



MetroScope Expert Peer Review Summary Report

(Meeting was held in October 2017)

November 2017

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MetroScope Peer Review Q&A Summary

Introduction

A list of questions was sent to the Expert Peer Review Panel members in advance of the formal peer review panel session. These questions were crafted to help panelist focus their attention on topics Metro Research Center (RC) Staff believed would be of importance for validating the MetroScope land use model, improving on existing land use forecasting analytics, and providing advice on future research and development strategies for model improvement. RC staff went over these questions with the panel members at a formal peer review session held at Metro on October 3, 2017. In addition to these comments, a panelist submitted additional post-meeting comments regarding best practice for estimating residential redevelopment capacity and a suggestion to reframe and simplify how policy makers may interpret complex land use scenario information.

Panelist submitted individual written responses to the Metro questions. This paper attempts to organize these responses and summarize them into similarly themed answers for each question. The paper is organized as a Q&A and as necessary will directly quote from responses given by individual panel members.

The comments in this document are part of a larger effort by Metro to improve the existing MetroScope land use model and to validate the integrity of the land use model. In the time available, research center staff has implemented some of the recommendations from the expert panel into the Urban Growth Management (UGM) forecast. The more time consuming and model intensive recommendations will be conducted after the 2018 UGM decision. Any errors in transcribing and summarizing individual peer review comments are solely that of Metro. RC staff may look to other land use models and model developers for additional advice on long-term strategies to maintain relying on the MetroScope land use model or consider other existing land use models.

Questions and summary answers

Overall methodology:

- Are the methods and mathematics of the model generally sound given its heritage and purposes?

Generally, most reviewers found the MetroScope land use framework to be sound.

But several reviewers indicated room for improvement given that there are now better data available, newer applicable econometric methods, newer land use modeling innovations that have been researched since MetroScope's inception over 25 years ago. Improved computing power was cited as allowing for more robust model treatments.

One reviewer noted that the formulation of the utility equations, the supply, demand and market clearing could be improved and updated; "...the choice probabilities should be consistent with each other and the all-encompassing utility function". This same reviewer noted that "demand functions are not homogenous of degree zero in prices and incomes". Rectifying this would "make the model simpler but more powerful and easier to solve".

Another reviewer had strong concerns about the model's approach for residential tenure preferences, and perhaps concerns on how tenure impacts housing affordability.

- **Overall goodness of fit –is MetroScope's current performance adequate for its intended purposes? Are there near term items Metro should focus on improving?**

The sensitivity test document provides some assurance that the model sensitivity is moving in the right direction in most cases, but reviewers found it harder to assess accuracy of the magnitude of the implied changes.

However, most reviewers reserved their opinions until they could evaluate the specific model coefficients and estimation diagnostics. Many noted it was "not possible to evaluate how some of the model's relationships compare to values found in the literature". A few cited the need to better understand more of the key pieces of the model.

A reviewer noted the employment submodel as needing "much more improving".

[RC staff have noted the uneven shortcomings of the non-residential submodel too and would welcome review panel members to offer specific remedies.]

A reviewer found the tenure choice

- **Overall validation "targets" and observed data—what observed time period(s) and data source(s) would you recommend given the rapid fluctuation of housing markets and business cycles?**

A reviewer made the point that the MetroScope validation is NOT a true validation: "validation is the practice of verifying model predictions against observed data, which requires backcasting from an earlier base year to a later year for which we have observed data."

[RC staff understand this, but were unable to in the allotted time frame to construct the necessary backcasting inputs and historical comparison data to perform this operation. Staff felt that the next best alternative was to perform the validation as it was described in the validation documentation.]

A couple reviewers noted that the 5-year increment of MetroScope forecasts is arbitrary and suggested going to 1 year increments if economic and real estate cycles are important. At 1-year intervals, the loss of information fidelity is minimized in the otherwise intervening years of a 5-year forecast interval.

Another reviewer made the helpful suggestion to also include MSA level data to contextualize the validation targets for the small area allocations. This reviewer noted that some of the discrepancies in the small area allocations could be explained away by MSA level factors.

More-detailed questions:

- **RC staff would particularly value peer review input on the *tenure* (own or rent) validation results and observed data used to validate tenure. Are you seeing marked fluctuations in tenure in your regions? What observed data do you use to understand tenure, and do you find the ESRI sources to be robust?**

Majority of reviewers say tenure should be modeled, perhaps specified as a binary choice model by household type as a function of: life cycle, age, income, number of kids, etc. A couple suggestions were made to disaggregate and estimate tenure choice for a sub-sample of recent movers vs. long-time stable residents.

Most modelers suggested looking to ACS (PUMS), Census, Zillow, CoreLogic or other databases (e.g., OHAS, other travel surveys) for estimation data. ESRI was not a database peer reviewers had any familiarity with.

One reviewer stated strongly that tenure should be “exogenously determined or assumed”.

- **Likewise, staff would particularly value peer review input on the *housing type* (single-family or multi-family) validation results and related observed data. What type choices do you observe recently in your urban regions? What observed data do you use to understand type, and do you find the ACS source to be robust?**

A reviewer noted that “the sensitivity testing results for the housing type choice are in the right direction”.

ACS and Census were cited by many reviewers as reasonable data sources, but one reviewer suggested that county assessor tax lot data might be a better source. [RC staff maintain a regional SF database in RLIS (GIS database) of existing SF housing stock and update this inventory regularly with permits and other administrative records.]

