Dynamic behavior of the model

Round: 2024 Nov Forecast, time: 03-Feb-2025 16:49:18.

1   Steady states

|	
Consumption gap, % [l_cons_gap]	0.00
Investment gap, % [l_inv_gap]	0.00
Gov. demand gap, % [l_gdem_gap]	0.00
Export gap, % [l_exp_gap]	−0.00
Output gap, % [l_y_gap]	0.00
Real exchng. rate gap, % [l_z_gap]	−0.00
RIR (policy) gap, % [r_gap]	0.00
RMC, % [rmc]	−0.00
Budget deficit, % of GDP [def_y]	11.00
Struct. deficit, % of GDP [def_y_str]	11.00
Discr. deficit, % of GDP [def_y_discr]	0.00
Fiscal grants, % of GDP [grants_y]	5.00
Core rel. price gap, % [l_rp_cpi_core_gap]	−0.00
Food rel. price gap, % [l_rp_cpi_food_gap]	0.00
Energy rel. price gap, % [l_rp_cpi_ener_gap]	0.00
Lending premium gap, % [prem_d_gap]	0.00
Inflation target, YY % [d4l_cpi_tar]	4.88
Headline CPI, ann. QQ % [dl_cpi]	4.88
Core CPI, ann. QQ % [dl_cpi_core]	4.48
Food CPI, ann. QQ % [dl_cpi_food]	6.86
Energy CPI, ann. QQ % [dl_cpi_ener]	4.88
Policy rate (IB rate used), % [i]	6.48
Policy rate tnd (IB rate used), % [i_tnd]	6.48
Real interest (policy) rate, % [r]	2.00
RIR (policy) trend, % [r_tnd]	2.00
Core rel. price tnd., ann. QQ % [dl_rp_cpi_core_tnd]	−0.40
Food rel. price tnd., ann. QQ % [dl_rp_cpi_food_tnd]	1.98
Energy rel. price tnd., ann. QQ % [dl_rp_cpi_ener_tnd]	0.00

2 Impulse response functions

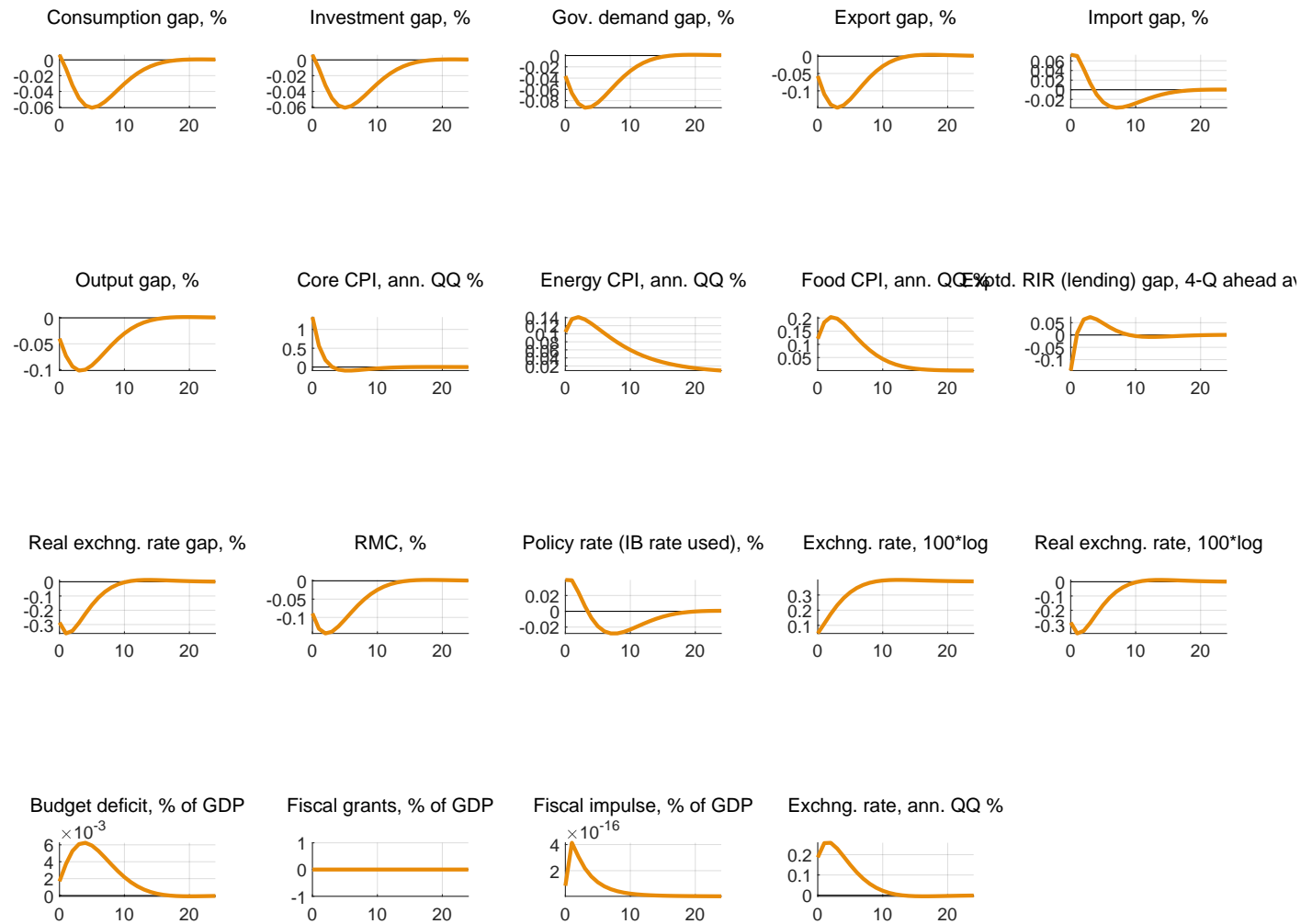# Responses to Cons. gap shock, % [shock_l_cons_gap]
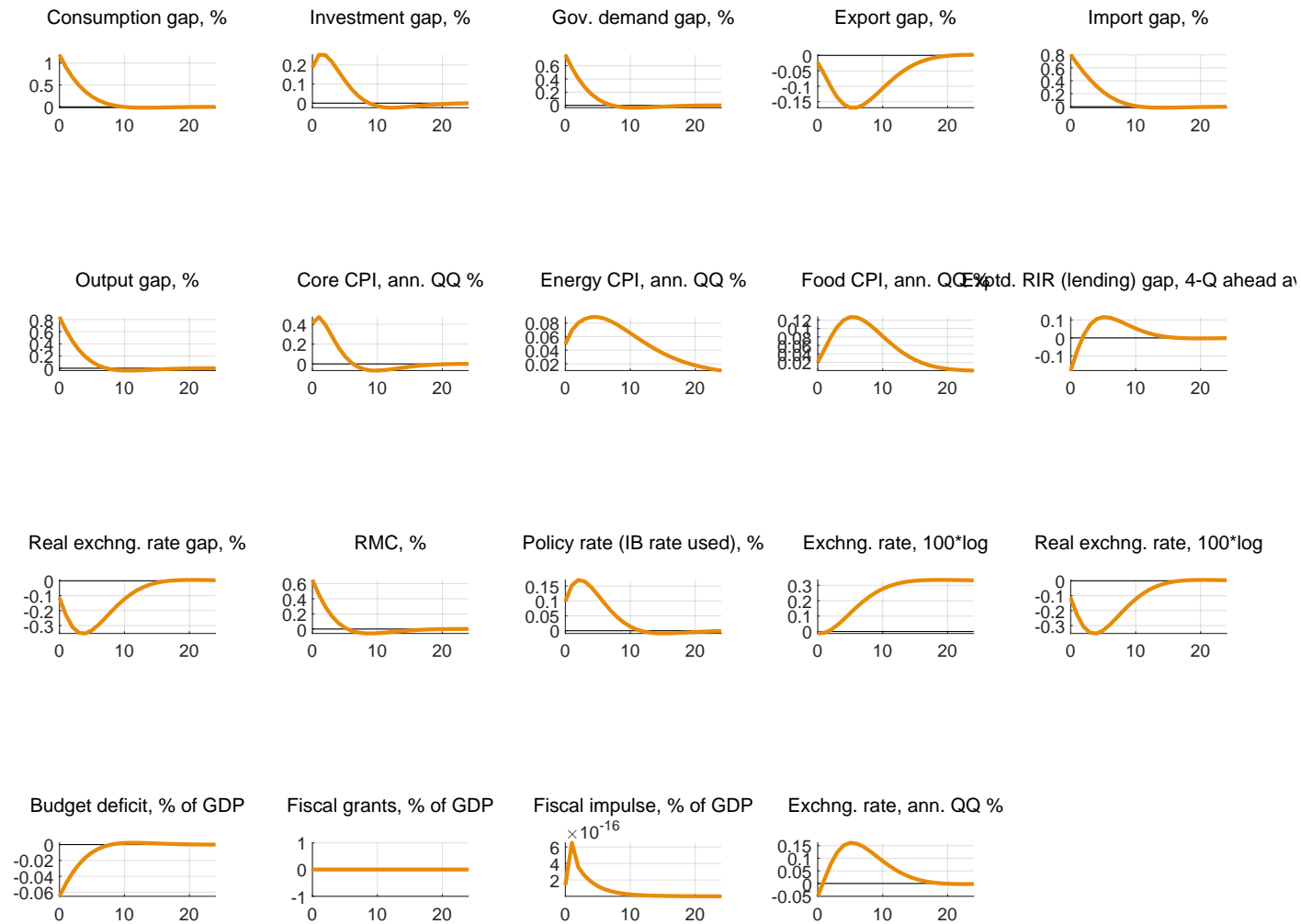
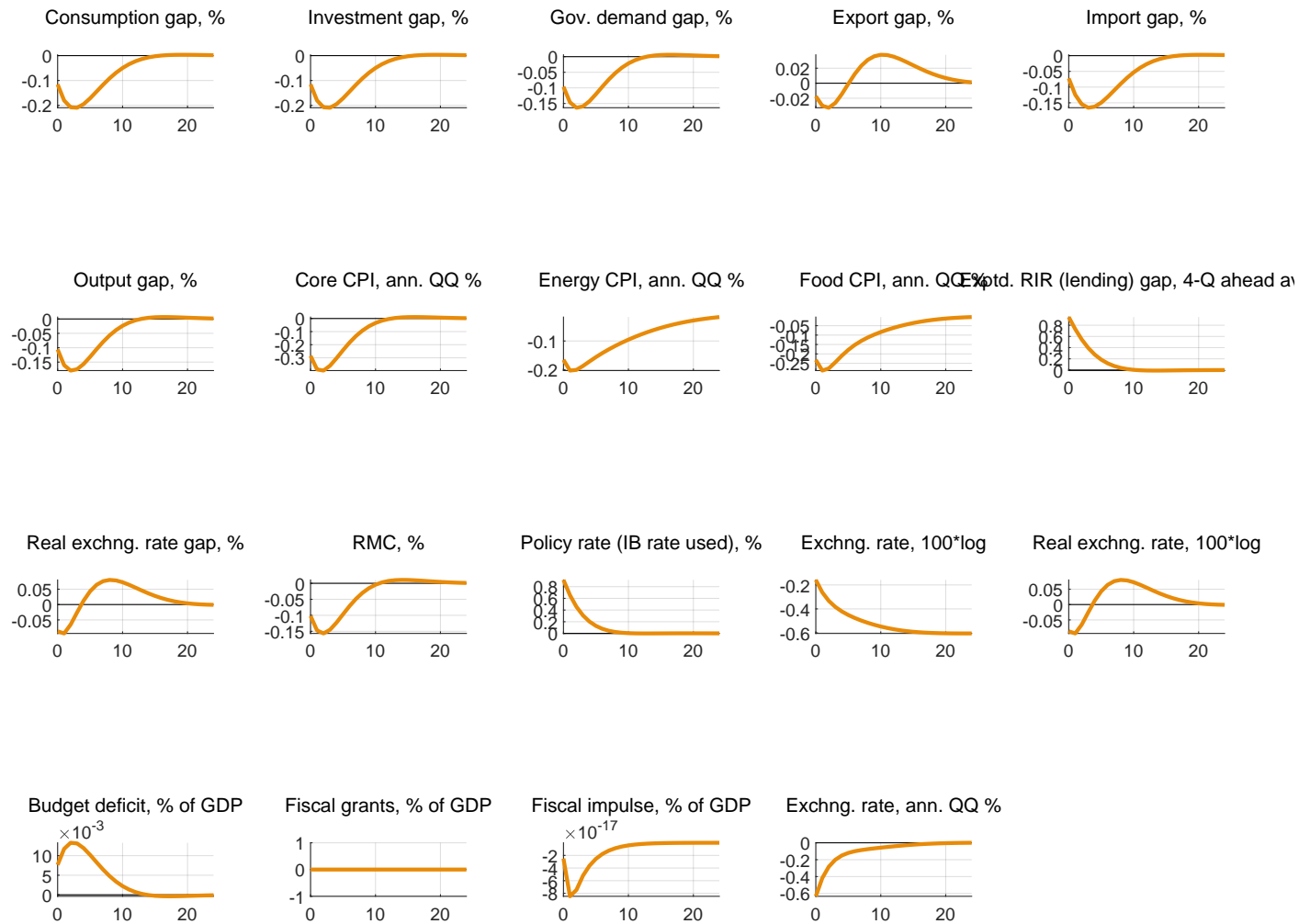# Responses to Inv. gap shock, % [shock_l_inv_gap]

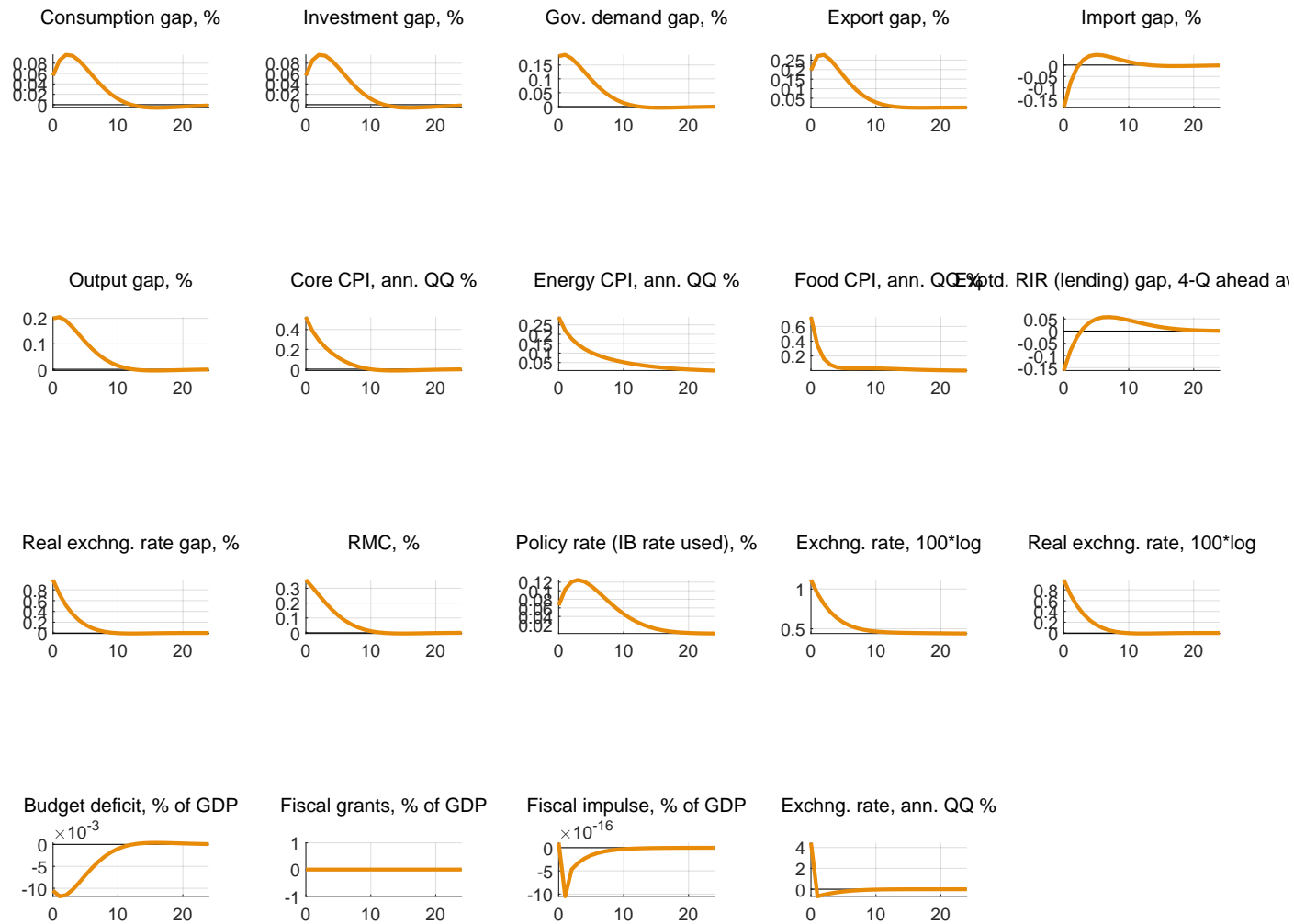# Responses to Export gap shock, % [shock_l_exp_gap]
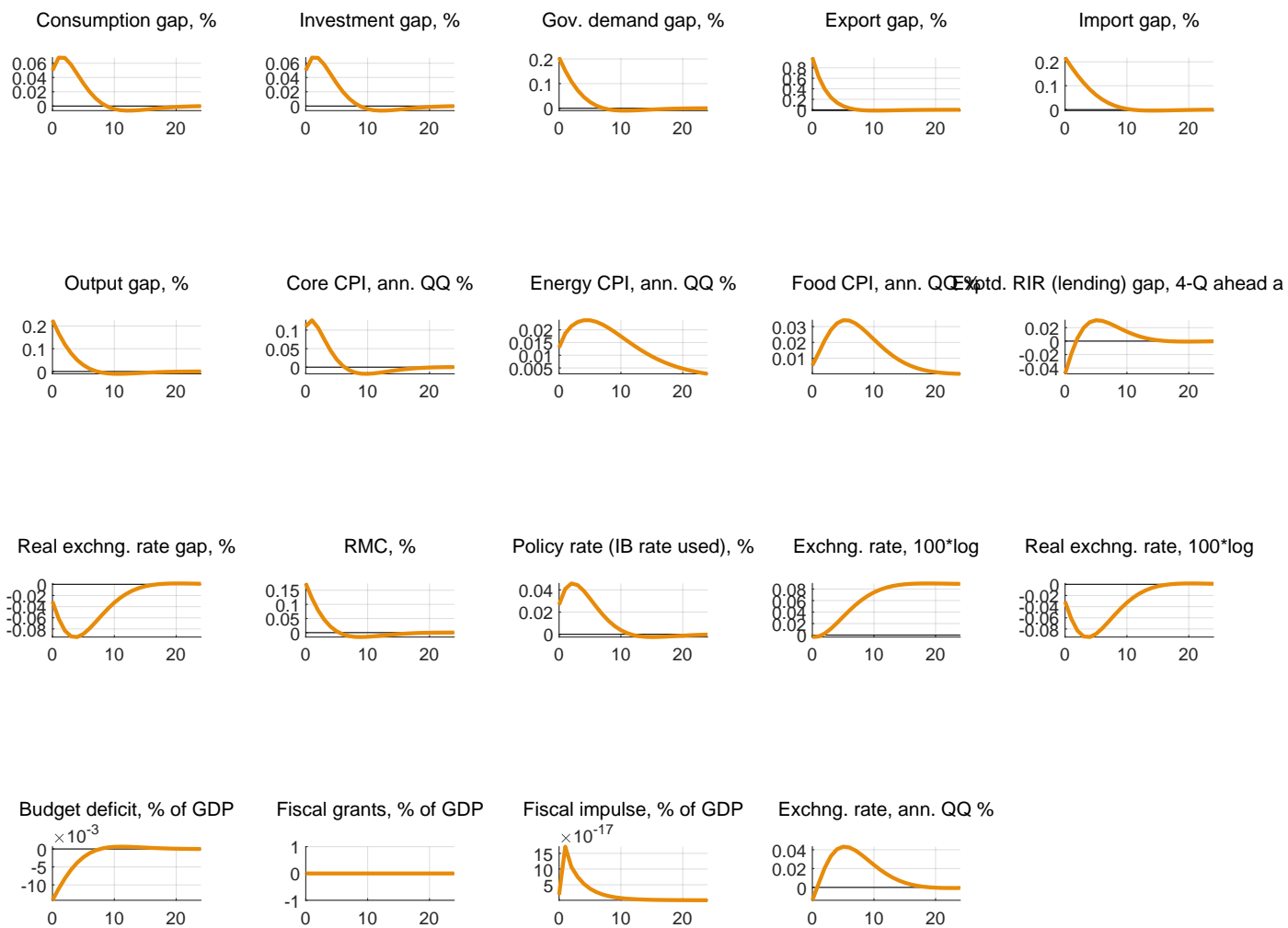
Responses to Core infl. shock, ann. QQ % [shock_dl_cpi_core]
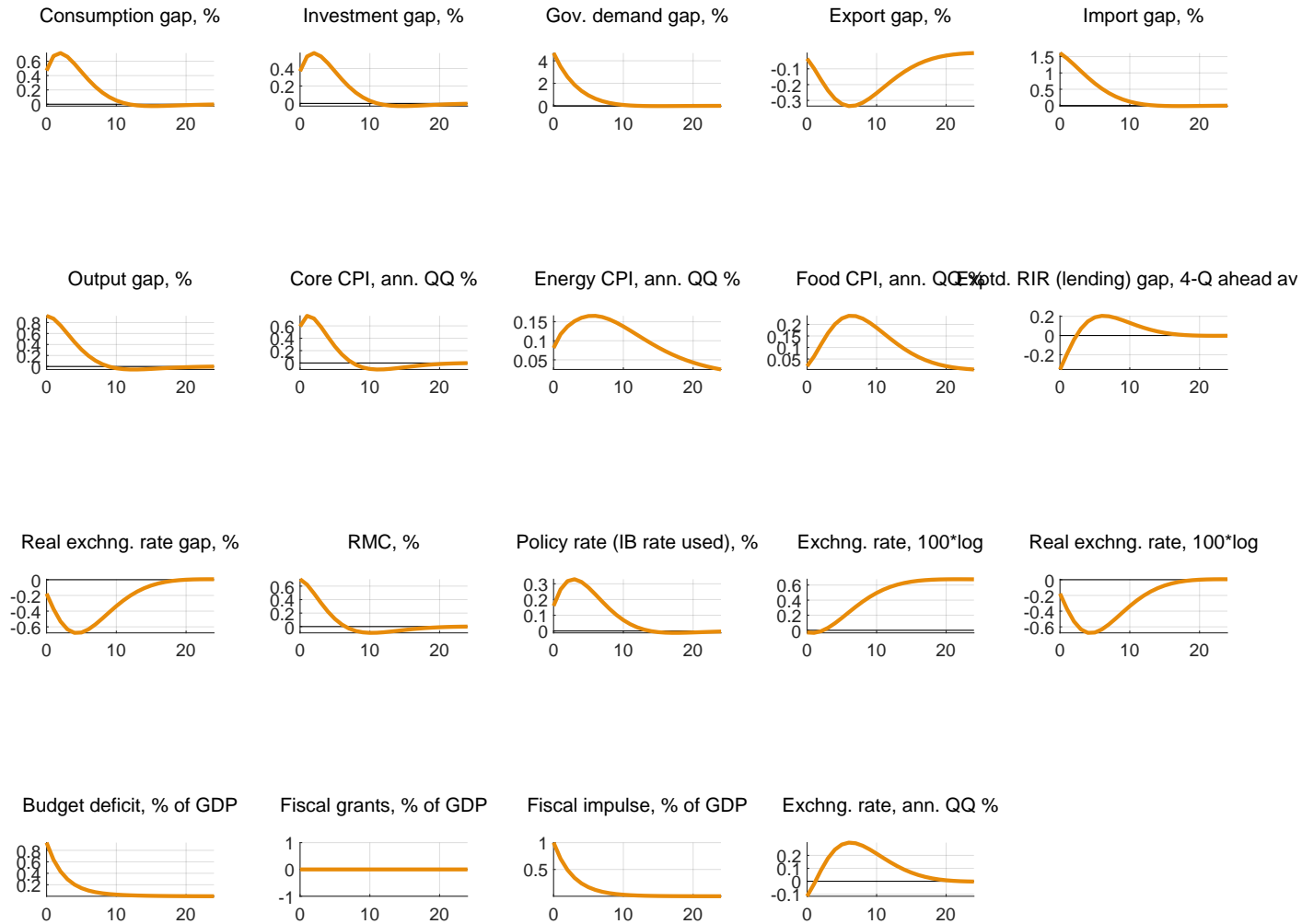
Responses to Policy rate shock, % [shock_i]

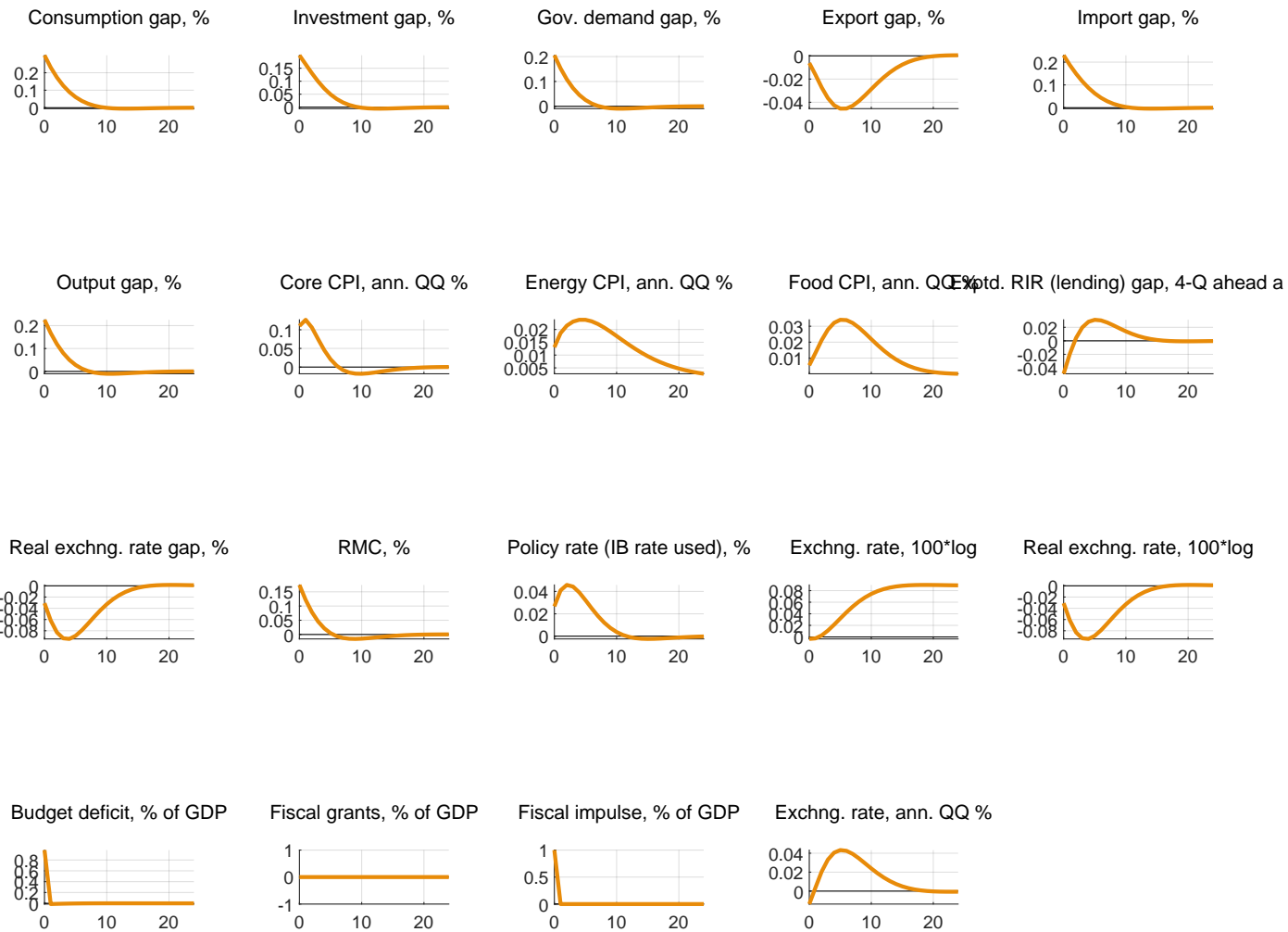# Responses to Exchng. rate shock, 100*log [shock_l_s]

Responses to Gov rev. discr. shock, % of GDP [shock_grev_y_discr]
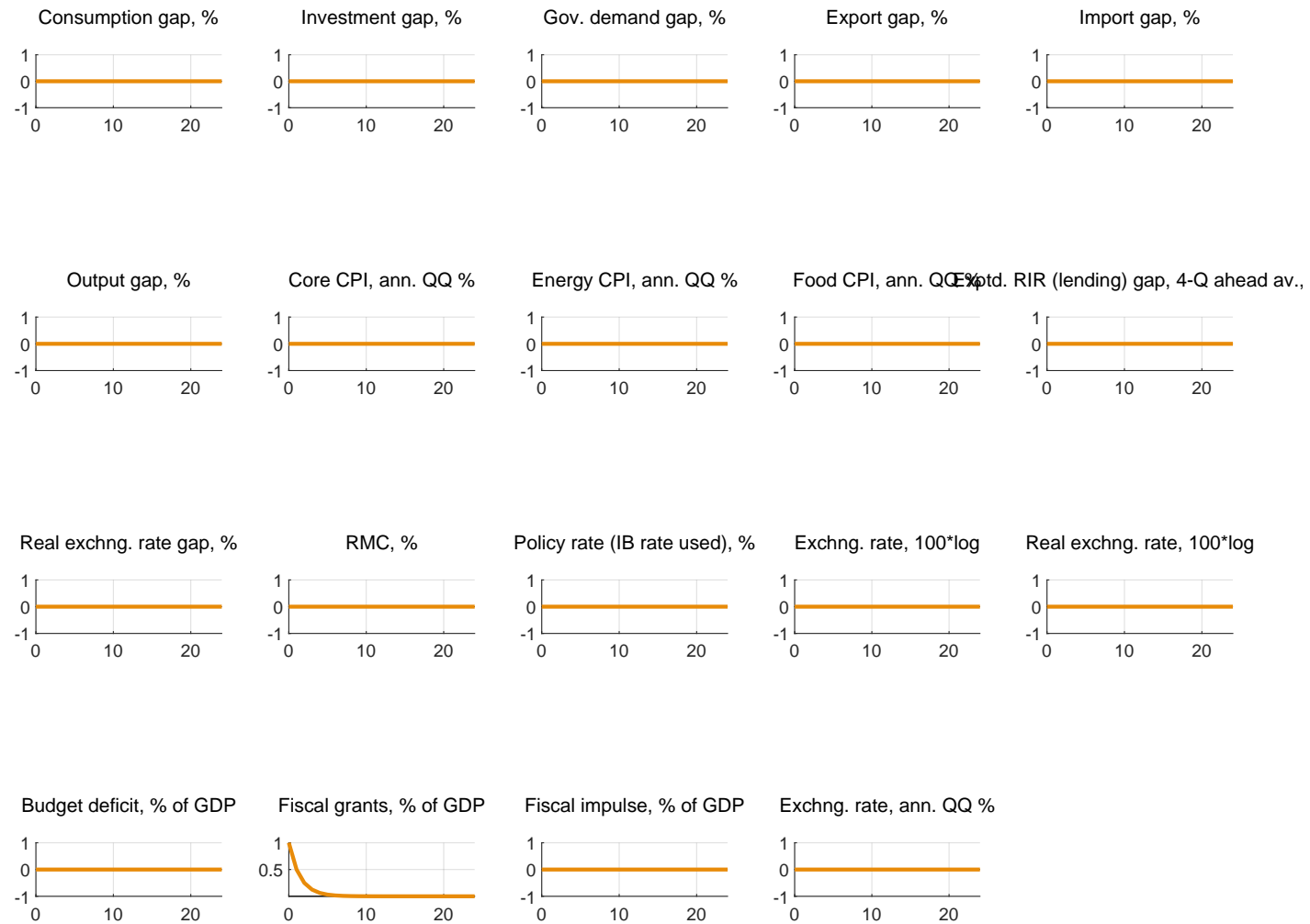
Responses to Gdem. discr. shock, % of GDP [shock_gdem_y_discr]

