Training sample regressions

Training sample begins in 1996-01-01 (earliest data for purchase-only house price index) and ends in 2014-01-01. We run regressions of state and local tax revenues (by revenue source) using annual data over the training sample, then predict annual data for the out of sample forecasts. Next we smooth those out of sample forecasts into quarterly levels (at an annual rate).

The tables below report the regression results for the given specification and then display the figures of the forecast alongside the realized values of the tax revenue components. The tax components are named as follows:

- gsrpt = Personal income taxes
- gsrpri = Production & Import taxes
- gsrcp = corporate taxes
- gsrs = Payroll taxes

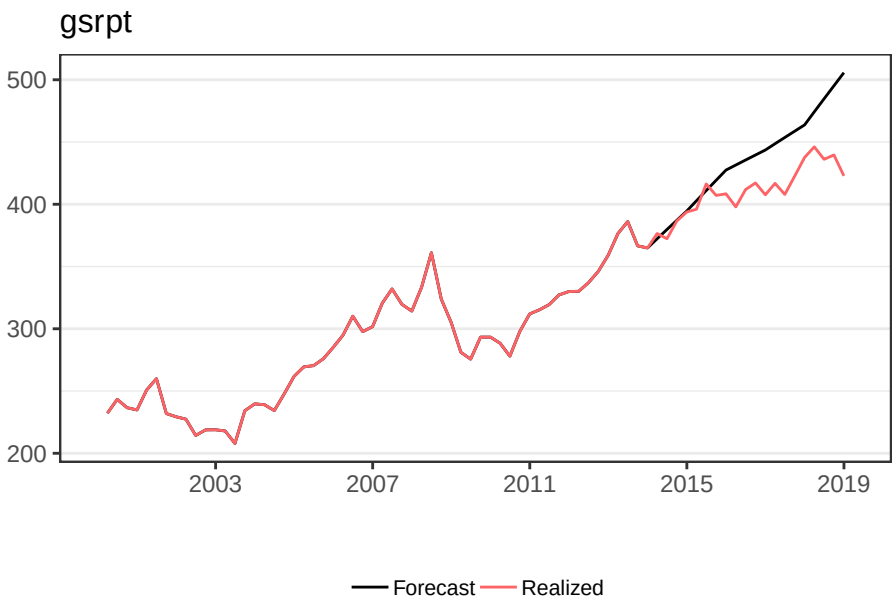
All values are in nominal billions of dollars, at seasonally-adjusted annual rates.

Nominal level regressions (with linear time trend)

Table 1: Nominal levels

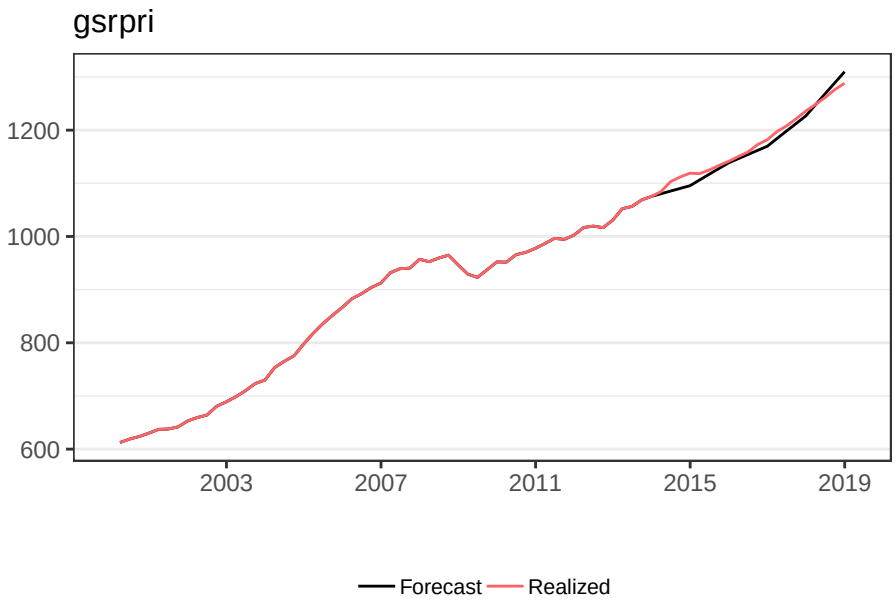
	Dependent variable:			
	gsrpt	gsrpri	gsrcp	gsrs
	(1)	(2)	(3)	(4)
t	-22.260^{***}	-13.975	-9.714^{*}	5.826^{**}
	(6.458)	(8.958)	(4.892)	(2.211)
gdp	0.083^{***}	0.070^{***}	0.009	-0.008^{*}
	(0.010)	(0.014)	(0.008)	(0.004)
gdp_l1	0.023	0.010	0.011	-0.0005
	(0.013)	(0.018)	(0.010)	(0.004)
gdp_l2	-0.024	-0.005	-0.003	-0.006
	(0.014)	(0.019)	(0.010)	(0.005)
hpx	-0.710^{*}	0.784	0.422	0.210
	(0.339)	(0.470)	(0.257)	(0.116)
hpx_l1	-0.542	-0.407	-0.322	0.022
	(0.435)	(0.603)	(0.329)	(0.149)
hpx_l3	0.596	0.546	-0.015	0.050
	(0.389)	(0.540)	(0.295)	(0.133)
hpx_l5	-0.904^{**}	0.624	0.273	0.022
	(0.339)	(0.470)	(0.257)	(0.116)
Constant	269.924^{***}	112.758	119.184^{*}	-75.899^{**}
	(82.556)	(114.513)	(62.540)	(28.268)
Observations	19	19	19	19
R^2	0.997	0.999	0.912	0.913
Adjusted R^2	0.994	0.999	0.841	0.843
Note:				*p<0.1; **p<0.05; ***p<0.01