Reviewers who commented on actual trends happening in their region said that MF housing has been increasing its share of construction. [RC staff maintain a regional MF database in RLIS of existing MF housing inventory that is updated with permits and other administrative records.]

A reviewer said that actual structure type split information are derived by estimates from the ACS and augmented by local permit data to produce more robust figures. Recent trends in the split of SF/MF new Seattle area construction since 2008 have tilted toward a higher share of MF than historically has been the case.

- **Do you find the use of coincidence ratio to evaluate the model's price estimates to be useful? Would you suggest a different test or comparison method?**

Other MPO reviewer cited use of the RMSE statistic.

- **Do you find the ACS 5-year product's housing price data to be robust?**

Yes, said one reviewer. Others suggested other sources. . .

An MPO reviewer cited use of county assessor's price data and local MLS data. A research reviewer preferred sales transaction data as better data source for housing prices.

- **Tenure split supply assumptions – How do other models treat this supplier issue? Is there another approach than applying this assumption to the input BLI that you might recommend?**

Two reviewers familiar with this question replied with similar thoughts: The decision to supply housing for rent or sale to owner-occupied housing should be the decision of the investor / builder. Price, relative to zoning and construction costs should determine supply by tenure- essentially the calculation should be based on ROI for the developer. [Metro RC is set on the path of building a "Developer Supply Processor" model that is based on a real estate development pro forma approach for estimating MF redevelopment supply. This approach is amenable to using price, zoning and construction cost variables to determine ROI solution for tenure supply splits.]

- **Fraction in the market (mechanism to meter land supply over 5 year increments in recognition of limits on the total ability of suppliers to provide housing and nonresidential space) – Have you any concerns with or suggestions for improving this approach?**

Reviewer comments point to a need to model or more detailed simulation how the land markets and development community make choices to build or not build at given price point. The mechanism for this simulation (particularly in light of a UGB) needs to be able to see price fluctuations lead to higher densities and infill within a UGB or that the higher price fluctuations “cause households and businesses to leave the UGB for elsewhere”.

- **Uncertainty –please suggest thoughts on how staff can quantify uncertainty when communicating the forecast results.**

The suggestion by several reviewers is to randomly perturb “the coefficients within the variance-covariance structure”. For exogenous terms in the model, perturb each within a specified range.

Other suggestions propose a more systematic series of “sensitivity tests” and then report the ranges, means, etc.

A reviewer suggested an approach of preparing high, medium and low estimates instead of a single set of values.

Where applicable and practical, display results using visualization techniques that employed error bands, ranges, or margin of error in tables.

- **Model’s “ramp-up” behavior: How concerned should staff be with this? Are you aware of other models behaving similarly? What enhancements would you suggest?**

This theme was voiced by an MPO practitioner and researcher: “. . . this is a common issue in simulation models, even though the magnitude of this “ramp-up” may differ.”

Both suggest that this phenomenon of land use models may stem from a mis-match or inconsistency in the base year data from the model’s perspective which tries to resolve in the first iteration. This appears to be a calibration issue.

A reviewer suggested that the “ramp-up” may be because the model’s handling of the developer land supply “does not contain an on the market factor to represent owner willingness to sell and develop.

- **Accessory Dwelling Units (ADU’s) – Do you have suggestions on how best to incorporate supply and demand for ADU’s into the current MetroScope algorithms?**

Short term I suppose it can be treated as added capacity/supply for RSF/RMF? Long-term ADUs may be added as a new housing type if it becomes (or expected to become) substantial.

A survey can be done to document a sample of such units, their sizes, when created and rental values and whether they are used for rental income or other purposes. Then one can estimate the probability that an ADU will be created.

A reviewer said that detailed ADU development history would be needed to estimate a model for future ADU development. [Metro with help from local cities are working together to build a longitudinal GIS database

Questions for long-term model development:

- **RC staff are well aware of other land use allocation model “families” in use. That said, are there developments in the MetroScope “family” of models that you would recommend staff examine for possible inclusion in MetroScope in the longer term? Especially, what improvements or additional variables would you recommend adding to the *employment* submodel?**

An MPO practitioner suggested these model improvement

- *Allow re-locations of existing households and jobs*
- *Potentially treat basic vs. non-basic employment separately.*
- *Supplement zoning with general plan and known development datasets.*
- *If not already doing so, incorporate mode specific accessibility variables.*
- **...or would you recommend that Metro move toward other model “families”? If yes, which and why?**

The current model seems to adequately address the needs of the agency. If that continues, we don't see a reason for changing to another model family said one reviewer.

Others recommended RELU-TRANS or Urbansim:

- *More flexible than MetroScope to take advantage of the data to capture the heterogeneity of households and employment choices*
- *RELU-TRANS purported by the author to be more capable of responding to the policy issues Portland Metro faces.*
- *Micro-level representation is an attractive feature of Urbansim*
- *Also, Urbansim is releasing a cloud version based on census block group data*
- **How would you recommend enhancing or changing the treatment of neighborhood characteristics and other preference factors?**

Reviewer had this to say: “There is now much research on neighborhood topology, one option is to use neighborhood topology directly in model estimation/prediction. For a household with children, school quality would be an influential factor that I don't see included.”

It was suggested that more explicit treatment of school and crime characteristics and effects might improve the neighborhood term in MetroScope.

Increase the geographic detail to obtain more spatial variability

Allow preference factor to change through the course of the forecast to account for trends rather than being completely exogenous.

Examine the specification of the hedonic model so the preference factor is less influential.

DRAFT