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An Evaluation of Residential Property Tax Assessments in the City of Detroit, 2016-2018

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KEY FINDINGS

- Average assessments in the City of Detroit have fallen each year since 2016.
- The proportion of homes assessed above the legal limit (50% of market value) has fallen from approximately one-half to one-third.
- Most lower-valued properties (less than $19,000 sale price) are still being assessed in excess of the legal limit.
- Assessment regressivity—over-assessment of low-valued properties relative to high-valued properties—has gotten worse.
- Assessments in Detroit did not meet industry standards for uniformity or regressivity

I. INTRODUCTION

The property tax is the single largest source of locally generated revenue for American local governments. Cities, counties, school districts, and special districts raise roughly $500 billion per year in property taxes, accounting for about 30% of general revenue at the local level.[1] Whether residents rent or own, property taxes directly or indirectly impact almost everyone.

In many cities, however, property taxes are inequitable: low-value properties face consistently higher tax rates than do high-value properties, resulting in regressive taxation that burdens low-income residents disproportionately. The following report evaluates the assessment system in the City of Detroit.

Several prior studies have concluded that assessments in Detroit historically have been inequitable.[2] In response to such concerns, the City initiated a parcel-by-parcel reappraisal of residential property in 2014, the first in nearly 60 years.[3] The results of this reappraisal were put into effect starting in 2017. To better understand the effects of these changes, the Center for

[1] *Property Taxes*, The Urban Institute, State and Local Finance Initiative (last accessed July 2019), https://www.urban.org/policy-centers/cross-center-initiatives/state-and-local-finance-initiative/projects/state-and-local-backgrounders/property-taxes.

[2] Atuahene, B. & Berry,C., *Taxed Out: Illegal Property Tax Assessments and the Epidemic of Tax Foreclosures in Detroit*, 9 U.C. Irvine L. Rev. 847 (2019). https://scholarship.law.uci.edu/ucilr/vol9/iss4/3; Hodge, T., McMillen, D., Sands, G., Skidmore, M., "Assessment Inequity in a Declining Housing Market: The Case of Detroit," *Real Estate Economics* (2017), Vol. 45, pp. 237-258.

[3] *The Detroit News*, Jan 23, 2017, "Property taxes going down for over half of Detroiters."

Municipal Finance at the University of Chicago (the Center) has undertaken a review of assessments conducted between 2016 and 2018.[4] [5]

A. Understanding Assessment Regressivity and Its Consequences

The property tax is, in principle, an *ad valorem* tax, meaning that the tax is proportional to the value of the property. Most textbook discussions of the property tax proceed as though a property's value is well known. But, in fact, this is seldom the case. For a property that has sold recently, the sale price is usually a reasonable approximation of its market value. But only a small proportion of properties change hands in any given year—on the order of 4% to 8% of properties in cities reviewed by the Center. For the vast majority of properties, which have not sold recently, localities must somehow estimate the value. This is the job of the local assessor.

When localities conduct assessments accurately, the resulting property taxes indeed constitute an *ad valorem* tax. However, when property assessment is inaccurate, the resulting property tax bills will also be inaccurate. Properties that are over-assessed—the assessed value is higher than the actual market value—will be over-taxed. Likewise, properties that are under-assessed—the assessed value is lower than the actual market value— will be under-taxed. While no assessment system is perfectly accurate, we are especially concerned with a particular type of inaccuracy known as *regressivity*. Assessments are regressive when low-value homes are assessed at a higher percentage of their true market value than are high-value homes. Regressive assessments lead to regressive taxation, which means that owners of low-value property pay too much in taxes while owners of high-value properties pay too little.

The remainder of this report evaluates assessment regressivity in Detroit using a combination of graphical and statistical methods.

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[4] The Center has separately conducted evaluations of assessment values in many of America's largest metro areas, including an earlier evaluation of Detroit. These earlier evaluations were focused on years prior to the period of observation of the present review.
[5] This evaluation is limited to the assessment of *residential* properties and does not include commercial, industrial, or agricultural property.

