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Article

Climate Transition Risk in the Real Estate Sector: Does Decarbonization-Driven Regulation Affect REIT Valuation?

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Abstract

Climate transition risk is emerging as a critical determinant of value in real estate finance as cities adopt increasingly stringent decarbonization policies, adding to the pressure of physical risk. Regulations impacting the construction sector, which represents 40% of global carbon emissions, have the potential to impact energy and commodities markets. New York City's Local Law 97 (LL97), which imposes binding emissions caps and financial penalties on large buildings, offers a case to examine how capital markets respond to building-sector climate regulation. This paper investigates whether and how U.S. equity Real Estate Investment Trusts (REITs) with exposure to New York City assets respond to climate transition policies like LL97. Using a standard event study framework, the analysis examines abnormal returns around two key milestones: the policy's approval as part of the Climate Mobilization Act in April 2019 and the onset of its enforcement phase in January 2024. Results show that the initial announcement generated statistically insignificant cumulative abnormal returns, suggesting that investors did not price LL97's long-term horizon implications at the time of the vote. By contrast, the enforcement milestone coincided with economically meaningful negative abnormal returns across most sampled REITs, particularly those with substantial New York City office exposure, although these effects are not statistically significant and can be attributed to broader sectoral stress. Cross-sectional tests reveal no significant differences between highly and moderately exposed groups. Overall, while isolating the impact of transition risk alone is empirically challenging, the findings suggest that climate-related transition risk is priced gradually, potentially non-material in the short term and can become more salient as implementation approaches.

Keywords: carbon emission; transition risk; regulatory risk; transition to low carbon economy; energy demand; commodities markets

1. Introduction

Climate risk has rapidly become one of the defining issues in real estate finance, including physical risk and transition risk. As cities adopt increasingly stringent decarbonization policies, buildings become subject to regulatory pressures that can alter operating costs, capital expenditure needs, and ultimately asset valuations. This evolution is particularly important because the building sector accounts for 40% of global emissions, making it a primary target for climate policy. Understanding environmental and policy issues is critical for energy economics and commodities markets. In particular, as cement and steel represent half of the emissions stemming from the construction sector, regulations can prioritize this sector. Moreover, the evolution of the construction sector can favor new business models and renewable energy and push the demand for metals that are essential to the energy transition, such as copper and nickel.

For investors and policymakers, understanding how markets respond to such regulation is both timely and essential. New York City's Local Law 97 (LL97), voted in 2019 and entering enforcement in 2024, is among the most ambitious climate policies targeting buildings worldwide. By imposing

binding emissions caps and financial penalties for non-compliance, LL97 represents a shift from information-based energy policies to a performance-based regulatory regime, from disclosure to actual decarbonization. This transition provides a rare opportunity to observe how capital markets respond when climate policy becomes financially consequential. It adds to the rich and growing literature on transition and climate finance (Deschryver & de Mariz, 2020b; de Mariz, 2024). How did financial markets react to key milestones in the rollout of Local Law 97?

The question is especially relevant because transition-related regulatory shocks remain a relatively new area of empirical financial research. LL97 offers a clear case to study: its geographic scope is narrow, its obligations are measurable, and its enforcement date introduces a defined moment when regulatory costs could become priced into valuations.

To address this, the study uses an event-study framework to analyze abnormal returns for U.S. equity REITs with New York City exposure around two critical dates: the 2019 announcement of LL97 and the beginning of its enforcement in 2024. A cross-sectional comparison further explores whether REITs with heavier NYC concentration faced different market reactions. The study analyzes the degree of a Real Estate Investment Trust (REIT)'s exposure to New York City properties to capture the influence of regulatory risk.

The paper proceeds with a review of the relevant literature (Section 2), a description of the data and methodology (Section 3), presentation of empirical results (Section 4), a discussion of their implications (Section 5), and concluding remarks (Section 6).

Literature Review

2.1. *The Context of Urban Decarbonization: New York City's Local Law 97*

The literature has stressed the relevance of the construction sector for energy and commodities markets. Rapidly growing energy demand raises concerns over supply shortage, while inputs used in construction such as cement and steel generate a meaningful part of global emissions. Buildings contribute between 20% and 40% of energy consumption in developed countries. (Perez-Lombard et al., 2007). More recent studies confirm that buildings are a major contributor to climate change, representing one third of global energy consumption and 25% to 40% of global CO₂ emissions. Population, wealth and urbanization in emerging nations are key upward drivers (Gonzalez-Torres et al., 2022; IFC, 2023). Cement and Steel Account for About 50 Percent of Carbon Emissions from Construction Materials (IFC, 2023).

