

QPM Model

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1: % =====
2: % Basic Quarterly Projection Model (QPM)
3: % =====
4:
5: !transition_variables
6: 'Real GDP (100*log)'                L_GDP
7: 'Trend in Real GDP (100*log)'        L_GDP_BAR
8: 'Output Gap (in %)'                 L_GDP_GAP
9: 'Quarterly Growth in Real GDP(in % pa)' DLA_GDP
10: 'Real GDP Growth YoY (in % pa)'      D4L_GDP
11: 'Real GDP Trend Growth QoQ annualized (in % pa)' DLA_GDP_BAR
12: 'Growth trend'      GROWTH_BAR
13:
14: 'Real Monetary Condition Index (in % pa)'      MCI
15:
16: 'CPI (level, 100*log)'                L_CPI
17: 'CPI Inflation QoQ annualized (in % pa)'      DLA_CPI
18: 'Expected CPI Inflation QoQ annualized (in % pa)' E_DLA_CPI
19: 'Expected CPI Inflation YoQ (in % pa)'      E_D4L_CPI
20: 'CPI Inflation YoY (in % pa)'            D4L_CPI
21: 'Inflation Target (in % pa)'            D4L_CPI_TAR
22:
23: 'Real Marginal Cost (in %)'            RMC
24:
25: 'Nominal Exchange Rate (LCY/FCY, 100*log)'      L_S
26: 'Nominal Exch. Rate Depreciation QoQ annualized (in % pa)' DLA_S
27: 'Nominal Exch. Rate Depreciation YoY (in % pa)'      D4L_S
28: 'Country Risk Premium (in % pa)'      PREM
29:
30: 'Nominal Policy Interest Rate (in % pa)'      RS
31: 'Real Interest Rate (in % pa)'      RR
32: 'Trend Real Interest Rate (in % pa)'      RR_BAR
33: 'Real Interest Rate Gap (in %)'      RR_GAP
34: 'Nominal Policy Neutral Interest Rate (in % pa)' RSNEUTRAL
35:
36: 'Real Exchange Rate (level, 100*log)'      L_Z
37: 'Trend Real Exchange Rate (level, 100*log)' L_Z_BAR
38: 'Real Exchange Rate Gap (in %)'      L_Z_GAP

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39: 'Real Exchange Rate Depreciation QoQ annualized (in % pa)'      DLA_Z
40: 'Trend Real Exchange Rate Depreciation QoQ annualized(in % pa)' DLA_Z_BAR
41:
42: 'Foreign Output Gap (in %)'      L_GDP_RW_GAP
43: 'Foreign Nominal Interest Rate (in % pa)'      RS_RW
44: 'Foreign Real Interest Rate (in % pa)'      RR_RW
45: 'Foreign Real Interest Rate Trend (in % pa)'   RR_RW_BAR
46: 'Foreign Real Interest Rate Gap (in %)'      RR_RW_GAP
47: 'Foreign CPI (level, 100*log)'      L_CPI_RW
48: 'Foreign Inflation QoQ annualized (in % pa)'   DLA_CPI_RW
49:
50: 'Unemployment rate'      UNEM
51: 'equilibrium value of the unemployment (NAIRU)'      UNEM_BAR
52: 'Unemployment Gap'      UNEM_GAP
53: 'Temporaty Variation in the trend'      DLA_UNEM_BAR
54:
55:
56: % ----- %
57: !transition_shocks
58: 'Shock: Output gap (demand)'      SHK_L_GDP_GAP< $\sigma=0.945042$ >
59: 'Shock: CPI inflation (cost-push)'      SHK_DLA_CPI< $\sigma=1.29932$ >
60: 'Shock: Exchange rate (UIP)'      SHK_L_S< $\sigma=1.81214$ >
61: 'Shock: Interest rate (monetary policy)'      SHK_RS< $\sigma=1.21483$ >
62: 'Shock: Inflation target'      SHK_D4L_CPI_TAR< $\sigma=0.274025$ >
63:
64: 'Shock: Real interest rate'      SHK_RR_BAR< $\sigma=0.630844$ >
65: 'Shock: Real exchange rate depreciation'      SHK_DLA_Z_BAR< $\sigma=8.6895$ >
66: 'Shock: Potential GDP growth'      SHK_DLA_GDP_BAR< $\sigma=0.717031$ >
67:
68: 'Shock: Foreign output gap'      SHK_L_GDP_RW_GAP< $\sigma=1.34401$ >
69: 'Shock: Foreign nominal interest rate'      SHK_RS_RW< $\sigma=0.364075$ >
70: 'Shock: Foreign inflation'      SHK_DLA_CPI_RW< $\sigma=3.15524$ >
71: 'Shock: Foreign real interest rate'      SHK_RR_RW_BAR< $\sigma=0.631733$ >
72:
73: 'Shock: Unemployment'      SHK_UNEM_BAR< $\sigma=0.748752$ >
74: 'Shock: Variation in its trend unemployment'      SHK_DLA_UNEM_BAR< $\sigma=0.488199$ >
75: 'Shock: Unemployment Gap'      SHK_UNEM_GAP< $\sigma=0.320768$ >
76: 'Shock: GDP trend'      SHK_L_GDP_BAR< $\sigma=1.67795$ >
77: % ----- %
78: !parameters
79: b1<0.648563> b2<0.112511> b3<0.449365> b4<0.588848>

