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Converting brown offices to green apartments

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Abstract

The conversion of brown office buildings to green apartments can contribute toward a solution to three pressing issues: oversupply of offices in a hybrid-and-remote-work world, shortage of housing, and excessive greenhouse gas emissions. We propose a set of criteria to identify commercial office properties that are physically suitable for conversion, yielding about 9 percent of all office buildings across the United States. We present a pro-forma real estate model that identifies parameters under which these conversions are financially viable. We highlight several policy levers available to federal, state, and local governments that could accelerate the conversion and that may be necessary should policymakers desire to create affordable housing. We highlight the role the Inflation Reduction Act could play in making more conversions financially viable.

Contents

I. Introduction

The COVID-19 pandemic has caused significant shifts in real estate markets, including increased urban-to-suburban migration (Gupta et al. 2022), residential rent and housing affordability issues, and reduced value of urban office and retail real estate due to the mass adoption of remote and hybrid work (Gupta, Mittal, and Van Nieuwerburgh 2023). These shifts threaten the fiscal health of cities because property taxes on these assets are major contributors to local government budgets; they risk triggering an urban doom loop in which public good provision declines, taxpayers leave, and property values fall further (Van Nieuwerburgh 2023). Additionally, the climate change crisis is leading to upcoming building regulations to reduce greenhouse gas (GHG) emissions; along with other factors, those regulations pose challenges to commercial real estate values, in particular to the values of older, lower-quality office buildings. At the same time, converting such buildings to uses that are in greater demand, such as apartments, is generally more responsible for the climate than razing such buildings and subsequently rebuilding from scratch.

Not every office property, however, is suitable for conversion. Three conditions must be met for a conversion to take place: (i) the building has to be physically suitable for conversion, (ii) the zoning and building codes have to permit and facilitate such a conversion, and (iii) the financial return of the conversion has to properly compensate the developer for the risk they are taking.

This policy proposal discusses all three necessary conditions and suggests pathways for making more office properties viable candidates for conversion into apartment buildings.

First, in section II we outline the parameters of a commercial property that make it a candidate for conversion. We produce an interactive financial calculator—which is further described in Appendix 2—that allows users to input characteristics of an existing commercial property and specifications for the post-conversion apartment building to determine whether a project is viable under certain conditions. The interactive financial calculator can be found here.

Second, in section III we propose ways the federal government could encourage conversions by (i) subsidizing commercial conversions using climate-related infrastructure resources, (ii) using the financial calculator to identify conversions eligible for subsidies, and (iii) sizing the subsidy using our financial calculator. A key aspect of our proposal is to highlight the relevance and availability of federal climate resources funded under the Inflation Reduction Act (IRA) that can be used to make more conversions—including those with affordable housing requirements—financially viable. Further regulatory guidance by the U.S. Department of Energy (DOE) and the Environmental Protection Agency (EPA) can clarify the suitability of federal funding toward these objectives.

Finally, in section III and Appendix 2 we propose ways for local governments to support conversions, including proposals regarding zoning, building codes, tax abatement, and debt subsidies.

II. The challenge

Three interrelated problems in urban real estate motivate this proposal: the housing affordability and supply crisis, office revenues and oversupply, and effects of conversion on rental housing and GHG emissions.

A. The housing affordability and supply crisis

There is a severe housing crisis in the United States, with the average renter spending at least 30 percent of their income on rent (Chen and Le 2022). While there is an undersupply of residential properties, there is an oversupply of office space. The demand for commercial office space is expected to remain weak due to the mass adoption of remote work, leading to record high vacancy rates and decreased office rent growth, and sparking concerns that some office buildings have become stranded assets. Gupta, Mittal, and Van Nieuwerburgh (2023) find that office cash flows declined by 17.4 percentage points nationwide between the end of 2019 and the end of 2022; the authors directly link declines in office demand to tenants' work-from-home (WFH) policies (Gupta, Mittal, and Van Nieuwerburgh 2023). Observed office values from the public markets indicate that investors perceive remote work as being highly persistent.

Affecting both residential and commercial properties are climate change–related regulations. The real estate sector is a major target for emissions-reduction policies because buildings account for 29 percent of all U.S. GHG emissions (Leung 2018). Regulations such as New York City's (NYC's) Local Law 97 impose fines on building owners for exceeding emission limits, which affects cash flows. Older properties are most affected, facing both weak office demand and noncompliance with emissions limits.

When left unaddressed, these challenges will lead to persistently high levels of office vacancies and an erosion of property values. Underutilization of offices due to remote work creates negative externalities in commercial neighborhoods: Less foot traffic contributes to more crime and public disorder, leading to lower retail sales, which in turn triggers lower retail property values and lower retail property tax revenues, as well as lower sales tax and income tax revenues. Reductions in public transit revenues represent other downstream consequences of lower office demand and commuter traffic.

Lower tax revenues combined with a balanced-budget requirement force cities to plug the fiscal hole by taxing residents and businesses more or cutting government spending. Budgets for local education, transportation, sanitation, and public safety will decline as a result, risking more urban decay and crime. Faced with higher taxes or lower public goods provision, some residents will leave the city in search of locations with a better amenities-to-tax ratio. The higher-skilled workers are more prone to leave due to stronger job prospects elsewhere and higher taxation where they currently live. These workers currently pay a disproportionate share of local income tax revenue. Increased out-migration lowers demand for local real estate and services, further lowering property, sales, and income tax revenues. This prompts additional cuts in government services, lowering the quality of life or increasing the cost of doing business. This population exodus can trigger an urban doom loop.

When faced with lower cash flows, owners of existing higher-emissions buildings who remain in business will struggle to afford the GHG emission fines and will lack the resources to invest in retrofits to improve the energy efficiency of their buildings.

B. Office revenues and oversupply

In the scenario described above, a city faces a fundamental misallocation of space: too much office space and too little housing. Keeping half-empty offices around prevents the creation of new housing. Subsidized conversions could preserve asset value while creating residential housing supply and addressing climate change concerns.

Typically, converting buildings is swifter, less expensive, and less environmentally damaging than demolishing them and constructing new ones. The rehabilitation of existing buildings produces 50 percent to 75 percent fewer carbon emissions than demolition and new construction. This concept of adaptive reuse is not new: It is a vital mechanism by which cities adapt to shifting economic realities.

A key hurdle in successfully implementing office conversions is the physical suitability of the office for conversion to apartments. To begin to address this challenge, we identify buildings that are plausible candidates for office conversion based on their physical characteristics. Equally important, buildings with substantial remaining office tenancy are unlikely to be viable candidates for conversion. The takeaway from our analysis is that a nationwide conversion strategy is viable because of the large number of plausible conversion candidates across the country. The potential exists for the reallocation of substantial space from office to apartment use.

We begin by identifying office buildings that are physically suitable for conversion; a full accounting of our methods can be found in Appendix 1. Starting from the universe of office properties, we develop an algorithm with criteria to select the most promising candidates.

1. Location

The rationale is to focus both on the locations where the negative effects of office vacancies are the strongest, and on the locations with strong transportation amenities. Because the transportation network was originally built to move workers into the central office district, residents in converted buildings will enjoy the benefit of network centrality in accessing other areas of the city, which is a desired and valued residential amenity. Although we exclude commercial properties outside the urban core in this proposal, they could still be viable candidates for other analyses.

2. Age of building

We believe that buildings built before 1990 are the most viable conversion candidates. Many historic buildings tend to be less expensive, have smaller floor plates, and have more character, all of which increases their conversion appeal.

3. Building class

We subset on Class A-, B, and C buildings, which are the properties facing greatest financial distress, which provides possible scope for conversion activity. We exclude Class A+ buildings since they have benefited from a flight to quality among the remaining office tenants.

4. Building size

The size of the building cannot be too big or too small, so we exclude buildings with a total size less than 25,000 square feet as well as large buildings with deep floor plates. Smaller buildings could be convertible, but they are less likely to attract institutional capital and federal grants. Deep floor plates have existing floor plans that start the building at a disadvantage: Too little interior light and air, too little plumbing, and too many elevators. Structural changes to remedy these buildings for residential use are likely cost prohibitive.

5. Current commercial tenant agreements

We narrow our sample of candidates further by selecting buildings with no (or few) major long-term leases left. We construct a measure of remaining lease duration based on the remaining lease length of all outstanding leases to the tenants in the building. We keep only buildings with a remaining lease duration of less than two years. Given weakness in demand, many office buildings are experiencing nontrivial vacancies. However, it is difficult to convert a building that still has substantial occupancy since the presence of existing tenants complicates a conversion project and buying out those tenants may ruin the economics of the conversion.

6. Brown buildings

The final criterion includes only brown buildings because green buildings may have a brighter future serving climate-conscious office tenants.

After following these protocols to assess potential conversions, we find that there is a nontrivial fraction of office assets that are physically suitable for conversion. Our estimates suggest that about 12 percent of office buildings in the commercial districts of the 105 largest cities in the U.S. are physically suitable for conversion. Removing properties that still have a substantial share of long-term tenants in place reduces this fraction to 10 percent. After removing relatively environmentally clean buildings from our sample, 9 percent of all existing commercial properties in large U.S. cities are potentially good candidates for conversion from brown offices to green apartments.

