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Shoring Up Property Tax Assessment Inequities in Monmouth County, New Jersey

BY ROBERT HAYWOOD SCOTT III AND JONATHAN DAIGLE

Abstract

New Jersey signed the Real Property Assessment Demonstration Program (ADP) into law effective at the beginning of 2014. The Monmouth County, New Jersey, Board of Taxation and the county's municipal assessors are the only tax officials in the state to implement the ADP. The program's intention is to improve real property tax assessment fairness and efficiency. After six years, there is now sufficient data to test whether Monmouth County's ADP program has reduced tax assessment inequities. We use the International Association of Assessing Officers' (IAAO) (1990; 2013) standard methods to analyze the effectiveness of Monmouth County's ADP. In addition, we use the Clapp (1990) and Birch-Sunderman (2014) models to study residential property tax assessments by comparing assessed values to actual sales, controlling for town-level effects, during the two years prior to implementation of the ADP (2012-2013) and the two most recent years (2018-2019). We find empirical evidence that both vertical and horizontal inequity of residential property tax assessments decreased after ADP implementation, but progressive tax assessment inequities still persist within the county.

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Introduction

This paper studies the effectiveness of a program to create greater equity in residential property tax assessments in Monmouth County, New Jersey. In 2013, New Jersey signed the Real Property Assessment Demonstration Program (ADP) into law (P.L.2013, c. 15), effective at the beginning of 2014. New Jersey's Monmouth County Board of Taxation and the county's municipal assessors were the only tax officials in the state to implement the ADP. Their intention was to improve real property tax assessment fairness and efficiency across the county. After six years, there is sufficient data to test whether the program has improved property tax assessment equity. We use IAAO's Standard on Ratio Studies (2013) and Standard on Property Appraisal and Assessment Administration (1990) methods to analyze whether Monmouth County's ADP improved residential property assessment equity. We also use the Clapp (1990) and Birch-Sunderman (2014) models to study residential property tax assessments by comparing assessed values to actual sales using town-level control variables during the two years prior to the ADP (2012-2013) and the two most recent years (2018-2019).

Monmouth County's ADP was adopted to create greater property tax assessment equity, which is important because New Jersey has high property taxes. There are historical and political reasons why assessment inequities exist. New Jersey's property tax assessment model persists mainly because of the status quo bias that leads to complacency and a lack of motivation to modernize. Yet there are significant costs associated with inaccurate assessments that result in some households paying more (or less) in property taxes than comparable households. These imbalances can compound for decades because revaluations are inconsistent. Accurate assessments are fundamental to fair property taxation. New Jersey's current property tax system has several problems, which we discuss in detail below, but the predominant issue is the irregularity of revaluations and reassessments.

New Jersey's property tax assessment model uses "implied" true market value to adjust assessments each year. Implied true market value is estimated using a director's ratio (or equalized valuation) calculated annually by the state using sales price data relative to assessments. But New Jersey has a ten-year revaluation cycle, so director's ratios can go unchecked for many years, resulting in increasingly inaccurate assessments. In addition, director's ratios are applied equally to entire towns, assuming property values increase or decrease at the same rate. This approach may be sensible in towns where homes are homogeneous, but most towns are heterogeneous based on type, size, age of homes, and their location (e.g., waterfront). When New Jersey's property tax laws were established, assessors did not have access to today's data and tools. Monmouth County's ADP uses annual reassessments and a five-year revaluation cycle to update the current assessment schedule.

The paper proceeds as follows: a brief description of property taxes in New Jersey. Then we explain Monmouth County's ADP and how it attempts to address some of the deficiencies of New Jersey's property tax assessment policies. Next, we use a variety of statistical techniques to assess any changes in Monmouth County's property tax assessment equity by comparing pre-ADP measures against post-ADP measures. Finally, we discuss the implications of our findings.

New Jersey Property Taxes

New Jersey's real property tax is an ad valorem tax, meaning a tax according to value. New Jersey's Constitution states in Article VIII, Section I, Paragraph I that "[p]roperty

shall be assessed for taxation under general laws and by uniform rules" (some minor exceptions for farmland). New Jersey has agreed to assess real property at "true value" or market value; however, no property should be "assessed at a ratio to true value which is above the common level or average ratio of all assessments in a taxing district. A common level range is permitted and is calculated at 15% above to 15% below the common level or average ratio" (New Jersey Treasury Division of Taxation 2020, 1).

In a recent study using data from 2018, New Jersey had the highest property taxes in the country (Kiernan 2020). New Jersey's effective real estate tax rate was 2.49%, and New Jersey has one of the country's highest median home values at $470,843 (as of July 31, 2022) (Zillow 2022). Therefore, a median-priced New Jersey home would have an average property tax bill of almost $10,000. Property taxes are the primary source of local financing for schools, infrastructure, and government and county services. Some states allow counties and municipal governments to implement income taxes and sales taxes, but New Jersey does not. This means that property taxes are almost exclusively the sole source of income for municipalities and counties. Thus, property tax assessment accuracy is particularly important in New Jersey, where inequities can result in hundreds of millions of dollars in misaligned tax payments if property owners are not paying the correct taxes according to true market value.

