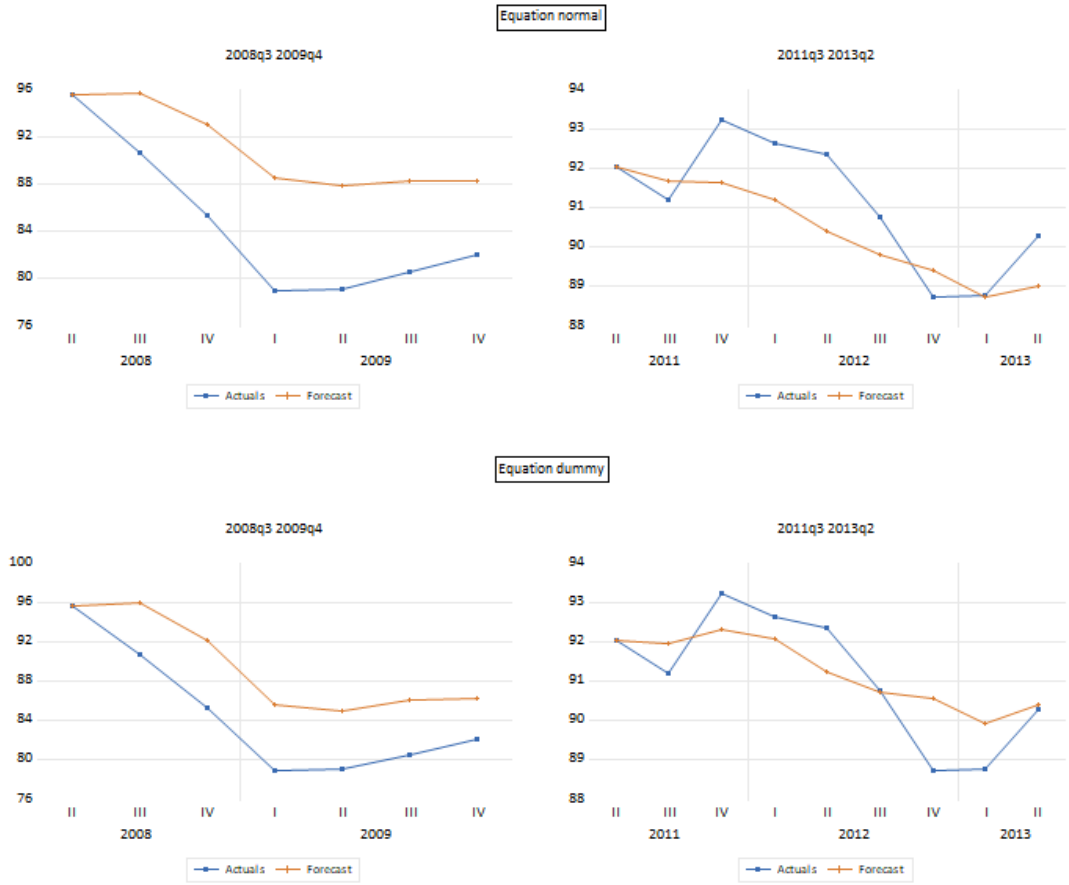
Focus on analysis of sub-sample performance:

```
eq_ip_static.speceval(spec_list="eq_ip_static_dummy",
   subsamples="2008q3-2009q4,2011q3-2013q2",
   horizons_forecast="1 2 4 8",oos="f", alias="normal
   dummy")
```

Sub-sample forecast performance

Including recession dummy interaction helps substantially in Great Recession.