[[1]]



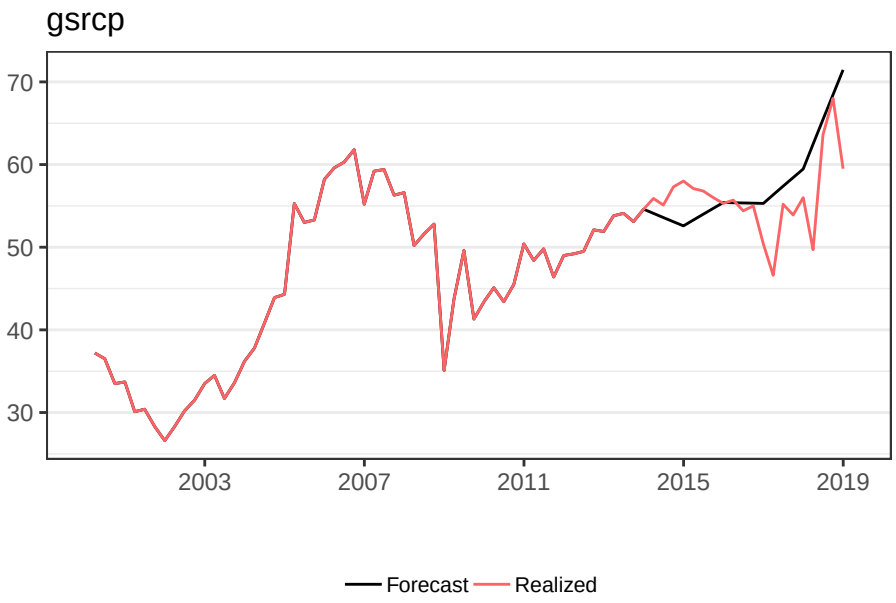
RMSD of forecast = 33.43

[[2]]



