The Assessment Gap: Racial Inequalities in Property Taxation*

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Abstract

We document a nationwide "assessment gap" which leads local governments to place a disproportionate fiscal burden on racial and ethnic minorities. We show that holding taxing jurisdictions and property tax rates fixed, black and Hispanic residents face a 10–13% higher tax burden for the same bundle of public services. We decompose this inequality into between- and within- neighborhood components and find just over half of the inequality arises between neighborhoods. We then present evidence on mechanisms. Property assessments are less sensitive to neighborhood attributes than market prices are. This generates spatial variation in tax burden within jurisdiction, and leads to over-taxation of highly minority communities. We also find appeals behavior and appeals outcomes differ by race. Inequality does not arise from either (i) racial differences in transaction prices or (ii) price-regressivity in assessment ratios stemming from location-neutral features of the housing stock.

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1 Introduction

Equitable property tax administration requires the ratio of assessed value to market value to be the same for all residents within any particular taxing jurisdiction. This paper documents the existence of a widespread and large racial assessment gap: relative to market value, assessed values are significantly higher for minority residents in the United States. This assessment gap places a disproportionate fiscal burden on minority residents: within the same tax jurisdiction, black and Hispanic homeowners bear a 10–13% higher property tax burden than white homeowners.

We obtain a property-level dataset spanning most properties in the US, along with a comprehensive record of property sale transactions and property tax assessments assembled from administrative data. We associate each property with the race and ethnicity of the home seller using Home Mortgage Disclosure Act records. In addition, we exploit a set of shapefiles that provide geographic delineation for the universe of local governments and other taxing entities in the U.S. to identify unique taxing jurisdictions. Properties belonging to the same jurisdiction face the same level of intended taxation, the same set of entities providing public services, and the same assessment practices.

Our main empirical exercise compares assessment ratios within these tax jurisdictions. The average assessment ratio for a black resident in our sample is 12.7% higher than for a white resident. For black or Hispanic residents in aggregate, the average assessment gap is 9.8%. We show that the assessment gap cannot be explained by racial or ethnic differences in realized market prices, nor is it simply a byproduct of racial wealth differences and the previously documented propensity for assessment ratios to be regressive (Paglin and Fogarty 1972, Engle 1975, Black 1977, Baar 1981, Clapp 1990, Sirmans et al. 2008, McMillen and Weber 2008). As a result of the assessment gap, minority residents are therefore paying a significantly larger effective property tax rate for the same bundle of public services. For the median minority homeowner, the differential burden is an extra $300–390 annually. This finding is strongly robust across most states in the U.S. We also produce county-level estimates to characterize the distribution of this assessment gap. The average black homeowner in a county at the 90th percentile of the assessment gap distribution has a 27% higher assessment ratio and pays an extra $790 annually in property tax.

We explore four potential channels that drive these assessment gaps in the data, and find supporting evidence for two and rule out two others. The first channel for which we find support is spatial, and concerns assessment misvaluations that occur at the neighborhood level. We show that assessed values and market prices align well on home-level characteristics but diverge on tract-level attributes. In other words, market prices capitalize highly local factors, but assessments are much less responsive. This generates spatial variation in the assessment ratio within jurisdiction. The fact that spatial inequality lands disproportionately on minority residents is a function of residential segregation — black and Hispanic residents face, on average, different neighborhood characteristics than white residents (Ananat 2011, Cutler et al. 1999, Massey and Denton 1993). Such segregation has long been a defining feature of U.S. housing markets, and was driven during the 20th century by both explicit public policies as well as collective action by white homeowners (Cook et al. 2021, Rothstein 2017, Loewen 2005, King 1995, Drake and Cayton 1970, Wolgemuth 1959). Therefore, our findings show that the legacy of historical racial discrimination can generate disparate taxation within today's minority communities, regardless of whether those misvaluations arise from any intent to actively discriminate.

The second channel concerns a racial differential that persists even after conditioning away spatial factors. Within U.S. Census block groups, which represent regions of approximately 1,200 people, an average minority homeowner has an assessment 5–6% higher relative to market price than her nonminority neighbor. This latter finding — which we also show is consistent across the distribution of individual income — is particularly surprising given that most assessors likely neither know, nor observe, individual homeowner race. We show that homeowner interactions with the bureaucracy of property tax administration can increase inequality, and provide supporting evidence by documenting racial differentials in assessment appeals. We use administrative records from Cook County, the second largest county in the U.S., to show that minority homeowners: (i) are less likely to appeal their assessment, (ii) conditional on appealing, are also less likely to win, and (iii) conditional on success, typically receive a smaller reduction than nonminority residents.

Turning to the potential channels that do not explain the outcomes, we first rule out a mechanical explanation unrelated to property tax administration: inequality arising from racial differences in transaction prices. An assessment gap might plausibly result from black or Hispanic sellers realizing lower prices than white homeowners for similar homes, even if assessments reflect the true value of a home. We rule out this possibility by showing that black and Hispanic sellers actually receive a price *premium* of 2–3%. This is consistent with the findings of (Bayer et al. 2017). If anything, racial differences in transaction prices suggest that our main findings are understated and constitute a lower bound.

We then rule out inequality due to price regressivity directly stemming from features of the housing stock. A well-documented pattern of regressive assessment ratios has been established by the literature, starting with Paglin and Fogarty (1972), and most recently in national studies by Berry (2021) and Amornsiripanitch (2021). Although evidence on mechanisms is scarce, one foundational assumption has been that price regressivity arises from differences in home-level attributes — that more unique, larger, and therefore more expensive homes are more difficult to assess (Paglin and Fogarty 1972). We employ two designs that allow us to control for price while stripping out all spatial factors. The first design controls for observable property features directly by augmenting our baseline specification with fixed effects for every unique combination of home attributes in the data. Our second design constructs a location-neutral price for each home by valuing its hedonic attributes according to national within-year valuations. We implement this measure by using it as an instrument for home price, and, alternatively, by creating fixed effects for price quantiles. Across all specifications, our estimates of inequality remain virtually the same. This finding cannot be understated: it shows that racial and ethnic inequality does not arise as a direct consequence of price regressivity; otherwise, attribute-driven price changes would shift our findings. Taken in conjunction with our evidence on spatial inequality, this shows the critical role of neighborhood-level misvaluation in generating racial and ethnic inequality, but also demonstrates one potential explanation for overall regressivity in assessment ratios.

The main contribution of this paper is to the literature on racial disparities in property taxation. Kahrl (2016) describes property tax rates as central to African American political mobilization during the Reconstruction era, and also provides examples of homeowners in the 1920s and 1930s suing local governments for relief from discriminatory assessments. Rothstein (2017) details similar developments in the 1960s and 1970s. Baar (1981) summarizes legal challenges to assessment practices throughout the 1970s, and notes a pattern of over-assessment in low-income and highly minority communities. Atuahene and Berry (2019) estimate a causal link between inflated assessments and tax foreclosures within one county in Michigan between 2009 and 2015.[1] We build upon this research by: (i) documenting the extent of racial and ethnic assessment gaps with comprehensive national data; (ii) partitioning the county into taxing jurisdictions so that our estimates provide an accurate measure differences in tax burden, while holding policy rates and public goods fixed; (iii) using administrative data to link

[1] In a related article Atuahene (2017) argues that present-day assessment practices in the city of Detroit should be considered federally illegal under the Fair Housing Act.

individual properties with homeowner race and ethnicity rather than relying on regional demographic aggregates; and (iv) evaluating mechanisms through which the assessment gap arises.

Several papers within the broader literature focusing on administrative-inequality in property taxes have explored the role of local racial and ethnic demographics in appeals outcomes. Weber and McMillen (2010), Doerner and Ihlanfeldt (2014), and Ross (2017) all show that neighborhood-level minority population share correlates with reduced propensity to appeal, lessened likelihood of success, and/or smaller reductions. McMillen (2013) shows that the total effect of appeals in Cook County increases uniformity with respect to the target assessment ratio, but also that the entire distribution becomes more regressive, in large part due to a lack of appeals originating from properties with the highest ex-ante assessment ratios. Our study is the first linking appeals records to individual homeowner race and ethnicity, permitting a within-neighborhood analysis and direct evidence on racial and ethnic differences.

The paper proceeds as follows. Section 2 describes the typical structure of local property taxation, highlights important institutional details, and outlines our empirical strategy. Section 3 categorizes possible sources of racial and ethnic variation in assessment ratios. Section 4 details the data sets we use. Section 5 presents the results, and Section 6 concludes.

2 Setting and Empirical Strategy

2.1 Local Property Taxes

In the United States, the vast majority of local governments levy an annual residential property tax. Each home is subject to some politically-established level of intended taxation, often representing tax levies across multiple independent governments. For instance, one home might be subject to property taxes imposed by a county, a city, and an independent school district. Tax bills are generated by applying the local policy rate of taxation to the home's assessment: an administrative valuation assigned to each property annually for tax purposes.[2] The local policy rate may be explicitly set (by direct voter approval, or through authority delegated to elected officials), or it may be indirectly

[2] While there are examples of localities imposing fixed, or unit property taxes, these tend to be specific levies approved to fund a particular project (or to cover debt service for a given bond issuance). We do not have any way of providing an aggregate breakdown of tax dollars raised by ad valorem taxation versus unit taxes; in every region we have looked at specifically, unit taxation is a very small portion of overall proceeds.

defined: a certain level of spending will be approved, and then this amount will be divided by the total value of local property, yielding an implicit rate. Assessments are typically generated at the county level, which means potentially more than 3,000 different processes employed.[3]

This structure of property tax administrative motivates our empirical test of property tax equity: assessment ratios must be identical for all homes facing the same level of intended taxation. This relationship must hold exactly for a pure ad valorem tax on the market value of property — a baseline that is regularly outlined in state legislation authorizing the property tax. From this starting point of a purely proportional tax on market value, however, most localities provide for deliberate deviation in the form of property tax exemptions. Based on certain eligibility criteria, a homeowner is shielded from having to pay taxes on some portion of the home's value. In Florida, for example, homeowners are exempt from property taxation on the first $25,000 of home value, but only for their primary residence.[4] Another common exemption applies to senior citizens. Because eligibility varies by resident within a region, property tax exemptions on the whole will induce variation in effective tax rates within a region where intended tax burden is held constant. Our focus on assessment ratios allows us to measure inequality without any confounding effects of exemption policies.

We hold intended taxation fixed by conducting our analysis within regions where every home faces the same set of overlapping governments. In Section 4, we describe the process of partitioning the U.S. into such regions, which we call taxing jurisdictions. Estimating inequality within taxing jurisdiction not only ensures that we hold fixed the (aggregate) policy rate, along with all relevant assessment practices (most critically the local target for assessment ratios), but also ensures that we compare homeowners receiving public goods and services from the same set of public entities. This also means that any inequality we find cannot arise from differing choices about the level of public goods provision. Although it is certainly possible that, for instance, the quality of educational services provided by an independent school district varies from school building to school building in ways that correlate with race, tax levels are determined by district rather than by school building, and therefore, all homeowners of the same district have implicitly entered into the same taxation-for-services compact.

[3] In some regions, the authority devolves to the township level. This appears to be relatively more common in the New England states.

[4] 2019 Florida Statues 196.031.1(a).

2.2 Assessment Algorithms

Automated Valuation Models or Computer Assisted Mass Appraisal are the standard for larger jurisdictions, as there are too many properties to make in-person inspection feasible. Some districts will cycle between more frequent mass appraisal and less frequent physical inspection; this latter component often involves only external inspection. An assessment is assigned to every property for each tax year, but in many locations, assessments are updated less than annually and therefore are reused for several years.

The International Association of Assessing Officers (IAAO) is the preeminent professional organization in this space, and it publishes professional standard guidelines for mass appraisal. The IAAO's standards essentially outline hedonic pricing models using a relatively small vector of property-level characteristics. Most districts have access to home-attribute information as part of property tax rolls.[5]

A standard general approach values homes as a function of housing stock characteristics, local characteristics, and a geographic fixed effect: $f(X_{it}, W_{it}, \gamma_{it})$. In a linear setting, assessors estimate and then attach hedonic prices to each home attribute, including physical characteristics as well as neighborhood characteristics. Presumably due to the challenge of observing and quantifying relevant neighborhood characteristics, it seems common to allow a geographic fixed effect to drive a portion of the price, rather than including a large vector of geographic covariates. Some assessors allow hedonic prices to vary by location as well.

Our sense is that rule-of-thumb approaches are also not uncommon: assessors increase the value of homes by X% in a given year, within a given region. While many locations have access to historical sales prices from transaction data, in some localities this information is not systematically collected.Professional capacity within assessing offices also varies widely. Smaller regions often hire consultants; larger regions are more likely to have dedicated in-house assessment staff.

2.3 Empirical Strategy

Our central estimating equation is:

$$ln(A_{ijt}) - ln(M_{ijt}) = \gamma_{jt} + \beta^r race_{ijt} + \epsilon_{ijt}. \tag{1}$$

[5] We have, however, heard from multiple county officials that sometimes this information is missing or unreliable.

