City of Philadelphia

Office of Property Assessment

Mass Appraisal Valuation

Methodology Overview

Tax Year 2019

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Introduction

For tax year 2019, the Office of Property Assessment (OPA) again determined the value of properties through mass appraisal valuation. The term tax year refers to the calendar year in which taxes are due. Assessments for tax year 2019 were certified to the state by March 31, 2018 and the real estate taxes based upon those assessments were due by March 31, 2019.

Mass appraisal is a widely accepted tool for the valuation of property for the purposes of taxation.
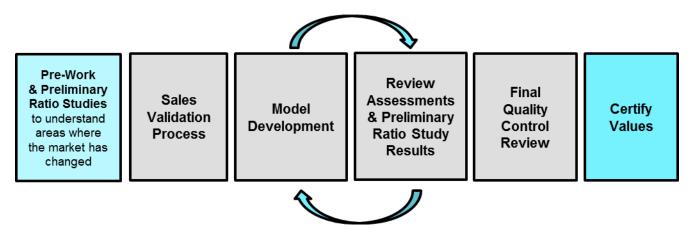
The goal of any valuation approach is to ensure that property assessments reflect current market conditions through the period being valued.

The following report outlines how OPA assesses values. This document highlights how this process is applied to single family residential properties.

Key Phases of the 2019 Assessment Process

OPA went through an iterative process to understand and identify areas where the market had changed since the last valuation and how to best reflect any market changes in assessed values of properties before certifying values for tax year 2019.

More detail on these steps is provided in this report.

Pre-Work & Preliminary Ratio Studies to understand areas where the market has changed	Sales Validation Process	Model Development	Review Assessments & Preliminary Ratio Study Results	Final Quality Control Review	Certify Values

The Sales Validation Process

The first step to assessing property values is sales validation.

OPA uses sales data to build valuation models. This means that the accuracy of valuation models depends on the accuracy of the sales data.

OPA examines all sale transactions that took place in prior years -- from January 2012 to June 2017 for the 2019 reassessment project -- to determine which sales are valid, arm's-length transactions that should inform valuation models and are the best indicators of the current value of similar properties.

The term **arm's length** means that a real estate transaction occurred in an open market arrived at through normal negotiations between an independent buyer and seller.

Sales that are determined to be invalid are removed:

- **Non-arm's length** transactions – like sales between related parties – may be removed if they may not accurately reflect fair market values.

- **Blanket transactions** where multiple properties transact under one value.

- **Bids, foreclosures** or **sales** with **no or atypical financing**.

- Sales reported from the Department of Records that used OPA data to determine a value for Transfer Tax purposes when the original sales price was not reflective of market value or was a nominal value, such as a $1.

The Sales Validation Timeline

It is important to keep in mind that OPA's assessments will always lag the current market because of the March 31st certification date.

State law requires OPA to certify assessments to the state by March 31st each year for use in the upcoming tax year that begins on January 1st of the following year.

While OPA examines the most recent sales possible, it also needs time to refine models and perform quality control processes before certifying. OPA also needs a sufficient number of sales to have a representative sample. This means that OPA uses transactions that took place over a multi-year period up to June 30 of the year preceding certification.

January 2012-June 2017	July 2017 - Feb. 2018	March 2018	June 2018	November 2018	January 2019	March 2019
OPA examined sales for 2019 reassessment (examine multiple years to ensure representative sample)	Modeling	Assessments certified to state 3/31	Budget adopted	Tax bills mailed to property owners	Start of year 2019 taxes are paid	Real estate tax due

As a result, the City's assessments will always lag the current market in the year the taxes are due by 9 months plus the amount of time it takes to refine models and perform quality control processes.

Model Development for Mass Appraisal Valuation

What Is Mass Appraisal Valuation?

Mass appraisal is the process of determining property values as of a given date by looking at **sales information** for many properties, **property characteristics**, and **statistical testing**.