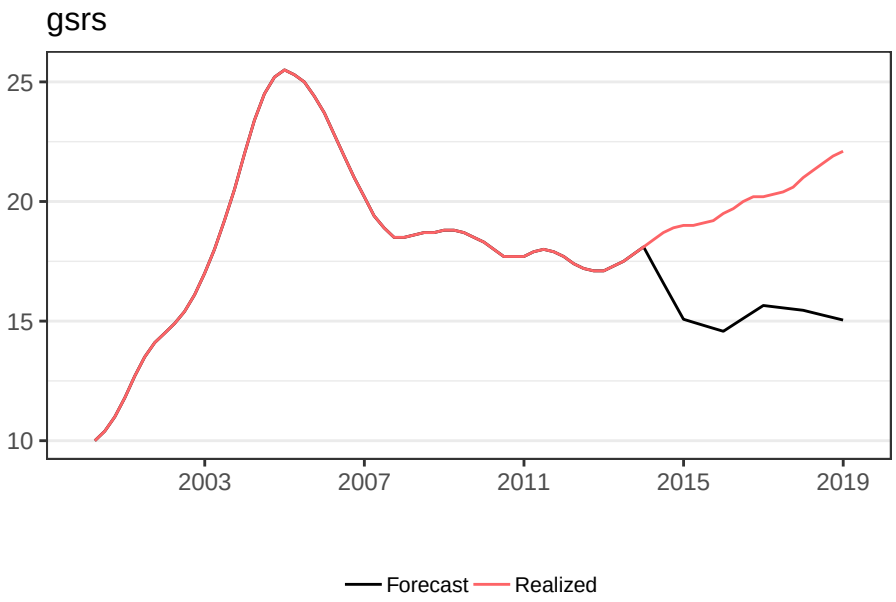
RMSD of forecast = 12.26

[[3]]



RMSD of forecast = 5.21

[[4]]



RMSD of forecast = 4.87

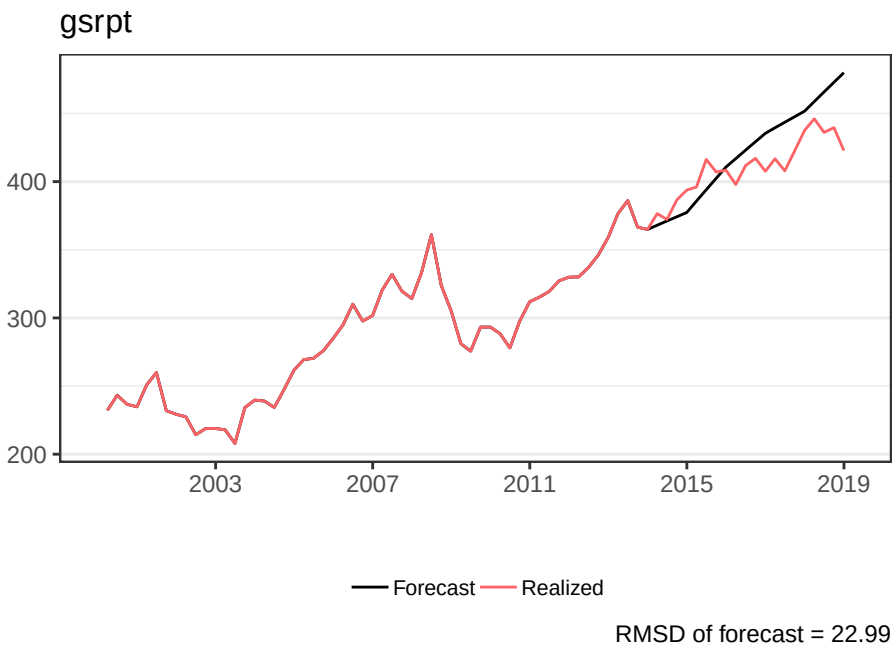
Regressions of tax rates

All variables taken as a share of nominal GDP, save the output gap (percent of potential GDP).

