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Short-Term Incidence of Property Tax Hikes on Professionally Managed Apartments – Evidence from Philadelphia

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Abstract

Property tax incidence — who ultimately bears the tax burden — has long been central to public finance. In markets with imperfect competition, tax incidence may vary with market structure and strategic interactions, allowing landlords to absorb more or less of the tax burden than standard tax incidence theory would suggest. Exploiting a policy shock of a delayed comprehensive reassessment in Philadelphia and a unique property-level longitudinal rent dataset, this study revisits the issue of short-term tax incidence of property tax. We document that about 73 percent of tax increases were passed through to tenants in professionally managed large-scale apartments, with effects emerging approximately three quarters after the policy shock. However, we find no significant evidence of tax-induced rent increases at the broader market level, likely due to the smaller tax increases faced by most large multifamily properties and weaker cost pass-through among smaller rentals. This paper enriches the tax incidence literature by providing new evidence on the short-term tax pass-through and sheds light on the heterogeneity of landlord behavior, with implications for the optimal design of property tax systems.

Keywords: real property tax; housing price; rent; property assessment
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1. Introduction

The property tax is the main own-source revenue for local governments in the United States.[1] Property tax hikes, as increased costs for property owners, can be shifted forward on to renters and capitalized into suppressed property values. Therefore, tax incidence — who bears the burden of property taxes — carries important policy implications. Standard tax incidence theory suggests that renters bear a smaller portion of the tax increases, as housing supply tends to be inelastic in the short run. In markets with imperfect competition, including the housing market, however, standard incidence formulas can be misleading. Weyl and Fabinger (2013) demonstrate that pass-through rates depend fundamentally on the curvature of supply and demand curves, not just their slopes. They suggest that in monopolistic or oligopolistic markets, landlords may absorb more or less of tax burden than simple elasticity comparisons would suggest, and this landlord proportion varies with market structure and strategic behavior of both sides.

Several studies suggest that large multifamily properties are likely far from perfect competition. Calder-Wang and Kim (2024) find evidence that the coordination channel like algorithmic pricing widely used by large multifamily landlords helps building managers set prices that are more responsive to market conditions. Another stream of studies suggest that technology-driven large corporate landlords are less concerned with tenant retention or vacancy, which can lead to systematic and more frequent rent increases (e.g., Raymond et al., 2018; Immergluck, 2018; Lee and Wylie, 2024; Harwood, et al., 2025). Of course, not all research points in the same direction. For instance, Coven (2024) suggests that large corporate landlords are capable of absorbing expenses through scale economy and thus are less likely to pass newly increased expenses on to tenants. The literature in general, however, suggests that small landlords are less likely to pass new expense increases to renters but more likely to renegotiate rental rates and keep rents at fixed rates for longer periods of time to avoid excessive costs associated with high turnover, evictions, and extended vacancies (e.g., Gomory, 2022; Balzarini and Boyd, 2024).

This study exploits a delayed revaluation in the city of Philadelphia (the City) as a policy shock to provide novel evidence on how tax increases affected rents in professionally managed

[1] This study focuses on the real estate tax on residencies only, not personal properties or business properties.

large apartment buildings and in the broader rental market. Given that the COVID pandemic triggered unprecedented increases in property prices and taxes (Bolhuis et al., 2022), the resulting assessment and tax increases could have created an upward pressure on rents, especially in jurisdictions that delayed revaluations. In May 2022, the City released new assessments for the 2023 tax year, with sharply increased assessed values (median increase at 36.7%) and tax levies (median increase at 34.4%) for properties in Philadelphia. These assessments and tax increases varied by property type: single-family rentals saw much larger increases than apartments, for two primary reasons — apartment buildings were valued differently than single-family homes, and many high-end apartments received 10-year tax abatements that exempted the increased value from new construction or improvements in the abatement period.[2]

This paper uses a difference-in-differences (DiD) framework and unique property-level longitudinal rental data to examine rent responses to tax increases in Philadelphia. Our rental data comes from RealPage, which is a property management software company that provides monthly data on lease terms, rents, and property characteristics for multiunit, professionally managed rental properties nationwide. Our results suggest that a 1 percentage point increase in the property tax rate (equivalent to 10 mills, or an additional $1 per $100 of assessed value) would lead to an 8.7% increase in effective rent. This translates to a pass-through rate of almost 75% for professionally managed apartments following the announcement of Philadelphia's 2023 assessments. The effects emerged approximately three quarters after the policy shock. This lag seems reasonable, given the time required for lease renewals after landlords face actual tax obligations and the administrative delays between assessment announcements and tax payment. The results are consistent across several measures of rental outcome: average asking and effective rent, and per-square-foot asking and effective rent. However, we find no significant evidence of tax-induced rent increases at the market level when compared with peer cities that did not experience a similar policy shock. The results depict a nuanced picture of the short-term impact of tax increases on landlords and tenants, suggesting a heterogeneous tax incidence across property types in Philadelphia.

[2] See more details of the tax abatement program in Section 2.1.

The two-pronged findings stem from our dual-level research design to isolate the impact of the tax shock: a continuous DiD analysis for professionally managed apartments in Philadelphia and a standard DiD analysis on city-level comparison between Philadelphia and 10 peer cities as the control group. The continuous DiD model examines how varying tax increases within Philadelphia correlate with differential rent responses among properties, revealing significant pass-through, in which landlords facing larger tax bills raised rents more aggressively, while the binary treatment comparison between Philadelphia and peer cities finds no detectable citywide divergence from national trends. Given that only a small share of professionally managed apartments experienced substantial tax increases and that smaller rental properties likely responded to tax increases differently than professionally managed apartment buildings, high pass-through rates in specific market segments did not translate into market-level impacts. The continuous DiD captures micro-level mechanisms for one segment of the market, while the binary model reflects macro-level equilibrium. Needless to say, long-term impacts warrant careful monitoring, as landlords may employ other cost-shifting strategies that will increase tax regressivity by straining the already-tight budgets of low-income renters.

The findings have important policy implications. When additional taxes on rentals are passed on to tenants through higher rents, they claim a larger share of household income of low-income families than for affluent households. Conversely, requiring landlords to absorb all tax increases inevitably disincentivizes investment in the rental market, reducing the supply of rental housing. Evidence of significant tax pass-through in certain market segments suggests that tenants bear at least part of the tax burden. Thus, property taxes can negatively affect the vulnerable population, who should be prioritized in the design of policies like exemptions and subsidies. That said, the insignificant market-level impact suggests that most landlords have been absorbing the tax increases, at least in the short term. More research is needed to track the long-term effects of property tax increases and identify how small landlords and single-family participants of the housing market respond to higher holding costs. Therefore, our findings will help inform the optimal design of property tax systems.

2. Institutional Background and Literature Review

2.1 Institutional Background

Compared with other major cities, Philadelphia had been more reliant on wage and business taxes than the property tax, although the pattern has changed significantly in recent years. As of 2020, property tax revenue in the City's general fund constituted less than half of what it represents in other cities (14.5% in Philadelphia versus the median of 31.5% in other cities) (Pew, 2022). Philadelphia has one tax rate for all property types, which makes less feasible the options to raise tax rates for nonresidential properties while keeping a low rate for residential properties.

The Commonwealth of Pennsylvania does not require local governments to reassess properties regularly (Ding and Hwang, 2021; Pew, 2022). Philadelphia had not conducted comprehensive reassessments from the 1980s until it adopted the Actual Value Initiative (AVI) in 2013. Although the AVI advocated annual assessments, the City did it less frequently — completing the first reassessment of all properties in 2013, followed by commercial properties in 2018, residential properties again in 2019, and all properties again in 2022 (effective for the 2023 tax year). The 2023 reassessment brought substantial increases: The median assessed value for residential properties rose by 36.7%, and the median tax levy increased by 34.4%, translating to a mean increase of approximately $630 per property (Figure 1).