II. DATA and METHODOLOGY

The standard approach for evaluating the quality and fairness of assessments is through a sales ratio study.[6] Indeed, the International Association of Assessing Officers (IAAO) advises that, "Local jurisdictions should use ratio studies as a primary mass appraisal testing procedure and their most important performance analysis tool."[7] The *sales ratio* is defined as the assessed value of a property divided by the sale price. A sales ratio study evaluates the extent of regressivity in a jurisdiction, along with assessment accuracy and other performance metrics. This is done by studying the distribution of sales ratios for properties sold within a specific time period.

For this evaluation, the Center has used data provided by the assessor's office in response to a request for the most recent data available for a ratio study as of June 2019. This data included residential properties that sold between the second quarter of 2016 and the first quarter of 2018 and were classified as arm's-length transactions by the assessor.[8] The data set contained homes with sale prices ranging from a low of $1,800 to a high price of $690,000.

The remainder of the report is organized as follows. Section III contains an overview of the data and shows changes in sales ratios over time. Section IV shows graphical analyses of assessment regressivity, comparing sales ratios across deciles of sale prices. Section V evaluates Detroit assessments against IAAO standards for uniformity and regressivity.

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[6] International Association of Assessing Officers. 2013. *Standard on Ratio Studies*.

[7] Ibid, p. 8.

[8] The data set provided by the local assessor did not contain definitions of the variables, nor did the local assessor's office provide any response when asked to provide these definitions. For this reason, the Center had to make a number of assumptions regarding the data. Most importantly, for constructing the sales ratios, the variable labeled as "assessed when sold" was assumed to denote the assessed value and the variable labeled "adj. sale price" was assumed to represent the sale price. In addition, we assumed that all sales marked as arm's length were valid observations. We further assumed that the citywide reappraisal was first reflected in the data in the second quarter of 2017. We limited our analysis to property class 401. If these assumptions are incorrect, the analysis will need to be adjusted accordingly.

III. CHANGES IN SALES RATIOS

The data provided by the assessor contained residential sales beginning in the second quarter of 2016 and continuing through the first quarter of 2018. As noted, we restrict our analysis to sales classified as arm's-length by the assessor.[9] We converted all assessed values and sale prices to 2018 dollars for inflation. Table 1 shows descriptive statistics for this data, broken down by quarter. It should be noted that the properties described below and listed prior to 2017-Q1 contains properties sold and assessed prior to the city-wide reappraisal. For example, Line 1 indicates that the locally-provided data used in this evaluation contained 975 arm-length sales in the second quarter of 2016; and among those properties, the median sale price was $25,000, while the median sales ratio was 50% (the constitutional maximum in Michigan).

Table 1: Descriptive Statistics

Quarter	Number of Arm's-Length Sales	Median Sale Price
2016 – Q2	975	$25,000
2016 – Q3	829	$28,000
2016 – Q4	1,067	$25,900
2017 – Q1	1,229	$26,000
2017 – Q2	1,459	$27,000
2017 – Q3	1,346	$29,250
2017 – Q4	1,421	$27,000
2018 – Q1	1,327	$29,900

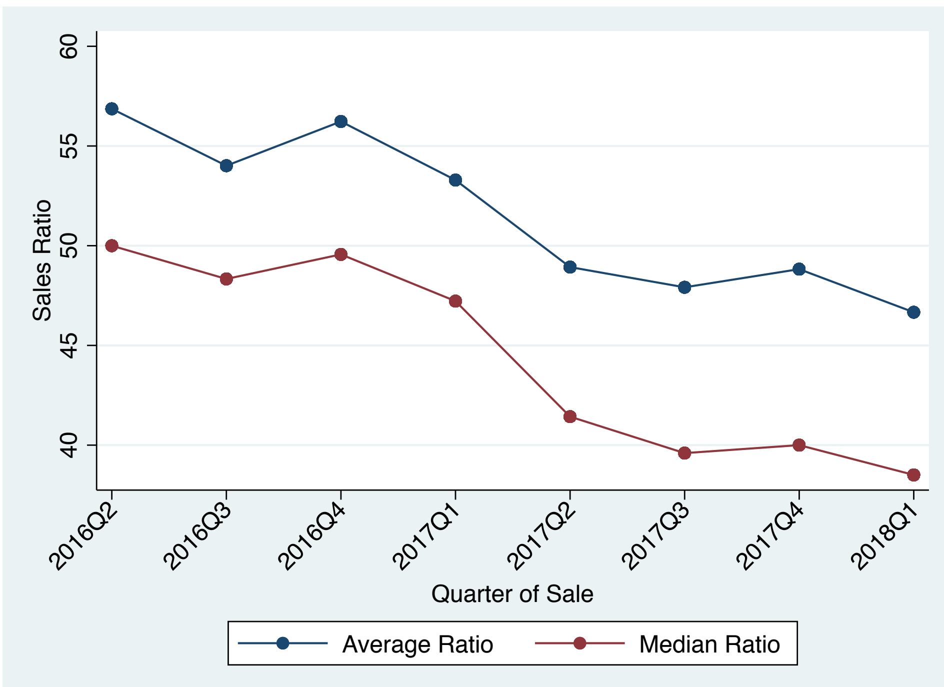
Figure 1.1 demonstrates this gradual decline in assessed values, showing both the median and average sales ratio quarterly from the second quarter of 2016 to the first quarter of 2018. The average ratio declined from 57 percent to 47 percent over this period, while the median ratio