Table 2: Shares of nominal GDP

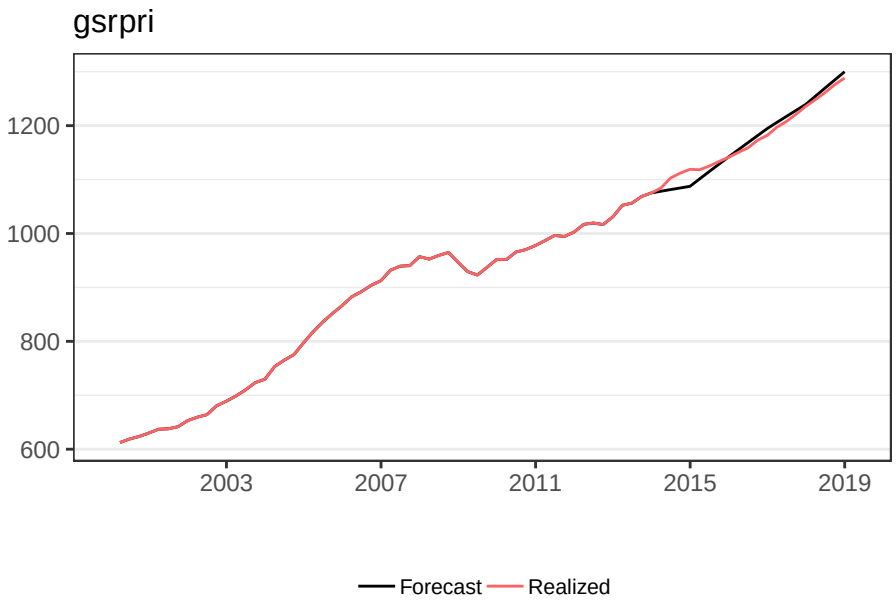
	Dependent variable:			
	gsrpt_gdp	gsrpri_gdp	gsrcp_gdp	gsrs_gdp
	(1)	(2)	(3)	(4)
hpx_gdp	-0.927^{*}	-0.536	0.175	0.362^{***}
	(0.461)	(0.440)	(0.223)	(0.091)
hpx_gdp_l1	0.254	0.215	-0.221	-0.114
	(0.568)	(0.542)	(0.275)	(0.112)
hpx_gdp_l3	0.327	1.838^{***}	0.403	-0.024
	(0.483)	(0.461)	(0.234)	(0.095)
hpx_gdp_l5	-0.680	-1.250^{***}	-0.140	0.084
	(0.412)	(0.393)	(0.200)	(0.081)
gdpgap	0.031^{**}	0.006	0.010	-0.005
	(0.013)	(0.012)	(0.006)	(0.003)
gdpgap_l1	0.040^{**}	-0.016	0.013	-0.002
	(0.016)	(0.015)	(0.008)	(0.003)
gdpgap_l2	-0.015	-0.048^{***}	-0.022^{***}	-0.005^{*}
	(0.013)	(0.013)	(0.007)	(0.003)
Constant	0.037^{***}	0.059^{***}	0.0004	-0.003^{**}
	(0.006)	(0.005)	(0.003)	(0.001)
Observations	19	19	19	19
R^2	0.817	0.909	0.792	0.898
Adjusted R^2	0.701	0.851	0.659	0.833
Note:				*p<0.1; **p<0.05; ***p<0.01

[[1]]



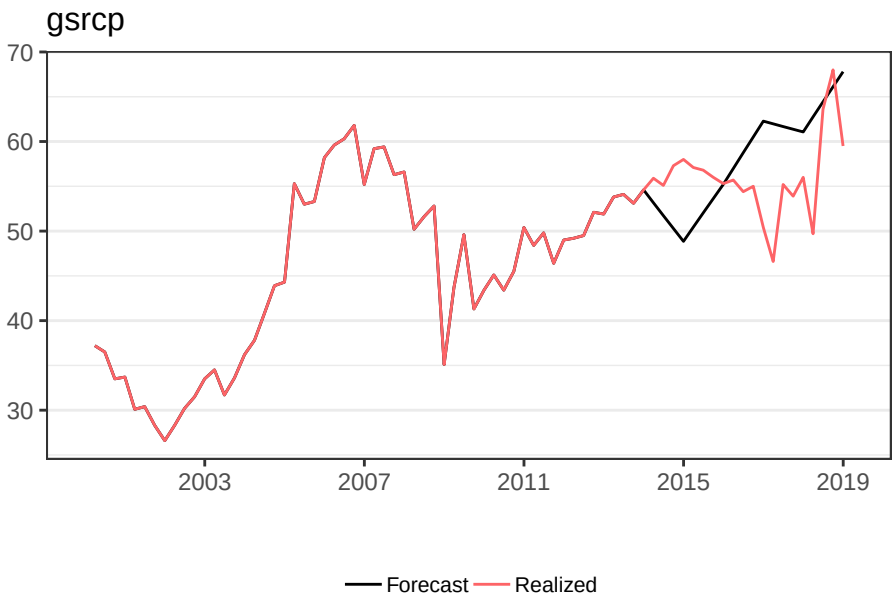
RMSD of forecast = 22.99

[[2]]



