Flow Diagram of Technology Model

Equation List of The Model

(equilibrium condition)

(001) A growth=
Av alpha chg*LN(Capital labor ratio/Capital labor ratio initial)*100
Units: Percent/Year

(002) Adjusted labor force=
Labor force*(1-Minimum unemployment rate)
Units: Person

(003) Aggregate demand=
Final sales+Desired inventory investment
Units: Unit/Year

(004) Alpha=
Capital output ratio*((1/Life of capital)+Interest rate)
Units: Dmnl

(005) Alpha growth=
Av alpha chg/Alpha
Units: 1/Year

(006) Alpha initial=
0.25
Units: Dmnl

(007) Av alpha chg=
(Alpha-Average alpha)/Time to average alpha
Units: 1/Year

(008) Average alpha=
INTEG (Av alpha chg,Alpha initial)
Units: Dmnl

(009) Average demand=
INTEG (Avr demand chg,Initial production)
Units: Unit/Year

(010) Average production=
INTEG (Prod chg,Initial production)
Units: Unit/Year

(011) Average wage=
INTEG (Avr wage chg,Wage)
Units: Unit/(Year*Person)

(012) Avr demand chg=
(Aggregate demand-Average demand)/Time to establish trend in demand
Units: Unit/(Year*Year)

(013) Avr wage chg=
(Wage-Average wage)/Trend time of productivity growth
Units: Unit/(Year*Person)/Year

(014) Capcity utilization=
0.5
Units: Dmnl

(015) Capital=
INTEG (Investment-Depreciation,Initial capital)
Units: Unit

(016) Capital growth=
((Investment-Depreciation)/Capital)*100
Units: Percent/Year

(017) Capital labor ratio=
Capital/Labor
Units: Unit/Person

(018) Capital labor ratio growth=
Technology growth
Units: Percent/Year

(019) Capital labor ratio initial=
Initial capital/Initial labor
Units: Unit/Person

(020) Capital output ratio=
Initial capital/Initial production
Units: Year

(021) Change from labor availability =
WITH LOOKUP (Relative labor availability,
([(0,-0.1)-(2,0.12)],(0,-0.1),(0.25,-0.09),(0.5,-0.07),(0.75,-0.04),(1,0),(1.25,0.04),(1.5,0.075),(1.75,0.1),(2,0.12)))
Units: 1/Year

(022) Change from productivity=
Avr wage chg/Average wage
Units: 1/Year

(023) Consumption=
Desired consumption*Effect inventory
Units: Unit/Year

(024) Consumption per capita=
Consumption per capita initial*Effect income on consumption per capita
Units: Unit/(Year*Person)

(025) Consumption per capita initial=
Propensity to consume*Initial permanent income/Initial population
Units: Unit/Year/Person

(026) Correction for growth in desired production=
Perceived growth in demand*Time to smooth SRD*Shortrun demand
Units: Unit/Year

(027) Correction to desired production =
WITH LOOKUP (Correction for growth in desiredproduction/Shortrun demand,
([(-3,0)-(4,3)],(-3,0.01),(-2,0.2),(1,0.5),(0,1),(1,2),(2,2.5),
(3,2.8),(4,3)))
Units: Dmnl

(028) Current disposable income=
Production-Taxes
Units: Unit/Year

(029) Depreciation=
Capital/Life of capital
Units: Unit/Year

(030) Desired capital=
Alpha*Longrun demand/((1/Life of capital)+Interest rate)
Units: Unit

(031) Desired consumption=
MIN(Desired consumption from population, Desired consumption from income)
Units: Unit/Year

(032) Desired consumption from income=
Propensity to consume*Permanent income
Units: Unit/Year

(033) Desired consumption from population=
Population*Consumption per capita
Units: Unit/Year

(034) Desired government spending=
GS fraction*Production
Units: Unit/Year

(035) Desired inventory=
Inventory coverage*Shortrun demand
Units: Unit

(036) Desired inventory investment=
MAX(0,(Desired inventory-Inventory)/Time to adjust inventory)
Units: Unit/Year

(037) Desired investment=
Depreciation+(Desired capital-Capital)/Time to adjust capital
Units: Unit/Year

(038) Desired labor=
MIN(Indicated desired labor,Adjusted labor force)
Units: Person

(039) Desired production=
Shortrun demand*Correction to desired production
Units: Unit/Year

(040) Economic growth=
Alpha*Capital growth+(1-Alpha)*Labor growth+A growth
Units: Percent/Year