Here *race* is a vector of indicator variables for racial and ethnic groups, and γ_{jt} is a jurisdiction-year fixed effect. In Section A of our Online Appendix, we show that this estimating equation arises directly from the null of an equitably administered proportional tax. The jurisdiction-year fixed effect is essential for two reasons. First, it ensures we compare homeowners taxed and served by the same set of governments, thereby ensuring that our estimates are interpretable as differences in tax burden while holding intended tax rates fixed. Second, these fixed effects control for different local choices of target assessment ratio.[6]

In equation 1, *race* is a categorical variable, making β^r a vector of estimated group-level deviations from the average realized assessment ratio. If β^W, the average assessment ratio for white residents, is statistically different from β^M, the average assessment ratio for any grouping of minority residents, this would be evidence of inequality in tax burden. The Online Appendix shows that this framework easily nests property tax exemptions, which are prevalent in most jurisdictions.

Our benchmark test for racial and ethnic inequality is closely linked to the legal notion of disparate impact. Department of Housing and Urban Development regulations state: "[a] practice has a discriminatory effect where it actually or predictably results in a disparate impact on a group of persons[...] because of race, color, religion, sex, handicap, familial status, or national origin."[7] Courts interpreting disparate impact claims have relied on exactly this type of test of group means.[8]

3 Potential Explanations for Assessment Ratio Variation

Within-jurisdiction variation in assessment ratios is a sufficient statistic for property tax inequality, regardless of what generates the variation. That said, after documenting magnitudes, this paper focuses on categorizing how this inequality arises. A range of plausible drivers could generate variation in assessment ratios, with sharply different policy implications.

[6] Along with local policy rates, intended tax burden is also characterized by the target assessment ratio, which is a local choice. For example, in a locality where a target assessment ratio is 0.4, a $200,000 home would receive an assessment of $80,000. Although one might expect the natural benchmark to be a target assessment ratio of 1.0 (a $200,000 home would receive an assessment of $200,000), a practical quirk of property tax administration is wide regional heterogeneity in target ratio. The state of Georgia, for instance, mandates that assessments be 40% of market value; Illinois selects a statewide ratio of 33.3%, but the largest county in the state chooses 10% instead; and Colorado's target, 7.15% as of 2021, evolves annually as a function of aggregate relative value between residential and non-residential real estate.

[7] 24 CFR 100.500(a).

[8] *Texas Dept. of Housing and Community Affairs v. Inclusive Communities Project, Inc.*, 576 U.S. 519 (2015).

3.1 Denominator, Not Numerator

Racial differences in transaction prices arising from any feature of housing market microstructure would induce variation in assessment ratios through the denominator (market values) even if the numerator (assessed values) were correct relative to a "true" latent home value. We rule out this explanation by using repeat sales to test for racial differences in transacted prices, and showing that the evidence supports minority home sellers receiving a price premium.[9] This is consistent with other findings from the literature (Bayer et al. 2017), and means that to the extent that racial differences in transacted prices exist, they lower our estimates of inequality.

Therefore, variation in *assessments* generates the inequality we find. Our analysis seeks to document and understand patterns in the aggregate outcomes of these local processes, but given the number of assessing districts nationwide, does not delve into the specific model employed by any locality.

3.2 Biased Assessors

We do not provide evidence of biased assessors exercising overt racial animus. Our findings are consistent with structural inequality: disparities that can arise from entrenched systems independently of any latent discriminatory intention or attitudes. In fact, assessors are unlikely to observe homeowner race or ethnicity in the majority of cases. In larger jurisdictions, in-person valuation tends to be unfeasible, and assessments are generated using automated valuation models without a site visit. Even when site visits do occur, they are often restricted to external examination of the property. We document inequality in the outcomes of such modeling, but cannot distinguish between model mistakes and deliberate distortion.

Though we do not have data on the race of assessing officers, or the public official ultimately responsible for property tax administration, we show that inequality is so broadly present in the majority of states and counties that it almost surely encompasses regions where those producing assessments are themselves members of racial and ethnic minorities. In addition, we use a measure of racial animus from Stephens-Davidowitz (2014) to show that inequality is economically and statistically significant within both high and low animus regions. Although our results certainly do not rule out overt racial discrimination, such discrimination is neither a necessary element nor a central implication

[9] Note that this is an average of within- and across-race transactions; the former is by far the largest proportion of sales. Therefore this means that the average minority home buyer also pays a premium.

of the inequality we document.

3.3 Price-Regressivity and Racial Wealth Gaps

Beginning with Paglin and Fogarty (1972), the property tax literature has documented the tendency for assessments to be regressive: lower priced homes seem to have lower assessment ratios on average. While early literature debated whether this pattern was an artifact of statistical bias (Kochin and Parks 1982, Clapp 1990, Black 1977), this pattern now is well established in the literature (McMillen and Singh 2020, Ross 2017, McMillen 2013, Weber and McMillen 2010, McMillen and Weber 2008), and within the last year two new studies have carefully documented the breadth of this finding nationally (Berry 2021, Amornsiripanitch 2021).

If assessment models were to somehow generate price-regressive assessment ratios in a way entirely unrelated to race or ethnicity, this regressivity — combined with racial wealth gaps and a correlation between wealth and home value — would mechanically induce racial inequality in property taxes. However, the issue is substantially more complex than this. A wide range of public policies spanning much of the 20th century created high levels of residential segregation in the United States. Institutional and social choices — including, but certainly not limited to, widespread redlining until the 1960s, "white flight" patterns, restrictive zoning policies, persistent public disinvestment in "underserved communities", and the design and siting of public housing — have exerted strong and persistent impacts on market prices in many predominantly minority communities, both directly and indirectly (Aaronson et al. 2020, Perry et al. 2018, Bruhn 2018, Rothstein 2017).

Accordingly, there is no justification for viewing home prices as a primitive, exogenous factor driving variation in assessment ratios, leaving only residualized variation to be explained by other factors such as race or ethnicity. The literature documenting the stylized fact of regressive assessment ratios has not settled on a cause of the pattern.[10] Most early studies alluded to more expensive homes being hard to value — and thus often assessed too low — because they are often larger, more idiosyncratic, and less standardized.[11]

[10] McMillen and Singh (2020): "One of the stylized facts of the literature on property assessments is that assessment rates – the ratio of assessed value to the sale price of a property – tend to be higher for low-priced properties. The source of this form of regressivity is unclear."

[11] As in, e.g., pp. 559–560 of Paglin and Fogarty (1972): "High priced houses tend to be more individual in terms of design, decorative details, etc. – matters which are not easily plugged into existing appraisal formulae and which consequently tend to be undervalued when using mass-appraisal techniques."

We explore the potential mechanism of attribute-driven regressivity by constructing a measure of price that relies only on property features (what does the house look like?) but is not affected by location (where is the house?). If our findings were a mechanical artifact of price regressivity in assessments, then this location-neutral measure of price would nonetheless strongly correlate with racial and ethnic inequality. We find the effect of this channel is negligible.

Our results do ultimately suggest that home location is important for understanding inequality. Residential segregation is an endemic feature of U.S. housing markets, and is tightly linked to historical polices overtly motivated by race. Therefore, controlling for components of price driven by location is undesirable — the control would be endogenous with respect to race. However, in this context, we also rule out a mechanical regressivity explanation by showing that conditioning on neighborhood-level wealth measures cannot explain inequality, and in fact that inequality is largest when comparing assessment ratios for black homeowners in low-income communities with assessment ratios for white homeowners in similarly low-income communities.

3.4 Spatial Factors

Location, location, location.

–Classic real estate maxim[12]

Perfectly accurate assessments would value local amenities in exact lock-step with housing markets. To explore whether differential valuation of local attributes generates a wedge between market values and assessments, we specify parallel hedonic models: one with assessed values as the dependent variable, and the other with market prices. All dependent variables are the same and include all property observables along with a range of neighborhood (tract) attributes reported in the American Community Survey. We find that both market prices and assessed valuations respond to all neighborhood features. However, the implied hedonic prices from the market model show that market prices are much *more* responsive than assessments are.

Misvaluation of spatial attributes mechanically creates spatial tax inequality. As a consequence of residential racial segregation, this inequality lands along racial and ethnic lines. The average black or Hispanic homeowner in the U.S. faces a different set of neighborhood attributes than the average

[12] Earliest known usage, Chicago Tribune, 1926.

white homeowner. Specifically, the average black or Hispanic homeowner lives in a neighborhood where local amenities push prices lower (after absorbing property characteristics) (Menendian et al. 2021, Perry et al. 2018, Reardon et al. 2015, Ananat 2011, Massey and Denton 1993). Therefore, the insufficient responsiveness of assessments leads to undervaluation in neighborhoods exposed to highly-valued amenities and relative over-valuation in neighborhoods exposed to negatively-valued amenities.

Beyond misspecification of the valuation model, we also explore the impact of common administrative policies that potentially interact with housing market features to create spatial variation in assessments. This includes assessment caps (a restriction year-to-year growth in assessments) and frequency of assessment reevaluation. Neither appears to be a meaningful driver of racial inequality.

3.5 Individual Drivers

Spatial factors cannot explain all of the inequality we find. We establish this by showing that inequality persists within small regions — an approximation to the ideal experiment of comparing two adjacent properties with homeowners of differing race or ethnicity.

As noted, assessor bias seems an implausible explanation for a race-based differential attached to individual homeowners within a neighborhood, simply because assessors generally have no reason to know the race of specific homeowners on any given street. Probabilistic inference based on regional demographics would be static within neighborhoods. And the analyses previously described already rule out inequality arising from sorting into different types of homes within neighborhood, or any differential propensity to maintain or improve properties.

We hypothesize that inequality within neighborhoods results from homeowner engagement with property tax bureaucracy. We test this hypothesis in Section 5.3.3 by focusing on assessment appeals. We find that minority homeowners are significantly less likely to appeal, less likely to be successful conditional on appealing, and get a lower reduction conditional on a successful appeal.

Other scholars have raised this possibility in a property tax setting. Existing work shows a correlation between neighborhood-level demographics and appeal outcomes. Weber and McMillen (2010) and Ross (2017) also use data from Cook County, along with tract-level demographic data, and find that high minority share census tracts correlate with fewer appeal applications and lower success rates. Doerner and Ihlanfeldt (2014) report similar findings in 2005–2009 data from Florida, using a between-block group analysis. To the best of our knowledge, we are the first to use property-level data on individual homeowner race and ethnicity to conduct a within-neighborhood analysis.

We also consider the possibility that assessment ratios are regressive with respect to homeowner income. While we find heterogeneities by level of income, racial and ethnic inequality persists across all income levels.

4 Data

The core research design of this paper rests on combining data from three sources. Annual property-level records of assessments, transactions, home characteristics, and geolocation come from ATTOM. Geographic Information System (GIS) detail on local government boundaries comes from Atlas Muni Data. And racial information of mortgage-holders is pulled from Home Mortgage Disclosure Act records. We merge these three sources to create a panel of observations at the property-year level. For each home, four pieces of information are observed: (i) the network of taxing entities touching that property; (ii) the annual assessment; (iii) whether any transaction occurs, along with the transacted price if so; and (iv) the race of the homeowner. For any analysis of assessment ratio, we restrict attention to homes which transact in an arms-length sale with an observed market price, and we focus on the race and ethnicity of the home seller (the homeowner at the time when the assessment was done). We merge this assembled dataset with standard data from the U.S. Census and the American Community Survey.

Each source is worth describing in a bit more detail. We obtain property-level records of assessments and transactions from ATTOM, a comprehensive dataset with annual observations on 118 million properties in the U.S. from 2003–2016. Assessment and transaction records are sourced from county assessor and recorder offices, respectively. We restrict our attention to residential properties of up to four units. Commercial property is generally assessed differently from residential properties, so we cannot draw inference from jurisdiction average assessment ratios without restricting to residential properties only. Further, multi-family homes (e.g. large apartment buildings) are sometimes subject to different assessment rules. The restriction to residential properties of one to four units gives us a set of properties that should always be assessed in the same way within jurisdiction. To avoid having to impute any market values, our baseline dataset includes only homes for which we observe the sale price in an arm's-length, full consideration transaction.[13] Importantly, each home is identified with a latitude and longitude for the parcel. These are used to geolocate the home within government borders. We form assessment ratios using assessments and transactions observed in the same period (year).

We obtain shapefiles for government boundaries from Atlas Investment Research's Atlas Muni Data. These 75,000 shapefiles are intended to span the universe of local governments in the U.S. The core set of shapefiles covers counties, cities, towns, schools, and special districts as defined by the U.S. Census. In addition, Atlas Muni Data developed proprietary shapefiles for any entity which has ever accessed public debt markets, as compiled from Municipal Securities Rulemaking Board filings. As debt issuance is very often paired with either broad authority to tax (in the case of general obligation bonds) or a voter-approved one-off tax levy (more common for revenue bonds), we consider each of these entities as a potential taxing entity. Collectively, in addition to the 50 states and D.C., the Atlas data covers 3,142 counties, 46,660 cities or towns, 13,709 independent school districts, and 11,924 special purpose districts. We use standard GIS techniques to associate each home with its encompassing network of overlapping governments. A taxing jurisdiction, then is defined as a set of homes which all face the same set of governments. This definition ensures that we hold constant assessment practices, the aggregate level of intended property taxation, and also the set of entities providing public goods and services.