Another program unique to Philadelphia is its 10-year tax abatement, introduced in the late 1990s to encourage builders and homeowners to invest in new housing and rehabilitation projects and development and attract residents and businesses.[3] The City Controller estimated that 2.5% of properties (over 14,300) received abatements in 2017, with 7% of the recipients capturing 51% of the benefits, most being hotels and large apartment buildings.[4]

Reassessments and the tax abatement program tended to affect different property types heterogeneously. Large multifamily properties are typically assessed using different valuation methods, which may lead to smaller, less radical changes in assessed values and resulting tax levies. For example, apartment buildings with five or more units are often valued using the income approach, which capitalizes the property's net operating income, or the cost approach for newer apartment buildings,[5] rather than the sales comparison approach used to assess single-

[3] Originally, the abatement program provided a 100% exemption on the value of improvements for the full 10-year period. Changes in 2022 introduced declining exemptions, at 100% in year one and decreasing by 10 percentage points each year until the abatement expires.
[4] See https://controller.phila.gov/wp-content/uploads/2018/07/tax-abatement-analysis-final-final-1.pdf.
[5] They could use the sales comparison approach when sufficient comparable sales data exist, but it is quite rare.

family properties (with 1–4 units). The income and cost approaches likely produce less dramatic changes in assessments for large apartment complexes compared with the sales comparison approach. Additionally, as large apartment properties are more likely to benefit from the tax abatement program than single-family homes, newly constructed apartment buildings with active abatements are largely shielded from tax increases. Consequently, changes in property taxes for large multifamily properties varied significantly across properties during the 2023 reassessment, making this an ideal context for examining property tax impacts.

2.2 Contribution to the Literature

This paper makes several contributions to the literature. First, while early studies focus on long-term tax incidence, this study examines the short-run responses to a tax shock by renters. Tax incidence is about the distribution of tax burden between landlords and tenants in the rental market. Only a handful of empirical studies focus on the effects of property taxes on rental housing or the burden on renters.[6] Extant studies suggest that property taxes would be partially capitalized into rents for rental properties in the long run, but the extent of pass-through varies wildly across the studies and is sensitive to renter mobility, the variation in public services in urban areas, and restrictions on rent increases, among other factors (Carroll and Yinger, 1994). The magnitude of tax incidence ranges from 15% (Carroll and Yinger, 1994) to 40–50% in more recent studies and almost 100% in a study of commercial real estate (Rolheiser, 2019). A recent study by Baker (2025) finds a 50–89% pass-through rate for new renters in Berkeley, California, as Proposition 13 created large discrepancies in property tax liability among landlords. The Institute on Taxation and Economic Policy (ITEP), whose analysis of the U.S. tax burden distribution is widely used by policy analysts, uses 50% as benchmark pass-through rate, based on the average empirical estimate found in the literature (Davis et al., 2024). Similarly, Koster and Pinchbeck (2021) found property taxes are not fully capitalized into housing values. The distribution of who actually bears the tax burden depends critically on household characteristics, financial constraints, and time preferences.

Theoretically, a tax increase raises the owner's cost of holding rental properties, which provides an incentive for them to reduce rental supply by pulling (some of) their properties off

[6] Examples are Orr, 1968, 1970; Heinberg and Oates, 1970; Carroll and Yinger, 1994; Goodman, 2005; Tsoodle and Turner, 2008; Muthitacharoen and Zodrow, 2012; Rolheiser, 2019.

the rental market, leading to a higher new equilibrium rent. As the elasticity of housing supply is usually quite low in the short term, the standard incidence theory predicts the pass-through of property tax to renters is likely to be small in the short run. Weyl and Fabinger (2013), however, suggests standard tax incidence calculations often prove unreliable in imperfectly competitive markets — the norm in most real-world scenarios, including housing. While elasticities (slopes) dictate pass-through under perfect competition, demand curvature is the primary driver under imperfect competition. When large-scale apartment owners collectively wield enough influence over supply and pricing, their supply curve could exhibit higher elasticity, and this empirical study can shed light on this issue.

Second, this study provides evidence — although indirect — that sheds light on the potentially heterogeneous behavior of different landlords. The literature presents a nuanced picture of landlord responses to financial pressures. Small-scale "mom-and-pop" landlords are generally more hesitant to increase rents or file for eviction compared with large corporate landlords (Fields, 2022; Gomory, 2022; Gurun et al., 2023; Balzarini and Boyd, 2024). Similarly, Calder-Wang and Kim (2024) found that large-scale rental companies are more responsive to changes in market conditions than other types of landlords. But some other studies suggest a countervailing force: Large-scale corporate landlords may be better equipped to absorb expenses through economies of scale and thus less likely to pass costs through to tenants (Coven, 2024). With increased institutional investor activity in the single-family market, an emerging literature finds some evidence — although not yet consistent — that large corporate investor activities correlate with neighborhood-level rent increases (Raymond et al., 2018; Immergluck, 2018; Lee and Wylie, 2024). Taken together, the net effect on tax incidence for large apartment buildings thus remains an empirical question. This study sheds light on this issue, too.

Finally, this paper uses property-level data and a DiD framework to isolate the impact of property tax increase on rents, which differs from most previous studies that use across-jurisdiction regressions to compare the extent to which rents vary with tax rates. Highly mobile tenants and wide differences in public services across jurisdictions make it difficult to derive the causal relationship from such cross-sectional or panel regressions (Orr, 1968, 1970; Calder-Wang and Kim, 2023). The use of property-level rent data adds depth and precision to our estimates beyond what higher-level aggregates can provide.

In short, while property tax is levied on property owners (landlords), part of the tax can be passed on from the landlord to renters. The literature suggests that while large landlords often have the financial "cushion" to absorb expense shocks, they also possess greater operational efficiency and market power that enable more aggressive cost pass-through. The pass-through of property tax to renters is still an empirical question and can be large in submarkets with more elastic housing supply or where landlords exercise market power via coordinated rent setting.

3. Data and Methodology

3.1 Methodology

The variation in tax increases across properties and the substantially larger increases in property tax in general following Philadelphia's delayed reassessment in May 2022 provides an excellent opportunity for this research. We primarily rely on DiD models to isolate the causal impact of tax increases on rental prices in both the large multifamily sector and at a broader market level.

First, we use a continuous DiD model to isolate the impact of tax increases on rental prices of large multifamily properties in Philadelphia.[7] This event history model can be specified as:

$$Y_{it} = \beta_0 + \beta_1 Treat_i + \beta_2 QTR_t + \beta_3 Treat_i{*}QTR_t + \beta_4 Prop_i + \Theta Zip_z + \varepsilon_{it} \quad (1)$$

where Y_{it} is the outcome measure (asking rent, effective rent, or asking/effective rent per square feet in log) for property i in month t. $Treat_i$ is a continuous treatment variable that represents the property tax change from 2022 to 2023. We use a standardized measure of tax change per $100 assessed value to ensure our results were not driven by differences in baseline property values or initial tax collection. A continuous treatment variable is preferable over a binary one, as this specification captures variation in treatment intensity, enabling us to estimate how outcomes respond to the magnitude of tax changes rather than merely distinguishing between treated and untreated properties. The interaction of tax change and quarter dummies ($Treat_i{*}QTR_t$) is our regressor of interest. It captures the effect of a one dollar increase per $100 assessed value in property tax on rents in a given quarter, relative to the baseline quarter (the second quarter of

2022).[8] $Prop_i$ is a vector of property-specific characteristics, and Zip_z is vector of zip code-effects.