The algorithm leaves us with a final, national sample of 2,431 properties whose physical attributes, remaining office tenants, and GHG emissions make them ripe for conversion to green apartments (table 1). These properties represent 11 percent of all office properties located in high-density commercial districts in 105 of the largest cities (2,431 properties out of 22,215 office buildings); these 2,431 properties total 198 million square feet. Because so many of these properties are in NYC, and since this is the place about which we have the most detailed information, we will separately consider issues of NYC properties throughout this paper. We focus on these urban properties because of the externalities associated with their operations (e.g.,

TABLE 1

Conversion candidate sample summary

	Candidates from algorithm, matched to administrative data	National candidates from algorithm	
	NYC	NYC	Excl. NYC
Initial sample	1,010	1,513	26,360
Location	814	1,469	20,746
Year built	784	1,352	14,174
Class	782	1,339	13,932
Size	778	1,205	10,116
Distance to core	611	758	2,585
Outstanding leases	401	573	2,301
Emissions	307	567	1,864
Total Emissions (tons of CO2)	**193,936**	**262,367**	**510,683**
Apartments Produced	**38,734**	**51,414**	**107,241**

Source: Energy and Water Data Disclosure for Local Law 84; CompStak

Note: Starting from the first row ("Initial sample"), the table applies successive filters to select conversion candidates. Each row shows the remaining number of properties after the filter in that row has been applied. Column "Candidates from algorithm, matched to administrative data" is based on the intersection of the GHG emission and CompStak data sets for NYC. In that column, the location filter selects properties in downtown and midtown Manhattan. The "Distance to core" filter for this column uses the depth and width of the building as inputs. Columns "National candidates from algorithm" start from the CompStak data sets. The location filter in these latter two columns selects properties in ZIP codes with residential density greater than 1,000 people per square mile. The "Distance to core" filter in these last two columns is computed as the square root of the average floor size divided by two, and properties where the result is greater than 60 feet (corresponding to greater than 14,400–square foot average floor plate) are filtered out.

foot traffic in adjacent urban neighborhoods and GHG emissions), but there are likely other plausible conversion targets in other parts of the country, as well as conversion potentials for other uses (i.e., life sciences, education, etc.).

We plot the total number of suitable conversion buildings, by decade of construction, in figure 1. Most of the conversion candidates in NYC are pre–World War II buildings, while the rest of the country features many post–World War II candidates.

7. Locations of conversion candidates

Figure 2 shows the location of the 2,431 conversion candidates. Table 2 provides a breakdown of our conversion candidates for the top 20 core-based statistical areas (CBSAs).

C. Effects of conversion on rental housing and greenhouse gas emissions

1. How many apartment units could be created if all of the properties identified here were to be converted?

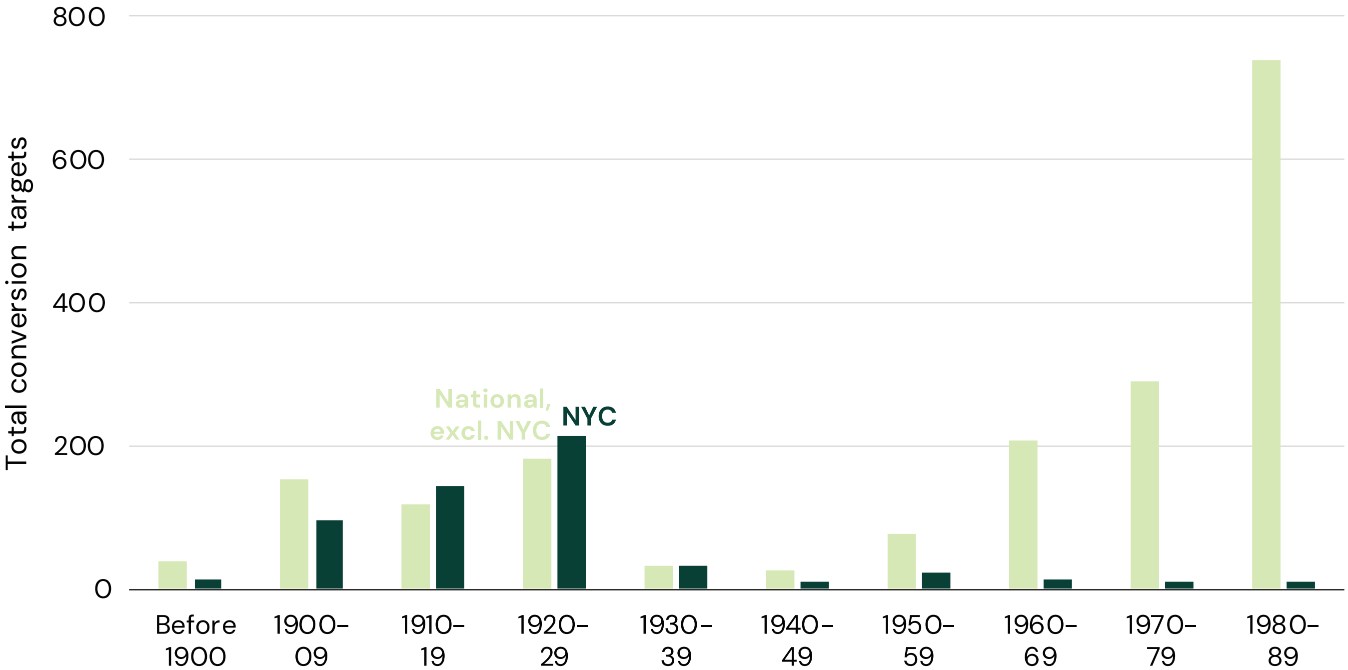
At 875 square feet per apartment unit, and after incorporating a 30 percent loss factor, these conversions could create 158,654 additional housing units. Scaling up for incomplete data coverage results in 367,750 apartment units. For comparison, about 260,000 apartment units were created in the U.S. in a typical year between 2001 and 2022.

2. How much GHG emission could be reduced by converting these properties?

The final conversion candidate sample accounts for 773,050 tons of predicted carbon dioxide (CO2)

FIGURE 1

Conversion targets by decade of construction



Source: CompStak; authors' calculations.

Notes: The figure plots total properties suitable for conversions, after applying all the filters in table 1, across decades of construction for the national sample, excluding NYC, as well as for NYC.

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emissions. Scaling up for incomplete data coverage results in 1,775,042 tons of predicted carbon emissions. These emissions could be reduced significantly by converting brown offices to energy-efficient green apartments. If we assume that brown office conversions result in apartment buildings that are 25 percent under the 2030 NYC emission cap, the total GHG emission reduction is 1,420,034 tons, or 80 percent. For comparison, buildings were responsible for 1.97 million tons of carbon emissions in NYC in 2019 (NYC Mayor's Office of Climate and Environmental Justice 2022). In summary, office-to-apartment conversions can make a meaningful dent in GHG emissions reduction.

3. Is office-to-apartment conversion financially viable?

We propose a model to demonstrate the financial viability of transforming traditional brown office buildings into ecofriendly apartments. This analysis is described in detail in Appendix 2. We assume that such transformation is structurally viable without requiring major reengineering and that all necessary regulatory approvals have been granted.

We take into account the triple headwinds of rising interest rates, the emergence and persistence of remote work, and GHG emission taxes which lower office values. We find that there is likely substantial value for investors in making these conversions.

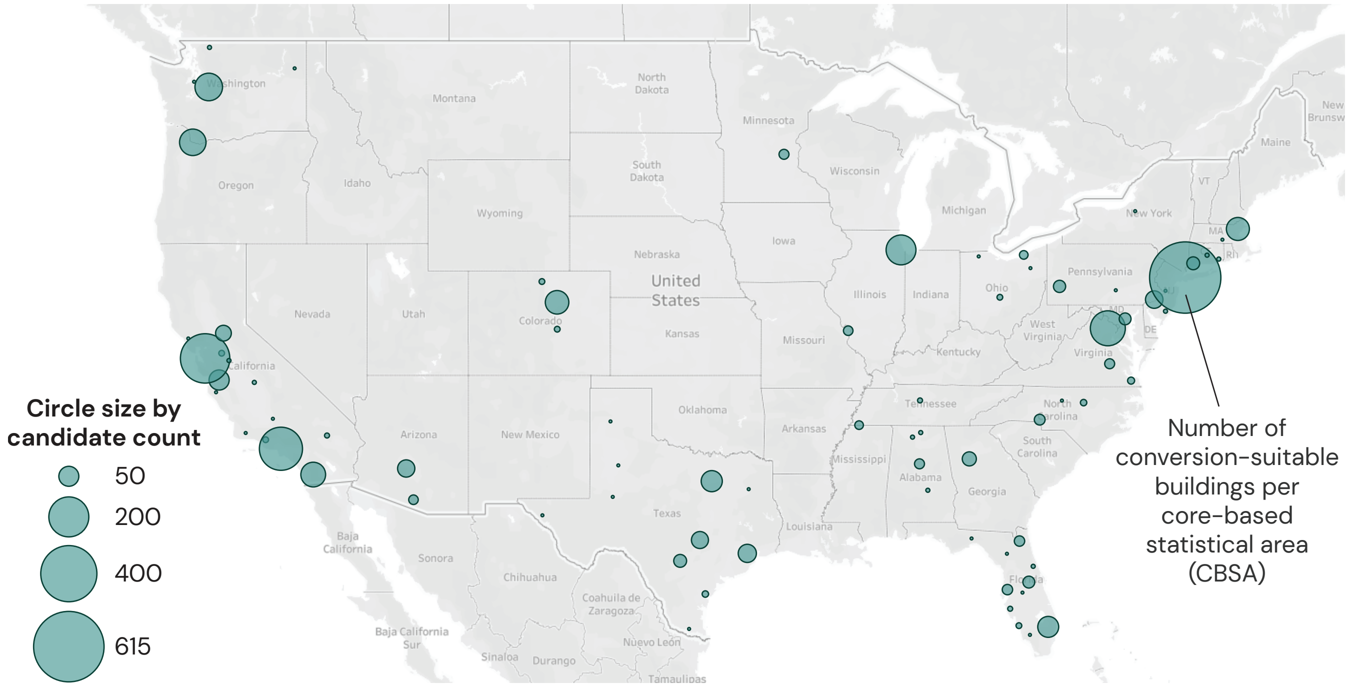
After moving through the procedures detailed in Appendix 2 for determining the property valuation of conversion candidates, we find that a property that had a pre-pandemic valuation of $100 million is presently valued at $38.9 million. This constitutes a 61 percent loss in value and is consistent with our prior forecasts. This office in our example was most likely financed with debt pre-pandemic. A 65 percent loan-to-value (LTV) ratio was common before the pandemic, amounting to an initial principal balance of $65 million. Commercial mortgages have little principal amortization, so there would likely still be $60 million in debt outstanding against this property at the time of the valuation (early 2023). The new $38.9 million valuation would mean that the initial $40 million investment in equity in the office is wiped out, and that the debt is sitting on a loss of $21.1 million, or 35 percent.