Responses to Gov exp. discr. shock, % of GDP [shock_oexp_y_discr]

Responses to Fiscal grants, % of GDP [shock_grants_y]

Responses to Foreign intr. rate shock, % [shock_istar]
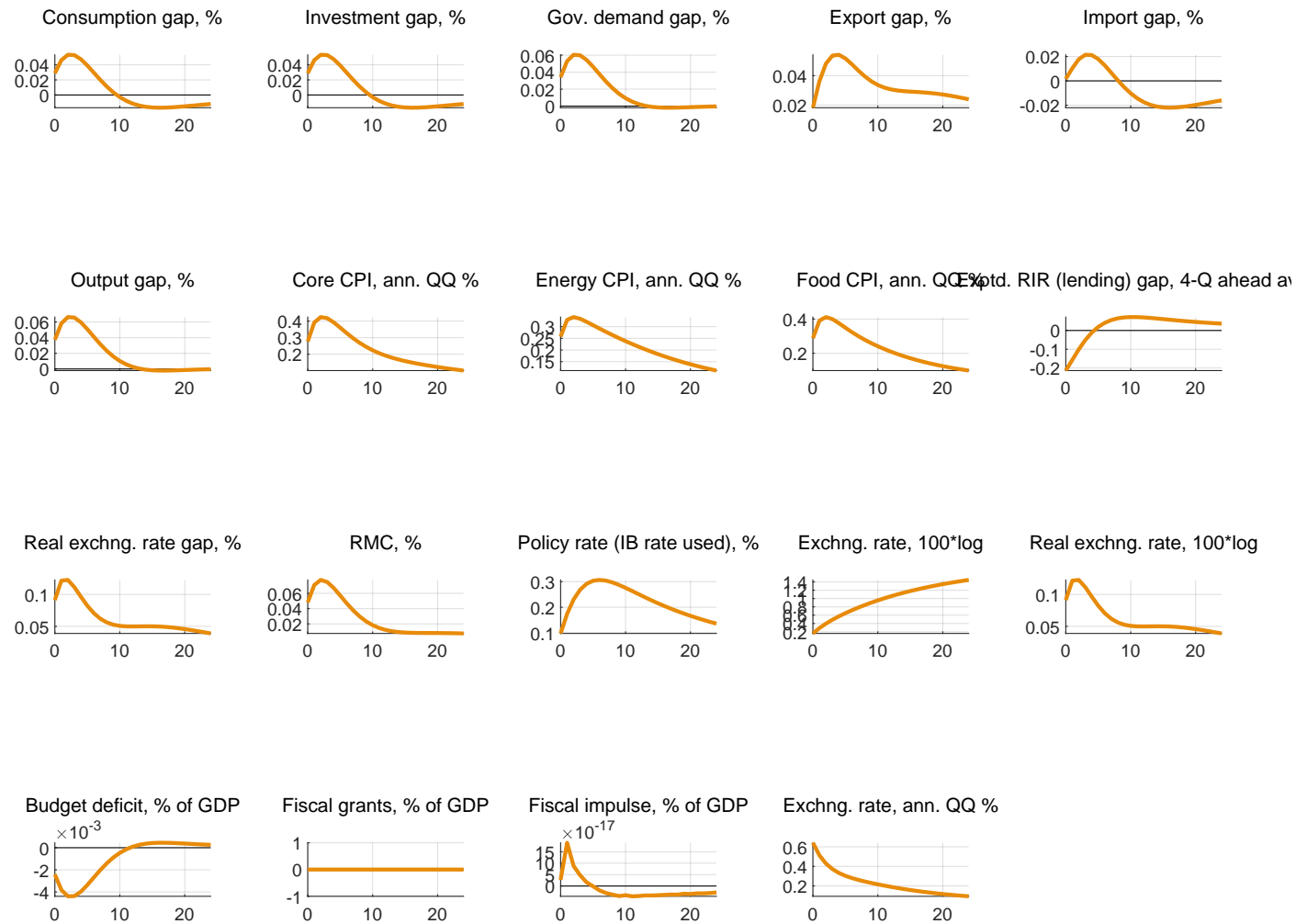
Responses to Foreign CPI shock, ann. QQ % [shock_dl_cpistar]

Responses to Foreign rel. food price gap shock, % [shock_l_rp_foodstar_gap]
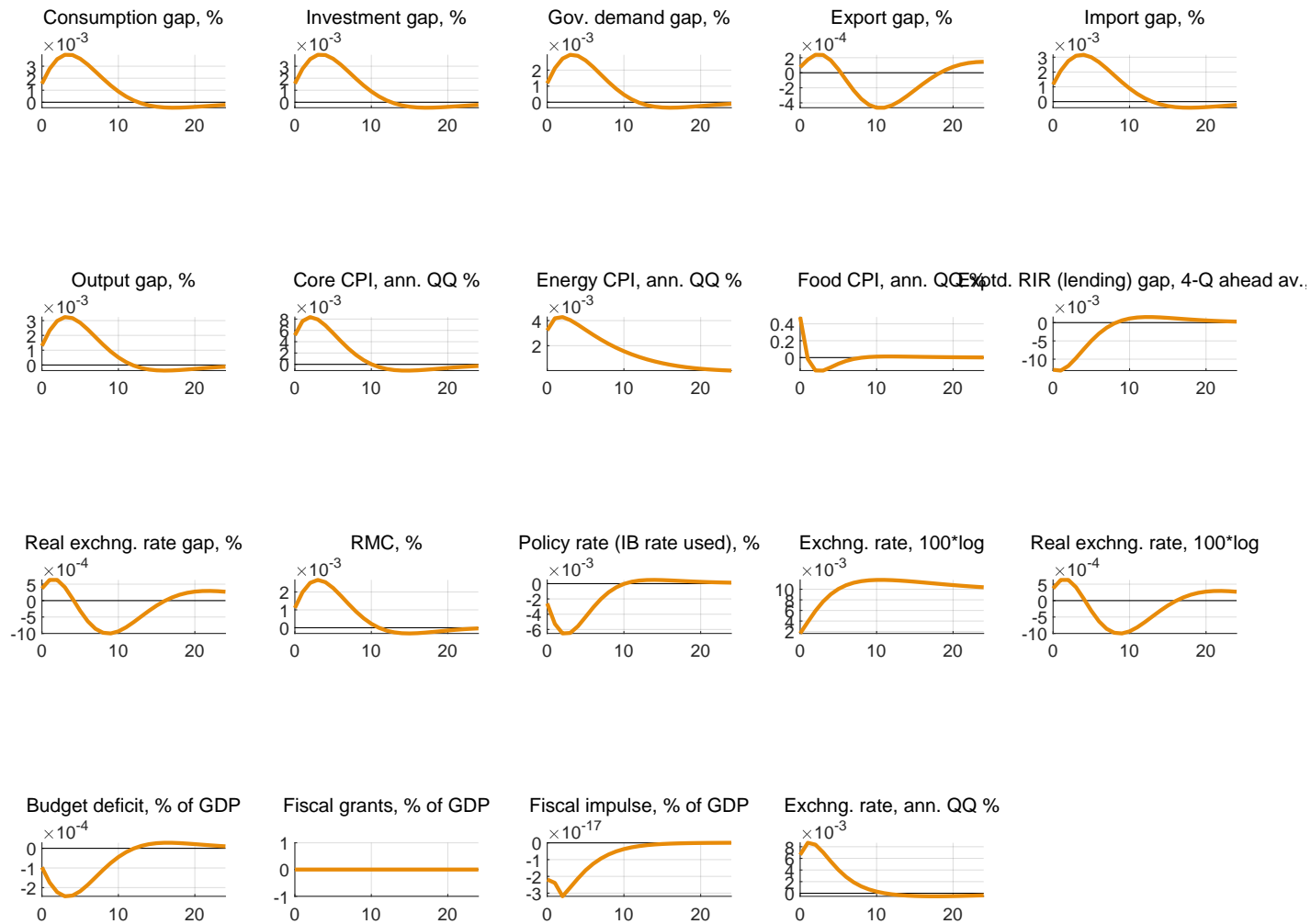
Responses to Foreign rel. ener. price gap shock, % [shock_l_rp_enerstar_gap]
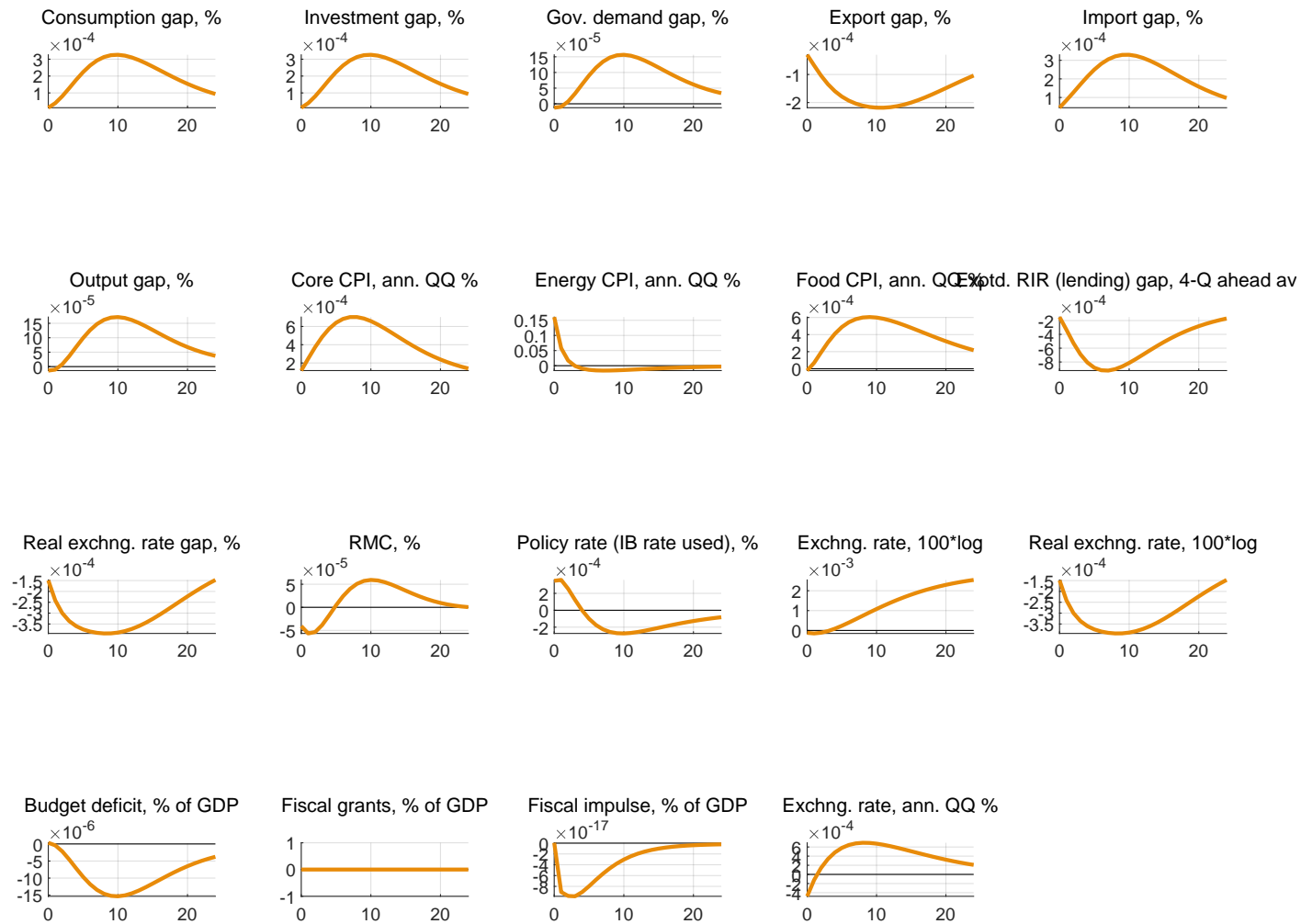
3　Variance decomposition