(041) Effect income on consumption per capita =
WITH LOOKUP (Production per capita average/Production per capita initial,
([(0,0)-(5,5)],(0,0.5),(0.5,0.66),(1,1),(1.5,1.69),(2,2.65),
(2.5,3.46),(3,3.99),(3.5,4.36),(4,4.63),(4.5,4.85),(5,5)))
Units: Dmnl

(042) Effect inventory =
WITH LOOKUP (Inventory availability,
([(0,0)-(1,1)],(0,0),(0.1,0.32),(0.2,0.51),(0.3,0.64),(0.4,0.75),
(0.5,0.84),(0.6,0.9),(0.7,0.96),(0.8,0.99),(0.9,1),(1,1)))
Units: Dmnl

(043) Effect of desired labor on fire time =
WITH LOOKUP (Desired labor/Labor,
([(0,0)-(2,3)],(0,0.25),(0.2,0.3),(0.4,0.39),(0.6,0.53),(0.8,0.7),
(1,1),(1.2,1.51),(1.4,2.29),(1.6,2.7),(1.8,2.91),(2,3)))
Units: Dmnl

(044) Effect of desired labor on hire time =
WITH LOOKUP (Desired labor/Labor,
([(0,0)(2,2)],(0,2),(0.2,1.93),(0.4,1.81),(0.6,1.68),(0.8,1.46),
(1,1),(1.2,0.77),(1.4,0.64),(1.6,0.58),(1.8,0.54),(2,0.5)))
Units: Dmnl

(045) Final sales=
Consumption+Government spending GS+Investment
Units: Unit/Year

(046) FINAL TIME = 350
Units: Year
The final time for the simulation.

(047) Fire=
Labor/Fire time
Units: Person/Year

(048) Fire time=
Fire time normal*Effect of desired labor on fire time
Units: Year

(049) Fire time normal=
19
Units: Year

(050) Fractional change in wage=
Change from productivity+Change from labor availability
Units: 1/Year

(051) Government spending GS=
Desired government spending*Effect inventory
Units: Unit/Year

(052) Growth of A=
Capital output ratio*(Wage/Capital labor ratio)*LN(Capital labor ratio/Capital labor ratio initial)*
((Capital labor ratio growth/100)-(Wage growth/100))*100
Units: Percent/Year

(053) GS fraction=
Initial GS fraction+STEP(GS fraction increase, GS increase start time)
Units: Dmnl

(054) GS fraction increase=
0
Units: Dmnl

(055) GS increase start time=
1000
Units: Year

(056) Hire=
Unemployment/Hire time
Units: Person/Year

(057) Hire time=
Hire time normal*Effect of desired labor on hire time
Units: Year

(058) Hire time normal=
1
Units: Year

(059) Indicated desired labor=
(1-Alpha)*Shortrun demand/Wage
Units: Person

(060) Indicated life of capital=
Initial life of capital-STEP(Initial life of capital-Minimum life of capital,Innovation start time)
Units: Year

(061) Initial capital=
Alpha initial*Initial production/((1/Initial life of capital)+Interest rate)
Units: Unit

(062) Initial depreciation=
Initial capital/Initial life of capital
Units: Unit/Year

(063) Initial GS=
3e+011
Units: Unit/Year

(064) Initial GS fraction=
Initial GS/Initial production
Units: Dmnl

(065) Initial labor=
1e+008
Units: Person

(066) Initial labor force=
Initial labor+Initial unemployment
Units: Person

(067) Initial life of capital=
14
Units: Year

(068) Initial permanent income=
(1-Tax rate)*Initial production
Units: Unit/Year

(069) Initial population=
Initial labor force/Labor participation figure
Units: Person

(070) Initial production=
2e+012
Units: Unit/Year

(071) INITIAL TIME = 0
Units: Year
The initial time for the simulation.

(072) Initial unemployment=
Hire time normal*(Initial labor/Fire time normal)
Units: Person

(073) Innovation delay=
50
Units: Year

(074) Innovation start time=
1000
Units: Year

(075) Interest rate=
0.03
Units: 1/Year

(076) Inventory=
INTEG (Production-Final sales,Inventory coverage*Initial production)
Units: Unit

(077) Inventory availability=
Inventory/Desired inventory
Units: Dmnl

(078) Inventory coverage=
0.3
Units: Year

(079) Investment=
Desired investment*Effect inventory
Units: Unit/Year

(080) Labor=
INTEG (Hire-Fire,Initial labor)
Units: Person

(081) Labor availability=
Desired labor/Labor force
Units: Dmnl

(082) Labor force=
Labor+Unemployment
Units: Person

(083) Labor force increase=
Labor participation figure*Population growth rate
Units: Person/Year