The Home Mortgage Disclosure Act (HMDA) mandates that financial institutions disclose certain information about mortgage applications and mortgage origination at an individual loan level, including applicant race and ethnicity. We merge HMDA records to the ATTOM dataset following the standard procedure in the literature (see, e.g. Bayer et al. 2017 or Bartlett et al. 2018), which relies on matching year, census tract, lender name, and dollar amount (rounded to thousands). We provide additional details of the merge in the Online Appendix.

The initial merge establishes race and ethnicity of the home buyer.[14] We care about the race and ethnicity of the *seller*, because the seller is the owner at the time when the assessment is generated. Therefore, we exploit the dynamic structure of the transactions dataset to build a panel of homes for which we know the declared race and ethnicity of the homeowner at each year. There are two relevant

[13] The recorder portion of the ATTOM dataset has several indicator flags for arm's-length transactions and partial interest sales, which collectively can be used to isolate transactions that reflect an accurate signal of market value.

[14] HMDA records also include information on co-applicants. We use race and ethnicity of the primary applicant only.

cases: (i) sales and (ii) refinance transactions. For sales, the transaction pins down the race/ethnicity of the buyer, which is then associated with that property in each subsequent year until the next observed transaction. For refinance transactions, we carry race and ethnicity not only forward in time but also backward, as the home does not change ownership.

One salient choice we make is to remove all California properties from the final dataset. We present estimates of racial and ethnic inequality in California in our Online Appendix. We remove California from the national sample due to the stringent limitations on assessment practices authorized by Proposition 13 in 1978. Other jurisdictions have enacted property tax caps; nevertheless, because of higher property tax caps or relatively lower home appreciation (as compared to California), these caps are less likely to bind than Proposition 13.[15] We do find similar patterns of inequality in California, however our subsequent analysis of mechanisms in this paper is less relevant for California, simply because assessments there are so mechanically driven by the restrictions of Proposition 13.

Our final baseline dataset is a panel of 6.9M homes spanning 49 states. The data are anonymized: each home is characterized by a unique ID variable. For each observation, we have an assessment ratio, know the associated taxing jurisdiction, and have the reported race and ethnicity of the homeowner. Each home is associated with a census tract and a census block group, permitting us to merge in tract-level variables from the American Community Survey five-year estimates.

Table 1 analyzes the balance between the subsample that merges to HMDA (with disclosed race/ethnicity) and the subsample that does not match. The estimates provided result from regressing each tract-level measure separately on a match indicator along with jurisdiction-year fixed effects. All coefficients are statistically significant but economically very small. Imbalance on racial demographics is, of course, an important potential confounder. We do not observe this. Homes in our matched sample are in tracts with, on average, 64–66bps lower minority population share. Matched homes are in regions with a population that is slightly larger (by 1.5%) and slightly older (by approximately 2 months). Various other socioeconomic indicators from ACS show a difference of less than half a percentage point. Features of the housing stock are very similar: matched homes are smaller by 10 square feet on average, and are built more recently by 1.7 years. The largest mismatch is on individual home prices: matched homes have transaction prices close to 4% higher than unmatched homes. The major exclusion from HMDA is all-cash transactions, so a difference on price is not surprising. No clear

[15] We include analysis of property tax caps in Section 5.3.2.

ex-ante prediction about bias is evident as a result of this imbalance, especially given that the racial demographics show we are not matching higher priced homes as a result of over- or under-selecting in minority communities. Assessment ratios for matched homes are 1% higher. Again, there is no clear prediction about potential bias to be made, and relative to the magnitude of our findings, this 1% imbalance is small.

5 Results

5.1 Baseline Findings: Assessment Gap

Our core specification follows equation 1. Assessment ratios are regressed directly on a categorical variable for racial and ethnic groups, along with a jurisdiction-year fixed effect to hold intended taxation fixed and to absorb variation arising from regional choices of assessment ratio target. By design, we focus on *unconditional* assessment ratio variation within taxing jurisdiction. For purposes of understanding inequality in tax burden, this is the meaningful statistic. This is an important distinction relative to other settings. For instance, in analyzing the black–white wage gap, proxies for productivity and skill are desirable controls. No natural benchmark holds that people should earn the same wage regardless of skill. For property taxation, however, our taxing jurisdictions characterize regions where every homeowner is subject to the same policy tax rate. From the standpoint of tax equity, no conditioning variables should be relevant: our equitable tax null must hold for every homeowner regardless of factors like wealth, education, home value, age, and race/ethnicity.

Across all our results, we consider two groupings of minority residents. The first is mortgage holders whose racial identification in HMDA is "black or African American." The second adds mortgage holders whose ethnic identification is "Hispanic or Latino" and thus combines the two largest racial and ethnic minorities in the country.[16] In all cases, the comparison group is non-Hispanic white residents.

Table 2 presents our baseline finding of a racial/ethnic assessment gap. Within jurisdiction, assessment ratios are 12.7% higher for black homeowners and 9.8% higher for black or Hispanic homeowners. Given a national median effective property tax rate of approximately 1.4%, and a median home value

[16] In our Online Appendix, we show results for a third grouping: all mortgage holders identified in HMDA as having any race other than white or black, and not of Hispanic or Latino ethnicity. This last grouping is not a natural division and masks a large amount of underlying racial heterogeneity. The data is not sufficient to conduct a more precise racial breakdown or a county-of-origin breakdown. We include these results for the sake of completeness.

of approximately \$207,000, this translates to an additional tax burden of \$300–\$390 per year for black and Hispanic homeowners.[17]

We show two results characterizing the distribution of the assessment gap. First, Figure 1 shows the assessment gap by state for black residents and for black and Hispanic residents. We present results only from states with at least 500 observations, which excludes seven states.[18] In the remaining set, the assessment gap is positive and strongly statistically significant in most states. For black homeowners, the state level estimates range from 33% to −3%. Estimates are positive and significant in 34 states, positive and insignificant in five, and negative and insignificant in three. For black or Hispanic homeowners, the pattern is very similar.

Second, we estimate the assessment gap at a county level. The results for black residents are shown in Figure 2. The distribution for black and Hispanic residents grouped together has a very similar shape.[19] We again restrict attention to counties with at least 500 observed assessment ratios. This reduces our sample to 671 counties. Our estimates range from 54% to −49%. The interquartile range is 14.8% to 4.7%. Point estimates are positive and significant at the 5% level in 391 counties, positive and insignificant in 219 counties, negative and insignificant in 53 counties, and negative and significant at the 5% level in eight counties. For a black homeowner at the 90th percentile of this distribution, the assessment gap would be 27%. For a \$207,000 home subject to a 1.4% tax rate, this would translate into an additional tax burden of \$790 annually.

Our empirical strategy is motivated by the direct link between assessment ratios and tax burden. In Section C.ii of our Online Appendix, we estimate pass-through between assessment ratios and tax payments, and show this links holds as expected in the data.

[17] Averaging over white, non-Hispanic residents, the median jurisdiction in our data realizes an effective tax rate of 1.4%. Other methods of computing a national median property tax rate return similar figures. We obtain a median home value of \$207,000 for minority homeowners by taking Zillow's national 2019 estimate of \$231,000, and reducing it by 10%, which reflects the ratio of black or Hispanic-owned home value to median home value in our baseline dataset for the latest available year (2016).

[18] These seven states are "non-disclosure" states, meaning that no law or administrative policy mandates the reporting of sales price. We are able to produce estimates for another set of seven non-disclosure states, as a sufficient volume of transactions are reported nonetheless. In these states, selection into reporting is a possibility. The remaining 34 states mandate disclosure (Dornfest et al. 2019).

[19] Results are available from the authors upon request.

5.1.1 Just Over Half of Inequality is Spatial

A large portion of inequality arises from home location. We establish this through a spatial decomposition that separates inequality within neighborhood from inequality between neighborhoods. The ideal experiment would compare two contiguous properties on the same street. Any distortion in assessment ratios arising from neighborhood factors would most plausibly be equivalent for these two homes. We do not observe transactions in sufficient quantity to conduct this analysis using literally adjacent homes, so we approximate this experiment by conditioning on successively smaller geographies and show that the estimates are stable.

Columns (2) and (3) of Table 2 list the results. Within census tracts, which are regions of 4,000 people on average, we find inequality of 6.4% for black homeowners and 5.3% for black or Hispanic homeowners (Column 2).[20] According to the U.S. Census Geographic Areas Reference Manual, census tracts are initially drawn with the goal of being "as homogeneous as possible with respect to population characteristics, economic status, and living conditions." This criterion provides additional support for our strategy of attempting to hold neighborhood composition fixed by looking within tract. However, tracts may be large enough that home prices are not identically affected by local factors. Column (3) shows inequality estimated within Census block groups — regions of 600–3,000 people. The estimates are approximately 50bps lower relative to the tract-level analysis (though not statistically different): the point estimates are 5.9% and 4.85% for black and black or Hispanic homeowners respectively.

For both groupings of minority homeowners, then, a bit more than 50% of the average inequality arises between neighborhoods, and is conditioned away within census block group. In Section 5.3, we explore mechanisms generating both spatial and non-spatial inequality.

5.2 Ruling Out Mechanical Explanations

Before exploring what *does* generate the assessment gap, we rule out two potentially important explanations. We first show that differences in transaction prices do not generate the inequality that we document. That is, black homeowners do not systematically realize lower sales prices, thereby pushing observed assessment ratios upwards. Second, we show that racial inequality is not a direct byproduct of price regressive assessment ratios: e.g., sorting into larger and more expensive homes

[20] As always, our analysis is within jurisdiction. Tracts are sometimes split between jurisdictions. Thus, to be precise, we use jurisdiction-tract-year fixed effects.

does not mechanically generate the assessment gap.

5.2.1 Inequality Does Not Arise from Differences in Transaction Prices

Several economics papers have explored the possibility that transaction prices are a function of race. Bayer et al. (2017) uses very similar housing microdata to the ATTOM dataset used in this paper and finds that black and Hispanic *buyers* pay a premium of around 2%. This effect is positive across virtually all racial and ethnic combinations of buyers and sellers, and is largest for within-race transactions (black seller and black buyer; or Hispanic seller and Hispanic buyer). In U.S. housing markets, the majority of transactions occur within-race. Therefore the Bayer et al. (2017) finding would suggest that minority assessment ratios in our sample (which are associated with the race and ethnicity of the home *seller*) may be understated by 2%.[21] In turn, this would imply that racial or ethnic differences in transacted prices *lower* our estimates of inequality by 2%.

Bayer et al. (2017) uses a within-property analysis and restricts attention to four large metropolitan areas to obtain sufficient transaction density. One embedded assumption is that home characteristics stay constant (and are therefore absorbed by the property-level fixed effect). We add additional evidence using a slightly different methodology that relaxes this assumption.

For the set of homes which sell more than once, we define P_0 as the first transaction price. We use ZIP code level home price indexes to form a predicted selling price:

$$\hat{P_{it}} = P_{i0} * \frac{HPI_{zt}}{HPI_{z0}} \tag{2}$$

where HPI_{zt} is a ZIP code HPI for time t.[22] We then run the following regression:

$$ln(P_{it}) - ln(\hat{P_{it}}) = \gamma_{bg,t} + \beta^r seller\ race_i + \epsilon_{izt} \tag{3}$$

where γ_{bg} is a census block group fixed effect. The left hand side is an unexpected component of transaction prices: the difference between realized and predicted prices. We include a fixed effect at the block group level to absorb spatial imprecision arising from the ZIP code HPI.[23] Coefficients on

[21] We construct assessment ratios using realized market prices as the denominator. Thus, if realized market prices are higher than "true" value, this would increase the denominator, and reduce the assessment ratio.

[22] We obtain ZIP code HPI measures from Zillow.

[23] By population, the average ZIP code is 7–8 times as large as a block group.

the categorical *seller race* variable are estimates of racial and ethnic differences in transacted prices which are not explained by local housing market conditions.

Table 3 shows the results. We estimate that black sellers receive 2.2% more than white sellers within the same census block group. Considering black or Hispanic sellers together, the estimated premium is 3.3%. This evidence lines up closely with the results presented in Bayer et al. (2017). The difference in transacted prices could arise from differential propensity to improve or maintain property, differences in how properties are "staged" for sale, or from a range of other housing market frictions. No matter the reason, these results suggest that, to the extent that a racial differential in market prices exists, realized market prices are slightly higher for minority sellers. This would lead to a *lower* assessment ratio for minority sellers, which means that our estimates of inequality are, if anything, biased downwards on the order of 2–3%.

