
**A Sales Ratio Study of the City of Philadelphia's
2013 Certified and 2014 Proposed Real Estate Assessments**

A Report to the Controller of the City of Philadelphia

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With the assistance of Ms. Bingbing Hou

May 2013

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Executive Summary of Major Findings
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1. OPA's proposed 2014 taxable property values, when compared to OPA-determined actual, arms length sales prices for the same properties, adjusted for inflation, are highly variable in quality. That variability is well beyond standards set by the International Association of Assessing Officers. Based on OPA data for assessed values and arms length prices over \$1,000, the variability, or coefficient of dispersion (COD) for taxable residential properties rose from 82% for the 2013 values to 112% for proposed taxable 2014 values. IAOO recommends, by contrast, that such variability between assessed and actual, arms length sales prices not exceed 5 to 15% for residential properties in older urban areas. (See map of results by zip code and Council District, Figure 1 below).
2. The OPA determination of whether a transaction was done at arms length, crucial to developing accurate models, and interpreting reassessment results, appears to have been stopped by OPA in April, 2012.
3. The overall level of assessment, for both actual 2013 assessments and for proposed 2014 assessments is significantly correlated with 2010 Census ethnicity of the underlying geographic areas. Using 5 digit zip codes of residential properties, both 2013 and proposed 2014 median levels of assessment show that as zip code areas become more African American, the median level of residential assessment rises, and that as zip code areas become more Caucasian, the median level of residential assessment falls. This is a statistically significant result for residential properties.

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4. In both actual 2013 and proposed 2014 residential assessed values, there is statistically significant evidence that more expensive taxable residential properties, as measured by the OPA determined sales price, are assessed at lower levels than less expensive taxable properties.

5. Common sense dictates that a reassessment that relies primarily on statistical modeling is only as good as the data about property characteristics that are used to predict the 2014 assessed values.

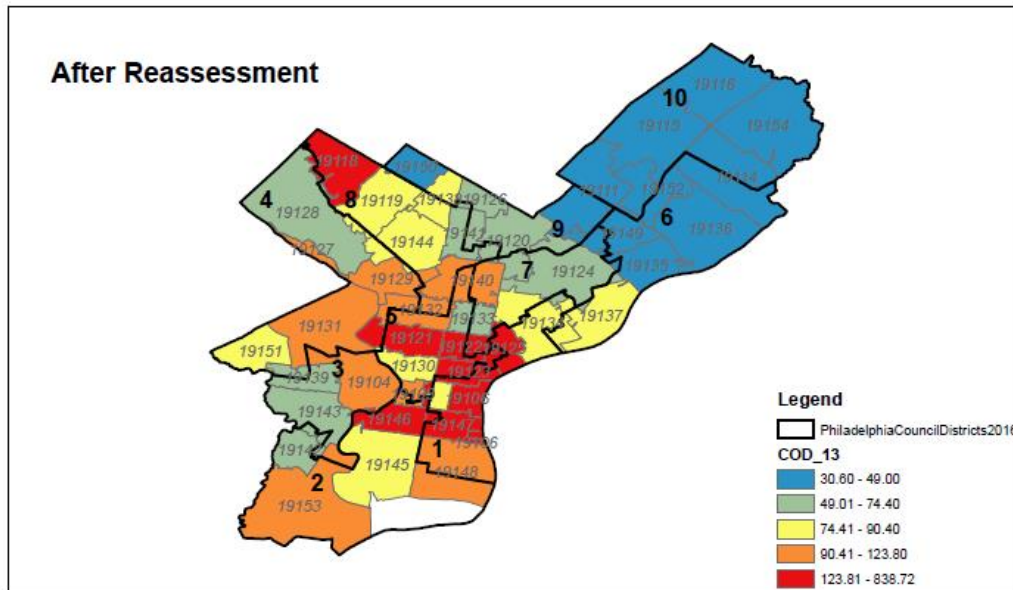
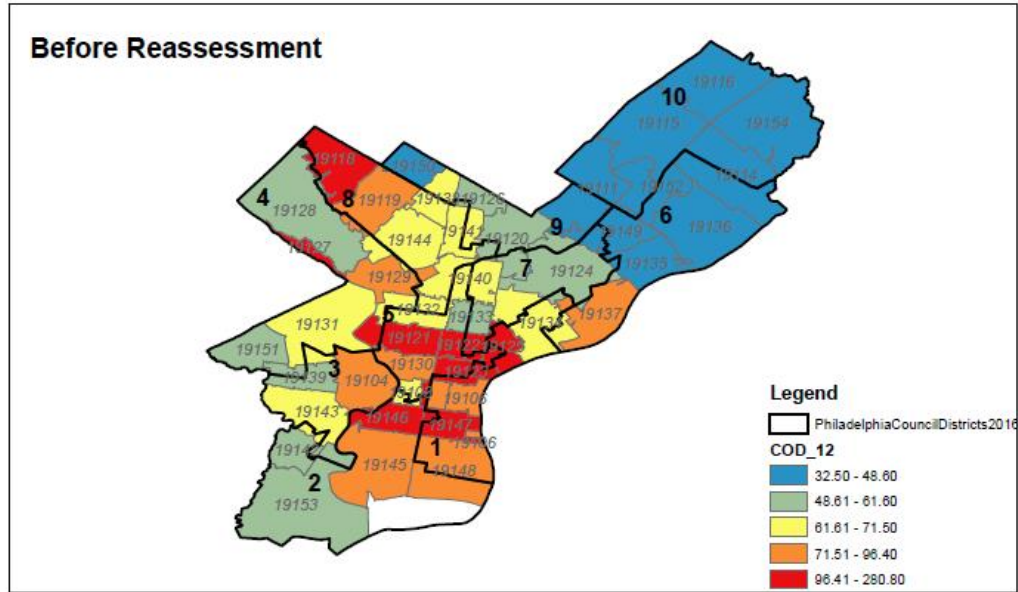
An examination of OPA data on exterior and interior characteristics indicates that many of the taxable properties to be reassessed are missing data on crucial characteristics. For example 29.9% of taxable residential properties in the universe of 457,400 taxable residential properties are coded as having zero stories or the number of stories is missing; 99.6% of these properties are missing an evaluation of Building Workmanship, and 45.9% are missing a score of the type of property site. The number of total rooms in the universe of 457,400 taxable residential properties was missing in 26% of OPA's records; 97% had no floor plans data, and 53% of the universe of these taxable residential properties had no information about the presence or absence of air conditioning.

Other measures such as Exterior Condition show very little differentiation in quality evaluation by OPA , and may be unduly optimistic: 87% of the 457, 400 taxable residential properties were graded as having "Average" or "Above Average" condition.

6. Compared to the in-process court-ordered reassessment of real estate in Allegheny County of about 544,000 taxable properties, the AVI initiative in the City of Philadelphia is doing an inferior job in terms of improving assessment uniformity and fairness. The level of non-uniformity in Philadelphia's residential reassessment results are double those of Allegheny County, and the level of regressivity in Philadelphia's reassessment results are even higher.

Figure 1: Philadelphia Median COD by 5 Digit Zip Code: inflation adjusted prices for all 5 years using FARGO Index; Council Districts 1-10 in black outline. Note: IAAO recommends COD of 5 to 15%.

5 years OPA Defined Arm length sales, Taxable Residential Properties Sale Price > \$1,000



0 3 6 12 Miles

Source: US Census Bureau
Philadelphia GIS Database
Philadelphia OPA

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1.0 Introduction

This report responds to an invitation by the Controller of the City of Philadelphia, effective April 11, 2013, to perform a timely and independent review of the pending reassessment of real property in the City of Philadelphia. The recent mailing of proposed 2014 assessed values, and the pending legislative decision to be effected by ordinance by Philadelphia City Council and the Mayor to certify the proposed 2014 assessed values for tax year 2014 makes such an independent review of broad interest. This report focuses on the relationship between the old and proposed assessed values and recently observed sales prices. Such comparisons inform on the accuracy and fairness of the results of the reassessment process. An examination of the plausibility and accuracy of the underlying data publicly available and used by the Office of Property Assessments of the City of Philadelphia to perform the reassessments, and a spatial analysis of aspects of old and new assessed values provide insights into how the results of the reassessments should be viewed. By correlating measures of the assessment level and quality of assessments with median earnings and ethnicity by 5 digit zip code, further insights about the fairness of reassessment results can be ascertained.

In 2012, Philadelphia Mayor Michael Nutter proposed that Philadelphia's real estate tax be based on 100% of the actual value of such real estate. Historically Philadelphia has subjected 32% of market or actual value to its real estate tax. To effect this change in the determination of taxable value of real property in Philadelphia, he reorganized the administration of real estate assessments, and the Office of Property Assessments (OPA) began in 2012 to reassess each of real properties in Philadelphia. This undertaking is described as the Actual Value Initiative (AVI).

While the City and School District of Philadelphia rely less on the local property tax than other jurisdictions in Pennsylvania and around the country,³ the valuation of Philadelphia's real property and the fairness of such valuations are sensitive and of widespread interest because these valuations underlie the distribution of tax burden that supports municipal and school finance. When overall revaluation is infrequent, as has been the case in Philadelphia, the changes in the distribution of tax burden can be dramatic and unsettling. Common sense and the law suggest that that each property to be assessed at its actual or market value so that the tax burden required supporting local finance be equitably or fairly distributed. This means that like or identical properties should be valued for assessment purposes at identical values. Assessment fairness or uniformity is accomplished when two identically sized, constructed and maintained houses, next door to each other are valued identically.

In practical terms, this standard of assessment fairness means that the assessed value of each property should reflect what an independent buyer and seller can agree to when buying/selling the property. A comparison of the assessed value (AV) to such an arms-length sales price (P) is accomplished by dividing

³ See Philadelphia Research Initiative (2012), Figure 2, p. 8.

the former by the latter or forming a sales ratio which is denoted throughout this study as AV/P. When actual or market value is the assessment standard, this ratio should always be 100%. That is, if assessment or valuation of each property has been accurate, then the ratio of the assessed value to what a buyer and seller can agree to transact that property will be 100%.

Consider two properties next door to each other that are identical in every feature. If one is assessed at 100% of market value and the other at 50% of their market value, then there is evidence of substantial variability or *non-uniformity* in the assessment process. On the other hand if both are assessed at 100% of their market value, then the assessment process is *uniform*, and both properties' owners will owe the same taxes. If properties that have more desirable characteristics such as more living space and larger lots, they will be more valuable (e.g. they sell for higher prices) than others. If all properties are valued at 100% of market value, then their owners, presumably in different economic circumstances, will be facing the same effective tax rates on their income to pay property taxes. If more expensive properties are valued at less than 100% of market value, and if less expensive properties are valued at more than 100% of market value, then the assessment process is said to be *regressive*. Conversely, if more expensive properties are valued at more than 100% of market value, and less expensive properties are valued at less than 100% of market value, then the assessment process is said to be *progressive*. In general the application of taxes to tax bases in Pennsylvania according to the Pennsylvania constitution must be strictly proportional to the tax base. Counties, municipalities and school districts may apply only one rate of property tax or millage to properties of different sizes and shapes, and, similarly, local jurisdictions and state government can only apply one rate of tax to taxable individual or corporate income.

Since only a fraction of the total inventory of real estate is sold in a given year, or over a period of several years, the task of reassessment is to make informed estimates of what the sales price would be for the 85 to 95% or so of real estate properties that are not sold in a given year. Typically, statistical methodology is employed in conjunction with professional judgment for the responsible organization, the Office of Property Assessments, to make such estimates. By independently examining these new estimates of assessed value, using standards and techniques developed by the professional appraisal industry, one can reach conclusions about how accurate and fair the reassessment effort has been.

The purpose of this study, requested by the Controller of the City of Philadelphia, is to perform sales ratio analysis of the late March, 2013 proposed assessed values for 2014 in the City of Philadelphia with a focus on residential property, using the universe of real estate transactions for years 2008 through 2012. The study utilizes data on historical, certified 2013 real estate assessed values (AV2013) and proposed 2014 real estate assessed values as of March 26, 2013 (AV2014) along with physical characteristics and sales information about each property as routinely maintained by the Office of Property Assessments of the City of Philadelphia. The analysis in this study has been conducted to the extent feasible in accordance with the International Association of Assessing Officers' 2013 Ratio Standards,⁴ and examines the general level of assessments before and after the reassessment, and examines the variability in assessments when compared to actual arms-length prices of such properties. By examining the general level of assessments before and after reassessment compared to actual sales prices, and these patterns in relation to median taxable income, one can evaluate whether or not the reassessment was regressive,

⁴ See IAAO(2013).

proportional or progressive. Measures of assessment uniformity, recommended by the IAAO will also be calculated and reported to ascertain whether or not the reassessment actually improved the uniformity of Philadelphia's real estate assessments.

This report is organized as follows. Section 2 provides general background on standard procedures for conducting sales-ratio studies, and the related statistical measures recommended by the International Association of Assessing Officers as reflected in their April, 2013 statement of standards. Section 3 describes the basic Philadelphia real estate data, and examines in detail key variables which are typically used in the reassessment process, and those used by the City of Philadelphia's Office Property Assessment. Section 4 examines the results of the reassessment in terms of the overall *level* of assessment and the overall *variability* in sales ratios (AV/P) , and then disaggregates this analysis in a number of different ways. In particular, Section 4 reports Coefficients of Dispersion (COD) and Price Related Differentials (PRD) in the aggregate and across five digit zip codes throughout Philadelphia under alternative sales ratio trimming methodologies. Section 5 analyzes across five digit zip codes the patterns of the level of assessments or median assessment ratios for 2013 and those proposed for 2014, and the COD and PRDs for 2013 and proposed for 2014 against 2010 median earnings of Philadelphia residents and the ethnicity of Philadelphia residents from the 2010 US Census of Population. Section 6 summarizes the findings of this study.