Scenario forecasts

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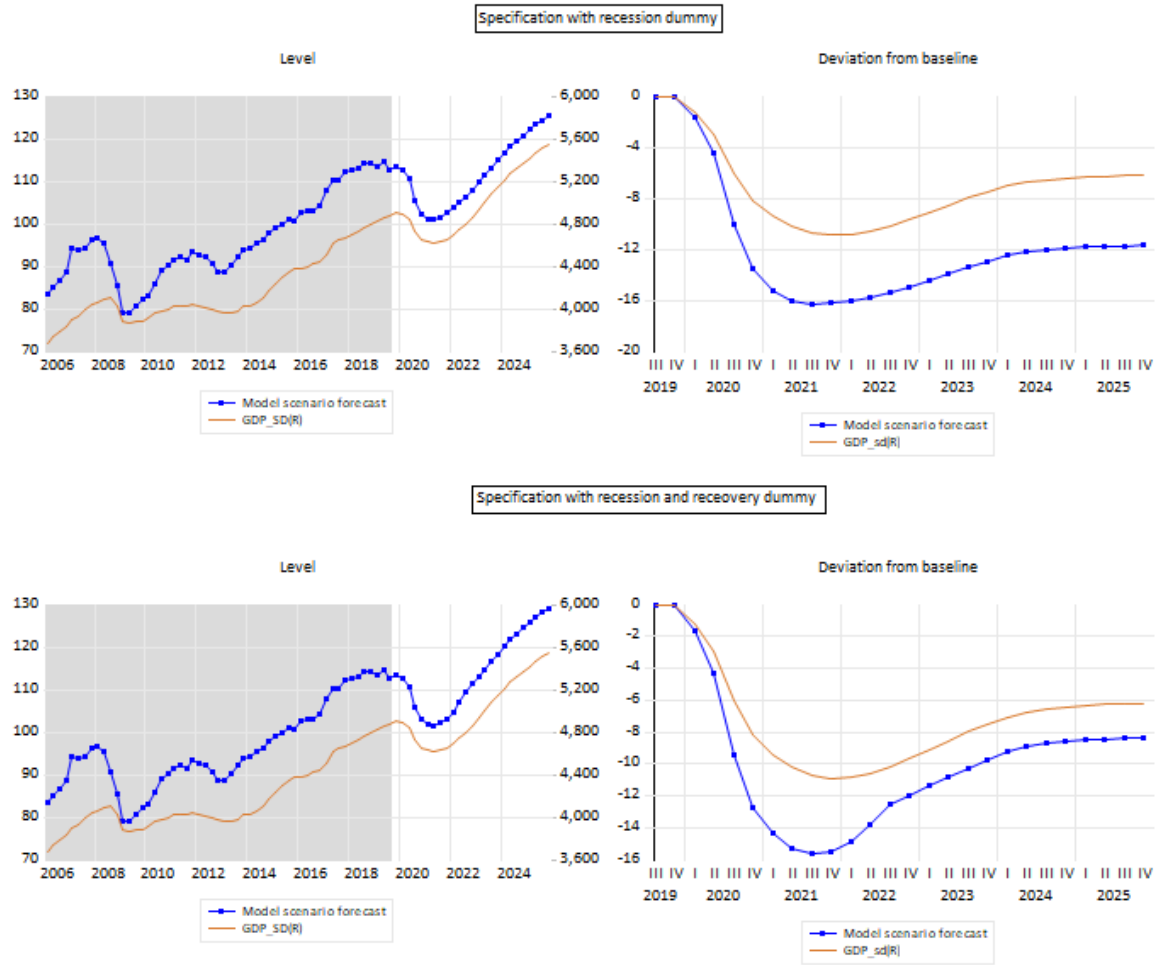
- Scenario forecasts for independent variables need to be included in the workfile, or loaded by pre-prepared subroutine.

```
eq_ip_dummy.speceval(scenarios="bl su sd")
```

Scenario forecasts

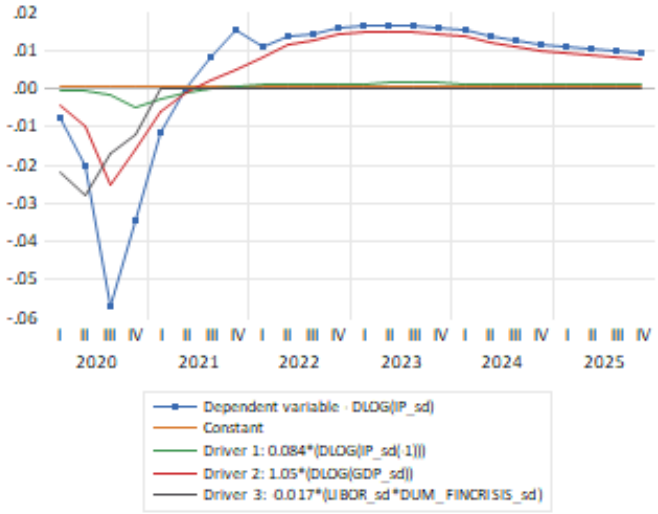
The equation with recession dummy leads to IP falling permanently and substantially behind the GDP → use recession-and-recovery dummy variable instead.

