

# Model File

*Generated by Python Framework*

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## 1 Model Information

name: *Smets and Wouters Model.*

file: */home/alexei/work/Framework/examples/models/Covid19/sw\_model.yaml*

### 1.1 Endogenous Variables Initial Values

a = 0.0, b = 0.0, c = 0.0, cf = 0.0, dc = 0.4, dinve = 0.4, dw = 0.4, dy = 0.4, epinfma = 0.0, ewma = 0.0, g = 0.0, inve = 0.0, invecf = 0.0, k = 0.0, kf = 0.0, kp = 0.0, kpf = 0.0, lab = 0.0, labf = 0.0, mc = 0.0, ms = 0.0, pinf = 0.0, pk = 0.0, pkf = 0.0, qs = 0.0, r = 0.0, rk = 0.0, rkf = 0.0, rrf = 0.0, spinf = 0.0, sw = 0.0, w = 0.0, wf = 0.0, y = 0.0, yf = 0.0, zcap = 0.0, zcapf = 0.0

### 1.2 Measurement Variables

OBS\_dc, OBS\_dinve, OBS\_dw, OBS\_dy, OBS\_lab, OBS\_pinf, OBS\_r

### 1.3 Parameters

calfa = 0.24, cbetabar = 0.99, ccy = 0.60, cfc = 1.50, cg = 0.18, cgamma = 1.00, cgy = 0.51, chabb = 0.64, cikbar = 0.03, cindp = 0.47, cindw = 0.32, ciy = 0.22, clandaw = 1.50, cmap = 0.00, cmaw = 0.00, constebeta = 0.74, cprobp = 0.60, cprobw = 0.81, crdy = 0.23, crhoa = 1.00, crhoas = 1.00, crhob = 0.58, crhog = 1.00, crhols = 0.99, crhoms = 0.00, crhopinf = 0.00, crhoqs = 0.72, crhow = 0.00, crk = 0.03, crkky = 0.24, crpi = 1.49, crr = 0.88, cry = 0.06, csadjcost = 6.01, csigl = 1.94, csigma = 1.50, ctou = 0.03, curvp = 10.00, curvw = 10.00, cwhlc = 0.85, czcap = 0.27

### 1.4 Shocks

ea, eb, eg, em, epinf, eqs, ew

### 1.5 Measurement Shocks

RES\_OBS\_dy, RES\_OBS\_dc, RES\_OBS\_dinve, RES\_OBS\_dw, RES\_OBS\_pinf, RES\_OBS\_r, RES\_OBS\_lab

## 1.6 Equations

$$1 : 0*(1-\text{calfa})*a + 1*a = \text{calfa}*\text{rkf}+(1-\text{calfa})*(wf)$$

$$2 : \text{zcapf} = (1/(\text{czcap}/(1-\text{czcap}))) * \text{rkf}$$

$$3 : \text{rkf} = (wf)+\text{labf}-kf$$

$$4 : kf = \text{kpf}(-1)+\text{zcapf}$$

$$5 : \text{invef} = (1/(1+\text{cbetabar}*c\gamma)) * (\text{invef}(-1) + \text{cbetabar}*c\gamma*\text{invef}(1)+(1/(c\gamma^2*\text{csadjcost}))*\text{pk}) + \text{qs}$$

$$6 : \text{pkf} = -\text{rrf}-0*b+(1/((1-\text{chabb}/c\gamma)/(\text{csigma}*(1+\text{chabb}/c\gamma))))*b + (\text{crk}/(\text{crk}+(1-\text{ctou}))*\text{rkf}(1) + ((1-\text{ctou})/(\text{crk}+(1-\text{ctou}))*\text{pkf}(1))$$

$$7 : cf = (\text{chabb}/c\gamma)/(1+\text{chabb}/c\gamma)*cf(-1) + (1/(1+\text{chabb}/c\gamma))*cf(+1) + ((\text{csigma}-1)*\text{cwhlc}/(\text{csigma}*(1+\text{chabb}/c\gamma)))*(\text{labf}-\text{labf}(+1)) - (1-\text{chabb}/c\gamma)/(\text{csigma}*(1+\text{chabb}/c\gamma)) + b$$