[9] It was not clear whether the data provided by the assessor had already been trimmed of outlier values. The following analyses use all arm's length transactions in the data set. However, when we apply IAAO outlier trimming guidelines (IAAO 2013, Appendix B), results do not change appreciably from those reported in this report.

declined from 50 percent to 38.5 percent. The largest quarterly drop came from Q1 to Q2 of 2017, when the reappraisal was first reflected in the data.

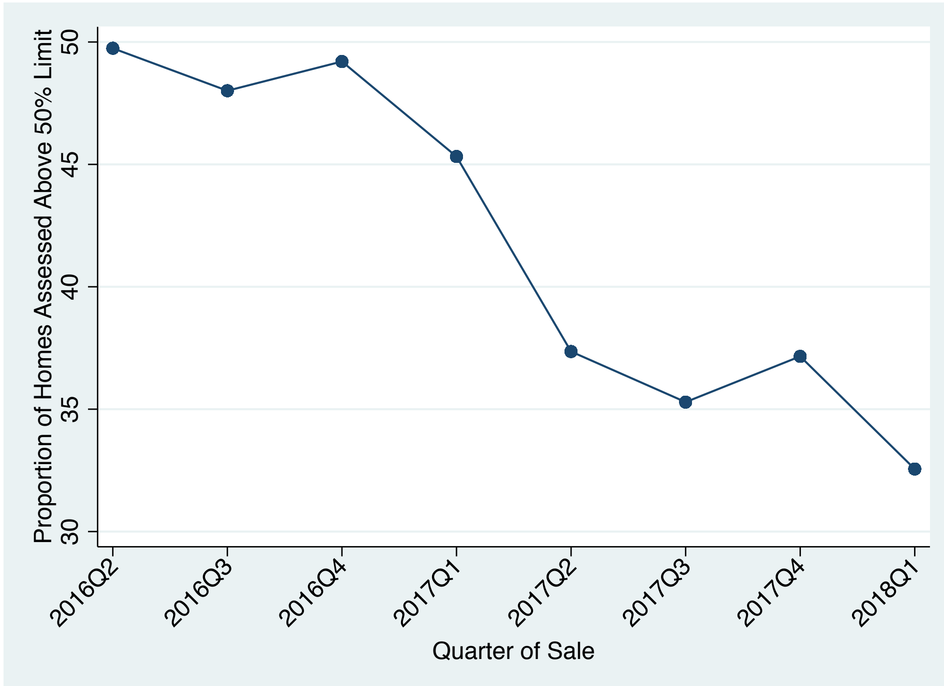
Under state law, the maximum limit for sales ratios in Detroit is 50% of market value.[10] Figure 1.2 shows that the proportion of homes assessed in excess of that limit has also fallen over time, from half of all homes in Q2 of 2016 to one-third of all homes in Q1 of 2018. This change represents a genuine improvement in compliance with the legal threshold, although a large proportion of homes is still being over-assessed relative to that threshold.

Figure 1.1: Mean and Median Sales Ratio over Time



[10] Michigan Constitution, Art. IX § 3.