5.2.2 Inequality Does Not Arise from Price-Regressivity in Assessment Ratios

As discussed in Section 3.3, if assessment ratios are regressive for reasons having nothing to do with race or ethnicity, the result would still be inequality in property taxes along racial and ethnic lines. To understand whether the inequality we find arises in this relatively mechanical way, we cannot simply control for price directly, as in:

$$ln(A_{ijt}) - ln(M_{ijt}) = \gamma_{jt} + \beta^r race_{ijt} + \Xi M_{ijt} + \epsilon_{ijt}. \tag{4}$$

The key flaw in the prior specification is the possibility that market price is a function of race: $M_{ijt} = f(race, H_{ijt})$, where H_{ijt} is a vector including without loss of generality all factors other than race affecting prices. In positing that race is an input to market prices, we do not have in mind racial differences in transaction prices (addressed in Section 5.2.1) but rather the widely-documented stylized fact of lower home prices in highly minority communities.[24] Assuming a linear functional form for market price and rewriting yields:

[24] Previous literature has explored whether low prices in highly minority communities is related to preferences for segregation or differences in local amenities like school quality (Bayer et al. 2007). In addition, amenities are a partial function of public investment, which also may be a function of race. It is beyond the scope of this paper to disentangle the role of race in home price formation. Equitable assessments mirror variation in market prices, regardless of their cause.

$$ln(A_{ijt}) - ln(M_{ijt}) = \gamma_{jt} + \beta^r race_{ijt} + \Xi(\xi^r race_{ijt} + \psi H_{ijt}) + \epsilon_{ijt}. \tag{5}$$

In equation 4, estimated racial inequality for black homeowners is β^B. However, the total racial effect is what we want to measure: $\beta^B + \Xi\xi^B$.

To accomplish this, we construct two methods that allow us to control for location-neutral drivers of price, while stripping out spatial factors linked to racial demographics or residential segregation. The first approach controls for property features directly in a high-dimensional, non-parametric manner. We augment our baseline specification with a fixed effect for every unique combination of home attributes in the data:

$$ln(A_{ijt}) - ln(M_{ijt}) = \alpha_{attr} + \gamma_{jt} + \beta^r race_{ijt} + \epsilon_{ijt}. \tag{6}$$

Here α_{attr} is a home-specific tupple of categorical variables capturing: size, number of bathrooms, and home vintage; along with indicators for fireplaces, patios, and/or swimming pools. We exclude properties missing data in any of the attribute fields, which results in a smaller sample than our baseline analysis. Section B.iv of the Online Appendix includes full details on how we establish categorical variables; our results are not sensitive to these choices at all. Table 4 shows the results. Column (1) repeats our baseline estimation of the assessment gap in this smaller subsample of homes; inequality is 12.03% and 9.33% respectively. The inclusion of attribute-fixed effects in column (2) changes estimates by less than 20 basis points in both cases.

We also use home characteristics to construct a continuous measure of home prices based only on features of the property stock. Year-by-year, for every home i in jurisdiction j and census tract n, we estimate implied hedonic attribute prices, using data from all states *except* s, the state containing home i:

$$ln(M_{injt,-s}) = \gamma_{jt} + \Theta_{st} X_{injt,-s} + \Gamma_{st} W_{njt,-s} + \epsilon_{injt,-s} \tag{7}$$

Homes are indexed by i, census tracts by n, and jurisdictions by j. State s is a function of i, which we omit for ease of notation. We estimate this equation separately for each year t. X denotes property attributes, and W denotes tract-level attributes. We then use estimated hedonic prices to construct a property-attribute-implied price for home i: $\ln(\hat{M}_{ijst}) = \hat{\Theta}_{st} X_{ijst}$. This price values each of i's specific property features at the level implied by national valuations. Therefore $\hat{M}$ includes no local information either in attribute price levels, or related to the within-jurisdiction location of home i.

We form fixed effects for quantiles of $\ln(\hat{M})$ to test for inequality within homes of similar attribute-implied value. We use 200 quantiles in column (3) of Table 4, and 500 quantiles in column (4). In column (5), we use jurisdiction-by-implied-price-quantile fixed effects. Across all specifications, our estimates of inequality remain essentially unchanged.

Finally, we use this implied price as an IV for market price in equation 4. This specification allows us to obtain an estimate for the portion of inequality generated by price regressivity related to only features of the property stock without the confounding influence of the home's location. In column (6), the estimated coefficient on attribute-implied price is approximately -3%. For a 100% increase in home price (0.67 log points), this suggests a 2.2% decrease in assessment ratio. Importantly, the results of column (6) shows that estimated racial and ethnic inequality is reduced by only 70–90bps; these estimates are not statistically different from those in column (1). This supports the notion that variation in home prices related to features of the housing stock does generate regressivity in assessment ratios, but it also shows that such patterns cannot explain racial and ethnic inequality.

5.3 What Does Explain the Assessment Gap?

5.3.1 Neighborhood Misvaluation

Spatial variation in assessment ratios is strongly correlated with racial demographics. This effect holds above and beyond inequality generated by individual homeowner race. Table 5, shows the national results of augmenting our baseline analysis with tract-level demographics:

$$ar_{injt} = \gamma_{jt} + \beta race_{injt} + \theta share_{c,jt} + \epsilon_{injt} \tag{8}$$

where ar is the log assessment ratio, i indexes house, j jurisdiction, n census tract, and t year. $share$ is the tract-level population share for a given racial or ethnic group. Fixed effects are again at the jurisdiction-year level. The coefficients on demographic shares are all strongly significant, showing that assessment gaps are substantially larger in highly minority communities.

In this section, we show that market prices are much more responsive to neighborhood-level attributes than assessments are. This generates spatial inequality in tax burden. In turn, residential sorting leads this spatial inequality to be correlated with race and ethnicity. In 2017, the average black resident in the U.S. lived in a tract with 43.5% black share, while the average white resident in the U.S. lived in a tract with 7.2% black share.[25] For black or Hispanic residents, the same figures are 56.6% and 17.2%, respectively.

To fix ideas, suppose that assessors impute values as a simple function of home size alone: $A_{injt} = f(X_{injt})$, where, as before, X is a vector of property attributes, including size, number of rooms, etc. It is well established in the housing literature that local amenities are also capitalized into home prices (Roback 1982, Gyourko and Tracy 1991, Cellini et al. 2010). Thus, suppose $M_{injt} = g(X_{injt},\ W_{njt})$, where also, as before, W is a vector of tract-level amenities including, for instance, local unemployment measures. If the market places a nonzero price on local unemployment, then tract-level variation in unemployment will generate variation in the assessment ratio. Further, if the market hedonic price for unemployment is negative, and if unemployment is correlated with minority demographic share (within jurisdiction), then the mismatch will generate an assessment ratio increasing in minority share.

The data is consistent with this very simple framework. We establish this by presenting evidence from two hedonic regressions: one with market values as the dependent variable, and the other with assessed valuations as the dependent variable. Specifically, we specify regressions of the form:

$$\ln(y_{injt}) = \gamma_{jt} + \Theta^y X_{injt} + \Gamma^y W_{njt} + \epsilon_{injt} \tag{9}$$

where $y \in \{A, M\}$, and i indexes home, j taxing jurisdiction, n census tract, and t year. As before, X_{injt} is a (potentially time-varying) vector of home characteristics including square feet, bedrooms, total rooms, and flags for various amenities, and W_{njt} is a vector of tract-level characteristics. We are interested in comparing $\hat{\Theta}^M$ with $\hat{\Theta}^A$, and $\hat{\Gamma}^M$ with $\hat{\Gamma}^A$. That is, we are interested in knowing whether hedonic characteristics appear to be *differently* capitalized into market valuations and assessed valuations.

Figure 3 conveys the results of this analysis. Each bar represents the sensitivity of the (log) assessment ratio with respect to a one standard-deviation change of the given variable. At zero, the assessment hedonic model matches the market hedonics. Above (below) zero, the market hedonic prices are larger (smaller) in magnitude than the corresponding assessment hedonic prices. Finally,

[25] Authors' calculations using American Community Survey data.

bars in black are property-level attributes, and bars in red are tract-level attributes. Figure 3 shows that within the context of this hedonic estimation, assessments line up well with market prices on home-level characteristics but match much less well on neighborhood characteristics. The property-attribute bars are all less than 1%: this means that a one standard-deviation shift on any of these dimensions induces less than a 1% shift in the assessment ratio. By contrast, misalignment on tract-level attributes between the assessment and market models is up to an order of magnitude larger. Further, the one variable which receives a greater loading in the assessment model than in the market model is square feet. Table 6 shows the estimated hedonic prices from both models. Notice that the signs of the coefficients are all relatively intuitive, with the possible exception of owner share. From columns (2) and (4), we can see that assessors clearly do pay attention to neighborhood characteristics in some manner, but don't place *enough* emphasis thereupon. As a whole, the evidence in Figure 3 suggests that assessors: (i) overweight the size of the home; (ii) value other home characteristics fairly precisely; and (iii) underweight local neighborhood composition characteristics.

At a technical level, this underweighting could arise from flawed valuation methods in several ways. Assessors commonly allow a geographic fixed effect to drive spatial variation in prices. In this case, if the geographic fixed effect is for too broad a region (an entire city or a quadrant of a city, for example), assessments would be insufficiently high in sub-regions the market values highly, and insufficiently low in sub-regions where market prices are low. A similar pattern would result if assessors generate assessments by applying local growth rates to the prior year's assessment, and the areas to which they assign a given rate are excessively large (if one growth rate were picked for an entire city, for example).

Insufficient responsiveness to neighborhood features is what generates spatial inequality in assessments, but the fact that minorities live in neighborhoods with different average characteristics is what causes inequality to land along racial and ethnic lines. This fact suggests increasing inequality in highly segregated areas. We test this prediction using a standard measure of residential segregation, an index of dissimilarity:

$$dis_C = \frac{1}{2}\sum_{n \in C} \left| \frac{b_n}{B_C} - \frac{w_n}{W_C} \right| \tag{10}$$

The summation is over tracts, n, in county C. b_n and w_n respectively denote the tract-level number of black and white residents. B and W are the total regional population of each race. The measure represents the share of the racial population that would need to move in order to reach zero segregation. Because most assessments are produced by county officials, we form this measure at the county-level. We also base the measure on the 2000 Decennial Census. This predetermined measure of segregation mitigates a story of exogenous mismeasurement that itself causes racial sorting in response. We then estimate inequality within deciles of segregation. It is important to note that we form deciles on counties, and that large counties are more segregated on average. Therefore the most segregated deciles have 5–10 times as many observations in the data as the least segregated.[26] Figure 4 shows the results. Inequality is almost steadily increasing in segregation for black homeowners. Considering Hispanic homeowners as well, inequality is relatively static until the highest two deciles. For both groupings of minority homeowners, inequality in the most segregated decile is sharply higher than in other regions.

Like home prices, wealth and racial segregation are also potentially linked in complex ways. However, higher tax burdens in highly minority neighborhoods are not simply a mechanical artifact of racial wealth gaps. We illustrate this by splitting our sample into vigintiles by tract-level median income. If neighborhood misvaluation were primarily a function of spatial wealth heterogeneity, inequality would shrink when estimated within narrow income bins. Figure 5 shows this does not happen. Tracts with above-median average income evince relatively stable inequality on the order of approximately 5%. This figure closely mirrors the magnitude of within-neighborhood inequality. Moving down the lower half of the spatial income distribution, inequality is monotonically increasing, which shows two things. First, inequality arising from neighborhood misvaluations is concentrated in areas of below median wealth. This is unsurprising given existing evidence on regressive assessment ratios. However, and second, assessment ratios for black residents in low-income neighborhoods are also much higher than assessment ratios for white residents in equally low-income neighborhoods, showing that regressivity cannot explain racial and ethnic inequality.

5.3.2 Spatial Drivers Unrelated to Model Misspecification

Even with a correct model, a range of administrative policies could generate spatial inequality. The deep unpopularity of the property tax, along with concerns about homeowner dislocation as a result of taxing an illiquid asset, has led to legislative constraints on taxation in many states (Wong 2020,

[26] Full regression output is available in Table A6 of our Online Appendix.

Paquin 2015). Many limiting policies apply to aggregate revenues or tax rate levels. These policies bind in ways that are orthogonal to our equitable tax null and are therefore not relevant for analyzing within-jurisdiction equity. Assessment caps, however — a constraint on the maximum year-over-year growth of an assessment — can potentially generate a mechanical wedge between market values and assessments.

From the Lincoln Institute of Land Policy, we obtain a record of assessment cap policies by year along with the cap rate of growth. We use these to perform three subanalyses regarding areas where: (i) there is no known cap policy, (ii) a cap exists, (iii) a cap exists and binds.[27] We determine whether the cap constraint binds within each year at the ZIP code level using HPIs from Zillow and the Federal Housing Finance Agency. Table 7 shows inequality estimated within each of these three subsamples. For black homeowners, observed inequality is 13.8% in regions without any known assessment gap and 13.6% in regions subject to a cap (values are not statistically different). However, within ZIP codes where the cap would have bound, inequality is 8.6%, suggesting the impact of assessment caps is to *reduce* racial and ethnic inequality.[28] Our interpretation is that in regions where caps bind, policy constrains assessors to disregard valuation models, preventing a portion of the misvaluation that we document.

Another potential explanation for spatial inequality is that assessments are correct when they are generated, but diverge over time. Market prices change continuously, but assessments are updated discretely. Although formally an assessment is assigned each year, localities may not update the valuations annually. State law often outlines a minimum reassessment frequency. We collect data on these state policies from the Lincoln Institute.[29] Mandated reassessment cycles range from 1 year to 9 years. Panel A of Table 8 shows the breakdown in our data. Panels B and C shows estimated inequality for each frequency. The absence of any reevaluation constraint (column 9) is clearly associated with higher inequality. Across regions with some policy governing reassessment, there is no clear association between frequency and inequality. Inequality is statistically equivalent at frequencies of 4, 8, and 9 years. Inequality in regions with 1- or 2-year cycles is 1–2 percentage points lower than the longest cycles; however this difference is also not statistically significant. Inequality is substantially higher

[27] The Lincoln Institute database covers state-policies, including those targeting specific subset counties.