Budget deficit, % of GDP [def_y]
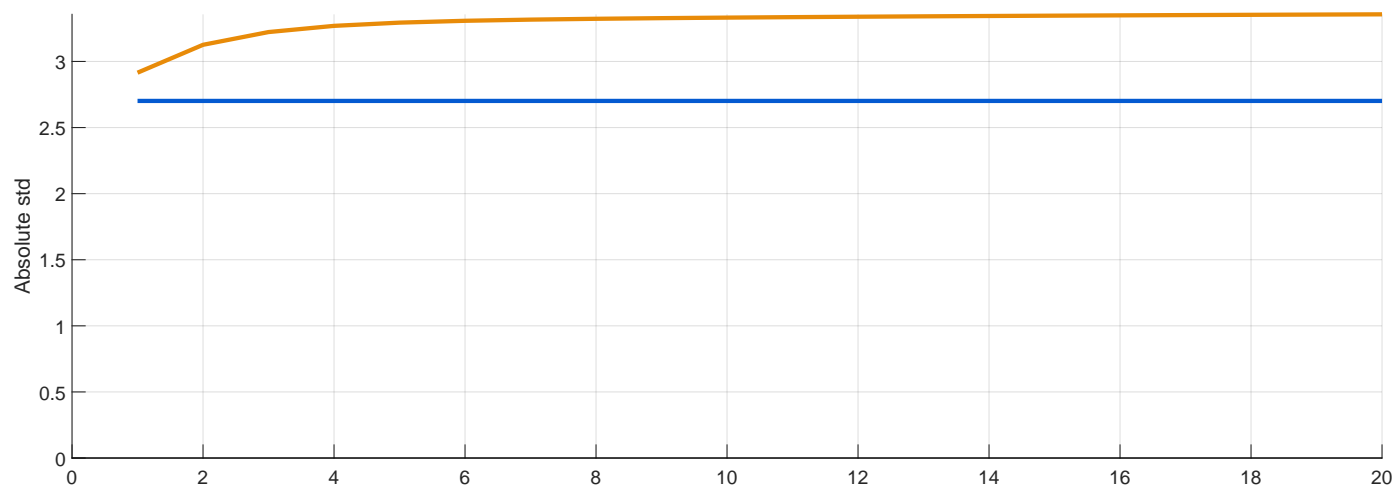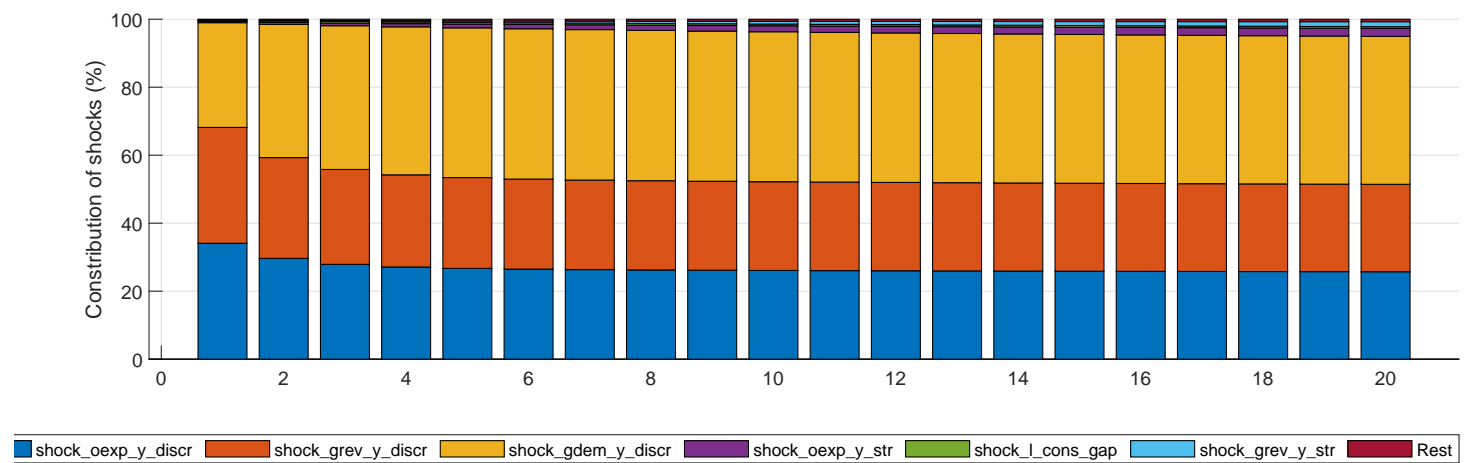
Govt. demand (G&S), % GDP [gdem_y]
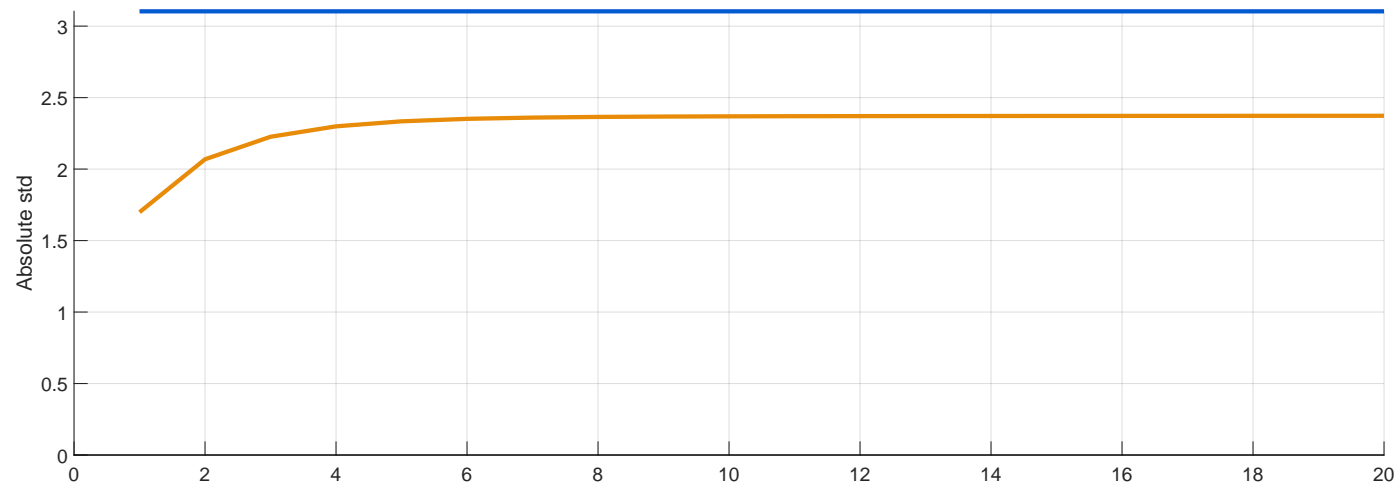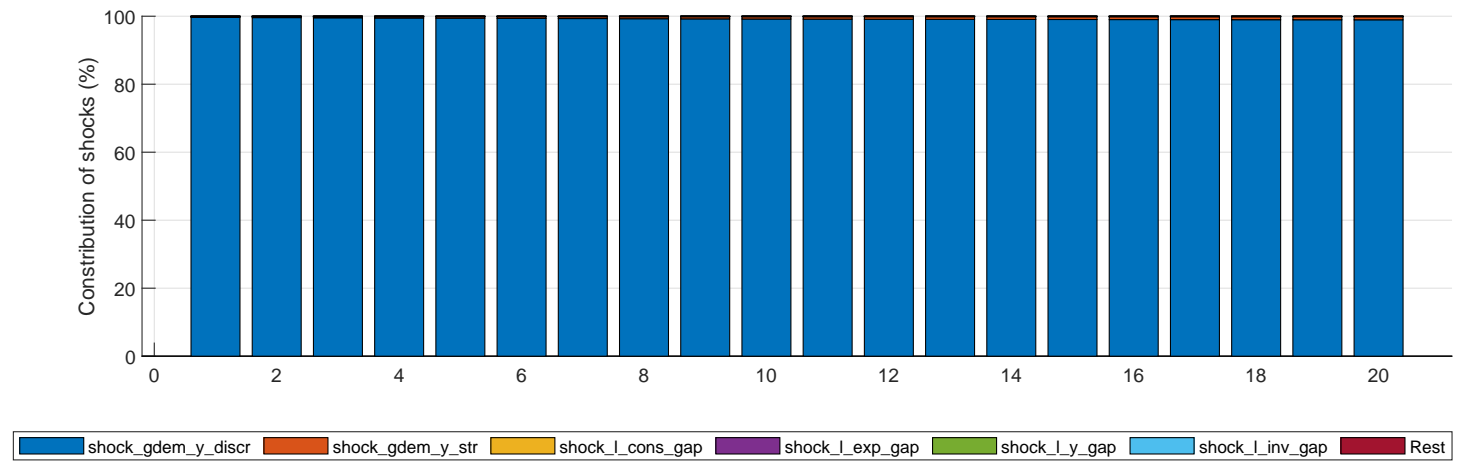
Other govt. exp., % to GDP [oexp_y]
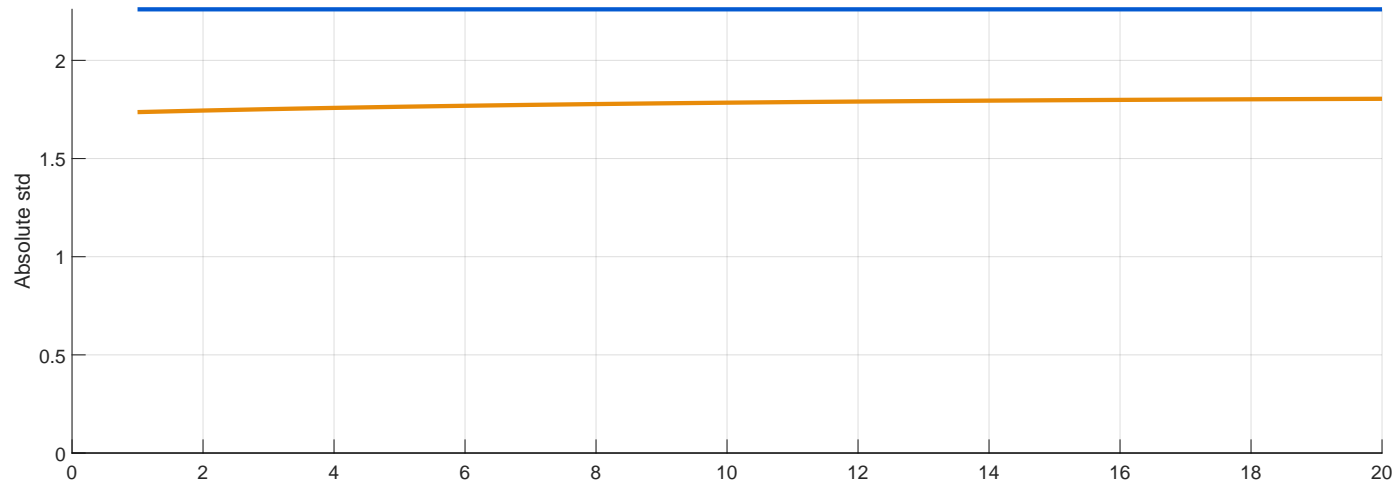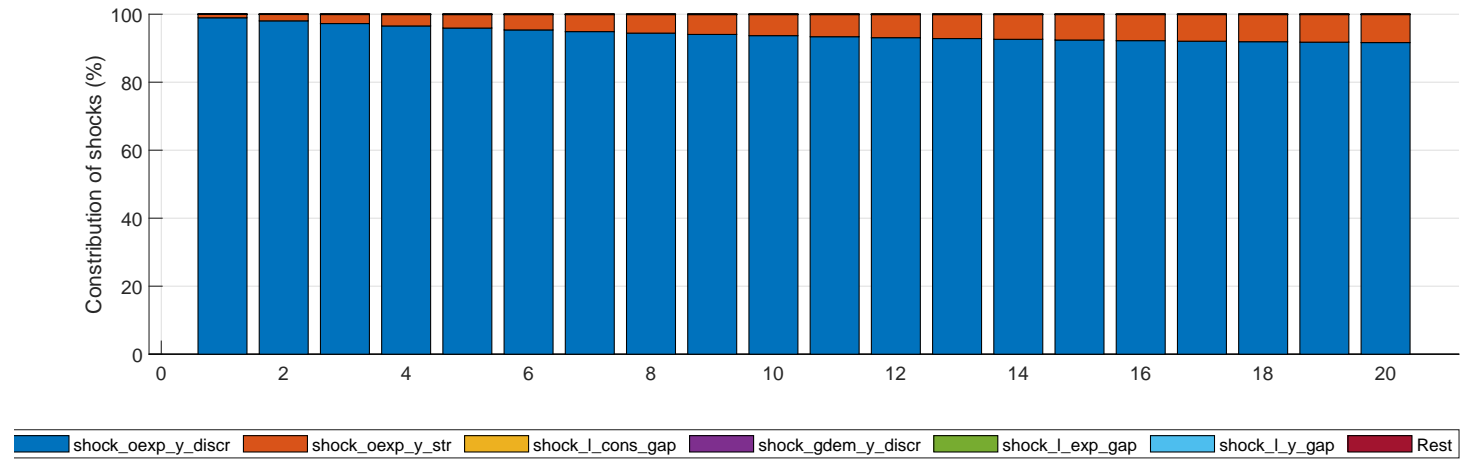
Govt. rev., % of GDP [grev_y]
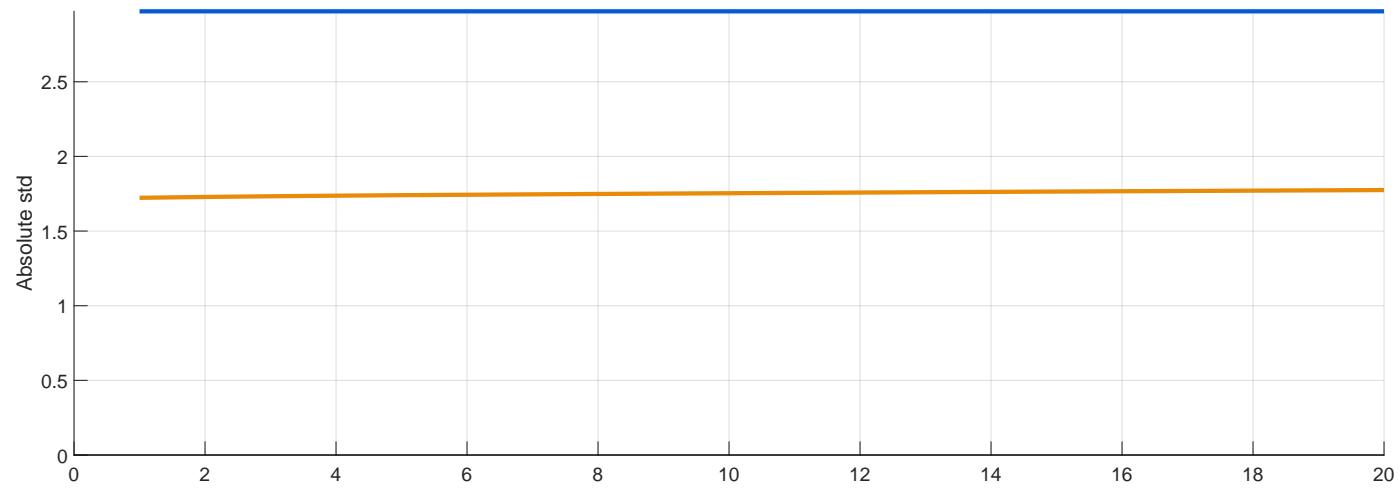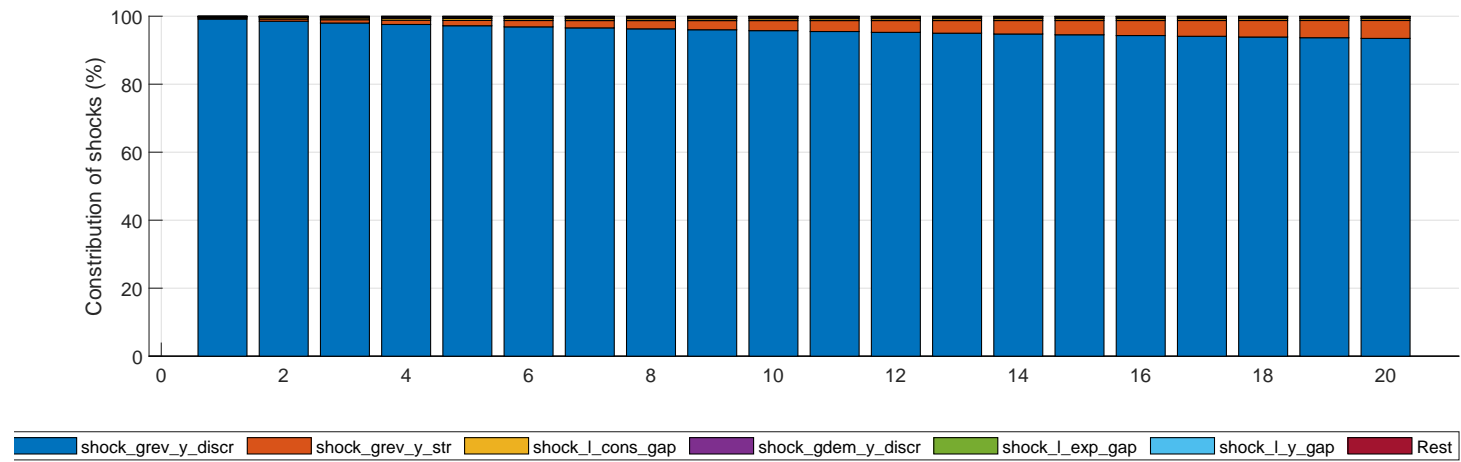
Fiscal grants, % of GDP [grants_y]
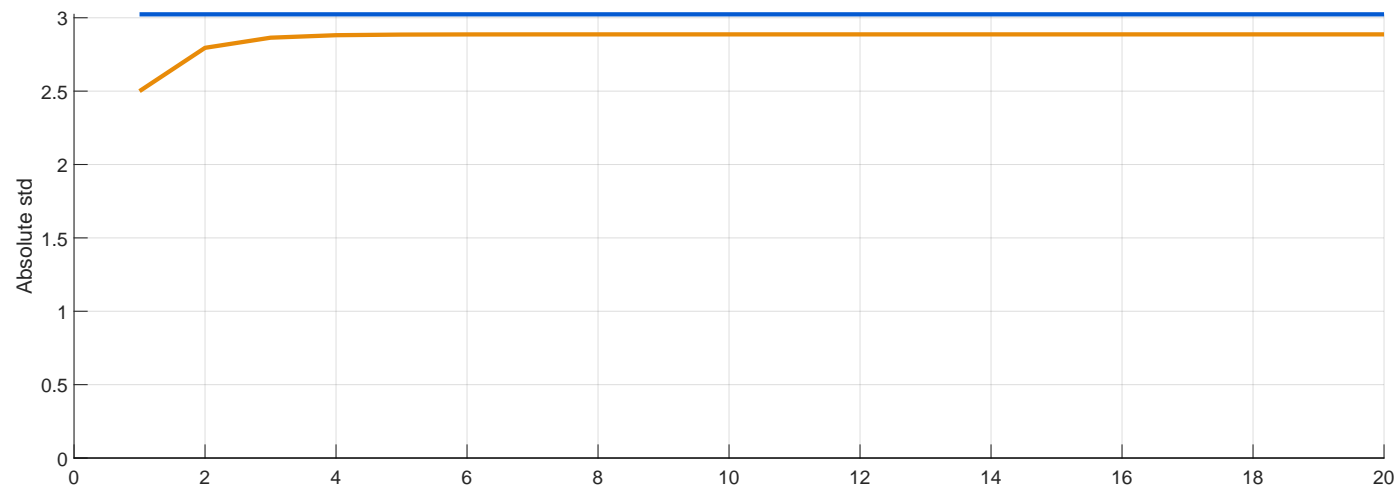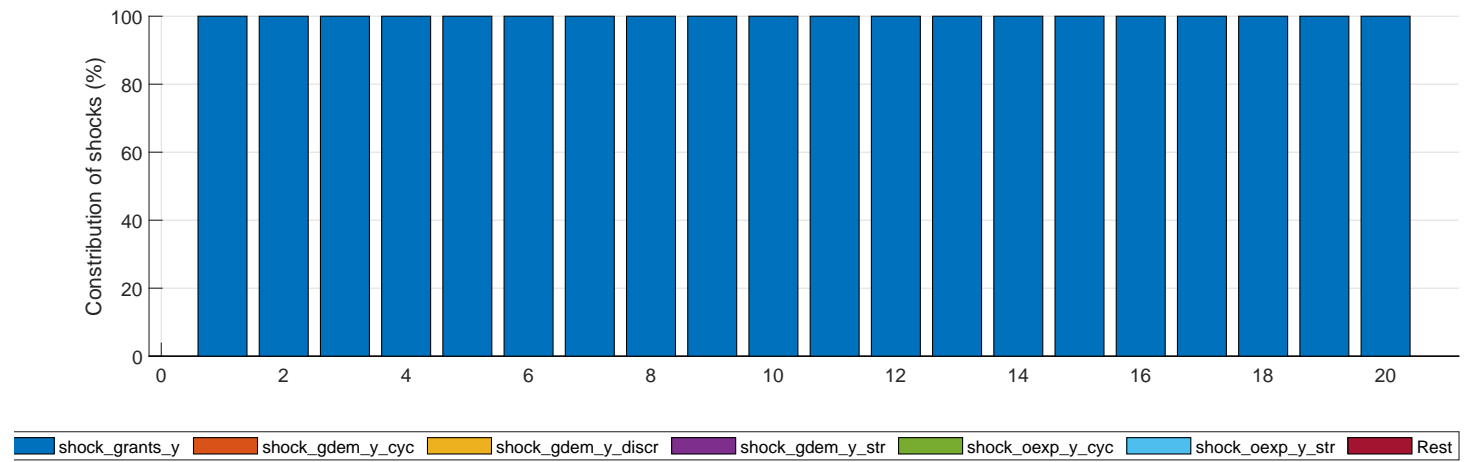
Consumption gap, % [l_cons_gap]
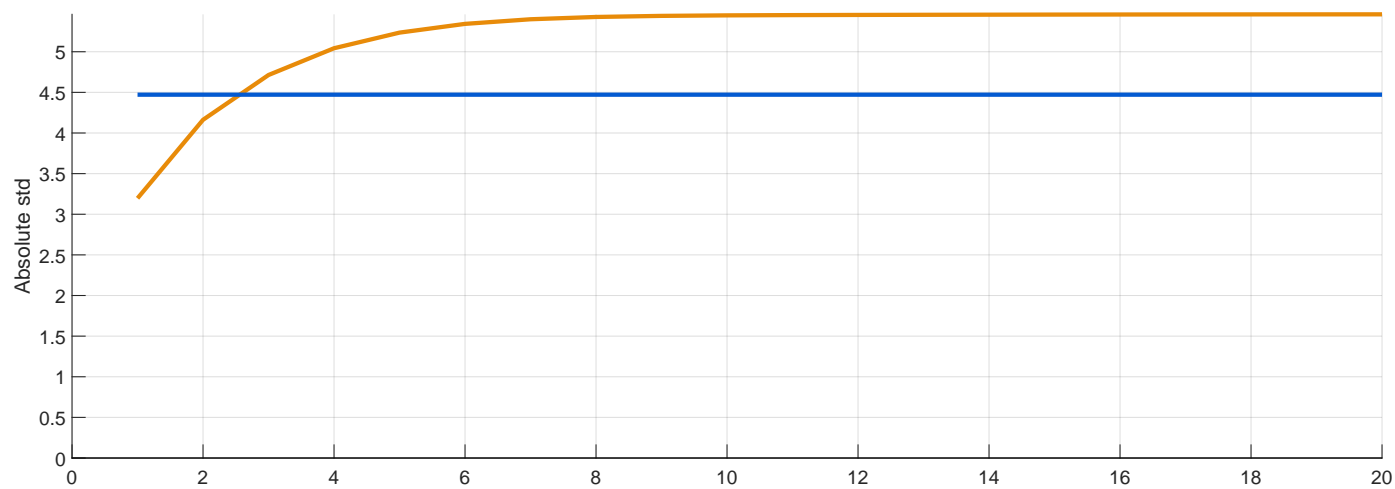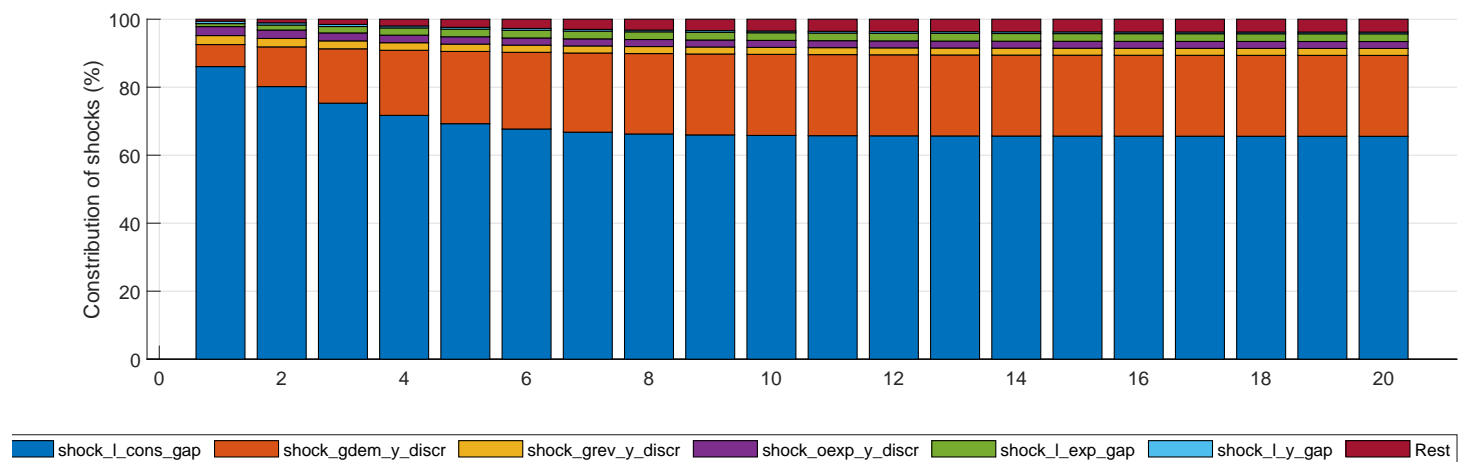
Consumption, ann. QQ % [dl_cons]
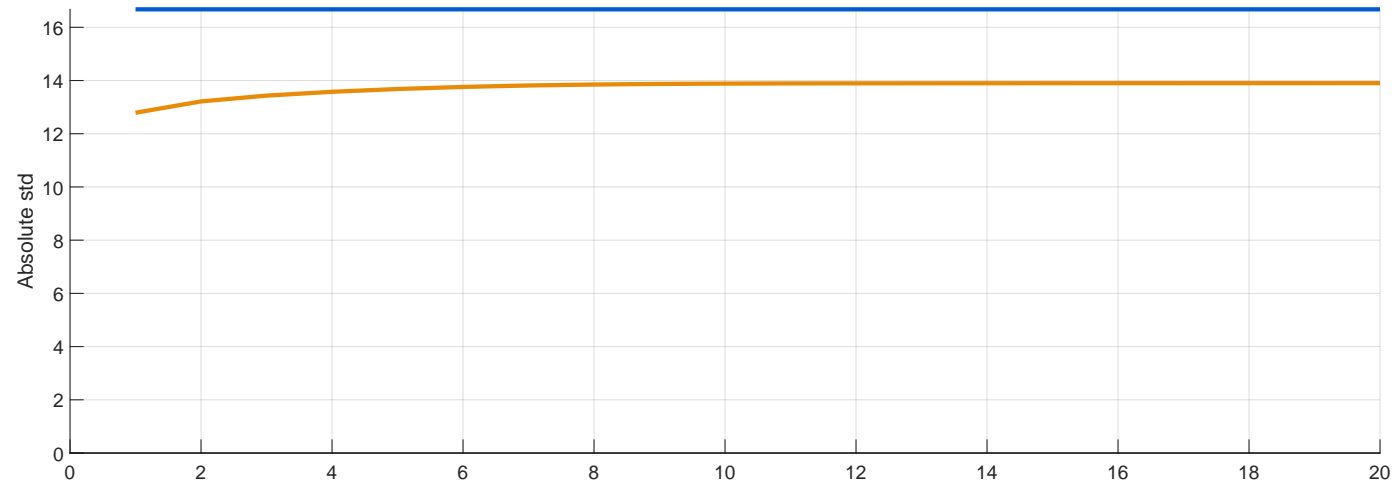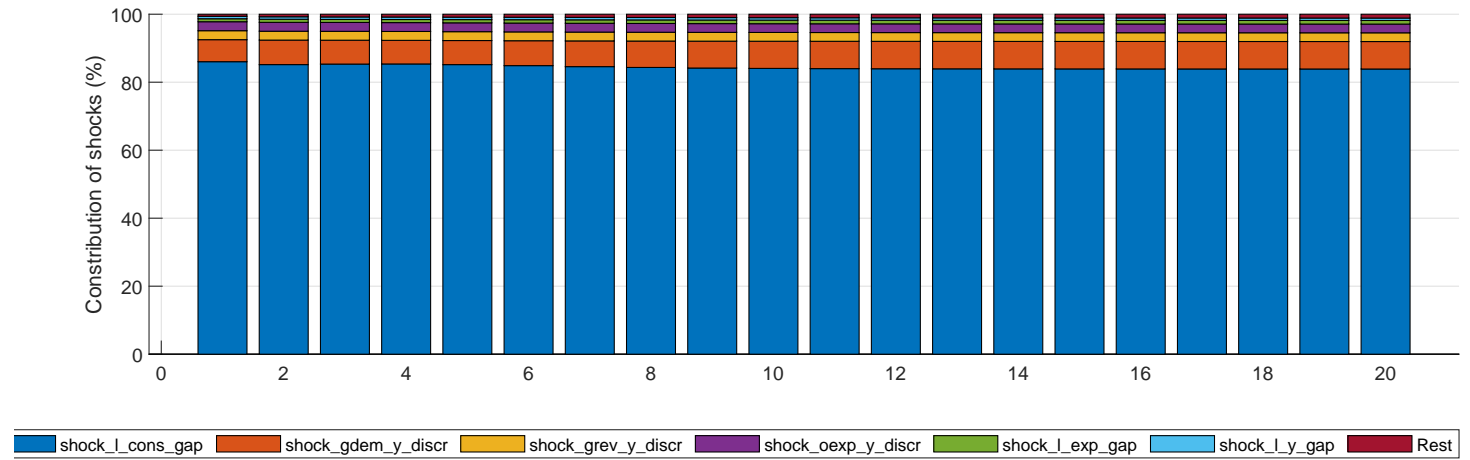
Investment gap, % [l_inv_gap]
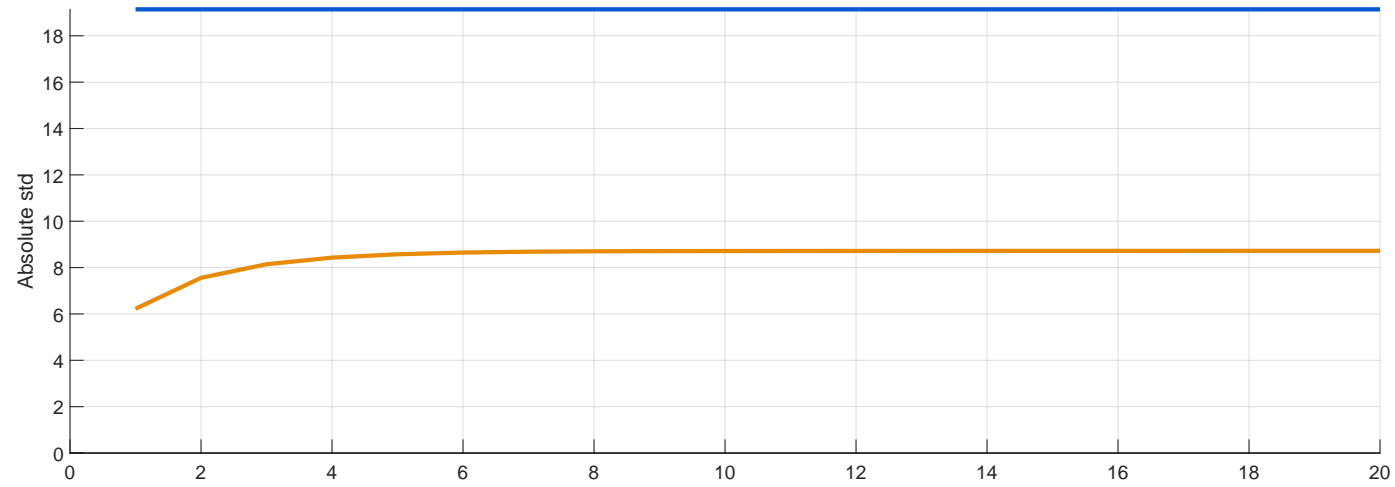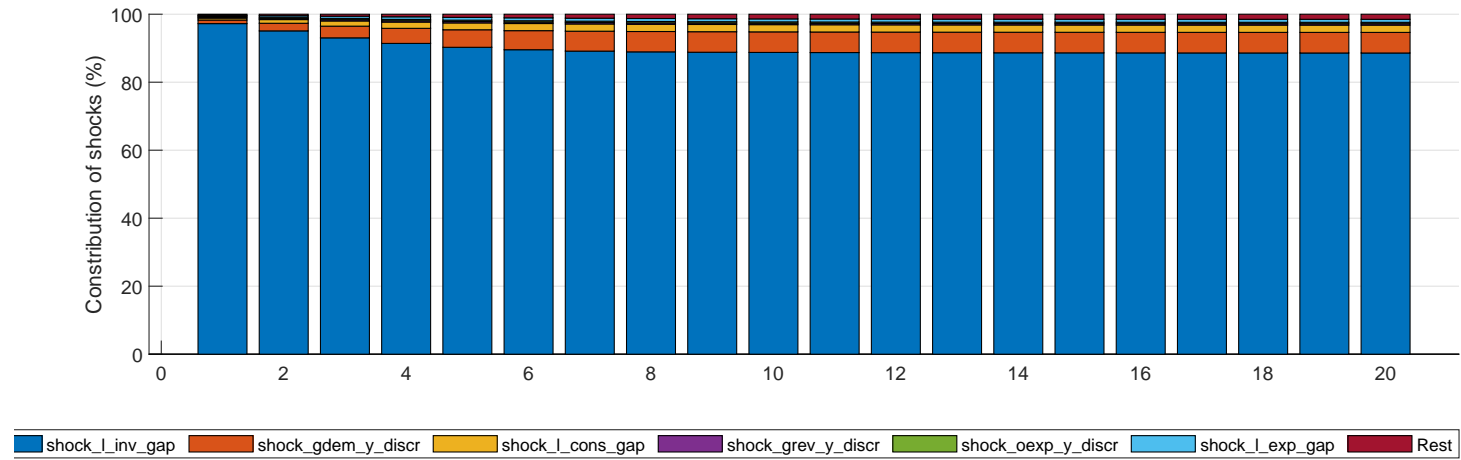
Investment, ann. QQ % [dl_inv]
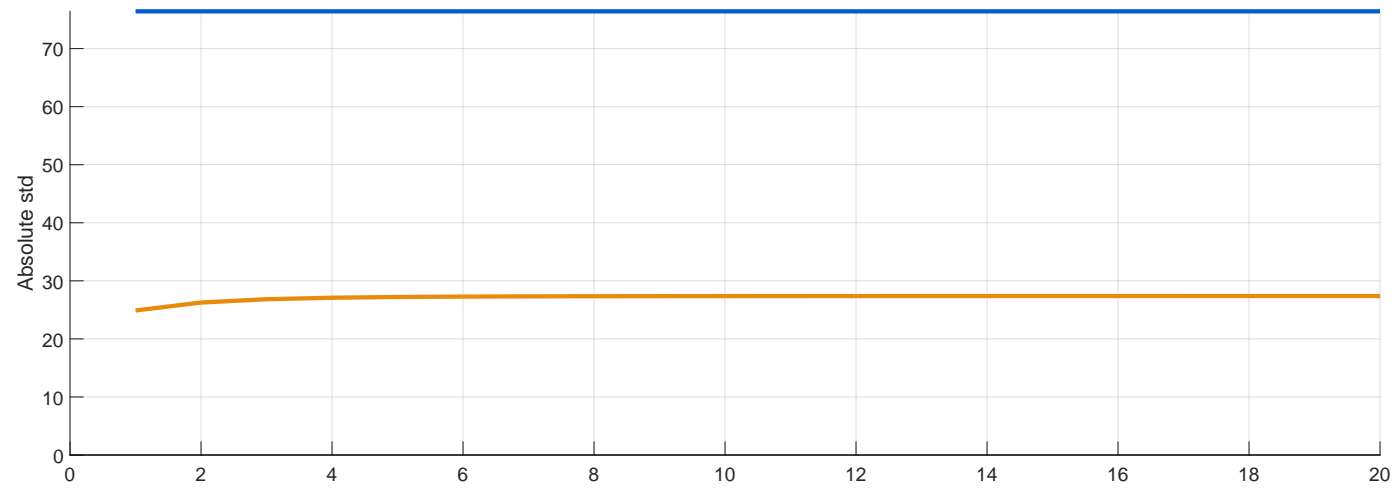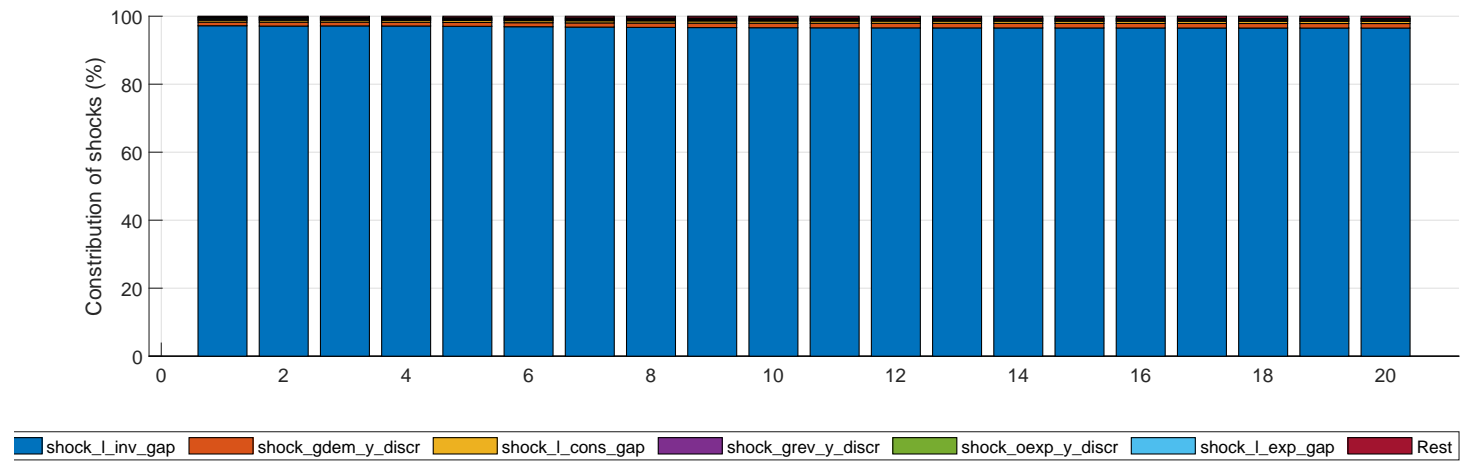
Gov. demand gap, % [l_gdem_gap]
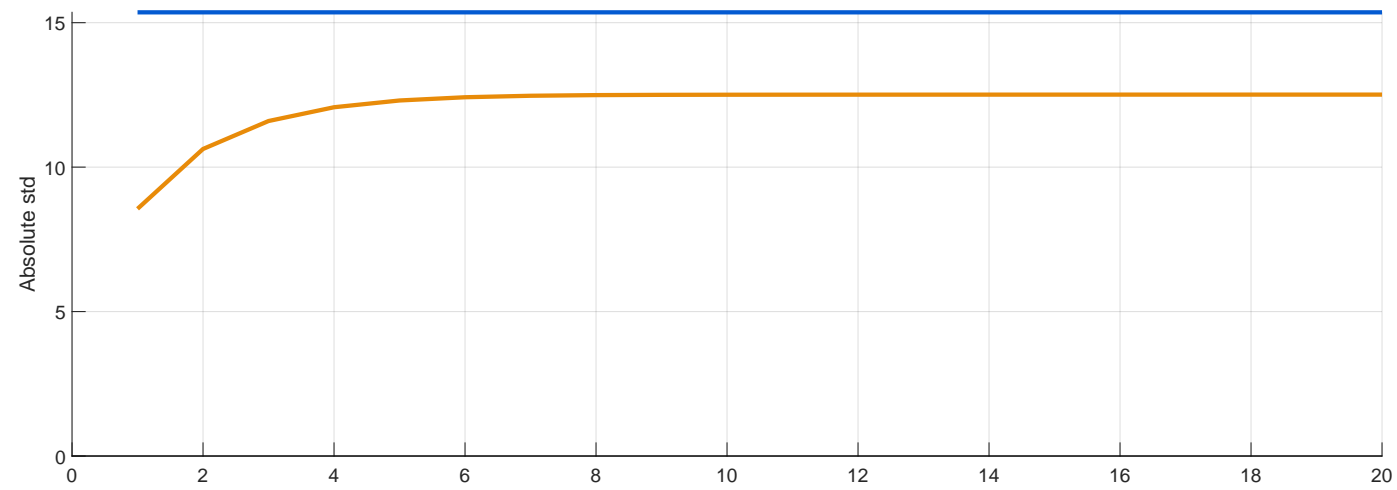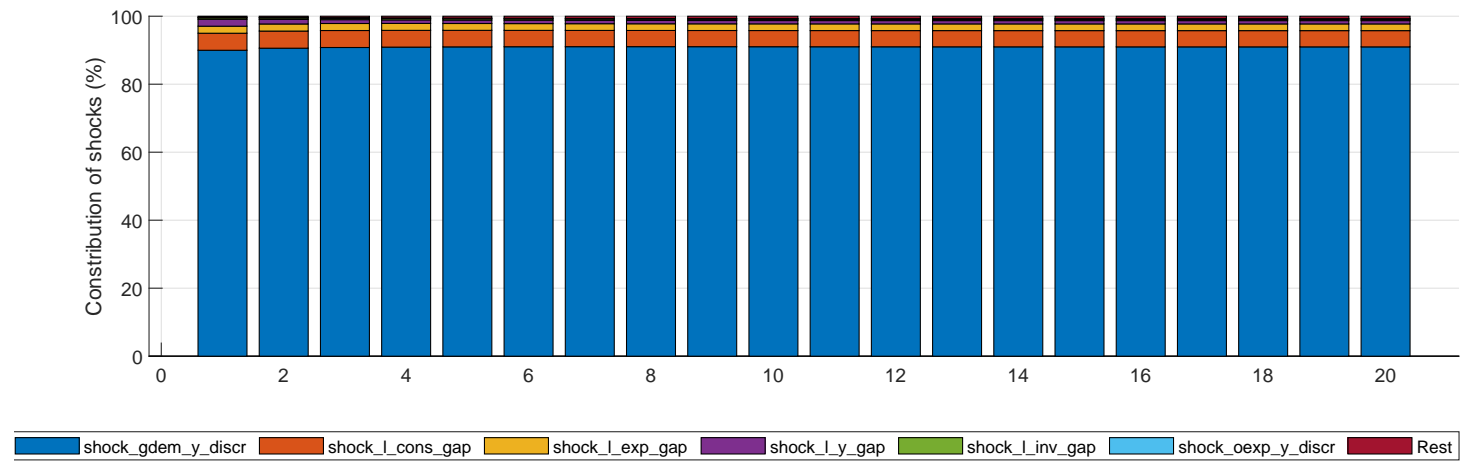
Gov. demand, ann. QQ % [dl_gdem]
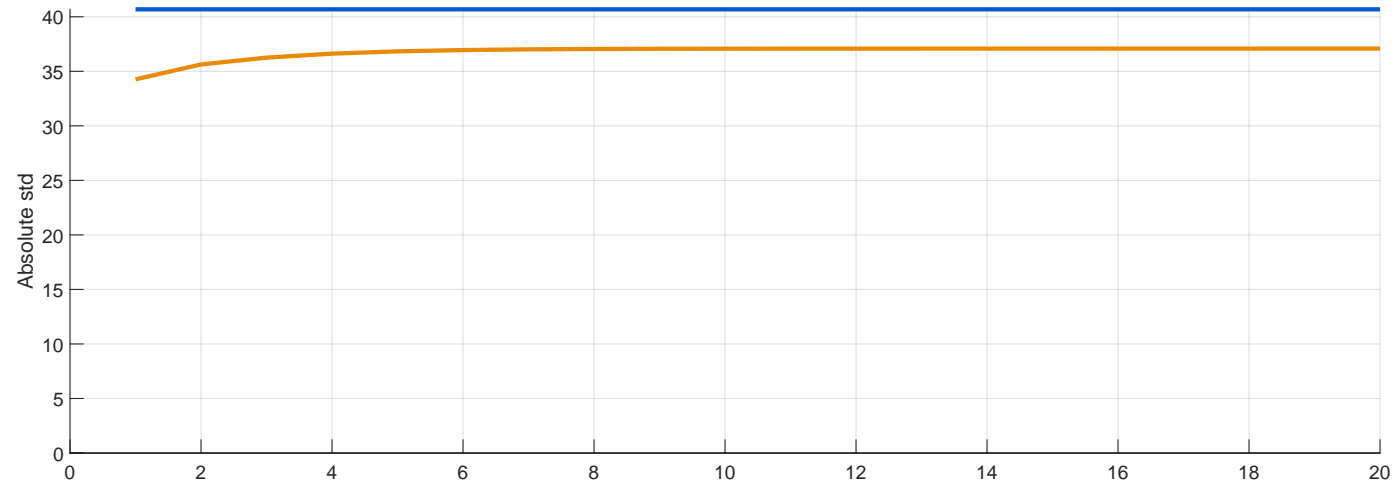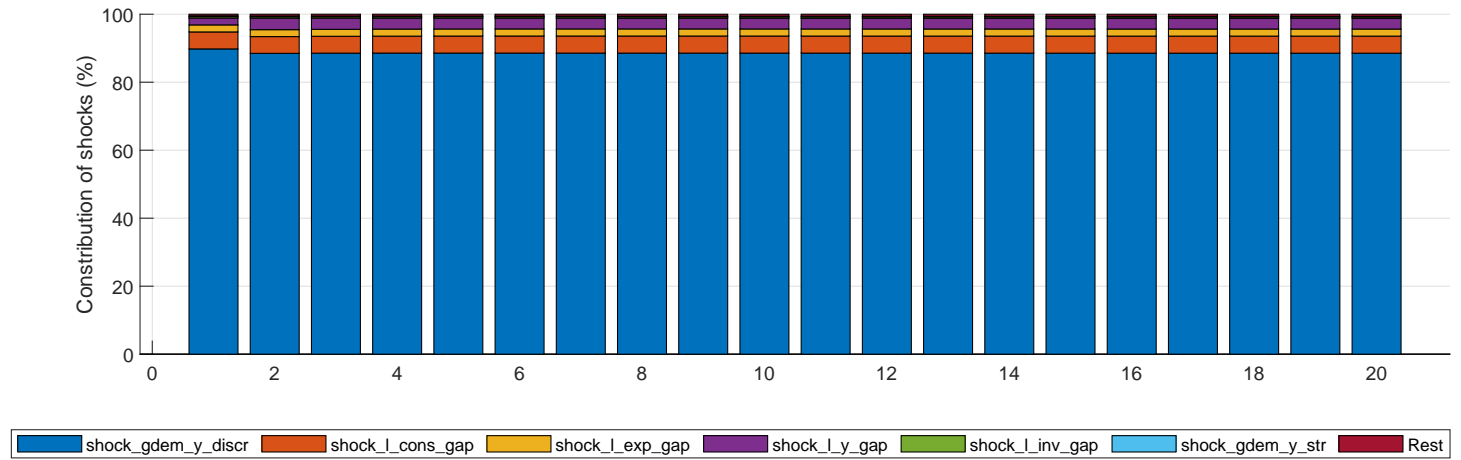
Export gap, % [l_exp_gap]