Additionally, we also study rent changes at the market level by comparing all RealPage properties in Philadelphia with those in peer cities and using the Zillow rent index data using standard DiD models. The event history specification of the model that estimates the average effect of reassessment on rents in Philadelphia versus the peer cities can be specified as:

$$Y_{zct} = \beta_0 + \beta_1 Philly_c + \beta_2 Qtr_t + \beta_3 Philly_c{*}Qtr_t + \Theta Zip_z + \varepsilon_{ict} \quad (2)$$

where Y_{zct} is the rent index for zip code z in city c during month t. $Post_t$ is an indicator of post-reassessment dummy to capture the period after the assessment's release in the second quarter of 2022.[9] The control group of 10 peer cities was chosen to isolate the impact of the property tax increase in Philadelphia. The cities were selected based on their similarity to Philadelphia in terms of population size and density, public transportation reliance, residential mobility patterns during the COVID-19 pandemic, and data availability (Rosenthal et al., 2022).[10] To mitigate the potential violation of the parallel trends assumption, we further employ a synthetic DiD (SDiD) model (Arkhangelsky et al., 2021) to verify the results from the standard DiD model.[11]

3.2 Data

This study uses data from several sources. The major one is the longitudinal rental data from RealPage, a company that provides property management software to owners and managers of apartment buildings. The RealPage dataset is a national sample of large, professionally managed multifamily properties (20+ units), with property characteristics and monthly updates of the dynamic variables on rents and vacancy. We focus on the 200-plus RealPage apartment buildings in Philadelphia and more than 2,800 such buildings in the peer cities.

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[8] Another specification of the continuous DiD model using a post-treatment dummy (post-Q2 2022) can estimate the average effect of the tax increases.

[9] As to the role that the expectation of a tax increase would play, while landlords may expect the assessment, the magnitude of the increase far exceeded their expectations. Tenants were less likely to pay attention to the tax increase, so the impact on their behavior would also be negligible pre-treatment.

[10] These cities are Baltimore; Boston; Chicago; Cleveland; Minneapolis; New York; Pittsburgh; Portland, OR; Seattle; and Washington, D.C. Our study period spans from 2020 to the first quarter of 2024, after the 2019 reassessment of residential properties in Philadelphia and ending just before the release of the next comprehensive reassessment in August 2024.

[11] Although the SDiD model offers significant advantages over the standard DiD approaches in most cases, our analysis primarily relies on the DiD model, as the SDID model weighs cities in the control group and makes it complicated to interpret the results that are already weighted by total units.

These buildings in Philadelphia have a total of 45,424 rental units as of March 2020, about 12.5% of the city's rental housing stock, with a mean effective rent of $1,955 as of May 2022, higher than the citywide average of around $1,500.[12] For each property, the dataset includes a set of static variables (e.g., property address, number of stories, number of units, average unit size, and construction year) and dynamic variables such as average asking and effective rent, asset ratings, as well as occupancy rates.

The second data source is CoreLogic, which provides property assessments, tax amounts, sales transactions, and property characteristics. The two datasets (RealPage and CoreLogic) were merged using property addresses and zip codes. For unmatched properties in Philadelphia, we manually verified addresses on the map using property tax data from the Philadelphia city government website.[13]

The final source is Zillow's Observed Rent Index (ZORI) that measures asking rents at zip code level for areas with sufficient market activity. Unlike RealPage, which covers professionally managed apartment buildings, ZORI is a repeat-rent index for a "typical" rental, weighted to represent the entire market. ZORI is used to capture broader market rent trends. Zillow data was used for descriptive analysis and market-level regression analysis.

4. Empirical Results

4.1 Descriptive Analysis

The effects of the reassessments under the AVI on residential properties are clearly illustrated in Figure 1. The median assessed value changed very little before the AVI but jumped sharply in 2014 when the city reassessed all properties under the AVI. Property taxes, on the other hand, increased only marginally after adopting the AVI, as the tax reform was designed to be revenue-neutral. The median assessed value and property tax increased slightly due to the

[12] The average rent is based on this report: https://www.economyleague.org/resources/rising-rents-greater-philadelphia-2022-update#:~:text=As%20detailed%20in%20figure%201,city's%20growing%20cost%20of%20living.

[13] Because RealPage apartment complexes could span multiple land parcels or constitute part of a larger parcel, not all addresses in RealPage data could be matched exactly with those in CoreLogic data based on property addresses alone. Nevertheless, we successfully matched over 90 percent (197 out of 221) of RealPage properties in Philadelphia and approximately 50 percent in other cities (without manual match). The website is https://property.phila.gov/.

2019 reassessments. Different from the 2013 and 2019 rounds of reassessment, both the median assessed value and tax levy increased sharply from the 2023 reassessments.

As Table 1 shows, however, single-family properties displayed very dramatic assessment increases in Philadelphia, with median assessed values jumping from $124,600 in 2022 to $174,200 in 2023, or an increase of 39.8%. When comparing it with its peer cities, Philadelphia experienced significantly different property assessment and taxation patterns across the two property types. For example, Philadelphia's median single-family tax levy rose from $1,667 to $2,307, a 38.4% increase, far exceeding the 3.3% increase in peer cities. This stark divergence in assessment and taxation patterns was likely driven by structural differences in municipal property reassessment systems. Properties in peer cities are either reassessed annually (like New York or Washington, DC) or regularly (like triennial reassessments[14] in Baltimore and Chicago) or not reassessed at all over a longer period (like in Pittsburgh, in 2000 and 2012, both court-ordered). On average, small but overall smooth increases in property taxes for single-family properties in the peer cities are likely due to their frequent adjustments (or lack of adjustments for Pittsburgh) in assessments or changes in tax rates.

For large apartments tracked through RealPage data, however, Philadelphia showed a very modest level of assessed value change, with a median increase of 7.0% in median assessed values, with a marginal change in tax levy of 0.9% from 2022 to 2023 (Table 1). The changes were only slightly larger than those in peer cities. But as Figure 2 shows, there was a large variation in the change in the tax rate (the tax change per $100 assessed value), with over half of properties (54.7%) experiencing an increase in property taxes. As mentioned earlier, this is likely due to different approaches used for apartment assessments and widespread tax abatements for newer apartments.

The increase in the asking rent for RealPage properties in the post-reassessment period was slightly larger than that in the peer cities, measured by either the mean asking rent, the standardized measure of the asking or effective rent per square foot (Table 2). At the market level, however, the rent increase, measured by Zillow's rent index (ZORI), in Philadelphia was lower than most of the peer cities (6.5% from May 2022 to March 2024 in Philadelphia versus an average of 8.9% in peer cities). The rent index is based on both single-family and multifamily

[14] Properties are reassessed once every three years, with approximately one-third reassessed each year.

rentals, so the trend for multifamily rentals could be different. Overall, the descriptive results suggest that there is no sign of a significantly larger increase in listing rents at the aggregate level compared with peer cities after the 2023 mass reassessment, except that the increase in asking rent for large apartments was slightly larger in Philadelphia.

4.2 Regression Analysis

We first present results from the continuous DiD regressions on the short-term impact of the tax increase on several measures of rent; the coefficient of the interaction term ($TREAT * QTR$) represents the tax increase's effect on the corresponding outcome measures in a particular quarter. As defined earlier, the control group consists of rental properties in Philadelphia with different levels of property tax changes from 2022 to 2023. We then discuss the results on the impact of the reassessment on RealPage properties or on the market-level rent measures based on a cross-city comparison.

Impact on Rent of Professionally Managed Apartments

Figure 3 shows the impact of the 2022 to 2023 property tax increase on the rents of professionally managed large-scale apartments. The coefficients of the interaction between tax increases and quarter dummies turn positive and statistically significant at the 0.001 level for both the asking and effective rent from the first quarter of 2023 (three quarters after the announcement of new assessments). By March 2024, almost two years after the policy shock, the estimated impact ranges from 8.7% (effective rent) to 9.0% (asking rent). To make these results explicit, for apartment buildings that had a $1 property tax increase per $100 of assessed value, their effective and asking rents would increase by 8.7% to 9.0% within one-and-a-half years.