[28] It is important to notice that caps possibly create inequality along other margins. In California, for instance, caps have led to large inequality with respect to homeowner tenure.

[29] Similar to assessment cap policies, we observe both statewide policies and state policies affecting certain large counties.

within 3-year and 6-year subsamples, but in both cases, the magnitude is driven by one locality (Cook County, IL in the former, and Ohio in the latter). Excluding those locations, the estimate for each frequency would be slightly lower than inequality under annual reassessment (column 1).

5.3.3 Homeowner Behavior Within Neighborhoods

A race-based differential that attaches to individual homeowners on the same block is somewhat surprising. A natural intuition might be assume racially biased assessors. We cannot, in fact, rule this out. However, as described in Section 3, an assessor performing mass appraisal of numerous properties is unlikely to know or perceive the race of any given homeowner.[30]

We show that individual homeowner engagement with the bureaucratic structure of tax administration can generate within-neighborhood inequality. In every jurisdiction of which we are aware, some process for appealing an assessment exists.[31] A long line of literature in the social sciences suggests a racial component in the extent to which individuals have confidence that public institutions are designed to serve them (extensively surveyed in Nunnally 2012). This belief may be accurate, or it may be inaccurate but lead to disengagement nonetheless. Therefore, one mechanism we hypothesize and test is racial differentials in propensity to appeal, likelihood of successful appeals, and degree of reduction conditional on appeal. If one group of residents is more effective at reducing assessment growth by navigating the appeals process, this would lead exactly to the wedge between assessments and transacted values that we observe.

We are unaware of any compiled dataset of appeals at a national level. We obtain a comprehensive record of appeals submitted to the Cook County Assessors Office between 2002 and 2015, courtesy of Robert Ross (Ross 2017). Covering 1.9M homes and a population of 5.2M (including the city of Chicago), Cook County is the second most populous county in the United States. The Cook County records contain the same anonymized property-ID variable as the ATTOM dataset and therefore are able to be merged directly with our baseline dataset. This yields three additional pieces of information for each property in Cook County: (i) if an appeal was filed in a given tax-year, (ii) whether the appeal was successful, and (iii) if successful, the amount of the reduction. Our Online Appendix

[30] Our estimates of within-neighborhood inequality hold block-group demographics fixed, so any probabilistic inference about race is not a plausible explanation.

[31] Our review of state legal codes suggests that two examples are most common: in one case appeals are made directly to a county assessor's office, and in the other case the state empowers some upstream board of review which has authority to adjust the local assessment.

contains further administrative details about appeals in Cook County.

We conduct our analysis within block-group-year, thereby comparing appeal propensity, success, and (conditional) magnitude of reduction between two homeowners from the same block group in the same year. Table 9 shows the results of this analysis. The estimates in columns (1) show that within-block group inequality in Cook County is approximately 5% – very close to the national average. Column (2) shows propensity to appeal. Column (3) shows sucess probability conditional on appeal. Column (4) shows the reduction conditional on success. The baseline rate of appeals in Cook County ranges from 10% to 21% annually during this period, with a mean of 14.6%. The estimate in column (2) shows that black homeowners are 1.1% less likely to appeal. The baseline success rate for assessment appeals in Cook County ranges from 52% to 80% during this period. The mean is 67.4%. The estimate in column (3) shows that black homeowners are 2.2 percentage points less likely to win, conditional on appealing. The mean reduction granted to a successful appeal in this sample is 12.0%. The estimate in column (4) shows that conditional on a successful appeal, black homeowners receive a reduction smaller by 0.48 percentage points. Results are broadly similar when considering black or Hispanic residents together.

Finally, column (5) in each panel shows the total impact of appeals on inequality in Cook County. We can measure the change in assessment ratios that results from appeals without observing transactions (because the market prices difference out):

$$\Delta \log(A_{it}) = \gamma_b t + \beta^r race_{it} + \epsilon_{it}. \tag{11}$$

Here, $\Delta log(A)$ is the (positive) reduction in assessment from appeals, so that a negative coefficient reflects increased inequality. For black homeowners, the total effect of appeals is 20bps of additional inequality per year. Median tenure in Cook County is approximately 14 years.[32] This combination suggests that appeal disparity would explain approximately 50% of within neighborhood-level inequality for the median homeowner — although this back-of-the envelope calculation abstracts away from any repeated-game dynamics in the homeowner's decision-making. A similar proportion is suggested by 16bps of annual appeals-driven inequality for black or Hispanic homeowners.

We have very little information on homeowners, and therefore cannot test several channels likely

[32] Author's calculations using American Community Survey data.

linked to appeal outcomes, like education or native language. We do have homeowner reported income from the HMDA records, and therefore we can estimate inequality within homeowner quantiles, paralleling the prior estimation using neighborhood income quantile. Figure 6 shows the results. Within block group, inequality is fairly stable across income vigintiles. For both groupings, the largest inequality comes within the highest income quintile.

5.4 Additional Heterogeneities and Discussion

It is natural to wonder how the assessment gap relates to racial attitudes. For each mechanism explored above, no active expression of bias is necessary, but neither can we rule it out. We use two measures of racial animus developed in Stephens-Davidowitz (2014) to split our sample into regions of high and low racial prejudice. In each sub-sample, we estimate the overall assessment gap and non-spatial component. The racial animus measures are derived from the regional intensity of Google searches containing the most offensive epithet used to refer to African-Americans. One measure is produced at the state-level, and the other at the media-market level. For the latter, we use a Nielsen crosswalk to assign the media market measure to counties. We then split our sample along the median of each measure and estimate the assessment gap in a pooled regression. As the measure is designed to capture prejudice towards African-Americans, we estimate the assessment gap only for black homeowners and not for other groupings of minority residents.

Table 10 shows the results. Using either measure, the assessment gap is significantly larger in high-animus regions. This holds both in the overall estimates shown in columns (2) and (4), and in the homeowner effect estimates in columns (3) and (5). In regions of below-median prejudice, the assessment gap is still economically and statistically significant. Several plausible mechanisms could lead the assessment gap to be increasing in racial animus. In higher animus regions, minority residents may be more hesitant to engage with property tax bureaucracy, thereby lowering propensity to appeal assessments. Active discrimination could also lead to lower success rates. On the spatial margin, high animus regions may lead to increased racial residential segregation along with a larger market-price capitalization of racially correlated factors, exacerbating neighborhood-level misvaluations.

Our data sample spans 2005–2016, and thus includes the final years of the housing boom that preceded the Great Recession, along with years following the crash. A range of research has shown racial and ethnic heterogeneities in exposure to housing markets during this period (Bayer et al. 2016, Rugh and Massey 2010). We produce estimates by year to explore how the assessment gap varies over the boom and bust cycle. Table 11 shows the results. Inequality is present in all years, except in 2005 for the grouping of black and Hispanic homeowners. There is an upward trend during 2005-2007, and then a sharp jump upwards in 2008. It seems highly plausible that this reflects larger price declines in minority neighborhoods, combined with sticky assessments. However, the pattern does not reverse quickly — showing that this cannot be solely a story about short-term frictions in updating assessments. Inequality remains near the 2008 peak through 2014 for both groupings of minority homeowners. In the last two years of the sample inequality declines somewhat, but is still higher than it was in 2007, nearly a decade after the Great Recession.

6 Conclusion

We document widespread racial and ethnic inequalities in property tax burdens in the U.S. Using shapefiles for a comprehensive set of local governments along with other quasi-governmental entities that levy taxes, we define taxing jurisdictions as regions with a unique set of overlapping taxing entities. Within each jurisdiction, an equitable tax benchmark requires the assessment ratio to be constant. Our first major finding is to document a nationwide assessment gap: assessment ratios are on average higher for minority homeowners. Holding jurisdiction — and thereby public services, intended taxation, and local assessment practices — fixed, the average assessment gap between black or Hispanic residents and non-Hispanic whites is 10–13%.

This inequality does not arise from racial differences in transaction prices — black or Hispanic homeowners selling their homes for lower prices. We also show that widely documented patterns of assessment ratio regressivity do not explain racial and ethnic inequality. We construct a measure of market price related only to housing stock features to remove the influence of location on prices. Controlling for this location-neutral price has a negligible effect on the assessment gap.

We show that neighborhood demographics are an important predictor of the assessment gap. Spatial inequality arises because assessments are less responsive to neighborhood characteristics than market prices are. This generates inequality between neighborhoods. As a consequence of residential racial sorting, black and Hispanic residents face a different average set of neighborhood characteristics, and therefore the misvaluation of these characteristics generates the spatial component of the assessment gap. We show that the assessment gap is largest in the most segregated regions. We show also that the assessment gap cannot be explained by average neighborhood home prices. Low-income black communities have sharply higher assessment ratios than low-income white communities.

Just under half of the assessment gap persists within neighborhoods. Using one large county as a case-study, we show that individual homeowner interactions with bureaucratic systems of property tax administration can generate within-neighborhood inequality. We show that black and Hispanic homeowners are less likely to appeal their assessment; conditional on appealing are less likely to succeed; and conditional on a successful appeal, receive small reductions. We quantify the total impact across this region, and find one annual appeals cycle generates 20bps of inequality between black and white homeowners within the same census block group.

Our baseline findings establish that minority residents in the U.S. face a higher property tax burden than their nonminority neighbors. Although the professional standards for the appraisal industry emphasize that equity in property taxation demands jurisdictionally-constant assessment ratios, the reality of property tax administration in the U.S. is that more jurisdictions fail to achieve this equity than not. In our Online Appendix, we present a proof-of-concept exercise showing that estimating equitable assessments is not an intractable problem: using publicly available zip-code level price indices, a simple framework for producing assessments can reduce inequality by up to 70%.

Striking racial wealth disparities in the U.S. have been widely documented. The inequality we document in taxation is a direct, ongoing, and current source of fiscal headwinds for minority families. We estimate an additional burden of \$300–\$390 per year for the median black or Hispanic family, and up to \$790 for families affected at the 90th percentile of the assessment gap. Residents of local governments implicitly enter a contract agreeing to a given level of taxation in exchange for a bundle of public amenities. This large-scale shifting of tax burden onto minority residents violates the notions of equity embedded in the implicit contracts that residents make with local governments.

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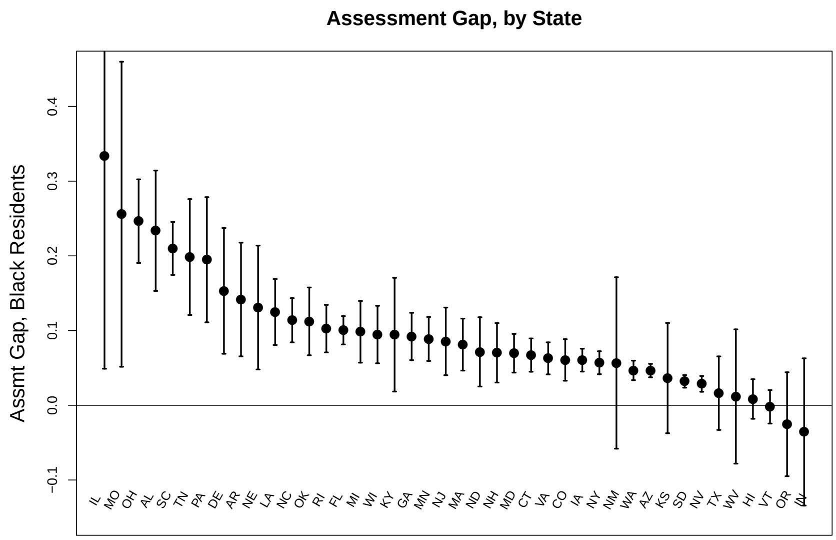
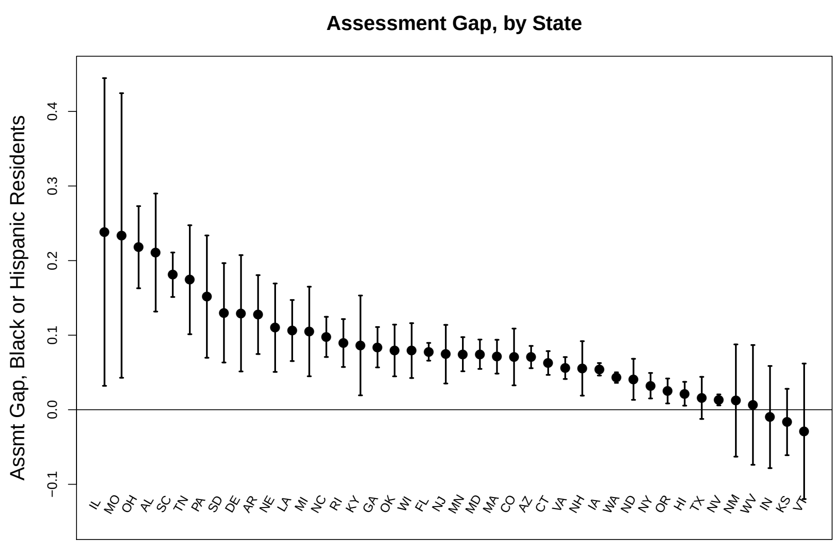
Figure 1: State Level Estimates of Assessment Gap