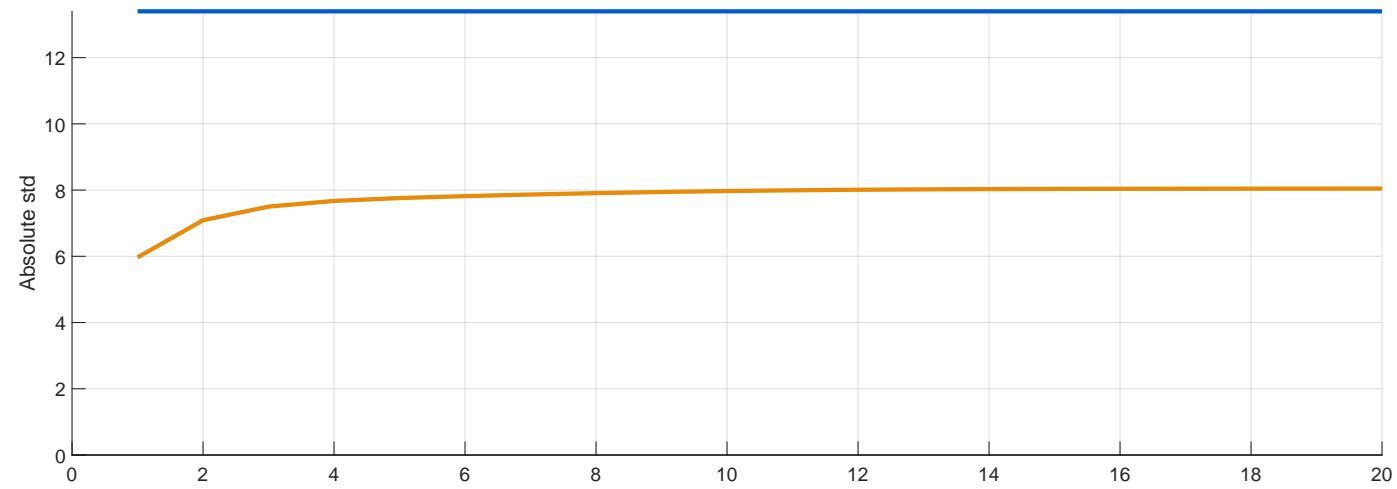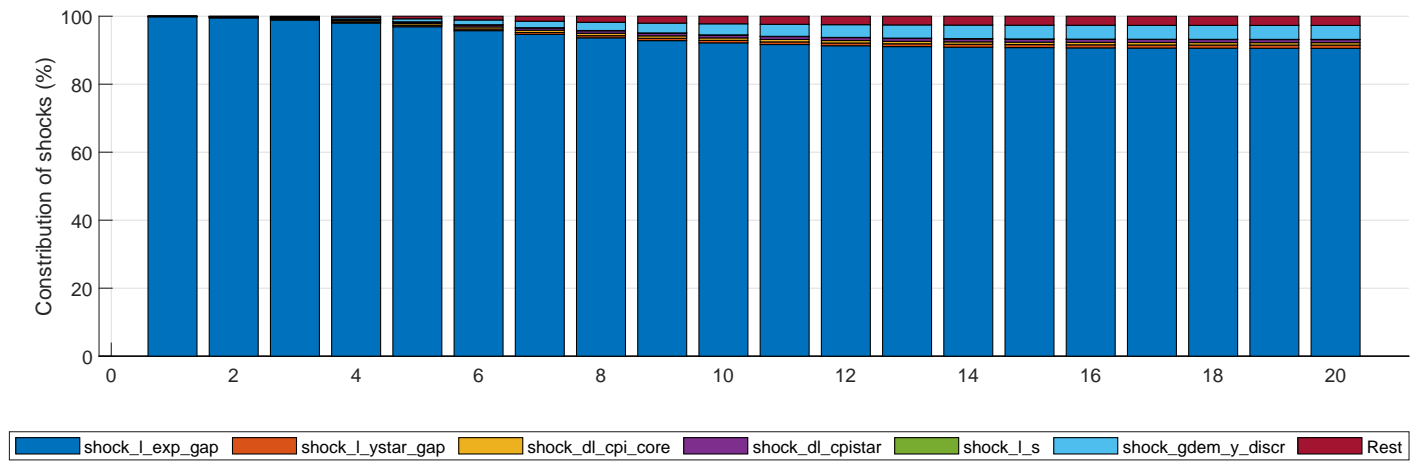
Export, ann. QQ % [dl_exp]
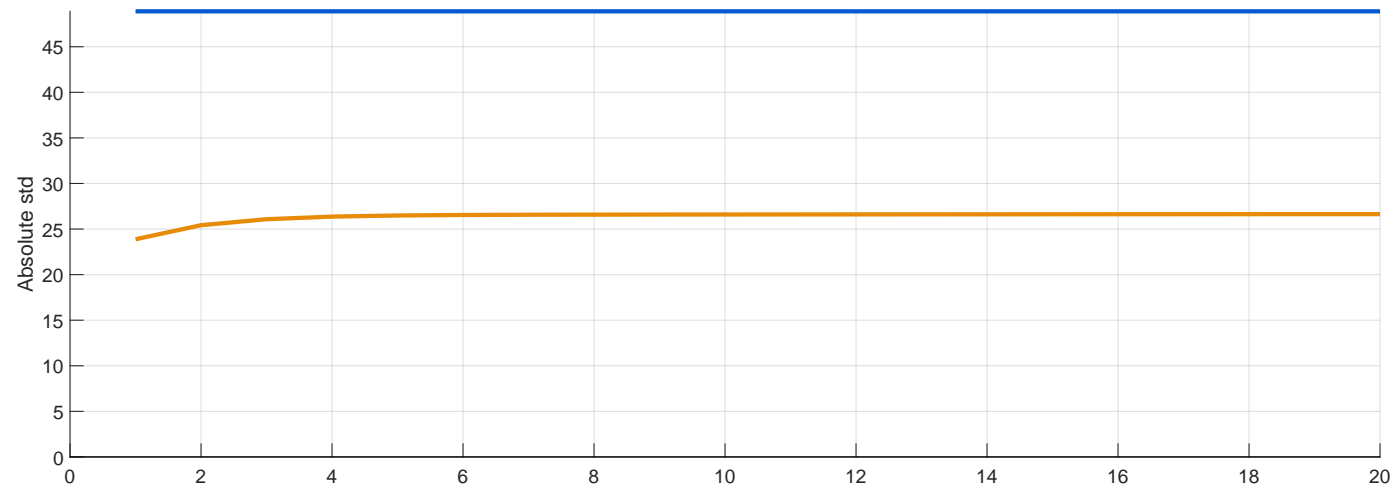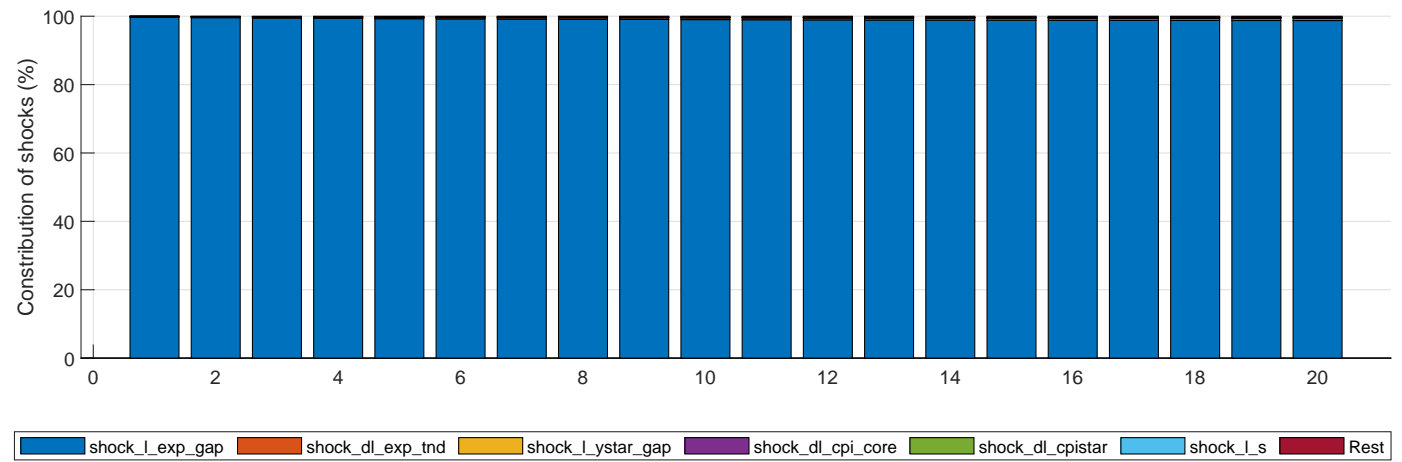
Import gap, % [l_imp_gap]
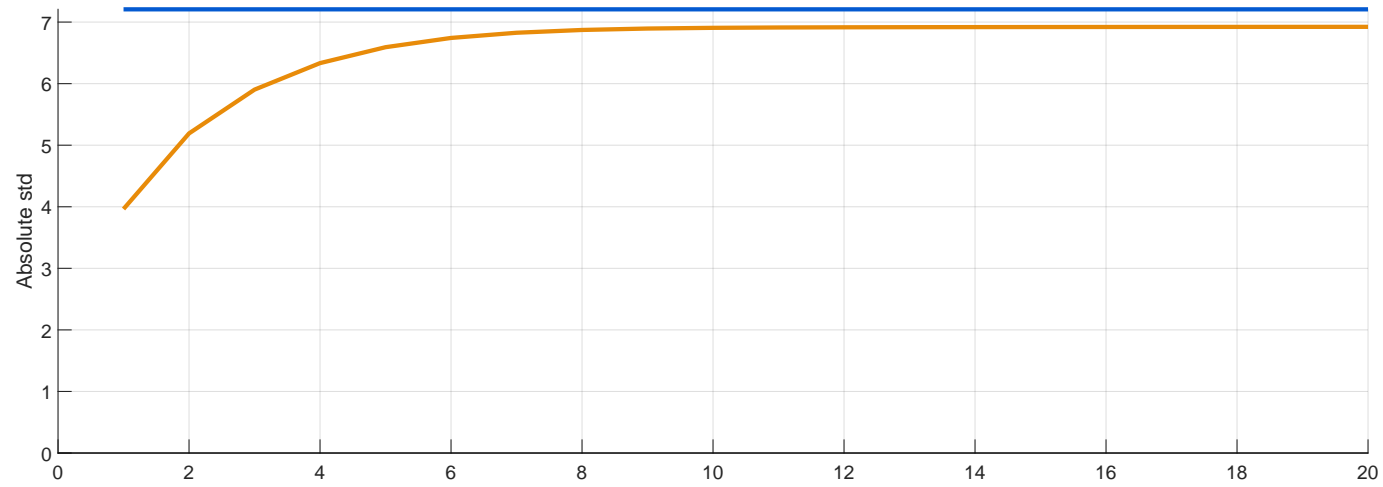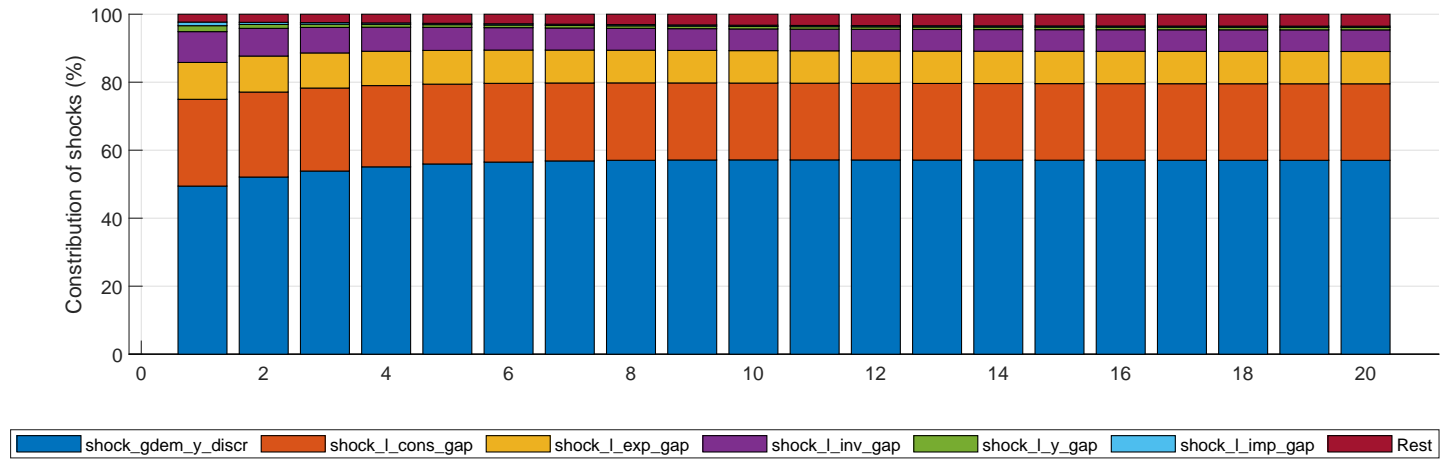
Import, ann. QQ % [dl_imp]
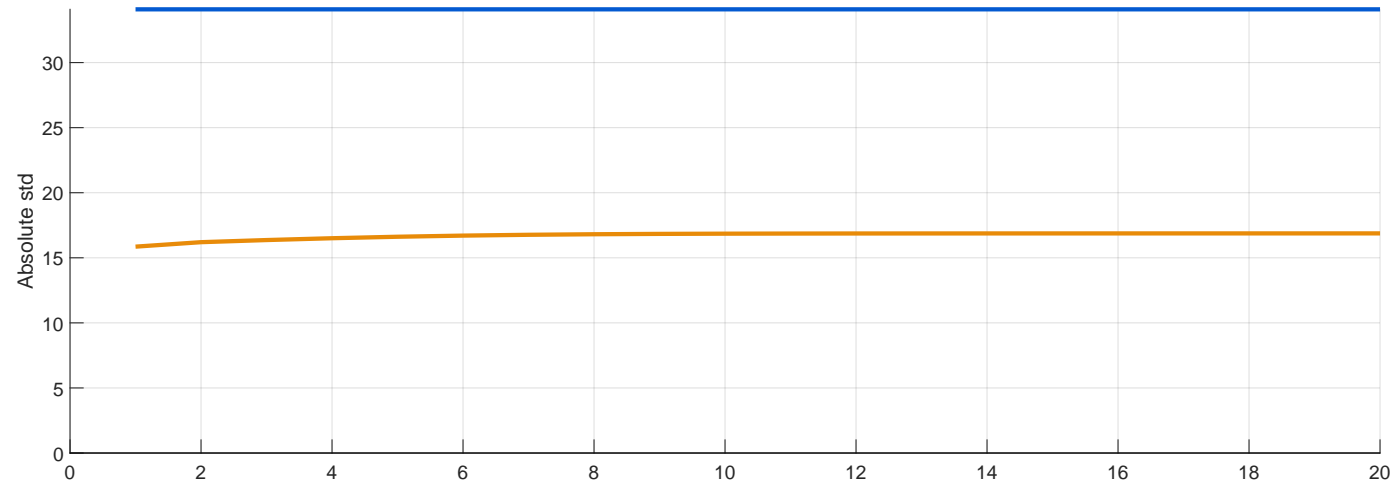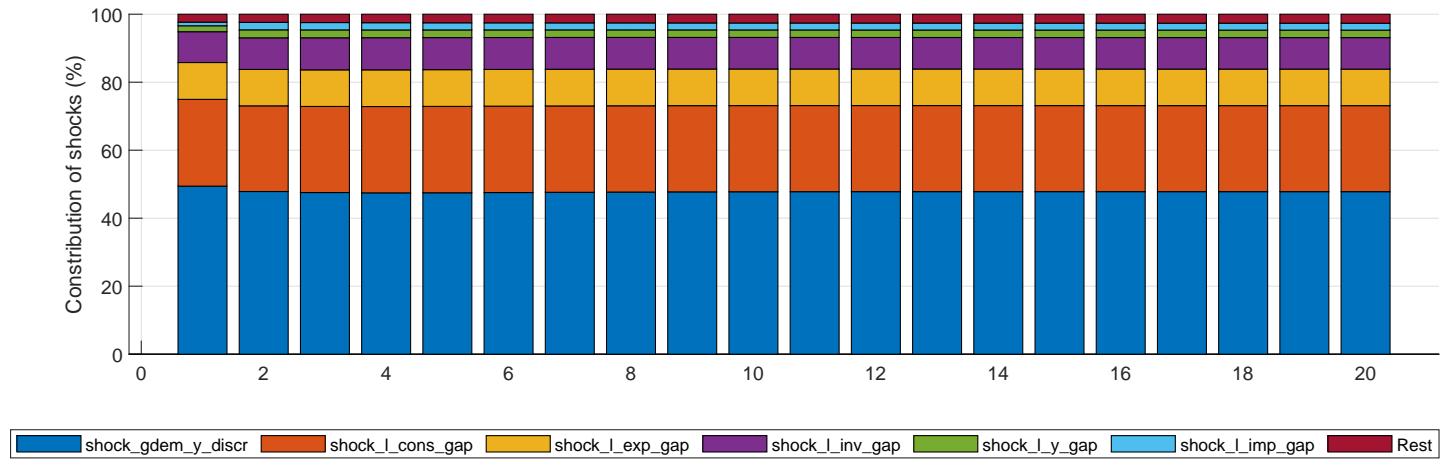
Output gap, % [l_y_gap]
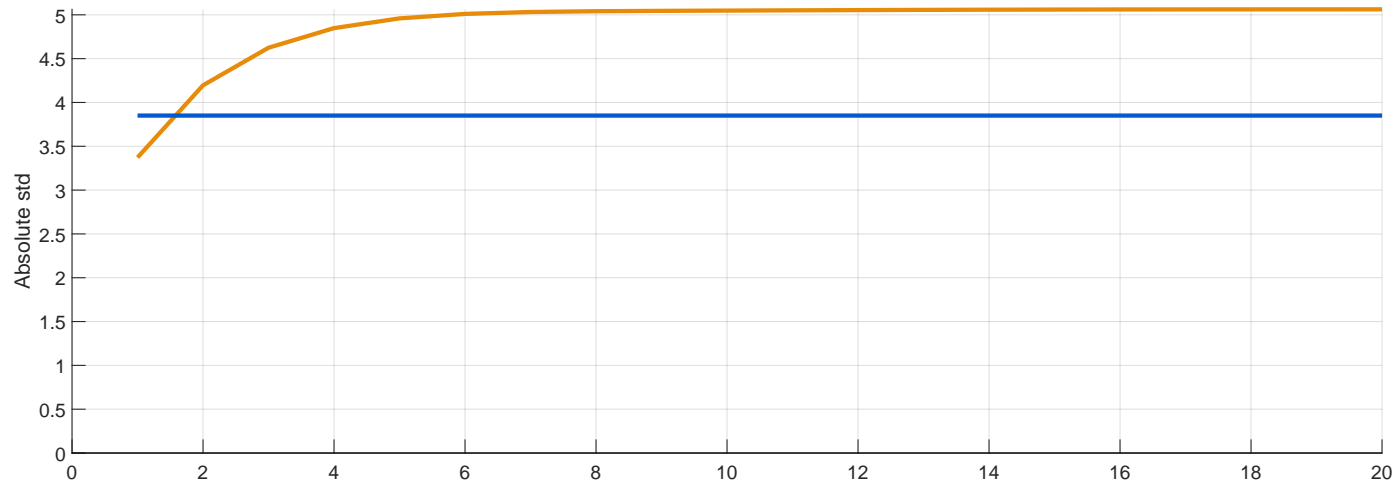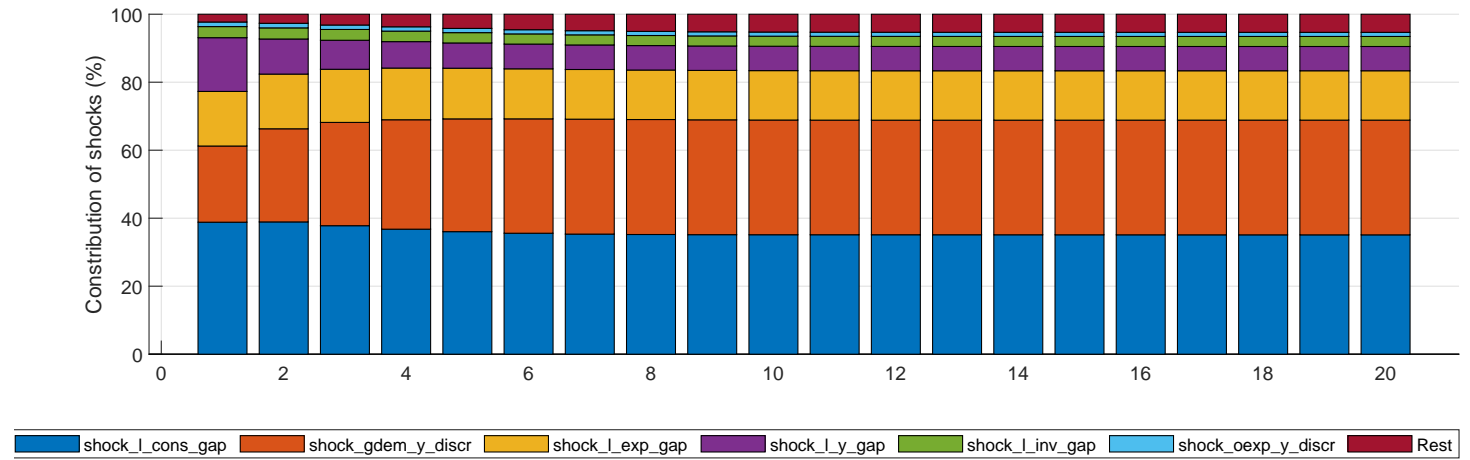
GDP, ann. QQ % [dl_y]
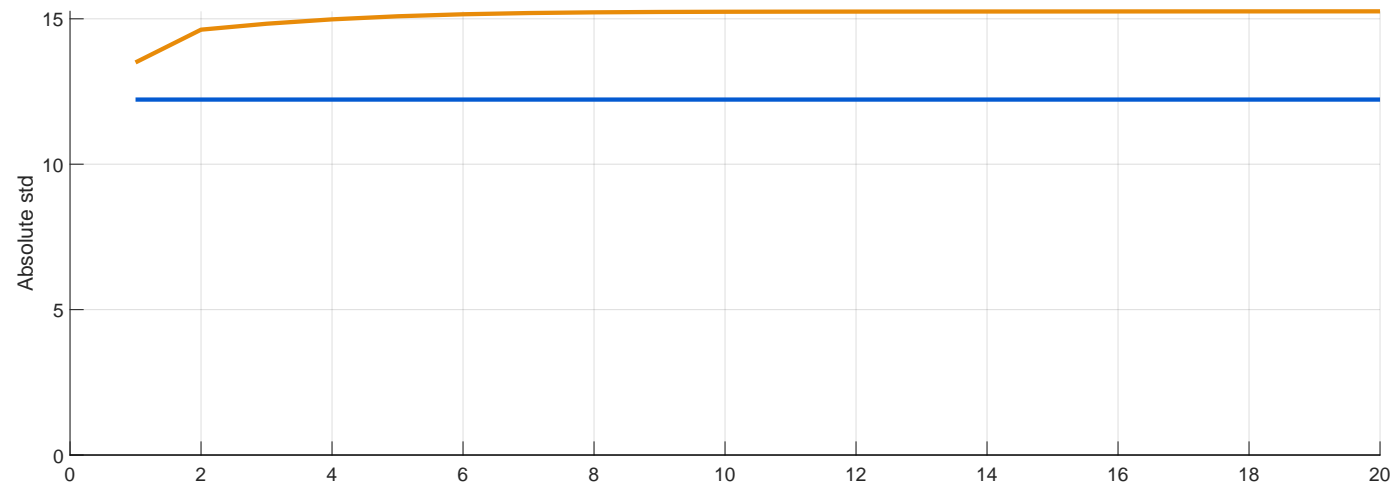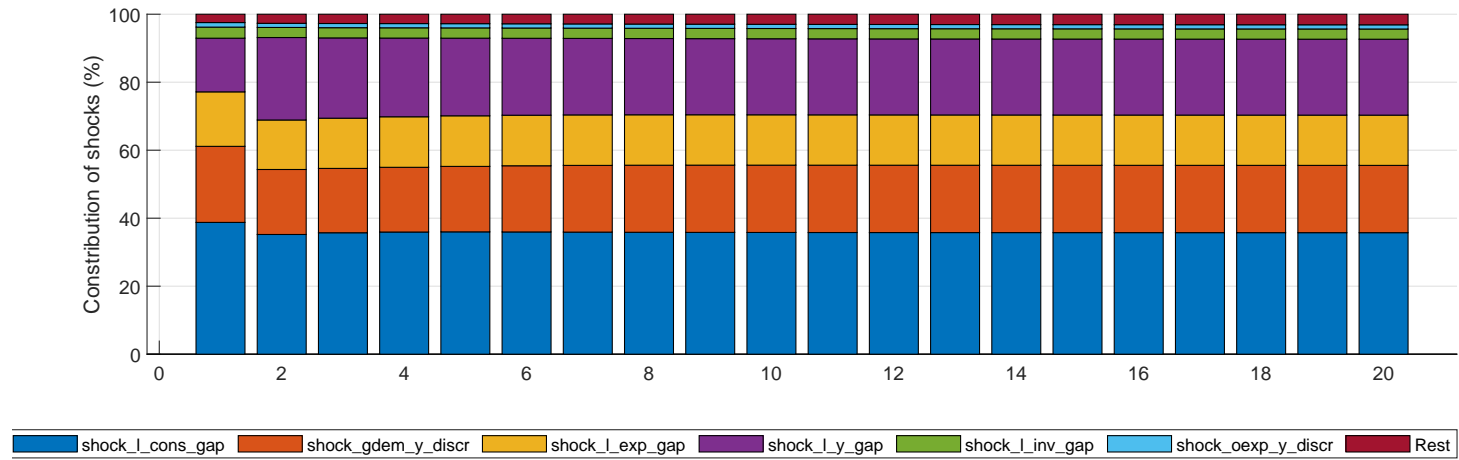
Headline CPI, ann. QQ % [dl_cpi]
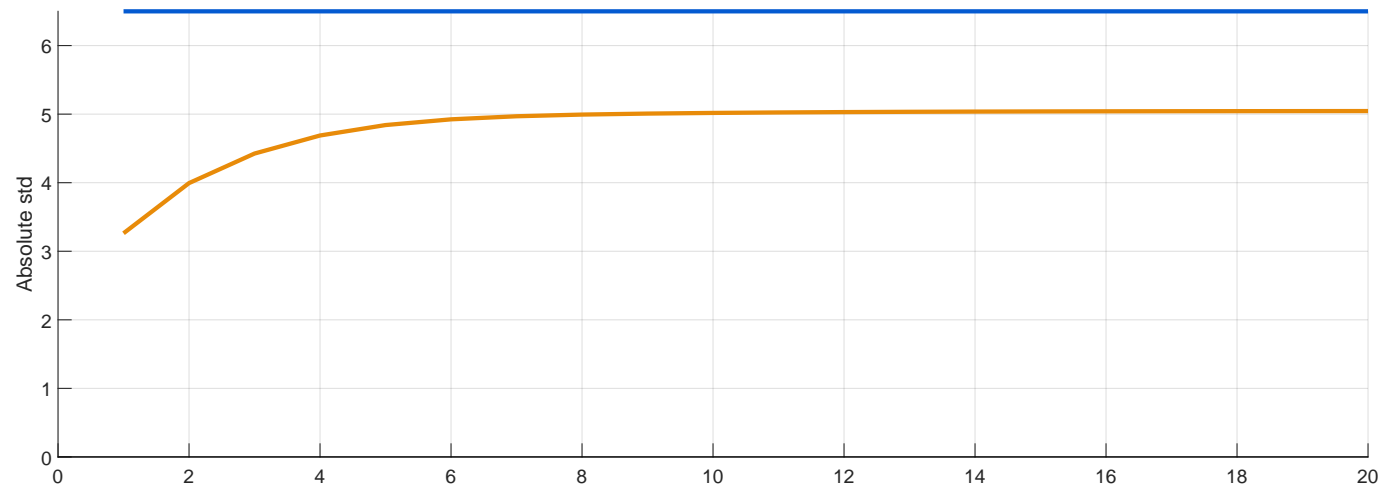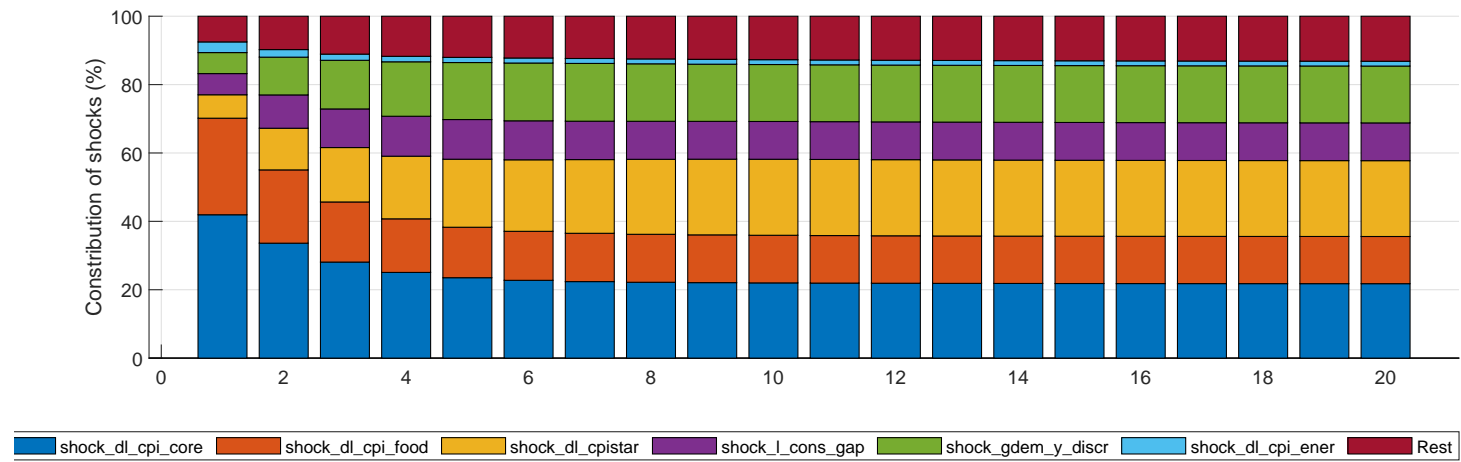
Core CPI, ann. QQ % [dl_cpi_core]
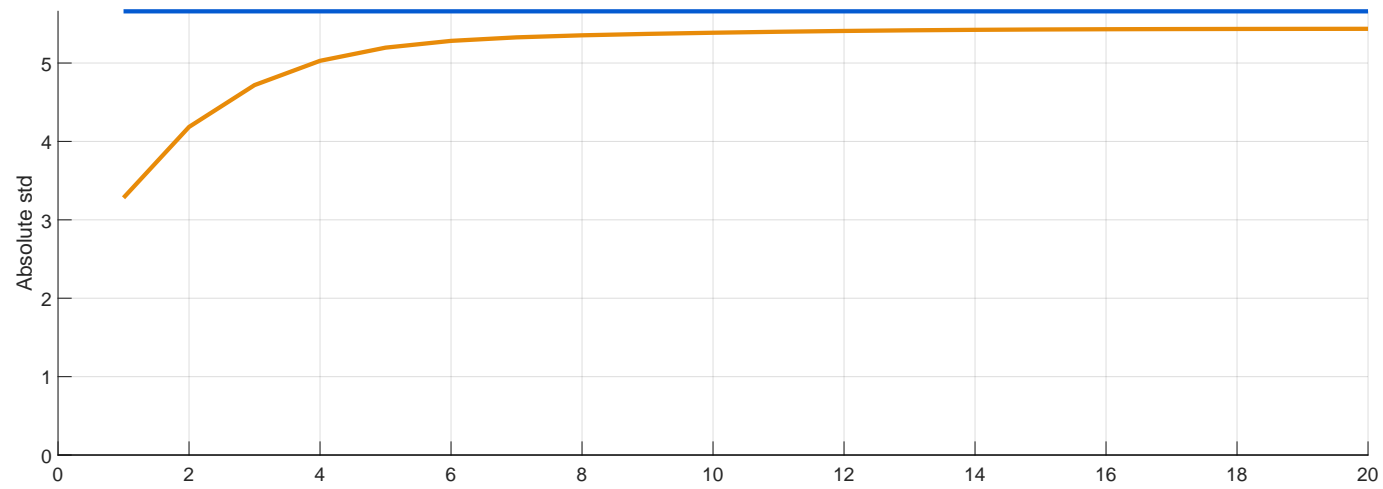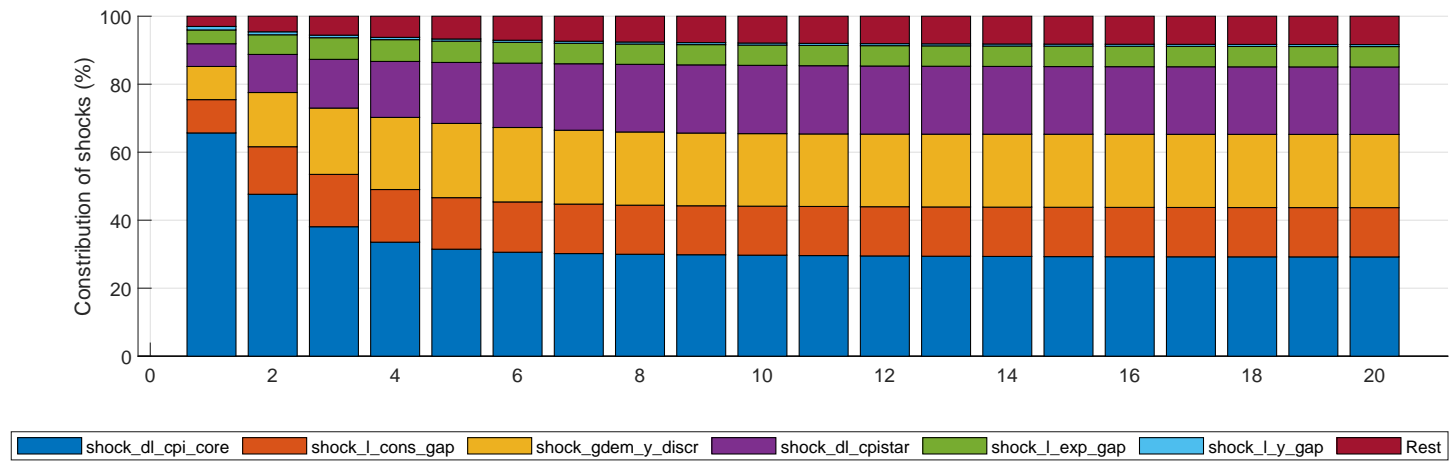
Food CPI, ann. QQ % [dl_cpi_food]
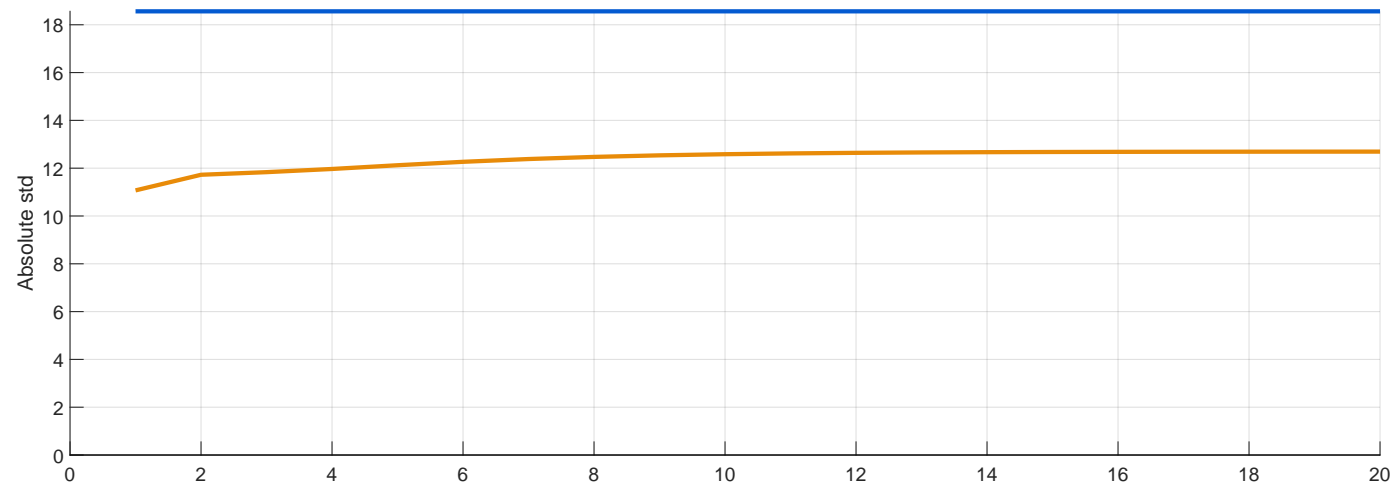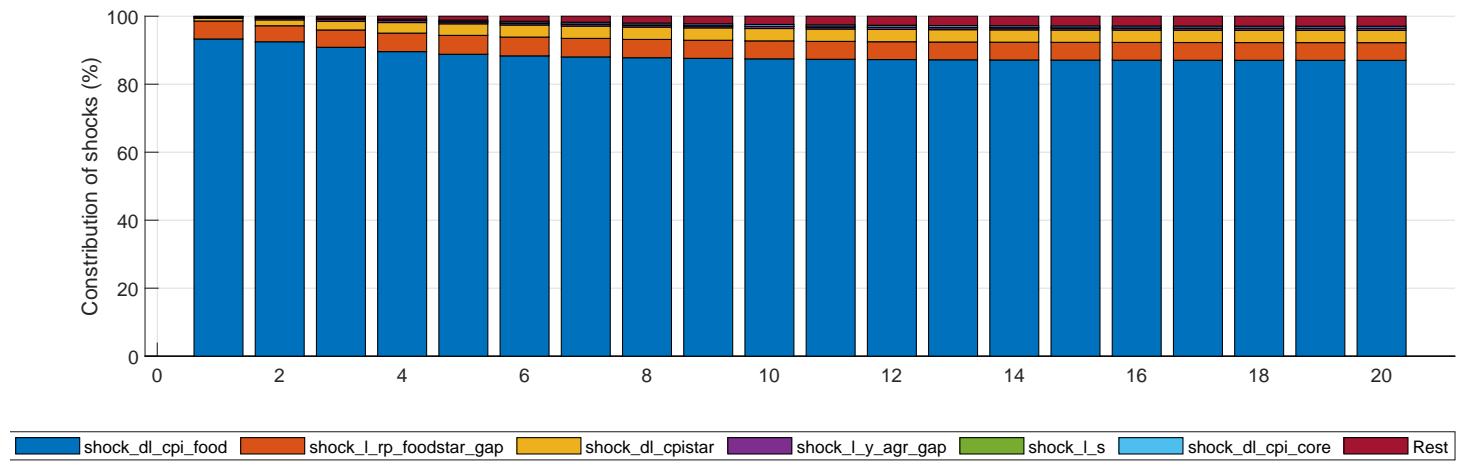
Energy CPI, ann. QQ % [dl_cpi_ener]
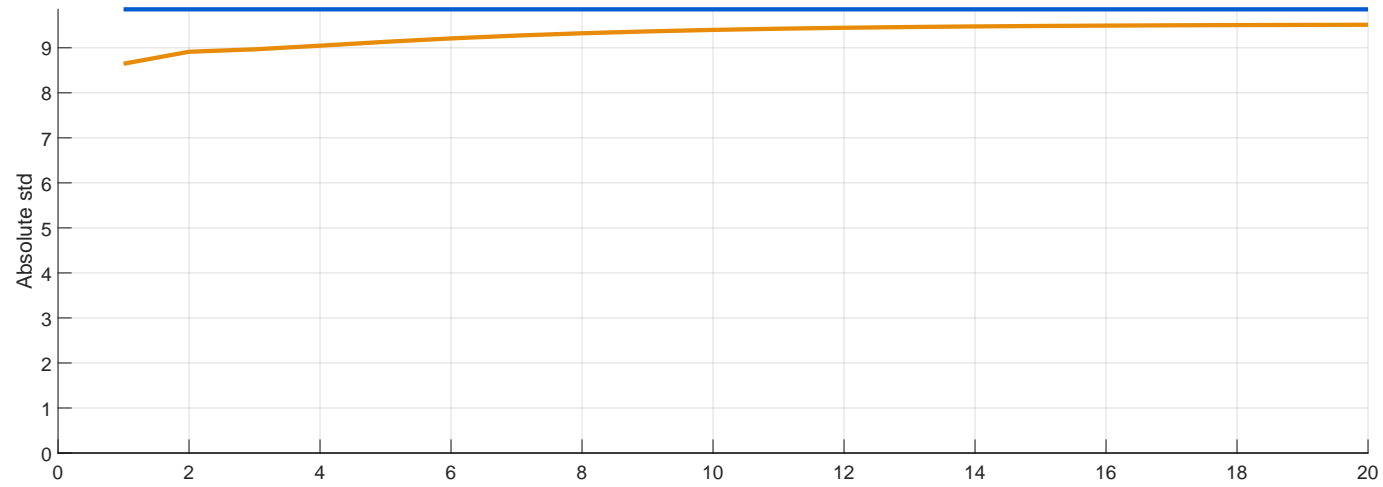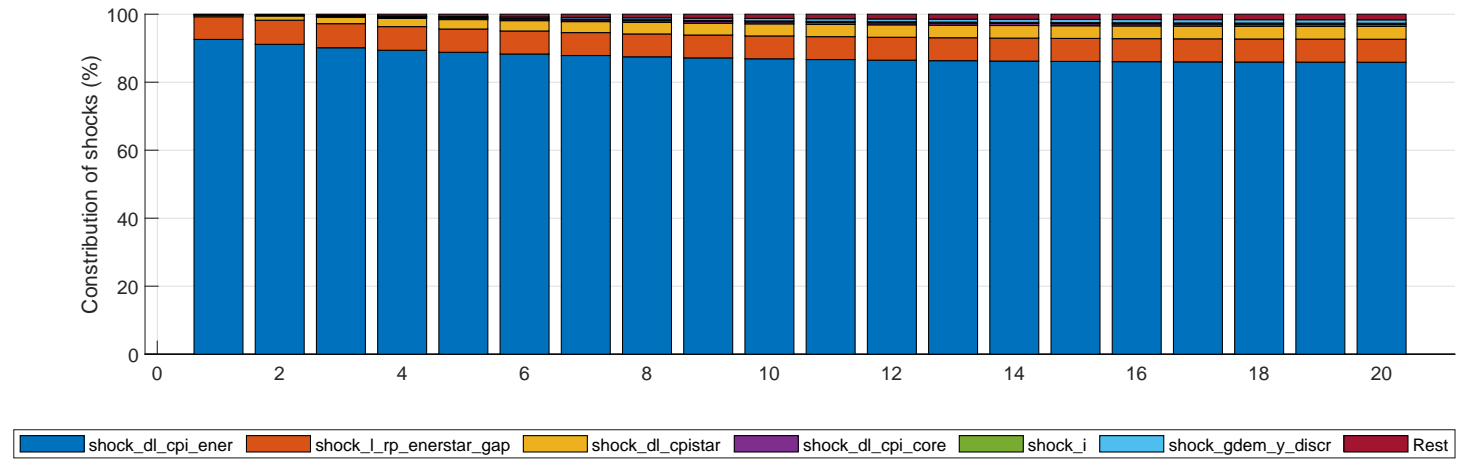
Core rel. price gap, % [l_rp_cpi_core_gap]
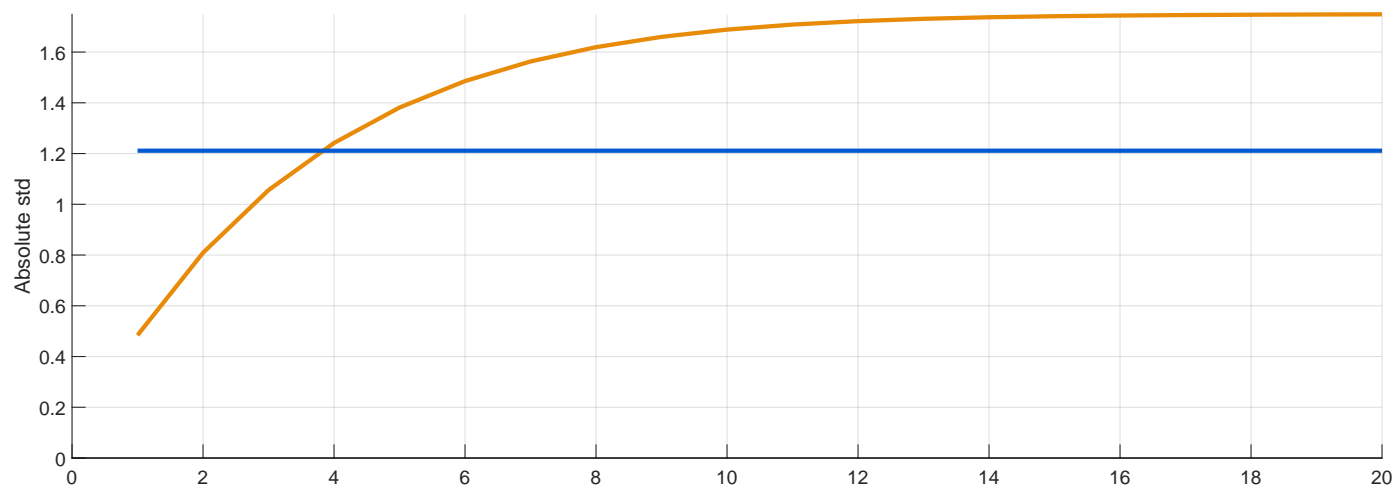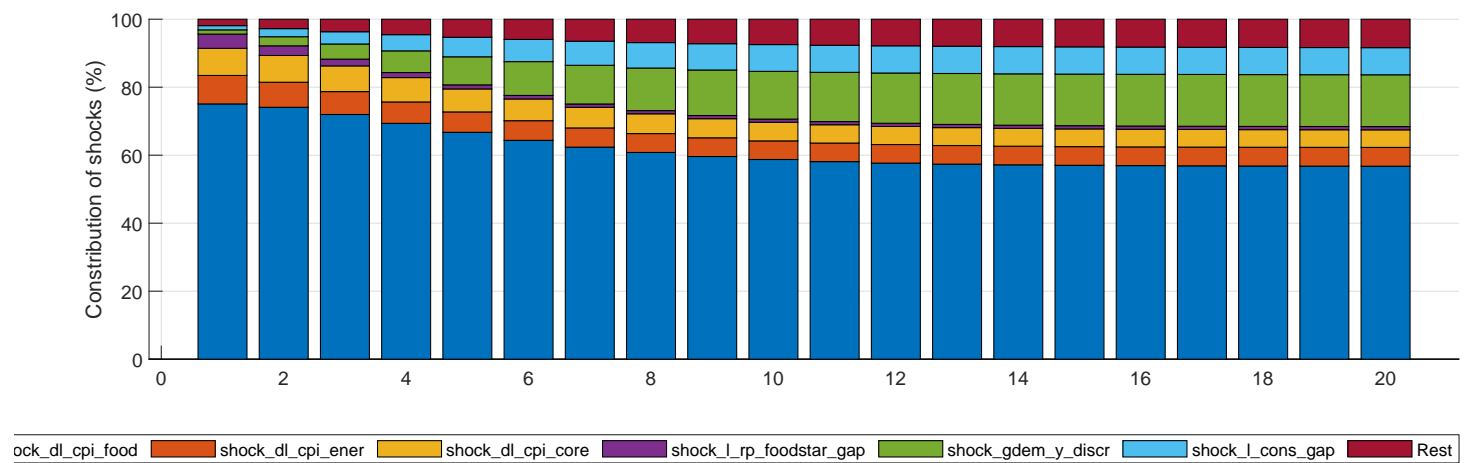
Food rel. price gap, % [l_rp_cpi_food_gap]
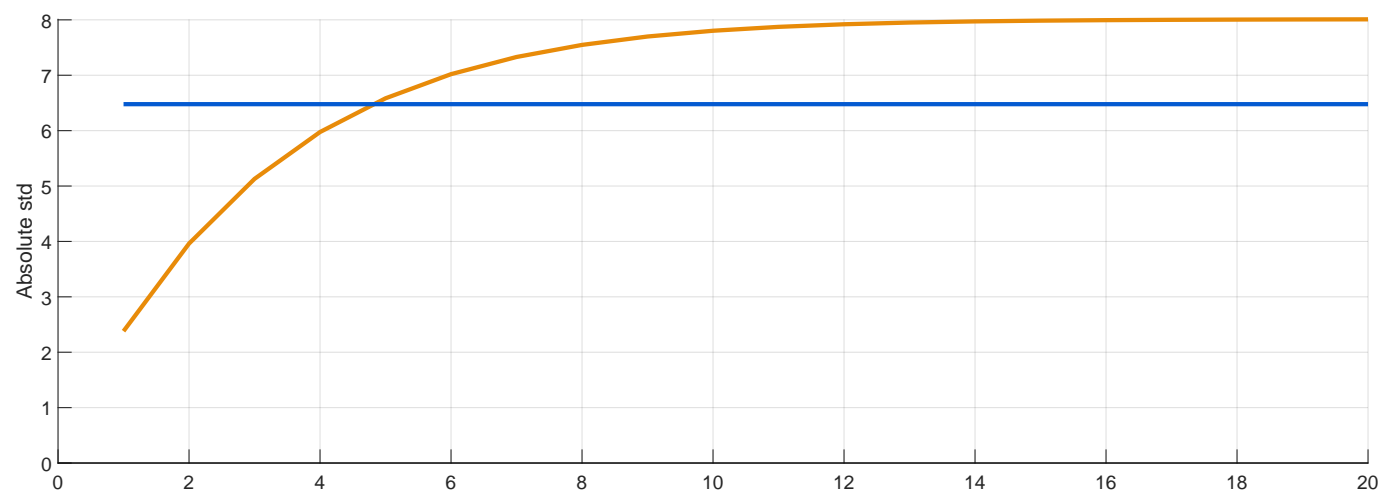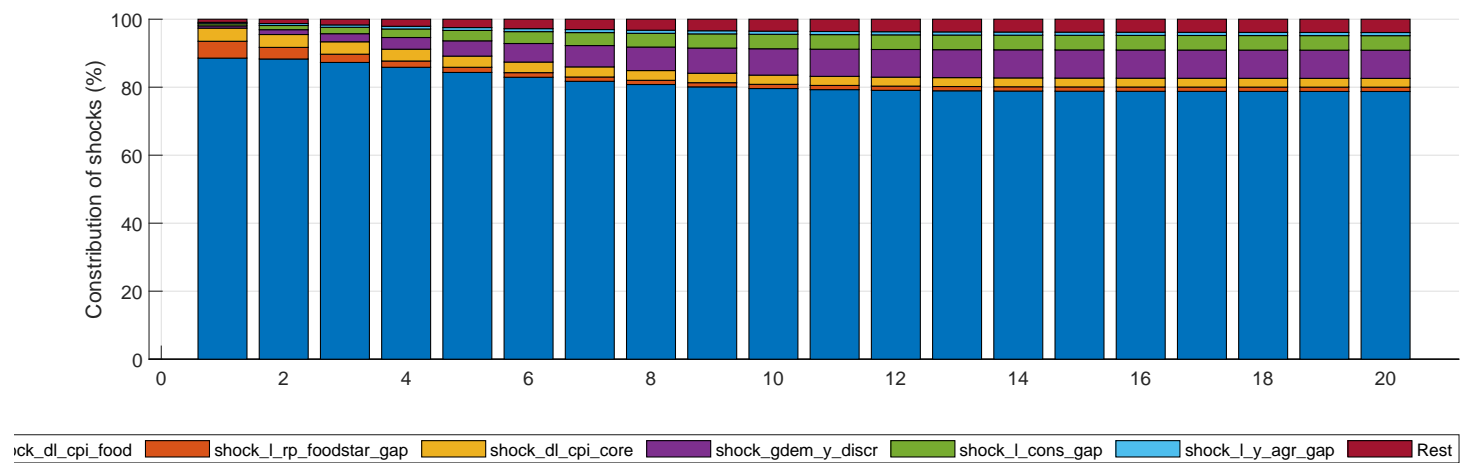