Figure 1.2: Proportion of Homes Assessed in Excess of Legal Limit (50%) over Time



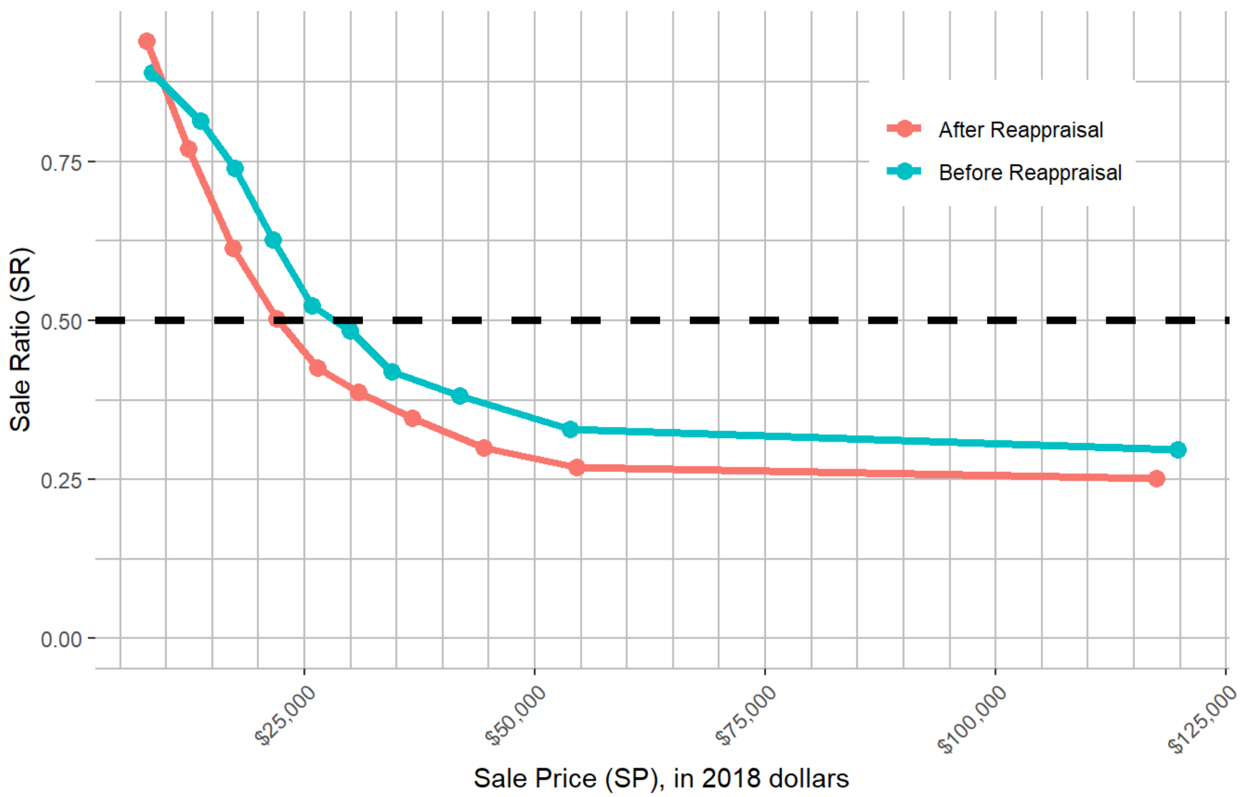
IV. GRAPHICAL ANALYSIS OF REGRESSIVITY

Section III demonstrates that sales ratios have fallen on average since 2016, but this does not speak to whether assessments were fair. The relationship between assessments and sale prices is regressive if less valuable homes are assessed at higher rates (relative to the market value of the home) than more valuable homes.

To evaluate regressivity in assessments, Figure 2 presents binned scatter plots of sales ratios against sale prices before and after Detroit's jurisdiction-wide reappraisal. We define the pre-reappraisal period as Q2 of 2016 through Q1 of 2017, and the post-reappraisal period as Q2 of 2017 through Q1 of 2018. This figure shows how sales ratios differ for homes at different points in the price spectrum before and after the reappraisal.

To construct this binned scatter plot, we divided the data into two groups, each represented by a separate line in the graph. Group one contains properties sold before the jurisdiction-wide reappraisal took effect in quarter two of 2017. Group two contains properties sold after the reappraisal took effect. Each group was then further divided into deciles (10 bins) of equal size according to sale price for each period. Each dot on the graph above represents 10% of the data within a period, and shows the average sales ratio and average sale price for one of these bins. Within each line, the dot on the far left shows the average sale price and average sales ratios for the bottom 10% of homes in terms of sale price during that period. The dot on the far right shows the average sale prices and average sales ratio for the top 10% of homes during the same period. The intervening dots show the average sales ratios for homes in the other bins of sale price. The horizontal dashed line denotes the legal assessment limit of 50%.