Panel A: Black Homeowners

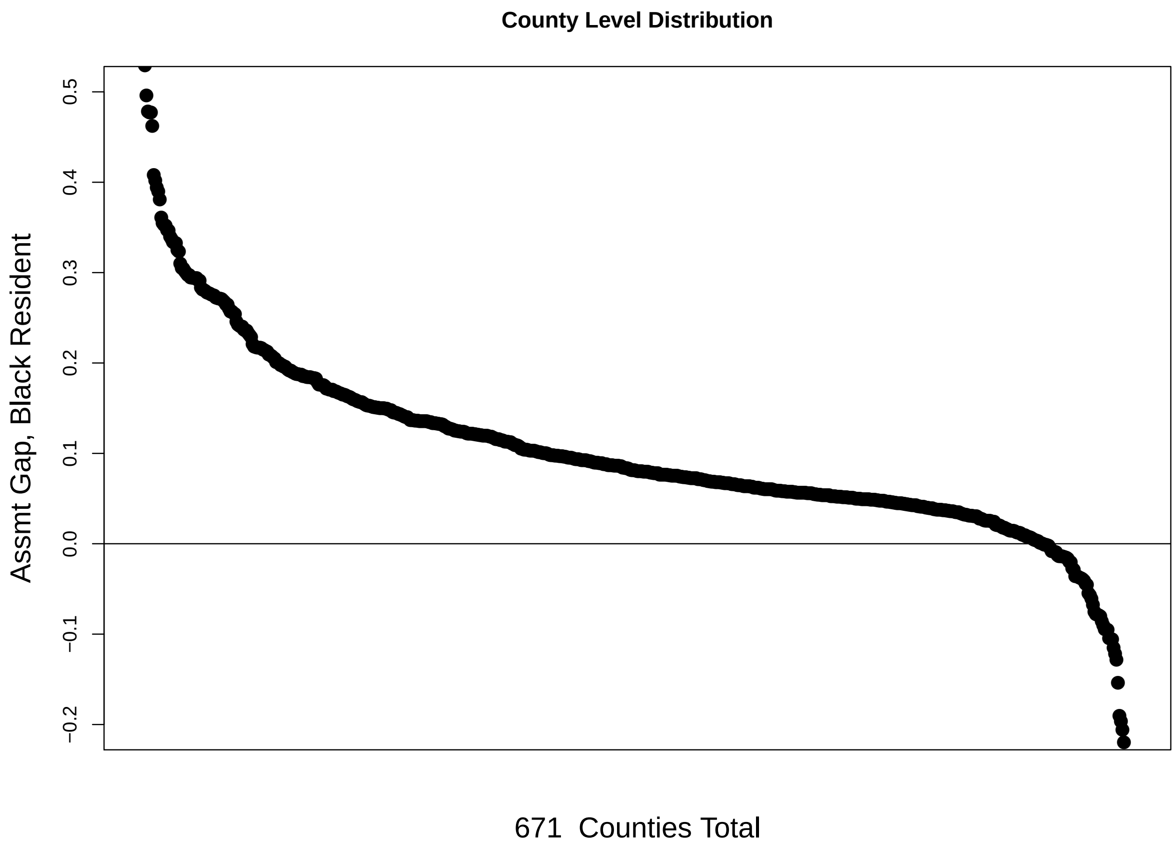


Panel B: Black or Hispanic Homeowners



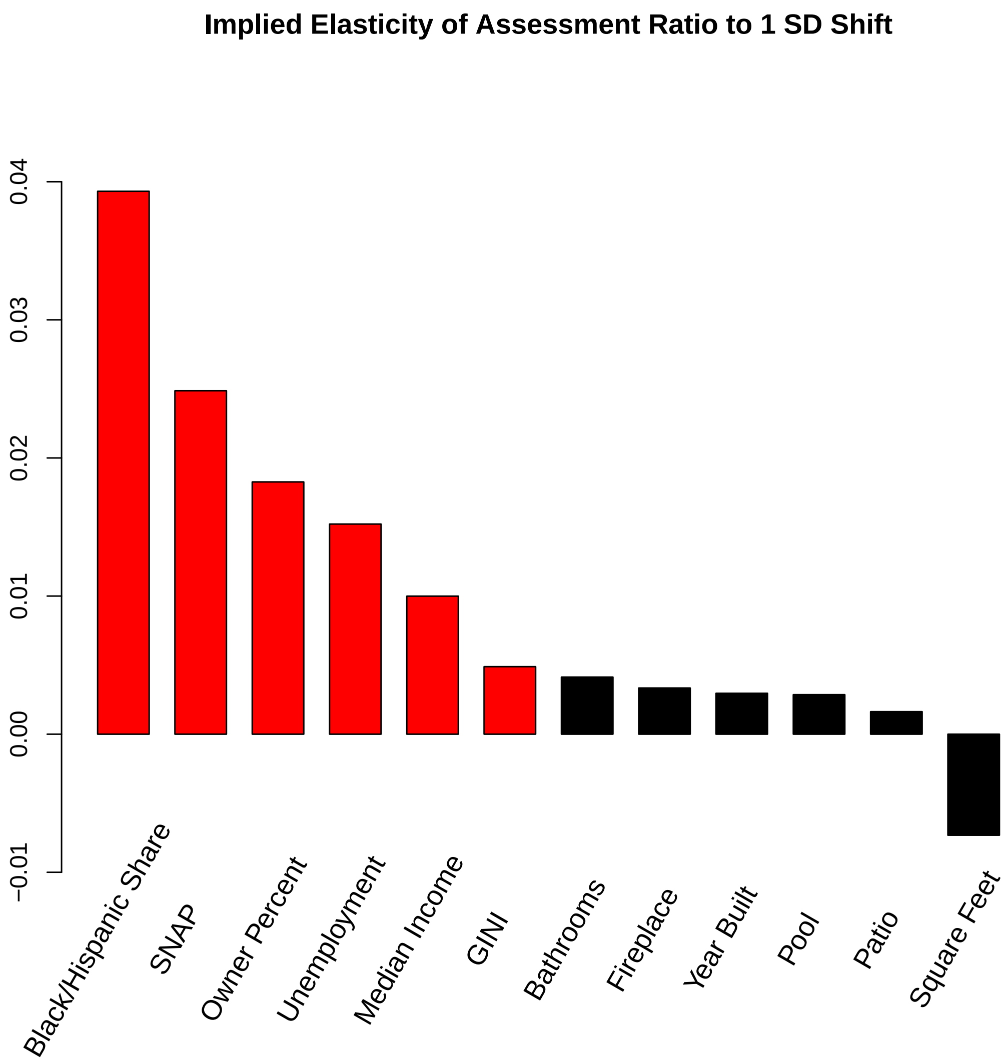
Note: These graphs show state-level estimates of the assessment gap. For every state with at least 500 observations, we regress log assessment ratio on a jurisdiction-year fixed effect and categorical variables for race and ethnicity. The top graph plots the estimated coefficient for black mortgage holders, along with a 95% confidence interval. The reference group is non-Hispanic white residents. Standard errors in the underlying regressions are clustered at the jurisdiction level.

Figure 2: County Level Estimates of Assessment Gap



Note: These graphs show county-level estimates of the assessment gap for black residents. For every county with at least 500 observations, we regress log assessment ratio on a jurisdiction-year fixed effect and categorical variables for race and ethnicity. We have sufficient data in 671 counties. We plot the estimated coefficient. For visual clarity, we do not include confidence intervals. Point estimates are positive and significant at 5% in 391 counties, positive and insignificant in 219 counties, negative and insignificant in 53 counties, and negative and significant at 5% in 8 counties. The reference group is non-Hispanic white residents. Standard errors in the underlying regressions are clustered at the jurisdiction level.

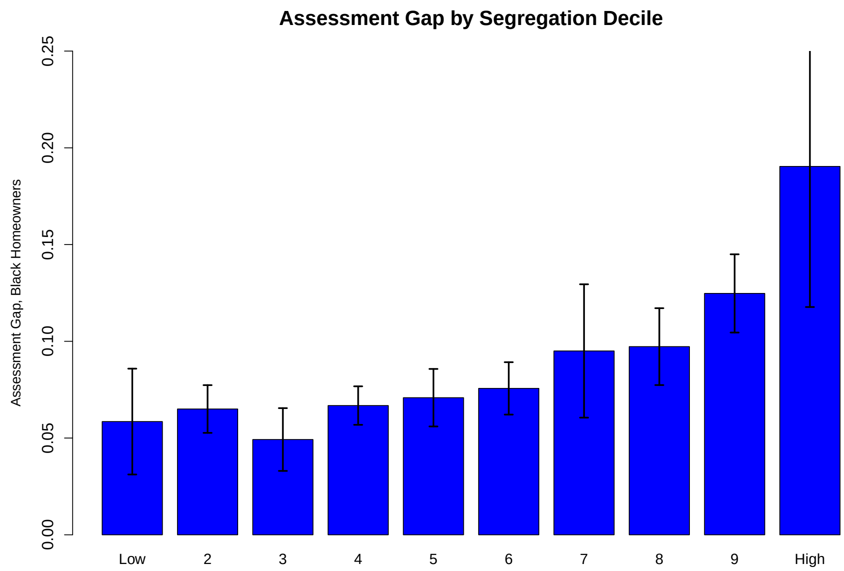
Figure 3: Hedonic Models: Mismatch



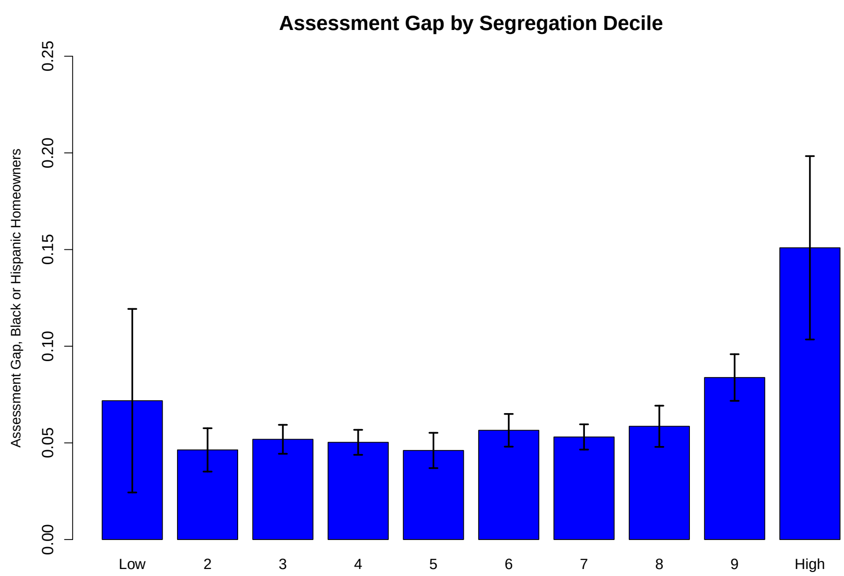
Note: Each bar in this figure plots the difference between two estimated hedonic prices: one estimated from a model with market values as the dependent variable, and one from a model with assessment values as the dependent variable. Otherwise, the two hedonic models are identical: all regressors are the same. Both market values and assessed values are logged in the underlying models, so the difference between the two estimated hedonic prices represents a proportional shift in the assessment ratio that arises from a one standard-deviation shift in the underlying variable. Bars in red are tract-level characteristics. Bars in black are property-level characteristics. A bar at zero would denote that the market-hedonic is the same as the assessment hedonic price. Larger bars signify a greater disconnect between market-hedonics and assessment-hedonics. Finally, bars above zero denote that estimated *market* hedonic prices are greater in (absolute) magnitude than assessed hedonic prices. Bars below zero denote that the assessment hedonic price is larger. Table 6 shows the estimated prices which underlie this figure.

