MetroScope Gen 3.5

Technical Reference

Who this is for:

Anyone programming MetroScope, but should also be useful for anyone preparing input data, running scenarios, or analyzing output data.

Additional documentation can be found in “MetroScope Operator Guide” and “MetroScope Theory and Practice”.

Contents:

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* Files and Directories
* Glossary / Lookup Tables
* Detailed Table Definitions
* Detailed Function Definitions

Draft 4/24/2013 Jim Cser, Metro Economic and Land Use Forecasting

**MetroScope Gen 3.5 Overview**

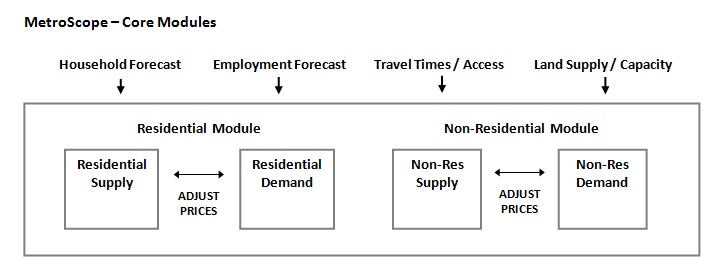
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How MetroScope works

MetroScope is an integrated set of econometric, land use, and transport models, currently used at Metro for producing regional forecasts and evaluating a wide range of policy scenarios.

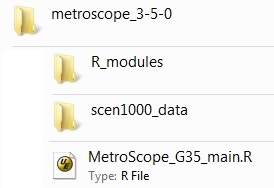
For each forecast year, regional control totals for demographics, households, and employment are provided from an econometric model. The land use model takes these forecasts and distributes them spatially over the buildable land capacity for the entire region. A transport module is integrated with the land use model, so that the household and employment distributions can respond to changes in travel time.

For both the core residential and non-residential modules, market forces determine both the supply and demand for real estate. If supply is less than demand, then prices are increased to make it more profitable to build. Likewise, if supply is greater than demand, prices are decreased to make housing more affordable. The modules are then iterated until supply matches demand.



MetroScope main directory:

All the required R scripts and data table are contained in the main directory, “metroscope\_3-5-0”. This directory can be copied to any other place on your machine , but make sure to edit the pathname in your scripts.



“MetroScope\_G35\_main.R” is the main control script. More details can be found in “MetroScope Operators Guide”.

R modules sub-directory:

“**R\_modules”** contains the R scripts for the MetroScope core functions. See the Detailed Function Definitions section in this document for more details.

G35\_globals.R = global constants

G35\_IO\_functions.R = data input/output functions

G35\_nonres\_demand\_module.R = non-residential demand module

G35\_nonres\_demand\_calcNonresAccess.R = non-residential demand travel access

G35\_nonres\_supply\_module.R = non-residential supply module

G35\_nonres\_supply\_calcNonresSupply.R = non-residential supply functions

G35\_res\_demand\_module.R = residential demand module

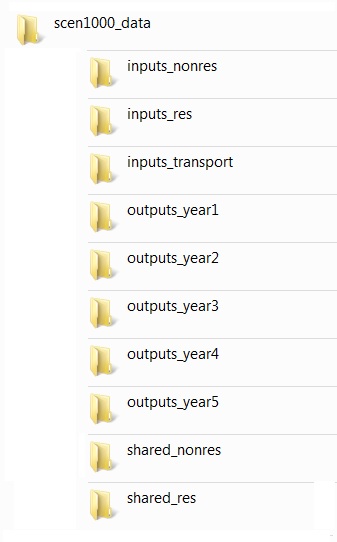
G35\_res\_demand\_functions.R = residential demand functions

G35\_res\_supply\_module.R = residential supply module

G35\_res\_supply\_functions.R = residential supply functions

Scenario data directories:

“**/scen1000\_data**” contains all the input and output file tables for a MetroScope scenario, (in this case #1000). For each new MetroScope scenario, a directory with the new scenario ID number must be manually created. This directory must contain the following subdirectories.



**/inputs\_nonres** = inputs for non-residential module

**/inputs\_res** = inputs for residential module

**/inputs\_transport** = res and non-res travel times

**/outputs\_year1** = all outputs for each year

**/outputs\_year2** = ‘’

**/outputs\_year3** = ‘’

**/outputs\_year4** = ‘’

**/outputs\_year5** = ‘’

/shared\_nonres = temporary files, for model use only

/shared\_res = temporary files, for model use only

All data tables are text files in the Comma-Separated-Variable (CSV) format. See Detailed File Descriptions section in this document.