Energy rel. price gap, % [l_rp_cpi_ener_gap]
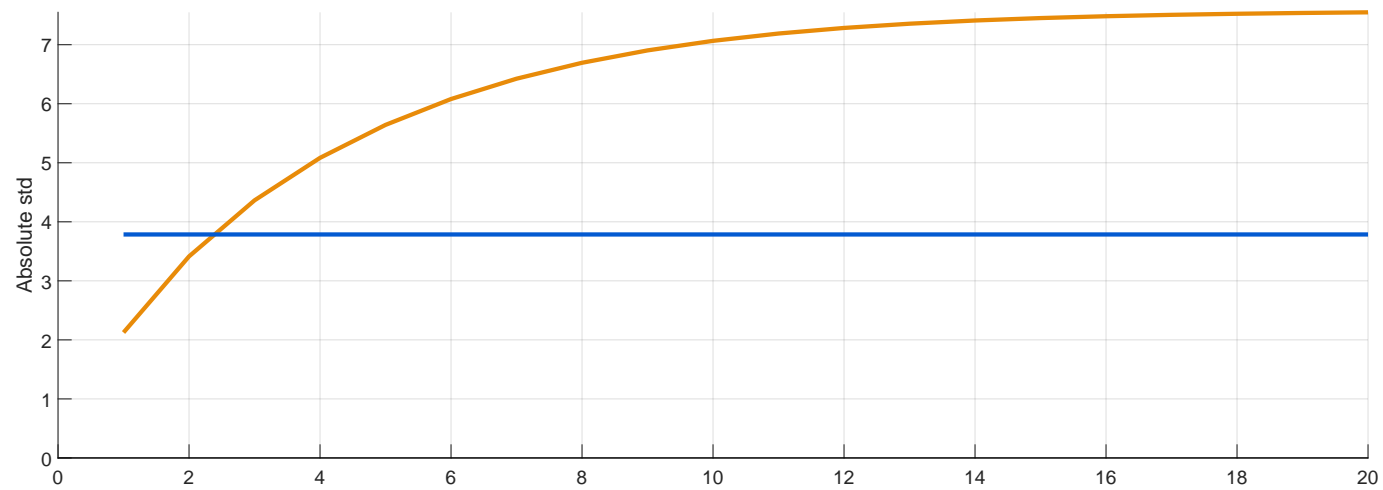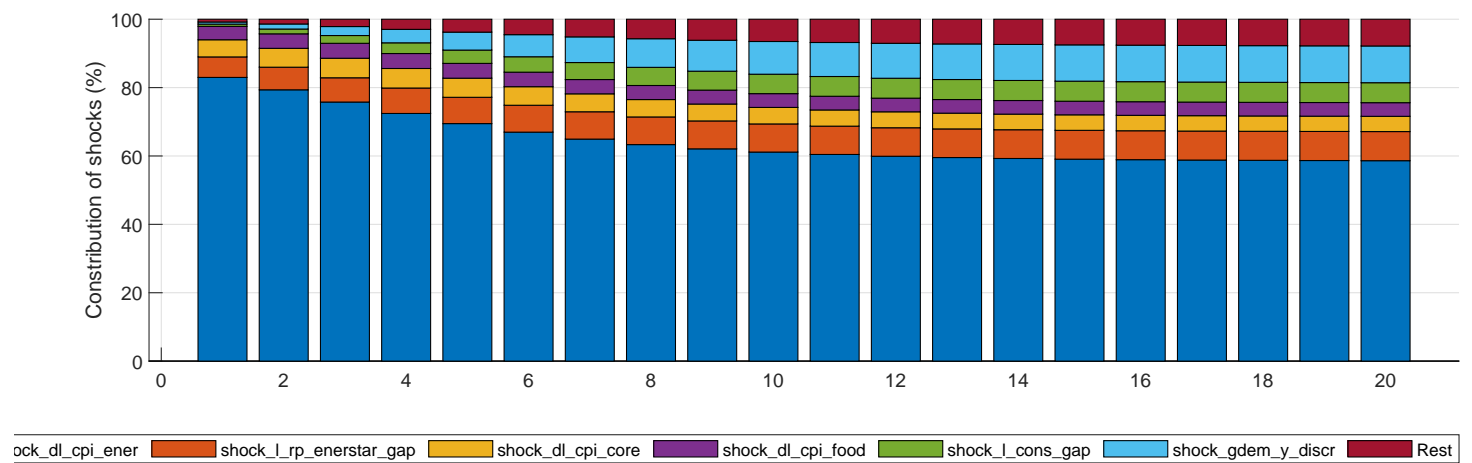
Policy rate (IB rate used), % [i]
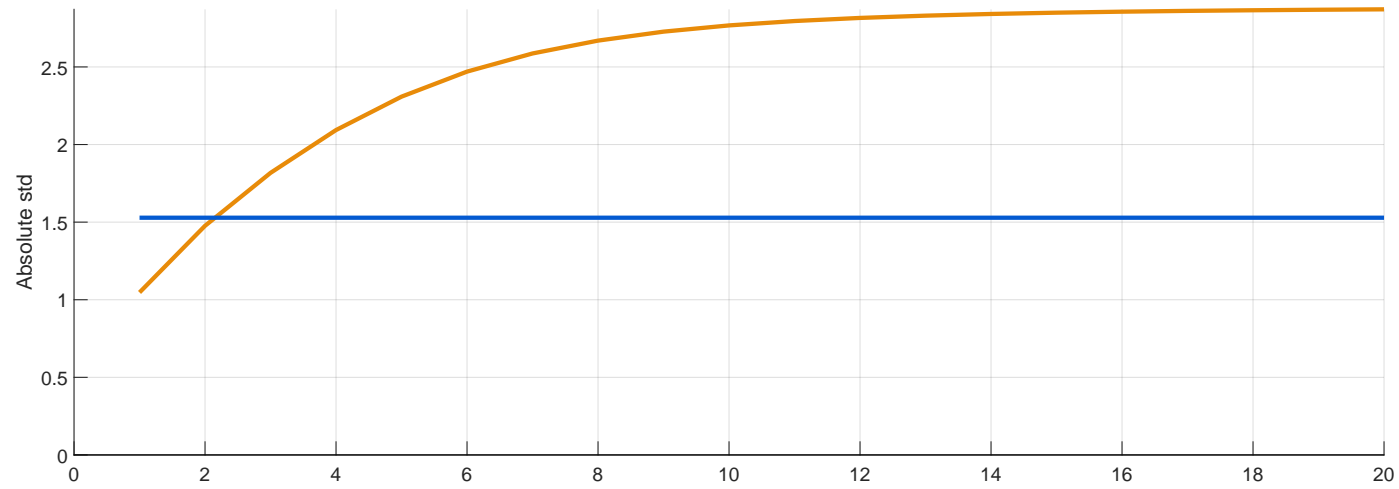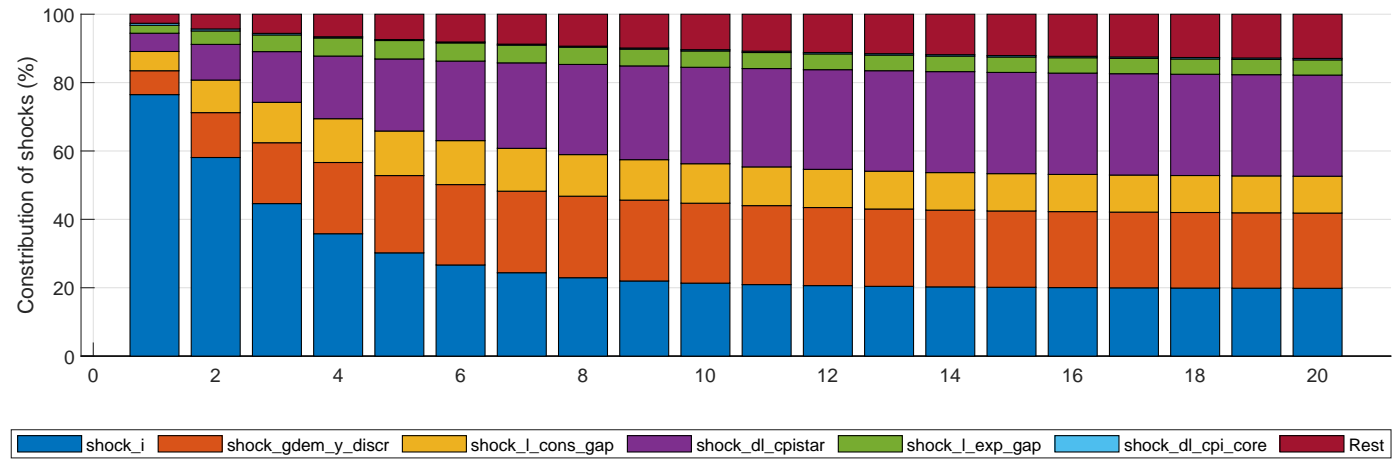
RIR (policy) gap, % [r_gap]
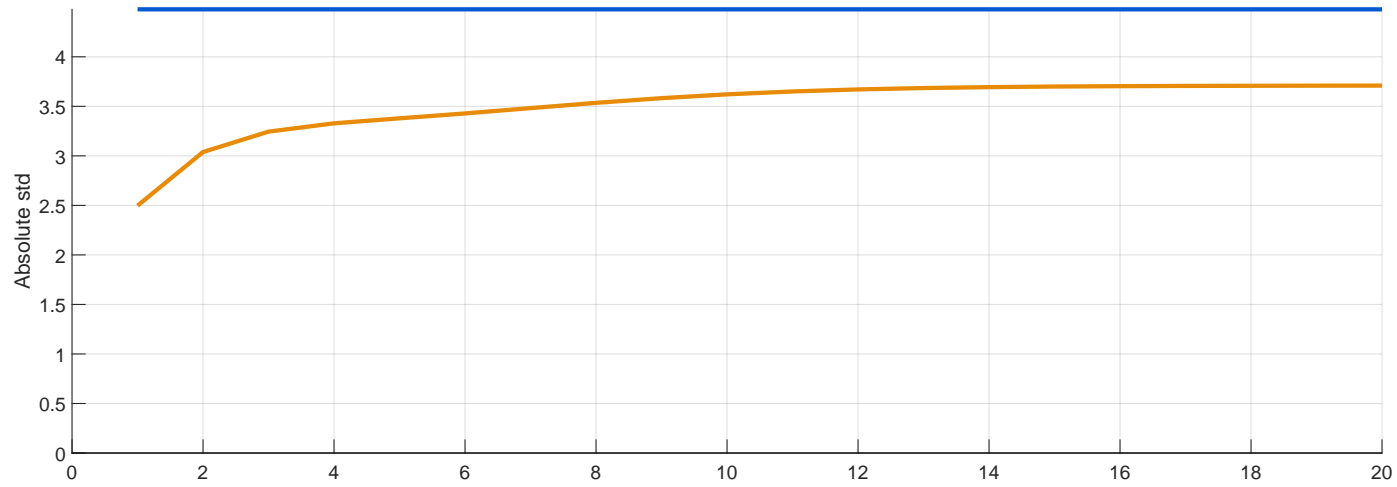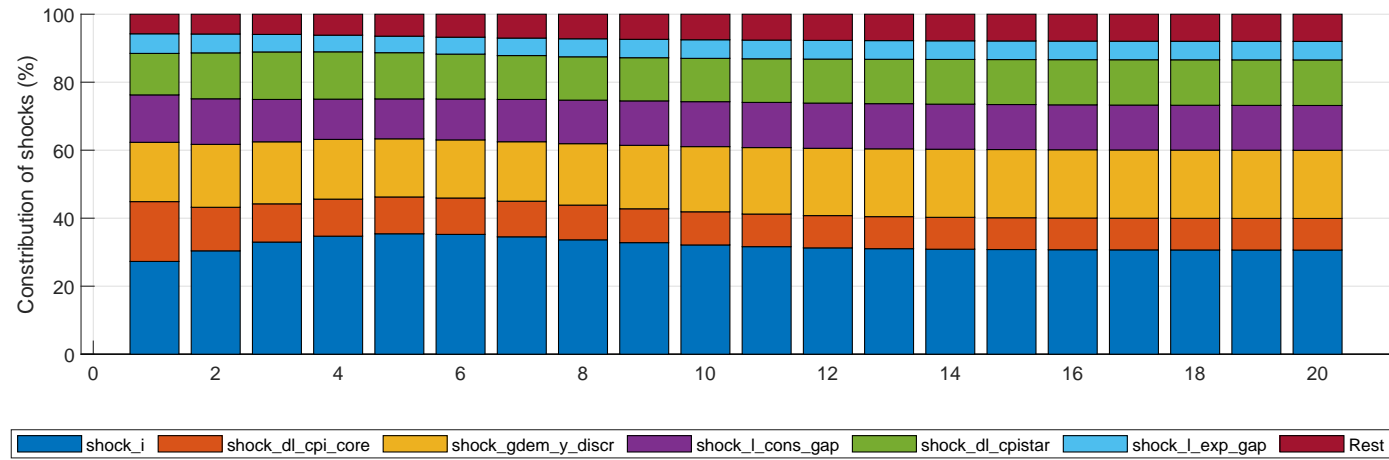
Exchng. rate, 100*log [l_s]
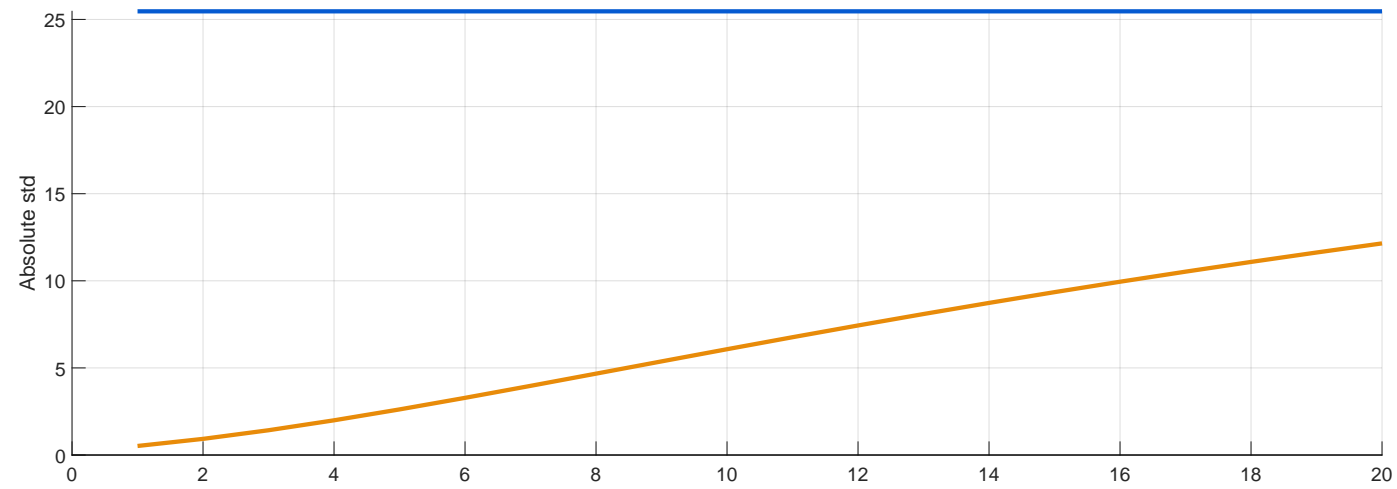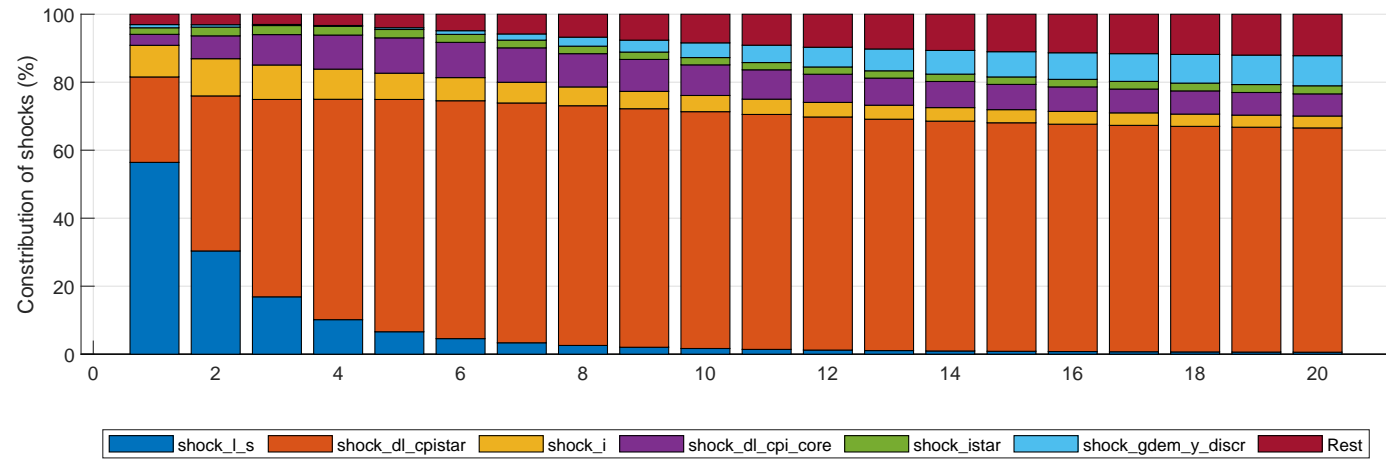
Real exchng. rate gap, % [l_z_gap]
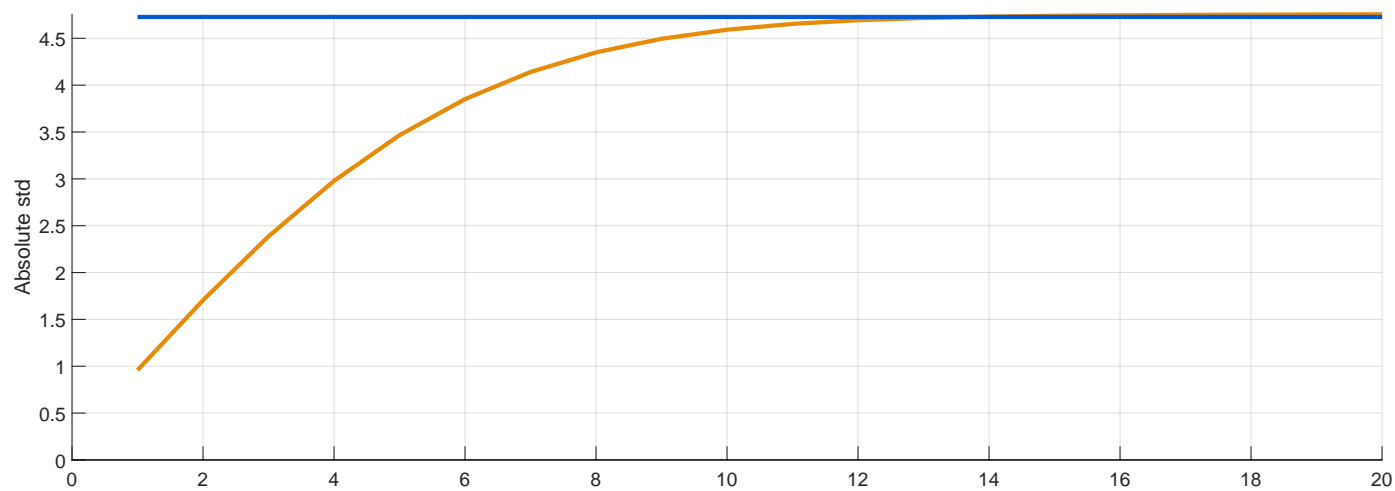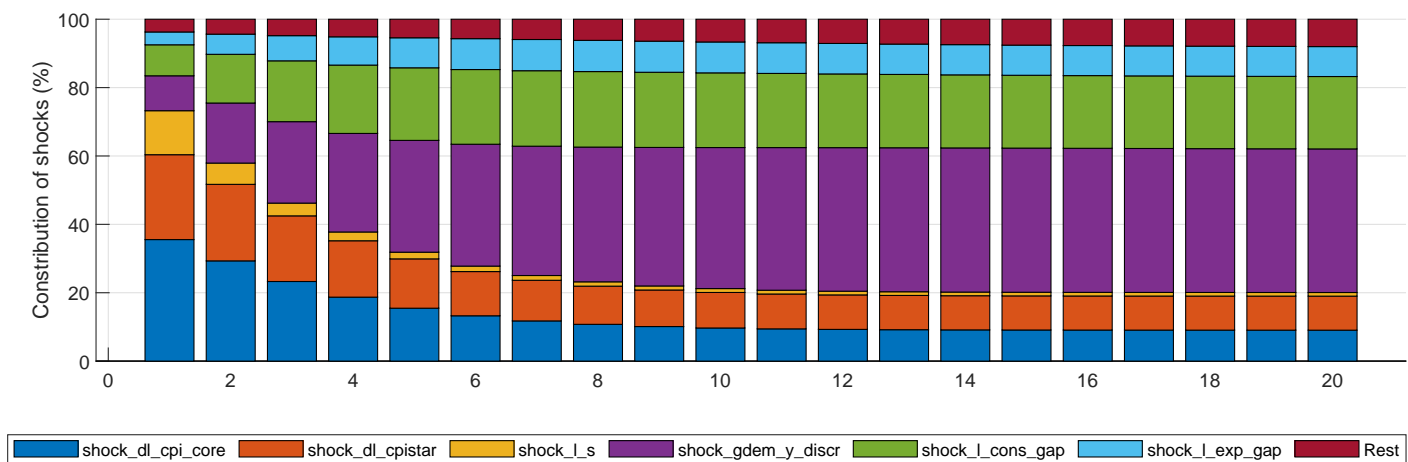
Foreign output gap, % [l_ystar_gap]
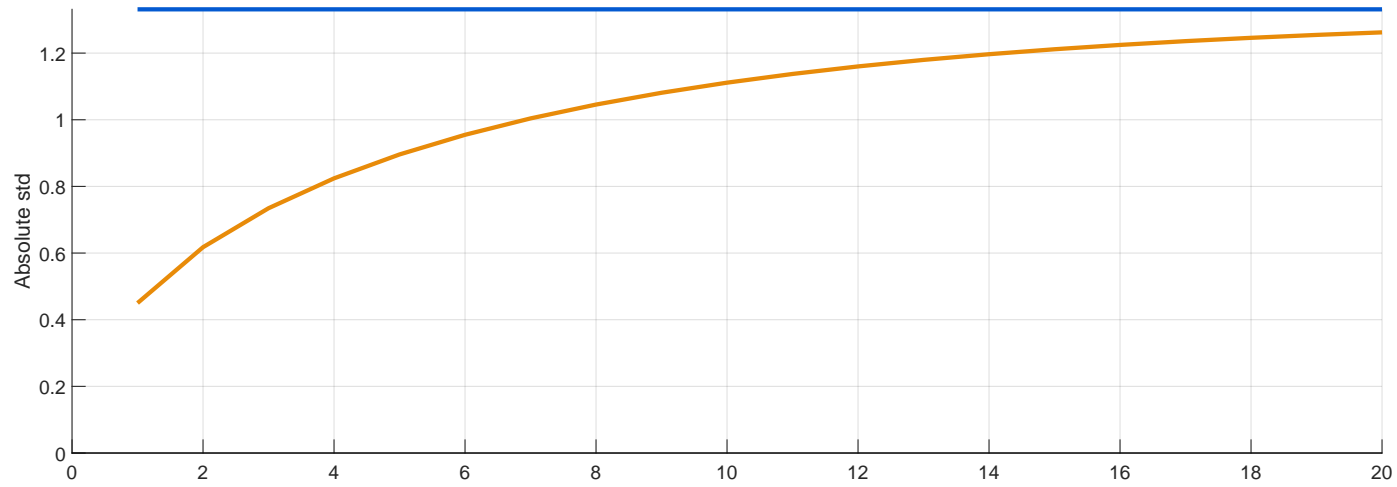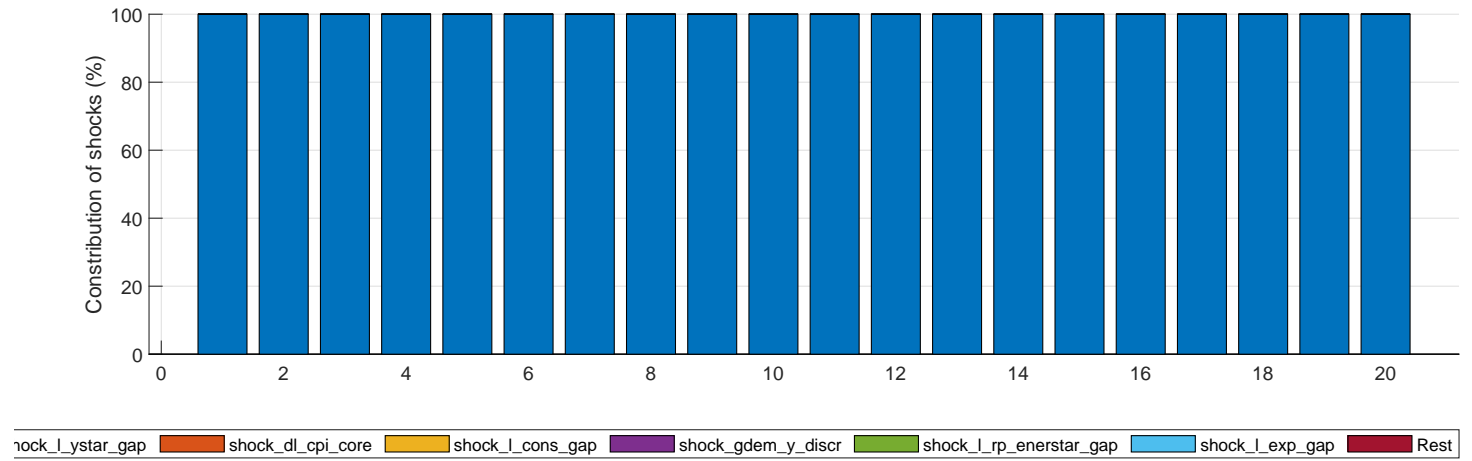
Foreign CPI, ann. QQ % [dl_cpistar]
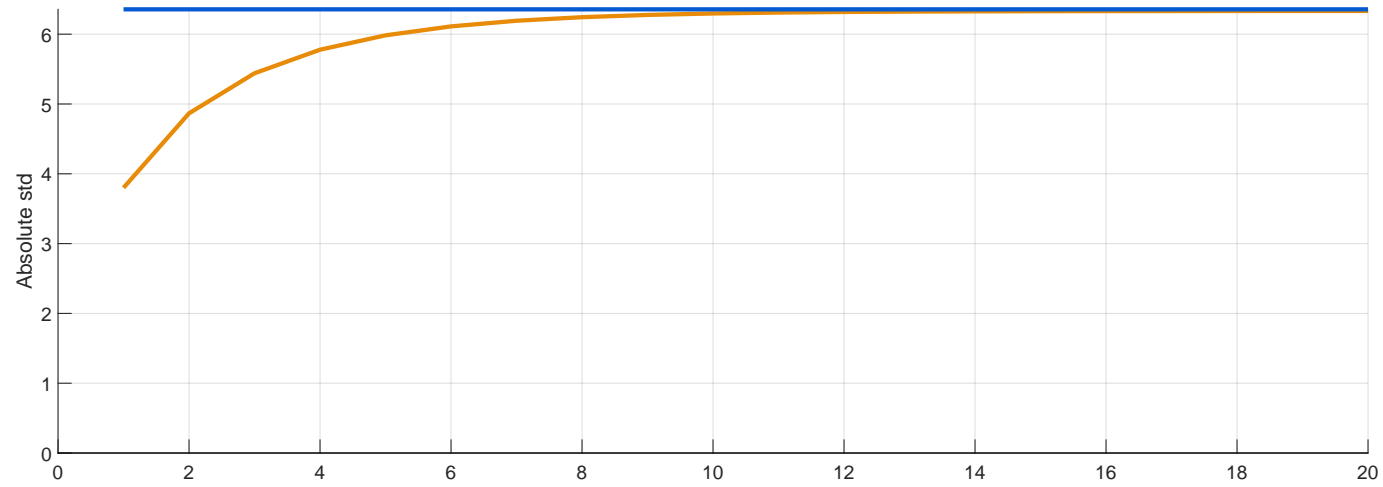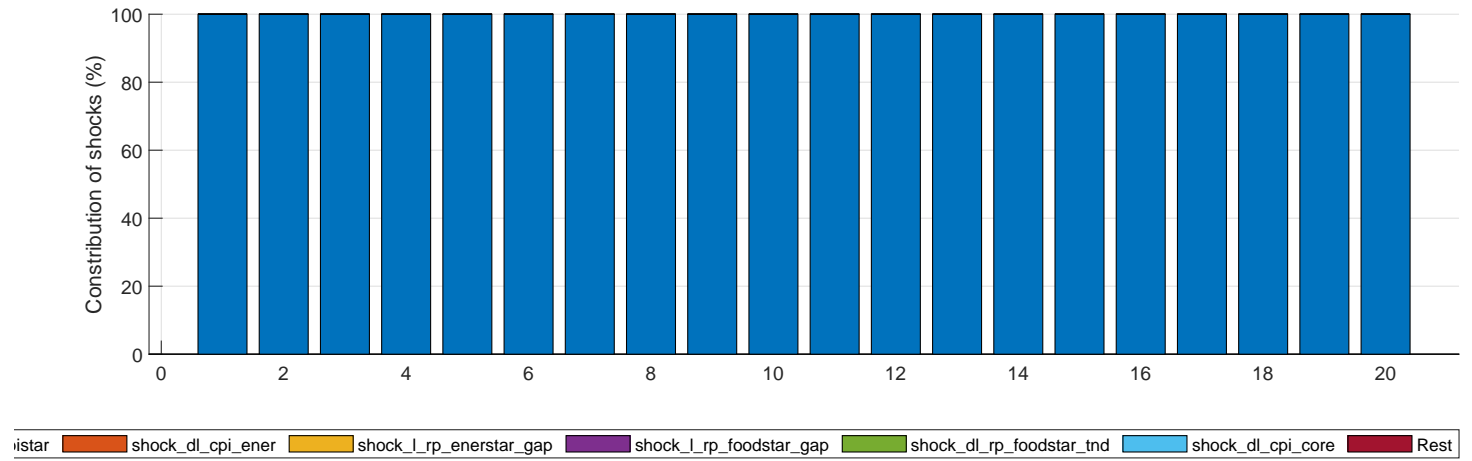
Foreign real interest rate trend, % [rstar_tnd]
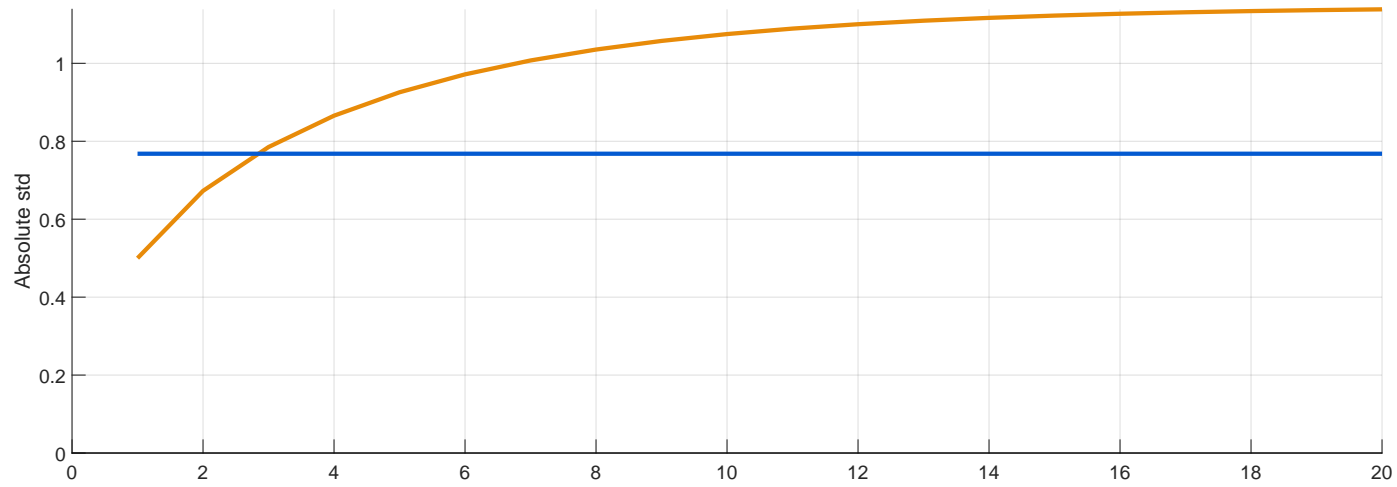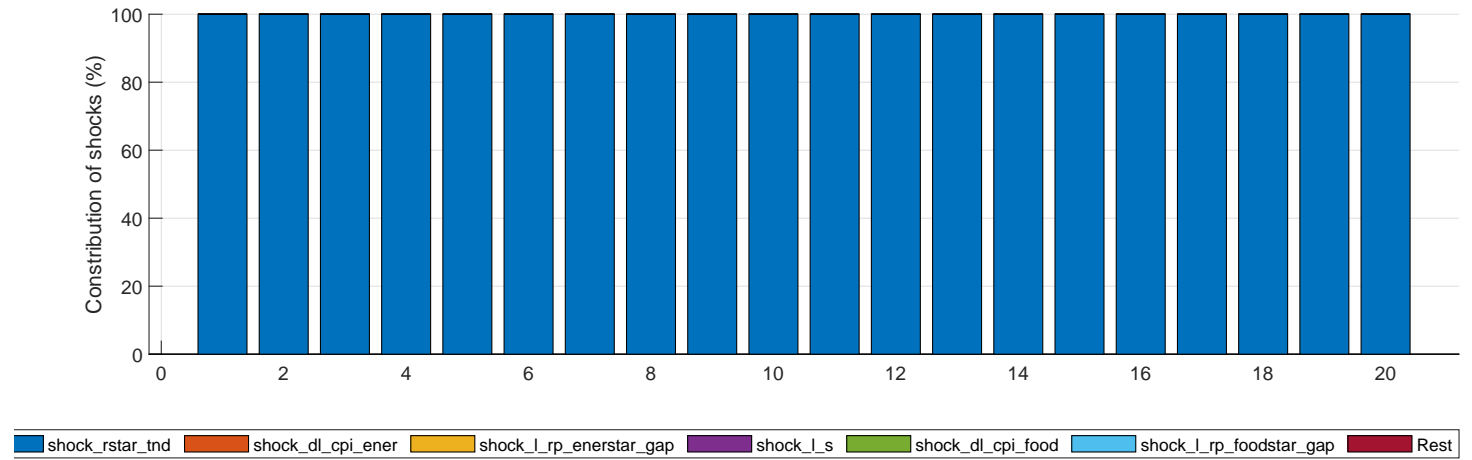
Foreign rel. food price gap, % [l_rp_foodstar_gap]
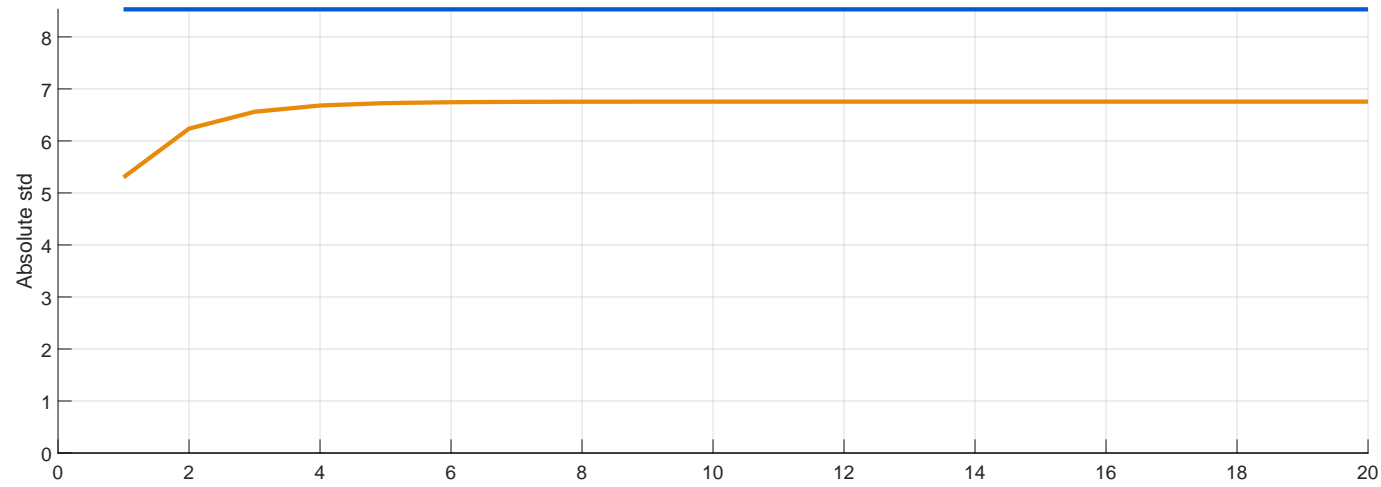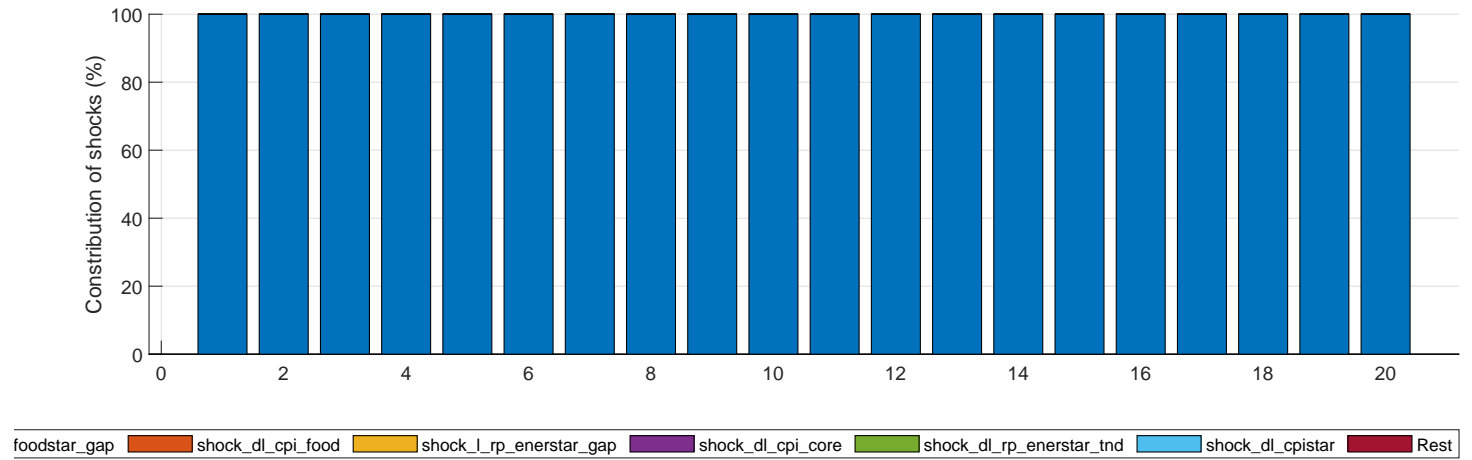
Foreign rel. ener. price gap, % [l_rp_enerstar_gap]
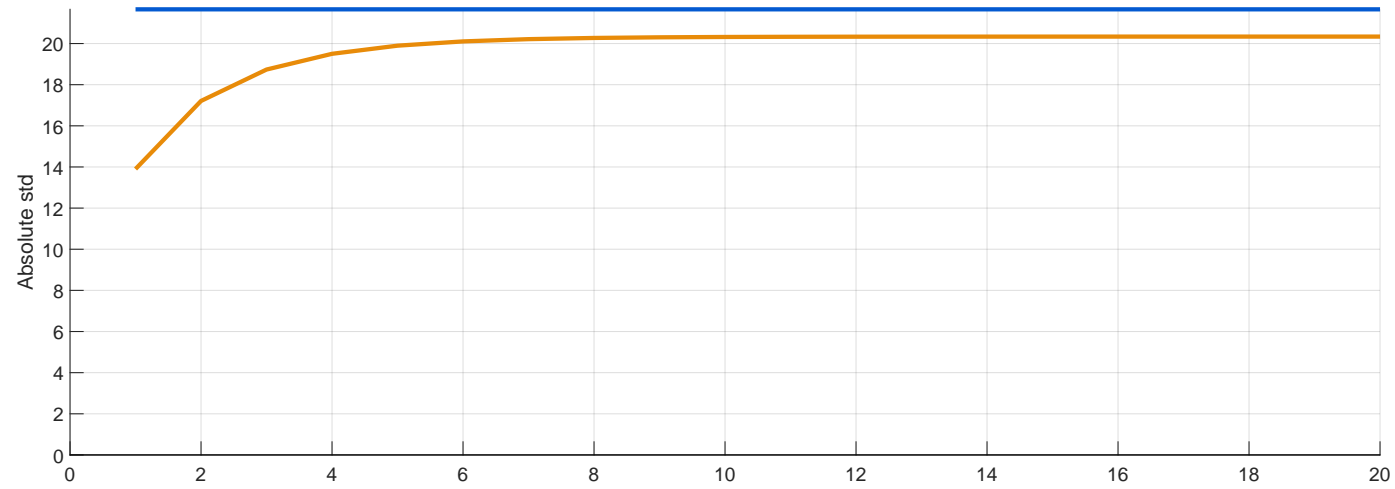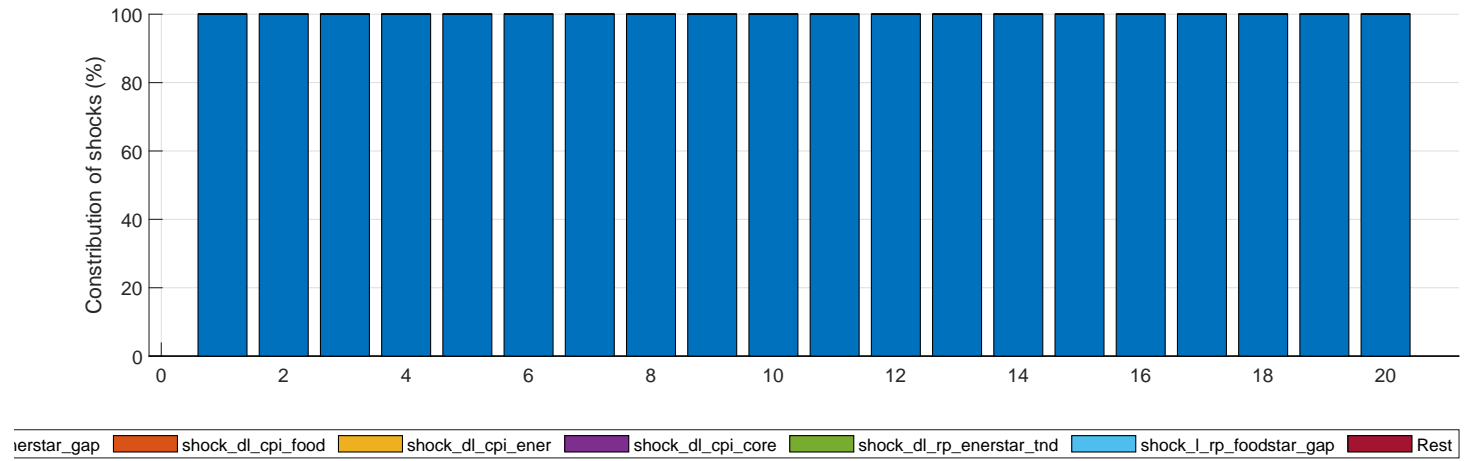
4   Standard deviations: asymptotic model vs. data