This loss of equity value, in combination with the cash flow shocks that impair the ability to make debt repayments, would likely trigger financial distress, resulting in the owner defaulting on the mortgage. Through a foreclosure sale, a short sale, or a deed-in-lieu of foreclosure, the asset would end up in the hands of a new buyer.

The financial distress of conventional office buildings sets the stage for the valuation of an alternative:

FIGURE 2

National candidates



Source: CompStak; authors' calculations.

green market-rate apartment buildings (see Appendix 1). We use a conversion cost estimate of $80 million for our hypothetical conversion project, which equates to $400,000 per apartment unit ($457.14 per square foot for the average 875 square foot apartment, or $320 per square foot for a building with 250,000 gross square feet before factoring in the loss factor). Earlier case studies have used a cost between $210,000 and $300,000. Our number is higher because our calculations are for a high-cost market. These costs, however, can vary significantly, depending on the unique attributes of the property (e.g., requirement for a light well, needed ventilation improvements, preferred luxury finishes, etc.), as well its location (with implications for labor costs, regulations, etc.). We return later in Appendix table A-3 to the robustness of our estimates with respect to this crucial parameter. We assume an additional $40 per square foot as a plausible estimate for the supplementary development costs required to enhance the building's energy efficiency, given that major construction is already under way.

The key conclusion of our analysis is that office-to-apartments conversions can be financially profitable, yielding a project internal rate of return (IRR) of 16.8 percent, which exceeds the cost of equity capital. Put differently, the conversion results in a positive net present value (NPV) of $4.1 million. While positive, this net present value is small compared to the overall project cost of $128.9 million. The safety margin is also small. Still, the central takeaway is that conversions can be financially viable if the developer can purchase the office building significantly below pre-pandemic valuation levels (e.g., a 61 percent discount in our example). Our calculations show that the conversion turns from positive to negative net present value at a purchase price of $43.2 million. This last calculation suggests that apartment conversions might help put a floor under office valuations, at least for properties that are suitable for conversion.

4. How many conversions that are physically feasible are also financially feasible with no subsidy?

This is a challenging question that ideally requires a building-by-building analysis; such analysis is beyond the scope of this paper, however. We take a first pass at this question by using a limited set of regional information. Specifically, we account for differences in (i) pre-pandemic office values for Class B offices, (ii) declines in office values over the period from December 2019 to December 2022, (iii) apartment rents, and (iv)

TABLE 2

Conversion candidates by core-based statistical area

Core-based statistical area (CBSA)	Candidate count	Total gross square feet (million)
New York-Northern New Jersey-Long Island	615	66.4
San Francisco-Oakland-Fremont	295	17.9
Los Angeles-Long Beach-Santa Ana	225	14.1
Washington-Arlington-Alexandria	148	11
Chicago-Naperville-Joliet	108	13.4
Seattle-Tacoma-Bellevue	92	6.3
Portland-Vancouver-Beaverton	85	5.1
San Diego-Carlsbad-San Marcos	74	3.7
Denver-Aurora	67	5.8
Boston-Cambridge-Quincy	64	3.6
Dallas-Fort Worth-Arlington	54	5.1
Miami-Fort Lauderdale-Pompano Beach	53	4.9
San Jose-Sunnyvale-Santa Clara	49	2.4
Houston-Sugar Land-Baytown	40	3.7
Philadelphia-Camden-Wilmington	37	3.4
Phoenix-Mesa-Scottsdale	36	2.2
Austin-Round Rock	35	1.8
Sacramento-Arden-Arcade-Roseville	30	1.2
Atlanta-Sandy Springs-Marietta	24	2.6
San Antonio	20	1.7

Source: CompStak.

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costs of construction across CBSAs. Since we use the same inputs for each building in a given CBSA, this exercise predicts that either all or none of the buildings would be financially feasible conversions. The last column of table 3 therefore reports either the total number of buildings that are physically suitable for conversion for those CBSAs for which the typical conversion is also financially feasible or zero for those CBSAs where the typical Class B office conversion is not financially feasible. The conversion assumes a 100 percent market-rate apartment rental building. Table 3 suggests that the typical conversion is financially feasible in NYC, San Francisco, San Jose, Washington DC, Boston, and Denver.

As table 3 shows, in six of the markets that we review conversions have positive net present value; in other words, about 58 percent of the potential conversions we have identified would be financially viable without government intervention. But just over 900 properties (42 percent) in the other 14 markets shown in table 3 would have a negative net present value absent investment from the public, whether from the federal, state, or local government.

5. What will happen to the buildings for which conversion is not profitable?

For some buildings, demolition and new construction may be viable—although this option is generally worse for the environment. Existing structures contain large amounts of embedded carbon in the form of steel, concrete, and other building materials. For some buildings, repurposing office space to cater to shifting office needs and to benefit from rising premiums on high-quality office buildings may be an answer. However, the total demand for such uses is likely limited. In other cases, buildings will remain partially vacant, continuing to lose value, thereby adding to the urban doom loop problem.

TABLE 3

Market rate conversion feasibility

	(1)	(2)	(3)	(4)	(5)
Core-based statistical area (CBSA)	**Initial price**	**New price**	**Apartment rent**	**Conversion cost**	**Positive net present value (NPV) conversions**
New York-Northern New Jersey-Long Island	400	172	8	360	615
San Francisco-Oakland-Fremont	343	88	7.6	353	295
Los Angeles-Long Beach-Santa Ana	192	76	5.17	304	0
Washington-Arlington-Alexandria	158	58	4.82	260	148
Chicago-Naperville-Joliet	81	32	3.29	325	0
Seattle-Tacoma-Bellevue	181	76	5.14	291	0
San Diego-Carlsbad-San Marcos	113	47	3.73	286	0
Portland-Vancouver-Beaverton	141	59	4.8	298	0
Denver-Aurora	90	38	4.38	249	67
Boston-Cambridge-Quincy	143	63	5.96	311	64
Dallas-Fort Worth-Arlington	88	37	2.71	234	0
Miami-Fort Lauderdale-Pompano Beach	130	57	3.85	232	0
San Jose-Sunnyvale-Santa Clara	233	98	7.16	340	49
Houston-Sugar Land-Baytown	79	29	2.41	236	0
Philadelphia-Camden-Wilmington	77	31	2.9	315	0
Phoenix-Mesa-Scottsdale	94	40	3.07	237	0
Austin-Round Rock	145	63	3.23	236	0
Sacramento-Arden-Arcade-Roseville	86	36	3.56	286	0
Atlanta-Sandy Springs-Marietta	83	37	2.82	243	0
San Antonio	84	38	2.16	228	0

Source: Real Capital Analytics; Gupta, Mittal, and Van Nieuwerburgh (2023); RSmeans; authors' calculations.

Note: For (1), we use data for 2019 Q4 from Real Capital Analytics on the hedonically adjusted average office value per square foot in each CBSA. We compute the ratio of each CBSA's office value relative to the NYC CBSA. We anchor the pre-pandemic NYC CBSA office value for Class B at $400 per square foot and apply the office value ratio to this number for the other markets. For (2), we use the percent decline in office values between the end of 2019 and the end of 2022 from Gupta, Mittal, and Van Nieuwerburgh (2023). Since this price decline is for all offices and not just Class B, but we know from Gupta, Mittal, and Van Nieuwerburgh (2023) that percentage price declines are much larger for Class B offices, we compute the percentage price change for Class B offices in CBSA i as: $\Delta p_i^B = 1-(1- \Delta p_i^{All})(1-c)$. We set c=0.34. For (3), we use data on the hedonically adjusted average apartment value per unit and the hedonically adjusted average apartment cap rate for 2019 Q4 and compute the Net Operating Income (NOI) as the product of these two numbers. We then divide the NOI by 0.7 to obtain the apartment rent. This assumes that operating expenses are 30 percent of rent revenues. We compute the ratio of apartment rent in each CBSA to that in NYC. We set the apartment rent in NYC to $8 per square foot for luxury rentals and apply the ratio to this amount for the other cities. For (4), we use the 2021 composite construction cost index data from RSmeans. The index captures hard and soft construction costs for commercial buildings. We express the index relative to NYC and anchor to conversion cost to the NYC value of $360 per square foot. The latter consists of the $320 conversion cost per gross square foot plus the $40 per gross square foot for the energy-efficiency upgrades. This information is available for 13 of the 19 top-20 CBSAs for which we have office and apartment price data. For the remaining six, we apply the construction cost index of a similar and/or geographically neighboring city.

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III. The proposal

The surge of remote work, the interest rate context, and existing and new environmental regulations have together introduced a unique challenge, yet also an opportunity for policymakers to make a once-in-a-generation investment in the urban environments of the future. This policy proposal has the primary goal of making financially viable an increase in physically viable conversions that also meet policymakers' attendant goals, such as an increase in affordable housing.

First, we identify the existing channels that policymakers at the federal and local government levels have to financially subsidize conversions. Second, we show how to use the financial calculator (described in Appendix 2) to identify conversions that subsidies are appropriate for and to assess the size of the subsidy. Finally, we propose several changes to local regulations and other nonfinancial policies that would spur socially desirable conversions.

A. Government subsidies for commercial conversions

1. Government resources to subsidize climate-related infrastructure

Since local governments may have limited resources to subsidize office conversions, it is reasonable to ask whether the federal government could chip in. Given the environmental aspects of the conversion considered, the Inflation Reduction Act (IRA) could be a promising route. Passed in August 2022, the IRA dedicates $369 billion over 10 years to promote clean energy, pollution reduction, and environmental justice. It contains a plethora of tax incentives for wind and solar energy, batteries, nuclear power, clean hydrogen production, electric vehicles, heat pumps, and much more.

While the IRA never explicitly mentions green office conversions, our reading suggests that there are five provisions in the act that could be relevant, but the DOE and the EPA need to provide further guidance. Without help from the IRA, apartment conversions risk being either green or affordable, but not both. Furthermore, the financial calculator that accompanies this proposal can also be used by policymakers to efficiently target and maximize IRA resources: It shows policymakers which properties could be profitable *without* IRA resources.