In developed countries, the most sustainable approach consists in retrofitting, adopting conservation behaviors or adaptation of the existing real estate, hence a focus by regulators on energy performance and renovation (European Commission, 2023). In developing economies, by contrast, the housing deficit suggests large demand for new construction and the potential to adopt innovative and sustainable building methods. A study of 10 significant emerging economies shows how policymaking is essential to incorporate renewable energy considerations into urban development (Oruç et al., 2025). Similarly, recent research shows the integration of smart buildings into smart cities, highlighting the connections between the construction sectors, energy and demand for materials (Apanaviciene et al., 2020).

With its dominant share of urban energy demand and emissions, its interconnectedness with hard-to-abate sectors of steel and cement, the building sector is increasingly relevant to urban climate policy. This is consistent with the institutional theory, which posits that regulations can impact organizational behaviour. Research suggests that stringent carbon regulations like emissions trading systems (ETS) can enhance corporates' ESG performance (Lee & Liang, 2024).

In the United States, buildings account for more than 70% of electricity consumption and roughly 40% of energy-related carbon emissions, with these patterns amplified in dense metropolitan areas such as New York City, where buildings were responsible for approximately 73% of total greenhouse gas (GHG) emissions in 2016 (Salimifard et al., 2022). This empirical profile positions the built environment as a central locus for mitigation activity and highlights how urban form, limited

on-site industry, and high heating and cooling loads concentrate decarbonization pressures on buildings rather than on other sectors.

LL97 enacted in 2019 as part of New York City's Climate Mobilization Act, is widely regarded as the most stringent building-sector climate regulation in the United States, showcasing the role of municipal regulations, alongside state and federal law (Wyman & Spiegel-Feld, 2020). It imposes binding GHG intensity limits on buildings larger than 25,000 square feet and requires covered properties to achieve emissions reductions of 40 per cent by 2030 and 80 per cent by 2050 relative to a 2005 baseline (Salimifard et al., 2022). The law differentiates performance standards across ten emissions groups based largely on occupancy type, thereby tailoring caps to operational profiles while still imposing aggregate reductions across the covered stock. Approximately 50,000 properties fall under the law's scope, making LL97 a large-scale regulatory intervention in a mature, capital-intensive asset class (Spiegel-Feld, 2019).

A central feature of LL97 is that it transforms the policy regime from information provision to performance enforcement. Buildings that exceed their emissions limits incur annual financial penalties, often referred to as carbon fines, while compliance options require capital-intensive retrofits, electrification of heating systems, improvements to building envelopes, operational changes, and constrained use of renewable energy credits and offsets (New York City Department of Buildings, 2023). The city's Advisory Board estimates that compliance will require between USD 16 and 24 billion in retrofit expenditure over the coming decade, with multifamily properties constituting the largest share of floor area and therefore the largest aggregate compliance gap.

This performance-based regime stands in contrast to earlier New York City policies such as Local Law 84 (LL84) on benchmarking and Local Law 87 (LL87) on energy audits. Benchmarking and transparency policies were designed to reduce information frictions and support voluntary improvements by requiring owners to measure, report, and in some cases disclose building energy use. National meta-analyses of such programmes find typical reductions in energy use intensity of around 3 to 8% over two to four years (Mims et al., 2017).

For New York City specifically, LL84 benchmarking has been associated with gradual declines in median energy use intensity, while LL87 audits generated relatively modest savings of around 2.5% in multifamily buildings and 4.9% in offices, largely attributable to low-cost operational measures rather than deep retrofits (Houde & Aldy, 2017). These findings are consistent with broader evidence on the "energy efficiency gap," which documents that cost-effective measures are not fully adopted under purely informational or voluntary regimes (Gillingham & Palmer, 2014). LL97 can therefore be interpreted as a second-generation policy that seeks to close this gap by embedding emissions performance directly into the regulatory framework and creating explicit regulatory risk for non-compliant assets, consistent with the literature that links sustainability measures with a strategic focus to reduce risk (Cippicani et al. 2025).

1.2. Regulatory Risk

The literature on transmission mechanisms between regulatory risk and firm value shows a complex relationship and multiple channels (Redondo Alamillos & de Mariz, 2022). The transition from benchmarking and voluntary improvement programs to binding emissions caps represents a distinct regulatory shock for building owners. Under LL84 and LL87, policy instruments focused on measuring and disclosing performance, on the assumption that improved information would address market failures related to asymmetric information, split incentives between owners and tenants, and discourage investment in efficiency (Mims et al., 2017; Gillingham & Palmer, 2014). Benchmarking and transparency were shown to support incremental efficiency gains and to enable market actors to incorporate energy performance into leasing and investment decisions.