In general, New Jersey's heavy reliance on property taxes results in a more progressive tax system. Since property taxes are the predominant source of income for towns, people with more expensive properties generally pay more in taxes. (Some states with low property taxes raise money using more regressive taxes, such as sales and excise taxes that fall predominantly on lower-income households.) This does, however, assume that property taxes are assessed accurately; namely, that similar homes in the same town are assessed at roughly equivalent values, which is called horizontal equity. In addition, homes in the same town should be assessed at a similar rate regardless of value, which is called vertical equity. As mentioned above, a strange artifact of New Jersey's real property tax system is a lack of consistency in the timing of reassessments and revaluations. For example, in 2018, Jersey City, New Jersey, conducted its first revaluation in thirty years. In fact, Jersey City, until 2018, had completed only one revaluation since 1972 (Ballotpedia 2020). As a result, Jersey City had some taxpayers paying more than was fair (based on fair market values) and others paying less. Without regular revaluations or reassessments, these inequities can compound over many years in New Jersey.

Monmouth County's Real Property Assessment Demonstration Program (ADP)

Monmouth County is on the east coast of New Jersey within the New York City metropolitan area. It is the most northern county along the Jersey Shore. It is the fifth most populated county (out of twenty-one counties) in New Jersey with over 600,000 residents. Of its fifty-three municipalities some are well-known, such as Asbury Park (which Bruce Springsteen helped make famous) and Long Branch (where many former US presidents had summer homes and vacationed), along with many other shore towns that are popular among tourists and people with summer homes.

There have been two legislative efforts to address New Jersey's property tax assessment inequities. First, the Property Tax Assessment Reform Act, also known as the Gloucester Pilot Program (P.L.2009, c. 118), enacted in 2010, replaced municipal assessors with a centralized county assessor model (White and Glocker-Hammond 2015). The idea was that a more centralized system would be more cost-efficient and increase assessment accuracy. White and Glocker-Hammond conducted a five-year review of the Gloucester

Pilot Program and found that it lowered systemwide costs by 46%. They also noted a reduction in the number of tax appeals.

The second effort was the Real Property Assessment Demonstration Program (ADP) (P.L.2013, c. 15), which was enacted in 2014 and is the focus of this paper. This legislation's two significant amendments include (a) granting counties statewide the option to conduct annual reassessments and (b) letting them change their assessment and appeals calendars.

New Jersey's Monmouth County Board of Taxation and the county's municipal assessors were the first in the state to implement the ADP (Clark et al. 2019). Unlike the Gloucester Pilot Program, Monmouth County's ADP retains municipal assessors. In addition, there are two principal components to the ADP.

First, the current model of ten-year revaluations is updated to an annual reassessment model with five-year internal inspections. Every five years, all properties will have an internal inspection (roughly 20% each year, though the percent inspected each year may vary). In the old model, there were no annual reassessments, so after a revaluation, assessments could remain stagnant for years or decades. Each town used its director's ratio to determine changes in real property values. As discussed above, the director's ratio is calculated for each town and is applied to all properties equally, which assumes the values of all properties in the town change at the same rate. A ten-year evaluation cycle exacerbates this problem because assessed values can diverge significantly from true market values. There is sufficient evidence (presented below) showing the severity of the current neglect in revaluations throughout New Jersey. Thus, it is suggested that annual reassessments provide the necessary assessment oversight and maintenance required to ensure fair taxation. In 1989, Bernards Township in Somerset County, New Jersey, received a special exemption from the state to conduct annual reassessments (Vance et al. 2018). Eventually, more towns in Somerset adopted annual reassessments. Robert Vance, Somerset County's tax administrator, used data comparing 2011 to 2013 across the county. He found that annual revaluation towns had 77% fewer appeals. He also found that the costs of annual reassessments were lower overall compared with the prior model that used an irregular revaluation cycle (Vance 2014).

Consequently, at the time of this writing (late 2021), sixteen out of twenty-one towns in Somerset used annual reassessments. Somerset consistently has the most accurate assessments across all counties in New Jersey.

Second, Monmouth County's ADP modified the assessment and appeal calendars to ensure municipalities' general tax rates are sufficient to collect the revenue required to meet the towns' financial needs. Previously, municipalities sent their assessment lists to the Monmouth County Tax Board in January. Then, around early March, each municipality would have public meetings discussing its annual tax levy. Once the tax levy was determined, the municipality used that as the amount it needed to raise in taxes. The problem with this timing is that property assessment appeals start in April at the County Tax Board, so reductions in assessments resulting from appeals reduce the tax base used by a municipality to calculate its general tax rate. The result is that the general tax rate may be too low to cover the tax levy. A municipality would need to either rely on financial reserves (if it has any) or emergency bonding that requires paying interest. Monmouth County's ADP changes the assessment sequence so that the County Tax Board appeal process occurs before municipalities make their budgets and set their general tax rates. This calendar adjustment allows a town to know its tax base before it sets the tax rate, which creates greater financial stability and reduces uncertainty. As a result of the change

in the calendar, towns that adopted Monmouth County's ADP avoided a total budget shortfall of over $23 million from 2014 to 2018 (Clark et al. 2019). In 2019, Gloucester also started using the updated appeals calendar.