The most prominent IRA program is the $27 billion EPA's Greenhouse Gas Reduction Fund (GGRF), which needs to be spent by September 2024. Using the GGRF to subsidize the green investment component of a brown office-to-green apartment conversion is not only compatible with the IRA's mission to reduce GHG emissions, but also, when the conversion creates affordable housing units, supports climate justice initiatives. The GGRF provides competitive grants in three buckets: (i) $12 billion for projects that reduce or avoid GHG emissions, (ii) $7 billion to enable low-income and disadvantaged communities to utilize zero-emission technologies, and (iii) $8 billion for climate-related activities in low-income and disadvantaged communities.

We believe that market-rate conversion projects that turn brown offices into green apartments should qualify for the first $12 billion bucket of grants. If such conversions also contain an affordable component, they should also qualify for the latter two parts of the GGRF (ii. $8 billion and iii. $7 billion). It is not a stretch to view the right to a green, clean, healthy living arrangement as a basic tenet of climate justice, which is one of the expressed goals of the IRA. It would make great sense for the EPA to identify energy-efficient, location-efficient adaptive reuse projects as eligible project types for funding from the GGRF.

Another provision of the IRA (section 179D, Commercial Buildings Energy-Efficient Tax Deduction) provides owners of commercial buildings (including Real Estate Investment Trusts [REITs]) who reduce the energy and power cost of interior lighting, Heating, Ventilation, and Air Conditioning (HVAC), and hot-water systems by at least 25 percent with a tax deduction of $2.50 to $5.00 per square foot by demonstrating improvement in energy use relative to existing energy use. We have already applied this green tax abatement in our model in subsection II.C.

Sections 50121 and 50122 of the IRA earmarks $4.3 billion in direct rebates to homeowners and owners of multifamily properties for energy efficiency upgrades of up to $400,000 when the retrofit achieves modeled energy savings of at least 35 percent (or $200,000 for 20 percent). It also provides $4.5 billion in rebates for electrification projects for low- and moderate-income households. Potentially, office conversions with an affordable component may qualify for both programs.

There is up to $1 billion in grants and $4 billion in loans from the U.S. Department of Housing and Urban Development (HUD) for upgrades that improve energy and water efficiency, improve air quality, implement building electrification, improve climate resilience, and implement other sustainability measures. Eligible entities are nonprofits and other owners of qualified affordable housing, including multifamily projects. This program could lower the cost of debt. While this program is currently targeted toward existing HUD multifamily properties, we suggest that it should be opened up further to cover conversions, similar to existing HUD programs (e.g., HOME Investment Partnerships Program, Housing Trust Fund, Community Development Block Grants, and section 108 Loan Guarantee Program) that fund conversions.

Finally, the Renewable Energy Investment Tax Credit (section 48, subsections 13102 & 13702), provides a tax credit of up to 30 percent of the cost of solar, geothermal, combined heat and power, storage, and other clean technologies. This credit can be further boosted if domestic content requirements are met, if the project is in energy community regions that are intensive in fossil fuel extraction, and if projects are in low-income areas or are dedicated to affordable housing. Eligible entities are taxpaying property owners (i.e., office, retail, etc.) who purchase eligible technologies.

2. Government resources to subsidize affordable housing

Aside from ensuring the viability of climate-responsible conversions, subsidies can also boost the availability of affordable rental properties. Conversions that generate only market-rate apartment units might not align with the goals of policymakers, since they have indicated a preference for creating affordable housing. Imposing an affordability mandate on an office-to-apartment conversion, however, naturally reduces its financial attractiveness.

We propose a menu of additional policy levers to make a conversion with an affordable housing component financially viable. We quantify the trade-off between generating additional affordable housing units and providing additional subsidies. Traditional local and federal policies, in particular property tax abatements and subsidized financing, have an important role to play. Creating green apartments from brown offices replaces a falling property tax revenue stream with an increasing one, generating resources for investments that ensure that cities will remain attractive places to live.

Federal government resources

The federal government runs several project-level programs that subsidize the creation and financing of affordable housing properties. The $9-billion Low-Income Housing Tax Credit (LIHTC) program administered by HUD, and distributed via the states, provides funds for the construction in low-income areas of new affordable housing properties (under the so-called 9 percent program, which effectively pays for 9 percent of the construction costs in each of the 10 years of the program) and the rehabbing of existing properties (under the 4 percent program). It is unclear whether existing office assets would qualify at all, and, if they do, under which of the two programs. It is also unclear how many of the nation's commercial districts would qualify as low-income areas. But if and where they qualify, LIHTC could be an avenue to create apartment buildings with deeper levels of affordability than otherwise feasible.

The Federal Home Loan Bank, Fannie Mae, and Freddie Mac all run large affordable housing finance programs under the oversight of the Federal Housing Finance Agency. These same entities have recently taken a renewed interest in climate change. There is an opportunity for the creation of a new office conversion finance program, possibly with special modalities for ecofriendly conversions. There is precedent for incorporating environmental assessments in these lending programs in the form of Fannie Mae and Freddie Mac's Green Bond program; that program specifically finances environmentally sustainable single- and multi-family properties.

Local government resources

Given the decline in property values and property tax revenues from urban offices and retail, cities might have only limited resources for office conversion subsidies. However, our calculations show that local governments will eventually see increased property tax revenues from office conversions. The initial drop in tax revenue during the conversion phase is more than compensated for by the increase in tax revenues once the apartment property has been stabilized. From the local government's perspective, an office conversion is an investment in future tax revenue.

If this incremental tax stream were to be segregated, it could serve as the collateral for a municipal bond issuance. The proceeds from such bond issuance could both pay for conversion subsidies and be used to offset the initial tax revenue shortfall. Property tax abatements and subsidized debt finance are two crucial policy levers to make office conversions financially viable. As shown in our hypothetical example below, our calculations show a substantial tax expenditure for each affordable housing unit. Relative to the status quo of a declining tax revenue stream from a poorly performing office, however, the tax revenues from a mixed-use apartment property are still much higher.

3. Quantifying the role of subsidies

To consider the role for local and federal subsidies in facilitating conversions with an affordable housing component, we return to our hypothetical conversion and begin with the economics of the conversion for a for-profit developer. As detailed in table A-3, our analy-sis shows that imposing a requirement on the conver-sion that 20 percent of apartment units be affordable renders the net present value negative, so the devel-oper will not pursue the opportunity.

In order to increase the net present value of affordable development, local governments can provide a property tax abatement during the affordability period (here, 25 years). Property tax abatements are a common policy tool used by local governments to create additional affordable housing. For our building, the property tax payment needs to be reduced by 40.5 percent between 2027 and 2051 in order to increase the net present value to the developer from –\$8.6 million to \$0. This tax abatement brings up the developer's internal rate of return to 14.8 percent, the minimum required to do the conversion under the affordability mandate.

This property tax abatement costs local governments \$40 million in lost tax revenue in present value, relative to a 100 percent market-rate rental building. In other words, each affordable unit costs the government \$1 million in forgone tax revenue.

Tax revenues remain nearly \$43 million higher relative to the status quo of keeping the property as a defunct office building. Seen from this perspective, an office-to-apartment conversion with 20 percent affordable units that receives enough subsidies to make the conversion financially feasible remains hugely beneficial to the taxpayer. These subsidies are an investment in affordable housing in the city center, financed with some of the incremental tax revenue.

Next, we ask how the calculus changes if we use IRA funding to pay for the green upgrades in the conversion, assumed to be \$40 per gross square foot or \$10 million for our hypothetical conversion. This IRA subsidy increases the net present value from -\$8.6 million to -\$0.3 million. Only a small property tax abatement of 1.5 percent is needed to lift the net present value to zero. The property tax expenditure to the local government, relative to a market-rate building, becomes \$596,841 per affordable apartment unit. Of course, the IRA grant adds \$250,000 in federal tax expenditures per affordable unit.

These calculations suggest that policymakers will have to choose between allowing market-rate units or providing additional subsidies so that developments with affordable units are penciled out. An IRA subsidy can greatly reduce the size of the local property tax abatement needed to realize affordable housing.

Another commonly implemented housing policy involves lowering the cost of debt for affordable housing projects. There are multiple such programs at both local and federal government levels.

In our model, we simplify this treatment by assuming that a certain percentage of both construction loans and mortgages can be obtained at below-market interest rates. We assume the subsidized portion of the construction loan enjoys a 200-basis point funding advantage and the mortgage a 100-basis point advantage. Concretely, for our building with 20 percent affordable units, we assume that 50 percent of the loan amounts benefit from the subsidy. This debt subsidy reduces the effective interest rates on the construction loan from 8.7 percent to 7.8 percent, and on the mortgage from 5.4 percent to 4.9 percent.

The subsidized debt policy increases the net present value in this hypothetical example to \$5.1 million and the internal rate of return to 13.1 percent, showing the utility of debt subsidies. Adding enough property tax abatements to get the developer's net present value up to zero requires a 24 percent tax abatement, which compares to a 40 percent tax abatement without debt subsidies. This tax abatement results in a total cost per affordable unit of \$928,867 compared to \$1.1 million without the subsidized debt.

B. Using the financial calculator to identify conversions eligible for subsidies

To help policymakers quantify what level of subsidy is appropriate across subsidizing debt and property tax abatements, we created a financial calculator to help developers and municipal policymakers evaluate conversion candidates. The basic design of the calculator is to automate the pro forma calculation of whether a conversion is financially feasible, and, if so, under which assumptions. It enables a developer to readily calculate whether to pursue a particular conversion candidate by plugging in their unique project characteristics. This financial tool also enables policymakers to quantify the extent of subsidies necessary to make projects pencil out and avoid the twin problems of too little subsidies (which mean projects never get off the ground) and over-subsidizing projects that already make financial sense.

To operationalize these objectives, the basic idea behind the calculator is that conversion projects can apply for IRA funds for the smaller amount of the green capital expenditure component of the conversion and the subsidy that brings the project's net present value to zero. We encourage policymakers to broaden eligibility of IRA funding to for-profit developers, potentially in a joint venture with nonprofits. After incorporating federal subsidies, local governments could plug in assumptions about the market conditions for the property in question, select a desired level of affordable housing, and then compute the necessary subsidies required for a project to pencil out. After identifying potential conversions that meet the above criteria, we propose that the federal government subsidizes only the conversions that are not otherwise profitable.