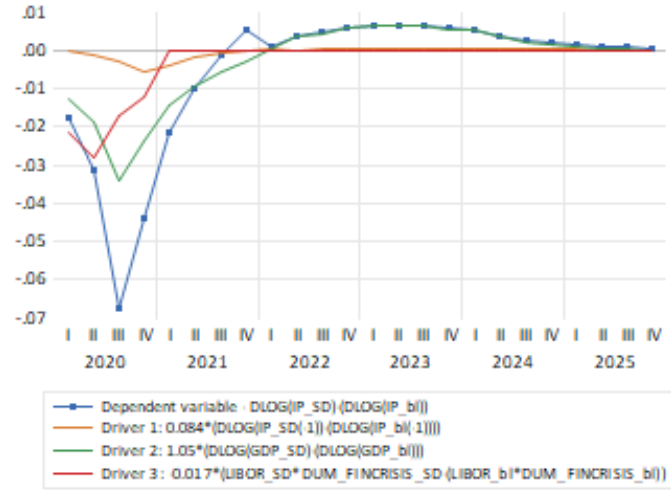


Decomposition graphs

In presence of multiple regressors scenario forecasts can be hard to understand $\Rightarrow$ `SpecEval` includes forecast decomposition graphs.

- Single scenario decomposition and scenario difference decomposition.





Other applications

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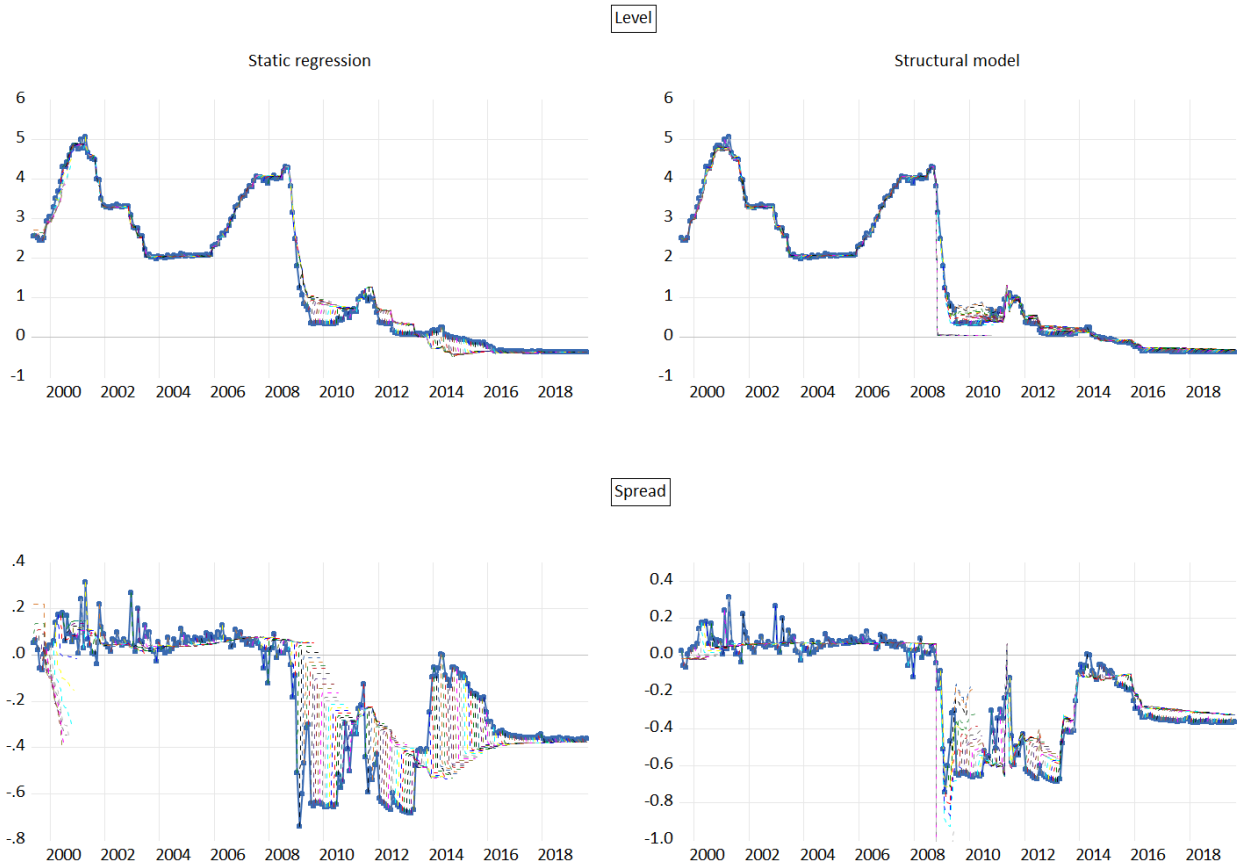
Additionally, all `SpecEval` outputs can be stored for further analysis.

