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:

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

MetroScope Gen 3.5 Overview

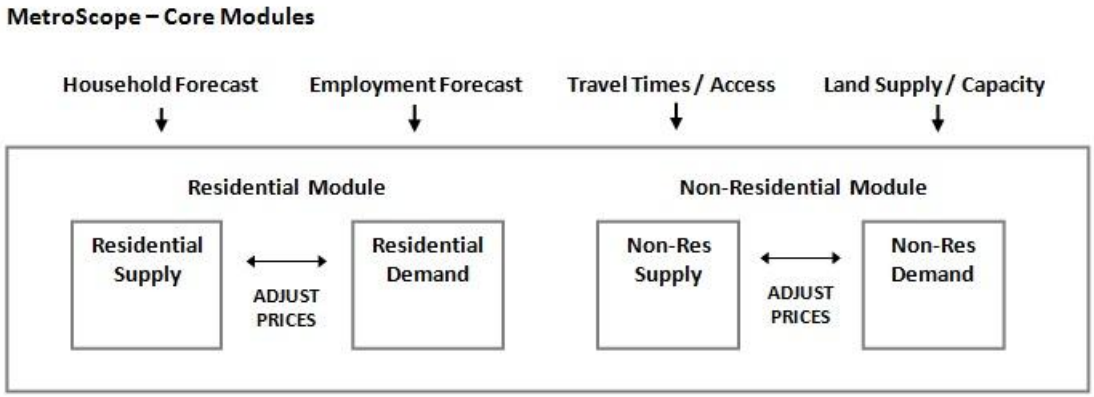
Draft 4/24/2013 Jim Cser, Metro Economic and Land Use Forecasting

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.

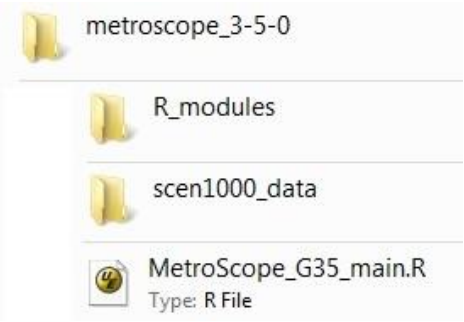
For each forecast year, regional control totals for demographics, households, and employment are provided from an econometric model. The land use model takes these forecasts and distributes them spatially over the buildable land capacity for the entire region. A transport module is integrated with the 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".

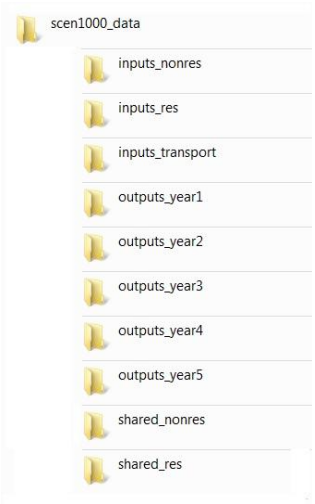
R modules sub-directory:

"**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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