Figure 4: Assessment Gap by Racial Segregation

Panel A



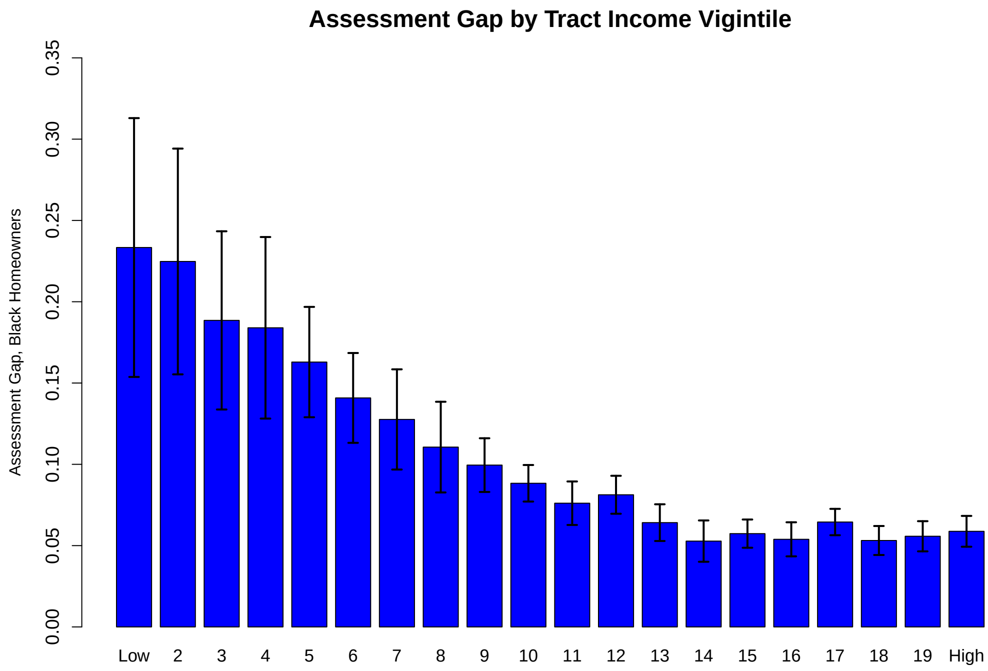
Panel B



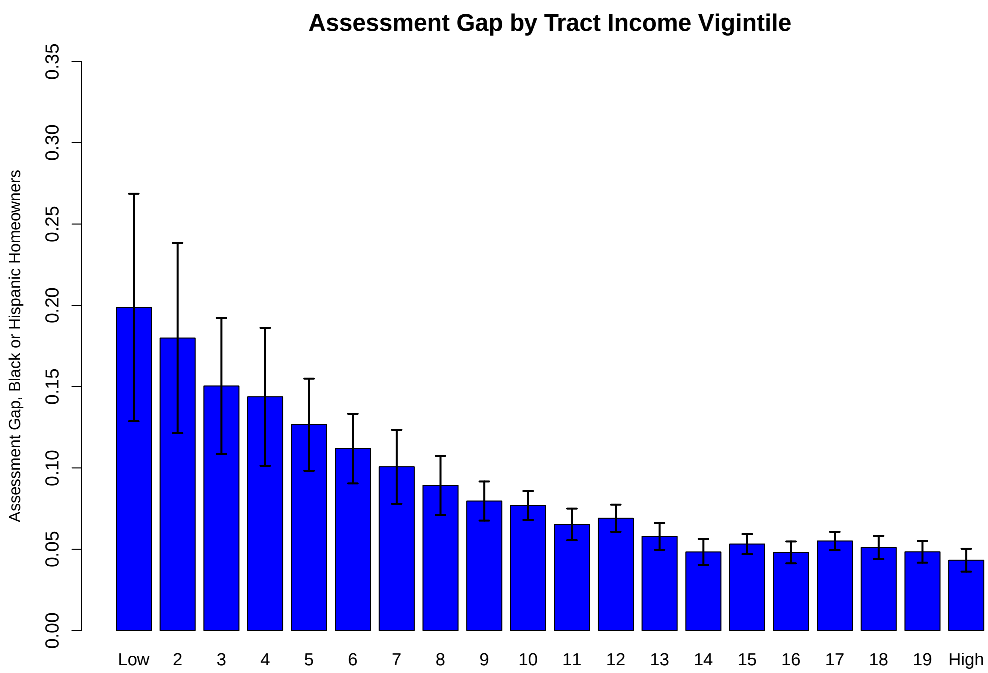
Note: In each panel, we assign counties to deciles by a county-level segregation measure, constructed from tract-level demographics from the 2000 Decennial Census. It is a stylized fact that larger counties have more segregation. As a result, the lowest deciles have substantially fewer observations than higher deciles. We estimate inequality separately in each decile following equation 1. Full regression output is available in our Online Appendix.

Figure 5: Assessment Gap by Neighborhood Income Quantile

Panel A



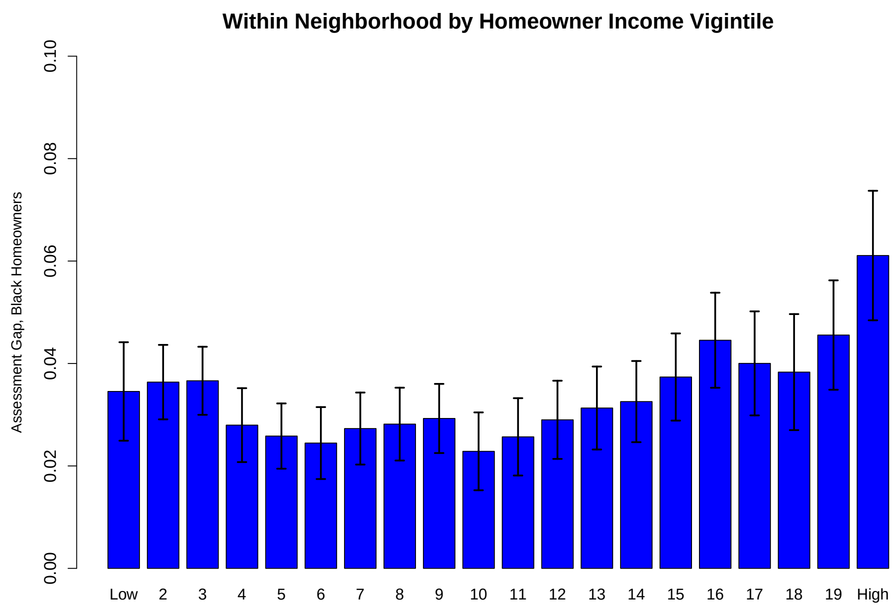
Panel B



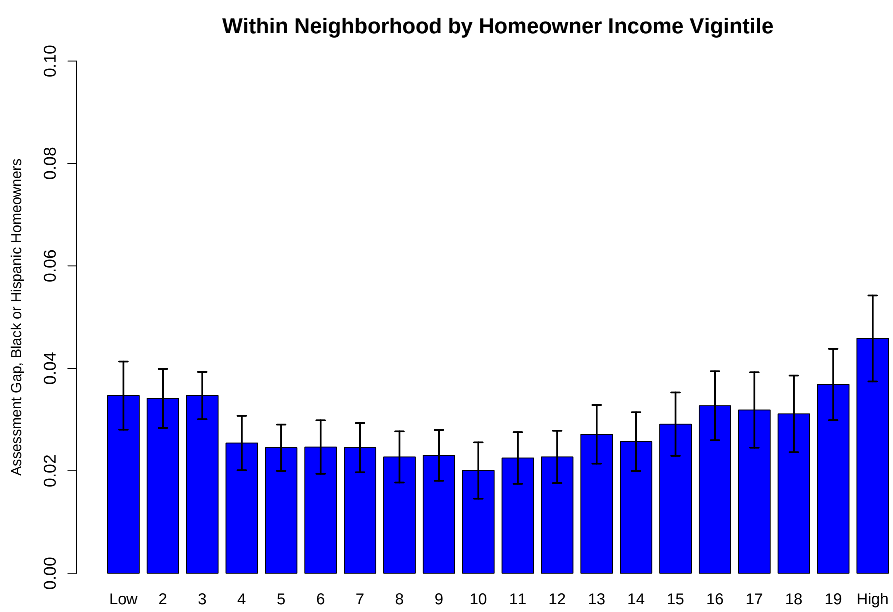
Note: In each panel, we assign tracts to each of 20 quantiles based on the tract-level distribution of median income.

Figure 6: Assessment Gap by Homeowner Income Quantile

Panel A: Black Homeowners



Panel B: Black or Hispanic Homeowners



Note: In each panel, we assign tracts to each of 20 quantiles based on homeowner reported income in HMDA records.

Table 1: Balance Table for HMDA Merge

Tract or Property Attribute	Difference
Panel A: Property Features	
Square Feet	-10.37782***
	(2.96618)
# Baths	0.0158***
	(0.00341)
Year Built	1.7324***
	(0.11026)
Patio or Porch (Binary)	0.00906***
	(0.00096)
Pool (Binary)	0.00933***
	(0.00071)
Fireplace (Binary)	0.02363***
	(0.00127)
Number of Stories	0.03054***
	(0.00211)
Panel B: Neighborhood Attributes	
Population Share Black	-0.00657***
	(0.00113)
Population Share Non-White	-0.00642***
	(0.0012)
Population Share Black or Hispanic	-0.00668***
	(0.00136)
Population Share White	0.00616***
	(0.00133)
Population (log)	0.01472***
	(0.0014)
Owner Percentage	0.00703***
	(0.0006)
Median Age (Yrs)	-0.15295***
	(0.05312)
Median Year Purchased	0.08712***
	(0.01941)
Median Home Value (log)	0.01448***
	(0.00261)
Median HH Income (log)	0.02008***
	(0.00207)
Unemployment Rate	-0.00177***
	(0.00024)
Not In Labor Force Share	-0.00386***
	(0.00044)
Gini Coefficient	-0.00247***
	(0.0002)
Share SNAP	-0.00471***
	(0.00059)
Panel C: Valuation	
Transaction Price (log)	0.03896***
	(0.00469)
Assessment Ratio (log)	0.00932***
	(0.00185)
Note:	*p<0.1; **p<0.05; ***p<0.01

Note: This table reports OLS estimates relating presence in the HMDA merge and tract characteristics. The dependent variable is a dummy variable equal to 1 if an observation was successfully merged to HMDA data, and 0 otherwise. All estimates include jurisdiction-year fixed effects. Errors clustered at the jurisdiction level.

Table 2: Baseline Assessment Gap Estimate

	log(Assessment Ratio)		
	(1)	(2)	(3)
Panel A: Black Homeowners			
Black Mortgage Holder	0.1266***	0.0640***	0.0588***
	(0.0150)	(0.0020)	(0.0019)
Panel B: Black or Hispanic Homeowners			
Black or Hispanic Mortgage Holder	0.0984***	0.0530***	0.0485***
	(0.0106)	(0.0015)	(0.0014)
Fixed Effects	Jurisd-Year	Jurisd-Year	Jurisd-Year
No. Clusters	37723	37723	37723
Observations	6,987,915	6,987,915	6,987,915
Note:			*p<0.1; **p<0.05; ***p<0.01

Note: This table shows our baseline findings of a racial assessment gap. Panel A presents our results for Black homeowners, and Panel B presents our results for Black or Hispanic homeowners. We regress the log assessment ratio on a set of fixed effects at the year $\times$ geography level and on categorical groupings by racial and ethnic identity. Columns (1), (2), and (3) show results using fixed effects at the jurisdiction-year, jurisdiction-tract-year, and jurisdiction-block group-year level, respectively. In all columns, the reference group is non-Hispanic white residents, and for clarity coefficients for groups not being considered in a given column are not reported. The estimates in this table reflect an assessment ratio differential for the given grouping of minority residents relative to non-Hispanic white residents. Standard errors are clustered at the jurisdiction level.

Table 3: Racial Differential in Transacted Prices

	Unexpected Component of Transaction Price	
	(1)	(2)
Black Seller	0.022***	
	(0.002)	
Black or Hispanic Seller		0.033***
		(0.002)
Fixed Effects	Jurisd-BG-Yr	Jurisd-BG-Yr
No. Clusters	18854	18854
Observations	2,135,966	2,135,966
Note:		*p<0.1; **p<0.05; ***p<0.01

Note: This table shows results from regressing the log difference of realized market price and predicted market price on a block-group-year fixed effect and categorical groupings by racial and ethnic identity. In all columns, the reference group is non-Hispanic white residents, and for clarity coefficients for groups not being considered in a given column are not reported. The estimates in this table reflect a racial differential in transaction prices net of predicted price. The predicted price is generated using ZIP code level home price indexes. Standard errors are clustered at the jurisdiction level.

Table 4: Assessment Gap with Attribute-Price Controls

Panel A

	log(Assessment Ratio)					
	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: Black Homeowners			
Black Mortgage Holder	0.1203***	0.1189***	0.1201***	0.1201***	0.1195***	0.1110***
	(0.0084)	(0.0082)	(0.0083)	(0.0083)	(0.0097)	(0.0071)
Transaction Price						−0.0320***
						(0.0042)
First Stage F-stat						>1000
			Panel B: Black or Hispanic Homeowners			
Black or Hispanic Mortgage Holder	0.0933***	0.0915***	0.0920***	0.0920***	0.0910***	0.0860***
	(0.0058)	(0.0056)	(0.0057)	(0.0057)	(0.0067)	(0.0049)
Transaction Price						−0.0307***
						(0.0042)
First Stage F-stat						>1000
Specification	Baseline	Attr. Bins	Syn Price (200)	Syn Price (500)	Syn-Jur Bins (200)	Syn Price IV
No. Clusters	25798	25798	25798	25798	25911	25798
Observations	4,674,430	4,674,430	4,674,430	4,674,430	4,674,430	4,674,430

Note: *p<0.1; **p<0.05; ***p<0.01

Note: This table shows our baseline findings of a racial assessment gap controlling for attributes of the property and attribute-implied home value. Panel A presents our results for Black homeowners, and Panel B presents our results for Black or Hispanic homeowners. In all specifications, we regress the log assessment ratio on jurisdiction-year fixed effects and on categorical groupings by racial and ethnic identity. Column (1) presents our baseline estimate. Column (2) augments the baseline specification with a fixed effect for every unique combination of home attributes in the data. Columns (3) & (4) control for attribute-implied price bins, as constructed in §§5.2.2. Column (5) controls for attribute-implied price bins × jurisdiction. Column (6) instruments for transaction price using the attributed-based leave-out-one instrument described in §§5.2.2. In all columns, the reference group is non-Hispanic white residents, and for clarity coefficients for groups not being considered in a given column are not reported. The estimates in this table reflect an assessment ratio differential for the given grouping of minority residents relative to non-Hispanic white residents. Standard errors are clustered at the jurisdiction level.