The financial calculator is available here.

C. Changing local regulations and other nonfinancial policies to spur conversions

Finally, we propose several changes to local regulations and other nonfinancial policies that would spur socially desirable conversions. State and local governments control many of the policy levers that impact the feasibility of office-to-apartment conversions. Above we have detailed how tax abatement and debt subsidies contribute to the financial viability of conversions. But to bring some of the identified buildings above and even more buildings into the stock of potential conversions, local governments will need to look at zoning rule and housing code changes. Local policymakers must work diligently to review zoning and building codes as well as administrative processes, in order to facilitate and accelerate office-to-apartment conversions.

Many cities are already reevaluating their zoning rules to make office conversions more feasible and economically viable. For instance, NYC's City of Yes zoning amendments, introduced in June 2022, aim to reach zero carbon emissions, economic opportunity, and housing opportunity.

Local governments can and should provide regulatory relief for office conversions by making changes to the zoning resolution, multiple dwelling law, housing and maintenance code, and building code. In addition, the permitting process should be streamlined to expedite the transition, in particular to allow conversions to happen as of right rather than requiring extensive discretionary review.

Zoning regulates the use and bulk (physical dimensions) of buildings. Parts of the central business district may need to be rezoned to allow for residential use. Such rezoning should be enabled as of right, meaning that owners should be able to convert buildings without being required to file for discretionary permits, which present substantial delays, additional costs, and uncertainty that can increase barriers to conversion or simply make conversion infeasible. Even when zoned for residential use, a converted building needs to comply with bulk regulations (i.e., restrictions on building height, setback lines, and the percentage of open areas). When those are more permissive for office than residential use, bulk regulations may stand in the way of an office conversion. More flexible standards should be developed so that more office buildings in commercial districts can be converted in their entirety for residential use. We suggest going even further to provide additional density bonuses for conversion targets in order to accommodate additional residential units, especially when the building height is below neighboring properties. Such bonuses may be justified on the grounds that apartments feature larger loss factors than offices, and so increasing height can offset space losses associated with the conversion.

Other zoning changes could eliminate parking space requirements and allow for additional types of residential housing such as supportive housing and student dormitories. Alternatively, conversion into other in-demand commercial uses (e.g., medical offices, educational institutions, daycare centers, retail shops, and hospitality businesses) may also be feasible in some cases and can provide additional local amenities valued by other residents.

Local municipalities may also need to revisit certain building code features, such as the requirements that each bedroom have a window. Some cities, such as NYC, mandate this requirement, but others, such as Washington, DC, and some student dormitories, do not. A window mandate is particularly onerous for office conversions of post–World War II buildings (29.5 percent of the NYC sample), for which wide floor plates necessitate bedrooms be placed along the perimeter of buildings, leaving substantial dead space in the center. Alternative uses in such cases may involve hollowing out a portion of the core from the center or side of the building, which may prove expensive (and lower the load factor) or using such space for common functions paired with micro units along the perimeter.

IV. Questions and concerns

Does this proposal apply only to urban areas?

No. The principles of office-to-apartment conversions apply equally to suburban locations. Naturally, the parameters that enter our financial model must be adapted to the specific office asset market under consideration. Office values are lower in suburban areas than in urban areas, and conversion costs may be lower as well. But so are apartment rents. Taxes though may differ. Our model allows the user to make these parameter adjustments.

Much of the suburban office stock in the U.S. is functionally obsolete and ripe for conversion, much like the Class B urban office. The main consideration that sets urban areas apart is the presence of significant amenities, first and foremost access to public transit, but also agglomeration benefits that arise from thick labor markets. This consideration, as well as the more mundane issue of data availability, explains our focus on urban office conversions.

Are there precedents for office-to-apartment conversions?

Conversions from office to market-rate apartment rentals were typical in the NYC financial district, where, in the 1980s, developers started to convert historic office buildings into luxury apartment units. The area, previously thinly populated, saw large numbers of new apartment units both from converted offices and from new apartment buildings on reclaimed land in Battery Park. It remains one of the highest-income areas in NYC today.

Concerns about growing income disparities in the area began to influence policymakers, who introduced property tax abatements—in the form of the 421-g tax incentive program—to both encourage conversion activity with an affordable housing component. A rationale for such programs may be to ensure that low-income residents have improved access to opportunity. The presence of residents at varying income levels may facilitate cross-class social connections and avoid the entrenched patterns of income segregation observed elsewhere in cities. The 421-g program accompanied looser zoning restrictions in the area to facilitate conversions and implemented a 14-year abatement of property taxes, during which time converted units were subject to rent stabilization.[1]

V. Conclusion

Seismic shifts in the real estate landscape, accelerated by the COVID-19 pandemic, have brought urban real estate to a critical crossroads. The urban exodus, housing affordability issues, and the diminished value of urban offices due to the widespread adoption of remote work have precipitated pressing challenges for the fiscal health of cities. These trends are amplified by additional headwinds surrounding higher interest rates and environmental considerations, which add up to a challenging environment for commercial real estate. At the same time, these shocks present a unique opportunity to reimagine urban spaces for a greener, more sustainable future.

Our policy proposal to incentivize the conversion of underused Class A-/B/C office buildings into green apartments addresses these challenges head on. It paves the way for restoring asset values and tax revenues, alleviating housing shortages, and meeting climate goals, while mitigating the negative externalities of vacant offices. We present a pro forma real estate model to demonstrate that such transformations are not only environmentally responsible but also financially viable under current market conditions as long as buildings are able to transact at fair values. We identify many possible conversion targets in cities across the country.

A key aspect of our proposal is identifying federal subsidy funds from the IRA to help finance these green projects. However, the execution of this proposal will also require concerted efforts from multiple stakeholders, involving modifications to local zoning regulations, building code adjustments, and local budgetary allocations. The trade-offs inherent in generating affordable housing units necessitate thoughtful policy design, balancing the benefits of more affordable housing with fiscal constraints.

While challenges abound, the potential to reshape urban landscapes is immense. Office conversions could facilitate urban redevelopment and allow cities to reinvent themselves to meet modern challenges.

Appendix 1. Detailing the algorithm developed to identify viable commercial properties

A1. Test case study: New York City (NYC)

Because our focus is on converting brown office buildings to green apartment buildings, we begin by studying NYC, where we can observe GHG emissions at the building level, allowing us to layer in environmental considerations. We then scale up the analysis to the entire U.S. We use the procedures outlined in section A2 of this Appendix.

1. Identifying conversion targets in NYC

We use building-level energy use data from the Energy and Water Data Disclosure for Local Law 84 and convert energy use to carbon equivalents. Emissions include both direct (on-site fossil fuel) and indirect (electricity use) emissions. We then compare emissions to the emission limits under Local Law 97. Passed as a part of the Climate Mobilization Act by the New York City Council in 2019, this local regulation aims to reduce emissions by 40 percent by 2030, and by 80 percent by 2050, and imposes steeply increasing carbon taxes to implement these goals. We find that 16 percent of large office buildings (i.e., above the 25,000 square foot threshold) are over the limits set for 2024, and that 72 percent of large office buildings are over the limits set for 2030. The emissions dataset contains 1,867 office properties in NYC (second column in table A-1). It shows that 70.5 percent of proper-ties in this sample were built before World War II and 92.7 percent of properties were built before 1990. The former group accounts for 44.8 percent of aggregate GHG emission fines that will need to be paid under the status quo after 2030, and the latter group accounts for 89.4 percent of total fines.

We merge the emissions data with CompStak, a dataset that contains detailed property and leasing characteristics for office buildings. The intersection with the GHG emission data set contains 1,014 properties. This sample has similar age and emissions distributions (columns "CompStak" in table A-1).

2. The conversion selection algorithm

To arrive at a sample of plausible office conversion candidates, we winnow down our sample of properties in a series of steps.

First, we impose a location requirement and keep only buildings located in midtown and downtown Manhattan built before 1990. The rationale here is to focus on the locations where the negative externalities from office vacancies are the strongest, as well as to focus on locations with strong transportation amenities. Because the transportation network was originally built to move workers into the central office district, residents in converted buildings will enjoy the benefit of network centrality in accessing other areas of the city, which is a desired and valued residential amenity.

Second, we keep only buildings built before 1990. This is consistent with the recommendation by the NYC Office Adaptive Reuse Study (New York City Department of City Planning 2023). We drop buildings smaller than 25,000 square feet, which may lack scale economies for conversion. Such projects may be attractive for smaller conversions but are unlikely to attract institutional capital. The administrative cost-benefit analysis of approving or subsidizing small projects may be unfavorable as well.

We drop buildings with deep floor plates. Specifically, we remove buildings with a distance from the window to the core that is more than 60 feet. In the NYC data, we observe building width and depth from the PLUTO data set (New York City Department of City Planning n.d.). This allows us to calculate the distance from the core of the building to the window as the width divided by two or the depth divided by two. We define distance to the core as the smaller of these two

TABLE A-1.

Descriptive statistics for office buildings subject to LL97

	Count		2024 fine (million $)		2030 fine (million $)	
Year built	Full	CompStak	Full	CompStak	Full	Compstak
Pre-War	1317	741	21.70	15.87	61.38	45.07
1945–1959	129	65	1.75	1.25	15.19	9.34
1960–1979	189	101	5.40	2.20	37.57	30.16
1980–1989	96	63	2.60	0.94	8.34	5.97
1990–1999	33	16	0.41	0.07	2.58	2.02
2000–2009	63	11	3.00	0.04	7.97	1.27
2010–2019	38	17	0.96	2.52	3.92	7.05
2020+	2	0	0.00	0.00	0.06	0.00
Total	**1,867**	**1,014**	**35.81**	**22.88**	**137.01**	**100.88**

Source: Energy and Water Data Disclosure for Local Law 84; CompStak

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numbers. Many modern office buildings have physical attributes that are unfavorable for apartment conversion. In particular, many massive full-block glass-and-steel office buildings feature deep floor plates that make it difficult to bring enough light and air into the interior of the structure. They would therefore require at least one core drilled in the middle or side of the structure to create enough natural light, which greatly adds to the cost of conversion. They typically also have inadequate plumbing to accommodate many bathrooms on each floor, might not have windows that can be opened, feature too many elevators, and otherwise present physical obstacles to conversion.