**/inputs\_nonres**

Inputs required for each of the model years. These are generally what you change to create new scenarios.

nonres\_supply\_acres\_added\_yearN Non-residential acres, added in current model year.

nonres\_demand\_emp\_controls\_yearN Regional employment control totals

Inputs common to all model years. These generally will not change from scenario to scenario.

nonres\_general\_params Parameters for both residential and non-residential modules

nonres\_demand\_access\_param Access parameters

nonres\_demand\_access\_time\_param Access parameters nonres\_demand\_baseline\_distribution\_param Share of emplcass employment into re types.

nonres\_demand\_baseline\_sqft\_emp Baseline value of square feet per employee.

nonres\_demand\_crossprice\_elasticity Cross price elasticity between real estate types

nonres\_demand\_directprice\_elasticity Direct price elasticity, by empclass

nonres\_demand\_directsqft\_elasticity Direct sqft elasticity, by empclass and re type

nonres\_demand\_hh\_year0 Households by ezone for the calibration model year

nonres\_locationprice\_year0 Non-residential location price in calibration year

nonres\_supply\_baselandvalue Base non-residential land value, in dollars per sqft.

nonres\_supply\_capitalcost Base non-residential capital cost, in dollars per sqft.

nonres\_supply\_capitalsubsidy Base non-residential capital subsidy, in dollars per sqft.

nonres\_supply\_cbdfactor Paramters for adjusting nonres supply in the CBD

nonres\_supply\_farclass\_param Nonres supply module parameters for each FAR class

nonres\_supply\_landcost Base non-residential land cost, in dollars per sqft.

nonres\_supply\_retype\_param Nonres supply module parameters for each FAR class.

nonres\_supply\_totalsupply\_year0 Total sqft supply in calibration year.

**/inputs\_res**

Inputs required for each of the model years. These are generally what you change to create new scenarios.

res\_supply\_acres\_added\_yearN Land use supply accounting for current model year.

res\_demand\_khia\_shares\_yearN Regional household shares by KHIA

res\_demand\_hh\_controls Regional totals for households and dwelling units

Note: for the demand hh controls, there is only one input file, with one row for each model year.

Inputs common to all model years. These generally will not change from scenario to scenario.

res\_general\_params General parameters

res\_general\_rzone\_lut Lookup table for the ezones to rzones

res\_demand\_accessindex\_nscore Location weights for auto access, neighborhood

res\_demand\_binshares\_year0 Housing price bin weights from calibration year

res\_demand\_emp\_yearN Employment by ezone from non-residential model

res\_demand\_hedonic\_params Parameters for residential housing cost calculation.

res\_demand\_housesize\_params Parameters for residential housing size choice.

res\_demand\_housingtype\_params Parameters for residential housing type choice.

res\_demand\_khia\_categories Values for each KHIA market segment

res\_demand\_khia\_params Parameters for each KHIA market segment

res\_demand\_kshare\_params Location weights for households with children.

res\_demand\_locationchoice\_params Parameters for residential location choice.

res\_demand\_lotsize\_params Parameters for residential location choice.

res\_demand\_tenure\_params Parameters for residential tenure choice.

res\_locationprice\_year0 Residential location price from calibration year

res\_supply\_base\_bldgcost Base building cost

res\_supply\_base\_lotprice Base lot price

res\_supply\_basesalesfraction Base fraction for land supply availability

res\_supply\_feesubsidy Cost or subsidy to building cost of each unit.

res\_supply\_zclass\_lotsize Available lot sizes for each zoning class

res\_totalsupply\_year0 Total DU supply from calibration year

**/inputs\_transport**

Inputs required for each of the model years. These are generally what you change to create new scenarios.

nonres\_traveltime\_yearN Non-residential ezone-to-ezone travel times

res\_traveltime\_yearN Residential ezone-to-rzone travel times

**/outputs\_yearN** (one file for each model year)

nonres\_supply\_acres\_consumed\_yearN Nonres acres, consumed in model year

nonres\_supply\_acres\_remaining\_yearN Nonres acres, consumed in model year

nonres\_demand\_emp\_yearN Total employment demand, by ezone, emplcass,

and real estate type

nonres\_demand\_empclass\_emp\_yearN Total employment demand, by ezone and emplcass

nonres\_demand\_hh\_yearN Households by ezone, from residential model

nonres\_demand\_sqft\_yearN Total square foot demand

nonres\_locationprice\_yearN Non-residential location price

nonres\_sqft\_newsupply\_yearN New regular sqft supply built in model year

nonres\_sqftUR\_newsupply\_yearN New UR sqft supply built in model year

nonres\_supply\_totalsupply\_yearN Total sqft supply

res\_supply\_acres\_consumed\_yearN Residential regular acres, consumed in model year

res\_supply\_acres\_remaining\_yearN Residential regular acres, consumed in model year