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80: a1<0.364399> a2<0.23835> a3<0.637254>
81: e1<0.5>
82: g1<0.7> g2<1.5> g3<0.375>
83: u1<0.65937> u2<0.397288> n1<0.9>
84:
85: rho_D4L_CPI_TAR<0.95>
86: rho_DLA_Z_BAR<0.536143>
87: rho_RR_BAR<0.95>
88: rho_DLA_GDP_BAR<0.724217>
89:
90: rho_L_GDP_RW_GAP<0.761152>
91: rho_RS_RW<0.95>
92: rho_DLA_CPI_RW<0.313073>
93: rho_RR_RW_BAR<0.95>
94:
95: rho_UNEM_BAR<0.221932>
96: rho_DLA_UNEM_BAR<0.874222>
97: rho_UNEM_GAP<0.252082>
98:
99: ss_D4L_CPI_TAR<3>
100: ss_DLA_Z_BAR<0>
101: ss_RR_BAR<3>
102: ss_DLA_GDP_BAR<3.3>
103:
104: ss_DLA_CPI_RW<2>
105: ss_RR_RW_BAR<0.5>
106:
107: ss_UNEM_BAR<11.1>
108:
109: %% ----- %
110: !transition_equations
111: %% == Aggregate demand (the IS curve) ==
112: L_GDP_GAP = b1<0.648563>*L_GDP_GAP{-1} - b2<0.112511>*MCI + b3<0.449365>*L_GDP_RW_GAP + SHK_L_GDP_GAP< $\sigma=0.945042$ >;
113:
114: %%-- Real monetary conditions index
115: MCI = b4<0.588848>*RR_GAP + (1-b4<0.588848>)*(- L_Z_GAP);
116:
117: %% == Inflation (the Phillips curve) ==
118: DLA_CPI = a1<0.364399>*DLA_CPI{-1} + (1-a1<0.364399>)*DLA_CPI{+1} + a2<0.23835>*RMC + SHK_DLA_CPI< $\sigma=1.29932$ >;
119:
120: %%-- Real marginal cost

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121: RMC = a3(0.637254)*L_GDP_GAP + (1-a3(0.637254))*L_Z_GAP;
122:
123: %- expected inflation
124: E_DLA_CPI = DLA_CPI{+1};
125: E_D4L_CPI = D4L_CPI{+4};
126:
127: %% === Monetary policy reaction function (a forward-looking Taylor-type Rule) ===
128: RS = g1(0.7)*RS{-1} + (1-g1(0.7))*(RSNEUTRAL + g2(1.5)*(D4L_CPI{+4} - D4L_CPI_TAR{+4})) + g3(0.375)*L_GDP_GAP + SHK_RS(σ=1.21483);
129:
130: %- Neutral nominal policy interest rate
131: RSNEUTRAL = RR_BAR + D4L_CPI{+1};
132:
133: %% === Modified Uncovered Interest Rate Parity (UIP) condition ===
134: L_S = (1-e1(0.5))*L_S{+1} + e1(0.5)*(L_S{-1} + 2/4*(D4L_CPI_TAR - ss_DLA_CPI_RW(2) + DLA_Z_BAR)) + (- RS + RS_RW + PREM)/4 + SHK_L_S(σ);
135:
136: %% === Definitions ===
137:
138: %- Fisher equation (RIR)
139: RR = RS - D4L_CPI{+1};
140:
141: %- Real exchange rate (RER)
142: L_Z = L_S + L_CPI_RW - L_CPI;
143:
144: %- Long-term version of UIP (consistency of trends)
145: DLA_Z_BAR{+1} = RR_BAR - RR_RW_BAR - PREM;
146:
147: %% === Identities ===
148: GROWTH_BAR = 4*(L_GDP_BAR - L_GDP_BAR{-1});
149: L_GDP_BAR = L_GDP_BAR{-1} + DLA_GDP_BAR/4 - n1(0.9)*(UNEM_BAR-UNEM_BAR{-1}) - (1-n1(0.9))*(UNEM_BAR{-1}-UNEM_BAR{-16}) + SHK_L_GDP_BAR;
150: DLA_Z_BAR = 4*(L_Z_BAR - L_Z_BAR{-1});
151: DLA_Z = 4*(L_Z - L_Z{-1});
152: DLA_GDP = 4*(L_GDP - L_GDP{-1});
153: DLA_CPI = 4*(L_CPI - L_CPI{-1});
154: DLA_S = 4*(L_S - L_S{-1});
155:
156: D4L_GDP = L_GDP - L_GDP{-4};
157: D4L_CPI = L_CPI - L_CPI{-4};
158: D4L_S = L_S - L_S{-4};
159:
160: %% === Gaps ===
161: RR_GAP = RR - RR_BAR;