To contextualize these findings, consider an average RealPage property in Philadelphia, which is a mid- to high-end rental, assessed at approximately $280,000 per unit,[15] with an average rent of $1,955. A $1 increase in the tax rate (per $100 assessed value) translates to an annual tax increase of approximately $2,800 per unit, while an 8.7% rent increase amounts to $2,041 annually (or 73% of the annual tax increase of $2,800). This suggests that landlords pass

[15] The estimation is based on a 5% cap rate and average expense rate of 40% (40% of gross income goes toward expenses and vacancy). The purchase cost per rental unit in Philadelphia typically ranges from $220,000 to $335,000 in recent years, according to Northmarq, a commercial real estate research firm.

through close to three-quarters (73%) of the tax increase to tenants via higher rents. The three quarter time lag reflects both institutional constraints and behavioral responses. Binding lease contracts prevent immediate rent adjustments, while the administrative timeline — from assessment announcement (May 2022) to bill receipt (late 2022) to payment (early 2023) — means landlords only faced actual cash flow impacts later in the timeline. The lag reflects the time needed for lease renewals to occur after landlords received concrete tax obligations. The standard DiD model (results in Table 3) confirms the average impact of tax increase is about 5.1% for asking rent and 3.3% for effective rent, which captures the average effect over the post-treatment period.

The magnitude of the pass-through rate documented here for professionally managed apartment complexes in Philadelphia is somewhat larger than the average rate of about 50% documented in the literature. This elevated rate is consistent with recent findings that larger, more sophisticated landlords are more likely to pass through costs quickly and systematically (e.g., Calder-Wang and Kim, 2024). By focusing on large apartment buildings, we are primarily observing the behavior of professional property management companies and institutional landlords rather than small-scale or individual landlords, who may face higher adjustment costs or maintain more informal relationships with tenants. Thus, our higher pass-through estimate likely reflects both the specific market segment studied and the characteristics of landlords operating in that segment. A significant pass-through of property tax increases to tenants from landlords of professionally managed apartments does not necessarily lead to broader market-level rent increases. It remains unclear how these micro-level rent adjustments aggregate to affect overall market equilibrium and whether the mechanisms identified here can generalize to other rental housing segments or local markets.

Impact on Market-Level Rent (Cross-City Comparison)

The aggregate-level analysis suggests reassessment did not trigger widespread rent increases across Philadelphia's rental market. As Figure 4 shows, when comparing the rent change of RealPage properties in Philadelphia against those in the peer cities based on standard DiD models, we do not find a significant rent increase for all RealPage properties associated with the 2023 reassessment in Philadelphia. None of the coefficients of interest, interaction of the treatment and the post-treatment quarter variables, is statistically significant, although the

coefficients are positive for the asking rent. In other words, there is no statistically significant evidence of property tax-induced rent increase for large multifamily properties at the aggregate level for Philadelphia after May 2022.

To further test the effect of property tax increases on the asking rent at the market level, a separate regression was run using the Zillow's ZORI index at the zip code level. Different from RealPage data that primarily covers large apartment buildings, ZORI is a repeat-rent index of a "typical" rental, weighted to represent the entire market, and is used to capture market-level rent dynamics. The results, as summarized in Table 4, suggest that at the market level, there was no statistically significant rent increase in Philadelphia compared with the peer cities. The rent change post-treatment in Philadelphia was statistically insignificant, and the sign was negative.

The seeming discrepancy between the two sets of results stems from different research designs measuring different aspects of the same phenomenon. The first analysis uses a continuous treatment approach, examining how the *magnitude* of tax increases correlates with rent changes among Philadelphia properties that experienced varying degrees of assessment increases. This within-Philadelphia comparison finds that properties with larger tax increases raised rents proportionally, yielding a close to three-quarters pass-through rate. In contrast, the second analysis employs a binary treatment design comparing *all* Philadelphia RealPage properties to those in peer cities, essentially measuring whether Philadelphia rents diverged from national trends after their reassessment.

These approaches are not contradictory but complementary. The first result demonstrates that within Philadelphia's large apartment sector, landlords with bigger tax bills raised rents more aggressively — a differential response to heterogeneous treatment intensity. However, the second result suggests this differential response within Philadelphia did not translate into citywide rent increases distinguishable from peer cities, likely because (1) only slightly over half of large multifamily properties saw tax increases during the 2023 reassessment, with most of these increases being small in magnitude; and/or (2) smaller multifamily and single-family rentals likely had weaker pass-through that diluted the aggregate signal, although we cannot test the second factor directly owing to data limitations. Of course, another possible reconciliation lies in the "missing intercept" problem inherent to the DiD design (Watson and Ziv, 2025): The estimates identify the *relative* rent response between properties facing larger versus smaller tax increases but cannot on their own establish whether this reflects heavily taxed properties raising

rents more, lightly taxed properties lowering rents, or some combination of both. However, the economic mechanism for a "lightly taxed rents falling" channel is poorly motivated: Absent a cost shock, standard economic theory provides no reason for profit-maximizing landlords to lower rents.

The reconciliation lies in recognizing that high pass-through rates at one segment of the market do not necessarily produce detectable citywide effects when aggregated. A landlord facing a $2,800 tax increase per unit may indeed raise rent accordingly, but if only a subset of properties experienced substantial increases, and if landlords in other segments of the market responded to tax increases differently, the city-level impact could remain statistically indistinguishable from the comparison cities. The continuous treatment model captures the micro-level mechanism, while the binary treatment model reflects the macro-level market equilibrium. Of course, it is still too early to observe the full effects of tax increases on rents just about two years after the reassessments. Landlords, however, may also resort to other means to shift the costs on to tenants in the long term, and the true total impact of tax increases still needs to be monitored carefully.

Identification Assumptions and Robustness Checks

There are important assumptions for the DiD approach used in this study. The parallel trend assumption, which assumes parallel trends prior to the treatment, is the most critical to ensure internal validity of DiD models. Results from the continuous DiD models suggest there is no significant evidence of a pre-trend (the interaction term is statistically insignificant prior to May 2022 in Table 3, and no pre-trend in Figure 3). In other words, there were no significant violations of the parallel trend assumption for the within-city comparison of RealPage properties during the pre-treatment period. But for the cross-city comparison, there was a pre-trend in the first two quarters of 2020, as Figure A1 in the Appendix suggests, in which rents in Philadelphia were significantly lower (about 5–6%) than those in the peer cities; in other words, Philadelphia did not experience as sharp a decline in rents as some of the peer cities in the early stages of the pandemic.

We ran a synthetic DiD model that can better address the pre-trend issue by weighting the control group differently. The SDiD results suggest that the impact on rents (either measured by effective rent or asking rent) is statistically insignificant (with the magnitude of the interaction

term ranging from -0.7% to -0.4% for the two measures), consistent qualitatively with the results from the DiD or event-history models, which is illustrated in Appendix Figure A2 based on the results for asking rents.

We also conducted analyses to evaluate whether the results are robust when alternative data or specifications are used. When focusing on RealPage properties with complete records[16] for each month, the regression results are qualitatively consistent with the results based on data for all properties. We also tried other specifications, like including additional cities or excluding more influential cities like New York and Chicago, the results are quite consistent.

Summary

In sum, we find credible evidence that at least in one segment of the rental market, professionally managed large multifamily properties, landlords have passed the increased property tax on to tenants with a significant amount. The significant effect of the larger tax increase on rents suggests a higher pass-through rate, even in the short term. The result of a generally significant effect of tax increase on observed rents is inconsistent with the theoretical analysis in support of a marginal short-term tax incidence. This is likely because large landlords are better equipped with data analytics tools and are more responsive to expense shocks. However, this has not led to broader market-level rent increases in the short term, likely because not all large apartments experienced large tax increases and tax pass-through rates are lower for smaller rentals.