However, the empirical record suggests that these tools alone are insufficient to drive the scale of investment required for deep decarbonization, consistent with the literature that emphasizes the need for clear incentives to overcome implementation hurdles and drive change at scale (Deschryver & de Mariz, 2020a). Mandatory audits under LL87 identified substantial technical potential for

savings, yet the realized reductions remained modest and were predominantly associated with low-cost operational changes. This pattern reinforces the theoretical expectation that, in the presence of transaction costs, capital constraints and bounded rationality (when building owners or firms do not undertake cost-effective energy upgrades, even when engineering analyses show positive net present value), information provision may not overcome the structural barriers to large-scale retrofits (Houde & Aldy, 2017; Gillingham & Palmer, 2014). This is also consistent with the most recent research showing that improvement in ESG profile may not always bring benefits to firm value and that the relationship is non-linear (Cippiciani et al., 2026).

LL97 addresses this investment gap by imposing enforceable emissions limits, thereby creating several channels of regulatory risk. First, there is capital expenditure risk, as owners must allocate significant resources to mechanical system upgrades, electrification, and envelope improvements, often with long and uncertain payback periods. Second, there is operating risk, since non-compliant buildings face recurring monetary penalties that directly reduce net operating income. Third, portfolio and market risk arises from the potential repricing of high-emissions assets as investors update expectations regarding future cash flows, liquidity and residual values. Finally, policy uncertainty remains a salient dimension, as future adjustments to emissions limits, enforcement practices and compliance pathways can alter the expected regulatory burden.

New York City has also considered complementary market-based mechanisms. A city-commissioned analysis of a potential carbon trading system for buildings concluded that trading could reduce aggregate compliance costs and local air pollution while preserving emissions targets, but that such a scheme would require additional legislative authority and careful design to prevent adverse distributional outcomes in populations that historically bear disproportionately high environmental burdens (NYC Mayor's Office of Climate and Environmental Justice, 2021). These deliberations underscore that LL97 not only introduces fixed regulatory obligations but also situates building owners within an evolving policy environment where future rules may further reshape the cost of non-compliance.

From an economic perspective, LL97 constitutes an exogenous, geographically concentrated regulatory shock that is well suited to analysis through an event-study framework. Because the law targets only buildings within New York City and applies emissions- and size-based penalties, it generates heterogeneity in regulatory exposure across real estate firms that can be exploited empirically. The methodology section of this paper uses this structure to test whether the announcement and the enforcement milestone of the law corresponded to a change in REIT share prices.

1.3. REITs and Market Valuation

REITs are a central vehicle through which public capital is invested in income-producing real estate. Equity REITs (EREITs) provide liquid claims on diversified property portfolios and are subject to specific regulatory requirements regarding income distribution, asset composition and leverage. The literature has shown that EREIT returns exhibit a hybrid character. On the one hand they are highly correlated with broader equity market indices and display stock-like volatility; on the other hand they retain a fundamental linkage to underlying real estate markets through income characteristics and sensitivity to property-level shocks (Giliberto, 1990; Hartzell & Webb, 1988).

Giliberto (1990) decomposes REIT and appraisal-based real estate returns into market and residual components and finds that the residual series, which capture property-market fundamentals after controlling for financial market effects, are significantly correlated. This indicates the presence of a common real estate factor and implies that shocks affecting property fundamentals, such as changes in regulatory obligations or operating costs, should propagate into REIT prices.

The performance of REITs is also shaped by their legal and regulatory environment. Cross-country analyses show that rules governing minimum capital, payout ratios, taxation of undistributed income and asset eligibility have statistically significant effects on both average returns and risk-adjusted performance (Eichholtz & Kok, 2007).

These findings underscore that formal regulatory design is a key determinant of REIT valuation, not merely a background constraint. In addition, surveys of institutional investors highlight that real estate is perceived as offering moderate expected returns, inflation hedging and diversification benefits, but that it is also exposed to interest rate risk, macroeconomic cycles and regulatory interventions that can generate substantial capital losses (Ghosh & Petrova, 2021; Benjamin et al., 2001; Hartzell & Webb, 1988).

LL97 introduces a novel form of regulatory risk into this landscape. Because the law applies only to buildings within New York City and imposes asset-level emissions caps and penalties, REITs with portfolios that are heavily concentrated in the city face higher potential compliance costs than geographically diversified peers.

The methodology adopted in this study uses an event-study approach, following a well-established approach, with the FTSE NAREIT All Equity REIT Index (RMZ) as the market benchmark, to test whether these location-specific regulatory obligations were reflected in abnormal returns around key LL97 milestones. By grouping REITs into high and moderate exposure categories based on New York City holdings, the analysis examines whether differences in transition risk translate into differential valuation effects at the time of the announcement and the onset of enforcement.