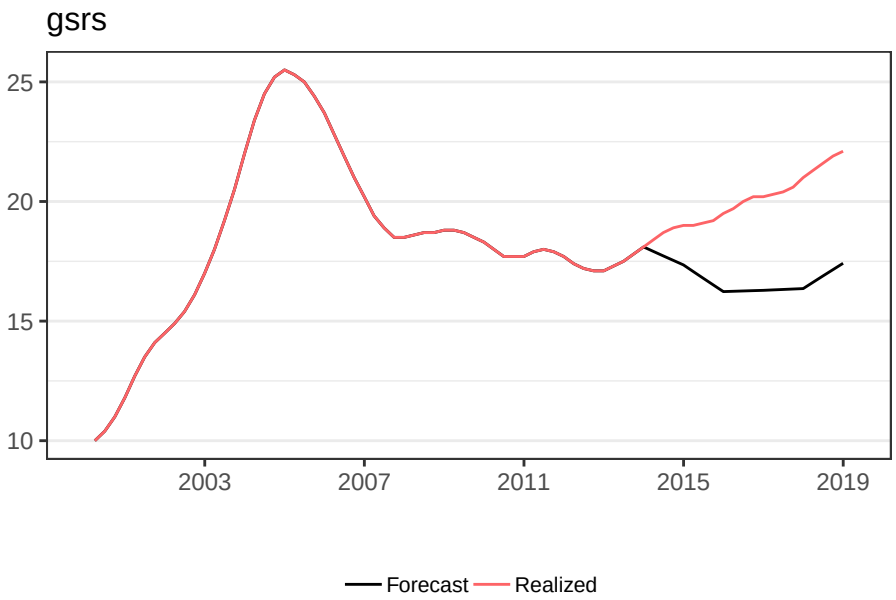
RMSD of forecast = 13.38

[[3]]



RMSD of forecast = 7.14

[[4]]



