

Appendix B

In this appendix all the equations of the model are given beginning with the underemployed sector. The notation is in Vensim text format and therefore it is possible to copy and paste the equation into Vensim and run the model. One remark concerning this procedure is to remove the heading for the sectors first.

Underemployed sector

U Underemployed $i[i]=$ INTEG (
 UA Underemployed arrivals $i[i]+UB$ Underemployed births $i[i]+LTU$ Labor to underemployed
 $i[i]$
 $[i]-UD$ Underemployed departures i
 $[i]-UTL$ Underemployed to labor $i[i]+UNZM$ Underemployed net zone movement $i[i]$,
 UI Underemployed initial $[i]*(12/11)$)

~

~

UI Underemployed initial $[i]=$
 10,10,10,10,480,10,10,10,480,10,10,10,10,10,10,10

~

~

UA Underemployed arrivals $i[i]=$
 (U Underemployed $i[i]+L$ Labor $i[i])*UAN$ Underemployed arrivals normal*AMMP
 Attractiveness for migration multiplier perceived

~ Person/year

~

UAN Underemployed arrivals normal=
 0.05

~ Fraction/year

~

AMMP Attractiveness for migration multiplier perceived= INTEG (
 CAMMP Change in AMMP,

1)

~ Dmnl

~

CAMMP Change in AMMP=
 (AMM Attractiveness for migration multiplier-AMMP Attractiveness for migration multiplier
 perceived\

)/AMMPT Attractiveness for migration multiplier perception time

~ Dmnl/year

~

AMMPT Attractiveness for migration multiplier perception time=
 20

~ year

~

AMM Attractiveness for migration multiplier=
 UAMM Underemployed arrivals mobility multiplier*"UHM Underemployed/housing
 multiplier"

PEM Public expenditure multiplier"UJM Underemployed/job multiplier"*UHPM
 Underemployed housing program multiplier*AMF Attractiveness for migration factor

```

~      Dmnl
~      |

UAMM Underemployed arrivals mobility multiplier= WITH LOOKUP (
  UMT Underemployed mobility total,
  ((0,0)-(0.15,3)],(0,0.3),(0.025,0.7),(0.05,1),(0.075,1.2),(0.1,1.3),(0.125,1.4),(0.15\
  ,1.5) ))
~      Dmnl
~      |

"UHM Underemployed/housing multiplier i"[i]= WITH LOOKUP (
  "UHR Underemployed/housing ratio i"[i],
  ((0,0)-(2,3)],(0,2.5),(0.25,2.4),(0.5,2.2),(0.75,1.7),(1,1),(1.25,0.4),(1.5,0.2),(\
  1.75,0.1),(2,0.05) ))
~
~      |

PEM Public expenditure multiplier= WITH LOOKUP (
  TPCR Tax per capita ratio,
  ((0,0)-(3,4)],(0,0.2),(0.5,0.6),(1,1),(1.5,1.6),(2,2.4),(2.5,3.2),(3,4) ))
~
~      |

"UJM Underemployed/job multiplier"= WITH LOOKUP (
  "URT Underemployed/job ratio total",
  ((0,0)-(3,2.75)],(0,2),(0.25,2),(0.5,1.9),(0.75,1.6),(1,1),(1.25,0.6),(1.5,0.4),(1.75\
  ,0.3),(2,0.2),(2.25,0.15),(2.5,0.1),(2.75,0.05),(3,0.02) ))
~
~      |

AMF Attractiveness for migration factor=
1
~      Dmnl
~      |

"UHR Underemployed/housing ratio i"[i]=
(U Underemployed i[i]*UFS Underemployed family size)/(UH Underemployed housing i[i]*\
  UHPD Underemployed housing population density)
~
~      |

UB Undereployed births i[i]=
U Underemployed i[i]*UBR Underemployed birth rate
~      Person/year
~      |

UBR Underemployed birth rate=
0.015
~      Fraction/year
~      |

LTU Labor to underemployed i[i]=
L Labor i[i]*LLF Labor layoff fraction
~      Person/year
~      |

LLF Labor layoff fraction= WITH LOOKUP (
  "LRT Labor/job ratio total",
  ((0,0)-(2,0.3)],(0,0),(0.5,0.01),(1,0.03),(1.5,0.1),(2,0.3) ))
~

```

~ |
 UD Underemployed departures i[i]=
 U Underemployed i[i]*UDN Underemployed departures normal*UDM Underemployed
 departure multiplier
 ~ Person/year
 ~ |

UDN Underemployed departures normal=
 0.02
 ~ Fraction/year
 ~ |

UDM Underemployed departure multiplier= WITH LOOKUP (
 (1.44*LN(AMM Attractiveness for migration multiplier)),
 ((-3,0)-(-4,8)],(-3,8),(-2,4),(-1,2),(0,1),(1,0.5),(2,0.25),(3,0.125),(4,0.1)))
 ~
 ~ |

UTL Underemployed to labor i[i]=
 UMN Underemployed mobility normal*UW Underemployed working[i]*UMMP
 Underemployed mobility multiplier perceived i\
 [i]+UTP Underemployed training program i[i]
 ~ Person/year
 ~ |

UMN Underemployed mobility normal=
 0.1
 ~ Fraction/year
 ~ |

UW Underemployed working[i]=
 U Underemployed i[i]*UFW Underemployed fraction working
 ~ Person
 ~ |

UMMP Underemployed mobility multiplier perceived i[i]= INTEG (
 CUMMP Change in UMMP i[i],
 1)
 ~ Dmnl
 ~ |

CUMMP Change in UMMP i[i]=
 (UMM Underemployed mobility multiplier i[i]-UMMP Underemployed mobility multiplier
 perceived i\
 [i])/UMMPT Underemployed mobility multiplier perception time
 ~ Dmnl/year
 ~ |

UMMPT Underemployed mobility multiplier perception time=
 10
 ~ year
 ~ |

UMM Underemployed mobility multiplier i[i]=
 LSM Labor supply multiplier*"LUM Labor/underemployed multiplier i"[i]*UEM
 Underemployed educational multiplier\
 *UMF Underemployed mobility factor
 ~ Dmnl
 ~ |

UMF Underemployed mobility factor=

1
~ Dmnl
~ |

UNZM Underemployed net zone movement i[i]=

"UIIM Underemployed internal into-zone movement i"[i]-"UIOM Underemployed internal out-of-zone movement i"\[i]

~
~ |

"UIIM Underemployed internal into-zone movement i"[a1]=

SUM(UIBZM Underemployed internal between zones movement i k[i!,a1]) ~|

"UIIM Underemployed internal into-zone movement i"[a2]=

SUM(UIBZM Underemployed internal between zones movement i k[i!,a2]) ~|

"UIIM Underemployed internal into-zone movement i"[a3]=

SUM(UIBZM Underemployed internal between zones movement i k[i!,a3]) ~|

"UIIM Underemployed internal into-zone movement i"[a4]=

SUM(UIBZM Underemployed internal between zones movement i k[i!,a4]) ~|

"UIIM Underemployed internal into-zone movement i"[a5]=

SUM(UIBZM Underemployed internal between zones movement i k[i!,a5]) ~|

"UIIM Underemployed internal into-zone movement i"[a6]=

SUM(UIBZM Underemployed internal between zones movement i k[i!,a6]) ~|

"UIIM Underemployed internal into-zone movement i"[a7]=

SUM(UIBZM Underemployed internal between zones movement i k[i!,a7]) ~|

"UIIM Underemployed internal into-zone movement i"[a8]=

SUM(UIBZM Underemployed internal between zones movement i k[i!,a8]) ~|

"UIIM Underemployed internal into-zone movement i"[a9]=

SUM(UIBZM Underemployed internal between zones movement i k[i!,a9]) ~|

"UIIM Underemployed internal into-zone movement i"[a10]=

SUM(UIBZM Underemployed internal between zones movement i k[i!,a10]) ~|

"UIIM Underemployed internal into-zone movement i"[a11]=

SUM(UIBZM Underemployed internal between zones movement i k[i!,a11]) ~|

"UIIM Underemployed internal into-zone movement i"[a12]=

SUM(UIBZM Underemployed internal between zones movement i k[i!,a12]) ~|

"UIIM Underemployed internal into-zone movement i"[a13]=

SUM(UIBZM Underemployed internal between zones movement i k[i!,a13]) ~|

"UIIM Underemployed internal into-zone movement i"[a14]=

SUM(UIBZM Underemployed internal between zones movement i k[i!,a14]) ~|

"UIIM Underemployed internal into-zone movement i"[a15]=

SUM(UIBZM Underemployed internal between zones movement i k[i!,a15]) ~|

"UIIM Underemployed internal into-zone movement i"[a16]=

SUM(UIBZM Underemployed internal between zones movement i k[i!,a16])

~
~ |

"UIOM Underemployed internal out-of-zone movement i"[a1]=

SUM(UIBZM Underemployed internal between zones movement i k[a1,k!]) ~|

"UIOM Underemployed internal out-of-zone movement i"[a2]=

SUM(UIBZM Underemployed internal between zones movement i k[a2,k!]) ~|

"UIOM Underemployed internal out-of-zone movement i"[a3]=

SUM(UIBZM Underemployed internal between zones movement i k[a3,k!]) ~|

"UIOM Underemployed internal out-of-zone movement i"[a4]=

SUM(UIBZM Underemployed internal between zones movement i k[a4,k!]) ~|

"UIOM Underemployed internal out-of-zone movement i"[a5]=

SUM(UIBZM Underemployed internal between zones movement i k[a5,k!]) ~|

"UIOM Underemployed internal out-of-zone movement i"[a6]=

SUM(UIBZM Underemployed internal between zones movement i k[a6,k!]) ~|

"UIOM Underemployed internal out-of-zone movement i"[a7]=
SUM(UIBZM Underemployed internal between zones movement i k[a7,k!]) ~|

"UIOM Underemployed internal out-of-zone movement i"[a8]=
SUM(UIBZM Underemployed internal between zones movement i k[a8,k!]) ~|

"UIOM Underemployed internal out-of-zone movement i"[a9]=
SUM(UIBZM Underemployed internal between zones movement i k[a9,k!]) ~|

"UIOM Underemployed internal out-of-zone movement i"[a10]=
SUM(UIBZM Underemployed internal between zones movement i k[a10,k!]) ~|

"UIOM Underemployed internal out-of-zone movement i"[a11]=
SUM(UIBZM Underemployed internal between zones movement i k[a11,k!]) ~|

"UIOM Underemployed internal out-of-zone movement i"[a12]=
SUM(UIBZM Underemployed internal between zones movement i k[a12,k!]) ~|

"UIOM Underemployed internal out-of-zone movement i"[a13]=
SUM(UIBZM Underemployed internal between zones movement i k[a13,k!]) ~|

"UIOM Underemployed internal out-of-zone movement i"[a14]=
SUM(UIBZM Underemployed internal between zones movement i k[a14,k!]) ~|

"UIOM Underemployed internal out-of-zone movement i"[a15]=
SUM(UIBZM Underemployed internal between zones movement i k[a15,k!]) ~|

"UIOM Underemployed internal out-of-zone movement i"[a16]=
SUM(UIBZM Underemployed internal between zones movement i k[a16,k!])
~
~ |

"UHM Underemployed/housing multiplier"= WITH LOOKUP (
"UHR Underemployed/housing ratio",
((0,0)-(2,3]),(0,2.5),(0.25,2.4),(0.5,2.2),(0.75,1.7),(1,1),(1.25,0.4),(1.5,0.2),(\n
1.75,0.1),(2,0.05))
~
~ |

UT Underemployed total=
SUM(U Underemployed i[i!])
~
~ |

AIMUM Attractiveness for internal migration underemployed multiplier i[i]=
"UHM Underemployed/housing multiplier i"[i]*ULAM Underemployed locational
attractiveness multiplier i\
[i]
~ Dmnl
~ |

AIMUMP Attractiveness for internal migration underemployed multiplier perceived k[k]=\
INTEG (
CAIMUMP Change in AIMUMP[k],
AIMUM Attractiveness for internal migration underemployed multiplier k[k])
~
~ |

AAAUJAZ Average accessibility attractiveness to underemployed jobs all zones=
SUM(UJ Underemployed jobs k[k!]/TDF Trip distribution function i[i!,k!])/16
~
~ |

AAUJZ Accessibility attractiveness to underemployed jobs zone i[i]=
SUM(UJ Underemployed jobs k[k!]/TDF Trip distribution function i[i,k!])
~
~ |