Figure 2: Sales Ratios by Price Decile, Before & After Reappraisal



Prior to the jurisdiction-wide reappraisal, the bottom 10% of homes in terms of sale price ($1,800 to $10,000) were assessed at nearly 90% of their price, on average, while the top 10% of homes ($60,000 and up) were assessed at less than 30% of their price. In other words, the bottom decile was assessed at three times the rate of the top decile. Moreover, the bottom half of homes (the leftmost five bins, containing sale prices below $27,000) had sales ratios above the 50% legal threshold, on average.

Consistent with the analysis in Section III, Figure 2 shows that sales ratios have fallen across the board (the curve shifted downward) after the reappraisal took effect. However, two additional findings are of particular importance.

First, while overall sales ratios have fallen, regressivity has not been reduced. The post-reappraisal curve continues to slope strongly downward because higher-priced homes continue to enjoy substantially lower sales ratios than low-priced homes. One simple measure of regressivity is to compare the relative sales ratios at the top and bottom of the price range. The 90/10 ratio is computed by dividing the sales ratio for the top decile by the sales ratio for the bottom decile. This ratio was approximately 33.5% before the reappraisal, and 26.1% afterward. In other words, prior to the reappraisal, homes in the bottom decile were assessed at a rate roughly three times higher than the rate applied to homes in the top decile. After the reappraisal, the bottom decile was assessed at a rate roughly four times higher than the top decile.

As Figure 2 demonstrates, regressivity has gotten worse after the reappraisal for two interrelated reasons. First, higher-priced homes experienced reductions in appraisal rates even though they were not over-assessed on average prior to the reappraisal. Second, the bottom decile of homes, which *was* being over-assessed prior to the reappraisal, actually experienced an increase in average assessment ratio after the reappraisal.

The second important finding is that a majority of low-priced homes in Detroit are still being assessed in excess of legal limits. Following the reappraisal, the bottom three deciles (homes priced below $19,000) were still being over-assessed on average. Moreover, the bottom 10% of homes were, if anything, more over-assessed after the reappraisal than before.

To highlight the issue of legally excessive assessment, Figures 3.1 and 3.2 show the proportion of homes in each price decile assessed above (represented in orange) or below (blue) the constitutional limit of 50 percent, before and after the reappraisal, respectively. For instance, the leftmost orange bar in the pre-appraisal graph (Figure 3.1) shows that nearly 90% of properties in the bottom price decile were assessed above 50 percent of their sale price, while the rightmost orange bar shows that in the top decile more than 90% of properties were assessed below 50% of their sale price.

Figure 3.2 shows these same proportions for properties assessed after the reappraisal took effect. The figures for post-appraisal assessments show some improvements, particularly for mid-priced homes. In particular, there was a substantial reduction in the proportion of homes in the 4th, 5th, and 6th deciles (roughly $19,000 to $32,000 in price) that were over-assessed. There were modest improvements in the 3rd decile, but still, a majority of those homes were being over-assessed after the reappraisal. There has been hardly any improvement, however, for the bottom two deciles, where the vast majority of homes are still being over-assessed, and in an even higher proportion than in the past.

Figure 3.1: Proportion of Properties Assessed Above and Below 50% of Price Pre-Reappraisal