Measuring Residential Property Tax Assessment Equity in Monmouth County

Property tax equity has two dimensions. First, horizontal equity, which means similar properties within the same municipality are assessed equally. Second, vertical equity, where the ratio of assessed value and sale value does not vary according to the prices of different properties. For example, if low-value homes have larger assessment-to-sale ratios than expensive homes, then there is regressivity. If expensive homes have larger assessment-to-sale ratios than low-value homes, then assessments are progressive. Of the two assessment biases, horizontal equity is easier to identify. The standard measure of assessment equity is the coefficient of dispersion (COD) (IAAO 2013). The COD is the average percentage deviation of the ratios from the median ratio calculated as follows:

$$COD = \frac{100}{R_m}\left[\frac{\sum_1^n |R_i - R_m|}{n}\right] \quad (1)$$

where R_m is the median ratio, and Ri is the observed ratio. A weighted COD, which uses COD weighted by the number of sales in a town, is also common. Both versions of COD are generally considered good measures of horizontal equity (IAAO 2013).

There is far more debate about how to measure vertical equity. The first formal attempt to measure vertical equity was made by Paglin and Fogarty (1972), using a simple linear regression with appraised value as the dependent variable and sale price as the independent variable. Cheng (1974) modified their equation by using the log forms of appraised value and sale price. Kochin and Parks (1982) modified Cheng's model by using log of sale price as the dependent variable and log of appraised value as the independent variable. Almy et al. (1978) used a ratio of appraised value-to-sale price as the dependent variable and sale price as the independent variable. Then there are a series of multiple regression models controlling for a variety of factors (Bell 1984; Clapp 1990; SanPietro et al. 2019; Sunderman et al. 1990).

IAAO (2013) recommends two standard measures for identifying vertical inequity: the price-related differential (PRD) and the coefficient of price-related bias (PRB). The PRD is a ratio where the numerator is the mean sales ratio of all homes in a town or district divided by the weighted mean of the sample. The PRD's denominator is the sum of all appraised values divided by the sum of all sale prices. IAAO (1990) states that a PRD ranging between 0.98 and 1.03 is acceptable. The PRD by itself does not indicate the severity of inequity, only whether it is regressive (above 1) or progressive (below 1). For example, if a PRD coefficient rises from 1.05 to 1.07, we do not know how much worse vertical inequity became. As a result, IAAO also suggests using the PRB coefficient to measure vertical inequity. The PRB measures "the percentage increase (decrease) in assessment ratios relative to the percentage increase in property values." The PRB coefficient is obtained by "regressing the percentage differences from the median assessment ratio on percentage differences from the median value" (Gloudemans 2011, 5). The PRB coefficient has a more straightforward interpretation than the PRD estimate because a PRB coefficient of 0.015, for example, tells us that the assessment ratios increase by 1.5% when values double. A negative value indicates assessment ratios fall when values double. Thus, positive PRB coefficients indicate progressivity and negative PRB coefficients regressivity.

In addition, vertical inequity can be identified with regression models that offer improved accuracy with the ability to control for a variety of factors. In this paper, we use the Clapp (1990) and Birch-Sunderman (2014) models. The Clapp model uses a two-stage method. The first stage finds a set of values, LnA*, to replace the assessment values in Kochin and Parks's (1982) model, where the equation is written as:

$$LnA = a_0 + a_1 Z \tag{2}$$

Where *LnA* is the natural log of the assessed value, and α_0 and α_1 are the intercept and slope parameters, respectively. The Z variable is an instrumental variable that is assigned the values of +1, 0, or -1 for the top, middle, and bottom third of all sales in the analysis. When equation 2 is applied, the result is a set of fitted *LnA* values, labeled *LnA**. There are three *LnA** generated values where the high, medium, and low property values typically receive the high, medium, and low *LnA** values. This provides the following equation:

$$LnS = \beta_0 + \beta_d LnA^* \tag{3}$$

Where LnS is the natural log of sales and LnA* as previously defined. When equation 3 is applied, the resulting gives an estimate for town vertical inequity that adjusts for measurement error bias present in the earlier models discussed. Consequently, when the coefficient is less than 1, the model indicates progressive vertical assessment inequity; when the coefficient is greater than 1, regressive inequity exists. The Clapp model overcomes the measurement error bias in the estimate for vertical equity found in the model developed by Kochin and Parks. "The bias occurs because the LnA values are only estimates of true market value" (Birch and Sunderman 2014, 91).

Birch and Sunderman (2014) proposed a model that extends the Clapp model by including neighborhood-specific (in our case, town-specific) dummy variables. They state that there exists a potential bias in tax district (in our case Monmouth County) vertical inequity estimates when using models such as Clapp that omit neighborhood variables (i.e., omitted variable bias). The inclusion of dummy variables for each individual neighborhood (town) results in the following equation:

$$LnS = c_0 + \Sigma_j^N = {}_1 c_{0j} D_j + c_d LNA^* \tag{4}$$

Where LnS is as earlier, (j = 1,2,…N) represents the dummy variable for each of the N towns. The dummy variables take values of 1 for sales in their town and 0 otherwise. The $cc0_{jj}$ coefficients provide the relative treatment of individual towns after town-value effects have been removed. The c_d coefficient is an estimate for town vertical inequity, adjusted for town horizontal inequity effects. Consequently, this can determine whether there are sufficient net treatment differences among the whole set of towns and whether town horizontal inequity is significant for the town in question. The model can be advanced to estimate net vertical inequity within each town, and the equation follows as:

$$LnS = e_0 + \Sigma_j^N = {}_1 e_{1j} LnA_j^{**} Dj + e_d LnA^* \tag{5}$$

Where the e_d coefficient represents district (county) vertical inequity after individual town horizontal and vertical inequity are controlled by the inclusion of the two sets of dummy variables.