AIMUM Attractiveness for internal migration underemployed multiplier k[a1]=

AIMUM Attractiveness for internal migration underemployed multiplier $i[a1]$ ~|
 AIMUM Attractiveness for internal migration underemployed multiplier $k[a2]=$
 AIMUM Attractiveness for internal migration underemployed multiplier $i[a2]$ ~|
 AIMUM Attractiveness for internal migration underemployed multiplier $k[a3]=$
 AIMUM Attractiveness for internal migration underemployed multiplier $i[a3]$ ~|
 AIMUM Attractiveness for internal migration underemployed multiplier $k[a4]=$
 AIMUM Attractiveness for internal migration underemployed multiplier $i[a4]$ ~|
 AIMUM Attractiveness for internal migration underemployed multiplier $k[a5]=$
 AIMUM Attractiveness for internal migration underemployed multiplier $i[a5]$ ~|
 AIMUM Attractiveness for internal migration underemployed multiplier $k[a6]=$
 AIMUM Attractiveness for internal migration underemployed multiplier $i[a6]$ ~|
 AIMUM Attractiveness for internal migration underemployed multiplier $k[a7]=$
 AIMUM Attractiveness for internal migration underemployed multiplier $i[a7]$ ~|
 AIMUM Attractiveness for internal migration underemployed multiplier $k[a8]=$
 AIMUM Attractiveness for internal migration underemployed multiplier $i[a8]$ ~|
 AIMUM Attractiveness for internal migration underemployed multiplier $k[a9]=$
 AIMUM Attractiveness for internal migration underemployed multiplier $i[a9]$ ~|
 AIMUM Attractiveness for internal migration underemployed multiplier $k[a10]=$
 AIMUM Attractiveness for internal migration underemployed multiplier $i[a10]$ ~|
 AIMUM Attractiveness for internal migration underemployed multiplier $k[a11]=$
 AIMUM Attractiveness for internal migration underemployed multiplier $i[a11]$ ~|
 AIMUM Attractiveness for internal migration underemployed multiplier $k[a12]=$
 AIMUM Attractiveness for internal migration underemployed multiplier $i[a12]$ ~|
 AIMUM Attractiveness for internal migration underemployed multiplier $k[a13]=$
 AIMUM Attractiveness for internal migration underemployed multiplier $i[a13]$ ~|
 AIMUM Attractiveness for internal migration underemployed multiplier $k[a14]=$
 AIMUM Attractiveness for internal migration underemployed multiplier $i[a14]$ ~|
 AIMUM Attractiveness for internal migration underemployed multiplier $k[a15]=$
 AIMUM Attractiveness for internal migration underemployed multiplier $i[a15]$ ~|
 AIMUM Attractiveness for internal migration underemployed multiplier $k[a16]=$
 AIMUM Attractiveness for internal migration underemployed multiplier $i[a16]$

~
~

AIMUMPT Attractiveness for internal migration underemployed multiplier perception time $k\backslash$
 =

5
~
~

UCZA Underemployed comparison zone i to average i =

AAUJZ Accessibility attractiveness to underemployed jobs zone $i[i]/AAAUJAZ$ Average
 accessibility attractiveness to underemployed jobs all zones

~
~

CAIMUMP Change in AIMUMP $[k]=$

(AIMUM Attractiveness for internal migration underemployed multiplier $k[k]-$ AIMUMP
 Attractiveness for internal migration underemployed multiplier perceived $k\backslash$
 $[k])/$ AIMUMPT Attractiveness for internal migration underemployed multiplier
 perception time k

~
~

UIBZM Underemployed internal between zones movement i $k[i,k]=$

"UIOMN Underemployed internal out-of-zone movement normal"*(((U Underemployed
 $i[i]/$ AIMUM Attractiveness for internal migration underemployed multiplier $i\backslash$
 $[i])*(U$ Underemployed $k[k]*$ AIMUMP Attractiveness for internal migration
 underemployed multiplier perceived $k\backslash$
 $[k]))$

/UT Underemployed total)

~

~

|

"UIOMN Underemployed internal out-of-zone movement normal"=

0.04

~

~

|

ULAM Underemployed locational attractiveness multiplier i[i]= WITH LOOKUP (

UCZA Underemployed comparison zone i to average[i],

((0,0)-(2,2]),(0,0.4),(0.25,0.4),(0.5,0.5),(0.75,0.65),(1,1),(1.25,1.3),(1.5,1.5),\
(1.75,1.6),(2,1.7)))

~

~

|

U Underemployed k[a1]=

U Underemployed i[a1] ~|

U Underemployed k[a2]=

U Underemployed i[a2] ~|

U Underemployed k[a3]=

U Underemployed i[a3] ~|

U Underemployed k[a4]=

U Underemployed i[a4] ~|

U Underemployed k[a5]=

U Underemployed i[a5] ~|

U Underemployed k[a6]=

U Underemployed i[a6] ~|

U Underemployed k[a7]=

U Underemployed i[a7] ~|

U Underemployed k[a8]=

U Underemployed i[a8] ~|

U Underemployed k[a9]=

U Underemployed i[a9] ~|

U Underemployed k[a10]=

U Underemployed i[a10] ~|

U Underemployed k[a11]=

U Underemployed i[a11] ~|

U Underemployed k[a12]=

U Underemployed i[a12] ~|

U Underemployed k[a13]=

U Underemployed i[a13] ~|

U Underemployed k[a14]=

U Underemployed i[a14] ~|

U Underemployed k[a15]=

U Underemployed i[a15] ~|

U Underemployed k[a16]=

U Underemployed i[a16]

~

~

|

"UHR Underemployed/housing ratio"=

(UT Underemployed total*UFS Underemployed family size)/(UHT Underemployed housing
total\

*UHPD Underemployed housing population density)

~

Dmnl

~

|

UHPD Underemployed housing population density=

12

~ people/housing unit
 ~ |

TPCR Tax per capita ratio=
 ((TC Tax collaections/P Population)+TPCSP Tax per capita subsidy program)/TPCN Tax per capita normal
 ~
 ~ |

TPCN Tax per capita normal=
 250
 ~ dollars/year
 ~ |

P Population=
 UT Underemployed total*UFS Underemployed family size+LT Labor total*LFS Labor family size\
 +"MPT Managerial-professional total"*"MPFS Managerial-professional family size"
 ~
 ~ |

"MPFS Managerial-professional family size"=
 5
 ~ Dmnl
 ~ |

LFS Labor family size=
 6
 ~ Dmnl
 ~ |

UFS Underemployed family size=
 8
 ~ Dmnl
 ~ |

UHPM Underemployed housing program multiplier= WITH LOOKUP (
 UHPR Underemployed housing program rate,
 ((0,0)-(0.05,3]),(0,1),(0.01,1.2),(0.02,1.5),(0.03,1.9),(0.04,2.4),(0.05,3))
 ~
 ~ |

UHPR Underemployed housing program rate=
 SUM(LCHP Low cost housing program[!])/UT Underemployed total
 ~ housing units/(year*man)
 ~ |

UJ Underemployed jobs k[a1]=
 UJ Underemployed jobs i[a1] ~|
 UJ Underemployed jobs k[a2]=
 UJ Underemployed jobs i[a2] ~|
 UJ Underemployed jobs k[a3]=
 UJ Underemployed jobs i[a3] ~|
 UJ Underemployed jobs k[a4]=
 UJ Underemployed jobs i[a4] ~|
 UJ Underemployed jobs k[a5]=
 UJ Underemployed jobs i[a5] ~|
 UJ Underemployed jobs k[a6]=
 UJ Underemployed jobs i[a6] ~|
 UJ Underemployed jobs k[a7]=

```

    UJ Underemployed jobs i[a7] ~~|
UJ Underemployed jobs k[a8]=
    UJ Underemployed jobs i[a8] ~~|
UJ Underemployed jobs k[a9]=
    UJ Underemployed jobs i[a9] ~~|
UJ Underemployed jobs k[a10]=
    UJ Underemployed jobs i[a10] ~~|
UJ Underemployed jobs k[a11]=
    UJ Underemployed jobs i[a11] ~~|
UJ Underemployed jobs k[a12]=
    UJ Underemployed jobs i[a12] ~~|
UJ Underemployed jobs k[a13]=
    UJ Underemployed jobs i[a13] ~~|
UJ Underemployed jobs k[a14]=
    UJ Underemployed jobs i[a14] ~~|
UJ Underemployed jobs k[a15]=
    UJ Underemployed jobs i[a15] ~~|
UJ Underemployed jobs k[a16]=
    UJ Underemployed jobs i[a16]
~
~

```

Labor sector

```

L Labor i[i]= INTEG (
    +LB Labor births i[i]+UTL Underemployed to labor i[i]+LA Labor arrivals i[i]-LD Labor
departures i\
    [i]-LTM Labor to manager i[i]-LTU Labor to underemployed i[i]+LNZM Labor net
zone movement i\
    [i],
    LI Labor initial i[i]*(14/21))
~
~

```

```

LI Labor initial i[i]=
50,50,50,50,10150,50,50,50,10150,50,50,50,50,50,50,50
~
~

```

```

LB Labor births i[i]=
L Labor i[i]*LBR Labor birth rate
~
Person/year
~

```

```

LBR Labor birth rate=
0.01
~
Fraction/year
~

```

```

LA Labor arrivals i[i]=
L Labor i[i]*LAN Labor arrivals normal*LAMP Labor arrival multiplier perceived
~
Dmnl
~

```

```

LAN Labor arrivals normal=
0.03
~
Fraction/year
~

```

```

LAMP Labor arrival multiplier perceived= INTEG (

```

CLAMP Change in LAMP,
1)
~
~ |

CLAMP Change in LAMP=
(LAM Labor arrival multiplier-LAMP Labor arrival multiplier perceived)/LAMPT Labor
arrival multiplier perception time
~ Dmnl
~ |

LD Labor departures i[i]=
L Labor i[i]*LDN Labor departures normal*LDM Labor departure multiplier
~ Person/year
~ |

LDN Labor departures normal=
0.02
~ Fraction/year
~ |

LDM Labor departure multiplier= WITH LOOKUP (
(1.44*LN(LAM Labor arrival multiplier)),
((-3,0)-(4,8)],(-3,8),(-2,4),(-1,2),(0,1),(1,0.5),(2,0.25),(3,0.125),(4,0.1))
~ Dmnl
~ |

LAM Labor arrival multiplier=
LAJM Labor arrival job multiplier*LAUM Labor arrival underemployed multiplier*LATM
Labor arrival tax multiplier\
*LAHM Labor arrival housing multiplier*LAF Labor arrival factor
~
~ |

LAJM Labor arrival job multiplier= WITH LOOKUP (
"LRT Labor/job ratio total",
((0,0)-(2,3)],(0,2.6),(0.25,2.6),(0.5,2.4),(0.75,1.8),(1,1),(1.25,0.4),(1.5,0.2),(\
1.75,0.1),(2,0.05))
~ Dmnl
~ |

LAUM Labor arrival underemployed multiplier= WITH LOOKUP (
"LURT Labor/Underemployed ratio total",
((0,0)-(5,2)],(0,0.4),(1,0.8),(2,1),(3,1.2),(4,1.3),(5,1.3))
~ Dmnl
~ |

LATM Labor arrival tax multiplier= WITH LOOKUP (
(1.44*LN(TR Tax ratio)),
((-2,0)-(4,2)],(-2,1.2),(0,1),(2,0.7),(4,0.3))
~
~ |

LAHM Labor arrival housing multiplier= WITH LOOKUP (
"LHR Labor/housing ratio",
((0,0)-(3,2)],(0,1.3),(0.5,1.2),(1,1),(1.5,0.5),(2,0.2),(2.5,0.1),(3,0.05))
~
~ |

LAF Labor arrival factor=

1
 ~ Dmnl
 ~ |

LTM Labor to manager i[i]=
 L Labor i[i]*LMN Labor mobility normal*LMMP Labor mobility multiplier perceived i[i]
 +LTPG Labor training program i[i]
 ~ Person/year
 ~ |

LMN Labor mobility normal=
 0.02
 ~ Fraction/year
 ~ |

LMMP Labor mobility multiplier perceived i[i]= INTEG (
 CLMMP Change in LMMP i[i],
 1)
 ~
 ~ |

CLMMP Change in LMMP i[i]=
 (LMM Labor mobility multiplier i[i]-LMMP Labor mobility multiplier perceived
 i[i])/LMMPT Labor mobility multiplier perception time
 ~ Dmnl/year
 ~ |

LMMPT Labor mobility multiplier perception time=
 15
 ~ year
 ~ |

LNZZ Labor net zone movement i[i]=
 "LIIM Labor internal into-zone movement i"[i]-"LIOM Labor internal out-of-zone movement
 i"
 [i]
 ~
 ~ |

"LIIM Labor internal into-zone movement i"[a1]=
 SUM(LIBZM Labor internal between zones movement i k[i!,a1]) ~|

"LIIM Labor internal into-zone movement i"[a2]=
 SUM(LIBZM Labor internal between zones movement i k[i!,a2]) ~|

"LIIM Labor internal into-zone movement i"[a3]=
 SUM(LIBZM Labor internal between zones movement i k[i!,a3]) ~|

"LIIM Labor internal into-zone movement i"[a4]=
 SUM(LIBZM Labor internal between zones movement i k[i!,a4]) ~|

"LIIM Labor internal into-zone movement i"[a5]=
 SUM(LIBZM Labor internal between zones movement i k[i!,a5]) ~|

"LIIM Labor internal into-zone movement i"[a6]=
 SUM(LIBZM Labor internal between zones movement i k[i!,a6]) ~|

"LIIM Labor internal into-zone movement i"[a7]=
 SUM(LIBZM Labor internal between zones movement i k[i!,a7]) ~|

"LIIM Labor internal into-zone movement i"[a8]=
 SUM(LIBZM Labor internal between zones movement i k[i!,a8]) ~|

"LIIM Labor internal into-zone movement i"[a9]=
 SUM(LIBZM Labor internal between zones movement i k[i!,a9]) ~|

"LIIM Labor internal into-zone movement i"[a10]=
 SUM(LIBZM Labor internal between zones movement i k[i!,a10]) ~|