1.4. Green Buildings, Energy Performance, and Regulatory Risk in Valuation

The literature on green buildings and energy performance provides an important link between building-level characteristics and asset valuation. Numerous studies have documented that voluntary environmental certifications such as LEED and ENERGY STAR are associated with higher rents, lower vacancy, and price premiums in commercial property markets (Eichholtz, Kok & Quigley, 2010; Fuerst & McAllister, 2011). These relationships have been interpreted as evidence that energy efficiency, environmental quality and associated reputational benefits are capitalized into property values through both cost savings and demand-side effects.

Work on the “value of green buildings” also highlights that these premiums may not be static. In the London office market, Chegut, Eichholtz and Kok (2014) show that certified buildings earn rent and transaction price premiums, but that the marginal value of certification declines as green space becomes more widespread, suggesting that environmental performance gradually becomes a baseline market expectation rather than a differentiating attribute.

Beyond direct financial outcomes, green buildings generate broader environmental and health benefits. MacNaughton et al. (2018) estimate that LEED-certified buildings in several major economies produced substantial energy savings and avoided emissions of carbon dioxide and conventional air pollutants, leading to health co-benefits whose monetary value in the United States is nearly equivalent to the energy cost savings themselves.

These findings, together with other studies of the health impacts of building energy policies, suggest that stringent building codes and performance standards can have significant societal returns in the form of improved air quality and reduced morbidity (Salimifard et al., 2022). Benchmarking and transparency policies occupy an intermediate position in this literature. Evaluations of U.S. programmes indicate that they support energy savings on the order of a few percentage points and help embed energy performance into real estate decision-making, but that their direct impact on asset values is more diffuse and mediated through subsequent investments (Mims et al., 2017). Recent work on demand flexibility and clustering approaches to benchmarking further argues that information-based policies could be enhanced by integrating temporal patterns of energy use and grid interactions, thereby aligning building operations more closely with system-level decarbonization goals (Andrews & Jain, 2022; Kontokosta et al., 2020).

LL97 effectively codifies many of the insights from this literature into a mandatory framework. For REITs that own assets in New York City, this shift implies that environmental performance becomes a direct determinant of expected cash flows, through both compliance costs and the risk of fines, and an indirect determinant through potential changes in tenant demand, occupancy and

investor perceptions of climate transition risk. In principle, buildings that are already efficient or that can be upgraded at relatively low cost may experience advantageous repositioning, while highly emissions-intensive properties may face brown discounts, liquidity constraints or accelerated obsolescence.

1.5. Synthesis and Research Gap

The existing literature provides a rich conceptual foundation for analysing LL97 as a regulatory shock to REIT valuations. Studies of benchmarking and audit policies show that information-based tools yield modest but non-trivial energy savings and help markets internalize energy performance, yet they also highlight persistent barriers to deep retrofits and the existence of an energy efficiency gap. Work on green buildings demonstrates that environmental performance and certification are increasingly capitalized into rents and prices and that the social benefits of energy-efficient buildings extend well beyond private cost savings. Analyses of LL97 itself document its stringency, its expected energy, emissions and health impacts, and the magnitude of required investment across the New York City building stock (Salimifard et al., 2022; New York City Department of Buildings, 2023). Finally, financial economics research on REITs and regulatory structure shows that property-level shocks and institutional design features are transmitted to public market valuations.

There is an extensive and growing literature on the relation between sustainability attributes and financial performance, in the form of meta-analyses or micro-studies that consider select countries of sectors (Friede et al., 2015; Possebon et al. 2022), highlighting in particular a channel of better access to funding (Flammer, 2021; Sayn-Wittgenstein et al. 2025). Despite this extensive body of work, there is limited empirical evidence on how capital markets respond to building-sector climate regulation at the moment when such policies are announced and when they enter into force. In particular, no existing study isolates the stock market reaction to LL97 across REITs. The event-study methodology employed in this paper is designed to fill this gap by testing whether the announcement of LL97 in 2019 and the onset of its enforcement phase in 2024 generated abnormal returns for U.S.-listed REITs and whether those returns varied systematically with firms' exposure to regulated properties. By linking the literature on urban decarbonization, building energy policy, green building valuation and REIT performance to an empirical analysis of abnormal returns, this study provides evidence on how climate-related regulatory risk is incorporated into real estate capital markets.

2. Methodology

This paper applies a standard event study methodology to examine how LL97 affected the stock market valuations of the U.S. REITs. In general, event studies are widely used in financial economics to assess whether new information is capitalized into asset prices (MacKinlay, 1997; Bergmann et al., 2020). In particular, they are suitable for analyzing policy shocks and sustainability-related regulatory changes because they capture the immediate market reaction to events perceived as financially material.