Data and Methodology

The sample for our study included residential property sales and assessments from 2012 to 2019 in Monmouth County, which we received from the state of New Jersey's Grantors Listing (2021). To test whether Monmouth County's ADP has been effective (so far) at improving tax assessment equity, we included sales and assessment data prior to its implementation (2012-2013) and the two most recent years (2018-2019), which gave the program several years to show empirical effects. We used only single-family, arm's-length transactions that had non-missing, non-zero price values identified by the state of New Jersey. Our total sample size was 13,146 sales, which was the combination of our pre-ADP sample size of 8,316 individual sales and our post-ADP sample size of 4,830 individual sales. These sales were only for towns that opted in to the ADP.

Table 1. Monmouth County, Sales Prices and Assessed Values: Summary Statistics

2012-2013 Sample [a]			
	Sales Price	Assessed Value	A/S Ratio [c]
Mean	448,473	458,321	1.044
Std. Dev.	388,961	389,655	0.185
Median	350,000	360,160	1.026
Min.	1,800	2,275	0.282
Max.	6,425,000	5,647,236	5.663
2018-2019 Sample [b]			
	Sales Price	Assessed Value	A/S Ratio [c]
Mean	513,813	480,858	0.945
Std. Dev.	504,612	405,385	0.114
Median	405,000	378,150	0.944
Min.	15,000	13,700	0.461
Max.	12,000,000	10,211,300	1.554

[a] A total of 8,316 individual sales out of 38 townships
[b] A total of 4,830 individual sales out of 38 townships
[c] A/S ratio = assessment-to-sales price ratio

Table 1 shows the descriptive statistics for sales price, assessed value, and assessment-to-sales ratio (A/S ratio) of our two data sets in this study. Average house prices in Monmouth County increased between 2012-2013 and 2018-2019 by 14.6%, and the median home price increased 15.7%. The average assessed value increased 4.9%, and the median assessed value increased 5%, so assessments increased less than sales prices between these two periods. Consequently, the A/S ratio went from over-assessed by an average of 4.4% to under- assessed by 5.5%. Thus, assessed values lagged market values, which explains the change from over-assessed to under-assessed in the strong housing market in Monmouth County during this period.

Following Birch and Sunderman (2014), we omitted towns with fewer than ten observations in either sample period, which totaled six towns. The elimination of towns with a

small number of transactions resolved two potential issues. First, these transactions did not require individual analysis if they contained no statistical evidence of inequity, and this was highly probable since the transaction information was limited. Second, adding town variables in the regression would have resulted in town inequity indicators that were unreliable and thus misleading because of the limited number of observations in these towns.

One interesting question is how A/S ratios changed from pre-ADP (2012-2013) to post- ADP (2018-2019) and where those changes occurred in the county. Figures 1 and 2 show hot spot analyses using the Getis-Ord Gi* statistic to determine where high (over-assessed) and low (under-assessed) A/S ratios cluster near one another spatially pre- and post-ADP (Payton 2006). We used a threshold distance of two miles, which was determined as the approximate radius (distance from the center of a municipality) based on the average surface area of municipalities in Monmouth County. Figure 1 shows pre-ADP clusters of the A/S ratios where over-assessments (i.e., ratios above 1) show significant clustering around the coast. Under-assessed areas have low A/S ratios (i.e., ratios below 1) and show clustering in the upper-middle and lower-middle regions of the county. In figure 2, which is post-ADP, the clusters have shifted, and the mid-coastal area is now under-assessed, and the upper-middle region of the county shows some over- assessment clustering.

Figure 1. A/S Ratios Pre-ADP Hot Spots in 2012-2013 in Monmouth County, New Jersey