2.0 Standards and Methodologies for Reassessment

The International Association of Assessing Officers is a long-standing professional association of professional real estate appraisers from around the world. Formerly located in Chicago, it is, now located in Kansas City, Missouri. The IAAO through an extensive committee process sets recommended technical standards for the assessment and re-assessment of real property. Their pronouncements and standards are routinely referenced in state laws governing the assessment of real and personal property, and proscribe the manner in which states, that permit fractional assessment at the local level, collect local assessment and sales data in order to create measures of equalized real estate value per school child. Such equalized values are used by virtually all states, including Pennsylvania, in their distribution of state aid to local school districts. Historically, the Pennsylvania State Tax Equalization Board (STEB) performed this function; it is now being done in the Pennsylvania Department of Community Affairs

It is well known that administrative data that compares the arms length sales price of property to historical or projected assessed values in an assessing jurisdiction is both voluminous and can easily be error prone. Errors occur in the collection and processing of sales price information due to manual recording errors as well as data processing errors. Sometimes a property sale between related parties, grandparent and grandchild for example, can be at prices that reflect more the nature of a family gift, rather than a sale between an aggressive seller, and a cost-minimizing buyer. It is not uncommon for the former transactions to be recorded at \$1, which does not reflect the economic value of the property being transferred. Sometimes a clerical error can result in the value of the improvement or building on a piece of land not being recorded, so that a computer model has no physical characteristics to take into account when making a prediction of what that particular property should be assessed at. Because of the "noisy"

nature of assessed value to sales price (AV/P) data, IAEO recommends focusing on the median or the mid-point of the distribution of (AV/P) data, rather than the mean or average of the distribution of (AV/P), because the mean can mistake the central tendency of the distribution of data because of a few outliers.

2.1 Definition and Purpose of the Coefficient of Dispersion (COD) in Measuring Assessment Uniformity

The assessing profession has developed a statistic based on the median assessment ratio, rather than the average assessment ratio, that summarizes overall how noisy or spread out the overall distribution of AV/P is. The statistic is called the Coefficient of Dispersion (COD), which is the average percentage deviation of AV/P from the median, and is calculated by⁵:

- 1) Subtract the median from each observed ratio of AV to P for valid sales prices
- 2) Take the absolute value of the calculated difference in 1) above
- 3) Sum the absolute differences
- 4) Divided the 3) by the number of observations on AV/P to obtain the *average absolute deviation*
- 5) Divide 4) by the overall median to get the average percentage deviation from the median
- 6) Multiply 5) x 100 to make it a percent.

Table 1 below displays the April, 2013 recommended standards for CODs by type of jurisdiction. In general IAEO suggests that the acceptable range for CODs calculated for residential properties in a jurisdiction such as Philadelphia should be between 5% and 15% with the lower COD being the best or preferred measure.

Table 1: International Association of Assessing Officers Ratio Standards

General Property Class	Jurisdiction Size/Profile/Market Activity	COD Range
Residential improved (single family dwellings, condominiums, manuf.)	Very large jurisdictions/densely populated/newer properties/active markets	5.0 to 10.0
	Large to mid-sized jurisdictions/older & newer properties/less active markets	5.0 to 15.0
	Rural or small jurisdictions/older properties/depressed market areas	5.0 to 20.0
Income-producing properties (commercial, industrial, apartments,)	Very large jurisdictions/densely populated/newer properties/active markets	5.0 to 15.0
	Large to mid-sized jurisdictions/older & newer properties/less active markets	5.0 to 20.0
	Rural or small jurisdictions/older properties/depressed market areas	5.0 to 25.0
Residential vacant land	Very large jurisdictions/rapid development/active markets	5.0 to 15.0
	Large to mid-sized jurisdictions/slower development/less active markets	5.0 to 20.0
	Rural or small jurisdictions/little development/depressed markets	5.0 to 25.0
Other (non-agricultural) vacant land	Very large jurisdictions/rapid development/active markets	5.0 to 20.0
	Large to mid-sized jurisdictions/slower development/less active markets	5.0 to 25.0

Source: IAEO(2013), Table 2-3, p. 34.

⁵ See IAEO(2013), Section 5.4.1.

2.2 Definition and Purpose of Measuring the Price Related Differential to Measure Regressivity, Proportionality, or Progressivity of Assessment Results

Above, examples were given of situations in which the level of assessment (AV/P) might decline as the measured sales prices of properties increased, and that was described as an example of a regressive assessment. Conversely if AV/P increases with measured sales prices of properties, which would be an example of a progressive assessment. The IAAO recommends⁶ calculating the ratio of the mean assessment ratio to *weighted* mean assessment ratio where the weight used is the arms length sales price of each property. This is the definition of the Price Related Differential (PRD). If the sample of properties that have sold is sufficiently large, then a PRD greater than 1.0 generally indicates that more expensive properties are under-assessed and less expensive properties are over assessed. The IAAO proscribes that PRDs should be between .98 and 1.03.⁷

In conjunction with performing this study, the author requested and received from the Pennsylvania Department of Revenue median total taxable income and mean total taxable income for Philadelphia residents by five digit zip code for tax year 2010. These data, when correlated with median AV/P per zip code will provide another way to examine the vertical equity of the 2013 certified and proposed 2014 residential property assessments.

2.3 Real Property in the City of Philadelphia as Reported by the Office of Property Assessments

As a matter of historical tax policy, the City of Philadelphia has subjected 32% of the market value of its taxable real estate to property taxation by the City and School District of Philadelphia. The AVI initiative proposes that 100% of the market value of taxable real estate in 2014 and thereafter.

3.0 Real Estate Market and Assessed Value Aggregates for 2013 vs. 2014

The total market value of real estate in 2013 is reported by OPA to be \$56.7B or \$18.1B of certified assessed value (before application of tax or homestead exemptions). Of this \$18.1B, 31.9% is tax exempt in terms of dollar value, leaving \$12.4 billion to be taxed for municipal and school purposes. Of this taxable value in 2013, 24% is attributable to taxable land valuation, and 76% is attributable to taxable building valuation. There are 556,030 taxable properties in 2013 according to OPA data tabulated by the authors. (See Table 2 below)

⁶ See IAAO(2013), Section 5.6.

⁷ See IAAO(2013), and 9.2.7.

The proposed values in 2014 show a total market value of \$137B of which \$37.4B is tax exempt property, and \$99.9B is taxable assessed values. The proposed 2014 values indicate that 72.7% of total market value will be taxable, compared to 68.1% in 2013. Among the 2014 taxable properties, 22.5% is attributable to the value of taxable land, and 77.5% is attributable to the taxable value of buildings. (See Table 3) Table 4 summarizes these compositional changes evident for 2013 and 2014.

Table 2: 2013 Certified Property Values in City of Philadelphia

Row	Aggregate Measure of Real Estate Tax Base [A]	# of Properties (B)	Values [C]	% Share of Properties [D]	% Share of Values [E]
1	2013 Certified Market Value based on 2011 Data	579,662	\$56,706,227,192		
2	2013 Certified Taxable Assessed Value based on 2011 Data (32%)	556,030	\$12,363,083,795	95.9%	68.1%
3	2013 Certified Exempt Assessed Value based on 2011 Data (32%)	23,632	\$5,782,908,905	4.1%	31.9%
4	2013 Certified Total Assessed Value based on 2011 Data (32%)	579,662	\$18,145,992,700	100.0%	100.0%
5	2013 Certified Assessed Value of Exempt Building based on 2011 data (32%)		\$4,537,284,220		78.5%
6	2013 Certified Assessed Value of Exempt Land based on 2011 data (32%)		\$1,245,624,685		21.5%
7	2013 Sum of Assessed Exempt Land and Buildings based on 2011 data (32%)	23,632	\$5,782,908,905		100.0%
8	2013 Assessed Value of Taxable Building based on 2011 data (32%)		\$9,400,289,436		76.0%
9	2013 Assessed Value of Taxable Land based on 2011 data (32%)		\$2,962,794,359		24.0%
10	2013 Sum of Assessed Taxable Land and Taxable Buildings (32%)	556,030	\$12,363,083,795		100.0%

Source: Authors' tabulations of Office of Property Assessment's March, 2013 Data CD

Table 3: 2014 Proposed Values for City of Philadelphia

Row	Aggregate Measure of Real Estate Tax Base [A]	# of Properties (B)	Values [C]	% Share of Properties [D]	% Share of Values [E]
1	2014 Proposed Actual or Market Value at 100%	579,662	\$137,327,363,300		
2	2014 Proposed Total Taxable Assessed Values	556,100	\$99,888,656,742	95.9%	72.7%
3	2014 Sum of Proposed Exempt Values	23,562	\$37,438,706,558	4.1%	27.3%
4	2014 Sum of Proposed Taxable + Exempt Values	579,662	\$137,327,363,300	100.0%	100.0%
5	2014 Proposed Exempt Building Assessed Value		\$26,130,089,613		69.8%
6	2014 Proposed Exempt Land Assessed Value		\$11,308,616,945		30.2%
7	2013 Sum of Proposed Exempt Land and Buildings based on 2011 data	23,562	\$37,438,706,558		100.0%
8	2014 Proposed Taxable Building Assessed Value		\$77,434,257,623		77.5%
9	2014 Proposed Taxable Land Assessed Value		\$22,454,399,119		22.5%
10	2014 Sum of Assessed Taxable Land and Taxable Buildings	556,100	\$99,888,656,742		100.0%

Source: Authors' tabulations of Office of Property Assessment's March 2013 Data CD

Table 4: Exempt vs. Taxable Real Estate in City of Philadelphia: 2013 vs. 2014(Proposed)

Type of Real Estate	2013	2014
Taxable Total	68.1%	72.7%
Exempt Building	78.5%	69.8%
Exempt Land	21.5%	30.2%
Taxable Building	76.0%	77.5%
Taxable Land	24.0%	22.5%

3.1 Patterns of 2013 and 2014 Proposed Values by Class of Property

The Office of Property Assessments classifies real estate into six classes of property. Table 5 displays the 2013 certified market values and proposed 2014 market values by each class of property. It is evident that residential property has become more important in the overall property tax base. In 2013 it was 41.4% of the total market value, while the proposed 2014 values indicate that residential property will be 47.1% of the total market value. Commercial, industrial and vacant land has all decreased in relative importance as a result of the reassessment. Overall, the proposed 2014 market values are 142% larger than in 2013. Overall the residential property class was 175% larger in 2014 than 2013, while 2014 industrial property market values were only 53% larger than in 2013. Vacant land was 208% larger in value in 2014 than 2013.

Table 5: Distribution of 2013 Certified and 2014 Proposed Values by Class of Property

Class of Property	2013 Market Value	2013 % Share	2014 Proposed MV	2014 % Share	Ratio of 2014/2013 Values
1. Residential	\$ 23,485,199,778	41.4%	\$ 64,613,443,800	47.1%	2.751
2. Hotels & Apartments	\$ 7,299,786,081	12.9%	\$ 18,422,853,500	13.4%	2.524
3. Store + Dwelling	\$ 994,533,434	1.8%	\$ 3,419,370,600	2.5%	3.440
4. Commercial	\$ 21,389,185,301	37.7%	\$ 43,565,803,500	31.7%	2.037
5. Industrial	\$ 2,317,538,900	4.1%	\$ 3,539,648,300	2.6%	1.527
6. Vacant Land	\$ 1,219,983,698	2.2%	\$ 3,766,243,600	2.7%	3.087
Total	\$ 56,706,227,192	100.0%	\$ 137,327,363,300	100.0%	2.422

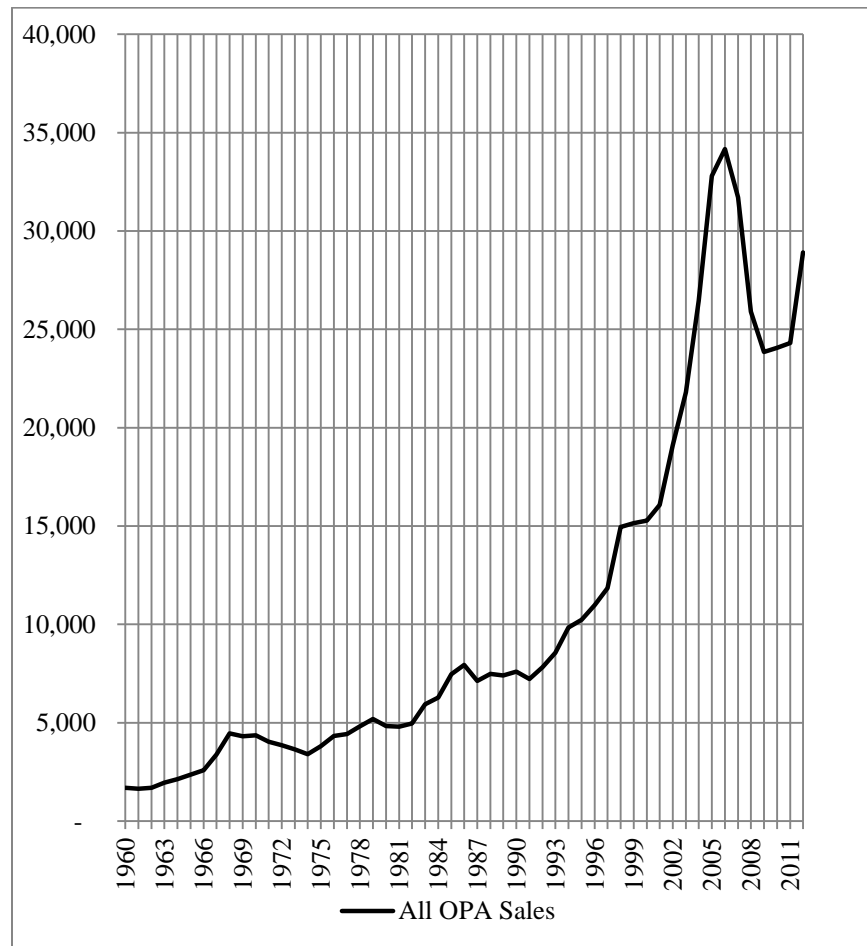
Source: Authors' tabulations of Office of Property Assessments March 26, 2013 Data CD

3.2 Sales of Real Property in the City of Philadelphia from 1960-2012 and 2008-2012

3.2.1 Number and Class of Property of Sales: 1960-2012

The OPA data base that is made available to the public reports the *last*⁸ date of sale of each property, and some sale dates go back several hundred years. Figure 2 displays the last sale date by year, and shows the growth in property sales, and the very steep decline beginning in about 2008. Note that there has been some recovery in 2011 and 2012 in property transactions.

Figure 2: Number of Sales per Year on OPA March 26, 2013 Data CD



⁸ By making public only the last sale, OPA in effect eliminates the opportunity to examine changes in sales prices over time of the same properties.