"LIIM Labor internal into-zone movement i"[a11]=

SUM(LIBZM Labor internal between zones movement i k[i!,a11]) ~|
 "LIIM Labor internal into-zone movement i"[a12]=
 SUM(LIBZM Labor internal between zones movement i k[i!,a12]) ~|
 "LIIM Labor internal into-zone movement i"[a13]=
 SUM(LIBZM Labor internal between zones movement i k[i!,a13]) ~|
 "LIIM Labor internal into-zone movement i"[a14]=
 SUM(LIBZM Labor internal between zones movement i k[i!,a14]) ~|
 "LIIM Labor internal into-zone movement i"[a15]=
 SUM(LIBZM Labor internal between zones movement i k[i!,a15]) ~|
 "LIIM Labor internal into-zone movement i"[a16]=
 SUM(LIBZM Labor internal between zones movement i k[i!,a16])

~
~

"LIOM Labor internal out-of-zone movement i"[a1]=
 SUM(LIBZM Labor internal between zones movement i k[a1,k!]) ~|
 "LIOM Labor internal out-of-zone movement i"[a2]=
 SUM(LIBZM Labor internal between zones movement i k[a2,k!]) ~|
 "LIOM Labor internal out-of-zone movement i"[a3]=
 SUM(LIBZM Labor internal between zones movement i k[a3,k!]) ~|
 "LIOM Labor internal out-of-zone movement i"[a4]=
 SUM(LIBZM Labor internal between zones movement i k[a4,k!]) ~|
 "LIOM Labor internal out-of-zone movement i"[a5]=
 SUM(LIBZM Labor internal between zones movement i k[a5,k!]) ~|
 "LIOM Labor internal out-of-zone movement i"[a6]=
 SUM(LIBZM Labor internal between zones movement i k[a6,k!]) ~|
 "LIOM Labor internal out-of-zone movement i"[a7]=
 SUM(LIBZM Labor internal between zones movement i k[a7,k!]) ~|
 "LIOM Labor internal out-of-zone movement i"[a8]=
 SUM(LIBZM Labor internal between zones movement i k[a8,k!]) ~|
 "LIOM Labor internal out-of-zone movement i"[a9]=
 SUM(LIBZM Labor internal between zones movement i k[a9,k!]) ~|
 "LIOM Labor internal out-of-zone movement i"[a10]=
 SUM(LIBZM Labor internal between zones movement i k[a10,k!]) ~|
 "LIOM Labor internal out-of-zone movement i"[a11]=
 SUM(LIBZM Labor internal between zones movement i k[a11,k!]) ~|
 "LIOM Labor internal out-of-zone movement i"[a12]=
 SUM(LIBZM Labor internal between zones movement i k[a12,k!]) ~|
 "LIOM Labor internal out-of-zone movement i"[a13]=
 SUM(LIBZM Labor internal between zones movement i k[a13,k!]) ~|
 "LIOM Labor internal out-of-zone movement i"[a14]=
 SUM(LIBZM Labor internal between zones movement i k[a14,k!]) ~|
 "LIOM Labor internal out-of-zone movement i"[a15]=
 SUM(LIBZM Labor internal between zones movement i k[a15,k!]) ~|
 "LIOM Labor internal out-of-zone movement i"[a16]=
 SUM(LIBZM Labor internal between zones movement i k[a16,k!])

~
~

AIMLM Attractiveness for internal migration labor multiplier i[i]=
 LLAM Labor locational attractiveness multiplier i[i]*LAUM Labor arrival underemployed
 multiplier i\

~
~

AIMLMP Attractiveness for internal migration labor multiplier perceived k[i]= INTEG (
 CAIMLMP Change in AIMLMP[i],
 AIMLM Attractiveness for internal migration labor multiplier k[i])

~

~ |

AAALJAZ Average accessibility attractiveness to labor jobs all zones=
SUM(LJ Labor jobs k[k!]/TDF Trip distribution function i[i!,k!])/16

~ |

AALJZ Accessibility attractiveness to labor jobs zone i[i]=
SUM(LJ Labor jobs k[k!]/TDF Trip distribution function i[i,k!])

~ |

LCZA Labor comparison zone i to average[i]=
AALJZ Accessibility attractiveness to labor jobs zone i[i]/AAALJAZ Average accessibility attractiveness to labor jobs all zones

~ |

AIMLM Attractiveness for internal migration labor multiplier k[a1]=
AIMLM Attractiveness for internal migration labor multiplier i[a1] ~|

AIMLM Attractiveness for internal migration labor multiplier k[a2]=
AIMLM Attractiveness for internal migration labor multiplier i[a2] ~|

AIMLM Attractiveness for internal migration labor multiplier k[a3]=
AIMLM Attractiveness for internal migration labor multiplier i[a3] ~|

AIMLM Attractiveness for internal migration labor multiplier k[a4]=
AIMLM Attractiveness for internal migration labor multiplier i[a4] ~|

AIMLM Attractiveness for internal migration labor multiplier k[a5]=
AIMLM Attractiveness for internal migration labor multiplier i[a5] ~|

AIMLM Attractiveness for internal migration labor multiplier k[a6]=
AIMLM Attractiveness for internal migration labor multiplier i[a6] ~|

AIMLM Attractiveness for internal migration labor multiplier k[a7]=
AIMLM Attractiveness for internal migration labor multiplier i[a7] ~|

AIMLM Attractiveness for internal migration labor multiplier k[a8]=
AIMLM Attractiveness for internal migration labor multiplier i[a8] ~|

AIMLM Attractiveness for internal migration labor multiplier k[a9]=
AIMLM Attractiveness for internal migration labor multiplier i[a9] ~|

AIMLM Attractiveness for internal migration labor multiplier k[a10]=
AIMLM Attractiveness for internal migration labor multiplier i[a10] ~|

AIMLM Attractiveness for internal migration labor multiplier k[a11]=
AIMLM Attractiveness for internal migration labor multiplier i[a11] ~|

AIMLM Attractiveness for internal migration labor multiplier k[a12]=
AIMLM Attractiveness for internal migration labor multiplier i[a12] ~|

AIMLM Attractiveness for internal migration labor multiplier k[a13]=
AIMLM Attractiveness for internal migration labor multiplier i[a13] ~|

AIMLM Attractiveness for internal migration labor multiplier k[a14]=
AIMLM Attractiveness for internal migration labor multiplier i[a14] ~|

AIMLM Attractiveness for internal migration labor multiplier k[a15]=
AIMLM Attractiveness for internal migration labor multiplier i[a15] ~|

AIMLM Attractiveness for internal migration labor multiplier k[a16]=
AIMLM Attractiveness for internal migration labor multiplier i[a16]

~ |

~ |

AIMLMPT Attractiveness for internal migration labor multiplier perception time k=
5

~ |

~ |

"LIOMN Labor internal out-of-zone movement normal"=
0.04

```

~
~ |
LJ Labor jobs k[a1]=
    LJ Labor jobs i[a1] ~|
LJ Labor jobs k[a2]=
    LJ Labor jobs i[a2] ~|
LJ Labor jobs k[a3]=
    LJ Labor jobs i[a3] ~|
LJ Labor jobs k[a4]=
    LJ Labor jobs i[a4] ~|
LJ Labor jobs k[a5]=
    LJ Labor jobs i[a5] ~|
LJ Labor jobs k[a6]=
    LJ Labor jobs i[a6] ~|
LJ Labor jobs k[a7]=
    LJ Labor jobs i[a7] ~|
LJ Labor jobs k[a8]=
    LJ Labor jobs i[a8] ~|
LJ Labor jobs k[a9]=
    LJ Labor jobs i[a9] ~|
LJ Labor jobs k[a10]=
    LJ Labor jobs i[a10] ~|
LJ Labor jobs k[a11]=
    LJ Labor jobs i[a11] ~|
LJ Labor jobs k[a12]=
    LJ Labor jobs i[a12] ~|
LJ Labor jobs k[a13]=
    LJ Labor jobs i[a13] ~|
LJ Labor jobs k[a14]=
    LJ Labor jobs i[a14] ~|
LJ Labor jobs k[a15]=
    LJ Labor jobs i[a15] ~|
LJ Labor jobs k[a16]=
    LJ Labor jobs i[a16]

```

```

~
~ |

```

```

LLAM Labor locational attractiveness multiplier i[i]= WITH LOOKUP (
    LCZA Labor comparison zone i to average[i],
    (([0,0)-(2,2]),(0,0.5),(0.25,0.5),(0.5,0.6),(0.75,0.75),(1,1),(1.25,1.25),(1.5,1.4)\
    ,(1.75,1.5),(2,1.6) ))

```

```

~
~ |

```

```

L Labor k[a1]=
    L Labor i[a1] ~|
L Labor k[a2]=
    L Labor i[a2] ~|
L Labor k[a3]=
    L Labor i[a3] ~|
L Labor k[a4]=
    L Labor i[a4] ~|
L Labor k[a5]=
    L Labor i[a5] ~|
L Labor k[a6]=
    L Labor i[a6] ~|
L Labor k[a7]=
    L Labor i[a7] ~|
L Labor k[a8]=

```

L Labor i[a8] ~|
 L Labor k[a9]=
 L Labor i[a9] ~|
 L Labor k[a10]=
 L Labor i[a10] ~|
 L Labor k[a11]=
 L Labor i[a11] ~|
 L Labor k[a12]=
 L Labor i[a12] ~|
 L Labor k[a13]=
 L Labor i[a13] ~|
 L Labor k[a14]=
 L Labor i[a14] ~|
 L Labor k[a15]=
 L Labor i[a15] ~|
 L Labor k[a16]=
 L Labor i[a16]
 ~
 ~ |

CAIMLMP Change in AIMLMP[k]=
 (AIMLM Attractiveness for internal migration labor multiplier k[k]-AIMLMP Attractiveness
 for internal migration labor multiplier perceived k\
 [k])/AIMLMPT Attractiveness for internal migration labor multiplier perception time
 k
 ~
 ~ |

"HLR Housing/labor ratio i"[i]=
 (WH Worker housing i[i]*WHPD Worker housing population density)/(L Labor i[i]*LFS
 Labor family size\
)
 ~
 ~ |

"LUR Labor/underemployed ratio i"[i]=
 L Labor i[i]/U Underemployed i[i]
 ~
 ~ |

UMT Underemployed mobility total=
 SUM(UM Underemployed mobility i[i!])/16
 ~
 ~ |

"LHR Labor/housing ratio"=
 (LT Labor total*LFS Labor family size)/(WHT Worker housing total*WHPD Worker housing
 population density\
)
 ~
 ~ |

LIBZM Labor internal between zones movement i k[i,k]=
 "LIOMN Labor internal out-of-zone movement normal"*(((L Labor i[i]/AIMLM
 Attractiveness for internal migration labor multiplier i\
 [i])*(L Labor k[k]*AIMLMP Attractiveness for internal migration labor multiplier
 perceived k\
 [k]))/LT Labor total)
 ~
 ~ |

LT Labor total=
 SUM(L Labor i[i!])
 ~
 ~ |

CUTLP Change in UTLP i[i]=
 (UTL Underemployed to labor i[i]-UTLP Underemployed to labor perceived i[i])/UTLPT
 Underemployed to labor perception time
 ~ Dmnl/year
 ~ |

UTLN Underemployed to labor net=
 SUM(UTL Underemployed to labor i[i!])-SUM(LTU Labor to underemployed i[i!])
 ~
 ~ ~ :SUPPLEMENTARY
 |

UFW Underemployed fraction working= WITH LOOKUP (
 "URT Underemployed/job ratio total",
 ((0,0)-(6,1]),(0,0.9),(1,0.8),(2,0.5),(3,0.33),(4,0.25),(5,0.2))
 ~ Dmnl
 ~ |

UTLP Underemployed to labor perceived i[i]= INTEG (
 CUTLP Change in UTLP i[i],
 UTLPI Underemployed to labor perceived initial i[i])
 ~ Dmnl
 ~ |

UTLPI Underemployed to labor perceived initial i[i]=
 1,1,1,1,35,1,1,1,35,1,1,1,1,1,1,1
 ~
 ~ |

UTLPT Underemployed to labor perception time=
 10
 ~ year
 ~ |

UM Underemployed mobility i[i]=
 UTLP Underemployed to labor perceived i[i]/U Underemployed i[i]
 ~ Fraction/year
 ~ |

LSM Labor supply multiplier= WITH LOOKUP (
 "LRT Labor/job ratio total",
 ((0,0)-(2,3]),(0,2.4),(0.5,2),(1,1),(1.5,0.4),(2,0.2))
 ~ Dmnl
 ~ |

"LUM Labor/underemployed multiplier i"[i]= WITH LOOKUP (
 "LUR Labor/underemployed ratio i"[i],
 ((0,0)-(5,2]),(0,0.2),(1,0.7),(2,1),(3,1.2),(4,1.3),(5,1.4))
 ~ Dmnl
 ~ |

"LURT Labor/Underemployed ratio total"=
 LT Labor total/UT Underemployed total
 ~

~ |
 UEM Underemployed educational multiplier= WITH LOOKUP (

 TPCR Tax per capita ratio,

 ((0,0)-(3,2)],(0,0.2),(0.5,0.7),(1,1),(1.5,1.3),(2,1.5),(2.5,1.6),(3,1.7)))