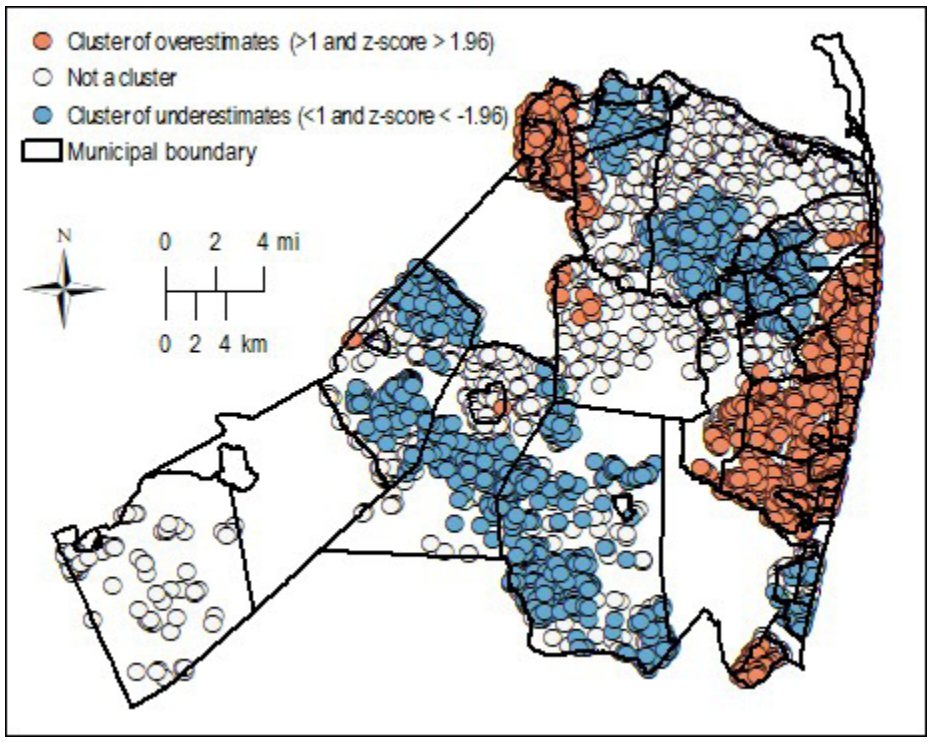
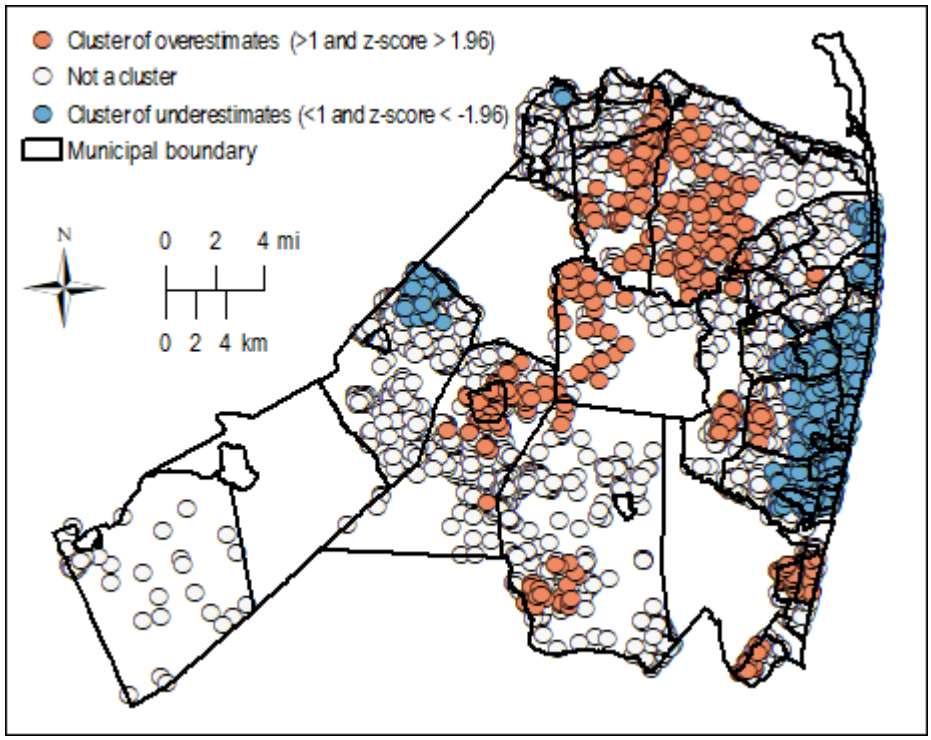


Figure 2. A/S Ratios Post-ADP Hot Spots in 2018-2019 in Monmouth County, New Jersey



IAAO Standards' Measures of Tax Assessment Equity

Table 2 includes the IAAO standard measures of assessment equity. The COD and the weighted COD measure horizontal equity, while the PRD and the PRB measure vertical equity. Our data is broken down into two data sets: pre-ADP (2012-2013) and post-ADP (2018-2019). Thirty-eight eligible towns implemented Monmouth County's ADP, and nine towns opted out. For the opt-in sample, all measures improved after the implementation of the ADP. The COD was reduced from 0.127 to 0.089 and the weighted COD was reduced from

0.121 to 0.096. Both BrownForsythe (p-value < 0.0001) and Levene's (p-value < 0.0001) tests reject equal variances between pre-ADP and post-ADP periods for the optin sample. Furthermore, the Kruskal-Wallis test (p-value < 0.0001) rejects equality of ratio medians between the preADP and postADP periods. Consequently, there is a statistically significant reduction in horizontal inequity for the optin towns.

Opt-out towns also experienced a reduction, but not as large as opt-in towns. It is possible that opt-out towns' COD reductions were a result of becoming more conscientious about their assessments, knowing that neighboring towns were adopting the ADP (suggesting a behavioral effect on assessors), but it is beyond the scope of this paper to determine whether this assertion is valid.