3.2.2 OPA Sales History Records: 2008-2012

When comparing newly assessed values to sales prices, the IAAO advises on choosing the most recent historical period of up to five years (2008-2012 for this study) in order to have a substantial number of transactions and predicted assessed values to make comparisons with. Table 6 shows the number of sales reported by OPA over the more recent period 2004-2012. It is evident calendar year 2007 was the year of most frequent sales with almost 32, 000 properties transacting. In 2012, it is evident that the property market has picked up from the low in 2009 of 23, 846 properties to last year’s total number of sales of 28,907.

IAAO also recommends on using only arms-length transactions of properties with reasonable sales prices. Fortunately, OPA classifies properties as arms length if the sales type is coded as an M or is left blank. Table 7 displays the sample counts to be used in the calculation of COD and PDR overall and by geographic area in Section 4 below. As can be seen, by focusing on just arms length, residential transactions of over \$1,000 in the period 2008-2012, the number of properties to be examined falls to 30, 159, and using a sales price of over \$10,000 reduces the sample to 27,506.

Table 6: OPA Last Year of Sale by Year and Property Class: 2004-2012

Year of Sale	Property Class, 1-6						Total
	1: Residential	2: Hotels and Apartments	3: Store with Dwelling	4: Commercial	5: Industrial	6: Vacant Land	
2004	21,492	2,162	818	563	227	1,183	26,445
2005	26,458	2,644	893	663	265	1,871	32,794
2006	27,931	2,427	946	663	245	1,945	34,157
2007	25,783	2,300	869	677	221	1,858	31,708
2008	21,424	1,859	735	599	195	1,094	25,906
2009	20,071	1,620	667	477	159	852	23,846
2010	19,778	1,865	723	564	180	956	24,066
2011	19,452	2,023	778	617	255	1,178	24,303
2012	22,882	2,215	854	744	309	1,903	28,907
Total	205,271	19,115	7,283	5,567	2,056	12,840	252,132

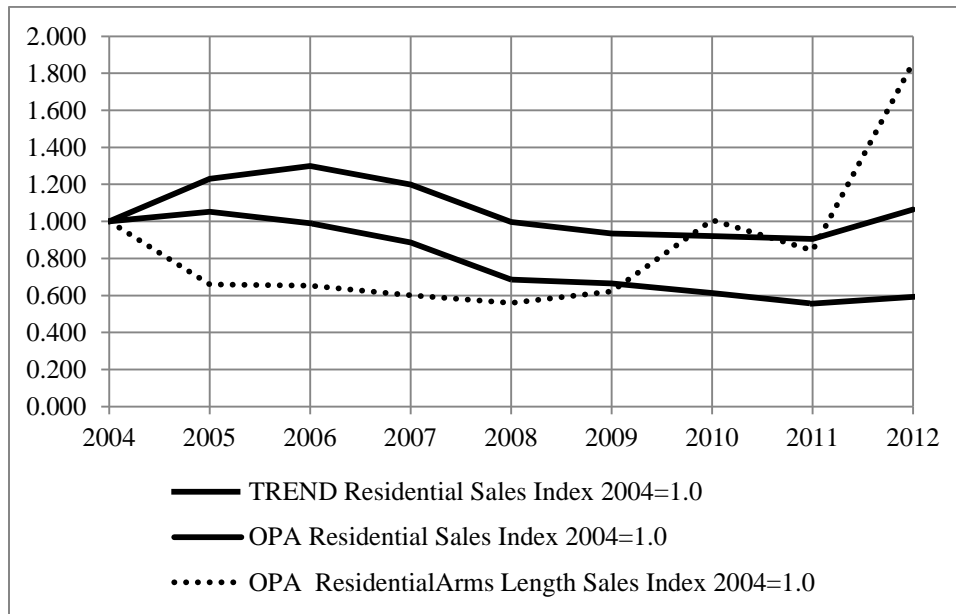
Table 7: Effect on Sample Counts of Using OPA Arms Length Determination, Residential Sales only, and Sales Price > \$1,000 or Sales Price > \$10,000

Year	Residential	Residential Arms Length	Residential Arms Length and Price > \$1,000	Residential Arms Length and Price > \$10,000
2008	21,424	3,482	3,449	3,021
2009	20,071	3,866	3,798	3,351
2010	19,778	6,268	6,228	5,612
2011	19,452	5,245	5,212	4,689
2012	22,882	11,560	11,472	10,833
Total	103,607	30,421	30,159	27,506

3.2.3 Comparison of OPA Residential Sales Patterns to regional TREND data

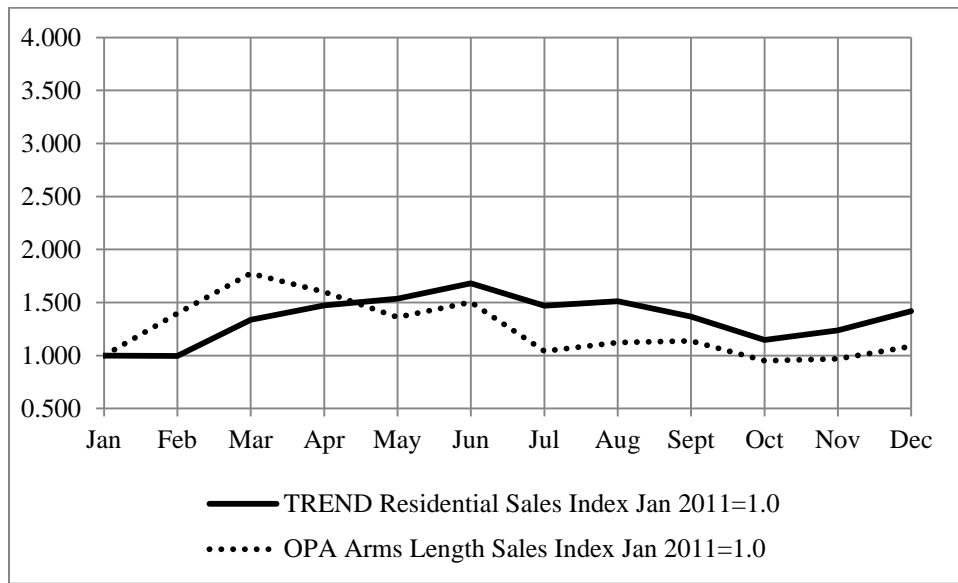
Realtors in South East Pennsylvania participate in a number of sales tracking activities, and one that is readily available is the annual sales report of residential properties collected by TREND of King of Prussia, Pennsylvania. Focusing on just residential sales measured by TREND, and arms length residential sales measured by OPA (and shown above in Table 7, we may compare the two patterns from 2004-2012 graphically by setting 2004 to an index base year of 1.0 or 100%. Figure 3 shows that the OPA residential sales index, and the OPA arms length index move in parallel over the 2005-2011 periods; however, in 2012, the number of OPA measured arms length sales jumped dramatically. (See Figure 4 below) Figure 5 repeats the monthly analysis for 2012, and it is clear that something happened between March, 2013 and April 2013 that led to a dramatic increase in the number of reported arms lengths transactions by OPA. Since OPA treats a sale type with a blank value as an arms length transaction, it is possible with the change in staff focus during the model building phase of the reassessment process that less time was devoted to keeping track of whether or not the residential transactions appeared to be arms length or not. Figure 6 shows a longer term tabulation of the sales type measurement, and indicates that the fraction of sales type determinations and entered as blanks has fluctuated widely over the period 1960-2012.

Figure 3: Comparison of Annual Residential Sales reported by TREND



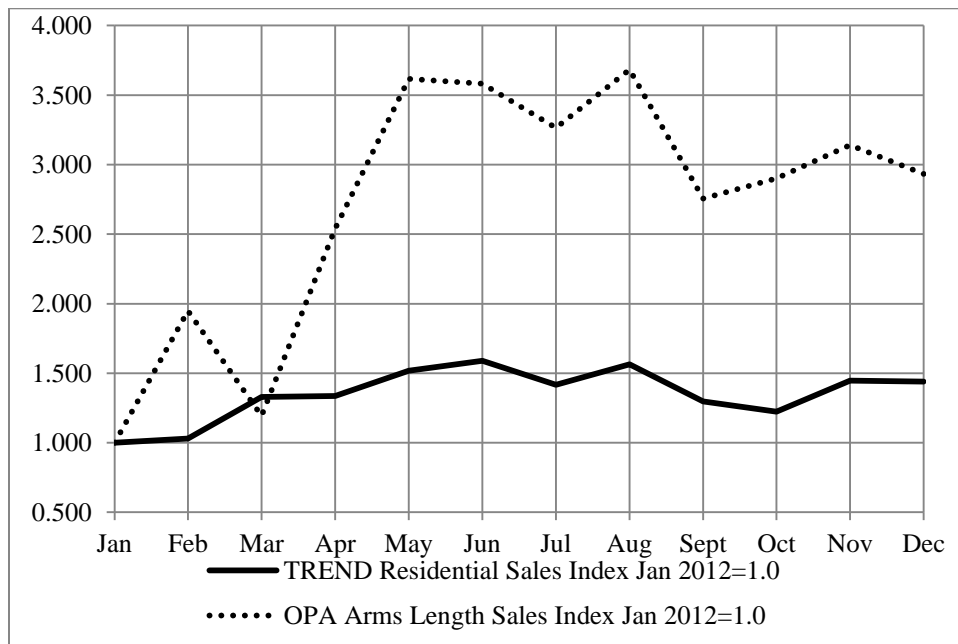
Source: Authors' tabulations of March, 2013 OPA Data CD and TREND Year to Date Reports

Figure 4: Monthly Share of Arms Length Transactions in 2011



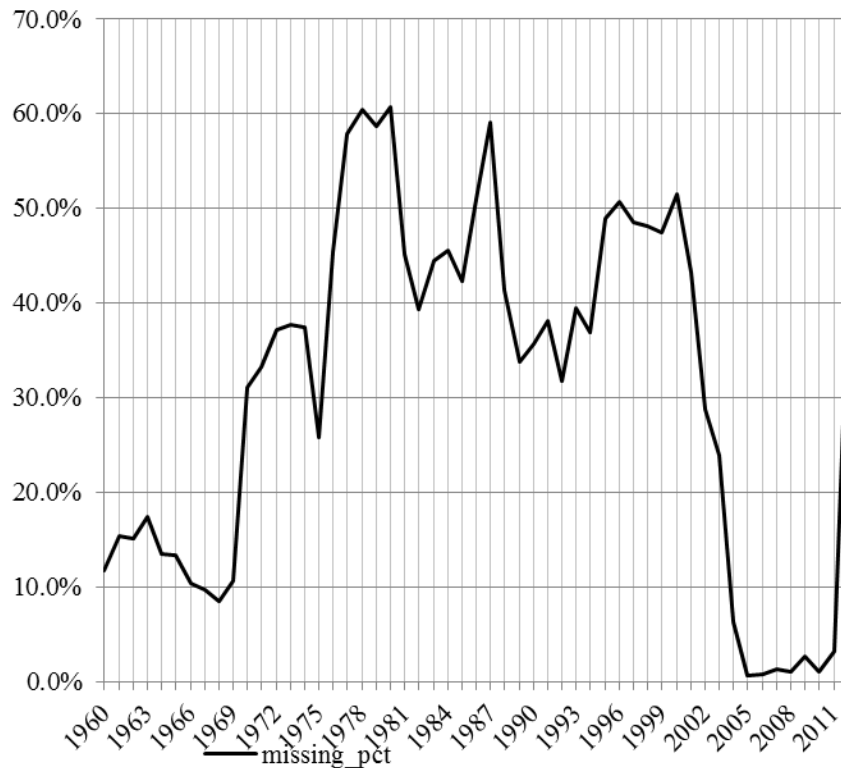
Source: Authors' tabulations of March, 2013 OPA Data CD and TREND Year to Date Reports

Figure 5: Monthly Share of Arms Length Transactions in 2012



Source: Authors' tabulations of March, 2013 OPA Data CD and TREND Year to Date Reports

Figure 6: Percent of OPA Sales Each Year without Sales Type Measure



3.3 Accuracy of Underlying Office of Property Assessment Data

Common sense dictates that the accuracy of any statistical models developed to predict the value of unsold properties depends crucially on the accuracy of the physical characteristics of these unsold properties. The IAAO suggests close attention be paid to the measurement of land and living area, the location and siting of properties, and the interior and exterior conditions. This section reports the results of tabulating these variables in the OPA data base to determine whether such data is typically available for residential properties.

Table 8 displays the results of tabulating a variety of exterior characteristics for all properties and for all residential properties. It is evident OPA has done a good job in keeping track of the building code, land area and living area for each property, as well as data on the year built. On the other hand 43% of the residential properties are missing the type of site they are located on, 21% are missing the number of stories of such buildings, and 96% are missing external determinations of building workmanship. Further investigation of the details of exterior condition, contained in Table 9, indicate that better than 86% of residential properties are “average” or “above average.” This failure to distinguish may be unduly optimistic.

Tables 10 and 11 make similar investigations of the patterns of interior characteristics. Pennsylvania is among a significant number of states which do not accord assessors the right of entry into a building for

assessment purposes. It is therefore likely that interior characteristics are not as completely characterized as external characteristics. Fully 91% of the total number of OPA properties are missing floor plan information,; for residential properties 96.7% are missing floor plans, 26% are missing the total number of rooms, 24% are missing the total number of bedrooms, 23.7% are missing the total number of bathrooms, and 38% are missing the basement type. Moreover, 47% of residential properties are missing a coding of the heating type, and 53% are missing information on whether or not air conditioning is present.