5. Conclusion and Implications

This paper provides new evidence on the incidence of property tax, with a focus on whether the tax increases for professionally managed apartment buildings in Philadelphia was passed on to renters. The results suggest that less than two years after a comprehensive reassessment, almost three-quarters of increased tax was transferred to tenants by landlords of these professionally managed apartments. But the impact at the market level is quite nuanced, likely because small landlords are more likely to absorb tax increases, while fewer large apartment complexes

[16] The RealPage sample, for example, is not a balanced sample, and a small share of properties could be added or dropped out from the panel each month, which may lead to biased estimates if newly added or dropped properties are systematically different.

experienced significant tax hikes. Future research would benefit from finer building-level cost data to directly explore the pass-through rates for single-family properties and from investigating the long-term effects of property taxes on various rental property types and overall renter welfare.

The findings have important implications for policymakers designing property tax policies. The results suggest that in at least one market segment — professionally managed apartment complexes — tenants are likely to bear a portion of the tax burden, even in the short term. Recognizing that property taxes can negatively affect stakeholders beyond homeowners, more vulnerable populations warrant careful consideration when designing policy tools such as tax exemptions and subsidies. Whether using property taxes as a revenue tool or for equity purposes, they should account for the heterogeneity of their impact.

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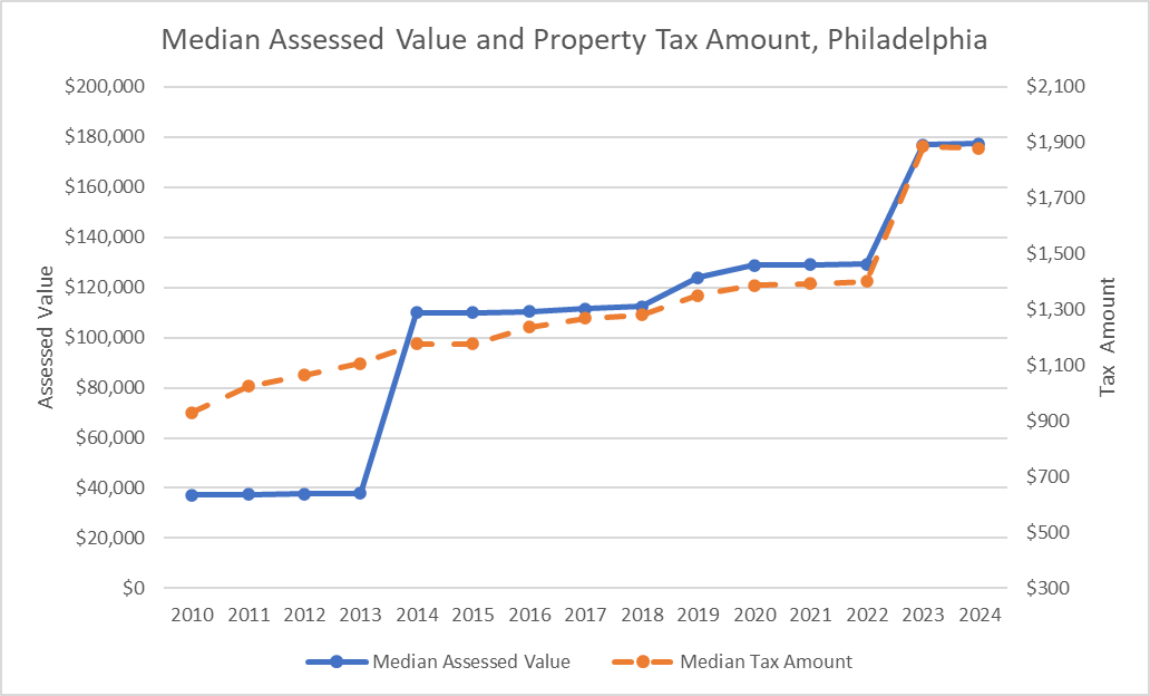


Figure 1. Trends of Median Assessed Value and Property Tax Levy for Properties in Philadelphia

Source: Authors' calculations based on CoreLogic data and data from the City of Philadelphia's Department of Revenue

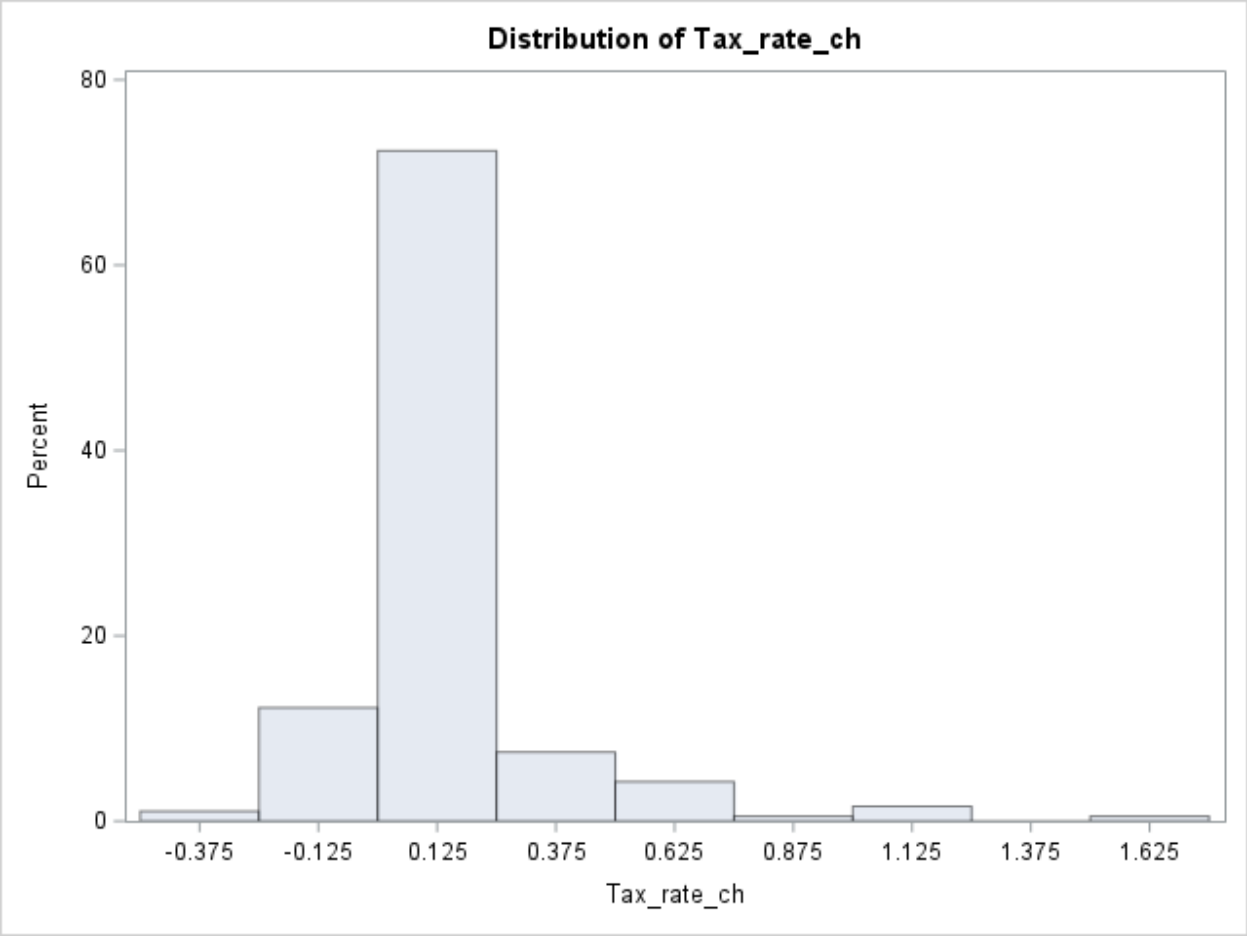


Figure 2. Property Tax Change (per $100 Assessed Value) from 2022 to 2023 for RealPage Properties in Philadelphia