res\_demand\_avghedonic\_bin\_yearN Average hedonic prices for each housing bin

res\_demand\_avghousesize\_bin\_yearN Average house size for each housing bin, in sqft

res\_demand\_avglotsize\_bin\_yearN Average lot size for each housing bin, in sqft

res\_demand\_binshares\_yearN Location weights for each housing price bin

res\_demand\_RzBin\_yearN Total demand, by rzone and housing bin

res\_demand\_RzEz\_yearN Total demand, by rzone and ezone

res\_demand\_RzKHIA\_yearN Total demand, by rzone and KHIA

res\_demand\_rzone\_yearN Total demand, by rzone

res\_locationprice\_yearN Residential location price

res\_newsupply\_yearN New regular households built in model year

res\_newsupplyUR\_yearN New UR households built in model year

res\_totalsupply\_yearN Total households in model year

Glossary and Category Definitions

From Residential Model:

**Res** Residential

**Regular** Land supply not given a building cost subsidy.

**UR, Urban** **Renewal** Land supply given a building cost subsidy

**Rzones** Residential zones, used by the residential model. Metro currently uses 425 residential zones, based on Year 2000 US Census tracts.

**Zclass** Residential zoning classes. Each class defined by minimum and maximum lot sizes per dwelling unit. Refer to input table "res\_supply\_zclass\_lotsize"

**Htypes** Residential housing types:

**OSF** Owner, Single Family

**OMF** Owner, Multi Family

**RSF** Renter, Single Family

**RMF** Renter, Multi Family

**Bins** Residential housing value bins. These are groupings of KHIA categories into eight value classes to allow more realistic supply and demand of different market segments. See "MetroScope Theory and Practice".

**HH, DU** Households, Dwelling Units. At Metro, the forecast is in households, then dwelling units are estimated by adding a 5% vacancy rate. Note: in the documentation and code, sometime the terms are used interchangeably.

**K, H, I, A, KHIA** Residential market segments, based on US Census categories. School-age children present (K), Household size (H), Income (I), Age of household head (A); collectively referred to as "KHIA".

Categories currently used at Metro:

**K = School Age Children Present**

k0 no kids 0

k1 with kids 1

**I = Income**

i1 Less than $14,999 10000

i2 $15,000 to $24,999 20000

i3 $25,000 to $34,999 30000

i4 $35,000 to $44,999 40000

i5 $45,000 to $59,999 52500

i6 $60,000 to $74,999 67500

i7 $75,000 to $99,999 87500

i8 $100,000 or more 125000

**H = Household Size**

h1 1 person 1

h2 2 persons 2

h3 3 persons 3

h4 4 persons 4

h5+ 5 or more persons 5.5

**A = Age of Household Head**

a1 Under 25 20

a2 25 to 44 35

a3 45 to 54 50

a4 55 to 64 60

a5 65 & over 70

From Non-Residential Model:

**Nonres** Non-Residential

**Emp** Employment Note: in the documentation and code, "emp" and "nonres" are sometimes used interchangeably.

**Regular** Land supply not given a building cost subsidy.

**UR, Urban** **Renewal** Land supply given a building cost subsidy

**Ezones** Employment zones, used by the non-residential model. Metro currently uses 72 employment zones, which are groups of residential zones.

**FAR** Floor-to-Area ratio categories, used by non-residential model. A measure of building square footage allowed for a given land supply acreage. Refer to table "nonres\_supply\_farclass\_param".

**RE, RE types** Non-residential real estate types:

**Man** Manufacturing

**War** Warehousing

**Ret** Retail

**Gen** General Office

**Med** Medical

**Gov** Government

**ManWar** Industrial land supply type. The non-residential model splits these into Manufacturing and Warehousing square footage types.

**RetGen** Commercial land supply type. The non-residential model splits these into Retail and General Office square footage types.

**MedGov** Institutional land supply type. The non-residential model splits these into Medical and Government square footage types.

**Empclass** Employment classes, defined by North American Industry Classification System (NAICS).

Employment class values currently used at Metro:

**Emp Class Industry NAICS**

1 Agriculture, timber 11, 21

2 Construction 23

3 Nondurable manufacturing 311, 312-316, 322, 323-327, 511

4 Durable man., metals, paper 321, 331, 332, 333, 335, 336, 337, 339

5 High tech manufacturing 334

6 Transport and warehousing 48, 49

7 Communications and utilities 22, 512, 515, 517, 518, 519

8 Wholesale trade 42

9 Retail trade 44, 45, 72

10 Finance, insurance, real estate 52, 53, 55

11 Consumer services 56, 71, 81

12 Health services 62

13 Business, professional services 54, 61

14 Other government Gov ownership (not NAICS 6111 in es202)

15 K-12 education Gov ownership (NAICS 6111 in es202)

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