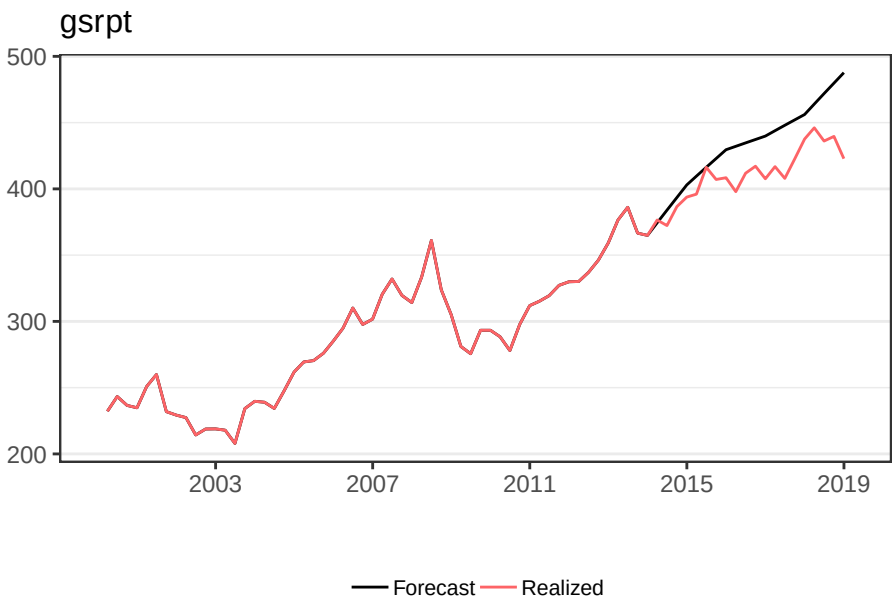
RMSD of forecast = 3.54

Differenced levels regressions

Table 3: Differenced levels

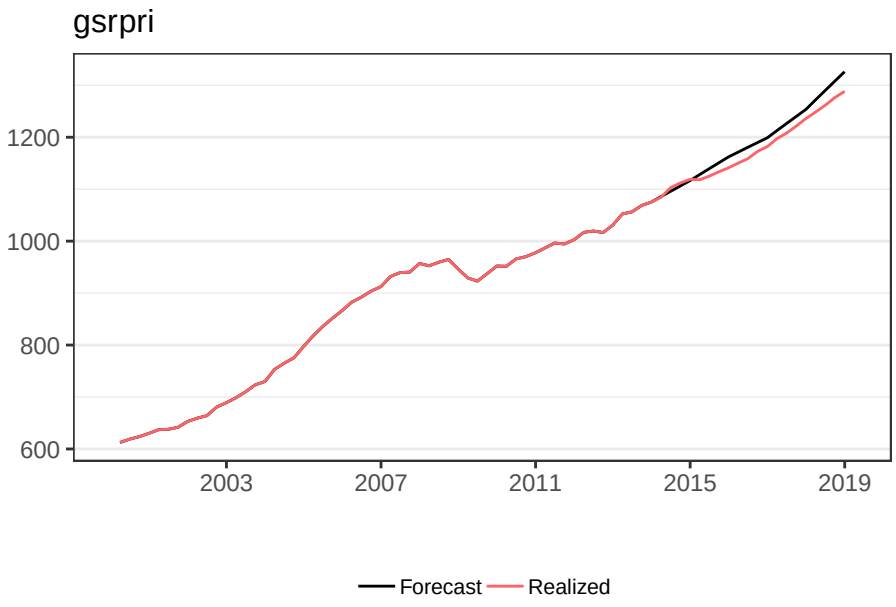
	Dependent variable:			
	gsrpt_d	gsrpri_d	gsrcp_d	gsrs_d
	(1)	(2)	(3)	(4)
gdp_d	0.046***	0.056***	−0.001	−0.003
	(0.009)	(0.006)	(0.003)	(0.002)
gdp_d_l1	0.019	−0.0004	0.003	−0.001
	(0.016)	(0.010)	(0.006)	(0.003)
gdp_d_l2	−0.010	−0.012	−0.003	−0.007*
	(0.018)	(0.012)	(0.007)	(0.003)
hpx_d	−1.040*	0.381	0.474**	0.140
	(0.480)	(0.309)	(0.185)	(0.091)
hpx_d_l1	0.893	0.304	−0.057	−0.064
	(0.546)	(0.351)	(0.211)	(0.104)
hpx_d_l3	−0.571	0.472	−0.105	0.183
	(0.565)	(0.364)	(0.218)	(0.108)
hpx_d_l5	−0.363	0.067	0.280	−0.098
	(0.484)	(0.312)	(0.187)	(0.092)
Constant	−9.897	4.141	−1.383	4.928**
	(11.276)	(7.261)	(4.359)	(2.148)
Observations	18	18	18	18
R^2	0.856	0.969	0.684	0.525
Adjusted R^2	0.755	0.947	0.462	0.193
Note:				*p<0.1; **p<0.05; ***p<0.01

[[1]]



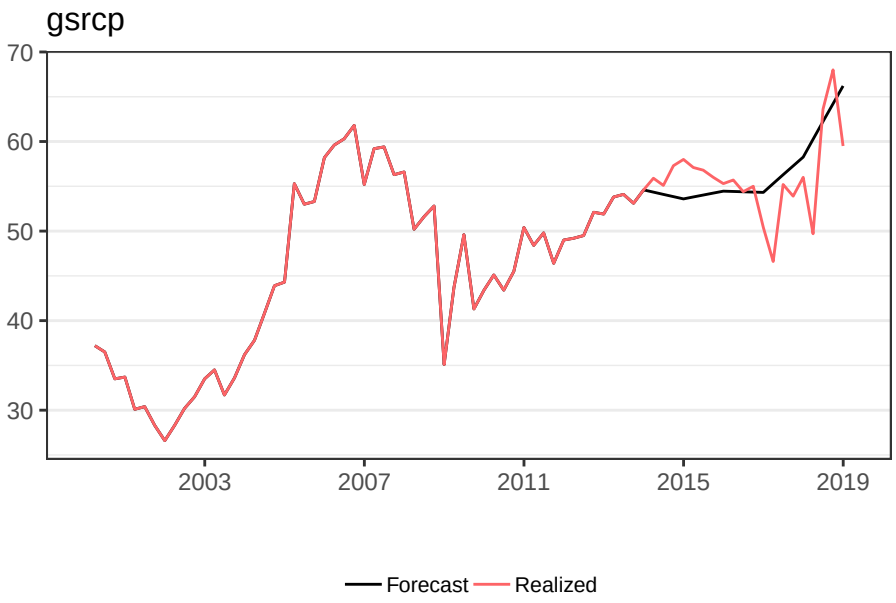
RMSD of forecast = 27.63

[[2]]