	, data	, model
Consumption, ann. QQ % [dl_cons]	15.75	13.90
Consumption, YY % [d4l_cons]	6.03	6.41
Investment, ann. QQ % [dl_inv]	75.26	27.39
Investment, YY % [d4l_inv]	30.85	11.01
Gov. demand, ann. QQ % [dl_gdem]	40.79	37.09
Gov. demand, YY % [d4l_gdem]	14.91	15.34
Export, ann. QQ % [dl_exp]	48.02	26.65
Export, YY % [d4l_exp]	16.70	10.57
Import, ann. QQ % [dl_imp]	33.72	16.88
Import, YY % [d4l_imp]	10.67	7.74
GDP, ann. QQ % [dl_y]	11.59	15.26
GDP, YY % [d4l_y]	5.24	6.41
Budget deficit, % of GDP [def_y]	2.72	3.41
Govt. rev., % of GDP [grev_y]	2.99	1.87
Govt. demand (G&S), % GDP [gdem_y]	3.71	2.37
Other govt. exp., % to GDP [oexp_y]	2.17	1.82
Fiscal grants, % of GDP [grants_y]	3.04	2.89
Headline CPI, ann. QQ % [dl_cpi]	6.42	5.05
Headline CPI, YY % [d4l_cpi]	4.80	4.16
Core CPI, ann. QQ % [dl_cpi_core]	5.67	5.44
Core CPI, YY % [d4l_cpi_core]	4.37	4.57
Food CPI, ann. QQ % [dl_cpi_food]	18.40	12.70
Food CPI, YY % [d4l_cpi_food]	10.92	8.31
Energy CPI, ann. QQ % [dl_cpi_ener]	9.35	9.52
Energy CPI, YY % [d4l_cpi_ener]	5.58	5.95
Policy rate (IB rate used), % [i]	1.54	2.89
Lending premium gap, % [prem_d_gap]	1.71	1.84
Exchng. rate, ann. QQ % [dl_s]	4.35	4.37
Exchng. rate, YY % [d4l_s]	3.95	3.91
Consumption gap, % [l_cons_gap]	4.50	5.46