2.1. Event Definition and Timeline

Based on the regulatory timeline of the LL97, this paper selected two events that may have conveyed financially material information to investors:

- **Event 1: Announcement of Local Law 97 (18 April 2019)**
18 April 2019 marks the point at which Local Law 97 was publicly approved as part of New York City's Climate Mobilization Act. This date is used as the first event because it represents the moment when formal regulatory intent became explicitly known and widely disclosed to markets. From the perspective of this event study, it is the first feasible date at which climate-related regulatory risk could have been incorporated into REIT valuations.
- **Event 2: Enforcement Milestone (2 January 2024)**
The second event, 2 January 2024, corresponds to the beginning of LL97's implementation and

compliance phase. At this point, buildings became subject to emissions caps and reporting obligations. For financial markets, this represents the shift from a long-term policy signal to an active regulatory regime with near-term cost implications.

Both events are exogenous to financial markets and plausibly treated as regulatory shocks.

2.2. Estimation and Event Windows

Following standard event-study practice, abnormal returns were computed using the market model, which estimates a REIT's expected return as a function of its historical sensitivity to the REIT market index:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \epsilon_{it} \quad (1)$$

where:

- R_{it} = daily log return of REIT i
- Daily returns are computed as log returns because they provide time-additive properties that simplify the aggregation of abnormal returns over multi-day event windows. Log returns also approximate continuously compounded returns and reduce skewness in high-frequency financial data, improving the statistical properties of the market model.
- R_{mt} = daily log return of the RMZ Index
- The RMZ Index is used as the market benchmark because it provides a comprehensive and sector-specific representation of U.S. equity REIT performance. Using the RMZ therefore yields more accurate expected return estimates within the market model and ensures that abnormal returns isolate firm-specific reactions rather than broader market movements.
- α_i, β_i estimated over an approximately one-year estimation window of about 250 trading days ending just before the start of the event window

For Event 1, the estimation period runs from 12 April 2018 to 12 April 2019. For Event 2, the estimation period goes from 3 January 2023 to 28 December 2023. Event windows were defined symmetrically around the event date to capture short-term market reactions:

- **(-1, +1)** three-day window
- For **Event 1**, the window spans **17–22 April 2019**, with the gap between 19 and 21 April reflecting the Good Friday and Easter weekend market closures.
- For **Event 2**, the window extends from **29 December 2023 to 3 January 2024**, as trading resumed only after the New Year's market closure.
- **(-3, +3)** seven-day window

For Event 1, the window covers **15–24 April 2019**, capturing the full reaction period while accommodating the holiday-related interruption.

For Event 2, the window spans **27 December 2023 to 5 January 2024**, allowing for potential delays in price adjustment during a period typically characterized by lower liquidity and year-end portfolio rebalancing.

The window ranges balance statistical power with sensitivity to confounding news. These window selections, in particular, ensure that each event's impact is measured over actual trading days and reflect the specific timing constraints imposed by holiday periods.

2.3. Abnormal and Cumulative Abnormal Returns

For each event, abnormal returns (ARs) were calculated as:

$$AR_{it} = R_{it} - (\alpha_i + \beta_i R_{mt}) \quad (2)$$

Cumulative abnormal returns (CARs) aggregate ARs across the event window:

$$CAR_i(t_1, t_2) = \sum_{t=t_1}^{t_2} AR_{it} \quad (3)$$

CARs were computed for each REIT for both events and both windows.

2.4. Cross-Sectional Analysis

To assess the heterogeneous effects of LL97, REITs were grouped into LL97 risk categories based on exposure to New York City properties:

- **High exposure:** REITs with substantial NYC-only or NYC-heavy portfolios (e.g., VNO, SLG, ESRT, ALX)
- **Moderate exposure:** Multi-state REITs with partial NYC exposure (e.g., BXP, EQR, AVB, KIM, UDR)

This classification reflects a theoretically justified expectation: REITs with higher NYC exposure face greater transition risk because LL97 applies only to buildings within the city and imposes size- and emissions-based penalties. Two-sample Welch t-tests (unequal variances) were used to evaluate whether mean CARs differed significantly across exposure groups.

3. Data

The starting universe consisted of all U.S.-listed REITs with tradeable equity securities, sufficient return history for model estimation, US country of Domicile, at least USD 100 million in revenue (T12M). The sample includes REITs classified as Office REIT, Residential REIT, Retail REIT, and Multi Asset Class REIT. The initial sample consisted of approximately 80 U.S. REITs. Screening for firms with material exposure to New York City or New York State holdings reduced the set to 20 REITs. From these, 13 REITs remained in the final sample based on the availability of continuous data from 2017–2025 and the presence of New York City assets sufficient to imply at least moderate exposure to Local Law 97.