 ~

 ~ |

LMM Labor mobility multiplier i[i]=

 MSM Manager supply multiplier*"MLM Manager/labor multiplier i"[i]*LEM Labor

 educational multiplier\

 *LMF Labor mobility factor

 ~ Dmnl

 ~ |

LMF Labor mobility factor=

 1

 ~ Dmnl

 ~ |

MSM Manager supply multiplier= WITH LOOKUP (

 "MR Manager/job ratio",

 (((0,0)-(2,3)],(0,2.3),(0.25,2.2),(0.5,2),(0.75,1.6),(1,1),(1.25,0.5),(1.5,0.2),(1.75\

 ,0.1),(2,0.05)))

 ~

 ~ |

"MR Manager/job ratio"=

 "MPT Managerial-professional total"/MJT Manager jobs total

 ~ Dmnl

 ~ |

MJ Manager jobs i[i]=

 NE New enterprise i[i]*NEM New enterprise management+MB Mature business i[i]*MBM

 Mature business management\

 +DI Declining industry i[i]*DIM Declining industry management+SI Service

 industry i\

 [i]*SIM Service industry management

 ~

 ~ |

NEM New enterprise management=

 4

 ~ persons/productive unit

 ~ |

MBM Mature business management=

 2

 ~ persons/productive unit

 ~ |

DIM Declining industry management=

 1

 ~ persons/productive unit

 ~ |

"MLM Manager/labor multiplier i"[i]= WITH LOOKUP (

 "MLR Manager/labor ratio i"[i],

 (((0,0)-(0.2,2)],(0,0.2),(0.05,0.7),(0.1,1),(0.15,1.2),(0.2,1.3)))

 ~

~ |

"MLR Manager/labor ratio i"[i]=
 "MP Managerial-professional i"[i]/L Labor i[i]
 ~ Dmnl
 ~ |

LEM Labor educational multiplier= WITH LOOKUP (
 TPCR Tax per capita ratio,
 ((0,0)-(3,2)],(0,0.2),(0.5,0.7),(1,1),(1.5,1.3),(2,1.5),(2.5,1.6),(3,1.7))
 ~ Dmnl
 ~ |

LAMPT Labor arrival multiplier perception time=
 15
 ~ year
 ~ |

WHPD Worker housing population density=
 6
 ~ people/housing unit
 ~ |

LAHM Labor arrival housing multiplier i[i]= WITH LOOKUP (
 "HLR Housing/labor ratio i"[i],
 ((0,0)-(3,4)],(0,0.05),(0.5,0.3),(1,1),(1.5,1.25),(2,1.5),(2.5,1.8),(3,2))
 ~
 ~ |

LAUM Labor arrival underemployed multiplier i[i]= WITH LOOKUP (
 "LUR Labor/underemployed ratio i"[i],
 ((0,0)-(5,2)],(0,0.4),(1,0.8),(2,1),(3,1.2),(4,1.3),(5,1.3))
 ~ Dmnl
 ~ |

Managerial-professional sector

"MP Managerial-professional i"[i]= INTEG (
 +"MPB Managerial-professional births i"[i]+LTM Labor to manager i[i]+MA Manager
 arrivals i\
 [i]-MD Manager departures i[i]
]+MNZM Manager net zone movement i[i],
 MPI Managerial professional initial i[i]*(39/50))
 ~
 ~ |

MPI Managerial professional initial i[i]=
 50,50,50,50,2150,50,50,50,2150,50,50,50,50,50,50,50
 ~
 ~ |

"MPB Managerial-professional births i"[i]=
 "MP Managerial-professional i"[i]*"MPBR Managerial-professional birth rate"
 ~ Person/year
 ~ |

"MPBR Managerial-professional birth rate"=
 0.0075
 ~ Fraction/year
 ~ |

MA Manager arrivals $i[i]=$
 "MP Managerial-professional $i''[i]*$ MAN Manager arrival normal*MAMP Manager arrival multiplier perceived

~ Person/year
 ~ |

MAN Manager arrival normal=

0.03
 ~ Fraction/year
 ~ |

MAMP Manager arrival multiplier perceived= INTEG (CMAMP Change in MAMP,

1)
 ~ Dmnl
 ~ |

CMAMP Change in MAMP=

(MAM Manager arrival multiplier-MAMP Manager arrival multiplier perceived)/MAMPT Manager arrival multiplier perception time

~ Dmnl/year
 ~ |

MAMPT Manager arrival multiplier perception time=

10
 ~ year
 ~ |

MD Manager departures $i[i]=$

"MP Managerial-professional $i''[i]*$ MDN Manager departures normal*MDM manager departure multiplier

~ Person/year
 ~ |

MDN Manager departures normal=

0.02
 ~ Fraction/year
 ~ |

MDM manager departure multiplier= WITH LOOKUP (

(1.44*LN(MAM Manager arrival multiplier),
 ((-3,0)-(4,8)],(-3,8),(-2,4),(-1,2),(0,1),(1,0.5),(2,0.25),(3,0.125),(4,0.1)))

~
 ~ |

MNZM Manager net zone movement $i[i]=$

"MIIM Manager internal into-zone movement $i''[i]-$ "MIOM Manager internal out-of-zone movement $i''\backslash$

[i]
 ~
 ~ |

"MIIM Manager internal into-zone movement $i''[a1]=$

SUM(MIBZM Manager internal between zones movement $i k[i!,a1]$) ~|

"MIIM Manager internal into-zone movement $i''[a2]=$

SUM(MIBZM Manager internal between zones movement $i k[i!,a2]$) ~|

"MIIM Manager internal into-zone movement $i''[a3]=$

SUM(MIBZM Manager internal between zones movement $i k[i!,a3]$) ~|

"MIIM Manager internal into-zone movement $i''[a4]=$

AIMMM Attractiveness for internal migration manager multiplier $i[i]=$
 MLAM Manger locational attractiveness multiplier $i[i]*MAPM$ Managerr arrival population multiplier $i\backslash$
 $[i]*MAHM$ Manager arrival housing multiplier $i[i]$

AIMMMP Attractiveness for internal migration manager multiplier perceived $k[k]=$ INTEG\
 (
 CAIMMMP Change in AIMMMP[k],
 AIMMM Attractiveness for internal migration manager multiplier $k[k]$)

AAAMJAZ Average accessibility attractiveness to manager jobs all zones=
 SUM(MJ Manager jobs $k[k!]/TDF$ Trip distribution function $i[i!,k!]/16$

TDF Trip distribution function $i[i,k]=$
 D Distance $i k[i,k]^2$

AALJZ Accessibility attractiveness to manager jobs zone $i[i]=$
 SUM(MJ Manager jobs $k[k!]/TDF$ Trip distribution function $i[i,k!]$)

AIMMM Attractiveness for internal migration manager multiplier $k[a1]=$
 AIMMM Attractiveness for internal migration manager multiplier $i[a1]$ ~|
 AIMMM Attractiveness for internal migration manager multiplier $k[a2]=$
 AIMMM Attractiveness for internal migration manager multiplier $i[a2]$ ~|
 AIMMM Attractiveness for internal migration manager multiplier $k[a3]=$
 AIMMM Attractiveness for internal migration manager multiplier $i[a3]$ ~|
 AIMMM Attractiveness for internal migration manager multiplier $k[a4]=$
 AIMMM Attractiveness for internal migration manager multiplier $i[a4]$ ~|
 AIMMM Attractiveness for internal migration manager multiplier $k[a5]=$
 AIMMM Attractiveness for internal migration manager multiplier $i[a5]$ ~|
 AIMMM Attractiveness for internal migration manager multiplier $k[a6]=$
 AIMMM Attractiveness for internal migration manager multiplier $i[a6]$ ~|
 AIMMM Attractiveness for internal migration manager multiplier $k[a7]=$
 AIMMM Attractiveness for internal migration manager multiplier $i[a7]$ ~|
 AIMMM Attractiveness for internal migration manager multiplier $k[a8]=$
 AIMMM Attractiveness for internal migration manager multiplier $i[a8]$ ~|
 AIMMM Attractiveness for internal migration manager multiplier $k[a9]=$
 AIMMM Attractiveness for internal migration manager multiplier $i[a9]$ ~|
 AIMMM Attractiveness for internal migration manager multiplier $k[a10]=$
 AIMMM Attractiveness for internal migration manager multiplier $i[a10]$ ~|
 AIMMM Attractiveness for internal migration manager multiplier $k[a11]=$
 AIMMM Attractiveness for internal migration manager multiplier $i[a11]$ ~|
 AIMMM Attractiveness for internal migration manager multiplier $k[a12]=$
 AIMMM Attractiveness for internal migration manager multiplier $i[a12]$ ~|
 AIMMM Attractiveness for internal migration manager multiplier $k[a13]=$
 AIMMM Attractiveness for internal migration manager multiplier $i[a13]$ ~|
 AIMMM Attractiveness for internal migration manager multiplier $k[a14]=$
 AIMMM Attractiveness for internal migration manager multiplier $i[a14]$ ~|
 AIMMM Attractiveness for internal migration manager multiplier $k[a15]=$

AIMMM Attractiveness for internal migration manager multiplier i[a15] ~|
AIMMM Attractiveness for internal migration manager multiplier k[a16]=
AIMMM Attractiveness for internal migration manager multiplier i[a16]

~
~ |

AIMMMPT Attractiveness for internal migration manager multiplier perception time k=

5
~
~ |

"MPR Manager/population ratio i"[i]=

"MP Managerial-professional i"[i]/(L Labor i[i]+U Underemployed i[i])

~
~ |

CAIMMMMP Change in AIMMMMP[k]=

(AIMMM Attractiveness for internal migration manager multiplier k[k]-AIMMMMP
Attractiveness for internal migration manager multiplier perceived k\
[k])/AIMMMPT Attractiveness for internal migration manager multiplier perception
time k

~
~ |

"MIOMN Manager internal out-of-zone movement normal"=

0.04
~
~ |

MJ Manager jobs k[a1]=

MJ Manager jobs i[a1] ~|

MJ Manager jobs k[a2]=

MJ Manager jobs i[a2] ~|

MJ Manager jobs k[a3]=

MJ Manager jobs i[a3] ~|

MJ Manager jobs k[a4]=

MJ Manager jobs i[a4] ~|

MJ Manager jobs k[a5]=

MJ Manager jobs i[a5] ~|

MJ Manager jobs k[a6]=

MJ Manager jobs i[a6] ~|

MJ Manager jobs k[a7]=

MJ Manager jobs i[a7] ~|

MJ Manager jobs k[a8]=

MJ Manager jobs i[a8] ~|

MJ Manager jobs k[a9]=

MJ Manager jobs i[a9] ~|

MJ Manager jobs k[a10]=

MJ Manager jobs i[a10] ~|

MJ Manager jobs k[a11]=

MJ Manager jobs i[a11] ~|

MJ Manager jobs k[a12]=

MJ Manager jobs i[a12] ~|

MJ Manager jobs k[a13]=

MJ Manager jobs i[a13] ~|

MJ Manager jobs k[a14]=

MJ Manager jobs i[a14] ~|

MJ Manager jobs k[a15]=

MJ Manager jobs i[a15] ~|

MJ Manager jobs k[a16]=

MJ Manager jobs i[a16]
 ~
 ~ |

MLAM Manger locational attractiveness multiplier i[i]= WITH LOOKUP (
 MCZA Manager comparison zone i to average[i],
 ((0,0)-(2.25,2)),(0,0.7),(0.25,0.7),(0.5,0.8),(0.75,0.9),(1,1),(1.25,1.1),(1.5,1.2)
),(1.75,1.3),(2,1.4),(2.25,1.4))
 ~
 ~ |

"MP Managerial-professional k"[a1]=
 "MP Managerial-professional i"[a1] ~|
 "MP Managerial-professional k"[a2]=
 "MP Managerial-professional i"[a2] ~|
 "MP Managerial-professional k"[a3]=
 "MP Managerial-professional i"[a3] ~|
 "MP Managerial-professional k"[a4]=
 "MP Managerial-professional i"[a4] ~|
 "MP Managerial-professional k"[a5]=
 "MP Managerial-professional i"[a5] ~|
 "MP Managerial-professional k"[a6]=
 "MP Managerial-professional i"[a6] ~|
 "MP Managerial-professional k"[a7]=
 "MP Managerial-professional i"[a7] ~|
 "MP Managerial-professional k"[a8]=
 "MP Managerial-professional i"[a8] ~|
 "MP Managerial-professional k"[a9]=
 "MP Managerial-professional i"[a9] ~|
 "MP Managerial-professional k"[a10]=
 "MP Managerial-professional i"[a10] ~|
 "MP Managerial-professional k"[a11]=
 "MP Managerial-professional i"[a11] ~|
 "MP Managerial-professional k"[a12]=
 "MP Managerial-professional i"[a12] ~|
 "MP Managerial-professional k"[a13]=
 "MP Managerial-professional i"[a13] ~|
 "MP Managerial-professional k"[a14]=
 "MP Managerial-professional i"[a14] ~|
 "MP Managerial-professional k"[a15]=
 "MP Managerial-professional i"[a15] ~|
 "MP Managerial-professional k"[a16]=
 "MP Managerial-professional i"[a16]
 ~
 ~ |

"MPR Manager/population ratio"=
 "MPT Managerial-professional total"/(LT Labor total+UT Underemployed total)
 ~ Dmnl
 ~ |

MCZA Manager comparison zone i to average[i]=
 AALJZ Accessibility attractiveness to manager jobs zone i[i]/AAAMJAZ Average
 accessibility attractiveness to manager jobs all zones
 ~
 ~ |