Table 8: Analysis of Exterior Characteristics of OPA Data Total and Residential Property Classes

Exterior Characteristic	Total Missing or Zero	Total Properties	% Missing or Zero in Total Properties	Total Missing or Zero in Residential	Total Residential Properties	% Missing or Zero in Residential Properties
Exempt Status: V260	539,372	579,662	93.0%	436,692	457,404	95.5%
Building Code: V280	0	579,662	0.0%	0	457,404	0.0%
Site Type: V330	265,893	579,662	45.9%	196,213	457,404	42.9%
Frontage: V340 (zero)	33,816	579,662	5.8%	32,561	457,404	7.1%
Depth: V350	33,862	579,662	5.8%	32,577	457,404	7.1%
Land Area V370	0	579,662	0.0%	0	457,404	0.0%
Topography: V380	36,864	579,662	6.4%	32,266	457,404	7.1%
View: V420 (missing+other)	7,981	579,662	1.4%	3,969	457,404	0.9%
Stories: V440 (zero)	173,420	579,662	29.9%	95,133	457,404	20.8%
General Construction: V450	15,256	457,404	3.3%	15,256	457,404	3.3%
Type of Dwelling: V460	575,328	579,662	99.3%	453,669	457,404	99.2%
Date Exterior Viewed: V470	19,484	579,662	3.4%	3,778	457,404	0.8%
Exterior Condition: V480 (missing or NA)	48,711	579,662	8.4%	588	457,404	0.1%
Bldg Workmanship V490	559,821	579,662	96.6%	440,385	457,404	96.3%
Year Built V500	57,349	579,662	9.9%	3,106	457,404	0.7%

Table 9: Exterior Quality by Class of Property

Exterior Condition	Property Type											
	1. Residential		2: Hotels and Apartments		3: Store with Dwelling		4: Commercial		5: Industrial		6: Vacant Land	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
0: Not Applicable	588	0.1%	261	0.6%	448	3.0%	2,159	14.3%	255	5.6%	45,000	99.3%
2: Newer/ Rehabbed	22,394	4.9%	1,896	4.6%	294	1.9%	583	3.9%	123	2.7%	5	0.0%
3: Above Average	16,287	3.6%	1,409	3.4%	484	3.2%	746	5.0%	405	8.9%	6	0.0%
4: Average	388,755	85.0%	34,554	83.3%	12,038	79.6%	10,379	68.9%	3,210	70.9%	269	0.6%
5: Below Average	18,583	4.1%	2,121	5.1%	921	6.1%	593	3.9%	334	7.4%	10	0.0%
6: Vacant	3,092	0.7%	515	1.2%	391	2.6%	452	3.0%	94	2.1%	41	0.1%
7: Sealed/ Open to Weather	7,700	1.7%	717	1.7%	543	3.6%	143	0.9%	105	2.3%	1	0.0%
Total	457,399	100.0%	41,473	100.0%	15,119	100.0%	15,055	100.0%	4,526	100.0%	45,332	100.0%

Table 10: Interior Characteristics

Interior Characteristic	Total Missing or Zero	Total Properties	% Missing or Zero in Total Properties	Total Missing or Zero in Residential	Total Residential Properties	% Missing or Zero in Residential Properties
Floor Plan: V520 (missing data)	528,976	579,662	91.3%	442,234	457,404	96.7%
Total Number of Rooms: V530 (missing data)	234,598	579,662	40.5%	120,967	457,404	26.4%
Total Number Bedrooms: V540	221,931	579,662	38.3%	111,592	457,404	24.4%
Total Number Bathrooms: 550	219,832	579,662	37.9%	108,207	457,404	23.7%
Sum of Bedrooms + Bathrooms	210,907	579,662	36.4%	101,457	457,404	22.2%
Basement Type (missing data): V560	275,480	579,662	47.5%	175,679	457,404	38.4%
Fireplaces (zero fireplaces): V580	467,485	579,662	80.6%	445,617	457,404	97.4%
Type of Heat (missing data): V590	312,490	579,662	53.9%	217,288	457,404	47.5%
Type of Fuel (missing data): V600	574,978	579,662	99.2%	453,240	457,404	99.1%
Interior Condition (missing data): V620	766	579,662	0.1%	30	457,404	0.0%
Central Air: V610	340,477	579,662	58.7%	241,267	457,404	52.7%
Amenity: V630	577,111	579,662	99.6%	455,097	457,404	99.5%
Utility Coding: V650	576,344	579,662	99.4%	454,744	457,404	99.4%
Sewer: V660	576,344	579,662	99.4%	454,744	457,404	99.4%
Living Area V680	46,738	579,662	8.1%	360	457,404	.8%

Table 11: Interior Condition Detail by Class of Property

Interior Condition	Type of Property Class											
	1: Residential		2: Hotels and Apartments		3: Store with Dwelling		4: Commercial		5: Industrial		6: Vacant Land	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0: Not Applicable	542	0.1%	216	0.5%	440	2.9%	2,105	14.0%	255	5.6%	44,973	99.3%
2: Newer/Rehabbed	22,954	5.0%	1,931	4.7%	299	2.0%	583	3.9%	123	2.7%	5	0.0%
3: Above Average	13,916	3.0%	1,264	3.0%	445	2.9%	630	4.2%	391	8.6%	6	0.0%
4: Average	391,772	85.7%	34,795	83.9%	12,100	80.0%	10,547	70.1%	3,224	71.2%	273	0.6%
5: Below Average	17,531	3.8%	2,045	4.9%	899	5.9%	597	4.0%	333	7.4%	10	0.0%
6: Vacant/No Occupancy	2,948	0.6%	503	1.2%	393	2.6%	447	3.0%	95	2.1%	42	0.1%
7: Sealed/Open to Weather	7,711	1.7%	716	1.7%	543	3.6%	143	1.0%	105	2.3%	1	0.0%
Total Non-Missing	457,374	100%	41,470	100%	15,119	100%	15,052	100%	4,526	100%	45,310	100%
Missing	30		4		1		7		3		766	
Total	457,404		41,474		15,120		15,059		4,529		46,076	

Table 12: Building Workmanship by Class of Property

Building Workmanship	1: Residential		2: Hotels and Apartments		3: Store with Dwelling		4: Commercial		5: Industrial		6: Vacant Land	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1: Low	6	0.0%	1	0.1%	2	0.7%	2	0.2%	2	2.9%	0	0.0%
2: Below Average	19	0.1%	6	0.4%	3	1.1%	7	0.9%	3	4.3%	0	0.0%
3: Average	5,904	34.7%	622	39.9%	81	28.4%	610	74.8%	55	79.7%	21	22.1%
4: Above Average	10,829	63.6%	926	59.5%	199	69.8%	192	23.5%	9	13.0%	72	75.8%
5: Superior	29	0.2%	2	0.1%	-	0.0%	2	0.2%	-	0.0%	0	0.0%
6: Highest	232	1.4%	-	0.0%	-	0.0%	3	0.4%	-	0.0%	2	2.1%
Total Not Missing	17,019	100.0%	1,557	100.0%	285	100.0%	816	100.0%	69	100.0%	95	100.0%
Missing	440,385	96.3%	39,917	96.2%	14,835	98.1%	14,243	94.6%	4,460	98.5%	45,981	99.8%
Total	457,404		41,474		15,120		15,059		4,529		46,076	

4.0 Measures of Assessment Uniformity and Fairness for Actual 2013 and Proposed 2014 Assessments

In this section, the level, variability, and vertical equity of 2013 assessments and the proposed 2014 assessments are reported. Afterwards, the results across OPA’s 6 classes of properties and then across Philadelphia’s five digit zip codes are presented.

Table 13 shows the overall measures of assessment, uniformity and regressivity. Several observations are in order. First the median sales ratios for 2013 are considerably below the 32%, which Philadelphia has historically stated as its predetermined ratio. It is between 16 and 17%. Second, the proposed 2014 median sales ratios are higher than 100% which suggests that many properties are being valued above their sales prices. Third, the COD, the measure of regressivity, is actually worse in 2014 than in 2013. Only by tossing out sales of \$10,000 or less is one able to reduce the 2014 COD to 70% which is over four times higher than the upper bound of 15% of the IAAO recommended standard. Finally, the 2014 proposed assessed values display considerably *worse* regressivity---more expensive properties are assessed at lower fractions of market value than less expensive properties---than in 2013, and in both old and new assessments the measured regressivity is materially beyond the upper bound of 1.03 recommended by the International Association of Assessing Officers.

Table 13: COD, PRD and Median Sales Ratio for All Property Classes

	Median Sales Ratio 2013 Assessment	Median Sales Ratio 2014 Assessment	COD 2013 Assessment	COD 2014 Assessment	PRD 2013 Assessment	PRD 2014 Assessment
All Property Class, Sale Price > \$1,000	16.9%	133.8%	84.26	117.06	1.74	2.27
All Property Class, Sale Price > \$10,000	15.8%	124.4%	60.03	70.91	1.38	1.63

4.1 Overall Results for Median Sales Ratios, CODs and PRDs by Property Class

4.1.1 Median Assessment ratios before and after reassessment by class of property

The very disappointing pattern of results in Table 13 is equally evident when the various quality measures are applied across classes of property. Again, in 2013, the median sales ratio (AV/P) for sales of taxable properties were well below the 32% which Philadelphia has stated is its

predetermined ratio. Single family and vacant land displayed sales ratios of 17%, while industrial property, mixed use and commercial property displayed sales ratios of between 22 and 24%. The proposed 2014 reassessments overshoot 100% of market value by a fair bit. The median single family property displays a medians sales ratio of 132%, while mixed use properties display a median 2014 sales ratio of 239%. (See Table 14 and 15 below)

Table 14: Median Sales Ratios for 2013 and 2014 by Property Class

5 years Arm Length Sales, Sale Price >\$1,000 (No Inflation Adjustment)

Property Class	Median Sales Ratio 2013 Assessment	Median Sales Ratio 2014 Assessment	Number of Sales Used
Single Family	17%	132%	30056
Multi-Family	18%	139%	2540
Mixed-Use	22%	239%	1088
Commercial	22%	152%	662
Industrial	24%	115%	291
Vacant Land	17%	93%	1016

Table 15: Median Sales Ratios for 2013 and 2014 by Property Class

5 years Arm Length Sales, Sale Price >\$10,000 (No Inflation Adjustment)

Property Class	Median Sales Ratio 2013 Assessment	Median Sales Ratio 2014 Assessment	Number of Sales Used
Single Family	15%	123%	27405
Multi-Family	17%	132%	2399
Mixed-Use	20%	215%	994
Commercial	21%	145%	632
Industrial	24%	112%	282
Vacant Land	9%	49%	590

4.1.2 COD's before and after reassessment

While the IAAO recommends CODs for urban, residential property of between 5 and 15%, the residential CODs for 2013 were about 4 times the IAAO upper bound,(compare 82% in 2013), and surprisingly are actually higher in 2014 than in 2013. The 2014 residential COD is found to be 111% in 2014. Table 16 and 17 show the COD's for sales over \$1,000 and \$10,000 respectively.

Table 16: COD for 2013 and 2014 by Property Class

5 years Arm Length Sales, Sale Price >\$1,000 (No Inflation Adjustment)

Property Class	COD 2013 Assessment	COD 2014 Assessment	Number of Sales Used
Single Family	82.04	111.69	30056
Multi-Family	93.49	135.26	2540
Mixed-Use	74.19	112.87	1088
Commercial	82.03	161.07	662
Industrial	96.29	126.30	291
Vacant Land	107.59	158.18	1016

Table 17: COD for 2013 and 2014 by Property Class

5 years Arm Length Sales, Sale Price >\$10,000 (No Inflation Adjustment)

Property Class	COD 2013 Assessment	COD 2014 Assessment	Number of Sales Used
Single Family	58.26	65.57	27405
Multi-Family	59.88	80.87	2399
Mixed-Use	53.43	69.26	994
Commercial	73.12	122.03	632
Industrial	84.29	109.64	282
Vacant Land	131.99	171.71	590

4.1.3 PRD Before and After Reassessment

Again, the calculated PRD's across property classes are even more disappointing than the CODs for residential property. Recall that the IAAO recommends that a PRD lie between .98 and 1.03; the 2013 PRD for residential property in Philadelphia is more than twice that level in 2013, and two and one half time larger in 2014. Every type of property being assessed displays greater regressivity under the 2014 proposed assessments than under the 2013 assessments. (See Table 18 and 19 below)

Table 18: PRD for 2013 and 2014 by Property Class

5 years Arm Length Sales, Sale Price >\$1,000 (No Inflation Adjustment)

Property Class	PRD 2013 Assessment	PRD 2014 Assessment	Number of Sales Used
Single Family	2.16	2.49	30056
Multi-Family	1.73	2.33	2540
Mixed-Use	1.79	2.44	1088
Commercial	1.28	2.30	662
Industrial	1.79	2.12	291
Vacant Land	2.40	1.60	1016

Table 19: PRD for 2013 and 2014 by Property Class

5 years Arm Length Sales, Sale Price >\$10,000 (No Inflation Adjustment)

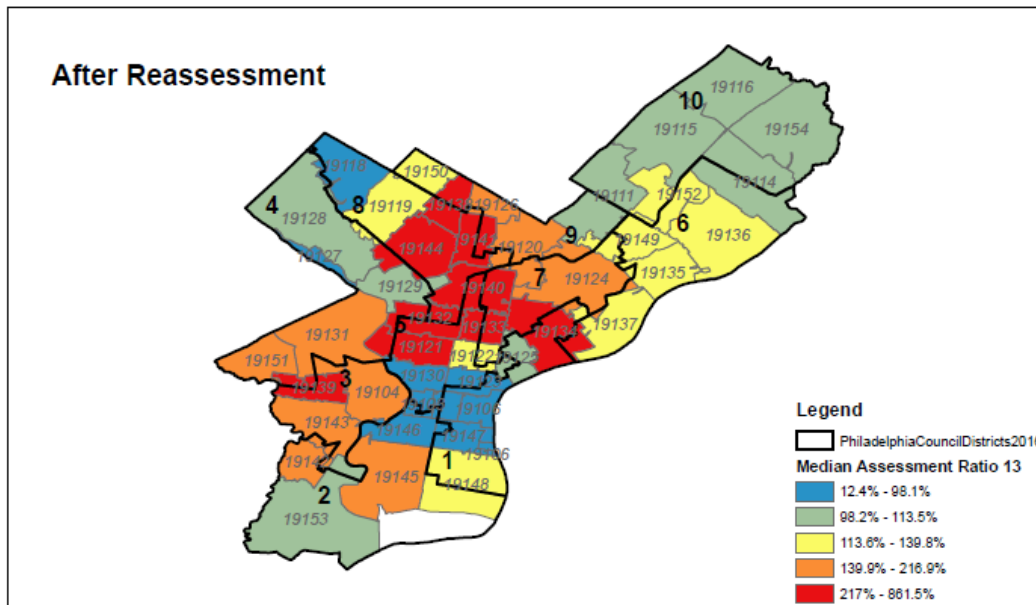
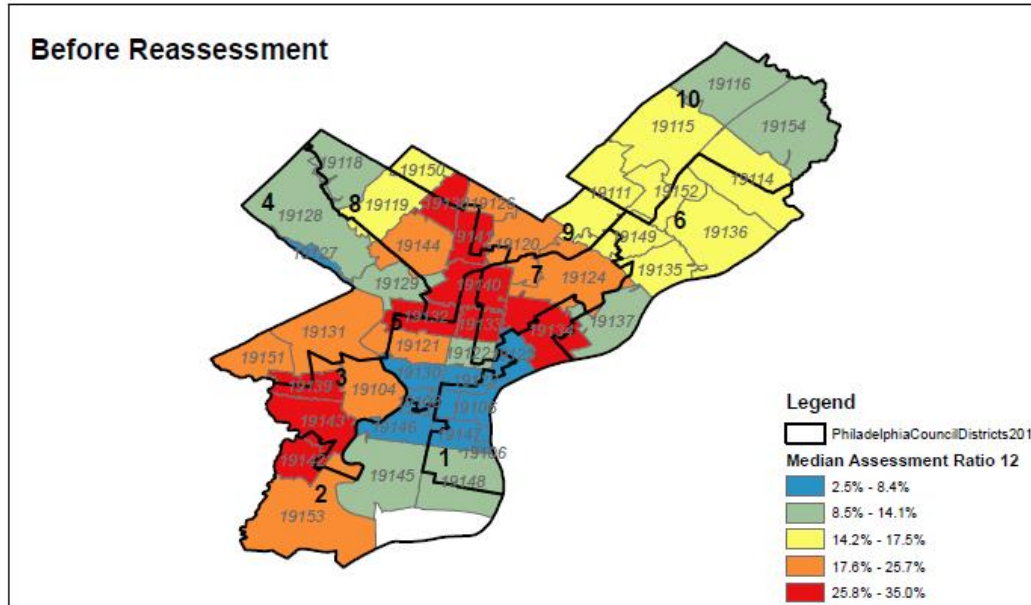
Property Class	PRD 2013 Assessment	PRD 2014 Assessment	Number of Sales Used
Single Family	1.72	1.78	27405
Multi-Family	1.33	1.66	2399
Mixed-Use	1.45	1.74	994
Commercial	1.16	1.82	632
Industrial	1.64	1.89	282
Vacant Land	1.53	0.93	590