Investment gap, % [l_inv_gap]	19.27	8.72
Gov. demand gap, % [l_gdem_gap]	15.46	12.51
Export gap, % [l_exp_gap]	13.49	8.05
Import gap, % [l_imp_gap]	7.26	6.92
Output gap, % [l_y_gap]	3.88	5.06
Real exchng. rate gap, % [l_z_gap]	4.76	4.76
RIR (policy) gap, % [r_gap]	4.51	3.71
Core rel. price gap, % [l_rp_cpi_core_gap]	1.22	1.75
Food rel. price gap, % [l_rp_cpi_food_gap]	6.52	8.02
Energy rel. price gap, % [l_rp_cpi_ener_gap]	3.81	7.59
Foreign output gap, % [l_ystar_gap]	1.34	1.32
Foreign CPI, ann. QQ % [dl_cpistar]	6.37	6.33
Foreign interest rate, % [istar]	1.91	1.44
Foreign real interest rate trend, % [rstar_tnd]	0.77	1.15
Foreign food price, ann. QQ % [dl_foodstar]	28.23	24.42
Foreign rel. food price gap, % [l_rp_foodstar_gap]	8.59	6.76
Foreign rel. food price tnd., ann. QQ % [dl_rp_foodstar_tnd]	2.96	1.15
Foreign ener. price, ann. QQ % [dl_enerstar]	67.58	60.39
Foreign rel. ener. price gap, % [l_rp_enerstar_gap]	21.81	20.34
Foreign rel. ener. price tnd., ann. QQ % [dl_rp_enerstar_tnd]	6.94	5.74