All financial data were obtained from Bloomberg, including daily closing prices for each REIT, FTSE NAREIT All Equity REIT Index (RMZ), revenue and geographic exposure metadata

Daily returns were computed from adjusted closing prices to correctly reflect dividends and corporate actions.

Each REIT was classified according to its geographic footprint:

- **NYC-only:** SLG, ESRT
- **NYC-heavy:** VNO, ALX
- **Multi-state with NYC exposure:** BXP, EQR, AVB, KIM, UDR, FRT, KRG, PDM, PGRE

This classification was based on public company disclosures and Bloomberg property-location metadata.

4. Results

4.1. Event 1: Initial Announcement (2019)

CARs for Event 1 were small and statistically insignificant:

- Mean CAR(-1,+1): **+0.04%**
- Mean CAR(-3,+3): **+0.15%**
- t-tests: $p = 0.98$ and $p = 0.94$

The announcement of LL97 did not meaningfully move REIT valuations. Investors likely viewed the regulation as distant, uncertain, and subject to political or administrative modification. This is consistent with literature showing weak initial pricing of long-horizon climate policy (Bolton & Kacperczyk, 2021).

4.2. Event 2: Enforcement Milestone (2024)

Event 2 produced material negative abnormal returns for most REITs:

- Mean CAR(-1,+1): **-3.81%**
- Mean CAR(-3,+3): **-2.89%**
- t-tests: $p = 0.63$ and $p = 0.79$

Every REIT except ALX and SLG exhibited negative CARs, other REITs hold substantial NYC office assets and their property type most vulnerable to LL97 due to emissions intensity and high retrofit costs.

Event 2 shows a consistent pattern of negative abnormal returns, with mean CARs of -3.81% and -2.89% , and only two REITs reacting positively. The largest declines occurred in firms with significant NYC office exposure, suggesting a concentrated valuation adjustment among assets most sensitive to LL97-related costs. While t-tests lack statistical significance, the uniform direction and magnitude of the CARs indicate a systematic market response at the onset of enforcement.

4.3. Cross-Sectional Results

To assess whether the market reaction to LL97 enforcement varied with firms' exposure to New York City properties, the sample was divided into REITs with moderate and high NYC exposure.

Group	Mean CAR2(-1,+1)	T-test p-Value	Mean CAR2(-3,+3)	T-test p-Value
Moderate exposure	-4.09%	0.72	-3.09%	0.86
High exposure	-3.16%	0.66	-2.45%	0.82

The group-level averages indicate that both categories experienced negative cumulative abnormal returns around the enforcement date. In the (-1,+1) window, moderate-exposure REITs exhibited a mean CAR of -4.09% , compared with -3.16% for the high-exposure group. A similar pattern appears in the broader (-3,+3) window, where moderate-exposure firms averaged -3.09% , while high-exposure firms averaged -2.45% .

Despite these numerical differences, Welch t-tests reveal no statistically significant separation between the groups, with p -values of 0.72 for the (-1,+1) window and 0.86 for the (-3,+3) window. This lack of significance is likely influenced by the small group sizes (only four firms in the high-exposure category), as well as intraclass heterogeneity, illustrated by idiosyncratic behavior within the high-exposure group (e.g., SLG and ALX showing markedly different CAR patterns). Moreover, the enforcement date occurred during a period of broader sectoral stress, including elevated interest rates and ongoing pressure in the office market, which may have produced sector-wide valuation effects that overshadowed differences in LL97 exposure.

Overall, the cross-sectional evidence suggests that while LL97 enforcement coincided with uniformly negative CARs, markets did not meaningfully differentiate between firms with moderate versus high NYC exposure. The regulatory event appears to have been priced primarily at the sector level rather than through granular, exposure-specific adjustments during the short event window.

5. Discussion

The empirical results provide insight into how financial markets incorporated the regulatory implications of Local Law 97 into REIT valuations. The two events represent different phases of policy development, and the market reactions observed across these stages are consistent with a gradual pricing-in of climate-related transition risk.

5.1. Event 1

The announcement of LL97 in April 2019, produced small and statistically insignificant cumulative abnormal returns across both event windows. The mean CARs of approximately +0.04% (-1,+1) and +0.15% (-3,+3) indicate no meaningful sector-wide repricing at the time the policy was first introduced. Several factors likely contributed to this muted reaction: LL97's provisions were still preliminary, investors faced considerable uncertainty regarding its long-term implementation, and the compliance horizon lay years ahead. Additionally, the event occurred immediately before the Easter holiday period, reducing liquidity and potentially delaying or diffusing price adjustments. LL97 was also a topic of debate before its passing on April 18, 2019, and markets may have partially priced it earlier in anticipation of its passing, reducing the severity of the change after the event. These results align with existing evidence that long-dated climate regulations are often not priced immediately, particularly when policy credibility or cost implications remain unclear.