"HMR Housing/manager ratio i"[i]=
 (PH Premium housing i[i]*PHPD Premium housing density)/("MP Managerial-professional
 i"\

[i]*"MPFS Managerial-professional family size")
 ~
 ~ |
 MIBZM Manager internal between zones movement i k[i,k]=
 "MIOMN Manager internal out-of-zone movement normal"*(((("MP Managerial-professional
 i"\
 [i]/AIMMM Attractiveness for internal migration manager multiplier i
 [i])*("MP Managerial-professional k"[k]*AIMMMP Attractiveness for internal migration
 manager multiplier perceived k\
 [k]))/"MPT Managerial-professional total")
 ~
 ~ |
 "MPT Managerial-professional total"=
 SUM("MP Managerial-professional i"[i!])
 ~
 ~ |
 MJT Manager jobs total=
 SUM(MJ Manager jobs i[i!])
 ~
 ~ |
 MPR Managerial professional labor ratio housing i[i]=
 0.2*PH Premium housing i[i]/(UH Underemployed housing i[i]+WH Worker housing i[i])
 ~
 ~ |
 SIM Service industry management=
 4
 ~
 ~ |
 MAF Manager arrival factor=
 1
 ~ Dmnl
 ~ |
 MAHM Manager arrival housing multiplier= WITH LOOKUP (
 "MHR Manager/housing ratio",
 ((0,0)-(3,1.5)],(0,1.3),(0.5,1.2),(1,1),(1.5,0.5),(2,0.2),(2.5,0.1),(3,0.05))
 ~ Dmnl
 ~ |
 MAM Manager arrival multiplier=
 MAJM Manager arrival job multiplier*MAPM Manager arrival population multiplier*MATM
 Manager arrival tax multiplier\
 *MAHM Manager arrival housing multiplier*MAF Manager arrival factor
 ~ Dmnl
 ~ |
 MAPM Manager arrival population multiplier= WITH LOOKUP (
 "MPR Manager/population ratio",
 ((0,0)-(0.1,2)],(0,0.3),(0.02,0.7),(0.04,1),(0.06,1.2),(0.08,1.3),(0.1,1.3))
 ~ Dmnl
 ~ |
 MATM Manager arrival tax multiplier= WITH LOOKUP (
 (1.44*LN(TR Tax ratio)),

```

(((-2,0)-(4,2)],(-2,1.4),(0,1),(2,0.7),(4,0.3) ))
~
~      |

MAHM Manager arrival housing multiplier i[i]= WITH LOOKUP (
  "HMR Housing/manager ratio i"[i],
  ((0,0)-(3,4)],(0,0.05),(0.5,0.4),(1,1),(1.5,1.5),(2,2),(2.5,2.2),(3,2.5) ))
~
~      |

MAPM Managerr arrival population multiplier i[i]= WITH LOOKUP (
  "MPR Manager/population ratio i"[i],
  ((0,0)-(0.1,2)],(0,0.3),(0.02,0.7),(0.04,1),(0.06,1.2),(0.08,1.3),(0.1,1.3) ))
~
  Dmnl
~      |

MAJM Manager arrival job multiplier= WITH LOOKUP (
  "MR Manager/job ratio",
  ((0,0)-(2,3)],(0,2.7),(0.25,2.6),(0.5,2.4),(0.75,2),(1,1),(1.25,0.4),(1.5,0.2),(1.75\
,0.1),(2,0.05) ))
~
  Dmnl
~      |

"MHR Manager/housing ratio"=
  ("MPT Managerial-professional total"*"MPFS Managerial-professional family size")/(PHT
Premiumhousing total\
  *PHPD Premium housing density
)
~
  Dmnl
~      |

Managers jobs k[a1]=
  MJ Manager jobs i[a1] ~|
Managers jobs k[a2]=
  MJ Manager jobs i[a2] ~|
Managers jobs k[a3]=
  MJ Manager jobs i[a3] ~|
Managers jobs k[a4]=
  MJ Manager jobs i[a4] ~|
Managers jobs k[a5]=
  MJ Manager jobs i[a5] ~|
Managers jobs k[a6]=
  MJ Manager jobs i[a6] ~|
Managers jobs k[a7]=
  MJ Manager jobs i[a7] ~|
Managers jobs k[a8]=
  MJ Manager jobs i[a8] ~|
Managers jobs k[a9]=
  MJ Manager jobs i[a9] ~|
Managers jobs k[a10]=
  MJ Manager jobs i[a10] ~|
Managers jobs k[a11]=
  MJ Manager jobs i[a11] ~|
Managers jobs k[a12]=
  MJ Manager jobs i[a12] ~|
Managers jobs k[a13]=
  MJ Manager jobs i[a13] ~|
Managers jobs k[a14]=
  MJ Manager jobs i[a14] ~|
Managers jobs k[a15]=

```

MJ Manager jobs i[a15] ~~|
 Managers jobs k[a16]=
 MJ Manager jobs i[a16]
 ~
 ~ |

Premium housing sector

PH Premium housing i[i]= INTEG (
 PHC Premium housing construction i[i]-PHO Premium housing obsolescence i[i],
 PHI Premium housing initial i[i])
 ~
 ~ |

PHI Premium housing initial i[i]=
 50,50,50,50,2150,50,50,50,2150,50,50,50,50,50,50
 ~
 ~ |

PHC Premium housing construction i[i]=
 PHCD Premium housing construction desired i[i]*LCRT Labor construction ratio total
 ~ housing units/year
 ~ |

PHCD Premium housing construction desired i[i]=
 PH Premium housing i[i]*PHCN Premium housing construction normal*PHM Premium
 housing multiplier i\
 [i]+PHCP Premium housing construction program i
 [i]
 ~
 ~ |

PHCN Premium housing construction normal=
 0.03
 ~ Fraction/year
 ~ |

PHM Premium housing multiplier i[i]=
 PHAM Premium housing adequacy multiplier*PHLM Premium housing land multiplier
 i[i]*PHPM Premium housing population multiplier i
 [i]*PHTM Premium housing tax multiplier*PHEM Premium housing enterprise multiplier*\
 PHGM Premium housing growth factor i
 [i]*PHF Premium housing factor*PHLC Premium housing location attractiveness i[i]*PHSM
 Premium housing social multiplier i\
 [i]
 ~ Dmnl
 ~ |

PHAM Premium housing adequacy multiplier= WITH LOOKUP (
 "MHR Manager/housing ratio",
 ((0,0)-(2,6]),(0,0),(0.25,0.001),(0.5,0.01),(0.75,0.2),(1,1),(1.25,3),(1.5,4.6),(1.75\
 ,5.6),(2,6))
 ~ Dmnl
 ~ |

PHLM Premium housing land multiplier i[i]= WITH LOOKUP (
 LFO Land fraction occupied area i[i],
 ((0,0)-(1,4]),(0,2.5),(0.1,2.4),(0.2,2.3),(0.3,2.15),(0.4,2),(0.5,1.8),(0.6,1.5),(\
 0.7,1.1),(0.8,0.6),(0.9,0.1),(1,0)
))

~ Dmnl
 ~ |

PHPM Premium housing population multiplier i[i]= WITH LOOKUP (

 MPR Managerial professional labor ratio housing i[i],

 ((0,0)-(0.1,2)],(0,0.5),(0.02,0.8),(0.04,1),(0.06,1.1),(0.08,1.2),(0.1,1.3)))

 ~ Dmnl

 ~ |

PHTM Premium housing tax multiplier= WITH LOOKUP (

 (1.44*LN(TR Tax ratio)),

 ((-2,0)-(4,1.5)],(-2,1.2),(0,1),(2,0.7),(4,0.3)))

 ~

 ~ |

PHEM Premium housing enterprise multiplier= WITH LOOKUP (

 NEGR New enterprise growth rate,

 (((-0.1,0)-(0.2,3)],(-0.1,0.6),(-0.05,0.8),(0,1),(0.05,1.2),(0.1,1.4),(0.15,1.6),(0.2\
 ,1.8)))

 ~ Dmnl

 ~ |

PHGM Premium housing growth factor i[i]= WITH LOOKUP (

 PHGR Premium housing growth rate[i],

 (((-0.1,0)-(0.2,3)],(-0.1,0.8),(-0.05,0.9),(0,1),(0.05,1.1),(0.1,1.2),(0.15,1.3),(0.2\
 ,1.4)))

 ~

 ~ |

PHF Premium housing factor=

 1

 ~ Dmnl

 ~ |

PHLC Premium housing location attractiveness i[i]= WITH LOOKUP (

 PHCZA Premium housing comparison zone i to average[i],

 (((0,0)-(2.25,6)],(0,0.6),(0.25,0.6),(0.5,0.7),(0.75,0.85),(1,1),(1.25,1.15),(1.5,1.3\
),(1.75,1.4),(2,1.5),(2.25,1.6)))

 ~

 ~ |

PHSM Premium housing social multiplier i[i]= WITH LOOKUP (

 "MPR Manager/population ratio i"[i],

 (((0,0)-(0.1,2)],(0,0.3),(0.02,0.7),(0.04,1),(0.06,1.2),(0.08,1.3),(0.1,1.3)))

 ~

 ~ |

PHO Premium housing obsolescence i[i]=

 PH Premium housing i[i]*PHON Premium housing obsolescence normal*PHOM Premium

 housing obsolescence multiplier i\

 [i]

 ~

 ~ |

PHOM Premium housing obsolescence multiplier i[i]= WITH LOOKUP (

 (1.44*LN(PHM Premium housing multiplier i[i])),

 (((-3,0)-(3,3)],(-3,2.8),(-2,2.6),(-1,2),(0,1),(1,0.5),(2,0.3),(3,0.2)))

 ~

 ~ |

PHON Premium housing obsolescence normal=
0.03

~
~ |

PHPD Premium housing density=
3

~ people/housing unit
~ |

AAMJAZ Average accessibility to managerial jobs all zones=

SUM((Managers jobs k[k!]/TDFC Trip distribution function construction i[i!,k!]))/16

~
~ |

AMJZ Accessibility to managerial jobs zone i[i]=

SUM(Managers jobs k[k!]/TDFC Trip distribution function construction i[i,k!])

~
~ |

PHCZA Premium housing comparison zone i to average[i]=

AMJZ Accessibility to managerial jobs zone i[i]/AAMJAZ Average accessibility to managerial jobs all zones

~
~ |

LFO Land fraction occupied area i[i]=

(HUT Housing units total i[i]*LPH Land per house+PUT Productive units total i[i]*LPP Land per production unit\
) / AREA Land i[i]

~
~ |

AREA Land i[i]=

AREA Land total/16

~
~ |

D Distance i k[i,k]=TABBED ARRAY(
1.5625 3.125 6.25 9.375 3.125 4.41942 6.98771 9.88212 6.25 6.98771

8.83883 11.2673 9.375\
9.88212 11.2673 13.2583

3.125 1.5625 3.125 6.25 4.41942 3.125 4.41942 6.98771 6.98771 6.25

6.98771 8.83883 9.88212\
9.375 9.88212 11.2673

6.25 3.125 1.5625 3.125 6.98771 4.41942 3.125 4.41942 8.83883 6.98771 6.25

6.98771 11.2673\
9.88212 9.375 9.88212

9.375 6.25 3.125 1.5625 9.88212 6.98771 4.41942 3.125 11.2673 8.83883

6.98771 6.25 13.2583\
11.2673 9.88212 9.375

3.125 4.41942 6.98771 9.88212 1.5625 3.125 6.25 9.375 3.125 4.41942

6.98771 9.88212 \
6.25 6.98771 8.83883 11.2673

4.41942 3.125 4.41942 6.98771 3.125 1.5625 3.125 6.25 4.41942 3.125

4.41942 6.98771 \
6.98771 6.25 6.98771 8.83883

6.98771 4.41942 3.125 4.41942 6.25 3.125 1.5625 3.125 6.98771 4.41942

3.125 4.41942 \
8.83883 6.98771 6.25 6.98771

8.83883 6.98771 6.25 6.98771

9.88212 6.98771 4.41942 3.125 9.375 6.25 3.125 1.5625 9.88212 6.98771
 4.41942 3.125 \
 11.2673 8.83883 6.98771 6.25
 6.25 6.98771 8.83883 11.2673 3.125 4.41942 6.98771 9.88212 1.5625 3.125 6.25
 9.375 3.125\
 4.41942 6.98771 9.88212
 6.98771 6.25 6.98771 8.83883 4.41942 3.125 4.41942 6.98771 3.125 1.5625
 3.125 6.25 4.41942\
 3.125 4.41942 6.98771
 8.83883 6.98771 6.25 6.98771 6.98771 4.41942 3.125 4.41942 6.25 3.125
 1.5625 3.125 6.98771\
 4.41942 3.125 4.41942
 11.2673 8.83883 6.98771 6.25 9.88212 6.98771 4.41942 3.125 9.375 6.25
 3.125 1.5625 9.88212\
 6.98771 4.41942 3.125
 9.375 9.88212 11.2673 13.2583 6.25 6.98771 8.83883 11.2673 3.125 4.41942
 6.98771 9.88212\
 1.5625 3.125 6.25 9.375
 9.88212 9.375 9.88212 11.2673 6.98771 6.25 6.98771 8.83883 4.41942 3.125
 4.41942 6.98771\
 3.125 1.5625 3.125 6.25
 11.2673 9.88212 9.375 9.88212 8.83883 6.98771 6.25 6.98771 6.98771 4.41942
 3.125 4.41942\
 6.25 3.125 1.5625 3.125
 13.2583 11.2673 9.88212 9.375 11.2673 8.83883 6.98771 6.25 9.88212 6.98771
 4.41942 3.125\
 9.375 6.25 3.125 1.5625

)
~
~ |

HUT Housing units total urban area=
 SUM(HUT Housing units total i[i!])
 ~
 ~ |

PUT Productive units total i[i]=
 NE New enterprise i[i]+MB Mature business i[i]+DI Declining industry i[i]+SI Service
 industry i\
 [i]
 ~ productive unit
 ~ |

PUT Productive units total urban area=
 SUM(PUT Productive units total i[i!])
 ~
 ~ |

TDFC Trip distribution function construction i[i,k]=
 D Distance i k[i,k]^3
 ~
 ~ |

WHT Worker housing total=
 SUM(WH Worker housing i[i!])
 ~
 ~ |

PHT Premiumhousing total=
 SUM(PH Premium housing i[i!])