5 Standard deviations: filtered shocks vs. model calibration

	, filtered	, calibrated
Cons. gap shock, % [shock_l_cons_gap]	3.48	2.50
Inv. gap shock, % [shock_l_inv_gap]	16.31	6.00
Export gap shock, % [shock_l_exp_gap]	10.62	6.00
Output gap shock, % [shock_l_y_gap]	1.68	1.00
Core infl. shock, ann. QQ % [shock_dl_cpi_core]	3.48	2.00
Food infl. shock, ann. QQ % [shock_dl_cpi_food]	14.10	9.00
Energy infl. shock, ann. QQ % [shock_dl_cpi_ener]	7.00	7.10
Policy rate shock, % [shock_i]	1.08	1.00
Lending premium shock, % [shock_prem_d_gap]	0.72	0.80
Exchng. rate shock, 100*log [shock_l_s]	0.64	0.35
Gov rev. discr. shock, % of GDP [shock_grev_y_discr]	1.89	1.73
Gdem. discr. shock, % of GDP [shock_gdem_y_discr]	2.59	1.73
Gov exp. discr. shock, % of GDP [shock_oexp_y_discr]	2.02	1.73
Fiscal grants, % of GDP [shock_grants_y]	2.64	2.50

Equations (parameter values taken from setparam.m)

```
 1: % ------------------------------------------------
 2: % ------------- Transition variables -------------
 3: % ------------------------------------------------
 4:
 5: !transition_variables
 6:
 7: % ------------------------------
 8: % -------- Fiscal policy ---------
 9:
10: "Fiscal impulse, % of GDP"  fisc_imp
11:
12: "Budget deficit, % of GDP"    def_y
13: "Struct. deficit, % of GDP"   def_y_str
14: "Cyc. deficit, % of GDP"      def_y_cyc
15: "Discr. deficit, % of GDP"    def_y_discr
16:
```

```
17: "Govt. demand (G&S), % GDP"          gdem_y
18: "Struct. govt. demand (G&S), % GDP"  gdem_y_str
19: "Cyc. govt. demand (G&S), % GDP"     gdem_y_cyc
20: "Discr. govt. demand (G&S), % GDP"   gdem_y_discr
21:
22: "Other govt. exp., % to GDP"         oexp_y
23: "Cyc. other govt. exp., % to GDP"    oexp_y_cyc
24: "Struct. other govt. exp., % to GDP" oexp_y_str
25: "Discr. other govt. exp., % to GDP"  oexp_y_discr
26:
27: "Govt. rev., % of GDP"          grev_y
28: "Struct. govt. rev., % of GDP"  grev_y_str
29: "Cyc. govt. rev., % of GDP"     grev_y_cyc
30: "Discr. govt. rev., % of GDP"   grev_y_discr
31:
32: "Fiscal grants, % of GDP"    grants_y
33:
34: % ----------------------------------------
35: % -------- Components of real GDP --------
36:
37: % ----- Private consumption -----
38:
39: "Consumption gap, %"           l_cons_gap
40: "Exptd. cons. gap, %"          e_l_cons_gap
41: "Consumption, 100*log"         l_cons
42: "Consumption, ann. QQ %"       dl_cons
43: "Consumption, YY %"            d4l_cons
44: "Consumption tnd., 100*log"    l_cons_tnd
45: "Consumption tnd., ann. QQ %"  dl_cons_tnd
46: "Consumption tnd., YY %"       d4l_cons_tnd
47:
48: % ----- Private investment -----
49:
50: "Investment gap, %"           l_inv_gap
51: "Exptd. investment gap, %"    e_l_inv_gap
52: "Investment, 100*log"         l_inv
53: "Investment, ann. QQ %"       dl_inv
54: "Investment, YY %"            d4l_inv
55: "Investment tnd., 100*log"    l_inv_tnd
56: "Investment tnd., ann. QQ %"  dl_inv_tnd
```

```
57: "Investment tnd., YY %"         d4l_inv_tnd
58:
59: % ----- Government demand for G&S -----
60:
61: "Gov. demand gap, %"            l_gdem_gap
62: "Gov. demand, 100*log"          l_gdem
63: "Gov. demand, ann. QQ %"        dl_gdem
64: "Gov. demand, YY %"             d4l_gdem
65: "Gov. demand, tnd., 100*log"    l_gdem_tnd
66: "Gov. demand, tnd., ann. QQ %"  dl_gdem_tnd
67: "Gov. demand, tnd., YY %"       d4l_gdem_tnd
68:
69: % ----- Exports of G&S -----
70:
71: "Export gap, %"            l_exp_gap
72: "Exptd. export gap, %"     e_l_exp_gap
73: "Export RMCI, %"           rmci_exp
74: "Export, 100*log"          l_exp
75: "Export, ann. QQ %"        dl_exp
76: "Export, YY %"             d4l_exp
77: "Export tnd., 100*log"     l_exp_tnd
78: "Export tnd., ann. QQ %"   dl_exp_tnd
79: "Export tnd., YY %"        d4l_exp_tnd
80:
81: % ----- Imports of G&S -----
82:
83: "Import gap, %"            l_imp_gap
84: "Import, 100*log"          l_imp
85: "Import, ann. QQ %"        dl_imp
86: "Import, YY %"             d4l_imp
87: "Import tnd., 100*log"     l_imp_tnd
88: "Import tnd., ann. QQ %"   dl_imp_tnd
89: "Import tnd., YY %"        d4l_imp_tnd
90:
91: % ----- GDP -----
92:
93: "Output gap, %"            l_y_gap
94: "Exptd. output gap, %"     e_l_y_gap
95: "GDP, 100*log"             l_y
96: "GDP, ann. QQ %"           dl_y
```

```
 97: "GDP, YY %"              d4l_y
 98: "GDP tnd., 100*log"      l_y_tnd
 99: "GDP tnd., ann. QQ %"    dl_y_tnd
100: "GDP tnd., YY %"         d4l_y_tnd
101:
102: % ----- Agricultural output -----
103:
104: "Agric. output gap, %"            l_y_agr_gap
105: "Exptd. agric. output gap, %"     e_l_y_agr_gap
106: "Agric. GDP, 100*log"             l_y_agr
107: "Agric. GDP, ann.QQ %"            dl_y_agr
108: "Agric. GDP, YY %"                d4l_y_agr
109: "Agric. GDP tnd., 100*log"        l_y_agr_tnd
110: "Agric. GDP tnd., ann.QQ %"       dl_y_agr_tnd
111: "Agric. GDP tnd., YY %"           d4l_y_agr_tnd
112:
113: % ----------------------
114: % -------- Prices --------
115:
116: % ----- Headline CPI
117:
118: "Headline CPI, 100*log"           l_cpi
119: "Headline CPI, ann. QQ %"         dl_cpi
120: "Exptd. Headline CPI, ann. QQ %"  e_dl_cpi
121: "Headline CPI, YY %"              d4l_cpi
122:
123: % ----- Core CPI -----
124:
125: "Core CPI, 100*log"               l_cpi_core
126: "Core CPI, ann. QQ %"             dl_cpi_core
127: "Exptd. Core CPI, ann. QQ %"      e_dl_cpi_core
128: "Core CPI, YY %"                  d4l_cpi_core
129:
130: % ----- Food CPI -----
131:
132: "Food CPI, 100*log"               l_cpi_food
133: "Food CPI, ann. QQ %"             dl_cpi_food
134: "Exptd. Food CPI, ann. QQ %"      e_dl_cpi_food
135: "Food CPI, YY %"                  d4l_cpi_food
136:
```

```
137: % ----- Energy CPI -----
138:
139: "Energy CPI, 100*log"          l_cpi_ener
140: "Energy CPI, ann. QQ %"        dl_cpi_ener
141: "Exptd. energy CPI, ann. QQ %" e_dl_cpi_ener
142: "Energy CPI, YY %"             d4l_cpi_ener
143:
144: % --------------------------------
145: % -------- Relative prices --------
146:
147: % ----- Real marginal cost gap -----
148:
149: "RMC, %"  rmc
150:
151: % ----- Core/headline relative prices -----
152:
153: "Core rel. price, 100*log"         l_rp_cpi_core
154: "Core rel. price, ann. QQ %"       dl_rp_cpi_core
155: "Core rel. price, YY %"            d4l_rp_cpi_core
156: "Core rel. price gap, %"           l_rp_cpi_core_gap
157: "Core rel. price tnd., 100*log"    l_rp_cpi_core_tnd
158: "Core rel. price tnd., ann. QQ %"  dl_rp_cpi_core_tnd
159: "Core rel. price tnd., YY %"       d4l_rp_cpi_core_tnd
160:
161: "Dir. ext. eff. in core, ann. QQ %" dl_cpi_core_direct
162:
163: % ----- Food/headline relative prices -----
164:
165: "Food rel. price, 100*log"         l_rp_cpi_food
166: "Food rel. price, ann QQ. %"       dl_rp_cpi_food
167: "Food rel. price, YY %"            d4l_rp_cpi_food
168: "Food rel. price gap, %"           l_rp_cpi_food_gap
169: "Food rel. price tnd., 100*log"    l_rp_cpi_food_tnd
170: "Food rel. price tnd., ann. QQ %"  dl_rp_cpi_food_tnd
171: "Food rel. price tnd., YY %"       d4l_rp_cpi_food_tnd
172:
173: "Dir. ext. eff. in food, ann. QQ %" dl_cpi_food_direct
174:
175: % ----- Energy/headline relative prices -----
176:
```

```
177: "Energy rel. price, 100*log"           l_rp_cpi_ener
178: "Energy rel. price, ann. QQ %"         dl_rp_cpi_ener
179: "Energy rel. price, YY %"              d4l_rp_cpi_ener
180: "Energy rel. price gap, %"             l_rp_cpi_ener_gap
181: "Energy rel. price tnd., 100*log"      l_rp_cpi_ener_tnd
182: "Energy rel. price tnd., ann. QQ %"    dl_rp_cpi_ener_tnd
183: "Energy rel. price tnd., YY %"         d4l_rp_cpi_ener_tnd
184:
185: "Dir. ext. eff. in energy, ann. QQ %" dl_cpi_ener_direct
186:
187: % ---------------------------------
188: % -------- Monetary policy --------
189:
190: % ----- Nominal interest rate -----
191:
192: "Policy rate (IB rate used), %"      i
193: "Policy rate tnd (IB rate used), %" i_tnd
194:
195: % ----- Real interest rate -----
196:
197: "Real interest (policy) rate, %"               r
198: "RIR (policy) gap, %"                          r_gap
199: "Exptd. RIR (policy) gap, %"                   e4_r_gap
200: "Exptd. RIR (lending) gap, 4-Q ahead av., %"  r4_gap
201: "RIR (policy) trend, %"                        r_tnd
202:
203: % ----- Lending premium -----
204:
205: "Lending premium, %"       prem_d
206: "Lending premium gap, %"  prem_d_gap
207:
208: % ----- Inflation target -----
209:
210: "Inflation target, YY %"            d4l_cpi_tar
211: "Headline CPI dev, 4-Q ahead YY %"  d4l_cpi_dev
212:
213: "Impl. core infl. target, YY %"    d4l_cpi_core_tar
214: "Impl. food infl. target, YY %"    d4l_cpi_food_tar
215: "Impl. ener. infl. target, YY %"  d4l_cpi_ener_tar
216:
```

```
217: % ----- Real monetary condition index -----
218:
219: "RMCI cons., %"      rmci_cons
220: "RMCI invest., %"    rmci_inv
221:
222: % -------------------------------
223: % -------- Exchange rate --------
224:
225: % ----- Nominal exchange rate ------
226:
227: "Exchng. rate, 100*log"         l_s
228: "Exchng. rate, ann. QQ %"       dl_s
229: "Exchng. rate, YY %"            d4l_s
230: "Exptd. exchng. rate, 100*log"  e_l_s
231:
232: "Exchng rate target, ann. QQ %"   dl_s_tar
233:
234: % ----- Sovereign risk premium -----
235:
236: "Risk premium, %"   prem
237:
238: % ----- Real exchange rate -----
239:
240: "Real exchng. rate, 100*log"        l_z
241: "Real exchng. rate, ann. QQ %"      dl_z
242: "Real exchng. rate, YY %"           d4l_z
243: "Exptd. RER, ann. QQ %"             e_dl_z
244: "Real exchng. rate trend, 100*log"  l_z_tnd
245: "Real exchng. rate trend, ann. QQ %" dl_z_tnd
246: "Real exchng. rate trend, YY %"      d4l_z_tnd
247: "Exp. RER trend., ann. QQ %"         e_dl_z_tnd
248: "Real exchng. rate gap, %"           l_z_gap
249:
250: % -------- Money demand --------
251:
252: "Money, 100*log"                l_md
253: "Real money, 100*log"           l_rmd
254: "Real money, ann. QQ %"         dl_rmd
255: "Real money, YY %"              d4l_rmd
256: "Change of velocity, ann. QQ %"   dl_v
```

```
257:
258: % ------------------------------------
259: % -------- External variables --------
260:
261: % ----- External demand -----
262:
263: "Foreign output gap, %"    l_ystar_gap
264:
265: % ----- Foreign prices -----
266:
267: "Foreign CPI, 100*log"          l_cpistar
268: "Foreign CPI, ann. QQ %"        dl_cpistar
269: "Foreign CPI, YY %"             d4l_cpistar
270: "Exptd. foreign CPI, 100*log"   e_dl_cpistar
271:
272: % ----- Foreign interest rate -----
273:
274: "Foreign interest rate, %"             istar
275: "Foreign real interest rate trend, %"  rstar_tnd
276:
277: % ----- World food prices -----
278:
279: "Foreign food price, 100*log"     l_foodstar
280: "Foreign food price, ann. QQ %"   dl_foodstar
281: "Foreign food price, YY %"        d4l_foodstar
282:
283: "Foreign rel. food price, 100*log"     l_rp_foodstar
284: "Foreign rel. food price, ann. QQ %"   dl_rp_foodstar
285: "Foreign rel. food price, YY %"        d4l_rp_foodstar
286:
287: "Foreign rel. food price gap, %"  l_rp_foodstar_gap
288:
289: "Foreign rel. food price tnd., 100*log"     l_rp_foodstar_tnd
290: "Foreign rel. food price tnd., ann. QQ %"   dl_rp_foodstar_tnd
291: "Foreign rel. food price tnd., YY %"        d4l_rp_foodstar_tnd
292:
293: % ----- World energy prices -----
294:
295: "Foreign ener. price, 100*log"     l_enerstar
296: "Foreign ener. price, ann. QQ %"   dl_enerstar
```

```
297: "Foreign ener. price, YY %"         d4l_enerstar
298:
299: "Foreign rel. ener. price, 100*log"      l_rp_enerstar
300: "Foreign rel. ener. price, ann. QQ %"   dl_rp_enerstar
301: "Foreign rel. ener. price, YY %"         d4l_rp_enerstar
302:
303: "Foreign rel. ener. price gap, %"    l_rp_enerstar_gap
304:
305: "Foreign rel. ener. price tnd., 100*log"     l_rp_enerstar_tnd
306: "Foreign rel. ener. price tnd., ann. QQ %"  dl_rp_enerstar_tnd
307: "Foreign rel. ener. price tnd., YY %"         d4l_rp_enerstar_tnd
308:
309: % ------------------------------------------------
310: % -------------- Transition shocks --------------
311: % ------------------------------------------------
312:
313: !transition_shocks
314:
315: "Fiscal grants, % of GDP"    shock_grants_y⟨σ=2.5⟩
316:
317: "Gdem. cyc. shock, % of GDP"     shock_gdem_y_str⟨σ=0.075⟩
318: "Gdem. str. shock, % of GDP"     shock_gdem_y_cyc⟨σ=0⟩
319: "Gdem. discr. shock, % of GDP"  shock_gdem_y_discr⟨σ=1.7321⟩
320:
321: "Gov exp. cyc. shock, % of GDP"     shock_oexp_y_str⟨σ=0.1732⟩
322: "Gov exp. str. shock, % of GDP"     shock_oexp_y_cyc⟨σ=0⟩
323: "Gov exp. discr. shock, % of GDP"   shock_oexp_y_discr⟨σ=1.7321⟩
324:
325: "Gov rev. str. shock, % of GDP"     shock_grev_y_str⟨σ=0.1⟩
326: "Gov rev. cyc. shock, % of GDP"     shock_grev_y_cyc⟨σ=0⟩
327: "Gov rev. discr. shock, % of GDP"   shock_grev_y_discr⟨σ=1.7321⟩
328:
329: "Cons. gap shock, %"             shock_l_cons_gap⟨σ=2.5⟩
330: "Inv. gap shock, %"              shock_l_inv_gap⟨σ=6⟩
331: "Export gap shock, %"            shock_l_exp_gap⟨σ=6⟩
332: "Import gap shock, %"            shock_l_imp_gap⟨σ=0.5⟩
333: "Output gap shock, %"            shock_l_y_gap⟨σ=1⟩
334: "Agric. output gap shock, %"  shock_l_y_agr_gap⟨σ=0.3⟩
335:
336: "Core infl. shock, ann. QQ %"     shock_dl_cpi_core⟨σ=2⟩
```

```
337: "Food infl. shock, ann. QQ %"      shock_dl_cpi_food⟨σ=9⟩
338: "Energy infl. shock, ann. QQ %"   shock_dl_cpi_ener⟨σ=7.1⟩
339:
340: "Policy rate shock, %"        shock_i⟨σ=1⟩
341: "Lending premium shock, %"   shock_prem_d_gap⟨σ=0.8⟩
342:
343: "Exchng. rate shock, 100*log"           shock_l_s⟨σ=0.35⟩
344: "Exchng. rate target shock, ann. QQ %"  shock_dl_s_tar⟨σ=0.3⟩
345:
346: "Real money dem. shock, ann. QQ %"  shock_dl_rmd⟨σ=1⟩
347: "Chng. of vel. shock, ann. QQ %"    shock_dl_v⟨σ=0.1⟩
348:
349: "Cons. tnd. shock, ann. QQ %"    shock_dl_cons_tnd⟨σ=0.25⟩
350: "Inv. tnd. shock, ann. QQ %"     shock_dl_inv_tnd⟨σ=0.5⟩
351: "Export shock, ann. QQ %"        shock_dl_exp_tnd⟨σ=0.75⟩
352: "Import tnd. shock, ann. QQ %"  shock_dl_imp_tnd⟨σ=0.25⟩
353:
354: "CPI target shocck, YY %"                shock_d4l_cpi_tar⟨σ=0.1⟩
355: "Food rel. price. tnd. shock, ann. QQ %"    shock_dl_rp_cpi_food_tnd⟨σ=0.5⟩
356: "Energy rel. price. tnd. shock, ann. QQ %"  shock_dl_rp_cpi_ener_tnd⟨σ=0.15⟩
357: "RER tnd. shock, ann. QQ %"               shock_dl_z_tnd⟨σ=0.1⟩
358: "Premium shock, %"                        shock_prem⟨σ=0.1⟩
359: "Agric. output tnd. shock, %"             shock_dl_y_agr_tnd⟨σ=0.06⟩
360:
361: "Foreign output gap shock, %"                  shock_l_ystar_gap⟨σ=0.45⟩
362: "Foreign CPI shock, ann. QQ %"                 shock_dl_cpistar⟨σ=3.8⟩
363: "Foreign intr. rate shock, %"                  shock_istar⟨σ=0.45⟩
364: "Foreign rel. food price gap shock, %"         shock_l_rp_foodstar_gap⟨σ=5.3⟩
365: "Foreign rel. ener. price gap shock, %"        shock_l_rp_enerstar_gap⟨σ=13.9⟩
366: "Foreign rel intr. rate rtnd. shock, %"        shock_rstar_tnd⟨σ=0.5⟩
367: "Foreign rel. food price tnd. shock, ann. QQ %"  shock_dl_rp_foodstar_tnd⟨σ=0.5⟩
368: "Foreign rel. ener. price tnd. shock, ann. QQ %"  shock_dl_rp_enerstar_tnd⟨σ=2.5⟩
369:
370: % ------------------------------------------
371: % --------------- Parameters -------------
372: % ------------------------------------------
373:
374: !parameters
375:
376: % -------------------------------
```

```
377: % -------- Steady states --------
378:
379: "steady state govt rev in % of GDP"           ss_grev_y_str⟨21⟩
380: "steady state govt other exp in % of GDP"     ss_oexp_y_str⟨6⟩
381: "steady state govt other exp in % of GDP"   ss_gdem_y_str⟨26⟩
382:
383: "SS of borrowing ratio, % of GDP"   ss_bor_str⟨6⟩
384: "SS of FCY debt share"              ss_debt_fcy_rat⟨0.846154⟩
385: "SS of fiscal grants ratio, % GDP"  ss_grants_y⟨5⟩
386:
387: "SS of FCY gov. debt. intr. prem., %" ss_prem_debt_fcy⟨NaN⟩
388: "SS of LCY gov. debt. intr. prem., %" ss_prem_debt_lcy⟨NaN⟩
389:
390: "SS of GDP growth, ann. QQ %"        ss_dl_y_tnd⟨7.23207⟩
391: "SS of agric.GDP growth, ann. QQ %" ss_dl_y_agr_tnd⟨7.23207⟩
392:
393: "CPI target, YY %"                   ss_d4l_cpi_tar⟨4.87902⟩
394: "SS of food rel. price, ann. QQ %"   ss_dl_rp_cpi_food_tnd⟨1.98026⟩
395: "SS of ener. rel. price, ann. QQ %" ss_dl_rp_cpi_ener_tnd⟨0⟩
396:
397: "SS of RER depr., ann. QQ %"  ss_dl_z_tnd⟨0⟩
398: "SS of risk premium, %"       ss_prem⟨2⟩
399: "SS of lending premium, %"    ss_prem_d⟨8.5⟩
400:
401: "SS of chng. of vel., ann. QQ %"  ss_dl_v⟨−2.02027⟩
402:
403: % --------------------------------------
404: % -------- Cyclical coefficients --------
405:
406: % ----- Fiscal parameters -----
407:
408: "Fiscal, grants. persist."                 d7⟨0.5⟩
409:
410: " grev_y_cyc response to cons * rev/GDP"     v1⟨0.012⟩
411: " grev_y_cyc response to imports * rev/GDP"  v2⟨0.006⟩
412: " grev_y_cyc response outputgap * rev/GDP"   v3⟨0.02⟩
413: " grev_y_str, lag"                          v4⟨0.99⟩
414:
415: "oexp_y_cyc,lag %"                          u1⟨0⟩
416: "oexp_y_cyc response output gap * oexp/GDP"  u2⟨0.012⟩
```

```
417: "oexp_y_str, lag %"                                    u3⟨0.95⟩
418:
419: "gdem_y_cyc (Govt demand G&S), lag"           t1⟨0⟩
420: "gdem_y_cyc response outputgap * gdem/GDP"   t2⟨0.023⟩
421: "gdem_y_str (Govt demand G&S), lag"          t3⟨0.95⟩
422: "gdem_y_discr (Govt demand G&S), lag"        t4⟨0.7⟩
423:
424: "gdem_y_discr in fiscal impulse" s1⟨1⟩
425:
426: % ----- GDP components -----
427:
428: "Consumption gap, lag"                 a1_cons⟨0.65⟩
429: "Consumption gap, expect."             a2_cons⟨0⟩
430: "Consumption gap, RMCI"                a3_cons⟨0.1⟩
431: "Consumption gap, output gap"          a4_cons⟨0.2⟩
432: "Consumption gap, fisc. imp."          a5_cons⟨0.25⟩
433: "Consumption gap, domestic in RMCI" a6_cons⟨1⟩
434:
435: "Investment gap, lag"                  a1_inv⟨0.65⟩
436: "Investment gap, expect."              a2_inv⟨0⟩
437: "Investment gap, RMCI(RIR, RER)"       a3_inv⟨0.1⟩
438: "Investment gap, output gap"           a4_inv⟨0.2⟩
439: "Investment gap, fisc. imp."           a5_inv⟨0.15⟩
440: "Investment gap, domestic in RMCI"   a6_inv⟨1⟩
441:
442: "Export gap, lag"                 a1_exp⟨0.65⟩
443: "Export gap, expect."             a2_exp⟨0⟩
444: "Export gap, RMCI(RIR, REER)"    a3_exp⟨0.2⟩
445: "Export gap, foreign dem."        a5_exp⟨0.3⟩
446: "Export gap, domestic in RMCI"   a6_exp⟨0⟩
447:
448: "Import gap, REER coeffient"          a1_imp⟨0.3⟩
449:
450: "Agric.output gap AR(1)"           r1_y_agr⟨0.4⟩
451:
452: % ----- Phillips curves -----
453:
454: "Core Phillips curve, lag"              b1⟨0.35⟩
455: "Core Phillips curve, RMC"              b2⟨0.2⟩
456: "Core Phillips curve, direct imp."      b3⟨0.05⟩
```

```
457: "Core Phillips curve, domestic in RMC"  b4⟨0.8⟩
458:
459: "Food Phillips c., lag"                   bf1⟨0.35⟩
460: "Food Phillips c.,RMC indirect importprice" bf2⟨0.1⟩
461: "Food Phillips c.,direct importprice"      bf3⟨0.1⟩
462: "+Food Phillips c., agric.output gap neg."  bf4⟨1.5⟩
463:
464: "Energy Phillips curve, lag"           be1⟨0.25⟩
465: "Energy Phillips curve, RMC"           be2⟨0.04⟩
466: "Energy Phillips curve, direct imp."  be3⟨0.02⟩
467:
468: % ----- Monetary policy rule -----
469:
470: "Policy rule, lag"            c1⟨0.8⟩
471: "Policy rule, inflation"      c2⟨1.2⟩
472: "Policy rule, output gap"     c3⟨0.2⟩
473: "Policy rule, FX target"      c4⟨0⟩
474: "Inflation target, persist."  c5⟨0.9⟩
475: "Lending premium, lag"        c6⟨0.9⟩
476:
477: % ----- Exchange rate -----
478:
479: "Exchng rate, UIP"                e1⟨0.5⟩
480: "Exchng rate expect., forward"    e2⟨0.5⟩
481: "Premium, persist."               e3⟨0.9⟩
482: "Exchng rate target, persist."    e4⟨0⟩
483: "Exchng rate target, infl. dev."  e5⟨0.3⟩
484: "Exchng rate target, REER gap"    e6⟨0.85⟩
485:
486: % ----- Money demand -----
487:
488: "Real money dem., lag"            m1⟨0.7⟩
489: "Real money dem., interest rate"  m2⟨0.5⟩
490: "Change velocity,lag"             m3⟨0.9⟩
491:
492: % ------------------------
493: % -------- Weights --------
494:
495: "Import gap, cons.share imports"      w_imp_cons⟨0.445714⟩
496: "Import gap, inv.share imports"       w_imp_inv⟨0.156⟩
```

```
497: "Import gap, govdemand share imports"    w_imp_gdem⟨0.276⟩
498: "Import gap, exp.share imports"          w_imp_exp⟨0.122286⟩
499:
500: "GDP gap, cons. share GDP"       w_y_cons⟨0.78⟩
501: "GDP gap, inv. share GDP"        w_y_inv⟨0.13⟩
502: "GDP gap, govdemand share GDP"   w_y_gdem⟨0.23⟩
503: "GDP gap, exp. share GDP"        w_y_exp⟨0.21⟩
504: "GDP gap, imp. share GDP"        w_y_imp⟨0.35⟩
505:
506: "Weight of core in CPI"   w_core⟨0.7747⟩
507: "Weight of food in CPI"   w_food⟨0.1577⟩
508: "Weight of energy in CPI" w_ener⟨0.0676⟩
509:
510: % ------------------------------------
511: % -------- Trend persistences --------
512:
513: "Cons. tnd. persist."             r_cons⟨0.95⟩
514: "Inv. tnd. persist."              r_inv⟨0.95⟩
515: "Gov. demand, tnd. persist."      r_gdem⟨0.95⟩
516: "Export tnd. persist."            r_exp⟨0.95⟩
517: "Import tnd. persist."            r_imp⟨0.95⟩
518: "Agric.output tnd. persist."      r2_y_agr⟨0.8⟩
519: "RER tnd. persist."               r_z⟨0.95⟩
520: "Food rel. price tnd. persist."   r_rp_food⟨0.9⟩
521: "Energy rel. price tnd. persist." r_rp_ener⟨0.9⟩
522:
523: % -------------------------------------------
524: % -------- Foreign block parameters --------
525:
526: "SS of foreign CPI, ann. QQ %"              ss_dl_cpistar⟨1.98026⟩
527: "SS of foreign real intr. rate, %"          ss_rstar_tnd⟨0⟩
528: "SS of foreign rel. food price, ann. QQ %"  ss_dl_rp_foodstar_tnd⟨0⟩
529: "SS of foreign rel. ener. price, ann. QQ %" ss_dl_rp_enerstar_tnd⟨0⟩
530:
531: "foreign demand persist."         r_ystar⟨0.94⟩
532: "foreign CPI persist."            r_cpistar⟨0.8⟩
533: "foreign interest rate persist."  r_istar⟨0.95⟩
534: "for. interest rate tnd. persist." r_rstar_tnd⟨0.9⟩
535: "for. rp food persist."           r_rp_foodstar_gap⟨0.62⟩
536: "for. rp energy persist."         r_rp_enerstar_gap⟨0.73⟩
```

```
537: "for. rp food tnd. persist."        r_rp_foodstar_tnd⟨0.9⟩
538: "for. rp energy tnd. persist."      r_rp_enerstar_tnd⟨0.9⟩
539:
540: % --------------------------------------------------
541: % ------------- Transition equations -------------
542: % --------------------------------------------------
543:
544: !transition_equations
545:
546: % -------------------------------
547: % -------- Fiscal policy --------
548:
549: grants_y   = d7⟨0.5⟩ * grants_y {-1} + (1-d7⟨0.5⟩) * ss_grants_y⟨5⟩ + shock_grants_y⟨σ=2.5⟩;
550:
551: grev_y = grev_y_str + grev_y_cyc + grev_y_discr;
552: grev_y_cyc = v1⟨0.012⟩ * l_cons_gap + v2⟨0.006⟩ * l_imp_gap + v3⟨0.02⟩ * l_y_gap + shock_grev_y_cyc⟨σ=0⟩;
553: grev_y_str = ...
554:             + v4⟨0.99⟩ * grev_y_str{-1} ...
555:             + (1-v4⟨0.99⟩) * ss_grev_y_str⟨21⟩ ...
556:             + shock_grev_y_str⟨σ=0.1⟩;
557: grev_y_discr = shock_grev_y_discr⟨σ=1.7321⟩;
558:
559: oexp_y = oexp_y_str + oexp_y_cyc + oexp_y_discr;
560: oexp_y_cyc = u1⟨0⟩ * oexp_y_cyc{-1} - u2⟨0.012⟩ * l_y_gap + shock_oexp_y_cyc⟨σ=0⟩;
561: oexp_y_str = ...
562:   + u3⟨0.95⟩ * oexp_y_str{-1} ...
563:   + (1-u3⟨0.95⟩) * ss_oexp_y_str⟨6⟩ ...
564:   + shock_oexp_y_str⟨σ=0.1732⟩;
565: oexp_y_discr = shock_oexp_y_discr⟨σ=1.7321⟩;
566:
567: gdem_y = gdem_y_str + gdem_y_cyc + gdem_y_discr;
568: gdem_y_cyc = t1⟨0⟩ * gdem_y_cyc{-1} - t2⟨0.023⟩ * l_y_gap + shock_gdem_y_cyc⟨σ=0⟩;
569: gdem_y_str = ...
570:     + t3⟨0.95⟩ * gdem_y_str{-1} ...
571:     + (1-t3⟨0.95⟩) * ss_gdem_y_str⟨26⟩ ...
572:     + shock_gdem_y_str⟨σ=0.075⟩;
573: gdem_y_discr = t4⟨0.7⟩ * gdem_y_discr{-1} + shock_gdem_y_discr⟨σ=1.7321⟩;
574:
575: l_gdem/100 = log(gdem_y / 100) + l_y/100;
576: l_gdem_tnd/100 = log(gdem_y_str / 100) + l_y_tnd/100;
```

```
577:
578: def_y       = gdem_y        + oexp_y        - grev_y;
579: def_y_str   = gdem_y_str    + oexp_y_str    - grev_y_str;
580: def_y_cyc   = gdem_y_cyc    + oexp_y_cyc    - grev_y_cyc;
581: def_y_discr = gdem_y_discr  + oexp_y_discr  - grev_y_discr;
582:
583: fisc_imp = ...
584:    + s1⟨1⟩ * gdem_y_discr  + oexp_y_discr  - grev_y_discr ...
585:    + def_y_str - def_y_str{-1};
586:
587: % -----------------------------
588: % -------- Real demand --------
589:
590: % ----- Consumption gap -----
591: % (note fisc_imp is indirect effect of l_gdem_gap)
592:
593: l_cons_gap = ...
594:    + a1_cons⟨0.65⟩ * l_cons_gap{-1} ...
595:    + a2_cons⟨0⟩ * e_l_cons_gap ...
596:    - a3_cons⟨0.1⟩ * rmci_cons ...
597:    + a4_cons⟨0.2⟩ * l_y_gap ...
598:    + a5_cons⟨0.25⟩ * fisc_imp ...
599:    + shock_l_cons_gap⟨σ=2.5⟩;
600:
601: rmci_cons = a6_cons⟨1⟩ * r4_gap + (1 - a6_cons⟨1⟩) * -l_z_gap;
602:
603: e_l_cons_gap = l_cons_gap{+1};
604:
605: % ----- Investment gap -----
606: %  (note fisc_imp is indirect effect of l_gdem_gap)
607:
608: l_inv_gap = ...
609:    + a1_inv⟨0.65⟩ * l_inv_gap{-1} ...
610:    + a2_inv⟨0⟩ * e_l_inv_gap ...
611:    - a3_inv⟨0.1⟩ * rmci_inv ...
612:    + a4_inv⟨0.2⟩ * l_y_gap ...
613:    + a5_inv⟨0.15⟩ * fisc_imp ...
614:    + shock_l_inv_gap⟨σ=6⟩;
615:
616: rmci_inv = a6_inv⟨1⟩ * r4_gap + (1 - a6_inv⟨1⟩) * -l_z_gap;
```

```
617:
618: e_l_inv_gap = l_inv_gap{+1};
619:
620: % ----- Export gap -----
621:
622: l_exp_gap = ...
623:    + a1_exp⟨0.65⟩ * l_exp_gap{-1} ...
624:    + a2_exp⟨0⟩ * e_l_exp_gap ...
625:    - a3_exp⟨0.2⟩ * rmci_exp ...
626:    + a5_exp⟨0.3⟩ * l_ystar_gap ...
627:    + shock_l_exp_gap⟨σ=6⟩;
628:
629: rmci_exp = a6_exp⟨0⟩ * r4_gap + (1 - a6_exp⟨0⟩) * - l_z_gap;
630:
631: e_l_exp_gap = l_exp_gap{+1};
632:
633: % ----- Import gap -----
634: % (RER added same for all importdemands,coeff REER>0,so -a1_imp)
635:
636: l_imp_gap = ...
637:    + w_imp_cons⟨0.445714⟩  * l_cons_gap ...
638:    + w_imp_inv⟨0.156⟩    * l_inv_gap ...
639:    + w_imp_gdem⟨0.276⟩  * l_gdem_gap ...
640:    + w_imp_exp⟨0.122286⟩    * l_exp_gap ...
641:    - a1_imp⟨0.3⟩        * l_z_gap ...
642:    + shock_l_imp_gap⟨σ=0.5⟩;
643:
644: % ----- Output gap -----
645: % (note direct effect of l_gdem_gap on l_y_gap)
646:
647: l_y_gap = ...
648:    + w_y_cons⟨0.78⟩   * l_cons_gap ...
649:    + w_y_inv⟨0.13⟩     * l_inv_gap ...
650:    + w_y_gdem⟨0.23⟩   * l_gdem_gap ...
651:    + w_y_exp⟨0.21⟩     * l_exp_gap ...
652:    - w_y_imp⟨0.35⟩     * l_imp_gap ...
653:    + shock_l_y_gap⟨σ=1⟩;
654:
655: e_l_y_gap = l_y_gap{+1};
656:
```

```
657: % ------------------------------------------
658: % -------- Agricultural output gap --------
659:
660: l_y_agr_gap = r1_y_agr⟨0.4⟩ * l_y_agr_gap{-1} + shock_l_y_agr_gap⟨σ=0.3⟩;
661:
662: e_l_y_agr_gap = l_y_agr_gap{+1};
663:
664: % ------------------------
665: % -------- Prices --------
666:
667: % ----- Core Phillips curve -----
668:
669: dl_cpi_core = ...
670:    + b1⟨0.35⟩ * dl_cpi_core{-1} ...
671:    + (1 - b1⟨0.35⟩ - b3⟨0.05⟩) * (e_dl_cpi_core) ...
672:    + b3⟨0.05⟩ * dl_cpi_core_direct ...
673:    + b2⟨0.2⟩ * rmc ...
674:    + shock_dl_cpi_core⟨σ=2⟩;
675:
676: rmc = b4⟨0.8⟩ * l_y_gap + (1 - b4⟨0.8⟩) * l_z_gap;
677:
678: dl_cpi_core_direct = dl_cpistar + dl_s - dl_z_tnd;
679:
680: e_dl_cpi_core = dl_cpi_core{+1};
681:
682: l_rp_cpi_core = l_cpi_core - l_cpi;
683:
684: % ----- Food Phillips curve -----
685: % agric. output gap in food inflation, with coeff as BNR-IMF -0.5
686:
687: dl_cpi_food = ...
688:    + bf1⟨0.35⟩ * dl_cpi_food{-1} ...
689:    + (1 - bf1⟨0.35⟩ - bf3⟨0.1⟩) * (e_dl_cpi_food) ...
690:    + bf3⟨0.1⟩ * dl_cpi_food_direct ...
691:    + bf2⟨0.1⟩ * (l_rp_foodstar_gap + l_z_gap + l_rp_cpi_core_gap - l_rp_cpi_food_gap) ...
692:    - bf4⟨1.5⟩ * l_y_agr_gap ...
693:    + shock_dl_cpi_food⟨σ=9⟩;
694:
695: dl_cpi_food_direct = dl_foodstar - dl_rp_foodstar_tnd + dl_s - dl_z_tnd ...
696:    - dl_rp_cpi_core_tnd + dl_rp_cpi_food_tnd;
```

```
697:
698: e_dl_cpi_food = dl_cpi_food{+1};
699:
700: l_rp_cpi_food = l_cpi_food - l_cpi;
701:
702: % ----- Energy Phillips curve -----
703:
704: dl_cpi_ener = ...
705:    + be1⟨0.25⟩ * dl_cpi_ener{-1} ...
706:    + (1 - be1⟨0.25⟩ - be3⟨0.02⟩) * (e_dl_cpi_ener)...
707:    + be3⟨0.02⟩ * dl_cpi_ener_direct ...
708:    + be2⟨0.04⟩  * (l_rp_enerstar_gap + l_z_gap  + l_rp_cpi_core_gap - l_rp_cpi_ener_gap)
709:    + shock_dl_cpi_ener⟨σ=7.1⟩;
710:
711: dl_cpi_ener_direct = dl_enerstar - dl_rp_enerstar_tnd + dl_s - dl_z_tnd ...
712:    - dl_rp_cpi_core_tnd + dl_rp_cpi_ener_tnd;
713:
714: e_dl_cpi_ener = dl_cpi_ener{+1};
715:
716: l_rp_cpi_ener = l_cpi_ener - l_cpi;
717:
718: % ----- Headline CPI level -----
719:
720: l_cpi = w_core⟨0.7747⟩ * l_cpi_core + w_food⟨0.1577⟩ * l_cpi_food + w_ener⟨0.0676⟩ * l_cpi_ener;
721:
722: e_dl_cpi = dl_cpi{+1};
723:
724: 0 = w_core⟨0.7747⟩ * l_rp_cpi_core_gap + w_food⟨0.1577⟩ * l_rp_cpi_food_gap + w_ener⟨0.0676⟩ * l_rp_cpi_ener_gap;
725:
726: % --------------------------------------
727: % -------- Monetary policy --------
728: % (standard, except ER deviation, but coeff=0)
729:
730: % ----- Inflation forecast based rule -----
731:
732: i = c1⟨0.8⟩ * i{-1} + (1 - c1⟨0.8⟩) * ( ...
733:    + i_tnd ...
734:    + c2⟨1.2⟩ * d4l_cpi_dev ...
735:    + c3⟨0.2⟩ * l_y_gap ...
736:    + c4⟨0⟩ * (dl_s - dl_s_tar) ...
```

```
737:    ) ...
738:    + shock_i⟨σ=1⟩;
739:
740: d4l_cpi_dev = d4l_cpi{+4} - d4l_cpi_tar;
741:
742: i_tnd = r_tnd + d4l_cpi_tar + dl_rp_cpi_core_tnd;
743:
744: % ----- Real interest rate -----
745:
746: r = i - e_dl_cpi_core;
747:
748: r_tnd = rstar_tnd + prem + e_dl_z_tnd;
749:
750: r4_gap = (r_gap + r_gap{+1} + r_gap{+2} + r_gap{+3}) / 4  + prem_d_gap;
751:
752: e4_r_gap = (r_gap + r_gap{+1} + r_gap{+2} + r_gap{+3}) / 4;
753:
754: % ----- Lending premium -----
755:
756: prem_d = prem_d_gap + ss_prem_d⟨8.5⟩;
757:
758: prem_d_gap = c6⟨0.9⟩ * prem_d_gap{-1} + shock_prem_d_gap⟨σ=0.8⟩;
759:
760: % ----- Inflation target -----
761:
762: d4l_cpi_tar = c5⟨0.9⟩ * d4l_cpi_tar{-1} + (1 - c5⟨0.9⟩) * ss_d4l_cpi_tar⟨4.87902⟩ + shock_d4l_cpi_tar⟨σ=0.1⟩;
763:
764: d4l_cpi_core_tar = d4l_cpi_tar + d4l_rp_cpi_core_tnd;
765:
766: d4l_cpi_food_tar = d4l_cpi_tar + d4l_rp_cpi_food_tnd;
767:
768: d4l_cpi_ener_tar = d4l_cpi_tar + d4l_rp_cpi_ener_tnd;
769:
770: % -------------------------------
771: % -------- Exchange rate --------
772: % (UIP & move to ER-target, det. by RER-tnd & target infl.diff.)
773:
774: l_s = ...
775:    + e1⟨0.5⟩ * (e_l_s - (i - istar - prem)/4) ...
776:    + (1 - e1⟨0.5⟩) * (l_s{-1} + dl_s_tar/4) ...
```

```
777:    + shock_l_s⟨σ=0.35⟩;
778:
779: e_l_s = ...
780:    + e2⟨0.5⟩ * l_s{+1} ...
781:    + (1 - e2⟨0.5⟩) * (l_s{-1} + 2*(dl_z_tnd + d4l_cpi_tar + dl_rp_cpi_core_tnd - ss_dl_cpistar⟨1.98026⟩)/4);
782:
783: prem = e3⟨0.9⟩ * prem{-1} + (1 - e3⟨0.9⟩) * ss_prem⟨2⟩ + shock_prem⟨σ=0.1⟩;
784:
785: dl_s_tar = e4⟨0⟩ * dl_s_tar{-1} + (1 - e4⟨0⟩) * ( ...
786:    dl_z_tnd + d4l_cpi_tar + dl_rp_cpi_core_tnd - ss_dl_cpistar⟨1.98026⟩ - e5⟨0.3⟩ * d4l_cpi_dev - e6⟨0.85⟩ * l_z_gap ...
787:    ) + shock_dl_s_tar⟨σ=0.3⟩;
788:
789: l_z = l_s + l_cpistar - l_cpi_core;
790:
791: e_dl_z = dl_z{+1};
792:
793: e_dl_z_tnd = dl_z_tnd{+1};
794:
795: % ----------------------------------
796: % ------- Real money demand --------
797: % (function of nominal i dev., cp. BNR: change in r-tnd)
798:
799: l_rmd = l_md - l_cpi;
800:
801: dl_rmd = ...
802:    + m1⟨0.7⟩ * dl_rmd{-1} ...
803:    + (1 - m1⟨0.7⟩) * (dl_y - dl_v + m2⟨0.5⟩ * (i - i_tnd)) ...
804:    + shock_dl_rmd⟨σ=1⟩;
805:
806: dl_v = m3⟨0.9⟩ * dl_v{-1} + (1 - m3⟨0.9⟩) * ss_dl_v⟨−2.02027⟩ + shock_dl_v⟨σ=0.1⟩;
807:
808: % ------------------------
809: % -------- Trends --------
810: % (weights for output-tnd are same as for output-gap)
811:
812: dl_cons_tnd   = r_cons⟨0.95⟩  * dl_cons_tnd{-1} + (1 - r_cons⟨0.95⟩)  * ss_dl_y_tnd⟨7.23207⟩ + shock_dl_cons_tnd⟨σ=0.25⟩;
813: dl_inv_tnd    = r_inv⟨0.95⟩   * dl_inv_tnd{-1}  + (1 - r_inv⟨0.95⟩)   * ss_dl_y_tnd⟨7.23207⟩ + shock_dl_inv_tnd⟨σ=0.5⟩;
814: dl_exp_tnd    = r_exp⟨0.95⟩   * dl_exp_tnd{-1}  + (1 - r_exp⟨0.95⟩)   * ss_dl_y_tnd⟨7.23207⟩ + shock_dl_exp_tnd⟨σ=0.75⟩;
815: dl_imp_tnd    = r_imp⟨0.95⟩   * dl_imp_tnd{-1}  + (1 - r_imp⟨0.95⟩)   * ss_dl_y_tnd⟨7.23207⟩ + shock_dl_imp_tnd⟨σ=0.25⟩;
816:
```

```
817: dl_y_tnd = ...
818:    + w_y_cons⟨0.78⟩   * dl_cons_tnd ...
819:    + w_y_inv⟨0.13⟩    * dl_inv_tnd ...
820:    + w_y_gdem⟨0.23⟩   * dl_gdem_tnd ...
821:    + w_y_exp⟨0.21⟩    * dl_exp_tnd ...
822:    - w_y_imp⟨0.35⟩    * dl_imp_tnd;
823:
824: dl_y_agr_tnd  =  r2_y_agr⟨0.8⟩  * dl_y_agr_tnd{-1} + (1 - r2_y_agr⟨0.8⟩) * ss_dl_y_agr_tnd⟨7.23207⟩ + shock_dl_y_agr_tnd⟨σ=0.06⟩; % no role ye
825:
826: dl_z_tnd       = r_z⟨0.95⟩ * dl_z_tnd{-1} + (1 - r_z⟨0.95⟩)  * ss_dl_z_tnd⟨0⟩   + shock_dl_z_tnd⟨σ=0.1⟩;
827:
828: dl_rp_cpi_food_tnd  = r_rp_food⟨0.9⟩ * dl_rp_cpi_food_tnd{-1} + (1 - r_rp_food⟨0.9⟩) * ss_dl_rp_cpi_food_tnd⟨1.98026⟩ + shock_dl_rp_cpi_food_t
829: dl_rp_cpi_ener_tnd  = r_rp_ener⟨0.9⟩ * dl_rp_cpi_ener_tnd{-1} + (1 - r_rp_ener⟨0.9⟩) * ss_dl_rp_cpi_ener_tnd⟨0⟩ + shock_dl_rp_cpi_ener_tnd⟨σ=
830:
831: % --------------------------------
832: % -------- External sector ---------
833:
834: l_ystar_gap    = r_ystar⟨0.94⟩ * l_ystar_gap{-1} + shock_l_ystar_gap⟨σ=0.45⟩;
835:
836: dl_cpistar     = r_cpistar⟨0.8⟩ * dl_cpistar{-1} + (1 - r_cpistar⟨0.8⟩) * ss_dl_cpistar⟨1.98026⟩ + shock_dl_cpistar⟨σ=3.8⟩;
837: e_dl_cpistar  = dl_cpistar{+1};
838:
839: istar          = r_istar⟨0.95⟩ * istar{-1} + (1 - r_istar⟨0.95⟩) * (ss_rstar_tnd⟨0⟩ + ss_dl_cpistar⟨1.98026⟩) + shock_istar⟨σ=0.45⟩;
840: rstar_tnd      = r_rstar_tnd⟨0.9⟩ * rstar_tnd{-1} + (1 - r_rstar_tnd⟨0.9⟩) * ss_rstar_tnd⟨0⟩ + shock_rstar_tnd⟨σ=0.5⟩;
841:
842: l_rp_foodstar = l_foodstar - l_cpistar;
843: l_rp_enerstar = l_enerstar - l_cpistar;
844:
845: l_rp_foodstar_gap   = r_rp_foodstar_gap⟨0.62⟩ * l_rp_foodstar_gap{-1} + shock_l_rp_foodstar_gap⟨σ=5.3⟩;
846: l_rp_enerstar_gap   = r_rp_enerstar_gap⟨0.73⟩ * l_rp_enerstar_gap{-1} + shock_l_rp_enerstar_gap⟨σ=13.9⟩;
847:
848: dl_rp_foodstar_tnd = r_rp_foodstar_tnd⟨0.9⟩ * dl_rp_foodstar_tnd{-1} + (1 - r_rp_foodstar_tnd⟨0.9⟩) * ss_dl_rp_foodstar_tnd⟨0⟩ + shock_dl_rp_f
849: dl_rp_enerstar_tnd = r_rp_enerstar_tnd⟨0.9⟩ * dl_rp_enerstar_tnd{-1} + (1 - r_rp_enerstar_tnd⟨0.9⟩) * ss_dl_rp_enerstar_tnd⟨0⟩ + shock_dl_rp_e
850:
851: % ------------------------------------
852: % -------- Trend/gap identities --------
853:
854: !for
855:   l_y, l_y_agr, l_cons, l_inv, l_exp, l_imp, l_gdem,
856:   r, l_z
```

```
857:    l_rp_cpi_food, l_rp_cpi_ener, l_rp_cpi_core
858:    l_rp_foodstar, l_rp_enerstar
859: !do
860:    !transition_equations
861:      ? = ?_tnd + ?_gap;
862: !end
863:
864: % ------------------------------
865: % -------- Growth rates --------
866:
867: !for
868:    y, y_tnd, cons, cons_tnd, inv, inv_tnd, gdem, gdem_tnd, exp, exp_tnd, imp, imp_tnd
869:    y_agr, y_agr_tnd,
870:    cpi, cpi_core, cpi_food, cpi_ener
871:    rp_cpi_food, rp_cpi_ener, rp_cpi_core, rp_cpi_food_tnd, rp_cpi_ener_tnd, rp_cpi_core_tnd
872:    s, z, z_tnd
873:    rmd
874:    cpistar, foodstar, enerstar
875:    rp_foodstar, rp_enerstar, rp_foodstar_tnd, rp_enerstar_tnd
876: !do
877:    !transition_equations
878:      dl_?  = 4 * (l_? - l_?{-1}); % ak we should *4 for flow variables
879:      d4l_? = (l_? - l_?{-4});
880: !end
881:
882: % ------------------------------------------------------------
883: % ------------- Measurement variables/equations -------------
884: % ------------------------------------------------------------
885:
886: % ----------------------------------
887: % -------- Hard observations --------
888:
889: !for
890:    def_y, grants_y, grev_y
891:    l_y, l_y_agr, l_cons, l_gdem, l_inv, l_exp, l_imp
892:    l_cpi, l_cpi_food, l_cpi_ener
893:    i, prem_d, l_s, l_md
894:    l_ystar_gap, l_cpistar, istar, rstar_tnd
895:    l_foodstar, l_enerstar
896:    l_rp_foodstar_gap, l_rp_enerstar_gap
```

```
897:  !do
898:    !measurement_variables
899:      obs_?
900:    !measurement_equations
901:      obs_? = ?;
902:  !end
903:
904:  % --------------------------------------------
905:  % -------- Expert/judgemental tunes --------AK added Oct 13, def_y, grev_y
906:
907:  !for
908:    gdem_y, oexp_y, def_y, grev_y
909:    gdem_y_str, oexp_y_str, grev_y_str
910:    gdem_y_cyc, oexp_y_cyc, grev_y_cyc
911:    grev_y_discr, oexp_y_discr, gdem_y_discr
912:    l_y_tnd, l_cons_tnd, l_inv_tnd, l_gdem_tnd, l_exp_tnd, l_imp_tnd
913:    d4l_cpi_tar, l_rp_cpi_food_tnd, l_rp_cpi_ener_tnd
914:    dl_cpi_core, dl_cpi_food, dl_cpi_ener, dl_cpi
915:    r_tnd, l_z_tnd, prem, dl_s_tar
916:    def_y_str, def_y_discr, grants_y
917:    l_y_gap, l_cons_gap, l_inv_gap, l_gdem_gap, l_exp_gap, l_imp_gap
918:    l_y_agr_gap
919:    l_z_gap
920:    l_y, d4l_y
921:    dl_s
922:    l_cpi_core
923:  !do
924:    !measurement_variables
925:      tune_?
926:    !measurement_equations
927:      tune_? = ?;
928:  !end
929:
930:  % ----------------------------------------------------------------------------
931:  % -------- Auxiliary variables/equations for shock tuning in the filter --------
932:
933:  !for
934:    shock_dl_cons_tnd⟨σ=0.25⟩
935:    shock_dl_cpi_ener⟨σ=7.1⟩
936:    shock_dl_cpi_core⟨σ=2⟩
```

```
937: !do
938:    !transition_variables
939:      aux_?
940:    !transition_equations
941:      aux_? = ?;
942:    !measurement_variables
943:      tune_?
944:    !measurement_equations
945:      tune_? = aux_?;
946: !end
947:
948: % -------------------------------------------------
949: % ------------- Reporting equations -------------
950: % -------------------------------------------------
951:
952: !parameters
953:
954: "Share of import prices in CPI"           mu_pimp⟨0.35⟩
955: "Share of export prices in GDP deflator"  mu_pexp⟨0.2⟩
956:
957: "share of fcy debt in total debt"        r_debt_fcy_rat⟨0.9⟩
958: "interest rate fcy debt persistence"     r_debt_fcy_intrate_pers⟨0.9⟩
959: "interest rate lcy debt persistence"     r_debt_lcy_intrate_pers⟨0.9⟩
960:
961: gamma_r⟨0.5⟩
962: gamma_k⟨0.5⟩
963: gamma_BP_tnd⟨0.9⟩
964: % AK 7/14/23 replace k_bar by l_BP_tnd; % log(BP)=k, BP cum inflows mln$,
965: % BP does not go to fixed ss level k_bar=log(6500), but to trend
966: % with initial value trend set equal to actual in readData
967:
968: "Import share in consumption"   lam_imp_cons⟨0.2⟩
969: "Import share in investment"    lam_imp_inv⟨0.42⟩
970: "Import share in govdemand"     lam_imp_gdem⟨0.42⟩
971: "Import share in exports"       lam_imp_exp⟨0.20381⟩
972:
973: !reporting_equations
974:
975: % True percentages (added Oct 28, '22)
976: !for
```

```
977:    y, cons, inv, gdem, exp, imp
978:    cpi, cpi_core, cpi_food, cpi_ener
979:    s, z
980: !do
981:    pct_?   = exp(dl_?/100)*100 - 100; % annualized: correct for stocks, incorrect for flows
982:    pct4_?  = exp(d4l_?/100)*100 - 100;
983: !end
984:
985: !for
986:    i, r
987: !do
988:    pct_?   = exp(?/100)*100 - 100;
989: !end
990:
991: % Levels exchange rate and nominal money demand
992: s    = exp(l_s/100);
993: md   = exp(l_md/100);
994: dl_md = 4*(l_md - l_md{-1}); % ak 7/15/23 must be annualized
995:
996: % Deflators (recall: all annualized, *4)
997:
998: dl_pexp = dl_pexpstar + dl_s;
999: dl_pimp = dl_pimpstar + dl_s;
1000:
1001: dl_pdom = (dl_cpi - mu_pimp⟨0.35⟩ * dl_pimp) / (1 - mu_pimp⟨0.35⟩);
1002:
1003: dl_py   = mu_pexp⟨0.2⟩ * dl_pexp + (1 - mu_pexp⟨0.2⟩) * dl_pdom;
1004: % deflator for govt demand assumed equal to dl_cpi_core to simplify
1005:
1006: % Nominal growth rates (recall:all annualized, *4)
1007:
1008: dl_nexp = dl_exp  + dl_pexp;
1009: dl_nimp = dl_imp  + dl_pimp;
1010: dl_ny   = dl_y    + dl_py;
1011: dl_ngdem = dl_gdem + dl_cpi_core;
1012: dl_ncons = dl_cons + dl_cpi_core; % 4/19 AK for ratios (% to nom GDP)
1013: dl_ninv  = dl_inv  + dl_cpi_core;
1014:
1015: % Nominal levels exports, imports, GDP
1016:
```

```
1017: nexp     = exp(log(nexp{-1}) + dl_nexp/100/4);
1018: nimp     = exp(log(nimp{-1}) + dl_nimp/100/4);
1019: ny       = exp(log(ny{-1}) + dl_ny/100/4); % get ny{-1} etc from dbAUX to have start value forecast
1020: ngdem    = exp(log(ngdem{-1}) + (dl_ngdem/100)/4); % idem
1021: ncons    = exp(log(ncons{-1}) + dl_ncons/100/4); % 4/19/23 AK for ratios
1022: ninv     = exp(log(ninv{-1}) + dl_ninv/100/4);
1023:
1024: tb_rat   = (nexp - nimp) / ny *100;
1025:
1026: % Capital account (Ostry/Ghosh/Chamon,2012:log(BP)=k; define rstar here, not done in model)
1027: % 7/14/23 trend eq for ss cumul capital inflows in line with real GDP, instead of k_bar
1028: rstar = istar - e_dl_cpistar;
1029: % first evaluate trend
1030: dl_BP_tnd = gamma_BP_tnd⟨0.9⟩ * dl_BP_tnd{-1} + (1-gamma_BP_tnd⟨0.9⟩) * ss_dl_y_tnd⟨7.23207⟩;
1031: l_BP_tnd = dl_BP_tnd/4 + l_BP_tnd{-1};
1032: % then evaluate level
1033: l_BP  = l_BP{-1} + gamma_r⟨0.5⟩ * ( (r - rstar - prem)/4 - e_dl_z ) ...
1034:     - gamma_k⟨0.5⟩ * (l_BP{-1} - l_BP_tnd);
1035: dBP_usd = exp(l_BP/100) - exp(l_BP{-1}/100);
1036:
1037: % evaluate debt and deficit first before rest of BOP and MON
1038: % ak debt changes with deficit-/-grants, nb def_y and grants are over Q-GDP, as is debt
1039: debt_y = ...
1040:    + debt_lcy_y{-1} * (1) / exp(dl_ny/400) ...
1041:    + debt_fcy_y{-1} * exp(dl_s/400) / exp(dl_ny/400) ...
1042:    + def_y - grants_y;
1043:
1044: debt_fcy_rat = r_debt_fcy_rat⟨0.9⟩ * debt_fcy_y{-1} / debt_y{-1} + (1 - r_debt_fcy_rat⟨0.9⟩) * ss_debt_fcy_rat⟨0.846154⟩;
1045:
1046: debt_fcy_y = debt_fcy_rat * debt_y;
1047:
1048: debt_lcy_y = debt_y - debt_fcy_y; % residual
1049:
1050: def_lcy_y = debt_lcy_y - debt_lcy_y{-1} * (1) / exp(dl_ny/400);
1051:
1052: def_fcy_y = debt_fcy_y - debt_fcy_y{-1} * exp(dl_s/400) / exp(dl_ny/400);
1053:
1054: % ak we need interest-rate update equations:
1055: % i_debt_fcy = r_debt_fcy_intrate_pers * i_debt_fcy{-1} + (1 -
1056: % r_debt_fcy_intrate_pers) * (ss_rstar_tnd + ss_dl_cpistar + ss_prem_debt_fcy)
```

```
1057: % i_debt_lcy = r_debt_lcy_intrate_pers * i_debt_lcy{-1} + (1 -
1058: % r_debt_lcy_intrate_pers) * (i_tnd + ss_prem_debt_lcy)
1059:
1060: intp_fcy_y = i_debt_fcy{-1}/400 * debt_fcy_y{-1} * exp(dl_s/400) / exp(dl_ny/400);
1061:
1062: intp_lcy_y = i_debt_lcy{-1}/400 * debt_lcy_y{-1} * (1) / exp(dl_ny/400);
1063:
1064: % External flow equilibrium (current account (RM=E-M) converted to mln $)
1065: % still need evaluate levels govt interest payments in usd for BOP
1066: dBG_usd = ( ( (def_fcy_y/100) * ny) /s ) * 1000; % for bor deficit RWFbln then to $mln
1067: NFG_usd = ( ( (grants_y/100)  * ny) /s ) * 1000; % net foreign grants govt RWFbln then to $mln
1068:
1069: dNFA_usd = (nexp - nimp) / s * 1000 + NFG_usd + dBG_usd + dBP_usd;
1070:
1071: % ak 7/15/23 trace monetary flows, share of bank in domestic financing deficit
1072: def_lcy_bank_y = 0.5 * def_lcy_y; % nb still over Q GDP in %!
1073: NCG = NCG{-1} + (def_lcy_bank_y/100) * ny;
1074:
1075: NFA = NFA{-1} + dNFA_usd * s/1000; % ignores ER valuation changes
1076:
1077: % Monetary flow equilibrium in bln RWF, private credit residual
1078: dNCP = diff(md) - dNFA_usd * s / 1000 - diff(NCG);
1079:
```