5.2. Event 2

The enforcement period began in January 2024 and produced clear and economically significant negative abnormal returns. The mean CARs of -3.81% (-1,+1) and -2.89% (-3,+3) suggest that markets reacted more sharply once LL97 transitioned from legislative intent to operational reality. Nearly every REIT in the sample experienced negative valuation impacts, with the largest declines observed among firms with substantial exposure to New York City office properties. These firms operate portfolios that are both emissions-intensive and costly to retrofit, placing them at heightened risk under LL97's compliance structure. The uniform direction and magnitude of the CARs indicate that enforcement materially altered expectations surrounding operating costs, retrofit expenditures, and long-term valuations, particularly for older office assets. Importantly, this repricing occurred against the backdrop of a post-COVID structural decline in office demand, where elevated vacancy rates and weaker leasing fundamentals have already compressed net operating income and asset liquidity. In such an environment, the incremental capital expenditure and compliance burdens imposed by LL97 may have amplified existing valuation pressures rather than operating as an isolated shock.

5.3. Cross-Sectional Analysis

However, the cross-sectional analysis shows that differences between REITs with moderate and high NYC exposure were modest and statistically insignificant. Mean CARs for the moderate group were slightly more negative (-4.09% and -3.09%) than those of the high-exposure group (-3.16% and -2.45%), but Welch t-tests yielded p-values of 0.72 and 0.86, respectively. Several factors likely contributed to the absence of statistical separation. First, the high-exposure group is small ($n = 4$), limiting statistical power. Second, intra-group heterogeneity introduces noise that weakens group-level contrasts. Geographic exposure may also be an imperfect proxy for regulatory burden, as emissions intensity, asset age, tenant mix, and retrofit feasibility vary materially within exposure categories, meaning that firms classified similarly may face different compliance costs under LL97. Finally, the enforcement event coincided with broader real estate market stress, including elevated interest rates and continued weakness in the US office sector, which likely generated sector-wide valuation pressure unrelated to LL97. These overlapping forces may have overshadowed finer distinctions in regulatory exposure during the short event window.

5.4. Limitations

The results should be interpreted with caution. The sample size is limited, and several REITs with NYC exposure were excluded due to insufficient data, potentially biasing group comparisons.

Our analysis relies on a single-factor market model using the RMZ index as the benchmark. This is appropriate for isolating sector-wide movements; however, this specification does not control for additional systematic risk factors that may influence REIT returns. Multifactor asset pricing models, such as the Fama-French three- or five-factor framework, incorporate size, value, profitability, and investment factors that are known to affect equity performance.

A more refined specification could compare LL97-exposed REITs to a matched control group of REITs with no New York City exposure, thereby controlling for sector-wide stress unrelated to the regulation. However, constructing such a control group proved challenging, as most publicly listed REITs with similar sectoral characteristics maintain geographically diversified portfolios that include at least some New York City assets. This overlap complicates the identification of a clear untreated benchmark. As a result, some portion of the observed negative abnormal returns may reflect more generalized real estate repricing rather than policy-specific effects tied uniquely to LL97.

Moreover, event windows around holidays (Easter in 2019 and New Year's in 2024) may introduce distortion in trading behavior.

Finally, LL97 compliance costs are likely to unfold over many years, meaning that short-term abnormal returns capture only the initial stages of the market's adjustment process.

5.5. Future Implications

Overall, the findings suggest that while the market did not respond meaningfully to the initial policy announcement, the enforcement milestone triggered a sector-wide repricing consistent with the recognition of climate-related transition risk. The lack of strong cross-sectional differentiation implies that, at least within a short event window, investors adjusted valuations broadly across the REIT sector rather than distinguishing finely based on NYC exposure levels. This pattern is consistent with an environment in which regulatory costs are perceived as both significant and uncertain, making it difficult for markets to precisely quantify firm-level exposure differences. The results highlight how climate regulation might become financially material only once implementation becomes imminent, reinforcing the view that climate transition risk is priced gradually and asymmetrically in real estate capital markets.

Further research is encouraged as more data will accumulate over time.