~
 ~ |

LFO Land fraction occupied urban area=
 (HUT Housing units total urban area*LPH Land per house+PUT Productive units total urban
 area\
 *LPP Land per production unit)/AREA Land total
 ~
 ~ |

AREA Land total=
 100000
 ~
 ~ |

CPHA Change in PHA[i]=
 (PH Premium housing i[i]-PHA Premium housing average i[i])/PHAT Premium housing
 averaging time
 ~ Dmnl/year
 ~ |

HUT Housing units total i [i]=
 PH Premium housing i[i]+WH Worker housing i[i]+UH Underemployed housing i[i]
 ~ housing units
 ~ |

LPH Land per house=
 0.1
 ~ acres/housing unit
 ~ |

LPP Land per production unit=
 0.2
 ~ acres/production unit
 ~ |

PHA Premium housing average i[i]= INTEG (
 CPHA Change in PHA[i],
 PH Premium housing i[i]*(1-PHGRI Premium housing growth rate initial*PHAT
 Premium housing averaging time\
))
 ~
 ~ |

PHAT Premium housing averaging time=
 10
 ~ year
 ~ |

PHGR Premium housing growth rate[i]=
 (PH Premium housing i[i]-PHA Premium housing average i[i])/(PH Premium housing i[i]*\
 PHAT Premium housing averaging time)
 ~
 ~ |

PHGRI Premium housing growth rate initial=
 0.03
 ~
 ~ |

Worker housing sector

WH Worker housing $i[i]=$ INTEG (PHO Premium housing obsolescence $i[i]+$ WHC Worker housing construction $i[i]-$ WHO Worker housing obsolescence $i\backslash$

[i],
WHI Worker housing initial $i[i]$)
~ housing unit
~ |

WHI Worker housing initial $i[i]=$
50,50,50,50,10150,50,50,50,10150,50,50,50,50,50,50

~
~ |

WHC Worker housing construction $i[i]=$
LCRT Labor construction ratio total*WHCD Worker housing construction desired $i[i]$

~ housing units/year
~ |

WHCD Worker housing construction desired $i[i]=$
WH Worker housing $i[i]*$ WHCN Worker housing construction normal*WHM Worker housing multiplier $i\backslash$

[i]+WHCP Worker housing construction program i
[i]
~ housing units/year
~ |

WHCN Worker housing construction normal=
0.03

~ Fraction/year
~ |

WHM Worker housing multiplier $i[i]=$
WHAM Worker housing adequacy multiplier*WHLM Worker housing land multiplier $i[i]*$ WHUM Worker housing underemployed multiplier i

[i]
*WHTM Worker housing tax multiplier*WHEM Worker housing enterprise multiplier table*\
WHGM Worker housing growth multiplier i
[i]*WHLC Worker housing location attractiveness $i[i]$
*WHF Worker housing factor*WHSM Worker housing social multiplier $i[i]$
~
~ |

WHAM Worker housing adequacy multiplier= WITH LOOKUP ("LHR Labor/housing ratio",
((0,0)-(2,3]),(0,0),(0.25,0.05),(0.5,0.1),(0.75,0.3),(1,1),(1.25,1.8),(1.5,2.4),(1.75\
,2.8),(2,3))

~
~ |

WHLM Worker housing land multiplier $i[i]=$ WITH LOOKUP (LFO Land fraction occupied area $i[i]$,
((0,0)-(1,4]),(0,2.5),(0.1,2.4),(0.2,2.3),(0.3,2.15),(0.4,2),(0.5,1.8),(0.6,1.5),\
0.7,1.1),(0.8,0.6),(0.9,0.1),(1,0))

~
~ |

WHUM Worker housing underemployed multiplier $i [i]=$ WITH LOOKUP (LUR Labor underemployed ratio housing $i[i]$,

```

~
~      [(0,0)-(5,2)],(0,0.8),(1,0.9),(2,1),(3,1.1),(4,1.2),(5,1.2) ))
~
~      |

WHTM Worker housing tax multiplier= WITH LOOKUP (
  (1.44*LN(TR Tax ratio)),
  [(-2,0)-(4,2)],(-2,1.2),(0,1),(2,0.7),(4,0.3) ))
~
~      |

WHEM Worker housing enterprise multiplier table= WITH LOOKUP (
  NEGR New enterprise growth rate,
  [(-0.2,0)-(0.6,2)],(-0.2,0.6),(-0.1,0.8),(0,1),(0.1,1.2),(0.2,1.4),(0.3,1.6),(0.4,\
  1.8) ))
~
~      |

WHGM Worker housing growth multiplier i[i]= WITH LOOKUP (
  WHGR Worker growth rate[i],
  [(-0.1,0)-(0.15,4)],(-0.1,0.8),(-0.05,0.9),(0,1),(0.05,1.1),(0.1,1.2),(0.15,1.3) )\
  )
~
~      |

WHLC Worker housing location attractiveness i[i]= WITH LOOKUP (
  ALLJZ Accessibility to labor jobs zone i[i]/AALJAZ Average accessibility to labor jobs all
  zones\
  ,
  [(0,0)-(2,2)],(0,0.5),(0.25,0.5),(0.5,0.6),(0.75,0.75),(1,1),(1.25,1.25),(1.5,1.4)\
  ,(1.75,1.5),(2,1.6) ))
~
~      |

WHF Worker housing factor=
  1
  ~      Dmnl
  ~      |

WHSM Worker housing social multiplier i[i]= WITH LOOKUP (
  "LUR Labor/underemployed ratio i"[i],
  [(0,0)-(5,2)],(0,0.8),(1,0.9),(2,1),(3,1.1),(4,1.2),(5,1.2) ))
~
~      |

WHO Worker housing obsolescence i[i]=
  WH Worker housing i[i]*WHON Worker housing obsolescence normal*WHOM Worker
  housing obsolescence multiplier i\
  [i]
~
~      |

WHON Worker housing obsolescence normal=
  0.02
  ~      Fraction/year
  ~      |

WHOM Worker housing obsolescence multiplier i[i]= WITH LOOKUP (
  (1.44*LN(WHM Worker housing multiplier i[i])),
  [(-3,0)-(3,4)],(-3,2.2),(-2,2),(-1,1.6),(0,1),(1,0.7),(2,0.5),(3,0.4) ))
~

```

~ |
 AALJAZ Average accessibility to labor jobs all zones=

$$\text{SUM}(\text{LDI Labor desired industry } k[k!]/\text{TDFC Trip distribution function construction } i[\backslash i!,k!])/16$$

~ |
 ALLJZ Accessibility to labor jobs zone i[i]=

$$\text{SUM}(\text{LDI Labor desired industry } k[k!]/\text{TDFC Trip distribution function construction } i[\backslash i,k!])$$

~ |
 LDI Labor desired industry k[a1]=
 LDI Labor desired industry i[a1] ~|
 LDI Labor desired industry k[a2]=
 LDI Labor desired industry i[a2] ~|
 LDI Labor desired industry k[a3]=
 LDI Labor desired industry i[a3] ~|
 LDI Labor desired industry k[a4]=
 LDI Labor desired industry i[a4] ~|
 LDI Labor desired industry k[a5]=
 LDI Labor desired industry i[a5] ~|
 LDI Labor desired industry k[a6]=
 LDI Labor desired industry i[a6] ~|
 LDI Labor desired industry k[a7]=
 LDI Labor desired industry i[a7] ~|
 LDI Labor desired industry k[a8]=
 LDI Labor desired industry i[a8] ~|
 LDI Labor desired industry k[a9]=
 LDI Labor desired industry i[a9] ~|
 LDI Labor desired industry k[a10]=
 LDI Labor desired industry i[a10] ~|
 LDI Labor desired industry k[a11]=
 LDI Labor desired industry i[a11] ~|
 LDI Labor desired industry k[a12]=
 LDI Labor desired industry i[a12] ~|
 LDI Labor desired industry k[a13]=
 LDI Labor desired industry i[a13] ~|
 LDI Labor desired industry k[a14]=
 LDI Labor desired industry i[a14] ~|
 LDI Labor desired industry k[a15]=
 LDI Labor desired industry i[a15] ~|
 LDI Labor desired industry k[a16]=
 LDI Labor desired industry i[a16]

~ |
 LUR Labor underemployed ratio housing i[i]=

$$(2/3)*\text{WH Worker housing } i[i]/\text{UH Underemployed housing } i[i]$$

~ |
 CWAHA Change in WHA[i]=

$$(\text{WH Worker housing } i[i]-\text{WHA Worker housing average } i[i])/ \text{WHAT Worker housing averaging time}$$

WHGR Worker growth rate[i]=
 (WH Worker housing i[i]-WHA Worker housing average i[i])/(WH Worker housing
 i[i]*WHAT Worker housing averaging time\
)
 ~ Fraction/year
 ~ |

WHGRI Worker housing growth rate initial=
 0.03
 ~
 ~ |

WHA Worker housing average i[i]= INTEG (
 CWA Change in WHA[i],
 WH Worker housing i[i]*(1-WHGRI Worker housing growth rate initial*WHAT
 Worker housing averaging time\
))
 ~
 ~ |

WHAT Worker housing averaging time=
 10
 ~ year
 ~ |

Underemployed housing sector

UH Underemployed housing i[i]= INTEG (
 WHO Worker housing obsolescence i[i]-SHD Slum housing demolition i[i]+LCHP Low cost
 housing program\
 [i],
 UHI Underemployed housing initial i[i])
 ~
 ~ |

UHI Underemployed housing initial i[i]=
 10,10,10,10,480,10,10,10,480,10,10,10,10,10,10,10
 ~
 ~ |

SHD Slum housing demolition i [i]=
 UH Underemployed housing i[i]*SHDN Slum housing demolition normal*SHDM SLum
 housing demolition multiplier i\
 [i]+SHDP Slum housing demolition program i[i]
 ~ housing units/year
 ~ |

SHDN Slum housing demolition normal=
 0.02
 ~ Fraction/year
 ~ |

SHDM SLum housing demolition multiplier i [i]=
 SHAM Slum housing abandoned multiplier*SHLM Slum housing land multiplier i[i]*SHDC
 Slum housing decrease based on favouribility\
 [i]*SHDF Slum housing demolition factor
 ~ Dmnl
 ~ |

SHAM Slum housing abandoned multiplier= WITH LOOKUP (

"UHR Underemployed/housing ratio",
((0,0)-(2,4]),(0,3.6),(0.5,2),(1,1),(1.5,0.6),(2,0.4))

~

~

|

SHLM Slum housing land multiplier i [i]= WITH LOOKUP (
LFO Land fraction occupied area i[i],
((0,0)-(1,8]),(0,8,1),(0,85,1.2),(0,9,1.6),(0,95,2.2),(1,6))

~ Dmnl

~

|

SHDC Slum housing decrease based on favouribility[i]= WITH LOOKUP (
ALLJZ Accessibility to labor jobs zone i[i]/AALJAZ Average accessibility to labor jobs all
zones\

'
((0,0)-(2.25,2]),(0,1.3),(0,25,1.3),(0,5,1.2),(0,75,1.1),(1,1),(1,25,0.9),(1,5,0.8\
,(1,75,0.7),(2,0.6),(2,25,0.5))

~

~

|

SHDF Slum housing demolition factor=

1

~ Dmnl

~

|

UHT Underemployed housing total=
SUM(UH Underemployed housing i[i!])