$$8 : yf = \text{ccy}*cf+\text{ciy}*invef+g + \text{crkky}*zcapf$$

$$9 : yf = \text{cfc}*(\text{calfa}*kf+(1-\text{calfa})*\text{labf} + a)$$

$$10 : wf = \text{csigl}*\text{labf}+(1/(1-\text{chabb}/c\gamma))*cf - (\text{chabb}/c\gamma)/(1-\text{chabb}/c\gamma)*cf(-1)$$

$$11 : \text{kpf} = (1-\text{cikbar})*\text{kpf}(-1)+(\text{cikbar})*invef + (\text{cikbar})*(c\gamma^2*\text{csadjcost})*\text{qs}$$

$$12 : \text{mc} = \text{calfa}*\text{rk}+(1-\text{calfa})*(w) - 1*a - 0*(1-\text{calfa})*a$$

$$13 : \text{zcap} = (1/(\text{czcap}/(1-\text{czcap}))) * \text{rk}$$

$$14 : \text{rk} = w+\text{lab}-k$$

$$15 : k = \text{kp}(-1)+\text{zcap}$$

$$16 : \text{inve} = (1/(1+\text{cbetabar}*c\gamma)) * (\text{inve}(-1) + \text{cbetabar}*c\gamma*\text{inve}(1)+(1/(c\gamma^2*\text{csadjcost}))*\text{pk}) + \text{qs}$$

$$17 : \text{pk} = -r+\text{pinf}(1)-0*b + (1/((1-\text{chabb}/c\gamma)/(\text{csigma}*(1+\text{chabb}/c\gamma))))*b + (\text{crk}/(\text{crk}+(1-\text{ctou}))*\text{rk}(1) + ((1-\text{ctou})/(\text{crk}+(1-\text{ctou}))*\text{pk}(1))$$

$$18 : c = (\text{chabb}/c\gamma)/(1+\text{chabb}/c\gamma)*c(-1) + (1/(1+\text{chabb}/c\gamma))*c(+1) + ((\text{csigma}-1)*\text{cwhlc}/(\text{csigma}*(1+\text{chabb}/c\gamma)))*(\text{lab}-\text{lab}(+1)) - (1-\text{chabb}/c\gamma)/(\text{csigma}*(1+\text{chabb}/c\gamma)) + \text{pinf}(+1) + 0*b + b$$

$$19 : y = ccy*c+ciy*inve+g + 1*crkky*zcap$$

$$20 : y = cfc*( calfa*k+(1-calfa)*lab +a )$$

$$21 : \text{pinf} = (1/(1+cbetabar*cgamma*cindp)) * ( cbetabar*cgamma*\text{pinf}(1) \\ +cindp*\text{pinf}(-1) +((1-cprobp)*(1-cbetabar*cgamma*cprobp)/cprobp)/((cfc-1)*curvp+1)*(mc) \\ ) + \text{spinf}$$

$$22 : w = (1/(1+cbetabar*cgamma))*w(-1) +(cbetabar*cgamma/(1+cbetabar*cgamma))*w(1) \\ +(cindw/(1+cbetabar*cgamma))*\text{pinf}(-1) -(1+cbetabar*cgamma*cindw)/(1+cbetabar*cgamma)*\text{pinf} \\ +(cbetabar*cgamma)/(1+cbetabar*cgamma)*\text{pinf}(1) +(1-cprobw)*(1-cbetabar*cgamma*cprobw)/((1+cbetabar*cgamma)*curvw+1))* (csigl*lab + (1/(1-chabb/cgamma))*c - ((chabb/cgamma)/(1-chabb/cgamma))*c(-1) -w) + 1*sw$$

$$23 : r = crpi*(1-crr)*\text{pinf} +cry*(1-crr)*(y-yf) +crdy*(y-yf-y(-1)+yf(-1)) +crr*r(-1) +ms$$

$$24 : a = crhoa*a(-1) + ea$$

$$25 : b = crhob*b(-1) + eb$$

$$26 : g = crhog*(g(-1)) + eg + cgy*ea$$

$$27 : qs = crhoqs*qs(-1) + eqs$$

$$28 : ms = crhoms*ms(-1) + em$$

$$29 : \text{spinf} = crhopinf*\text{spinf}(-1) + \text{epinfma} - \text{cmap}*\text{epinfma}(-1)$$