4.2 Residential Assessment Results in 2013 and 2014 Proposed by Zip Code

In this and following sections, taxable, residential assessment patterns before and after reassessment are displayed across Philadelphia's 46 zip codes in terms of median assessment ratios using OPA Arms Length designations *and* using sales of over \$1,000 and sales of over \$10,000. PRDs of the same data are displayed across the 46 5 digit zip codes. Section 4.3 then displays summary results of CODs, Median Assessment ratios and PRDs before and after reassessment for 8 other limitations on the underlying data. Note that each of the zip code maps below also displays the outline of the 10 City Council districts

4.2.1 Median Assessment Ratios by Zip Code before and after Reassessment

Figure 7: Philadelphia Median Assessment Ratio by 5 Digit Zip Code Inflation adjusted prices for all 5 years using FARGO Index; Council Districts 1-10 in black outline. 5 years OPA Defined Arm length sales, Taxable Residential Properties Sale Price > \$1,000



0 3 6 12 Miles

Source: US Census Bureau
Philadelphia GIS Database
Philadelphia OPA

Table 20: Philadelphia Median Assessment Ratio by 5 Digit Zip Code

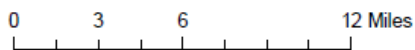
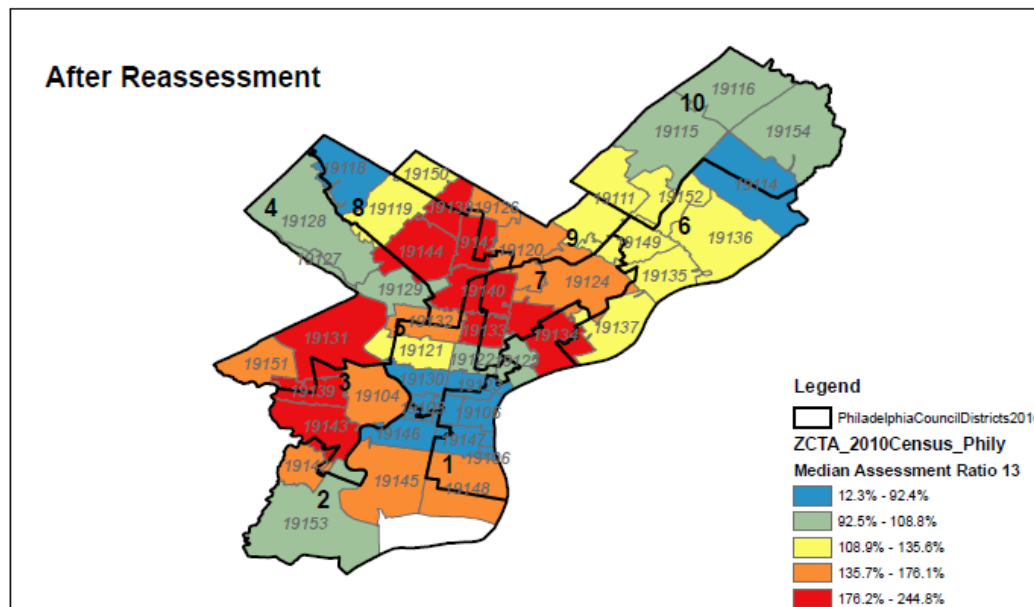
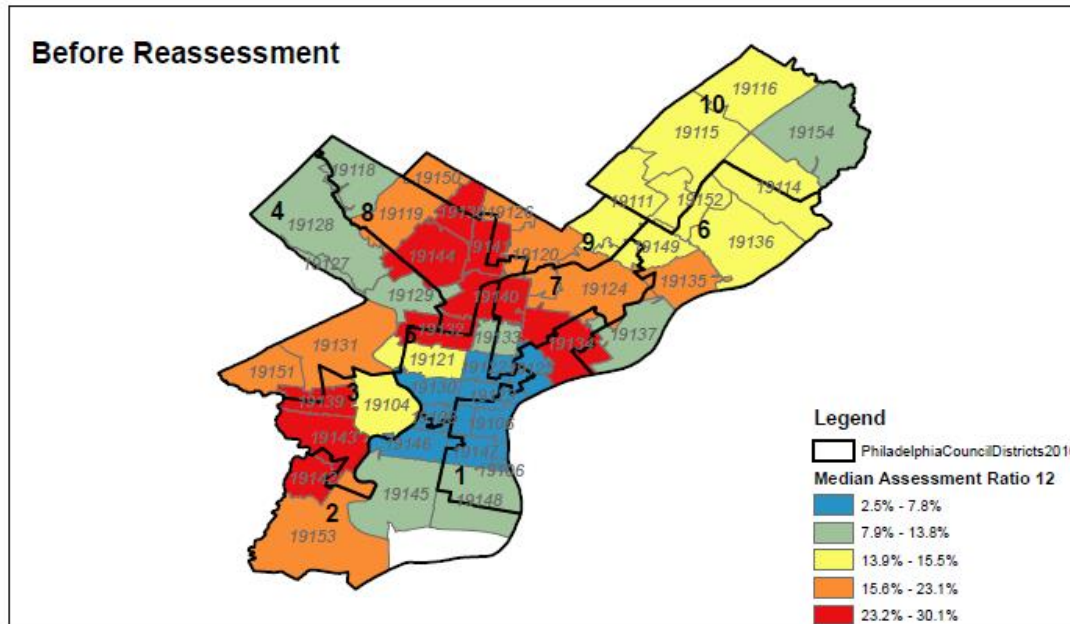
Inflation adjusted prices for all 5 years using FARGO Index; 5 years OPA Defined Arm length sales, Taxable Residential Properties Sale Price > \$1,000

ZIP CODE	Median Sales Ratio 2013 Assessment	Median Sales Ratio 2014 Assessment
19102	2.50%	12.40%
19103	6.90%	59.00%
19104	19.10%	216.90%
19106	7.00%	63.80%
19107	6.80%	73.70%
19111	15.40%	113.50%
19114	15.50%	101.50%
19115	15.50%	101.20%
19116	14.10%	103.10%
19118	13.00%	91.30%
19119	15.80%	123.30%
19120	21.70%	164.20%
19121	25.30%	218.50%
19122	8.50%	129.30%
19123	4.40%	19.40%
19124	22.00%	168.50%
19125	8.10%	108.00%
19126	19.80%	151.10%
19127	8.40%	96.10%
19128	11.90%	98.80%
19129	13.10%	100.80%
19130	7.80%	90.00%
19131	24.80%	198.60%
19132	31.50%	223.00%
19133	35.00%	861.50%
19134	29.30%	244.40%
19135	17.50%	135.90%
19136	15.40%	119.30%
19137	12.80%	127.90%
19138	26.70%	221.80%
19139	28.40%	262.70%
19140	31.90%	321.90%
19141	26.10%	231.30%
19142	31.50%	186.90%
19143	30.10%	214.00%
19144	25.70%	261.30%
19145	14.00%	157.90%
19146	5.90%	98.10%
19147	7.10%	92.70%
19148	10.70%	139.80%
19149	15.30%	120.00%
19150	17.20%	126.00%
19151	19.80%	162.50%
19152	15.20%	114.00%
19153	19.2%	105.3%
19154	13.80%	108.80%

Figure 8: Philadelphia Median Assessment Ratio by 5 Digit Zip Code

Inflation adjusted prices for all 5 years using FARGO Index; Council Districts 1-10 in black outline.

5 years OPA Defined Arm length sales, Taxable Residential Properties Sale Price > \$10,000



Source: US Census Bureau
Philadelphia GIS Database
Philadelphia OPA

Table 21: Philadelphia Median Assessment Ratio by 5 Digit Zip Code

Inflation adjusted prices for all 5 years using FARGO Index; 5 years OPA Defined Arm length sales, Taxable Residential Properties Sale Price > \$10,000

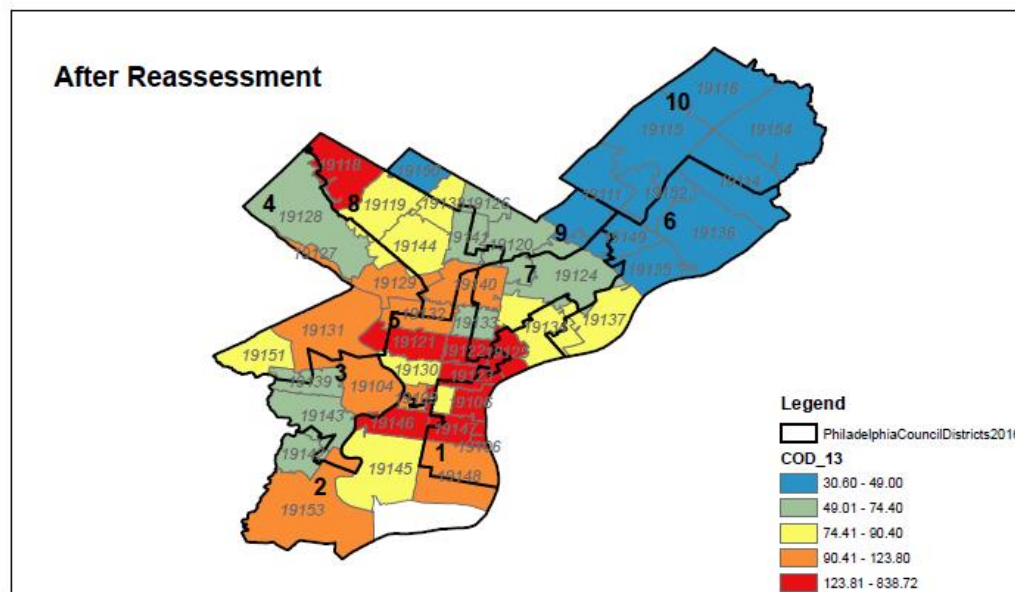
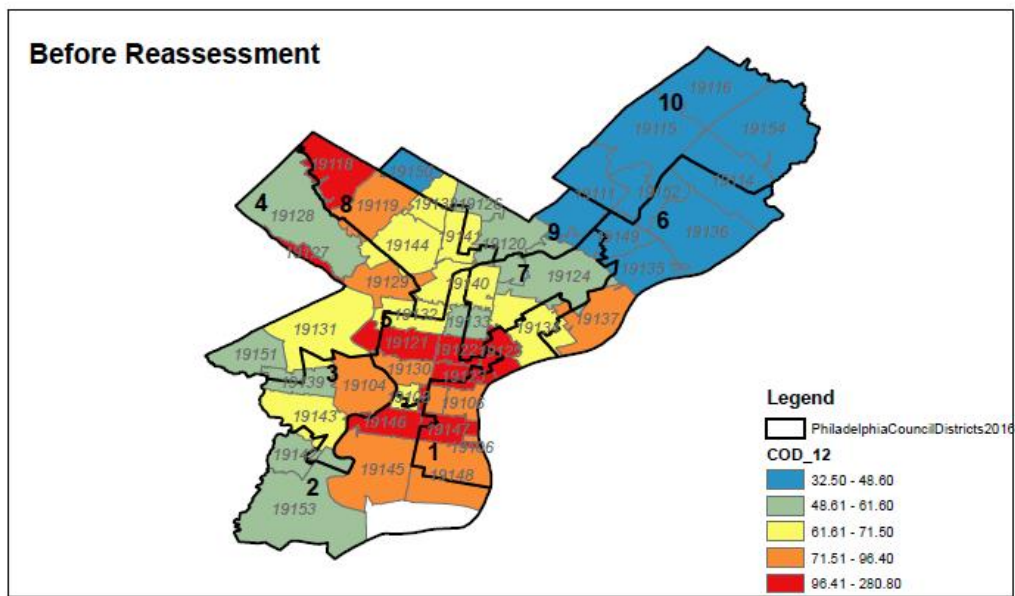
ZIP CODE	Median Sales Ratio 2013 Assessment	Median Sales Ratio 2014 Assessment
19102	2.50%	12.30%
19103	6.90%	59.00%
19104	14.10%	157.40%
19106	6.90%	62.80%
19107	6.60%	73.20%
19111	15.30%	113.50%
19114	15.50%	17.20%
19115	15.50%	101.20%
19116	14.10%	103.10%
19118	13.00%	91.00%
19119	15.70%	122.90%
19120	21.40%	160.70%
19121	14.90%	131.40%
19122	5.20%	96.70%
19123	4.40%	18.90%
19124	21.40%	163.20%
19125	7.50%	101.20%
19126	19.70%	150.40%
19127	8.40%	96.10%
19128	11.90%	98.80%
19129	12.90%	96.50%
19130	7.80%	89.90%
19131	23.10%	178.80%
19132	23.70%	166.80%
19133	10.70%	231.30%
19134	24.80%	206.60%
19135	17.40%	135.60%
19136	15.40%	119.20%
19137	12.70%	126.50%
19138	25.50%	212.70%
19139	25.90%	239.10%
19140	25.90%	244.80%
19141	25.30%	227.50%
19142	30.10%	176.10%
19143	27.80%	195.60%
19144	24.10%	240.40%
19145	13.50%	148.20%
19146	4.70%	87.60%
19147	7.00%	92.40%
19148	10.60%	136.70%
19149	15.30%	119.90%
19150	17.20%	125.80%
19151	19.2%	160.6%
19152	15.20%	113.90%
19153	19%	105%
19154	13.80%	108.80%

4.2.2 COD's by zip codes before and after reassessment

Figure 9: Philadelphia Median COD by 5 Digit Zip Code

Inflation adjusted prices for all 5 years using FARGO Index; Council Districts 1-10 in black outline.