~

~

|

New enterprise sector

NE New enterprise i [i]= INTEG (
NEC New enterprise construction i[i]-NED New enterprise decline i[i],
NEI New enterprise initial[i])

~ productive unit

~

|

NEI New enterprise initial[i]=
0.01,0.01,0.01,0.01,100,0.01,0.01,0.01,100,0.01,0.01,0.01,0.01,0.01,0.01,0.01

~

~

|

NEC New enterprise construction i [i]=
LCRT Labor construction ratio total*NECD New enterprise construction desired i[i]

~

~

|

NECD New enterprise construction desired i [i]=
NECN New enterprise construction normal*EM Enterprise multiplier\
*ELC Enterprise location decision i[i]*BIDF Business industry density factor

~

~

|

NECN New enterprise construction normal=
0.05

~ Dmnl

~

|

EM Enterprise multiplier=

"EMM Enterprise manager/job multiplier"*ELM Enterprise land multiplier*"ELJM Enterprise labor/job multiplier"\
 *ETM Enterprise tax multiplier*EGM Enterprise growth multiplier*EF Enterprise factor

~
 ~ |

"EMM Enterprise manager/job multiplier"= WITH LOOKUP (
 "MR Manager/job ratio",
 ((0,0)-(2,2]),(0,0.1),(0.25,0.15),(0.5,0.3),(0.75,0.5),(1,1),(1.25,1.4),(1.5,1.7),\
 (1.75,1.9),(2,2)))

~
 ~ |

ELM Enterprise land multiplier= WITH LOOKUP (
 LFO Land fraction occupied urban area,
 ((0,0)-(1,2]),(0,1),(0.1,1.15),(0.2,1.3),(0.3,1.4),(0.4,1.45),(0.5,1.4),(0.6,1.3),\
 (0.7,1),(0.8,0.7),(0.9,0.4),(1,0)))

~
 ~ |

"ELJM Enterprise labor/job multiplier"= WITH LOOKUP (
 "LRTP Labor/job ratio total perceived",
 ((0,0)-(2,2]),(0,0),(0.25,0.05),(0.5,0.15),(0.75,0.4),(1,1),(1.25,1.5),(1.5,1.7),\
 (1.75,1.8),(2,1.8)))

~
 ~ |

ETM Enterprise tax multiplier= WITH LOOKUP (
 (1.44*LN(TR Tax ratio)),
 ((-2,0)-(4,2]),(-2,1.3),(-1,1.2),(0,1),(1,0.8),(2,0.5),(3,0.25),(4,0.1)))

~
 ~ |

EGM Enterprise growth multiplier= WITH LOOKUP (
 NEGR New enterprise growth rate,
 (((-0.1,0)-(0.2,2]),(-0.1,0.6),(-0.05,0.8),(0,1),(0.05,1.2),(0.1,1.4),(0.15,1.8),(0.2,\
 2)))

~
 ~ |

EF Enterprise factor=

1
 ~ Dmnl
 ~ |

ELC Enterprise location decision i[i]=
 1,0.0001,0.0001,0.0001,1,1,0.0001,0.0001,1,1,0.0001,0.0001,1,0.0001,0.0001,0.0001

~
 ~ |

BIDF Business industry density factor=
 (NECF New enterprise construction factor*NET New enterprise total+MBCF Mature business construction factor\
 *MBT Mature business total+DICF Declining industry construction factor*DIT Declining industry total\
)/6

~
 ~ |

NECF New enterprise construction factor=

1
~ Dmnl
~ |

MBCF Mature business construction factor=

0.5
~ Dmnl
~ |

DICF Declining industry construction factor=

0.3
~ Dmnl
~ |

NED New enterprise decline i [i]=

NE New enterprise i[i]*NEDN New enterprise decline normal*EDM Enterprise decline multiplier i\

[i]
~
~ |

NEDN New enterprise decline normal=

0.08
~ Fraction/year
~ |

EDM Enterprise decline multiplier i [i]= WITH LOOKUP (

(1.44*LN(EM Enterprise multiplier),
([(-3,0)-(-3,2)],(-3,2),(-2,1.8),(-1,1.5),(0,1),(1,0.7),(2,0.5),(3,0.5)))

~
~ |

NEA New enterprise average= INTEG (

CNEA Change in NEA,
SUM(NE New enterprise i[i!])+SIT Service industry total*(1-NEGR New enterprise growth rate initial\

*NEAT New enterprise averaging time
))

~ productive unit
~ |

CNEA Change in NEA=

((NET New enterprise total+SIT Service industry total)-NEA New enterprise average)/NEAT
New enterprise averaging time

~ productive unit/year
~ |

NEGR New enterprise growth rate=

((NET New enterprise total+SIT Service industry total)-NEA New enterprise average)/(\
(NET New enterprise total+SIT Service industry total)*NEAT New enterprise averaging time\

)
~ Fraction/year
~ |

NET New enterprise total=

SUM(NE New enterprise i[i!])

~
~ |

NEGR New enterprise growth rate initial=
0.03

~
~ |

NEAT New enterprise averaging time=
10

~ year
~ |

Mature business sector

MB Mature business i [i]= INTEG (
NED New enterprise decline i[i]-MBD Mature business decline i[i],
MBI Mature business initial[i])
~ productive unit
~ |

MBI Mature business initial[i]=
0.001,0.001,0.001,0.001,500,0.001,0.001,0.001,500,0.001,0.001,0.001,0.001,0.001,0.001\,
,0.001

~
~ |

MBD Mature business decline i [i]=
MB Mature business i[i]*MBDN Mature business decline normal*BDM Business decline
multiplier i\

[i]
~ productive unit/year
~ |

BDM Business decline multiplier i[i]= WITH LOOKUP (
(1.44*LN(EM Enterprise multiplier)),
((-3,0)-(3,2)],(-3,2),(-2,1.8),(-1,1.5),(0,1),(1,0.7),(2,0.5),(3,0.4))

~
~ |

MBDN Mature business decline normal=
0.05

~ Fraction/year
~ |

MBT Mature business total=
SUM(MB Mature business i[i!])

~
~ |

Declining industry sector

DI Declining industry i [i]= INTEG (
MBD Mature business decline i[i]-DID Declining industry demolition i[i],
DII Declining industry initial[i])
~ productive unit
~ |

DII Declining industry initial[i]=
0.001,0.001,0.001,0.001,50,0.001,0.001,0.001,50,0.001,0.001,0.001,0.001,0.001,0.001,\,
0.001

~

~ |
 DID Declining industry demolition i [i]=
 DI Declining industry i[i]*DIDN Declining industry demolition normal*
 DIDM Declining industry demolition multiplier i\
 [i]+DIDP Declining industry demolition program i[i]

~ |
 DIDN Declining industry demolition normal=
 0.03
 ~ Fraction/year
 ~ |

DIDM Declining industry demolition multiplier i[i]=
 DIEM Declining industry enterprise multiplier*DILM Declining industry land multiplier i\
 [i]*DIDF Declining industry demolition factor
 ~ Dmnl
 ~ |

DIEM Declining industry enterprise multiplier= WITH LOOKUP (
 (1.44*LN(EM Enterprise multiplier)),
 ((-3,0)-(3,4)],(-3,0.4),(-2,0.5),(-1,0.7),(0,1),(1,1.6),(2,2.4),(3,4))
 ~ Dmnl
 ~ |

DILM Declining industry land multiplier i [i]= WITH LOOKUP (
 LFO Land fraction occupied area i[i],
 (((0.8,0)-(1,8)],(0.8,1),(0.85,1.2),(0.9,1.6),(0.95,2.2),(1,6))
 ~
 ~ |

DIDF Declining industry demolition factor=
 1
 ~ Dmnl
 ~ |

DIT Declining industry total=
 SUM(DI Declining industry i[i!])
 ~
 ~ |

Service industry sector

SI Service industry i[i]= INTEG (
 SIC Service industry construction i[i]-SID Service industry demolition i[i],
 SII Service industry intial i[i])
 ~
 ~ |

SII Service industry intial i[i]=
 1,1,1,1,85,1,1,1,85,1,1,1,1,1,1,1
 ~
 ~ |

SIC Service industry construction i[i]=
 SICD Service industry construction desired i[i]*LCRT Labor construction ratio total
 ~
 ~ |

SICD Service industry construction desired $i[i]=$
 SI Service industry $i[i]*$ SICN Service industry construction normal*SIM Service industry multiplier $i\backslash$

$[i]$
 ~
 ~ |

SICN Service industry construction normal=
 0.05

~
 ~ |

SIM Service industry multiplier $i[i]=$
 "EMM Enterprise manager/job multiplier"*SILM Service industry land multiplier $i[i]*$ "ELJM Enterprise labor/job multiplier"

$i\backslash$
 *ETM Enterprise tax multiplier*EGM Enterprise growth multiplier*SILC Service industry location attractiveness $i\backslash$
 $[i]*$ SFPD Service factor population ratio multiplier*SFHD Service factor housing multiplier $i\backslash$

$[i]$
 ~
 ~ |

SILM Service industry land multiplier $i[i]=$ WITH LOOKUP (
 LFO Land fraction occupied area $i[i]$,

((0,0)-(1,4]),(0,2,2),(0,1,2,2),(0,2,2,1),(0,3,2,05),(0,4,2),(0,5,1,9),(0,6,1,7),\n
 0,7,1,4),(0,8,0,8),(0,9,0,2),(1,0)))

~
 ~ |

SILC Service industry location attractiveness $i[i]=$ WITH LOOKUP (
 ACSZ Accessibility of households to service zone $i[i]/$ AACSZ Average accessibility of

households to service all zones\

,
 ((0,0)-(2,2]),(0,0,5),(0,25,0,5),(0,5,0,6),(0,75,0,75),(1,1),(1,25,1,3),(1,5,1,5),\n
 (1,75,1,65),(2,1,7)))

~
 ~ |

SFPD Service factor population ratio multiplier= WITH LOOKUP (
 SR Service ratio,

((0,6,0)-(1,75,2]),(0,5,0,6),(0,75,0,8),(1,1),(1,25,1,2),(1,5,1,5),(1,75,1,8)))

~
 ~ |

SFHD Service factor housing multiplier $i[i]=$ WITH LOOKUP (
 SFHDR Service factor housing ratio $i[i]$,

((0,0)-(2,2]),(0,0,8),(0,25,0,8),(0,5,0,85),(0,75,0,9),(1,1),(1,25,1,15),(1,5,1,3)\n
 ,(1,75,1,5),(2,1,9)))

~
 ~ |

SID Service industry demolition $i[i]=$

SI Service industry $i[i]*$ SIDN Service industry demolition normal $i*SIOM$ Service industry obsolescence multiplier $i\backslash$

$[i]$
 ~
 ~ |

SIDN Service industry demolition normal $i=$

0.05

~

~

|

SIOM Service industry obsolescence multiplier i[i]= WITH LOOKUP (
(1.44*LN(SIM Service industry multiplier i[i]),
(((-3,0)-(3,2)),(-3,2),(-2,1.8),(-1,1.5),(0,1),(1,0.7),(2,0.5),(3,0.5)))

~

~

|

SR Service ratio=
P Population/(SIT Service industry total*SPSRN Service unit per population normal)

~

~

|

AACSZ Average accessibility of households to service all zones=
SUM(HUT Housing units total k[k!]/TDFC Trip distribution function construction i
[i!,k!])/16

~

~

|

ACSZ Accessibility of households to service zone i[i]=
SUM(HUT Housing units total k[k!]/TDFC Trip distribution function construction i[i,k\
!])

~

~

|

HUT Housing units total k[a1]=
HUT Housing units total i[a1] ~|
HUT Housing units total k[a2]=
HUT Housing units total i[a2] ~|
HUT Housing units total k[a3]=
HUT Housing units total i[a3] ~|
HUT Housing units total k[a4]=
HUT Housing units total i[a4] ~|
HUT Housing units total k[a5]=
HUT Housing units total i[a5] ~|
HUT Housing units total k[a6]=
HUT Housing units total i[a6] ~|
HUT Housing units total k[a7]=
HUT Housing units total i[a7] ~|
HUT Housing units total k[a8]=
HUT Housing units total i[a8] ~|
HUT Housing units total k[a9]=
HUT Housing units total i[a9] ~|
HUT Housing units total k[a10]=
HUT Housing units total i[a10] ~|
HUT Housing units total k[a11]=
HUT Housing units total i[a11] ~|
HUT Housing units total k[a12]=
HUT Housing units total i[a12] ~|
HUT Housing units total k[a13]=
HUT Housing units total i[a13] ~|
HUT Housing units total k[a14]=
HUT Housing units total i[a14] ~|
HUT Housing units total k[a15]=
HUT Housing units total i[a15] ~|
HUT Housing units total k[a16]=
HUT Housing units total i[a16]

~

~ |
 SIT Service industry total=
 SUM(SI Service industry i[i!])
 ~
 ~ |
 SPRHN Service unit per housing normal=
 150
 ~
 ~ |
 SPSRN Service unit per population normal=
 900
 ~
 ~ |
 SFHDR Service factor housing ratio[i]=
 HUT Housing units total i[i]/(SI Service industry i[i]*SPRHN Service unit per housing
 normal\
)
 ~
 ~ |

Tax sector

TC Tax collaections=
 AV Assessed value*TAN Tax assessment normal*TR Tax ratio
 ~ dollars/year
 ~ |
 AV Assessed value=
 HAVAT Housing assessed value area total+BAVAT Business assessed value area total
 ~ thousand dollars
 ~ |
 HAVAT Housing assessed value area total=
 SUM(HAV Housing assessed value[i!])
 ~
 ~ |
 HAV Housing assessed value[i]=
 PH Premium housing i[i]*PHAV Premium housing assessed value+UH Underemployed
 housing i\
 [i]*UHAV Underemployed housing assessed value+WH Worker housing
 i[i]*WHAV Worker housing assessed value
 ~
 ~ |
 PHAV Premium housing assessed value=
 30
 ~ thousand dollars/housing unit
 ~ |
 UHAV Underemployed housing assessed value=
 5
 ~ thousand dollars/housing unit
 ~ |
 WHAV Worker housing assessed value=

15
~ thousand dollars/housing unit
~ |

BAVAT Business assessed value area total=
SUM(BAV Business assessed value[i!])
~
~ |

BAV Business assessed value[i]=
NE New enterprise i[i]*NEAV New enterprise assessed value+MB Mature business
i[i]*MBAV Mature business assessed value\
+DI Declining industry i[i]
*DIAV Declining industry assessed value+SI Service industry i[i]*SIAV Service industry
assessed value
~
~ |

NEAV New enterprise assessed value=
500
~ thousand dollars/productive unit
~ |

MBAV Mature business assessed value=
300
~ thousand dollars/productive unit
~ |

DIAV Declining industry assessed value=
100
~ thousand dollars/productive unit
~ |

SIAV Service industry assessed value=
400
~
~ |

TAN Tax assessment normal=
50
~ dollars/year/thousand dollars
~ |

TR Tax ratio= WITH LOOKUP (
(1.44*LN(TRNP Tax ratio needed perceived)),
([(-2,0)-(4,4)],(-2,0.3),(-1,0.5),(0,1),(1,1.8),(2,2.8),(3,3.6),(4,4))
~ d
~ |

TAI Tax assessment indicated=
TNT Tax needed total/AV Assessed value
~ dollars/(year*thousand dollars)
~ |

TRNP Tax ratio needed perceived= INTEG (
CTRNP Change in TRNP,
TRN Tax ratio needed)
~
~ |

TRNPT Tax ratio needed perception time=

30

~

~

|

TN Tax needed i[i]=

("MP Managerial-professional i"[i]"*MPFS Managerial-professional family size"*TMP Tax per management person\

+L Labor i[i]*LFS Labor family size

*TLP Tax per labor person+U Underemployed i[i]*UFS Underemployed family size*TUP Tax per underemployed person\

)*TCM Tax collection multiplier

~ dollars/year

~

|

TCM Tax collection multiplier= WITH LOOKUP (

"LURT Labor/Underemployed ratio total",

((0,0)-(3,2),(0,2),(0.5,1.6),(1,1.3),(1.5,1.1),(2,1),(2.5,0.9),(3,0.8))

~

~

|

TNT Tax needed total=

SUM(TN Tax needed i[i!])