Table 2. Pre- and Post-ADP IAAO Standard Measures

38 Opt-In Towns			9 Opt-Out Towns	
Measure	Pre-ADP	Post-ADP	Pre-ADP	Post-ADP
COD	0.127	0.089	0.127	0.109
Weighted COD	0.121	0.096	0.124	0.107
PRD	1.022	1.010	1.022	1.002
PRB	**-0.016**	0.000	**-0.026**	**0.023**

Bold figures indicate p-value < 0.0001

The PRD in table 2 shows a reduction in regressive vertical inequity from 1.022 to 1.010, though the pre-ADP value of 1.022 is not outside IAAO's acceptable equity assessment range (0.98 to 1.03) (IAAO 1990). The PRB coefficient is -0.016 and is statistically significant for the pre-ADP period. There is a 1.6% decrease in assessment ratio when property value doubles. Consequently, this is evidence of regressive vertical inequity as lowvalue properties are overvalued relative to high-value properties. However, the PRB coefficient is indistinguishable from 0 for the post-ADP period and indicates vertical unbiased tax assessment. The opt-out towns also experienced a reduction in PRD, from 1.022 to 1.002. However, the opt-out towns still display inequity based on the PRB coefficient that switched from regressive (-0.026) to progressive (0.023) vertical inequity. In summary, according to IAAO standard measures, the ADP has reduced both horizontal and vertical inequity for the optin sample.

Application of the Clapp Model and Birch-Sunderman Model

To make a clean comparison, we removed the nine towns that opted out of the program to evaluate its potential benefits. Rather than constructing a hedonic model, we adjusted all assessments according to the director's ratio based on the town and the year. This enabled us to make comparisons between the assessed values and the sales prices in the same period.

Table 3 provides the results of the analysis with the Clapp model as equation 3. The resulting slope coefficient for the 2012-2013 sample is 1.019, indicating that regressive taxes exist because the coefficient is greater than 1. This coefficient was significantly different from 1, with a t-statistic of 2.72. However, the resulting slope coefficient for the 2018-2019 sample is 1.000, indicating a change to neutral property taxes.

Table 3. Clapp Model (3) and Birch-Sunderman Model (4 and 5) Results

2012-2013 Sample				2018-2019 Sample		
Equation	Estimator	t-statistic[a]	R^2	Estimator	t-statistic[a]	R^2
(3)	1.019	2.72	0.7101	1.000	0.00	0.7144
(4)	0.930	-9.17	0.9995	0.904	-10.44	0.9996
(5)	0.414	-49.64	0.9997	0.434	-39.37	0.9997

[a] Based on the null hypothesis the true district vertical inequity coefficient is equal to 1.00 (neutral property taxes).

The Birch-Sunderman model consists of two equations extending the Clapp model:

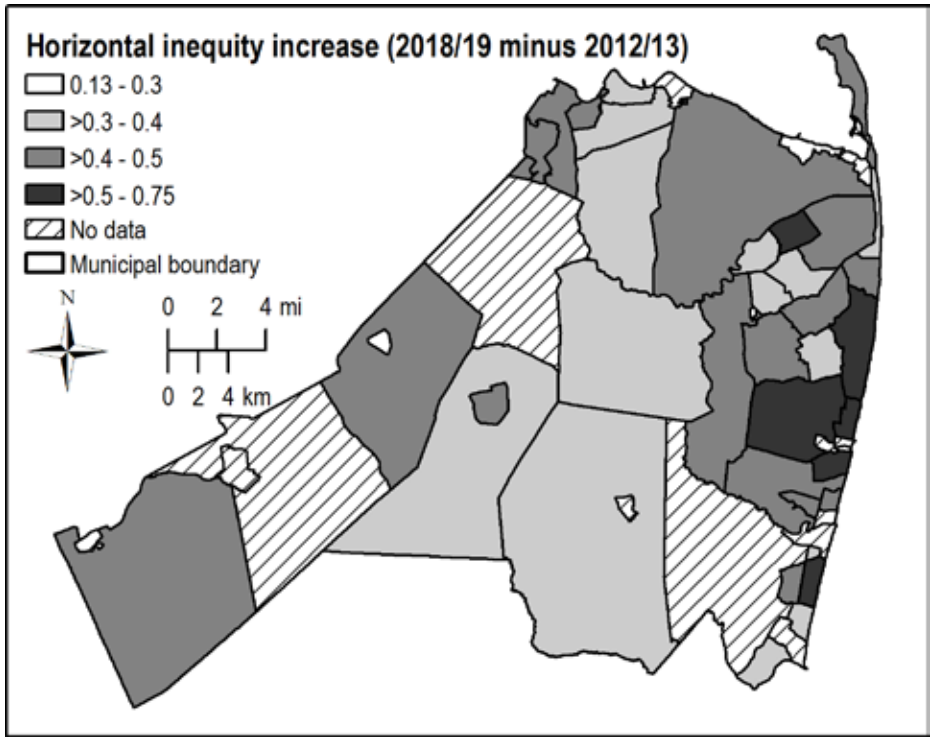
equation 4, which accounts for town-level horizontal inequity, and equation 5, which accounts for both town-level horizontal and vertical inequity. The results of applying both equations to the two sample periods (pre- and post-ADP) are shown in table 3. We used joint F-tests to determine whether adding town-specific dummy variables was appropriate. Using Birch-Sunderman to address town-specific inequities in Monmouth County does not differ significantly from the original use of the model for neighborhood-level inequities. Our argument for this use is that Monmouth County (and all of New Jersey) is a composition of small towns that, when looking at population and geographical sizes, are in most instances similar in size to neighborhoods within a city. The F-tests were significant, with p-values of <0.001; thus, adding the town-specific dummies resolved the omitted variable bias present in the Clapp model (equation 3). We also looked at the R2 values for all three models and found that these too increased from equations 3 to 5 (table 3). These findings confirm that, in this analysis, the Birch-Sunderman model addresses the omitted variable bias present in the Clapp model and is the appropriate specification.