5 years OPA Defined Arm length sales, Taxable Residential Properties Sale Price > \$1,000



0 3 6 12 Miles

Source: US Census Bureau
Philadelphia GIS Database
Philadelphia OPA

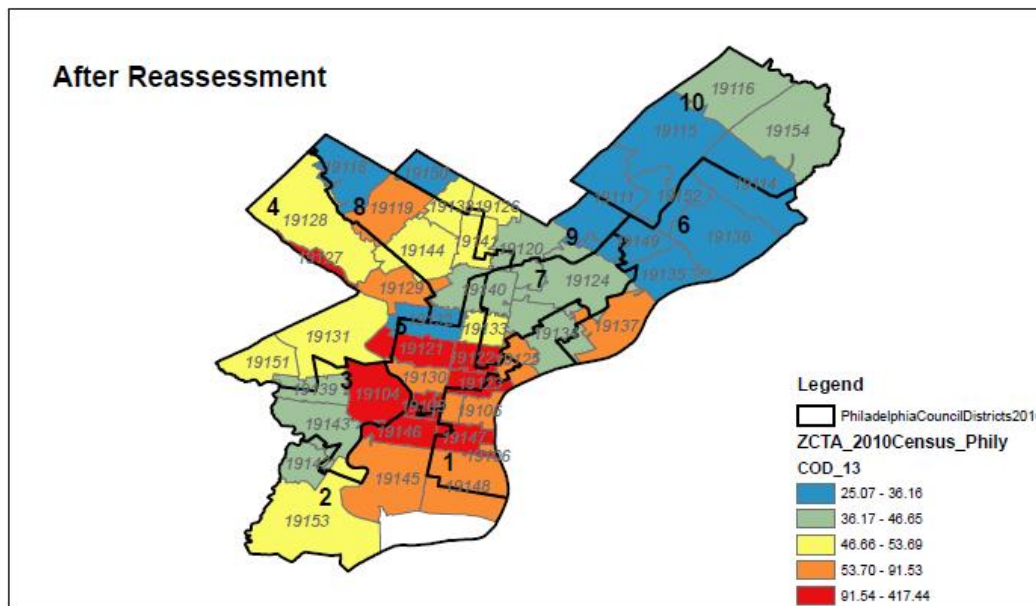
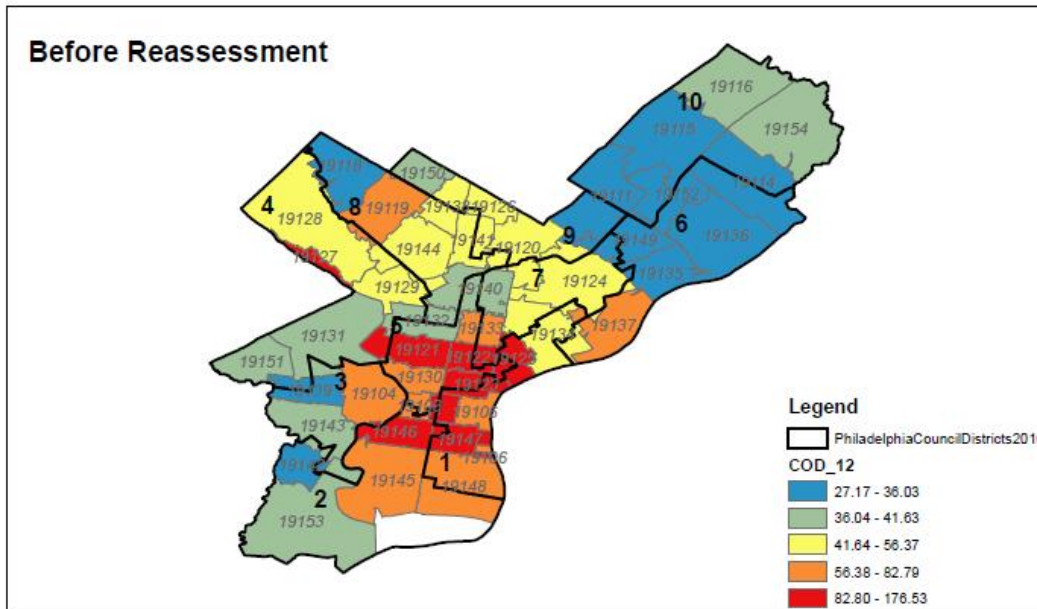
Table 22: Philadelphia Median COD by 5 Digit Zip Code Inflation adjusted prices for all 5 years using FARGO Index, 5 years OPA Defined Arm length sales, Taxable Residential Properties Sale Price > \$1,000

ZIP CODE	COD 2013 Assessment	COD 2014 Assessment	Number of Sales Used
19102	290.31	882.67	112
19103	72.17	101.64	421
19104	81.95	120.32	296
19106	87.08	125.47	369
19107	99.79	83.15	172
19111	31.68	30.39	1130
19114	31.93	35.29	522
19115	33.03	33.33	554
19116	38.87	40.46	502
19118	202.84	225.70	111
19119	74.85	85.72	393
19120	58.12	64.74	1309
19121	98.94	130.95	508
19122	173.89	294.41	232
19123	203.46	506.23	364
19124	58.25	67.44	1737
19125	131.71	147.06	605
19126	60.23	52.98	175
19127	115.03	89.98	162
19128	52.26	49.94	611
19129	80.39	93.44	178
19130	74.49	83.45	520
19131	71.24	94.31	685
19132	69.19	99.81	863
19133	57.40	65.26	476
19134	70.10	85.01	1953
19135	37.78	40.21	1010
19136	37.96	37.99	748
19137	73.91	77.84	230
19138	69.27	81.50	624
19139	56.34	61.49	777
19140	69.15	92.17	1083
19141	61.40	62.52	402
19142	59.97	75.08	1065
19143	70.14	74.61	1204
19144	72.35	77.92	623
19145	70.23	82.38	986
19146	238.82	248.93	1244
19147	113.90	123.93	748
19148	77.59	96.07	966
19149	33.63	34.07	1371
19150	47.28	48.08	292
19151	60.29	83.38	504
19152	32.03	29.51	562
19153	59.74	108.74	216
19154	32.84	32.92	439
TOTAL	81.98	111.69	30056

Figure 10: Philadelphia Median COD by 5 Digit Zip Code

Inflation adjusted prices for all 5 years using FARGO Index; Council Districts 1-10 in black outline.

5 years OPA Defined Arm length sales, Taxable Residential Properties Sale Price > \$10,000



0 3 6 12 Miles

Source: US Census Bureau
Philadelphia GIS Database
Philadelphia OPA

Table 23: Philadelphia Median COD by 5 Digit Zip Code Inflation adjusted prices for all 5 years using FARGO Index, 5 years OPA Defined Arm length sales, Taxable Residential Properties Sale Price > \$10,000

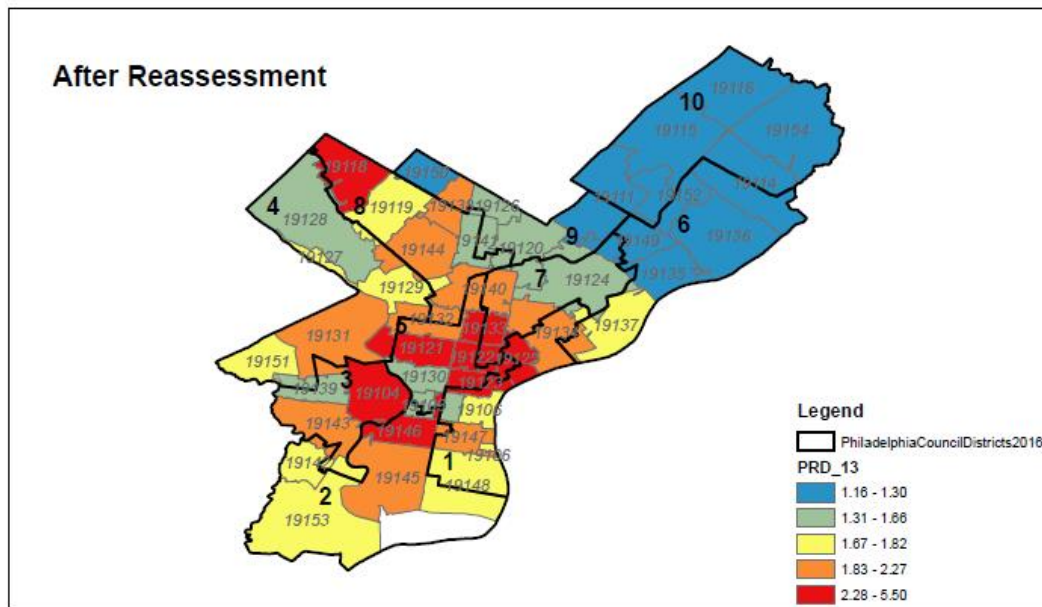
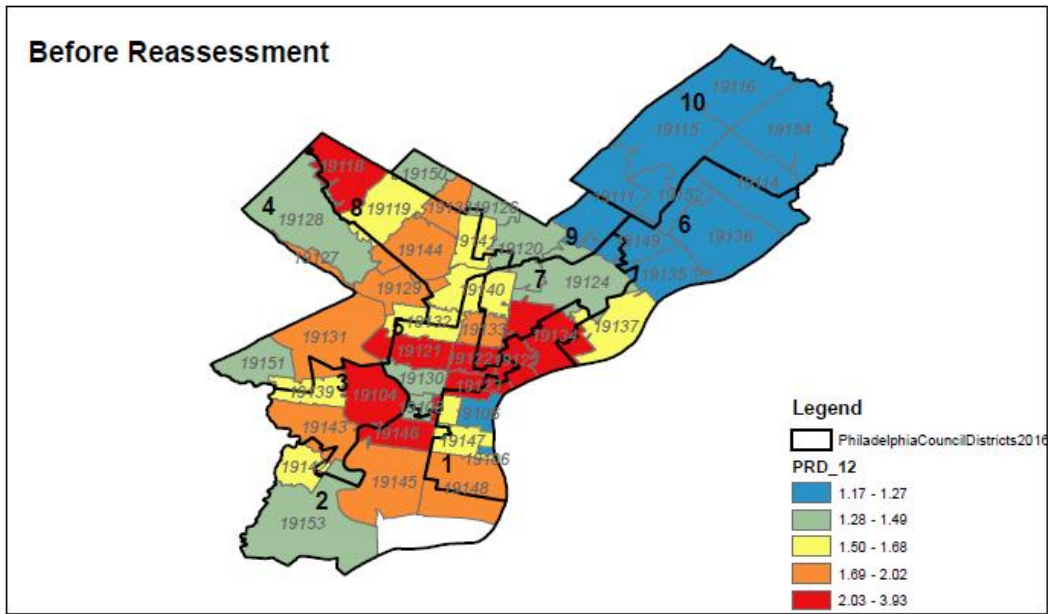
ZIP CODE	COD 2013 Assessment	COD 2014 Assessment	Number of Sales Used
19102	95.07	306.65	111
19103	67.48	92.99	421
19104	81.83	99.42	240
19106	82.79	90.32	368
19107	89.76	78.33	170
19111	31.72	30.60	1128
19114	32.47	35.74	522
19115	34.43	33.89	554
19116	40.51	41.78	502
19118	31.78	28.42	110
19119	65.60	78.25	389
19120	41.69	45.80	1275
19121	87.79	95.08	318
19122	137.53	113.83	180
19123	159.21	417.45	361
19124	41.87	46.65	1661
19125	89.56	91.53	555
19126	53.76	48.66	173
19127	119.92	95.34	162
19128	54.02	51.72	611
19129	56.37	74.24	170
19130	77.14	84.65	519
19131	41.63	52.93	603
19132	38.16	35.69	498
19133	73.29	48.38	95
19134	44.40	43.31	1518
19135	35.23	36.16	1004
19136	35.84	35.59	745
19137	69.45	71.45	226
19138	47.53	53.26	587
19139	34.03	38.62	657
19140	41.07	40.32	734
19141	43.71	47.24	385
19142	36.03	43.36	974
19143	41.38	46.60	1060
19144	49.16	52.29	562
19145	65.07	66.77	942
19146	176.53	133.05	1115
19147	103.56	110.53	742
19148	65.35	78.72	942
19149	31.19	31.01	1367
19150	36.13	36.17	290
19151	39.25	53.69	484
19152	27.17	25.07	561
19153	37.35	50.57	214
19154	36.06	36.46	439
TOTAL	61.65	67.60	27246

4.2.3 PRD's by zip codes before and after reassessment

Figure 11: Philadelphia PRD by 5 Digit Zip Code

Inflation adjusted prices for all 5 years using FARGO Index; Council Districts 1-10 in black outline.