These first screening criteria ensure that we focus on properties in the urban core, which have sufficient scale, reasonable floor plate depth, and are older and of lower quality than average. Such buildings are both browner and less expensive, making them better candidates for conversion to green apartments. At this stage of the selection process, we have 611 NYC buildings in the candidate set.

After we restrict the sample to buildings with limited long-term leases and remaining lease durations of less than two years, we are left with 401 plausible conversion candidates. Finally, we remove green buildings and select high-emission properties; approximately 76 percent of the conversion target list exceeds the 2030 GHG limit. This leaves us with 307 brown office–to–green apartment conversion candidates.

Our final candidate sample represents 30 percent of the initial 1,010 NYC office properties and 14.6 percent of the initial square footage. This sample accounts for a total of $17.5 million in GHG emission fines under the 2030 limit, or 15.3 percent of total emissions, and 17.3 percent of total fines for the initial sample.

A2. Scaling up conversions nationally

Having selected conversion candidates for NYC, we can scale up the exercise to the entire U.S. We apply the same selection criteria we used for NYC to all 105 office markets covered by the CompStak dataset. That is, we identify older, lower-quality office buildings of sufficient scale and with small enough floorplates located in downtown areas.

To implement the location requirement (step 1), we select office properties located in ZIP codes with at least 1,000 residents per square mile. This helps us select commercial districts rather than suburban office clusters. Since the national algorithm does not condition on the availability of GHG emission data and considers other dense neighborhoods besides midtown and downtown Manhattan, the initial set of buildings for NYC is about 50 percent larger than in the previous exercise. We apply the national algorithm to NYC in the second column of table 1. To implement the low distance-to-core requirement (step 5) in the national sample, we select office buildings with floor plates below 14,400 square feet. For the national sample, we proxy for the size of the average floor plate as the total building size divided by the number of floors.

Table 1 shows how, starting with the CompStak universe of office buildings, each step of the algorithm reduces the number of conversion candidates. This results in 2,874 conversion candidates nationally, of which 573 properties are located in NYC.

We do not have data on GHG emissions for buildings outside NYC, complicating step 7 of our algorithm. We can impute a GHG emission level for each building, however, based on that building's characteristics. To do so, we estimate the relationship between emissions and building characteristics in the NYC sample of conversion candidates and use the estimated regression coefficients for this imputation. We select the properties with imputed emissions in excess of the imputed emissions limit according to the 2030–34 NYC parameters.

Appendix 2. A framework and method for determining the economic viability of converting particular commercial properties into apartments

The model is composed of two primary elements. The first element calculates the current value of maintaining the property as a Class B brown office building. This calculation is based on the discounted value of net cash flows over the forthcoming decade and the remaining value at the point of sale after 10 years.

We make plausible assumptions about revenues and costs for a representative Class B office building and discount these cash flows using a typical discount rate to obtain the fair market value of the office.

We perform this office valuation both from a pre-pandemic vantage point and in the current environment. This current value is significantly lower than pre-pandemic office valuation levels, which reflects the extent to which office values have been impaired by remote work, higher interest rates, and climate change regulation. We assume that this depressed current value is the acquisition price of the property slated for conversion to apartments.

The second element is the value derived from converting the brown office building into a green apartment building. Initially, we consider a market-rate rental project built without subsidies. We make plausible assumptions about the cost and timeline for construction to achieve the conversion to multifamily use, likely financing expenses (higher due to the rising interest rate environment), and likely future net income and property taxes as an apartment rental property. Our model sells the apartment 10 years after acquisition, aligning with the 10-year holding period used in the office valuation.

The green aspect of the conversion enters our calculation in several ways. First, because the green apartment building is built to modern energy efficiency standards, it does not incur any GHG emission fines. Second, we assume low vacancy rates, given strong projected demand for urban living in a green building. Third, we assume a rent premium due to the value tenants place in living in a green building. Fourth, green status lowers operational expenses due to energy cost reductions. Fifth, green status lowers both construction and permanent financing costs, given lenders' stated intent to enhance the sustainability features of their loan portfolio. Sixth, we assume a risk discount (i.e., a lower beta) compared to a regular apartment building due to the building's green status, which results in a boost to the building's valuation.

1. What is the value of a brown Class B office building pre-pandemic?

We envision a generic 250,000 gross square feet Class B office property. For concreteness' sake, we apply our model to NYC, although it is generic and applies equally to all cities in the U.S., as long as input parameters are properly adjusted.

Before the pandemic, such an office in NYC would be worth about $400 per square foot, or $100 million. This valuation can be justified using our pro forma model under the following assumptions on cash flows, which are realistic for the few years just before the pandemic. We assume a net effective rent (NER) of $49.44 per square foot per year, representing about 70 percent of the pre-pandemic average Manhattan office rent, reflecting that Class B properties command below-average rents. Second, we assume the building faces a 12 percent constant vacancy rate, around the pre-pandemic office vacancy rate in Manhattan. And third, we assume a 5.5 percent discount rate, which is the sum of the 10-year Treasury rate of 2.0 percent, a good assumption for the average 10-year yield over the 10-year period from 2013 to 2022, plus a risk premium of 3.5 percent.

TABLE A-2.

Key model parameters

	Office pre-pandemic	Office post-pandemic	Apartment market	Apartment affordable
		Building characteristics		
Rentable space (square feet)	212,500	212,500	175,000	175,000
		Rent and vacancy		
Monthly rent ($/square foot)	4.12	3.50	8	6.84
Annual rent growth	1.5%	1%	2.5%	2.3%
Vacancy	12%	17%	5%	4.5%
Annual vacancy growth	–	1%	–	–
		Operational expenses		
Credit loss	1.5%	3%	–	–
Operating expenses (% gross rent)	30%	30%	27%	27%
		Financing conditions		
Exit discount rate	5.5%	8.41%	7.41%	7.21%
Exit cap rate	4%	7.41%	4.91%	4.91%
		Property Taxes		
Property tax rate of market value	1.9%	1.9%	1.4%	1.4%
Property tax collected (NPV, million $)	54.9	21.7	104.6	81.3
		Environmental attributes		
GHG taxes 2024–29 ($/square foot)	–	0.32	–	–
GHG taxes 2030– ($/square foot)	–	0.72	–	–
		Conversion details		
Months to design	–	–	30	30
Months to lease up	–	–	18	18
Hard and soft costs	–	–	80	80
Green improvements	–	–	10	10
		Bottom line		
NOI 2033 (million $)	4.7	3	11.5	9.2
Valuation 2022 (million $)	100	38.9	–	–
NPV 2022 (million $)	–	–	4.1	-8.6
IRR 2022	–	–	16.8%	12.1%

Source: Compstak; authors' calculations.

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The first column of table A-2 summarizes the key model parameters. This $100 million building generates $54.9 million in total current and future property tax revenues for the city in present value terms.[2]

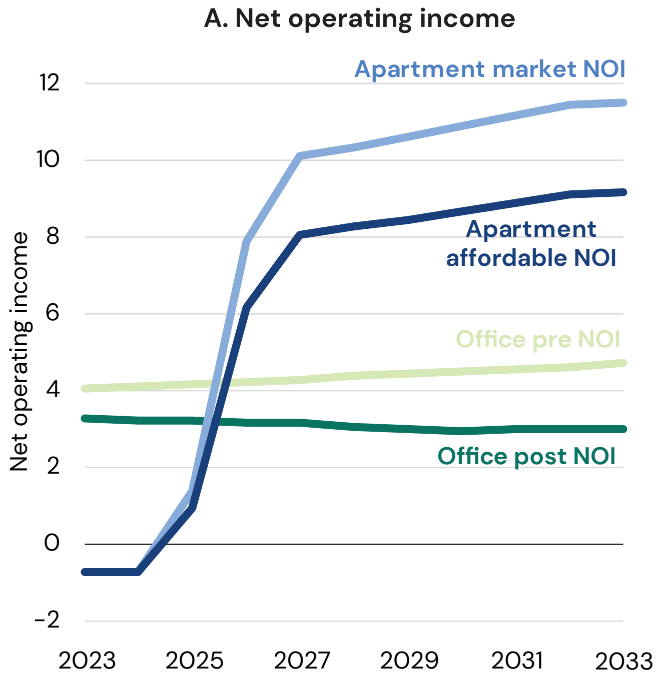
Figure A-1 graphs two key model outputs: annual net operating income (NOI) in Panel A and annual property tax revenue in Panel B, plotted over the course of the 10-year holding period from 2023 to 2033. The light green lines represent the output for the pre-pandemic office.

2. How much value have Class B offices lost in recent years?

Over the past few years, the environment for Class B offices has changed radically with the arrival of triple headwinds: the rise in interest rates, the rise in remote work, and GHG tax considerations. We make three modifications to our model to highlight the valuation impacts of these three forces. The parameters and key results are shown in table A-2 and in the "office post" lines in figure A-1.

FIGURE A-1.

Model results over time, 2023–33



Source: Authors' calculations.

Notes: The figure shows outputs from the model over time for the four cases examined (offices before the pandemic, offices after the pandemic, market-rate apartments, and apartments with an affordable component). The left panel plots the property's net operating income or NOI (Panel A) and the right panel plots property tax revenues in millions of dollars (Panel B).

Rise in interest rates

First, we consider the impact of changes in interest rates. We increase the 10-year interest rate from 2.0 percent to the observed 10-year Treasury yield as of March 29, 2023, equal to 3.5 percent. We use the complete 10-year rate forward curve until the close of 2032 for discounting future cash flows. The rise in interest rates alone shrinks the property's value from $100 million to $63.1 million. The 10-year rate has risen since March, more than 1 percentage point through mid-October. Incorporating those higher interest rates would further shrink the property's value.