Note: Authors' calculations based on RealPage data and CoreLogic data

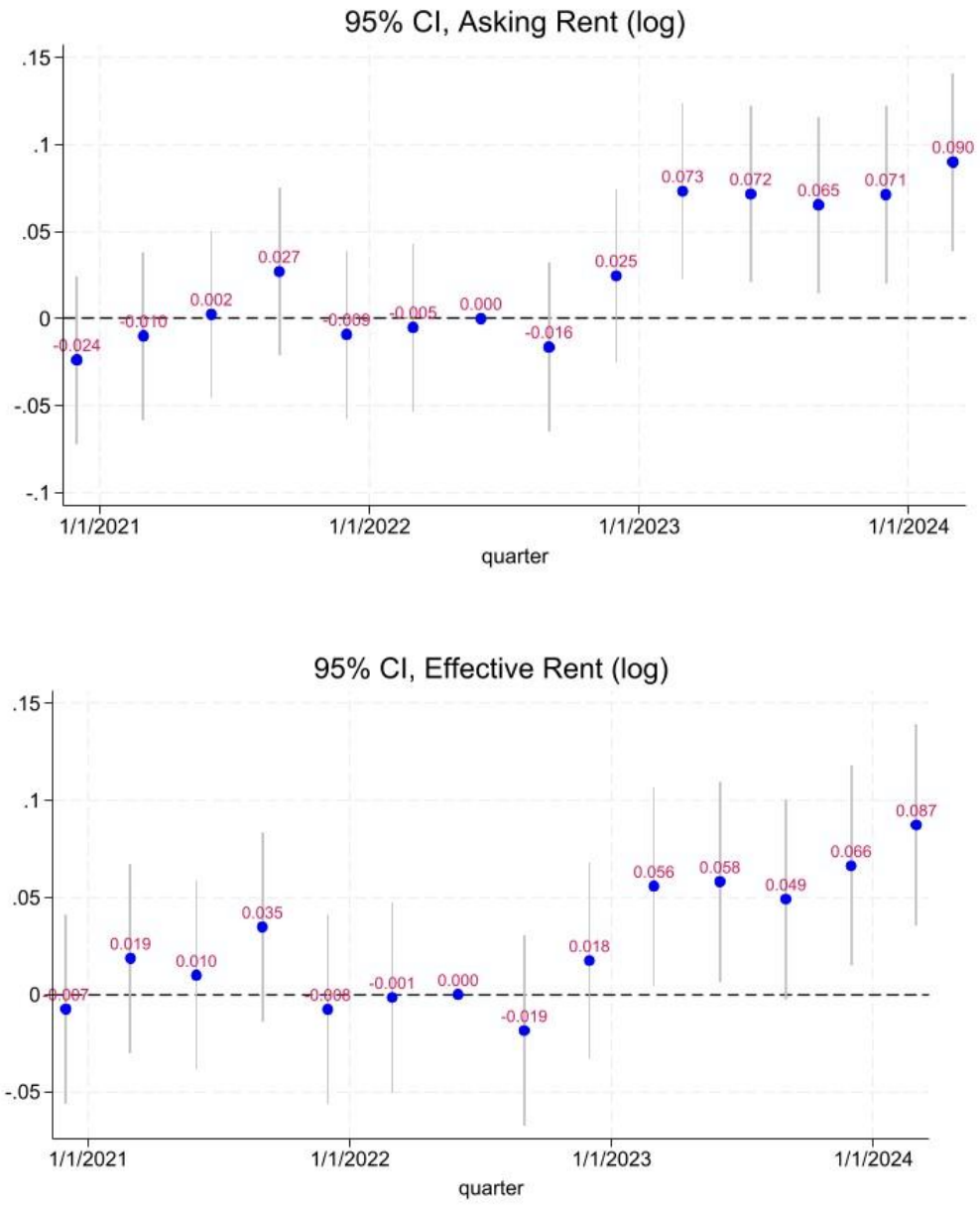


Figure 3. Effects of Tax Increase on Asking Rent (Top) and Effective Rent (Bottom), RealPage Properties in Philadelphia Only (Continuous DiD Model)

Source: Authors' calculations based on RealPage data and CoreLogic data (Q4 2020–Q1 2024)

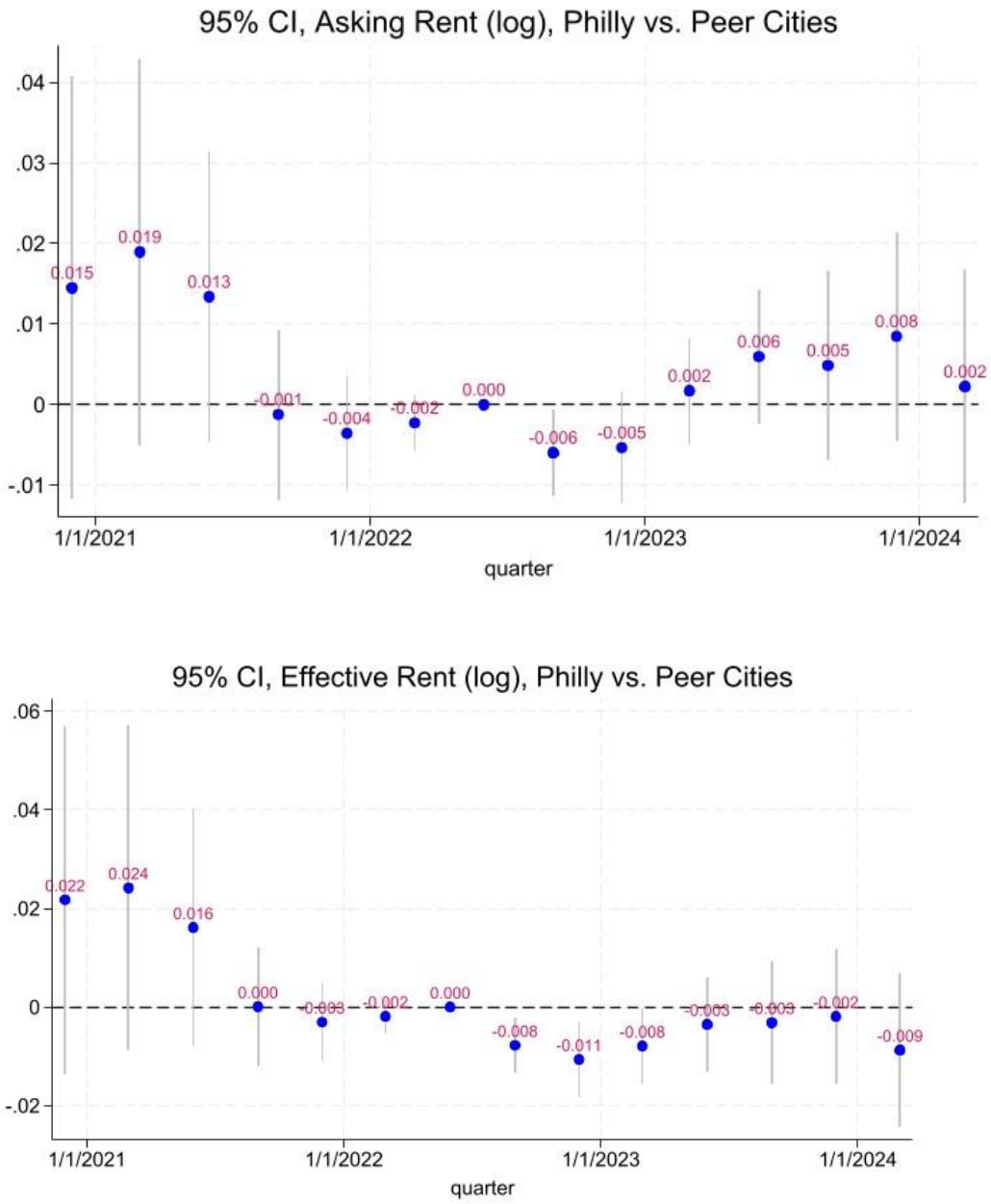


Figure 4. Effects of Mass Reassessment on Asking Rent (Top) and Effective Rent (Bottom), Philadelphia and Peer City Comparison (Standard DiD Model)