The Birch-Sunderman results suggest mixed findings on the effects of the ADP. Equation 4 shows that progressive taxes exist because the coefficient is less than 1. It (along with equation 5) is also less than the Clapp model coefficient, meaning the Clapp model generated upwardly biased coefficients due to the omitted variable bias. In equation 5, when factoring in both horizontal and vertical inequity, the statistic improves from a pre-ADP coefficient of 0.414 to 0.434 post-ADP. The post-ADP coefficient of 0.434 is still progressive (below 1) but does show an improvement in assessment equity compared with the pre-ADP years.

In both the pre-ADP and post-ADP, all neighborhood net vertical inequity coefficients from equation 5 are positive, which means that all these towns have more progressive vertical inequity compared with Monmouth County (i.e., taxing district). Twenty of the thirty-eight towns showed statistically significant improvements in gross vertical tax equity between pre-ADP and post-ADP. More important, the pre-ADP data set showed thirty-two of the thirty-eight towns had gross vertical inequity coefficients greater than 1, and the 2018-2019 data set showed twenty-nine out of thirty-eight towns with coefficients above 1. These findings indicate that most towns have progressive vertical inequity relative to Monmouth County; however, many of these inequities decreased, overall, from pre-ADP to post-ADP.

Figure 3 shows the change in horizontal inequity among the ADP opt-in towns generated by the Birch-Sunderman model. We subtracted the post-ADP values from the pre-ADP values and mapped them across Monmouth County by town. We can see that in several towns along the mid-coastal (shore) region, horizontal inequity increased the most. The rest of the county shows a mix of change.

Figure 3. Monmouth County Change in Horizontal Inequity from Pre-ADP to Post-ADP



In Figures 4 and 5, we mapped the change in vertical inequity across Monmouth County for opt-in towns. There are some visible changes in vertical inequity between pre- and post-ADP implementation. Our vertical inequity coefficient scales are not identical matches between the two maps because of the change in the range of data, so they are not perfect comparisons, but they are close enough to show relative change.

Figure 4. Monmouth County Vertical Inequity Pre-ADP

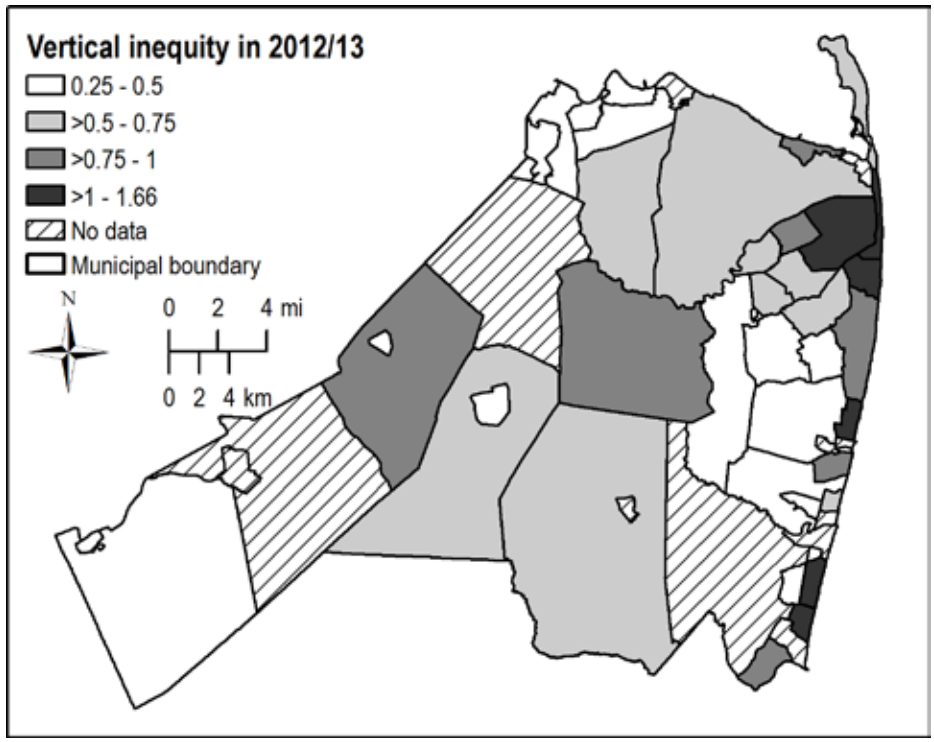
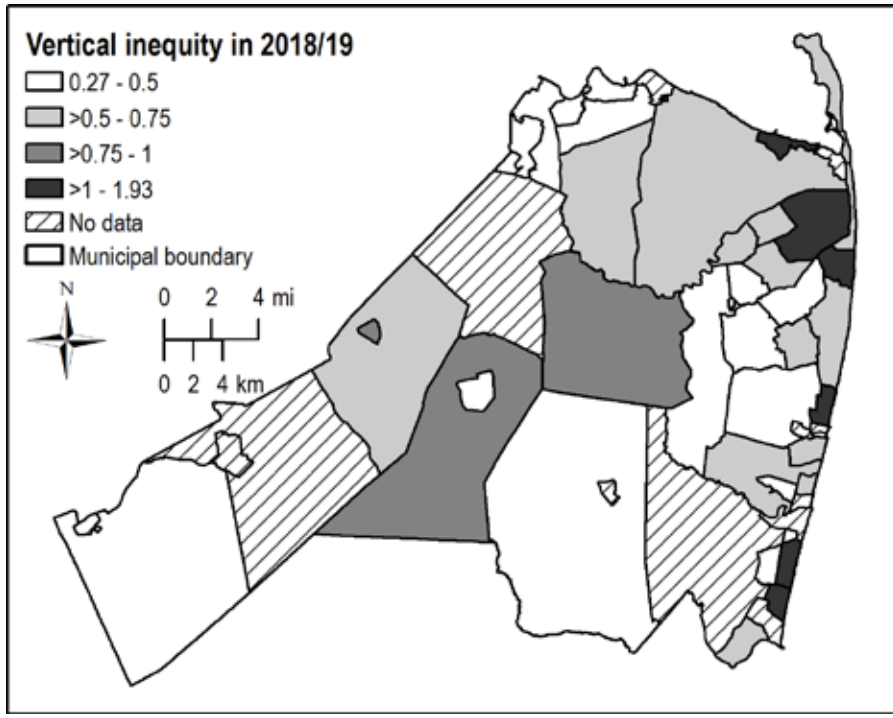