Table 5: Race and Demographic Shares

	log(Assessment Ratio)	
	(1)	(2)
Black Mortgage Holder	0.079***	
	(0.004)	
Black Share	0.299***	
	(0.046)	
Black or Hispanic Mortgage Holder		0.067***
		(0.003)
Black or Hispanic Share		0.277***
		(0.042)
Fixed Effects	Jurisd-Year	Jurisd-Year
No. Clusters	37679	37679
Observations	6,944,439	6,944,439
Note:	*p<0.1; **p<0.05; ***p<0.01	

Note: This table augments our baseline assessment gap findings in Table 2 with one measure of spatial variation: tract-level demographic shares. We regress the log assessment ratio on a jurisdiction-year fixed effect, categorical groupings by racial and ethnic identity, and tract-level demographic shares from the American Community Survey. In all columns, the reference group for mortgage holder race and ethnicity is non-Hispanic white residents, and for clarity other mortgage holder coefficients are not reported. The mortgage holder coefficients in this table reflect an assessment ratio differential for the given grouping of minority residents relative to non-Hispanic white residents. The share coefficients represent additional variation in the assessment ratio that correlates with demographic composition of the surrounding tract, holding mortgage holder race fixed. Standard errors are clustered at the jurisdiction level.

Table 6: Hedonic Prices

	Market	Assessment	Market	Assessment
	(1)	(2)	(3)	(4)
Black Share	-0.092^{***}	-0.056^{***}		
	(0.004)	(0.004)		
Black or Hispanic Share			-0.117^{***}	-0.078^{***}
			(0.006)	(0.005)
Median HH Income	0.157^{***}	0.144^{***}	0.145^{***}	0.135^{***}
	(0.008)	(0.008)	(0.008)	(0.008)
Unemployment	-0.027^{***}	-0.013^{***}	-0.030^{***}	-0.015^{***}
	(0.003)	(0.002)	(0.004)	(0.002)
SNAP Share	-0.089^{***}	-0.061^{***}	-0.075^{***}	-0.050^{***}
	(0.006)	(0.004)	(0.006)	(0.004)
Owner Share	-0.049^{***}	-0.032^{***}	-0.053^{***}	-0.035^{***}
	(0.005)	(0.003)	(0.005)	(0.004)
GINI	0.066^{***}	0.059^{***}	0.058^{***}	0.053^{***}
	(0.004)	(0.004)	(0.004)	(0.004)
Square Feet	0.256^{***}	0.264^{***}	0.256^{***}	0.264^{***}
	(0.029)	(0.030)	(0.029)	(0.030)
Bathrooms	0.107^{***}	0.103^{***}	0.107^{***}	0.103^{***}
	(0.017)	(0.017)	(0.017)	(0.017)
Year Built	0.031^{***}	0.028^{***}	0.030^{***}	0.028^{***}
	(0.003)	(0.003)	(0.003)	(0.003)
Other Attributes	Y	Y	Y	Y
Fixed Effects	Jurisd-Year	Jurisd-Year	Jurisd-Year	Jurisd-Year
No. Clusters	26152	26152	26152	26152
Observations	4,877,658	4,877,658	4,877,658	4,877,658
R^2	0.773	0.942	0.773	0.942
Note:				*p<0.1; **p<0.05; ***p<0.01

Note: This table reports estimated hedonic prices from two separate hedonic models. The first model uses (log) market as the dependent variable. These estimates are reported in columns 1 and 3. The second model uses (log) assessed values as the dependent variable. These estimates are reported in columns 2 and 4. Otherwise, the two hedonic models are identical: all regressors are the same. The table omits estimated coefficients for indicator variables stating whether a property has a patio, pool, or fireplace. Standard errors are clustered at the jurisdiction level. Figure 3 shows the difference between attribute-coefficients graphically.

Table 7: Effect of Assessment Caps on Inequality

	log(Assessment Ratio)		
	No Cap	Cap Exists	Cap Exists and Binds
	(1)	(2)	(3)
Panel A: Black Homeowners			
Black Mortgage Holder	0.1384***	0.1366***	0.0860***
	(0.0115)	(0.0373)	(0.0089)
Panel B: Black or Hispanic Homeowners			
Black or Hispanic Mortgage Holder	0.1065***	0.1080***	0.0607***
	(0.0084)	(0.0230)	(0.0052)
Fixed Effects	Jurisd-Year	Jurisd-Year	Jurisd-Year
No. Clusters	28589	9374	4492
Observations	4,025,841	2,295,890	509,245
Note:			*p<0.1; **p<0.05; ***p<0.01

Note: This table shows our findings of a racial assessment gap in areas with different policies regarding a cap rate of growth. Panel A presents our results for Black homeowners, and Panel B presents our results for Black or Hispanic homeowners. In all specifications, we regress the log assessment ratio on jurisdiction-year fixed effects and on categorical groupings by racial and ethnic identity. Column (1), (2), and (3) respectively present results for areas with no known cap policy, areas with a cap, and areas with a cap that is binding. In all columns, the reference group is non-Hispanic white residents, and for clarity coefficients for groups not being considered in a given column are not reported. The estimates in this table reflect an assessment ratio differential for the given grouping of minority residents relative to non-Hispanic white residents. Standard errors are clustered at the jurisdiction level.

Table 8: Assessment Gap by Reassessment Cycle

	log(Assessment Ratio)								
	1yr	2yrs	3yrs	4yrs	5yrs	6yrs	8yrs	9yrs	none
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Black Homeowners									
Black Mortgage Holder	0.1081***	0.1113***	0.1855**	0.1277***	0.1565***	0.1919***	0.1202***	0.1231***	0.2502***
	(0.0078)	(0.0337)	(0.0833)	(0.0186)	(0.0250)	(0.0323)	(0.0156)	(0.0224)	(0.0447)
Panel B: Black or Hispanic Homeowners									
Black or Hispanic Mortgage Holder	0.0898***	0.0892***	0.1420***	0.1017***	0.1055***	0.1504***	0.1026***	0.1096***	0.1970***
	(0.0056)	(0.0189)	(0.0530)	(0.0117)	(0.0206)	(0.0300)	(0.0142)	(0.0226)	(0.0449)
Fixed Effects	Jurisd-Year	Jurisd-Year	Jurisd-Year	Jurisd-Year	Jurisd-Year	Jurisd-Year	Jurisd-Year	Jurisd-Year	Jurisd-Year
No. Clusters	11686	3867	4424	7887	5639	5636	1783	66	2358
Observations	2,437,030	701,784	880,924	558,264	863,890	545,436	231,146	35,077	68,180

Note: *p<0.1; **p<0.05; ***p<0.01

Note: This table shows our findings of a racial assessment gap in areas with different reassessment cycles. Panel A presents our results for Black homeowners, and Panel B presents our results for Black or Hispanic homeowners. In all specifications, we regress the log assessment ratio on jurisdiction-year fixed effects and on categorical groupings by racial and ethnic identity. Columns (1)–(8) present results for areas with a reassessment cycle in place but with varying cycle lengths. Column (9) presents results for areas with no reassessment cycles in place. In all columns, the reference group is non-Hispanic white residents, and for clarity coefficients for groups not being considered in a given column are not reported. The estimates in this table reflect an assessment ratio differential for the given grouping of minority residents relative to non-Hispanic white residents. Standard errors are clustered at the jurisdiction level.

Table 9: Cook County Appeals

	Dependent Variable:				
	Inequality/BG (%)	Appeal	Win Appeal	Reduction	Total Effect
	(1)	(2)	(3)	(4)	(5)
Panel A: Black Homeowners					
Black Mortgage Holder	5.231***	−1.075***	−2.243***	−0.478***	−0.202***
	(0.585)	(0.104)	(0.368)	(0.119)	(0.021)
Panel B: Black or Hispanic Homeowners					
Black or Hispanic Mortgage Holder	5.118***	−1.158***	−2.054***	−0.259***	−0.161***
	(0.426)	(0.080)	(0.254)	(0.075)	(0.014)
Baseline Rate	NA	14.6	67.4	12.0	N/A
Fixed Effects	BG-Year	BG-Year	BG-Year	BG-Year	BG-Year
No. Clusters	426	3954	3924	3881	3954
Observations	141,535	3,072,521	617,157	441,424	3,071,538

Note: *p<0.1; **p<0.05; ***p<0.01

Note: This table uses administrative microdata on property tax appeals in Cook County. Column (1) shows the baseline within-block group inequality in Cook County. Column (2) shows unconditional propensity to appeal. Column (3) conditions on a homeowner having filed an assessment appeal. Column (4) conditions on a successful appeal. Column (5) estimates the total impact of appeals on inequality within tax year. In columns (2) and (3), the dependent variable is a binary indicator. In column (4), the dependent variable is the reduction amount divided by the proposed assessment. In column (5), the dependent variable is the log difference between pre-appeal and post-appeal assessments. Homeowners who don't appeal are assumed to have zero change. Fixed effects across all columns are at the block-group-year level. Standard errors are clustered at the block group level. The baseline rates for (i) appeal propensity, (ii) winning appeal, and (iii) reduction conditional on a successful appeal are reported in the first line below the estimates. Coefficients and baseline rates are reported as percents.

Table 10: Sample Split by Racial Attitudes

	log(Assessment Ratio)				
	Baseline	By Media Market		By State	
	(1)	(2)	(3)	(4)	(5)
Black Mortgage Holder	0.128***				
	(0.015)				
Black, High Animus		0.150***	0.070***	0.145***	0.076***
		(0.022)	(0.003)	(0.011)	(0.003)
Black, Low Animus		0.084***	0.055***	0.106***	0.049***
		(0.008)	(0.002)	(0.033)	(0.002)
Wald Test F-Stat	N/A	8.13	14.55	1.24	55.61
Fixed Effects	Jurisd-Yr	Jursid-Yr	Jurisd-Tract-Yr	Jurisd-Yr	Jursid-Tract-Yr
No. Clusters	37106	37106	37106	37106	37106
Observations	6,856,585	6,856,585	6,856,585	6,856,585	6,856,585

Note: *p<0.1; **p<0.05; ***p<0.01

Note: This table shows results of using the measures of racial animus described in Stephens-Davidowitz (2014) to split our sample into regions of above- and below-median prejudice. Column 1 shows baseline results before splitting the sample. Columns 2 and 3 use a media-market measure of animus. We use a Nielsen crosswalk to associate media markets with individual counties. Columns 4 and 5 use a state-level measure of animus. For each measure, the first result (column 2 or 4) shows the overall assessment gap. The second result shows the homeowner effect estimated within jurisdiction-tract-year. For all specifications, standard errors are clustered at the jurisdiction level.

Table 11: Assessment Gap by Year

	log(Assessment Ratio)											
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A: Black Homeowners												
Black Mortgage Holder	0.0309***	0.0354***	0.0844***	0.1765***	0.1914***	0.1701***	0.1628***	0.1822***	0.1497***	0.1691***	0.1254***	0.1077***
	(0.0082)	(0.0084)	(0.0111)	(0.0217)	(0.0334)	(0.0339)	(0.0244)	(0.0283)	(0.0116)	(0.0316)	(0.0089)	(0.0100)
Panel B: Black or Hispanic Homeowners												
Black or Hispanic Mortgage Holder	−0.0001	0.0190***	0.0586***	0.1526***	0.1637***	0.1334***	0.1293***	0.1375***	0.1093***	0.1208***	0.0842***	0.0724***
	(0.0075)	(0.0068)	(0.0086)	(0.0150)	(0.0194)	(0.0224)	(0.0182)	(0.0197)	(0.0080)	(0.0221)	(0.0056)	(0.0064)
Fixed Effects	Jurisd-Year	Jurisd-Year	Jurisd-Year	Jurisd-Year	Jurisd-Year	Jurisd-Year	Jurisd-Year	Jurisd-Year	Jurisd-Year	Jurisd-Year	Jurisd-Year	Jurisd-Year
No. Clusters	14683	15799	16563	15456	16457	17749	18177	18963	18719	19756	24269	15898
Observations	666,184	609,361	579,293	489,501	524,133	473,830	502,070	522,700	584,978	561,824	820,940	648,098

Note: *p<0.1; **p<0.05; ***p<0.01

Note: This table shows our findings of a racial assessment gap by year. Panel A presents our results for Black homeowners, and Panel B presents our results for Black or Hispanic homeowners. In all specifications, we regress the log assessment ratio on jurisdiction-year fixed effects and on categorical groupings by racial and ethnic identity. In all columns, the reference group is non-Hispanic white residents, and for clarity coefficients for groups not being considered in a given column are not reported. The estimates in this table reflect an assessment ratio differential for the given grouping of minority residents relative to non-Hispanic white residents. Standard errors are clustered at the jurisdiction level.