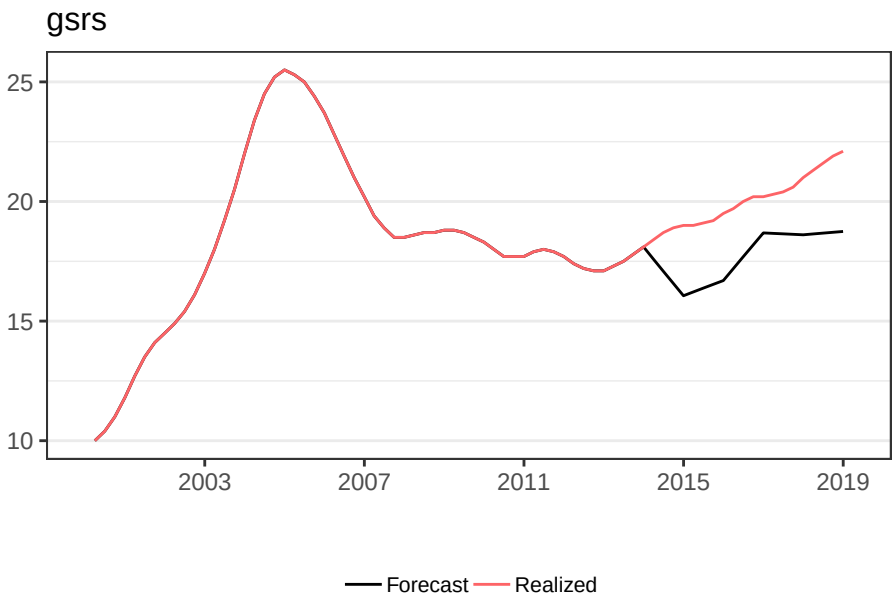
RMSD of forecast = 19.59

[[3]]



RMSD of forecast = 4.13

[[4]]

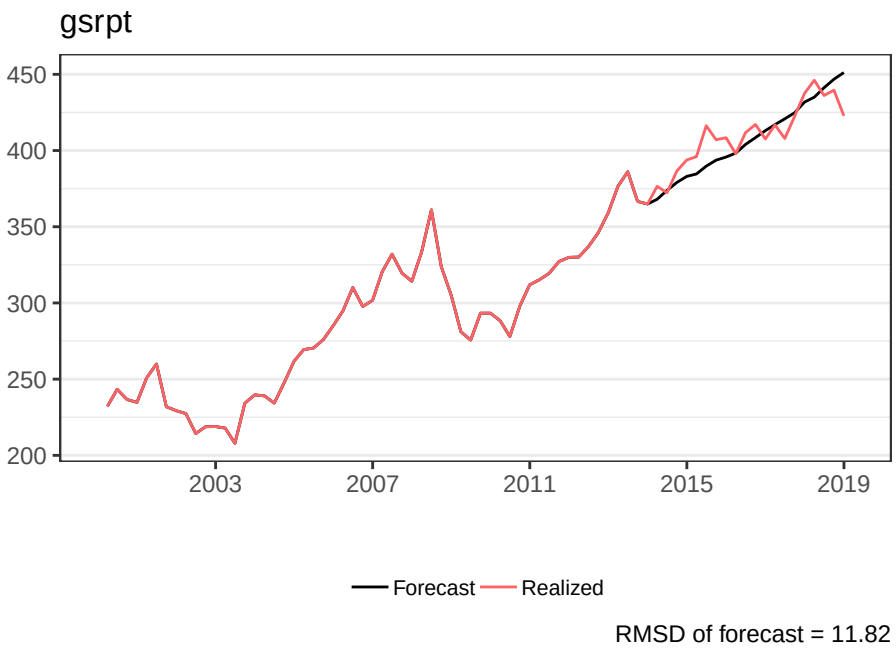


RMSD of forecast = 2.43

Assuming constant tax rate

Personal income taxes grow with nominal private consumption. All other taxes grow with nominal GDP.

[[1]]