Figure 5. Monmouth County Vertical Inequity Post-ADP



Conclusion

New Jersey's Real Property Assessment Demonstration Program (ADP) was implemented in Monmouth County, New Jersey, in 2014 to improve real property tax assessments. The principal changes were (a) moving from irregular assessment cycles to annual reassessments with five-year internal inspections and (b) moving the county tax appeals process to prior to towns setting their budgets. After six years we have sufficient sales data to test the effects of Monmouth County's ADP program on tax assessment inequities. Monmouth County tax officials found that the ADP has improved the accuracy of assessments and reduced opt-in towns' budget shortfalls after they changed the appeals calendar so that appeals happen prior to municipalities setting their tax levies (Clark et al. 2019). In this paper, we used publicly available data and current models of residential property tax assessment inequity to determine whether horizontal and vertical tax assessment inequities improved after the ADP was implemented in Monmouth County.

Using IAAO's standard measures of horizontal inequity (COD and weighted COD), we found that the thirty-eight towns in Monmouth County that adopted the ADP experienced declines in horizontal inequity when comparing two data sets comprising pre-ADP years (2012-2013) and post-ADP years (2018-2019). The COD decreased from 0.127 in the pre-ADP years to 0.089 post-ADP years, indicating an improvement in horizontal inequity. The weighted COD also decreased from 0.121 to 0.096. To measure changes in vertical inequity, we calculated the price-related differential (PRD) and coefficient of price-related bias (PRB). The PRD showed a reduction in vertical inequity from 1.022 to 1.010; however, these numbers do not indicate the size of the reduction in vertical inequity. As a result, we also calculated the PRB, which does give us a measure of impact on vertical inequity. Our PRB coefficients showed a change from a slightly regressive tax assessment coefficient of -0.016 to a neutral coefficient of 0.000. We found similar effects, though less substantial, in the nine towns that opted out of the ADP.

We used the Clapp (1990) and Birch and Sunderman (2014) models to identify inequity in residential property tax assessments by comparing assessed values to actual sales, controlling for town-specific effects pre- and post-ADP. The Clapp model showed that the thirty-eight Monmouth County towns that adopted the ADP experienced, as a group, an overall reduction in vertical inequity from a progressive tax value of 1.019 to a neutral value of 1.000. The Clapp model, however, is susceptible to omitted variable bias, which the Birch-Sunderman model resolves by adding town-specific dummy variables. Our analysis found the Birch-Sunderman model to be the correct specification for our analysis. The results showed that tax assessments are generally progressive across Monmouth County; however, the coefficient did improve from 0.414 pre-ADP to 0.434 post-ADP. We also found that a majority of the thirty-eight ADP opt-in towns in Monmouth County had more progressive taxes than Monmouth County as a whole. These findings, along with the IAAO standard measures, suggest that Monmouth County's pre-ADP assessment inequity improved post-ADP; however, progressive tax assessment inequities persist. Additionally, the years of our analysis occurred during significant house price growth across Monmouth County, so it is unknown at this time how the ADP will perform when the market softens or home prices fall.

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