5 years OPA Defined Arm length sales, Taxable Residential Properties Sale Price > \$1,000



0 3 6 12 Miles

Source: US Census Bureau
Philadelphia GIS Database
Philadelphia OPA

Table 24: Philadelphia PRD by 5 Digit Zip Code

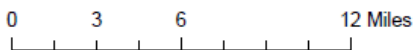
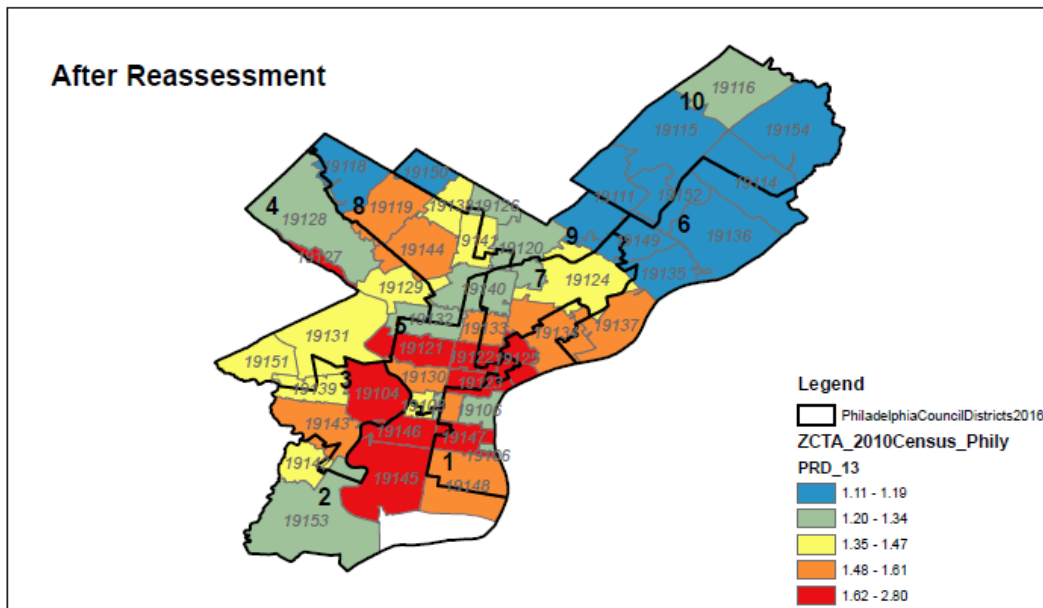
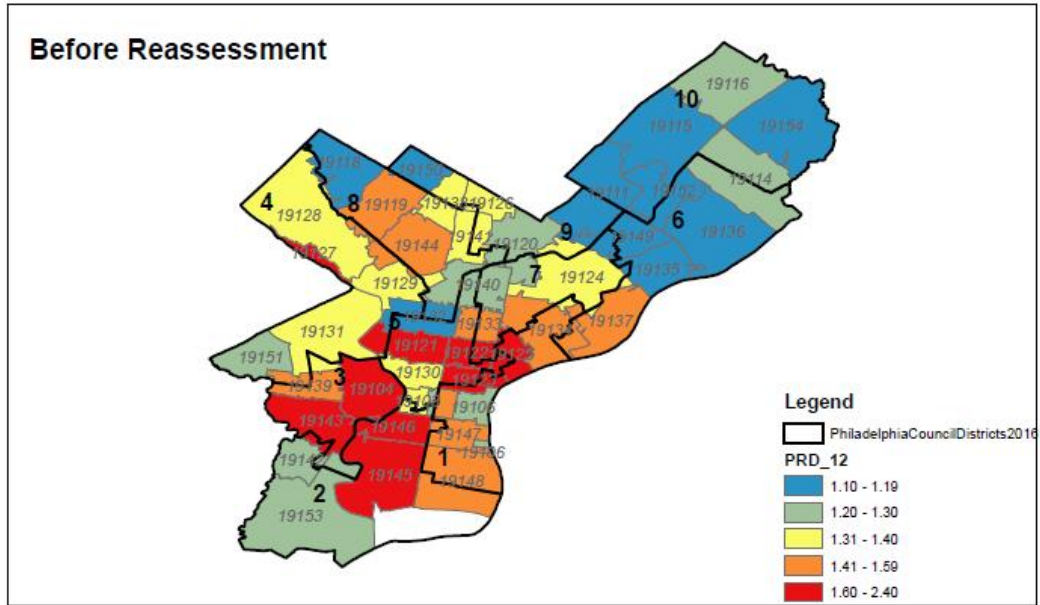
Inflation adjusted prices for all 5 years using FARGO Index, 5 years OPA Defined Arm length sales, Taxable Residential Properties Sale Price > \$1,000

ZIP CODE	PRD 2013 Assessment	PRD 2014 Assessment	Number of Sales Used
19102	2.62	3.03	112
19103	1.36	1.44	421
19104	2.63	3.10	296
19106	1.27	1.70	369
19107	1.55	1.66	172
19111	1.18	1.17	1130
19114	1.20	1.19	522
19115	1.19	1.17	554
19116	1.27	1.30	502
19118	2.76	3.10	111
19119	1.64	1.75	393
19120	1.40	1.45	1309
19121	3.76	4.03	508
19122	3.02	5.20	232
19123	2.39	2.95	364
19124	1.48	1.58	1737
19125	2.32	2.69	605
19126	1.46	1.40	175
19127	1.98	1.74	162
19128	1.36	1.34	611
19129	1.69	1.76	178
19130	1.36	1.62	520
19131	1.74	2.03	685
19132	1.59	1.91	863
19133	2.01	2.30	476
19134	2.07	2.27	1953
19135	1.21	1.22	1010
19136	1.21	1.21	748
19137	1.64	1.73	230
19138	1.70	1.86	624
19139	1.67	1.65	777
19140	1.68	1.94	1082
19141	1.58	1.61	402
19142	1.55	1.68	1065
19143	2.02	1.88	1204
19144	1.86	2.01	623
19145	1.90	2.19	986
19146	3.93	5.50	1244
19147	1.68	2.23	748
19148	1.68	1.82	966
19149	1.17	1.17	1371
19150	1.27	1.27	292
19151	1.49	1.67	504
19152	1.18	1.16	562
19153	1.41	1.78	216
19154	1.18	1.18	439
TOTAL	2.21	2.55	30055

Figure 12: Philadelphia PRD by 5 Digit Zip Code

Inflation adjusted prices for all 5 years using FARGO Index; Council Districts 1-10 in black outline.

5 years OPA Defined Arm length sales, Taxable Residential Properties Sale Price > \$10,000



Source: US Census Bureau
Philadelphia GIS Database
Philadelphia OPA

Table 25: Philadelphia PRD by 5 Digit Zip Code

Inflation adjusted prices for all 5 years using FARGO Index, 5 years OPA Defined Arm length sales, Taxable Residential Properties Sale Price > \$10,000

ZIP CODE	PRD 2013 Assessment	PRD 2014 Assessment	Number of Sales Used
19102	1.23	1.22	111
19103	1.36	1.44	421
19104	2.03	2.14	240
19106	1.23	1.27	368
19107	1.45	1.58	170
19111	1.17	1.16	1128
19114	1.20	1.19	522
19115	1.19	1.17	554
19116	1.27	1.30	502
19118	1.10	1.15	110
19119	1.49	1.61	389
19120	1.24	1.26	1275
19121	2.40	2.40	318
19122	1.67	2.02	180
19123	1.94	2.40	361
19124	1.30	1.35	1661
19125	1.68	1.82	555
19126	1.37	1.33	173
19127	1.98	1.74	162
19128	1.36	1.34	611
19129	1.34	1.44	170
19130	1.36	1.59	519
19131	1.34	1.47	603
19132	1.18	1.25	498
19133	1.52	1.54	95
19134	1.59	1.59	1518
19135	1.16	1.17	1004
19136	1.17	1.17	745
19137	1.52	1.59	226
19138	1.40	1.46	587
19139	1.41	1.37	657
19140	1.27	1.29	734
19141	1.35	1.40	385
19142	1.30	1.35	974
19143	1.60	1.48	1060
19144	1.52	1.59	562
19145	1.71	1.86	942
19146	2.36	2.80	1115
19147	1.52	1.99	742
19148	1.49	1.58	942
19149	1.13	1.14	1367
19150	1.15	1.15	290
19151	1.25	1.36	484
19152	1.12	1.11	561
19153	1.19	1.28	214
19154	1.18	1.18	439
TOTAL	1.75	1.81	27246

4.3 Other Experiments in Calculating Assessment Quality Measures.

While it has been stated that OPA’s COD is 13.9%, we have not been able to find such a ratio after applying typical data trimming rules. Table 26 and 27 show the overall results for eight looks at the OPA sales data. Median 2014 sales ratios remain stubbornly above 100%, measures of assessment uniformity remain at least 3 times recommended levels of assessment non-uniformity, and the regressivity in the new assessments continues to be 60% above the IAAO standard.

Table 26: Taxable Residential Properties with Sale Price > \$1,000

	COD 2013 Assessment	COD 2014 Assessment	PRD 2013 Assessment	PRD 2014 Assessment	Median Sales Ratio 2013 Assessment	Median Sales Ratio 2014 Assessment
No Inflation Adjustment, 5 Year of Sale (2008-2012)	82.04	111.69	2.16	2.49	16.5%	131.8%
Inflation Adjusted, 5 Year of Sale (2008-2012)	81.98	111.69	2.21	2.55	16.5%	131.7%
No Inflation Adjustment, 2 Year of Sale (2011-2012)	94.73	113.06	2.09	2.25	14.5%	119.4%
Inflation Adjusted, 2 Years of Sale (2011-2012)	90.31	106.90	2.09	2.25	14.4%	118.3%

Table 27: Taxable Residential Properties with Sale Price > \$10,000

	COD 2013 Assessment	COD 2014 Assessment	PRD 2013 Assessment	PRD 2014 Assessment	Median Sales Ratio 2013 Assessment	Median Sales Ratio 2014 Assessment
No Inflation Adjustment, 5 Year of Sale (2008-2012)	58.26	65.57	1.72	1.78	15.3%	122.8%
Inflation Adjusted, 5 Year of Sale (2008-2012)	58.16	65.58	1.72	1.78	15.4%	122.7%
No Inflation Adjustment, 2 Year of Sale (2011-2012)	59.50	62.74	1.63	1.66	13.8%	113.1%
Inflation Adjusted, 2 Years of Sale (2011-2012)	59.40	62.67	1.63	1.65	13.8%	112.9%

5.0 Spatial Patterns of Assessment Quality and Ethnicity, Median and Mean Income

In this section the results of measuring the level, uniformity, and regressivity of the 2013 and proposed 2014 assessments are juxtaposed to patterns of ethnicity and income of the residents of the 46 zipcodes in Philadelphia. First maps of ethnicity and mean and median income are presented, and then the assessment measures from Section 4 above are correlated to ethnicity and income measures. The purpose of this section is to inquire whether or not ethnic groups differentially benefit or not from the reassessment, and whether or not the regressivity results

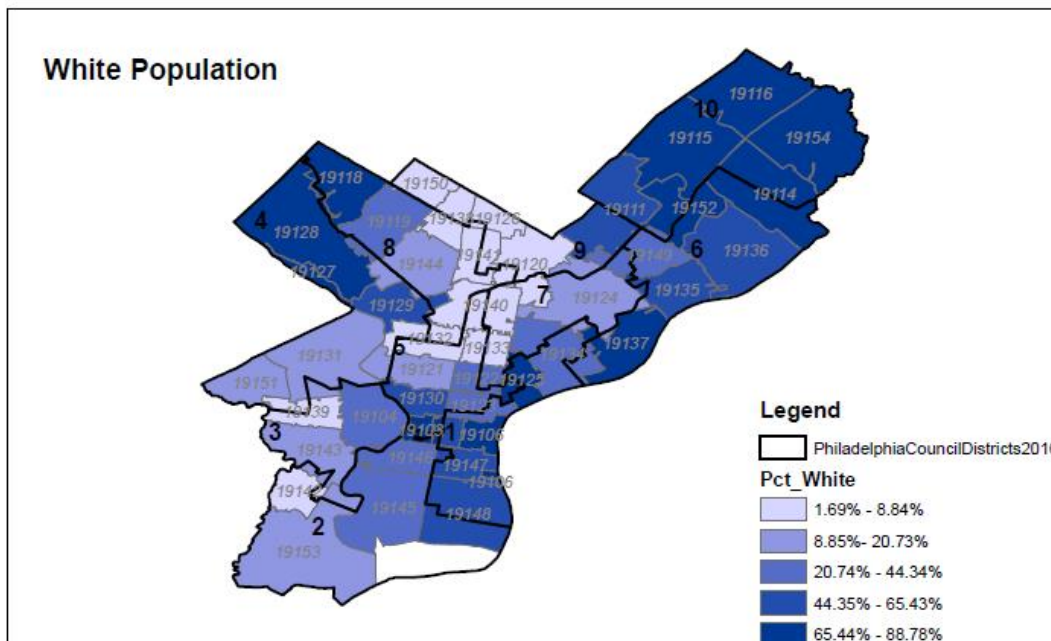
reported above are equally apparent when examining median incomes of the areas in which the assessment results are being measured.

5.1 2010 Census of Population Ethnicity Patterns by Zip Code

Philadelphia has been racially diverse for many, many years, and a question arises how the above assessment quality measures related to living patterns of whites and blacks. Figures 13 display the 2010 Census of Population’s ethnic counts by 5 digit zip code and City Council district. As is well known, the living patterns by ethnicity in Philadelphia are rather concentrated.

Figure 14 and 15 display, respectively the mean and median taxable individual income by zipcode. These income data are due to the Pennsylvania Department of Revenue.