Source: Authors' calculations based on RealPage data and CoreLogic data (Q4 2020–Q1 2024)

Table 1. Changes in Median Assessed Value and Tax Levy of Single-Family and RealPage Properties, Philadelphia vs. Peer Cities

Property Type	Geography	Median Assessed Value		Change	Median Tax Levy		Change	Change in Tax Levy per 100 Assessed Value
		2022	2023		2022	2023		
Single Family								
	Philadelphia	$124,600	$174,200	39.8%	1,667	2,307	38.4%	42.7%
	Peer Cities	$175,600	$199,290	13.5%	3,731	3,854	3.3%	4.4%
RealPage Property								
	Philadelphia	$17,331,150	$18,540,000	7.0%	$155,452	$156,784	0.9%	0.3%
	Peer Cities	$19,206,220	$19,948,467	3.9%	$213,190	$214,167	0.5%	0.1%

Source: Authors' calculations based on CoreLogic property data and data from the City of Philadelphia's Department of Revenue. Peer cities include Baltimore, Boston, Chicago, Cleveland, Minneapolis, New York, Pittsburgh, Portland, Seattle, and Washington, DC.

Table 2. Summary Statistics of RealPage Rent Data for Philadelphia and Peer Cities

Variables	May, 2022		March, 2024 (% Change from 2022)	
	Philadelphia	Peer Cities	Philadelphia	Peer Cities
Number of units	45,424	592,795		
Mean unit size	844	790		
Mean occupancy rate	90.0%	92.3%		
Median number of stories	5	6		
Median construction year	1986	2008		
Mean asking rent	$1,985	$2,509	$2,065 (4.0%)	$2,594 (3.4%)
Mean effective rent	$1,955	$2,455	$2,004 (2.5%)	$2,542 (3.5%)
Mean asking rent/sq ft	$2.40	$3.25	$2.57 (6.8%)	$3.35 (3.1%)
Mean effective rent/sq ft	$2.36	$3.18	$2.49 (5.1%)	$3.28 (3.3%)

Source: Author's calculations based on RealPage data; weighted by number of units of corresponding property.

Table 3. Summary: Coefficients of Interaction Terms/Impact on Rents (RealPage Data, Continuous DiD)

	ln(Asking Rent)			ln(Effective Rent)			ln(Asking Rent/SqFt)			ln(Effective Rent/SqFt)		
	Coef.	Std.Err.	P>t	Coef.	Std.Err.	P>t	Coef.	Std.Err.	P>t	Coef.	Std.Err.	P>t
Treat (Tax Increase)	-0.045	0.008	<.0001	-0.025	0.008	0.001	-0.048	0.008	<.0001	-0.028	0.008	0.000
Post_assmnt_23	0.006	0.008	0.431	0.008	0.008	0.348	0.006	0.008	0.465	0.007	0.009	0.383
Treat*Post_assmnt_23	**0.051**	0.010	<.0001	**0.033**	0.010	0.001	**0.054**	0.010	<.0001	**0.036**	0.010	0.000

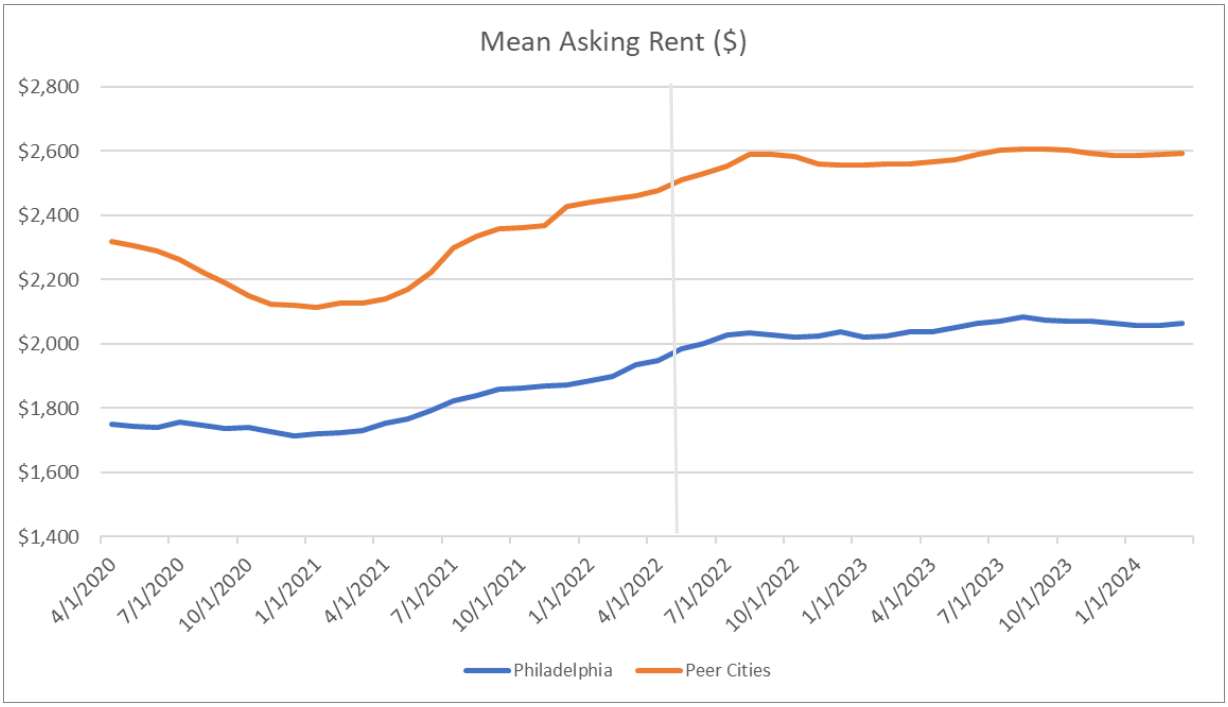
Source: Authors' calculations based on the RealPage data; other control variables include asset grade, average unit size, occupancy rate, number of stories (categorical), construction year (categorical), and quarter and zip code dummies, weighted by number of units.

Table 4. Summary of Impact of 2023 Reassessment in Philadelphia on Rents (Zillow Rent Index, Standard DiD Model)

	Zillow Observed Rent Index ($)			Zillow Observed Rent Index (log)		
	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t
Philly	-1477.841	47.023	0.000	-0.682	0.010	0.000
Post_assmnt_23	63.942	27.630	0.043	0.022	0.005	0.001
Philly*Post_assmnt_23	-161.624	88.469	0.098	-0.035	0.016	0.052

Source: Authors' calculations based on the Zillow ZORI data (Q4 2020–Q1 2024). Other control variables include quarterly and zip code fixed effects. Standard errors clustered at the city level.