Conclusions

This study investigates how U.S. REITs reacted to two key milestones in the rollout of a decarbonization regulation, namely New York City's Local Law 97. The announcement in 2019 generated no meaningful valuation response, indicating that markets did not incorporate the long-term regulatory implications at that early stage. In contrast, the window around the start of enforcement in 2024 displays sizable negative abnormal returns for most REITs, with the largest declines among firms concentrated in NYC office assets. However, these effects are not statistically significant, and the enforcement date overlaps with broader sectoral pressures. As a result, the observed declines cannot be attributed to LL97 with confidence.

Cross-sectional tests show no statistically significant differences between REITs with moderate versus high NYC exposure, reflecting the small sample size, intra-group heterogeneity, and broader sectoral pressures in early 2024.

Overall, the findings suggest that climate transition risk is priced gradually and primarily at the point when regulatory costs become visible. While the study is constrained by limited data and short event windows, it is consistent with previous literature on the pricing of regulatory risk and it provides insights on how climate regulation can influence real estate valuations and highlights the importance of enforcement timing in driving market reactions.

A) Appendix I: Company Overview

Ticker	Company	HQ	Primary Sector	Geo Focus (NYC)	Market Cap	Revenue T12M	Approx. Property Count*	LL97 Exposure

				Exposure	(USD bn)	(USD bn)		
BXP	BXP Inc.	Boston, MA	Office	Multi-state incl. NYC	10.98	3.46	~54 properties	Moderate
EQR	Equity Residential	Chicago, IL	Residential	Multi-state incl. NYC	23.23	3.08	~300 buildings	Moderate
AVB	AvalonBay Communities	Arlington, VA	Residential	Multi-state incl. NYC + NY State	25.21	3.01	~295 properties	Moderate
KIM	Kimco Realty	Jericho, NY	Retail	Multi-state incl. NYC	13.68	2.12	~530 centers	Moderate
VNO	Vornado Realty Trust	New York, NY	Office	NYC-heavy	6.69	1.81	~22 major office assets	High
UDR	UDR Inc.	Denver, CO	Residential	Multi-state incl. NYC	11.63	1.70	~170 communities	Moderate
FRT	Federal Realty Investment Trust	Bethesda, MD	Retail	Multi-state incl. NYC	8.39	1.25	~105 retail centers	Moderate
SLG	SL Green Realty Corp	New York, NY	Office	NYC-only	3.04	0.97	~70 properties (NYC only)	High

KRG	Kite Realty Group	Indianapolis, IN	Retail	Multi-state incl. NYC	4.90	0.85	~185 retail centers	Moderate
ESRT	Empire State Realty Trust	New York, NY	Office	NYC-only	1.15	0.77	~14 NYC properties	High
PGRE	Paramount Group	New York, NY	Office	Multi-state incl. NYC	1.46	0.72	~12 Class A assets	Moderate
PDM	Piedmont Office Realty Trust	Atlanta, GA	Office	Multi-state incl. NYC	1.02	0.57	~48 properties	Moderate
ALX	Alexander's Inc.	New York, NY	Mixed-use (Retail/Office)	NYC-only	1.08	0.22	~6 assets	High

B) Appendix II: Comparison Table

REIT	CAR1(-1,+1)	CAR2(-1,+1)	Delta	CAR1(-3,+3)	CAR2(-3,+3)	Delta
BXP US Equity	0,00151694	-0,0375964	0,03911329	0,00181438	-0,0252496	0,02706394
EQR US Equity	-0,0004146	-0,0305408	0,03012617	-0,0011729	-0,012729	0,01155611
AVB US Equity	-0,0011687	-0,0364063	0,03523755	-0,0021456	-0,0348261	0,03268056
KIM US Equity	0,0045424	-0,053894	0,05843639	0,00736646	-0,0503051	0,05767155
VNO US Equity	6,6007E-05	-0,0844575	0,08452353	0,00250432	-0,0907865	0,09329082
UDR US Equity	-0,0003399	-0,0293746	0,02903476	-0,0014111	-0,0037129	0,0023018
FRT US Equity	0,00055373	-0,0389352	0,0394889	0,00087611	-0,0281016	0,02897769
SLG US Equity	0,00265664	-0,001645	0,00430167	0,00663897	-0,0059818	0,01262081
KRG US Equity	0,00548269	-0,0357912	0,04127389	0,00875303	-0,0454605	0,05421349
ESRT US Equity	0,00271959	-0,0302949	0,03301448	0,00615318	-0,0187765	0,02492969

PGRE US Equity	0,00146007	-0,066228	0,06768803	0,00366015	-0,0659157	0,06957584
PDM US Equity	-1,943E-05	-0,0396245	0,03960506	-0,0003449	-0,0120641	0,01171921
ALX US Equity	-0,0120575	-0,0099765	-0,002081	-0,0126922	0,01759559	-0,0302878

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