To determine a property's value, assessing officers must rely upon valuation equations, tables, and schedules developed through mathematical analysis of market data.

What Is a Valuation Model?

Any appraisal, whether single-property appraisal or mass appraisal, uses a model, that is, a representation in words or an equation of the relationship between **value and variables representing factors of supply and demand**.

Mass appraisal models attempt to represent the market for a specific type of property in a specified area.

OPA uses Multiple Regression Analysis (MRA), a technique for estimating something unknown on the basis of known and available data.

In mass appraisal, the **unknowns are market values**. The knowns are **sales prices**, **income and expense data**, and **property characteristics.**

Unknowns:	Known & Available Data:
Market values	Sales prices
	Income and expense data
	Property characteristics

MRA models the relationship between property characteristics and value, so that value can be estimated from a set of known characteristics. MRA is widely used in the assessment industry.

Why Are Models Used in Property Valuation?

Effective valuation models need to do two things:

1. Provide a good estimate for the most typical property *and*
2. Explain why other properties have different values than the typical property

Because prices for real estate fluctuate for many different reasons, assessment models must be able to account for variance from the typical property.

Models are designed to **produce uniform values** and **minimize errors**.

Mass Appraisal Valuation

OPA starts by **assigning properties to general use classes** based on highest and best use, which normally equates to current use (class examples: single family residential, small multi-family, vacant land, retail, offices, apartment buildings).

Mass appraisal uses models – equations and formulas - that represent the relationship between **value and variables representing factors of supply and demand**. These models seek to represent the market demand for a specific type of property in a specific area (example: a single family row home in XYZ North Philadelphia neighborhood)

Valuation models are developed for defined property groups and market areas.

For residential properties, OPA divides the city into **Geographic Market Areas (GMAs).** This geographic division ("stratification") is appropriate when the value of property attributes varies significantly among areas and each area is large enough to provide an adequate number of sales.

For example, the demand for row homes in Neighborhood X may be greater than in Neighborhood Y; this impacts the value of homes in both areas.

To model residential parcels, the OPA uses several years of sales data and data related to the physical characteristics of the parcels to estimate value using a **comparable sales approach**.

Development of Sub-Markets

Prior to selecting comparable properties, OPA must define the relevant sub-markets for properties — which is a set of properties that would be considered alternates in the mind of the typical buyer of such property.

Based on the number of sub-markets in Philadelphia, OPA used 14 geographic models for single family homes for several reasons:

- Land values, economic conditions, and preferences for various property attributes can vary based on sub-market.

- Modeling by sub-market helps ensure these differences are most accurately reflected in property values.

Variables are entered and tested in a statistical analysis called **regression** to determine if the market(s) recognized "premiums" (i.e. characteristics that would result in higher values) or "penalties" (attributes that would result in lower values). As there are **non-linear relationships** in the contributory value of certain variables, the OPA uses logarithms or exponents for their coefficients.

The models are designed to maximize uniformity as measured in the assessment industry, and to produce a reasonable degree of accuracy in the estimates of value for a specific point in time.

Geographic Market Areas

As part of the process for determining property values, OPA also reviewed sales data to identify areas of real estate activity where similar properties sell for similar prices.

Within sub-markets, OPA uses sales data to look at areas or pockets of real estate activity where similar properties are selling for similar prices. These smaller geographic units are called **Geographic Market Areas (GMAs).**

OPA recognizes approximately 650 GMAs within the city. Each parcel lies within a GMA and is assigned to the correct GMA through an automated map-based process.

The **GMA boundaries are reviewed and adjusted as needed each year** to maximize the integrity of the location variables. This is based on analysis of patterns of change in use, price, and sales activity.

In OPA models, each GMA is a separate variable that may receive an adjustment in comparison to the most typical GMA.

Property Inspections

Properties are inspected to update OPA's records and to give evaluators a high degree of certainty that the property will be valued based on its current characteristics. This is done both in person and using software programs.