This significant decrease in value is largely attributed to the spike in the exit cap rate from 4 percent to 6.4 percent, given the forward rate for 2032 is 4.4 percent or 241 basis points above the previously assumed 2 percent rate. This large jump in the exit cap rate diminishes the exit value from $117.7 million to $73.4 million, even though cash flows remain stable. The rest of the effect comes from applying a higher discount rate to all cash flows when calculating the present value.

It is important to underline the 36.9 percent plunge in value for a property that is otherwise in good health. The magnitude of the value drop illustrates the power of convexity. Interest rate (cap rate) increases, when coming off a low base rate of interest (a low cap rate), can dramatically lower property values.

Rise in remote work

Next, we introduce several assumptions to model the cash flow problems emerging from the shift to work-from-home (WFH). Substantial research has grown to document the rise in remote work since the start of the pandemic, with survey evidence highlighting the apparent persistence of remote work (Aksoy et al. 2022). These shifts have large implications for both the cash flows and the risks inherent in traditional office buildings, as firms respond to these trends by adjusting their office demand.

We incorporate these adjustments in our model by accounting for a Class B office becoming a riskier asset, either due to greater risk in cash flows in the WFH environment or because investors could have grown more risk averse. To capture this increase in risk, we increase the unlevered office risk premium from 3.5 percent to 4 percent. The value of the building drops from $63.1 million to $58.6 million due to this increase in risk.

We additionally account for the immediate challenges of remote work on a reduction in rents by 15 percent, from $49.44 to $42.03 per square foot annually. This decrease corresponds to the observed fall in active lease revenue in the NYC data (measured using the CompStak data). This decrease is phased in over time by presuming that a fixed fraction of leases expires each period and by applying the decrease to only newly signed leases. This reduction in office rents reduces the property value to $48 million.

We then decrease rent growth from 1.5 percent to 1.0 percent per year for similar reasons, lowering the value of the building further to $44.1 million.

Next, we elevate the vacancy rate in the property from 12.0 percent to 17.0 percent to reflect the increase in a Class B Manhattan office, consistent with the evolution of the NYC vacancy rate between the end of 2019 and the end of 2022. This lowers the value to $38 million.

Furthermore, we increase the vacancy rate by 1.0 percentage point each year so that it grows from 17.0 percent in 2023 to 27.0 percent by 2033 and remains constant at 27.0 percent after 2033. This reflects further declines in occupancy as pre-pandemic leases continue to roll off and Class B tenants have better options in higher-quality buildings. This lowers the value to $29.8 million. Finally, we increase the credit loss from 1.5 percent to 3.0 percent to reflect rising tenant nonpayment, resulting in an office value of $28.4 million.

The above calculations were made under the assumption that the property tax remained unchanged from its pre-pandemic value (specifically at 1.9 percent of the pre-pandemic market value and growing at 1.5 percent per annum). This assumption implies that, by 2032, the effective tax rate will have escalated to 9.0 percent of the market value of the building. However, it is rather unlikely that such a massive depreciation in value, as detailed above, would happen without a substantial reassessment of the tax over the course of the 10-year holding period. The city authorities would likely adjust the assessed value downward automatically as the net operating income (NOI) on similar properties dropped. The NOI is a key measure of operational profits for real estate and serves as a base for both property taxation and valuation. Alternatively, the landlord could contest the tax bill, and could present a compelling argument for a downward revision.

In light of this reality, we incorporate an 8.05 percent annual reduction in the tax bill. This gradual reduction restores the effective tax rate to its pre-pandemic value of 1.9 percent of the actual market value by 2032. The reduction in tax leads to a significant increase in the NOI by 2033 and, in turn, a substantial increase in the exit valuation. The responses in property taxes hedge to an extent the shock from remote work. The result is an office value of $40.5 million.

Greenhouse gas tax considerations

Finally, we take into account the environmental impact on the office's valuation. We factor in the GHG emission fines stipulated by Local Law 97, set at $0.32 per square foot from 2024 until 2029, and at $0.72 per square foot from 2030 onward for NYC. These penalties are calculated based on the published fines for Class B office buildings in 2024 and 2030. They total to $80,000 per annum from 2024 to 2029 and $180,000 annually thereafter. In this scenario, the enactment of Local Law 97 reduces the office building's value to $38.9 million, or by an additional 4.1 percent.

Implications for property valuation

To sum up, a property that had a pre-pandemic valuation of $100 million is presently valued at $38.9 million after taking into account the triple forces of rising interest rates, the emergence of remote work, and environmental taxes. This constitutes a 61 percent loss in value. Interestingly, this figure aligns closely with the forecasts for Class B office spaces in the model provided by Gupta, Mittal, and Van Nieuwerburgh (2023).

3. Converting the office to apartments

3.1 Modeling the conversion process

The financial distress of conventional office buildings sets the stage for the valuation of an alternative: green market-rate apartment buildings. The parameters for this valuation are shown in table A-2.

The first phase involves construction and lease-up, followed by the stabilization phase when the apartment building is fully occupied and functional as an apartment property. We anticipate a timeline of 30 months for the completion of the transformation, inclusive of the permitting phase. This process is expedited in comparison to a ground-up development, which could take well over five years in NYC. The redevelopment phase is followed by an 18-month period required to lease the new apartment building.

We assume that the net rentable square footage of the revamped apartment building is 175,000 square feet, which is 70 percent of the total 250,000 gross square feet. This accommodates a larger loss factor for apartments (30 percent) than for office spaces (15 percent) to account for the loss of interior space due to deep floorplates or, potentially, for the necessity to construct an inner courtyard (i.e., a light well). At an average of 875 square feet per unit, the conversion allows for the creation of 200 apartment units within the property.

We assume it costs $38.9 million to acquire the old office building at its revised fair market value, $80 million for the hard and soft construction costs of conversion (excluding the cost of debt), and $10 million for supplementary green enhancements not already incorporated as part of a standard conversion. The conversion cost of $80 million equates to $400,000 per apartment unit ($457.14 per square foot for the average 875–square foot apartment, or $320 per square foot for a building with 250,000 gross square feet before factoring in the loss factor). A 2023 Urban Land Institute report discusses 21 recent conversion case studies with a median hard and soft conversion cost of $255,000 (Kramer, Eyre, and Maloney 2023). Half of the case studies have a cost between $210,000 and $300,000. Our number is higher because our calculations are for a high-cost market. These costs, however, can vary significantly depending on the unique attributes of the property (e.g., requirement for a light well, ventilation improvements, luxury finishes, etc.) as well its location (with implications for labor costs, regulations, etc.). We return to table A-3 to assess the robustness of our estimates with respect to this crucial parameter. The additional $40 per square foot is a plausible estimate for supplementary development costs required to en-hance the building's energy efficiency, given that major construction is already under way.[3]

3.2. How is the conversion financed?

The funding for this project comes from both debt and developer equity. We assume that the developer ob-tains 65 percent of the total $128.9 million in acquisi-tion and development costs from a construction loan and covers the rest with equity (contributed over the course of the construction phase). This construction loan is drawn in stages: a first tranche at the end of 2022 to buy the office building, a second tranche in 2023 for 50 percent of the conversion costs, a third tranche in 2024 for 30 percent of the conversion costs, and the final tranche in 2025 for the last 20 per-cent of the conversion costs. The construction loan has a variable rate priced at secured overnight financ-ing rate (SOFR) plus 4.5 percent, for a total interest rate of 8.75 percent in the first year.

By the end of 2026, the lease-up period concludes, and the asset is stabilized. The developer then secures a permanent, fixed-rate mortgage with a 30-year amortization period. The interest rate on the loan is set to the 10-year Treasury forward rate as of lease-up plus a 1.75 percent spread for a total interest rate of 5.44 percent. To set the loan-to-value ratio, the lender values the collateral using the 2026 cap rate, calculated from the 2026 discount rate and the rent growth rate. Considering a 2027 NOI of $10.1 million, the building's end-of-2026 value is $241.2 million.[4]

3.3. What are the cash flows from the apartment building?

The economic viability of converting to apartments hinges on the generation of sufficiently high cash flows from these apartments. We base our calculations on the assumption that the newly-converted apartment building will charge a standard rent comparable to new, upscale multifamily properties in NYC. This amounts to a rent of $8 per square foot monthly in 2023 (the 90th percentile of Manhattan rents in May 2023), in addition to a green rent premium of 3.1 percent.[5] This implies a monthly rent of $7,217 per unit (of 875 square feet). We assume that apartment rents (for green assets) grow at 2.5 percent per year after 2023. We assume that the vacancy rate is 5 percent for green NYC apartments and will be constant over time. We assume no credit losses.

These revenues are balanced against operating costs that are expected to be 27 percent of potential gross rent for standard new apartments (excluding property taxes but including recurring capital expenditures). However, for our green building we expect 5 percent lower operating costs due to energy efficiency gains.

Another significant cost change occurs following the conversion of the building into an apartment complex in 2027, when the property tax rate changes from 1.9 percent (office) to 1.4 percent (apartments). This property tax change resulting from change in property type is applied to the end-of-2026 property value of $237.2 million, yielding an annual 2027 property tax of $3.3 million, which then grows at the rate of rents (2.5 percent). Interestingly, this conversion results in the government collecting more property tax in present value terms over time.

The result of these shifts is that the NOI is projected to rise from $10.1 million in 2027 to $11.5 million in 2033. By the end of 2032 the building is sold, and its value is calculated as the 2033 NOI divided by the 2032 cap rate for a green apartment asset (4.91 percent). This results in an exit value of $234.7 million before, and $230 million after, sales fees and transaction taxes. After repaying the outstanding mortgage balance of $109 million, the net sales proceeds amount to $121 million at the end of 2032.

3.4. Main result: Does conversion make financial sense?

Our model shows a before-tax internal rate of return (IRR) for the office-to-apartment conversion of 16.8 percent for the developer. This is a levered return or equity return.