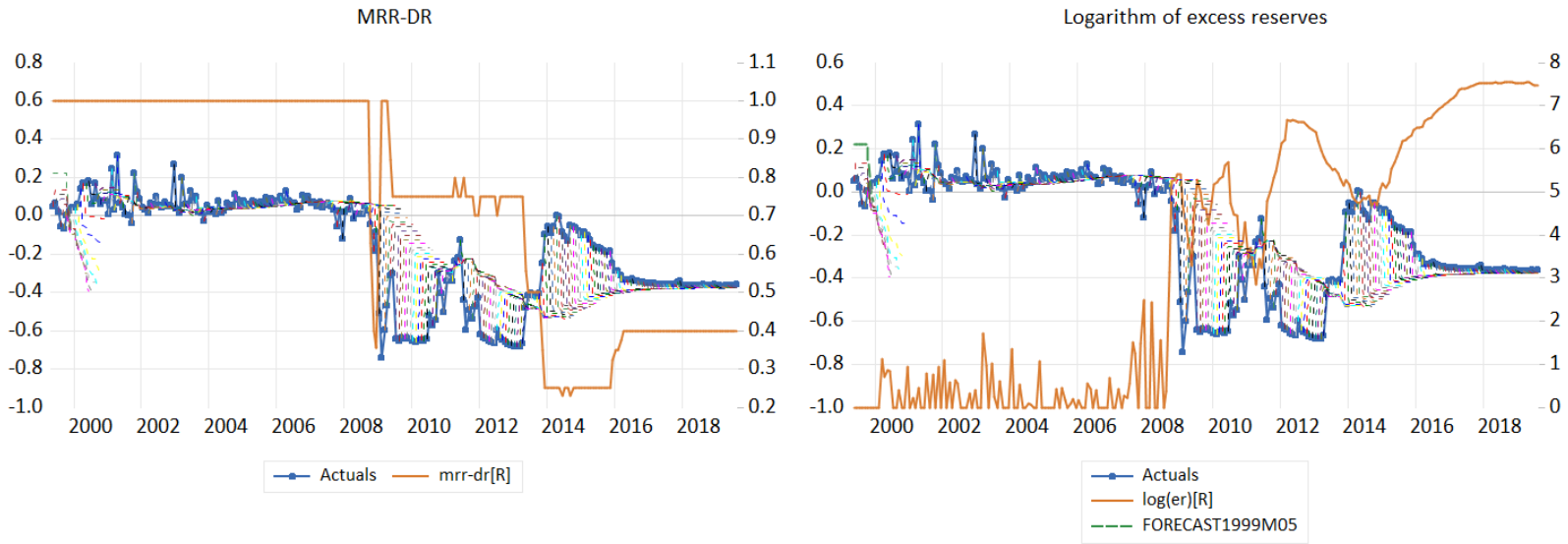
Spread transformation I

Policy rates are main source of variation in market rates, so that forecasts from different models look very similar ⇒ focus on spread transformation.



Spread transformation II

Transformation in forecast graphs can be usefully combined with inclusion of additional variables.



Spread transformation III

Transformation can be important in scenario analysis.