OPA determines which properties will be inspected based on the last inspection date and indicators that a property may have changed (permits, a sale, appeal, First Level Review adjustment or inquiry).

Inspections are limited to what can be seen from the curb. Interior inspections are done by owner invitation. This process helps OPA evaluators to collect data on characteristics of properties throughout the city. Other tools, such as permit information from the Department of Licenses + Inspections, aerial and street level photography, and private property listings that describe other characteristics are also used.

Variables Used in Mass Appraisal Valuation

In addition to location, other attributes that have an effect on sales price are included in each model. Physical characteristics that were used in the model included:

- Property type
- Building square footage
- Era built (relative age)
- Lot size
- Garage type and spaces
- Off street parking (in those neighborhoods where this is determined to be valuable, such as center city)
- Interior condition (or presumed interior condition)
- View amenity
- Proximity to amenities

By state law, OPA is only allowed to consider the attributes of each property when estimating value. OPA is **not** permitted and does not consider attributes such as:

- Income, either of the owner/occupant or the surrounding neighborhood. (In property assessment there, is no such thing as a 'poor' or 'low income' or 'wealthy' neighborhood – only low priced or high price properties)
- Ethnicity of the owner/occupant or the surrounding neighborhood
- Crime statistics
- Length of ownership
- Consumer price indexes
- Identity of the owner/occupant
- Any other demographic data
- It is illegal for OPA to make any adjustment to value based on data about *people*.

Time Adjustments

OPA examines **multiple years of sales data** to **ensure a representative sample** when determining property values.

During a multi-year sales analysis period, market conditions may change.

Through regression analysis, OPA builds a compound adjustment index for each model that allows sales from any given month in the sales analysis period to be calibrated to the effective date of appraisal. By adjusting each sale for time, the OPA is able to remove the time adjustment variables from the final iteration of the model.

A sale price from a high point in the market is therefore adjusted downwards to the equivalent in today's prices, while a sale from a low point in the market would be adjusted upwards. Since every sale is adjusted for time, there is no need to 'weight' sales based on the time that they transacted.

Defining a "Typical" Property within Each Model

Each model defines a 'base' or typical property and compares each property to the base and makes adjustments for the differences.

First, the **regression models** consider all attributes entered, removing the least significant variables one at a time, until all that remains are the variables that contribute significantly to sale price. In this way every model will develop a unique set of base values, adjustment coefficients and time adjustments.

Properties, including those that did not sell, are matched to the appropriate model.

Each property is valued like the base property, and a series of compound multipliers are applied to that (base) value in conformance to the adjustment coefficients for that model.

There is no single formula that is used, as each model will generate a different constant and a different set of adjustment coefficients.

Determining Land Value Allocation

When a structure is present on a property, the total market value reflects the combined value of the building (improvement) and land (residual land).

The **value of the residual land is influenced by the structure on the property**. There is no market for residual land alone. For example, you cannot typically buy the land underneath someone's house, instead you buy the entire property.

The City offers tax incentives to abate or reduce the value of the improvement. This means that it is necessary to determine how much of the total property value is attributed to the land – the **"contributory value of land"**.

There are six industry accepted methods to determine the value of residual land. The approach that OPA employs from among those 6 makes the most sense for a jurisdiction as large and as complex as Philadelphia.

OPA examines location, lot size, building size, type of building, condition of building, garage type/other spaces, view, zoning, degree of slope, and whether or not the property has air conditioning. From a model using those factors, the land allocation percentage is determined for each property.

Citywide, this method generates land allocations that range from 8% for a condo in a high rise building with very little land to 60% for a small building in poor condition on a very large lot. The most common allocations in the city are between **15% and 30%.**

Projecting the Values from a Coefficient File

Each model produces a base value and a set of adjustment coefficients.

In order to project values, OPA uses two processes:

1. Within its statistical modeling software, modelers maximize the mathematical accuracy of the projections by measuring the projections against known sales prices and characteristics *at time of sale.*
2. Programming staff uses the base value and adjustment coefficients from each model to perform the same calculations in the property databases for both sold and unsold properties using *current* characteristics.