(084) Labor growth=
((Hire-Fire)/Labor)*100
Units: Percent/Year

(085) Labor participation figure=
0.4
Units: Dmnl

(086) Life of capital=
SMOOTH3I(Indicated life of capital, Innovation delay, Initial life of capital)
Units: Year

(087) Longrun demand=
INTEG (LRD chg,Initial production)
Units: Unit/Year

(088) LRD chg=
(Aggregate demand-Longrun demand)/Time to smooth LRD
Units: Unit/(Year*Year)

(089) Minimum life of capital=
14
Units: Year

(090) Minimum unemployment rate=
0.02
Units: Dmnl

(091) Normal availability of labor=
0.95
Units: Dmnl

(092) Perceived growth in demand= ACTIVE INITIAL (
SMOOTH(Trend in demand, Time to perceive trend in demand),
0)
Units: 1/Year

(093) Permanent income=
INTEG (Permanent income change,Initial production-Taxes)
Units: Unit/Year

(094) Permanent income change=
(Current disposable income-Permanent income)/Time to smooth
income
Units: Unit/Year/Year

(095) Population=
INTEG (Population growth rate,Initial population)
Units: Person

(096) Population growth=
Population growth fraction*100
Units: Percent/Year

(097) Population growth delay=
50
Units: Year

(098) Population growth fraction=
SMOOTH3I(STEP(Population growth fraction scenario,Population
growth start time), Population growth delay/4, 0)
Units: 1/Year

(099) Population growth fraction scenario=
0
Units: 1/Year

(100) Population growth rate=
Population growth fraction*Population
Units: Person/Year

(101) Population growth start time=
1000
Units: Year

(102) Potential production=
Initial production*((Capital/Initial capital)^Alpha)*((Labor/Initial labor)^(1-Alpha))
Units: Unit/Year

(103) Prod chg=
(Production-Average production)/Time to average production
Units: Unit/(Year*Year)

(104) Production=
(1-Capcity utilization)*Potential production+Capcity utilization* Desired production
Units: Unit/Year

(105) Production growth=
(Prod chg/Average production)*100
Units: Percent/Year

(106) Production per capita=
Production/Population
Units: Unit/(Year*Person)

(107) Production per capita average=
ACTIVE INITIAL (SMOOTH(Production per capita,
Time to average production per capita),Production per capita initial)
Units: Unit/(Year*Person)

(108) Production per capita initial=
Initial production/Initial population
Units: Unit/(Year*Person)

(109) Production per labor=
Production/Labor
Units: Unit/(Year*Person)

(110) Production per labor growth=
Production growth-Labor growth
Units: Percent/Year

(111) Propensity to consume=
(Initial permanent income-Initial depreciation)/Initial permanent income
Units: Dmnl

(112) Relative labor availability=
Labor availability/Normal availability of labor
Units: Dmnl

(113) SAVEPER =
TIME STEP
Units: Year
The frequency with which output is stored.

(114) Shortrun demand=
INTEG (SRD change,Initial production)
Units: Unit/Year

(115) SRD change=
(Aggregate demand-Shortrun demand)/Time to smooth SRD
Units: Unit/(Year*Year)

(116) Tax rate=
Initial GS/Initial production
Units: Dmnl

(117) Taxes=
Tax rate*Production
Units: Unit/Year

(118) Technology growth=
Capital growth-Labor growth
Units: Percent/Year

(119) TIME STEP = 0.0625
Units: Year
The time step for the simulation.

(120) Time to adjust capital=
3
Units: Year

(121) Time to adjust inventory=
0.4
Units: Year

(122) Time to average alpha=
0.0625
Units: Year

(123) Time to average production=
0.0625
Units: Year

(124) Time to average production per capita=
2
Units: Year

(125) Time to establish trend in demand=
5
Units: Year

(126) Time to perceive trend in demand=
5
Units: Year

(127) Time to smooth income=
2.5
Units: Year

(128) Time to smooth LRD=
4
Units: Year

(129) Time to smooth SRD=
0.5
Units: Year

(130) Trend in demand=
Avr demand chg/Average demand
Units: 1/Year

(131) Trend time of productivity growth=
5
Units: Year

(132) Unemployment=
INTEG (Fire+Labor force increase-Hire,Initial unemployment)
Units: Person

(133) Unemployment rate=
(Unemployment/Labor force)*100
Units: Percent

(134) Wage=
INTEG (Wage change,(1-Alpha)*Initial production/Initial labor)
Units: Unit/Year/Person

(135) Wage change=
Fractional change in wage*Wage
Units: Unit/(Year*Person)/Year

(136) Wage growth=
Fractional change in wage*100
Units: Percent/Year