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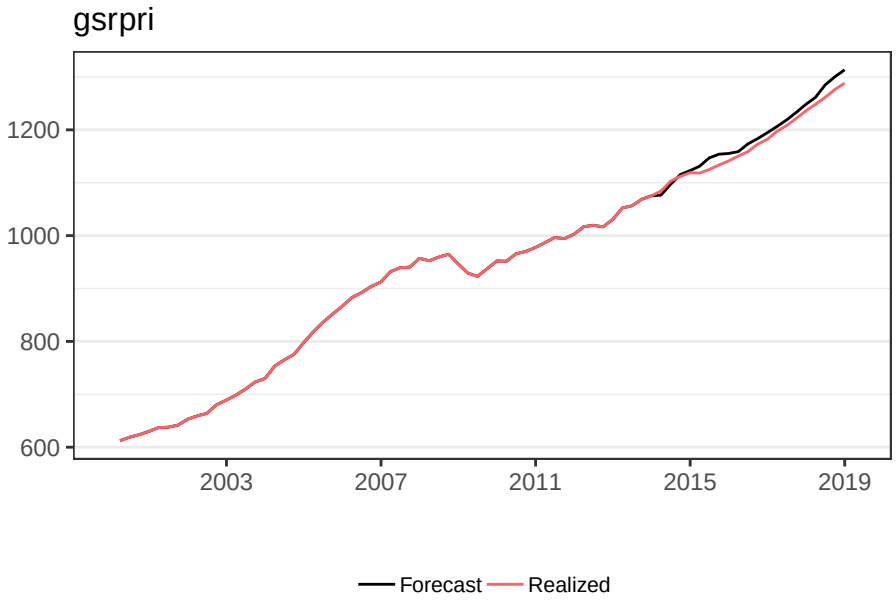
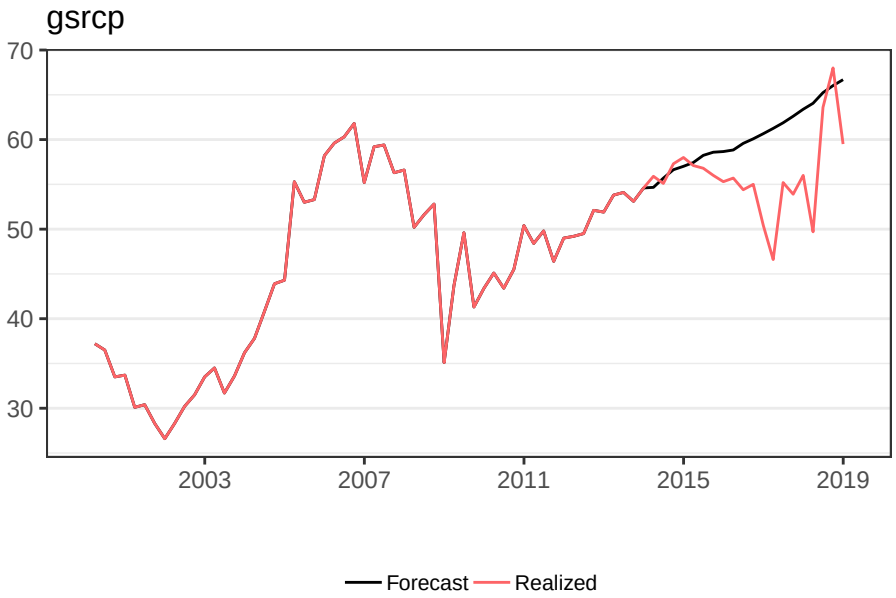


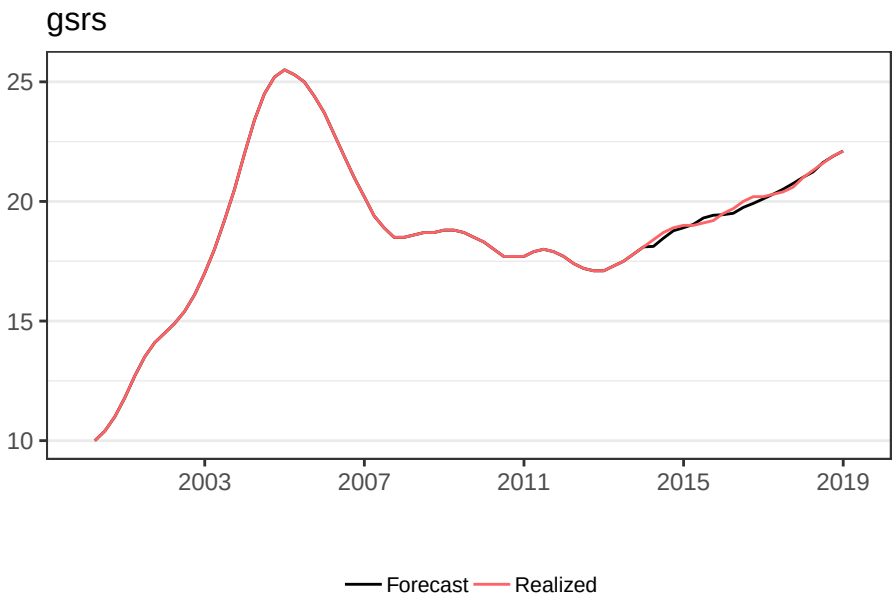
RMSD of forecast = 14.72

[[3]]



RMSD of forecast = 6.5

[[4]]



RMSD of forecast = 0.16

RMSD of forecasts by regression specifications

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	Nominal Levels	Tax Rates & Output Gap	Differenced Levels	Constant tax rate
gsrpt	33.43	22.99	27.63	11.82
gsrpri	12.26	13.38	19.59	14.72
gsrcp	5.21	7.14	4.13	6.50
gsrs	4.87	3.54	2.43	0.16