The basic form of the model is:

Constant * (Adj Coefficient$_1^{0 \text{ or } 1}$)* * (Adj Coefficient$_2^{0 \text{ or } 1}$)* ... (Adj Coefficient$_n^{0 \text{ or } 1}$)* (Scalar attribute$_1^{Adj \text{ } Coefficient}$)...* (Scalar *attribute*$_n^{Adj \text{ } Coefficient}$) = Assessed Value

How Does the Formula Work?

OPA creates multiple models to help capture market differences in different geographic areas and property classifications across the city.

The values of **constants** and **adjustments** for different attributes will vary across models to reflect differences (example: change in demand, construction costs)

However, each model functions the same way:

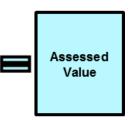| The model starts with a **Constant** for a value of "**typical property**" in a specific area. The value of the "typical property" varies by model. | ✕ | The **Constant** is multiplied by a series of **Adjustments**. The **Adjustments** reflect the value of the *presence* or *absence* of certain indicators that impact value, for example:
• Property type (ranch, 2- or 3-story twin home…)
• Condition (compared to average for the model)
• Interior condition (compared to average for the model)
• Age / era built
• Garage type / space
• Street classification (residential, along main highway…) | ✕ | The **Constant** is also multiplied by **Scalar Attributes** which represent adjustments that have a specific number (square feet, distance):

• Building size
• Lot size
• Proximity (distance to / from) | = | **Assessed Value** |

Review of Assessments and Preliminary Ratio Studies

Review by Evaluators

After OPA produces values using the models, all market value projections and land allocations are reviewed by OPA's professional evaluation staff.

The staff reviews any projections that appear to be outliers to determine if an adjustment is needed. For example, the model may generate an extreme value for one property based on its unique characteristics. Evaluation staff may need to make manual adjustments to value the property in line with similar peers and sales but without recalibrating the entire model that works for the majority of properties.

During this process, evaluation staff manually adjust any value that is not reasonable or similar to neighboring properties.

Quality Control and Testing

Before OPA certifies final property values, staff applies automated quality control measures to examine outputs and help refine assessment models as well as correct any outliers.

In particular, OPA examines several measures to evaluate the quality of assessments during the modeling process and upon final certification of values to the state.

OPA conducts sales ratio studies to evaluate assessment quality and uniformity, and to serve as a guide for further improvement in future projects. Sales ratio studies compare:

- **Assessments to sales prices.** OPA examines the median, average, and weighted median ratio of assessed value to sale price. The industry standard is 0.90 to 1.10 (90% to 110%). However, OPA targets a median ratio of between 0.95 to 1.02 (95% to 102%).

- **Coefficient of Dispersion (COD).** The COD is the most common measure of uniformity for assessments. This measures the average deviation of all ratios from the median ratio (less than <15% is considered within industry standards for jurisdiction like Philadelphia).

- **Price Related Differential (PRD).** The PRD measures the equity between lower and higher value properties (progressivity < 1.0 ; regressivity > 1.0). Values between 0.98 and 1.03 are considered within industry standards.

Certification of Values

OPA is required by state law to certify property values for the upcoming year by March 31st.

Additionally, each year OPA is required to submit its assessed values to an independent state body, the State Tax Equalization Board (STEB).

STEB reviews the assessed values and sales data to determine how closely each county's values compare to market value as determined by STEB. They publish a Common Level Ratio (CLR) to indicate these results on a percentage basis.

Philadelphia's most recent CLR was 98.7% (2017).

This means that OPA's assessments tracked the market value of sales validated by STEB, and its performance fell within state required guidelines of coming within 15% of the stated common level ratio (100%).

More information about STEB is available on the Board's website:

https://dced.pa.gov/local-government/boards-committees/tax-equalization-division/