~

~

|

CTRNP Change in TRNP=

(TRN Tax ratio needed-TRNP Tax ratio needed perceived)/TRNPT Tax ratio needed perception time

~ Dmnl/year

~

|

TRN Tax ratio needed=

TAI Tax assessment indicated/TAN Tax assessment normal

~ Dmnl

~

|

TUP Tax per underemployed person=

300

~ dollars/(year*Person)

~

|

TLP Tax per labor person=

200

~ dollars/(year*Person)

~

|

TMP Tax per management person=

150

~ dollars/Person/year

~

|

Job sector

"LRTP Labor/job ratio total perceived"= INTEG (

CLRTP Change in LRTP,

1)

~

~

|

CLRTP Change in LRTP=
 ("LRT Labor/job ratio total"-LRTP Labor/job ratio total perceived)/"LRPT Labor/job ratio perception time"

~ Dmnl
 ~ |

"LRPT Labor/job ratio perception time"=

5
 ~ year
 ~ |

"LRT Labor/job ratio total"=

LT Labor total/LJT Labor jobs total
 ~
 ~ |

LJT Labor jobs total=

SUM(LJ Labor jobs i[i!])
 ~
 ~ |

LJ Labor jobs i [i]=

LDC Labor desired for construction i[i]+LDI Labor desired industry i[i]
 ~
 ~ |

LDI Labor desired industry i [i]=

NE New enterprise i[i]*NEL New enterprise labor+MB Mature business i[i]*MBL Mature business labor\
 +DI Declining industry i[i]*DIL Declinin industry labor+SI Service industry i[i]*SIL Service industry labor
 ~
 ~ |

NEL New enterprise labor=

20
 ~ persons/productive unit
 ~ |

MBL Mature business labor=

15
 ~ persons/productive unit
 ~ |

DIL Declinin industry labor=

10
 ~ persons/productive unit
 ~ |

SIL Service industry labor=

20
 ~
 ~ |

LDC Labor desired for construction i [i]=

PHCD Premium housing construction desired i[i]*PHCL Prenium housing construction labor\
 +WHCD Worker housing construction desired i[i]*WHCL Worker housing construction labor\
 +NECD New enterprise construction desired i[i]*NECL New enterprise construction labor

+LCHCL Low cost housing construction labor*LCHCD Low cost housing construction
desired i\
[i]+SICD Service industry construction desired i[i]*SICL Service industry
construction labor
~
~ |

PHCL Premium housing construction labor=
2
~ man years/housing unit
~ |

WHCL Worker housing construction labor=
1
~ man years/housing unit
~ |

NECL New enterprise construction labor=
20
~ man years/productive unit
~ |

LCHCL Low cost housing construction labor=
0.6
~ man years/housing unit
~ |

SICL Service industry construction labor=
20
~
~ |

"ULJR Underemployed/labor job ratio i"[i]= WITH LOOKUP (
"LRT Labor/job ratio i"[i],
((0,0)-(2,2)],(0,1.15),(0.5,0.8),(1,0.5),(1.5,0.25),(2,0.1)))
~
~ |

"LRT Labor/job ratio i"[i]=
L Labor i[i]/LJ Labor jobs i[i]
~
~ |

UJ Underemployed jobs i[i]=
LJ Labor jobs i[i]*"ULJR Underemployed/labor job ratio i"[i]+UJP Underemployed job
program i\
[i]
~
~ |

LCRT Labor construction ratio total= WITH LOOKUP (
"LRT Labor/job ratio total",
((0,0)-(2.5,2)],(0,0.001),(0.5,0.5),(1,0.9),(1.5,1.1),(2,1.15),(2.5,1.2)))
~
~ |

UJT Underemployed jobs total=
LJT Labor jobs total*"ULJRT Underemployed/labor job ratio total"+SUM(UJP
Underemployed job program i\
[i!])

```

~
~
"URT Underemployed/job ratio total"=
  UT Underemployed total/UJT Underemployed jobs total
~
~

```

```

LCHPC Low cost housing program coefficient=
  0
  ~ housing units/man/year
  ~

```

```

"ULJRT Underemployed/labor job ratio total"= WITH LOOKUP (
  "LRT Labor/job ratio total",
  ((0,0)-(2,2)],(0,1.15),(0.5,0.8),(1,0.5),(1.5,0.25),(2,0.1) )
~
~

```

City development programs

```

UTP Underemployed training program i[i]=
  U Underemployed i[i]*UTR Underemployed training rate*IF THEN ELSE(Time>=SWT1
Switch time\
  ,1,0)
  ~ Person/year
  ~

```

```

UTR Underemployed training rate=
  0
  ~ Fraction/year
  ~

```

```

SWT1 Switch time=
  0
  ~ year
  ~

```

```

LTPG Labor training program i[i]=
  L Labor i[i]*LTR Labor training rate*IF THEN ELSE(Time>=SWT2 Switch time,1,0)
~
~

```

```

LTR Labor training rate=
  0
  ~ Fraction/year
  ~

```

```

SWT2 Switch time=
  0
  ~ year
  ~

```

```

PHCP Premium housing construction program i[i]=
  PH Premium housing i[i]*PHCR Premium housing construction rate*PHLM Premium
housing land multiplier i\
  [i]*IF THEN ELSE(Time>=SWT3 Switch time,1,0)
~
~

```

PHCR Premium housing construction rate=

0
~ Fraction/year
~ |

SWT3 Switch time=

0
~
~ |

WHCP Worker housing construction program i[i]=

HUT Housing units total i[i]*WHCR Working housing construction rate*WHLM Worker housing land multiplier i\
[i]*IF THEN ELSE(Time>=SWT4 Switch time,1,0)

~
~ |

WHCR Working housing construction rate=

0
~ Fraction/year
~ |

SWT4 Switch time=

0
~ year
~ |

SHDP Slum housing demolition program i[i]=

UH Underemployed housing i[i]*SHDR Slum housing demolition rate*IF THEN ELSE(Time>=SWT5 Switch time\
,1,0)*Policy 1 applied to zone i[i]

~ housing units/year
~ |

SHDR Slum housing demolition rate=

0.05
~ Fraction/year
~ |

SWT5 Switch time=

250
~ year
~ |

NECP New enterprise construction program i[i]=

(PUT Productive units total i[i]*NECR New construction rate*ELM Enterprise land multiplier\
*IF THEN ELSE(Time>=SWT6 Switch time,1,0))*Policy 1 applied to zone i[i]

~
~ ~ :SUPPLEMENTARY
~ |

NECR New construction rate=

0
~ Fraction/year
~ |

SWT6 Switch time=

0
~ Fraction/year

```

~          |
DIDP Declining industry demolition program i[i]=
  DI Declining industry i[i]*DIDR Declining industry demolition rate*IF THEN ELSE(Time\
    >=SWT7 Switch time,1,0)
~
~          |

DIDR Declining industry demolition rate=
  0
  ~      Fraction/year
  ~          |

SWT7 Switch time=
  0
  ~      year
  ~          |

TPCSP Tax per capita subsidy program=
  TPCS Tax per capita subsidy*IF THEN ELSE(Time>=SWT8 Switch time,1,0)
  ~      dollars/(year*Person)
  ~          |

TPCS Tax per capita subsidy=
  0
  ~
  ~          |

SWT8 Switch time=
  0
  ~      year
  ~          |

UJP Underemployed job program i[i]=
  U Underemployed i[i]*UJPC Underemployed job program coefficient*IF THEN
ELSE(Time>=SWT9 Switch time\
  ,1,0)
~
~          |

UJPC Underemployed job program coefficient=
  0
  ~      Dmnl
  ~          |

SWT9 Switch time=
  0
  ~      year
  ~          |

LCHP Low cost housing program[i]=
  LCHCD Low cost housing construction desired i[i]*LCRT Labor construction ratio total
  ~      housing units/year
  ~          |

LCHCD Low cost housing construction desired i[i]=
  U Underemployed i[i]*LCHPC Low cost housing program coefficient*WHLM Worker
housing land multiplier i\
  [i]*IF THEN ELSE(Time>=SWT10 Switch time,1,0)
~

```

~ |
 SWT10 Switch time=
 0
 ~ year
 ~ |

Policy 1 applied to zone i[i]=
 0
 ~
 ~ |

Indicators

LFOH Land fraction occupied by housing i[i]=
 (HUT Housing units total i[i]*LPH Land per house)/AREA Land i[i]
 ~
 ~ ~ :SUPPLEMENTARY
 |

FUOP Fraction underemployed of population i[i]=
 (U Underemployed i[i]*UFS Underemployed family size)/P Population i[i]
 ~
 ~ |

FUOPT Fraction underemployed of population total=
 (UT Underemployed total*UFS Underemployed family size)/P Population
 ~
 ~ |

FMPOP Fraction managers of population i[i]=
 ("MP Managerial-professional i"[i]*"MPFS Managerial-professional family size")/P
 Population i\ [i]
 ~
 ~ |

FLOP Fraction labor of population i[i]=
 (L Labor i[i]*LFS Labor family size)/P Population i[i]
 ~
 ~ |

FLOP Fraction labor of population total=
 ("MPT Managerial-professional total"*"MPFS Managerial-professional family size")/P
 Population
 ~
 ~ |

FMPOP Fraction managers of population total=
 (LT Labor total*LFS Labor family size)/P Population
 ~
 ~ |

P Population i[i]=
 "MP Managerial-professional i"[i]*"MPFS Managerial-professional family size"+L Labor
 i[i]*LFS Labor family size+U Underemployed i[i]*UFS Underemployed family size
 ~
 ~ |

H Households total=

"MPT Managerial-professional total"+LT Labor total+UT Underemployed total

~

~

|

HJR Households to job ratio=

H Households total/JT Jobs total

~

~

|

HBSR Housing units to business structures ratio=

HUT Housing units total urban area/PUT Productive units total urban area

~

~

~

:SUPPLEMENTARY

|

"MPPFT Managerial population/population fraction total"=

"MPT Managerial-professional total"/P Population

~

~

~

:SUPPLEMENTARY

|

LM Labor mobility i[i]=

LTM Labor to manager i[i]/L Labor i[i]

~

~

~

:SUPPLEMENTARY

|

JT Jobs total=

UJT Underemployed jobs total+LJT Labor jobs total+MJT Manager jobs total

~

~

|

LFOIT Land fraction occupied by industry total=

(PUT Productive units total urban area*LPP Land per production unit)/AREA Land total

~

~

~

:SUPPLEMENTARY

|

LFOHT Land fraction occupied by housing total=

(HUT Housing units total urban area*LPH Land per house)/AREA Land total

~

~

~

:SUPPLEMENTARY

|

LFOI Land fraction occupied by industry i[i]=

(PUT Productive units total i[i]*LPP Land per production unit)/AREA Land i[i]

~

~

~

:SUPPLEMENTARY

|

k:

a1,a2,a3,a4,a5,a6,a7,a8,a9,a10,a11,a12,a13,a14,a15,a16

~

~

|

i:

a1,a2,a3,a4,a5,a6,a7,a8,a9,a10,a11,a12,a13,a14,a15,a16

~

~

|

```

*****
      .Control
*****~
      Simulation Control Parameters
      |

FINAL TIME = 500
      ~      year
      ~      The final time for the simulation.
      |

INITIAL TIME = 0
      ~      year
      ~      The initial time for the simulation.
      |

SAVEPER = 1
      ~      year [0,?]
      ~      The frequency with which output is stored.
      |

TIME STEP = 0.125
      ~      year [0,?]
      ~      The time step for the simulation.
      |

```