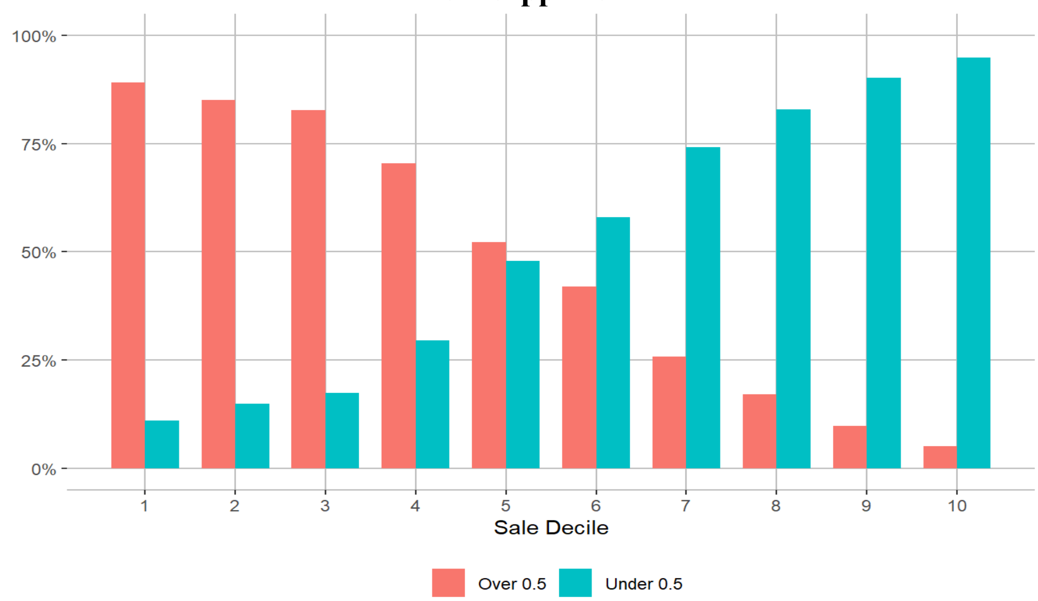
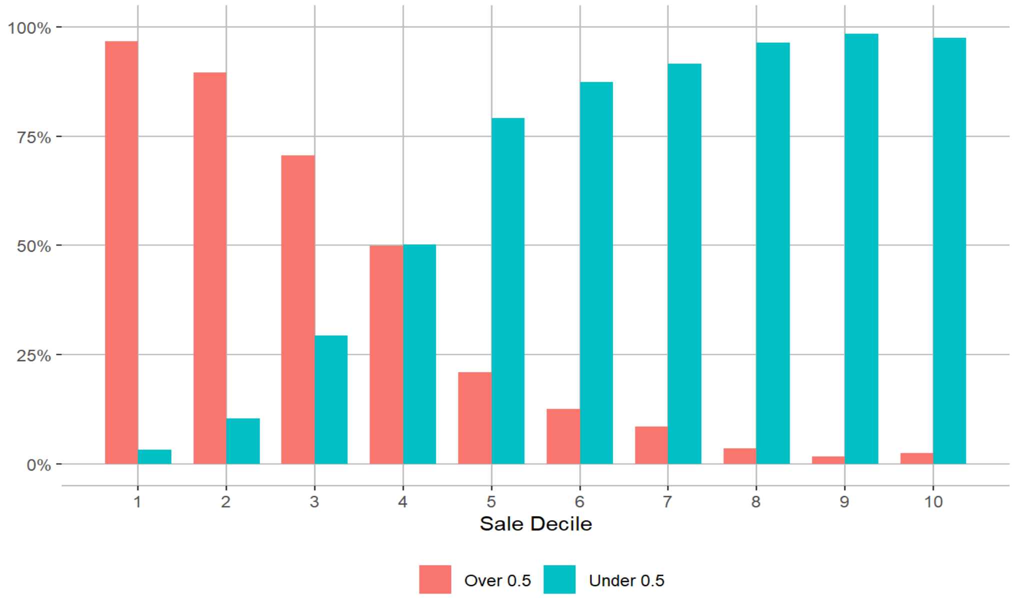


Figure 3.2: Proportion of Properties Assessed Above and Below 50% of Price Post-Reappraisal



V. INDUSTRY STANDARDS

The analyses in Section IV provide graphical evidence of regressivity in property assessments. This section evaluates several standard statistics used in the evaluation of assessment quality.

The IAAO defines standards for assessment efficacy, including standards for uniformity and regressivity, and specifies acceptable maximum and minimum levels for these metrics (IAAO 2013). The Center evaluated Detroit assessments under the three most commonly used metrics: the coefficient of dispersion (COD); the price-related differential (PRD); and the coefficient of price-related bias (PRB). Our analysis indicates that assessments in Detroit did not meet IAAO standards in any year and have become worse according to all three metrics after the reappraisal. Table 2 below provides the respective levels for Detroit's COD, PRD, and PRB both before and after the reappraisal went into effect. All three industry standards of assessment quality have gotten worse since the reappraisal.