Figure 13: Ethnicity Patterns in Philadelphia by Zip Code, 2010 Census



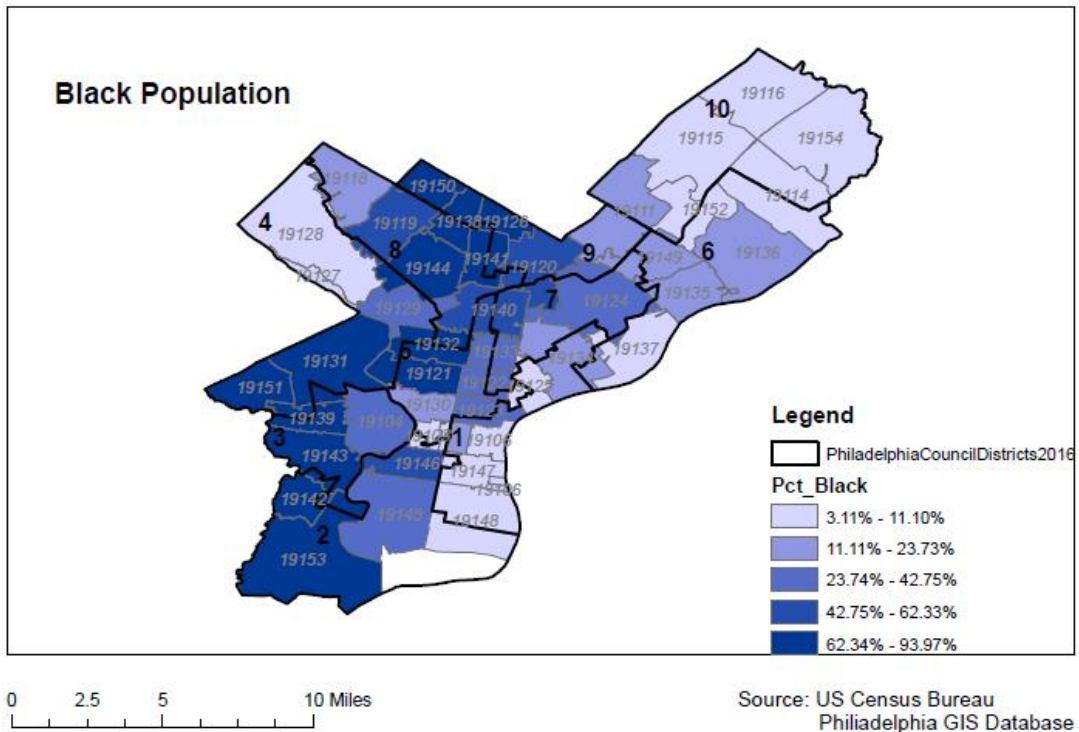


Figure 14: Distribution of Mean Income in Philadelphia by Zip Code, 2010 Census

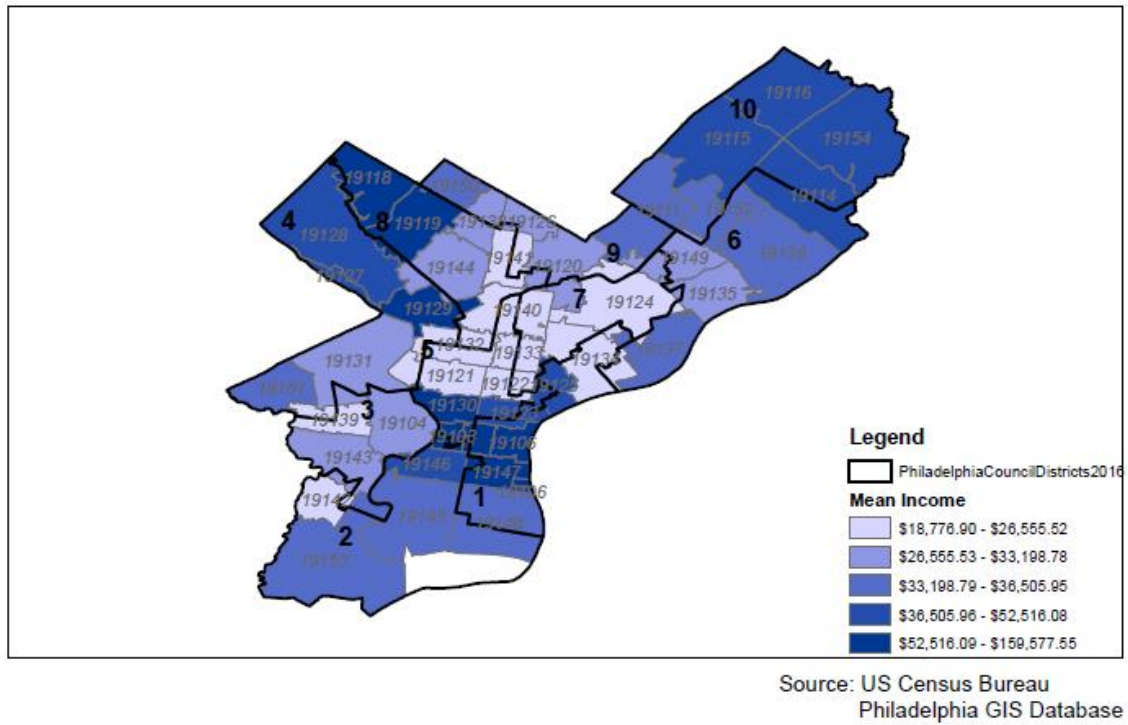
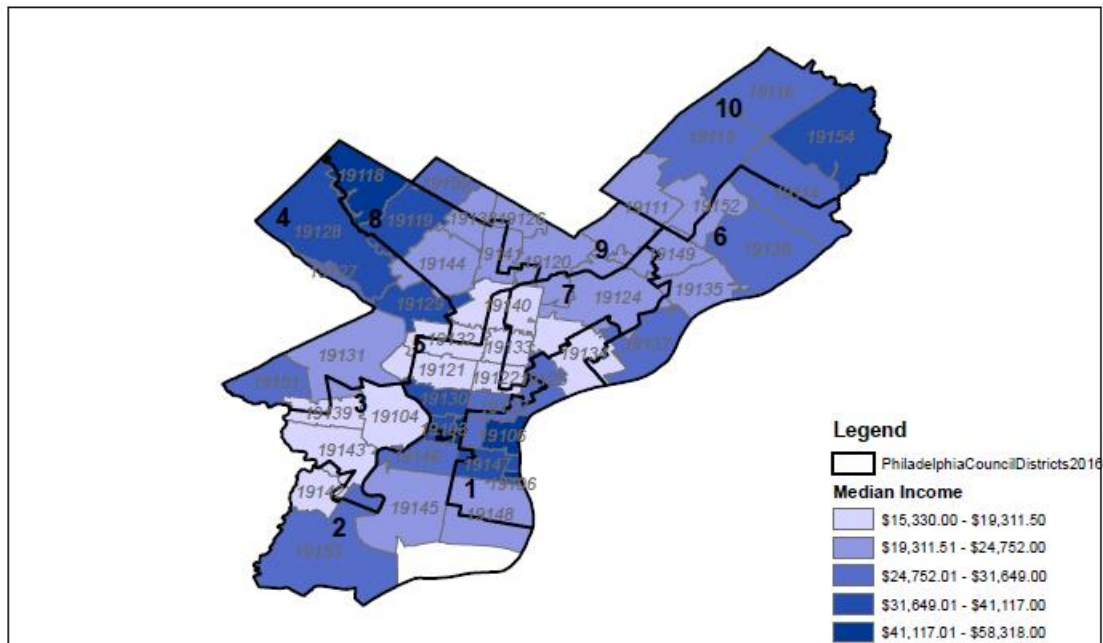


Figure 15: Distribution of Median Income in Philadelphia by Zip Code, 2010 Census



Source: US Census Bureau
Philadelphia GIS Database

5.2 Correlations of 2013 and 2014 Sales Ratios, Mean and Median Earnings, Ethnicity across Zip Codes

In comparing two sets of numbers across 46 zip codes, there are several questions to be answered. First, do the numbers show a positive or negative relationship? Second, is the relationship systematic or not. Third, if the relationship is systematic, is it numerically substantial? A simple correlation between two variables can answer the first question. The so-called Pearson r varies between -1.0 and $+1.0$ answers. When it is negative, it means that as one variable value goes up, the other goes down and vice versa. If the correlation coefficient is very large and close to -1.0 or $+1.0$, one can infer that the relationship is increasingly systematic. One can inquire if the observed correlation is due to chance and is thereby misleading, or is large, and not due to chance. Finally, by looking at the extent to which one variable and another move together, one can answer the third question.

Table 28 reports the simple correlations between median assessment ratios for 2013 and 2014 and percent black, percent white, and percent Hispanic from the 2010 Census. It is quite apparent from this calculation that there is a positive and statistically significant relationship

between the Median Sales Ratio and the Percent Black from the 2010 Census. Conversely, there is an inverse and statistically significant relationship between the median residential sales ratio and percent White. While the results are not due to chance in 2013 or 2014, the strength of the relationship as measured by the size of the correlation coefficient is lower in 2014 than in 2013 for blacks and whites. On the other hand, we also observe that Hispanic areas are more heavily assessed in 2014 than in 2013, and that the strength or size of that relationship doubled. Finally, it is interesting to note that there is no statistically significant relationship between ethnicity and the COD or measure of assessment uniformity in either 2013 or 2014. (See Table 29)

Table 28: Correlation of Median Sales Ratio for 2013 and 2014 and Ethnicity across Philadelphia’s 5 Digit Zip Codes

Median Residential Sales Ratio Measure	Percent Black from 2010 Census	Percent White from 2010 Census	Percent Hispanic from 2010 Census
Median Residential Sales Ratio 2013	0.65025	-0.74407	0.32458
Odds of Correlation being Misleading	<.0001	<.0001	0.0278
Median Residential Sales Ratio 2014	0.31073	-0.52862	0.62502
Odds of Correlation being Misleading	0.0356	0.0002	<.0001

Table 29: Correlation COD and Mean and 2010 Ethnicity across Philadelphia’s 5 Digit Zip Codes

Measure of Assessment Variability for Residential Properties	Percent Black from 2010 Census	Percent White from 2010 Census	Percent Hispanic from 2010 Census
Coefficient of Dispersion for 2013	-0.11671	0.13936	-0.06819
Odds of correlation being misleading	0.4398	0.3556	0.6525
Coefficient of Dispersion for 2014	-0.11163	0.1184	-0.04425
Odds of correlation being misleading	0.4602	0.4332	0.7703

While ethnicity is not correlated with assessment uniformity, this is not the case when relationships between the level of assessments measured by the median residential sales ratio and the two measures of economic income. For both before and after reassessment, we see that both measures of income are inversely related to the median sales ratio. That is, the resident income measures tell the same story as the PDR calculations do for both 2013 and 2014. The assessments are regressive in impact.

Table 29: Correlation of Median Sales Ratio for 2013 and 2014 and Mean and Median 2010 Taxable Income across Philadelphia's 5 Digit Zip Codes

Median Sales Ratio Measure	2010 PA Revenue Department Mean Taxable Income	2010 PA Revenue Department Median Taxable Income
Median Residential Sales Ratio for 2013	-0.59832	-0.70585
Odds of Correlation being misleading	<.0001	<.0001
Median Residential Sales Ratio for Proposed 2014	-0.43058	-0.54485
Odds of Correlation being misleading	0.0028	<.0001

The final set of calculations involve examining how sharply variables such as ethnicity and assessment level as measured by the median sales ratio move around. One can imagine two variables are very correlated, but one does not show much change as another changes, they simply move together.⁹ Table 31 displays what is called an *elasticity* calculation which answers the question: if an area becomes 1% more black, how much we expect the median sales ratio to rise in relative terms. Table 31 indicates that such a 1 % increase in black composition of a zip code would be accompanied by a .31% relative increase in the median sales ratio for 2013. However, in 2014, that effect is doubled to .6%. On the other hand, the effect of an increase of 1% relative increase in the white composition of a zip code would be associated with a -.3 percent relative decline in the median sales ratio in both years. These two results are based on highly statistically significant results. The effect of a change in Hispanic population is not statistically significant on the other hand.

Table 30: Elasticity Calculations for Table 26

	Percent Black from 2010 Census	Percent White from 2010 Census	Percent Hispanic from 2010 Census
Median Sales Ratio 2013	0.31563	-0.33198	0.0242
t-ratio	4.73	-5.97	0.25
Median Sales Ratio 2014	0.66267	-0.34136	0.14136
t-ratio	4.68	-5.11	1.3

The second set of these elasticity calculations focuses on the relationship between the two median sales ratios, for 2013 and 2014, and the 2010 mean and median taxable income in each zip code. Both income measures show a negative relationship between income and the median sales ratio, and both negative relationships get more severe in 2014 compared to 2013. A 1% relative increase in median income is associated with a 1.55 % relative decline in the 2014 median sales ratio. The results confirm the earlier PRD results.

⁹ More specifically the entries in Table 30 and 31 are the slopes of bivariate regressions between the natural log of, say, the median sales ratio for 2013, and the median percent black in 2010 across each 5 digit zip code.

Table 31: Elasticity Calculations for Table 27

	2010 PA Revenue Department Mean Taxable Income	2010 PA Revenue Department Median Taxable Income
Median Sales Ratio 2013	-0.88335	-1.32884
t-ratio	-7.78	-7.07
Median Sales Ratio 2014	-0.9875	-1.55187
t-ratio	-7.63	-7.64

6.0 Summary of Findings

The purpose of this study has been to examine in a compressed time frame the level, uniformity, and regressivity of the 2014 proposed reassessments in progress in Philadelphia. Using standard evaluation techniques, a large number of calculations have been performed on publicly available data on 2013 and proposed 2014 assessments. Both the underlying accuracy of the physical characteristics of the properties has been examined, and the actual results of the reassessment have been examined.

Using the most recent standards promulgated in April, 2013 by the International Association of Assessing Officers, it is abundantly clear that the 2014 proposed assessments are extremely non-uniform, and extremely regressive. Moreover, there is compelling evidence that black areas of Philadelphia are over assessed in 2013 and will be over assessed in 2014, while white areas have been under-assessed in 2013 and will be under-assessed in 2014. The non-uniformity observed in 2013 and 2014 assessments are literally multiples of the maximum non-uniformity that the IAAO considers to be within professional practices. Similarly, the regressivity observed in the 2013 and 2014 assessments is extremely high. Allegheny County, which is comparable in size and complexity of residential properties to Philadelphia, has in 2013 after reassessment a COD of 57% while Philadelphia's 2014 COD, comparably calculated is 112%. Allegheny County's PRD after reassessment in 2013 is 1.28 whereas Philadelphia's PRD, comparably calculated for 2014 is 2.49.

An examination of the characteristics of the properties being assessed indicates that very large proportions of residential properties do not yet have sound data with which to model and assess. Focusing on residential property, 43% did not have a coding for the type of site, 21% did not have a count of the height or number of stories of the property, 99% were missing data on the

type of dwelling, 97% did not have information on building workmanship, 97% were missing data on the floor plan, 26% were missing data on the total number of rooms, 24% were missing data on the total number of bedrooms, and 24% were missing data on the total number of bathrooms. Furthermore, 38% were missing data on the type of basement, 47% were missing data on the type of heat, and 53% were missing data on the presence or absence of central air.

7.0 References

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