Appendix



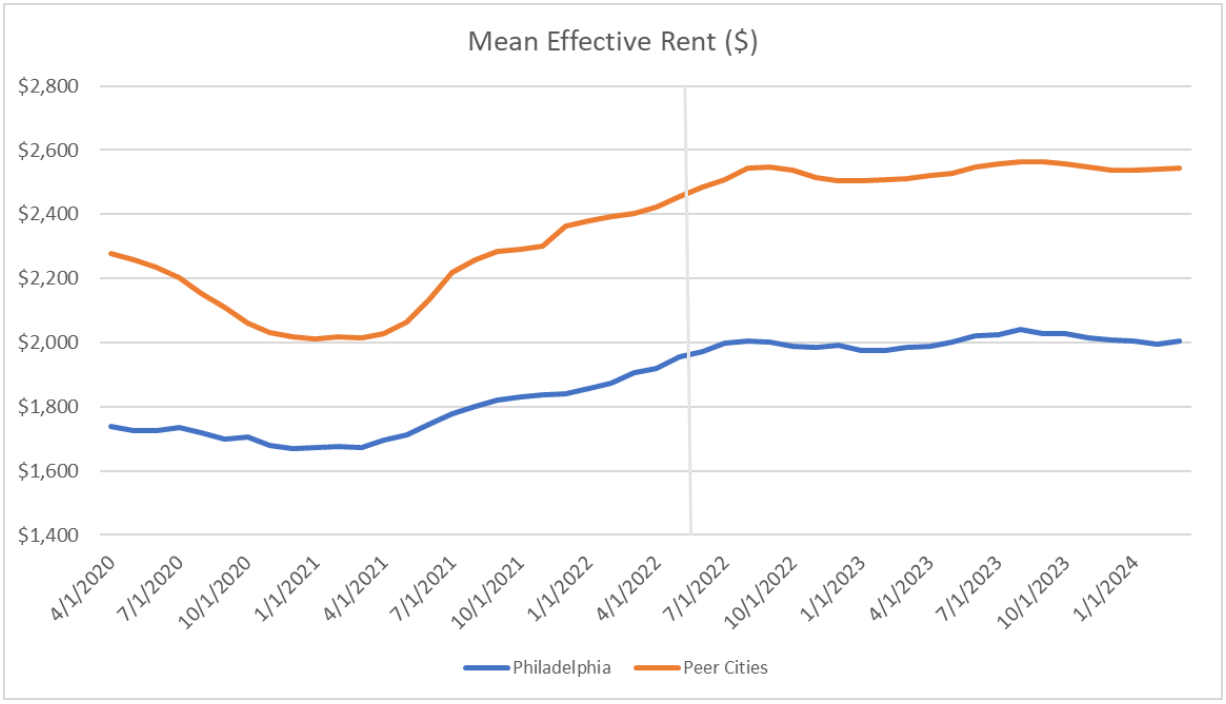
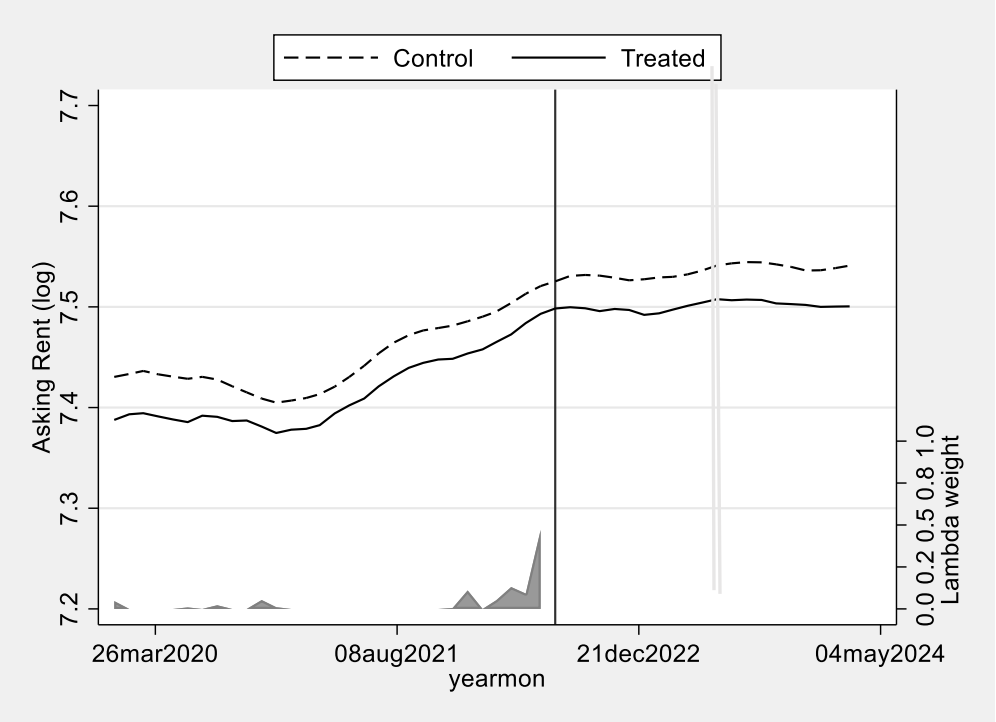


Figure A1. Mean Asking Rent (Top) and Effective Rent (Bottom) in Philadelphia and Peer Cities, Q1 2020–Q1 2024
Source: Authors' calculations based on RealPage data.



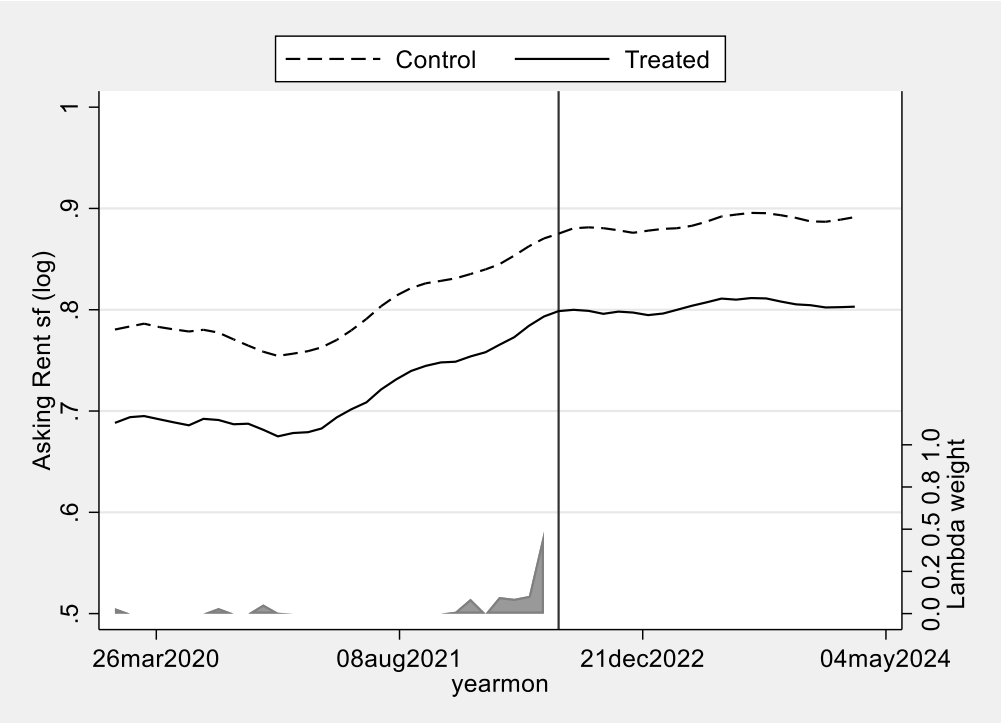


Figure A2. Synthetic Difference-in-Differences Model Results: Effects on RealPage Asking Rent (Top) and Asking Rent per Square Feet (Bottom)

Source: Authors' calculations based on RealPage data.