Table 2: Metrics of Assessment Quality

	IAAO Acceptable Range	Detroit Before Reappraisal	Detroit After Reappraisal
COD	5 to 15	46.26	50.08
PRD	0.98 to 1.03	1.30	1.35
PRB	-0.05 to 0.05	-0.26	-0.45

Coefficient of Dispersion

The COD is a measure of uniformity based on the average percentage deviation of the ratios from the median, expressed as a percentage of the median. For example, given a COD of 15%, a property worth $100,000 has a 50% chance to be assessed between $85,000 and $115,000. The IAAO sets an acceptable range for the COD at between 5 and 15. Higher values indicate less uniformity. As Table 2 shows, even after reappraisals took effect, Detroit's COD remains more than three times the acceptable maximum.

Price-Related Differential

The PRD is a measure of regressivity (also known as vertical equity) calculated by dividing the mean sales ratio by the price-weighted mean ratio. For example, assume a jurisdiction contains two homes, one worth $100,000 assessed at 12% of the sale price and a second worth $1,000,000 assessed at 8% of the sale price. The mean ratio would be 10% (12% + 8% divided by 2) while the weighted mean ratio would be 8.4% (12% * 100,000 + 8% * 1,000,000 divided by 1,100,000). The resulting PRD (10% divided by 8.4%) would be 1.20. Higher values of PRD indicate greater regressivity. The IAAO sets an acceptable range for the PRD at between .98 and 1.03. Table 2 shows that Detroit assessments substantially exceed permissible levels of PRD, and actually worsened slightly following the reappraisal.

Coefficient of Price-Related Bias

The PRB is a regression-based measure that estimates the relationship between the sales ratio and a given proxy for actual property value determined by giving equal weight to sale price and assessed value. PRB measures the change in the assessment ratio that can be expected to result from a 100% change in this value proxy. For example, a PRB of 0.031 indicates that assessment ratios increase by 3.1% when the home value increases by 100%. Lower (more negative) values of PRB indicate greater regressivity. The IAAO sets an acceptable range for the PRB at -.05 to .05. Table 2 shows that Detroit assessments substantially exceed acceptable levels, and became far worse after the reappraisal.

VI. Conclusion

This report evaluates assessment regressivity in the City of Detroit between 2016 and 2018. We find that assessments fell during this period on average, but the majority of low-valued homes, especially those in the bottom 30%, continue to be assessed above the legal threshold of 50% of market value. Overall regressivity has gotten worse rather than better following the 2017 reappraisal.

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Appendix A: Evaluating Regressivity Due to Measurement Error

One limitation of sales ratio studies is that a property's sale price may be an imperfect indication of its true market value. Given inevitable random factors in the sale of any individual property, the final price may include some "noise." If so, this will introduce measurement error into the analysis, which could lead to the appearance of regressivity when there is none. For instance, consider two hypothetical homes that are identical and each worth $100,000. If both homes went up for sale at the same time, one might fetch a price of $105,000, say if the seller is a particularly savvy negotiator, while the other home might garner only $95,000, say if the buyer is a particularly savvy negotiator. If the assessor appropriately valued both homes at $100,000, a sales ratio analysis would indicate regressivity (the higher-priced home is under-assessed and the lower-priced home would be over-assessed, relative to the sale price). While there is no reliable correction for measurement error of this kind, as long as the extent of measurement error is small, relative to the price, the extent of bias will also be small.

We use Monte Carlo simulations to estimate the extent of measurement error that would need to exist for any of our tests to falsely show regressivity due to measurement error. We compare our results with thousands of simulated scenarios to determine the likelihood that our results would be reproduced in the market absent regressivity.

The simulations are conducted as follows. First, using the same data set that was used for the main analysis, we construct a simulated sale price for each property that is set equal to the actual assessed value. In this scenario, where simulated sale prices are always equal assessed value, the assessments will appear to be perfect according to all of our metrics and there will be no regressivity. We then "jitter" the simulated sale prices by adding random noise drawn from a normal distribution with a mean of zero and a standard deviation of k percent. While we think that measurement error on the order of only a few percentage points is plausible in real data, we consider values of k from 1 to 25. To be concrete, when k is equal to one percent, the simulated sale price is set equal to the assessed value multiplied by (1 plus a random shock drawn from a normal distribution with a mean of zero and a standard deviation of .01). The shock is drawn independently for each property in the data set. For each value of *k*, we run 1000 simulations and record the value of each regressivity metric computed in each simulation. The mean value of each metric across the 1000 simulations is reported for each value of *k*.