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162: L_Z_GAP    = L_Z - L_Z_BAR;
163: L_GDP_GAP   = L_GDP - L_GDP_BAR;
164:
165: %% === Trends ===
166: D4L_CPI_TAR = rho_D4L_CPI_TAR(0.95)*D4L_CPI_TAR{-1} + (1-rho_D4L_CPI_TAR(0.95))*ss_D4L_CPI_TAR(3) + SHK_D4L_CPI_TAR(σ=0.274025);
167: DLA_Z_BAR   = rho_DLA_Z_BAR(0.536143)*DLA_Z_BAR{-1} + (1-rho_DLA_Z_BAR(0.536143))*ss_DLA_Z_BAR(0) + SHK_DLA_Z_BAR(σ=8.6895);
168: RR_BAR      = rho_RR_BAR(0.95)*RR_BAR{-1} + (1-rho_RR_BAR(0.95))*ss_RR_BAR(3) + SHK_RR_BAR(σ=0.630844);
169: DLA_GDP_BAR = rho_DLA_GDP_BAR(0.724217)*DLA_GDP_BAR{-1} + (1-rho_DLA_GDP_BAR(0.724217))*ss_DLA_GDP_BAR(3.3) + SHK_DLA_GDP_BAR(σ=0.71703);
170:
171: %% === Foreign Sector Equations ===
172: L_GDP_RW_GAP = rho_L_GDP_RW_GAP(0.761152)*L_GDP_RW_GAP{-1} + SHK_L_GDP_RW_GAP(σ=1.34401);
173: DLA_CPI_RW   = rho_DLA_CPI_RW(0.313073)*DLA_CPI_RW{-1} + (1-rho_DLA_CPI_RW(0.313073))*ss_DLA_CPI_RW(2) + SHK_DLA_CPI_RW(σ=3.15524);
174: RS_RW        = rho_RS_RW(0.95)*RS_RW{-1} + (1-rho_RS_RW(0.95))*(RR_RW_BAR + DLA_CPI_RW) + SHK_RS_RW(σ=0.364075);
175: RR_RW_BAR    = rho_RR_RW_BAR(0.95)*RR_RW_BAR{-1} + (1-rho_RR_RW_BAR(0.95))*ss_RR_RW_BAR(0.5) + SHK_RR_RW_BAR(σ=0.631733);
176: RR_RW        = RS_RW - DLA_CPI_RW;
177: RR_RW_GAP    = RR_RW - RR_RW_BAR;
178:
179: DLA_CPI_RW   = 4*(L_CPI_RW - L_CPI_RW{-1});
180:
181: %% === Labour Market Equations ===
182: UNEM_GAP = UNEM_BAR - UNEM;
183: UNEM_BAR = rho_UNEM_BAR(0.221932)*UNEM_BAR{-1} + (1-rho_UNEM_BAR(0.221932))*ss_UNEM_BAR(11.1) + DLA_UNEM_BAR - u1(0.65937)*(L_GDP_GAP{-8}+L_GDP_GAP{+8})/2 + SHK_UNEM_BAR;
184: %UNEM_BAR = rho_UNEM_BAR*UNEM_BAR{-1} + (1-rho_UNEM_BAR)*ss_UNEM_BAR + DLA_UNEM_BAR - u1*(L_GDP_GAP{-8}+L_GDP_GAP{+8})/2 + SHK_UNEM_BAR;
185: DLA_UNEM_BAR = rho_DLA_UNEM_BAR(0.874222)*DLA_UNEM_BAR{-1} + SHK_DLA_UNEM_BAR(σ=0.488199);
186: UNEM_GAP = rho_UNEM_GAP(0.252082)*UNEM_GAP{-1} + u2(0.397288)*L_GDP_GAP + SHK_UNEM_GAP(σ=0.320768);
187: %% ----- %
188: !measurement_variables
189: OBS_L_GDP
190: OBS_L_GDP_GAP
191: OBS_L_CPI
192: OBS_RS
193: OBS_L_S
194: OBS_D4L_CPI_TAR
195:
196: OBS_L_GDP_RW_GAP
197: OBS_DLA_CPI_RW
198: OBS_RS_RW
199: OBS_UNEM
200:
201: !measurement_equations
202: OBS_L_GDP = L_GDP;