$$30 : \text{epinfma}=\text{epinf}$$

$$31 : sw = crhow*sw(-1) + ewma - cmaw*ewma(-1)$$

$$32 : ewma=ew$$

$$33 : kp = (1-cikbar)*kp(-1)+cikbar*inve + cikbar*cgamma^2*csadjcost*qs$$

$$34 : dy=y-y(-1)$$

$$35 : dc=c-c(-1)$$

$$36 : \text{dinve}=inve-inve(-1)$$

$$37 : dw=w-w(-1)$$

## 1.7 Measurement Equations

- 1 :  $OBS\_dy = dy + ctrend$
- 2 :  $OBS\_dc = dc + ctrend$
- 3 :  $OBS\_dinve = dinve + ctrend$
- 4 :  $OBS\_dw = dw + ctrend$
- 5 :  $OBS\_pinf = pinf + constepinf$
- 6 :  $OBS\_r = r + conster$
- 7 :  $OBS\_lab = lab + constelab$

## 1.8 Legend

- a -- Productivity process
- b -- Scaled risk premium shock
- c -- Consumption
- calfa -- Capital share
- cf -- Consumption flex price economy
- cfc -- Fixed cost share
- cg -- Steady state exogenous spending share
- cgy -- Feedback technology on exogenous spending
- chabb -- External habit degree
- cindp -- Indexation to past prices
- cindw -- Indexation to past wages
- clandaw -- Gross markup wages
- cmap -- Coefficient on MA term price markup
- cmaw -- Coefficient on MA term wage markup
- constebeta -- Time preference rate in percent
- constelab -- Steady state hours
- constepinf -- Steady state inflation rate
- cprobp -- Calvo parameter prices
- cprobw -- Calvo parameter wages
- crdy -- Taylor rule output growth feedback
- crhoa -- Persistence productivity shock
- crhob -- Persistence risk premium shock
- crhog -- Persistence spending shock
- crhoms -- Persistence monetary policy shock
- crhopinf -- Persistence price markup shock
- crhoqs -- Persistence risk premium shock
- crhow -- Persistence wage markup shock

crpi -- Taylor rule inflation feedback  
 crr -- interest rate persistence  
 cry -- Taylor rule output level feedback  
 csadjcost -- Investment adjustment cost  
 csigl -- Frisch elasticity  
 csigma -- Risk aversion  
 ctou -- Depreciation rate  
 ctrend -- Net growth rate in percent  
 curvp -- Curvature Kimball aggregator prices  
 czcap -- Capacity utilization cost  
 dc -- Consumption growth rate  
 dinve -- Investment growth rate  
 dw -- Wage growth rate  
 dy -- Output growth rate  
 ea -- Productivity shock  
 eb -- Risk premium shock  
 eg -- Spending shock  
 em -- Monetary policy shock  
 epinf -- Price markup shock  
 epinfma -- Auxiliary price markup moving average variable  
 eqs -- Investment-specific technology shock  
 ew -- Wage markup shock  
 ewma -- Auxiliary wage markup moving average variable  
 g -- Exogenous spending  
 inve -- Investment  
 invef -- Investment flex price economy  
 k -- Capital services  
 kf -- Capital services flex price economy  
 kp -- Capital stock  
 kpf -- Capital stock flex price economy  
 lab -- Hours worked  
 labf -- Hours worked flex price economy  
 labobs -- Log hours worked  
 mc -- Gross price markup  
 ms -- Monetary policy shock process  
 pinf -- Inflation  
 pinfobs -- Inflation  
 pk -- Real value of existing capital stock  
 pkf -- Real value of existing capital stock flex price economy  
 qs -- Investment-specific technology  
 r -- Nominal interest rate  
 rk -- Rental rate of capital  
 rkf -- Rental rate of capital flex price economy  
 robs -- Federal funds rate  
 rrf -- Real interest rate flex price economy  
 spinf -- Price markup shock process

sw -- Wage markup shock process  
w -- Real wage  
wf -- Real wage flex price economy  
y -- Output  
yf -- Output flex price economy  
zcap -- Capital utilization rate  
zcapf -- Capital utilization rate flex price economy