Intuitively, this exercise shows how much spurious regressivity would exist if assessed values were accurate on average but sale prices contain random noise of a given value, *k*. We then compare the actual value of the regressivity metrics from the real data with the values from the simulated data so recover an estimate of the amount of noise that would be necessary to produce the observed regressivity statistic if there were in fact no bias in assessments.

Figures A1 to A4 show the results of our simulations. The dots in each graph show the mean value of the metric in question across the 1000 simulations for each value of *k*. The solid line in each graph shows the value of the metric in the real data.

Figure A1: COD Monte Carlo Distribution

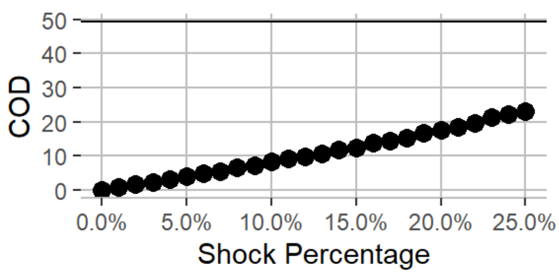


Figure A3: PRB Monte Carlo Distribution

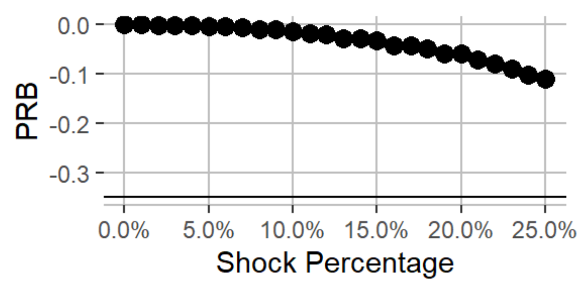


Figure A2: PRD Monte Carlo Distribution

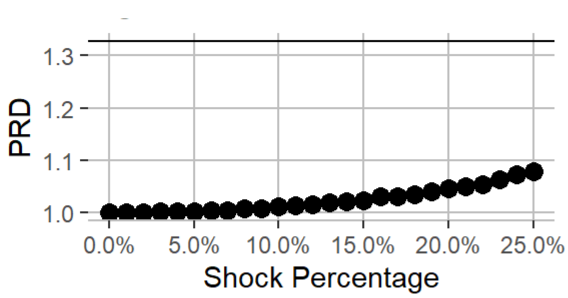
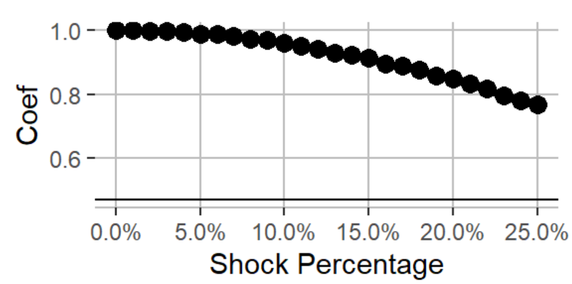


Figure A4: Log(Assessed Value) ~ Log(Sale Price) Monte Carlo Distribution



For instance, Figure A1 shows the simulations for the COD. In the simulations with zero noise, assessments always equal sale price and the COD is zero. As we gradually increase the amount of noise in the simulated sale prices, the estimated COD increases. The simulations show that the COD can be inflated by random factors in sale prices. However, even in the simulation where k is 25 percent, the COD in the simulated data (roughly 22) is nowhere near as large as the COD in the actual data (roughly 50). This suggests that the observed problems in the real data cannot be due to measurement error, unless the measurement error is well above 25% of sale price. Given that measurement error of 25% is already implausibly large, we can be confident that our conclusion that the assessments are regressive cannot be due to measurement error.

Figures A2 to A4 show the results of the same simulation exercise for the PRD, PRB, and the coefficient from a regression of log(Assessed Value) against log(Sale Price). In each case, measurement error would have to be even larger than 25 percent in order to produce regressivity as extreme as the level measured in the real data. All of these results bolster our conclusion that assessments in Detroit are regressive and that the observed regressivity is not the result of measurement error in sale prices.