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203: OBS_L_GDP_GAP = L_GDP_GAP;
204: OBS_L_CPI = L_CPI;
205: OBS_RS      = RS;
206: OBS_L_S     = L_S;
207: OBS_D4L_CPI_TAR = D4L_CPI_TAR;
208:
209: OBS_L_GDP_RW_GAP = L_GDP_RW_GAP;
210: OBS_DLA_CPI_RW   = DLA_CPI_RW;
211: OBS_RS_RW        = RS_RW;
212: OBS_UNEM          = UNEM;
213:
214: %% ----- %
215: Legend
216: _GAP      cyclical deviation from a trend
217: _BAR      trend (equilibrium)
218: ss_       steady-state value
219: DLA_      q-o-q change
220: D4L_      y-o-y change
221: _RW       foreign variable
222: SHK_      equation residual
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Steady state

| Variable | Description | Value |
|--------------|---|-------|
| L_GDP_GAP | Output Gap (in %) | 0 |
| DLA_GDP | Quarterly Growth in Real GDP(in % pa) | 3.3 |
| D4L_GDP | Real GDP Growth YoY (in % pa) | 3.3 |
| DLA_GDP_BAR | Real GDP Trend Growth QoQ annualized (in % pa) | 3.3 |
| GROWTH_BAR | Growth trend | 3.3 |
| MCI | Real Monetary Condition Index (in % pa) | 0 |
| DLA_CPI | CPI Inflation QoQ annualized (in % pa) | 3 |
| E_DLA_CPI | Expected CPI Inflation QoQ annualized (in % pa) | 3 |
| E_D4L_CPI | Expected CPI Inflation YoQ (in % pa) | 3 |
| D4L_CPI | CPI Inflation YoY (in % pa) | 3 |
| D4L_CPI_TAR | Inflation Target (in % pa) | 3 |
| RMC | Real Marginal Cost (in %) | 0 |
| DLA_S | Nominal Exch. Rate Depreciation QoQ annualized (in % pa) | 1 |
| D4L_S | Nominal Exch. Rate Depreciation YoY (in % pa) | 1 |
| PREM | Country Risk Premium (in % pa) | 2.5 |
| RS | Nominal Policy Interest Rate (in % pa) | 6 |
| RR | Real Interest Rate (in % pa) | 3 |
| RR_BAR | Trend Real Interest Rate (in % pa) | 3 |
| RR_GAP | Real Interest Rate Gap (in %) | 0 |
| RSNEUTRAL | Nominal Policy Neutral Interest Rate (in % pa) | 6 |
| L_Z_GAP | Real Exchange Rate Gap (in %) | 0 |
| DLA_Z | Real Exchange Rate Depreciation QoQ annualized (in % pa) | 0 |
| DLA_Z_BAR | Trend Real Exchange Rate Depreciation QoQ annualized(in % pa) | 0 |
| L_GDP_RW_GAP | Foreign Output Gap (in %) | 0 |
| RS_RW | Foreign Nominal Interest Rate (in % pa) | 2.5 |
| RR_RW | Foreign Real Interest Rate (in % pa) | 0.5 |
| RR_RW_BAR | Foreign Real Interest Rate Trend (in % pa) | 0.5 |
| RR_RW_GAP | Foreign Real Interest Rate Gap (in %) | 0 |
| DLA_CPI_RW | Foreign Inflation QoQ annualized (in % pa) | 2 |
| UNEM | Unemployment rate | 11.1 |
| UNEM_BAR | equilibrium value of the unemployment (NAIRU) | 11.1 |
| UNEM_GAP | Unemployment Gap | 0 |

| Variable | Description | Value |
|--------------|----------------------------------|-------|
| DLA_UNEM_BAR | Temporaty Variation in the trend | 0 |