Determining whether this is a reasonable equity return, given the associated risks, is challenging due to the investment's complex nature. The conversion entails a blend of a speculative four-year development, akin to a high-risk opportunistic private equity investment, followed by a six-year stabilized asset investment, akin to a lower-risk core (private equity) investment.

An approximate way to estimate the levered beta for the stabilized (core) phase is to multiply the unlevered beta by the assets-to-equity ratio, which is two in this case (given a loan-to-value ratio of 0.5). With an unlevered beta of 0.6, we derive a levered beta of 1.2. The fair discount rate, consequently, is the 10-year Treasury yield plus a risk premium of 6 percent (1.2 times 5 percent). With an average 10-year forward Treasury yield of around 3.9 percent, the fair cost of equity capital is around 9.9 percent. Indeed, this is a plausible value for a levered return in a core real estate investment. We use this discount rate to discount the value of the stabilized apartment building's cash flows back to the end of 2026, obtaining the value of the stabilized apartment building at that time.

To discount this 2026 value back to the end of 2022, we use a much higher discount rate to reflect the much higher risk associated with the development and lease-up phase. We use the 10-year Treasury yield plus a risk premium of 12 percent, twice the value for the stabilized investment.

As is common for the initial development stage, the cash flows to the equity investor are negative (2023–25). To reflect the commitment associated with these outlays, it is customary to discount them at the risk-free rate (10-year Treasury yield). By discounting them at a low rate, we increase the present value of the outlays, and lower the net present value (NPV) of the overall conversion project. This builds conservatism into the approach.

4. How do the deal economics change with an affordable housing component?

A key aspect of the economic viability of the above office-to-apartment conversion was the ability to lease new units at market rates. Is it economically feasible to create affordable units as part of an office-to-apartment conversion? If not, what government subsidies (i.e., which programs and how many dollars) are needed to make such programs pencil out?

4.1. How to define affordability?

We define an affordable rental housing unit as one where a tenant whose income is at 80 percent of the area median income (AMI) does not spend more than 30 percent of household income on rent. AMI for a family of three is $96,080 in NYC. An affordable rent is therefore $1,922 per month per unit (of 875 square feet), or $2.20 per square foot. This compares to the market rent of $7,217 per unit or $8 per square foot. This definition of affordable housing is between two and three times the poverty line across the U.S. and aligns with the standard for federal low-income rental assistance programs. However, it does not necessarily provide deeply affordable housing to poor and near-poor households without additional rental subsidies.

The model considers several ways in which affordable units differ from market-rate units. First, we assume that the affordable units do not earn the green building rent premium we assumed for market-rate units. Second, we assume that the rent on an affordable unit grows at a slower pace than the rent on a market-rate unit, which is consistent with rent-stabilization practices. We set this rent growth rate to 1.5 percent per year, compared to 2.5 percent for market-rate units. Third, we assume that the vacancy rate for affordable units is only 2.5 percent, compared to 5 percent for market-rate units, to reflect the fact that there is excess demand (a long waiting list) to get into a new apartment building at below-market rents. Fourth, we assume that affordable units have lower risk given rent stabilization and low vacancy. We assume an unlevered beta that is 0.2 lower (for the affordable units only). Fifth, the property tax bill reflects the lower market value of the property. Sixth, we assume that the affordability mandate lasts for a finite period (25 years), after which the property reverts to a market-rate property.

4.2. What are the conversion returns under affordability mandate but without subsidies?

If the office-to-apartment conversion mandates 20 percent affordable units, the developer must set aside 40 of the 200 apartments for below-market tenants. This is a version of mandatory inclusionary housing. Without subsidies, the IRR of the investment falls from 16.8 percent to 12.1 percent, and the NPV drops from $4.1 million to –$8.6 million. The cost in terms of forgone developer profit per affordable unit provided is $318,345.

Given that the NPV is negative, the developer would not pursue the conversion. Increasing the percentage of affordable units or lowering the income threshold for affordability would make the conversion even less attractive. This shows that even modest affordability requirements can ruin the economics of the deal.

4.3. What does the affordability mandate cost taxpayers and society?

The affordability requirement lowers the NPV of tax collections by $23.3 million (in NPV terms) *relative to the market-rate development*, or $581,742 per affordable unit. The combined cost to produce the 40 affordable units to the government (in lost tax revenue) and the developer (in lost profit) is $36 million, or $900,087 per affordable unit.

There is, however, another way to look at these tax implications. *Relative to the status quo*, which is a poorly performing Class B office building that brings in only $21.7 million in NPV of tax revenues, the tax revenues from the apartment property with affordability mandate are nearly $60 million higher. The apartment building with 20 percent affordable units captures 72 percent of the increase in tax revenues of a 100 percent market-rate apartment building. Since the NPV from conversion for the developer is negative, thus preventing the conversion from taking place, a natural suggestion is to use some of the increase in tax revenues (obtained by moving away from the status quo) to subsidize the conversion.

5. How sensitive are the conversion economics to different assumptions?

The model's results rely on various assumptions, so it is crucial to understand how changes in key parameters might affect the outcomes. By returning to the baseline model parameters and modifying one variable at a time while keeping others constant, we can observe the sensitivity of the results. Table A-3 pro-vides a summary of these findings. The model's con-clusions are most sensitive to conversion cost esti-mates, apartment rent levels, acquisition price of the asset, the building's suitability for conversion, and the affordable housing mandate. This underscores the im-portance of doing the analysis case by case.

5.1. How sensitive are results to construction costs?

The first key parameter is the hard and soft conversion cost. We vary it from $200,000 per unit, among the lowest estimates in the literature, to $500,000 per unit, a higher estimate that might reflect higher costs of labor, supply chain disruptions, or (unforeseen) structural issues with the conversion. For every $100,000 per unit in extra conversion costs, the NPV goes down by about $17 million, or $82,806 per unit ($95 per net rentable square foot).

5.2. How sensitive are results to apartment rents?

The conversion's profitability is highly dependent on the rental market's robustness. In the baseline model, we assumed a monthly rent of $8 per square foot for a new market-rate apartment. After accounting for a 3.1 percent green rent premium, this equals $7,217 monthly rent per unit. However, if the base rent drops to $7 per square foot (or $6,315 monthly post-green premium), the NPV becomes negative. If it drops further to $6 per square foot ($5,413 monthly), the NPV is substantially negative.

There could be a trade-off between creating high-end apartments with high rent and high conversion cost and creating somewhat less expensive apartments at a lower cost. For instance, at a rent of $6 per square foot, a much lower conversion cost of $225,594 per unit (as opposed to the baseline $400,000 per unit) is required to maintain the baseline NPV.

A similar trade-off could arise across markets. Markets like NYC or San Francisco may have high conversion costs and high apartment rents, while other markets like in Minneapolis or St. Louis have much lower apartment rents but also lower conversion costs. See the discussion in the main text around table 3.

5.3. How sensitive are results to the acquisition cost?

In the baseline model, the office building is purchased at a significant discount from its original valuation (61 percent). But at that price, the previous owner might be underwater on their mortgage and unwilling to sell. Similarly, in a distress debt situation in which the owner has handed the office keys to the lender, the existing lender may not be willing or able to take such a large loss.

For instance, at a 50 percent discount ($200 per square foot instead of $155 per square foot), the NPV decreases to –$6.42 million. Conversely, at an even larger 75 percent discount, the NPV increases to $17.30 million.

5.4. How sensitive are results to the loss factor? The power of the density bonus

The suitability of a building for conversion, represented by the loss factor, also significantly influences profitability. The NPV can decrease by $24.8 million if the loss factor is 45 percent (about 30 apartment units fewer) or increase by the same amount if the loss factor is only 15 percent.

Zoning policy can confer a density bonus for the creation of affordable housing units. A density bonus is equivalent to a lower loss factor in our model. A 10 percent loss factor corresponds to 257 apartment units, which is a 28.6 percent density bonus compared to 200 units in the benchmark model. The NPV of $53.7 million is large and positive. This illustrates the power of the density bonus. Moreover, this policy has no direct fiscal cost.

5.5. How sensitive are results to the scope of the affordability mandate?

The affordable housing mandate, which involves varying the share of affordable housing units and adjusting the property tax abatement and share of subsidized construction and permanent debt, accordingly, impacts NPV, IRR, and the present discounted value (PDV) of tax revenues. Specifically, for a share of affordable units of *x* percent, we reduce property taxes by *x* percent and provide subsidized construction and permanent financing for a portion of *x* percent of the respective loans, where *x* is set to 0, 10, 20, 30 percent in the last panel of table A-3.

The NPV and IRR decrease when the share of affordable units increases even as the tax expenditure increases. This suggests that proportional debt subsidies and tax abatements cannot entirely compensate for the reduced rents from the affordable units.

6. Providing more details around calculations in table 3

Table 3 provides the geographic distribution of office buildings that were physically suitable for conversion to apartments. We now ask whether these conversions are also financially feasible.

This is a challenging question that ideally requires a building-by-building analysis. Such analysis is beyond the scope of this paper. We take a first pass at this question by using a limited set of regional information. Specifically, we account for differences in (1) pre-pandemic office values for Class B offices, (2) declines in office values over the December 2019 to December 2022 period, (3) apartment rents, and (4) costs of construction across CBSAs. These numbers are listed in table A-2. Besides the office purchase price, the con-version cost, and the apartment rent, all other model parameters are held fixed at their benchmark values (and hence do not vary regionally). Since we use the same inputs for each building in a given CBSA, this ex-ercise predicts that either all or none of the buildings are financially feasible conversions. The last column of the table therefore reports either the total number of buildings that are physically suitable for conversion for those CBSAs for which the typical conversion is also financially feasible or zero for those CBSAs where the typical Class B office conversion is not financially fea-sible. The conversion assumes a 100 percent market-rate apartment rental building.

Table 3 suggests that the typical conversion is financially feasible in NYC, San Francisco, San Jose, Boston, and Denver. These are markets where apartment rents are high enough to overcome the purchase cost of the office building and the cost of conversion. While informative, we reiterate that these are just averages that likely hide substantial variation within CBSAs.

Endnotes

1. The Citizens Budget Commission (CBC) estimates that the 421-g program was used for conversions totaling 13 million square feet of office space in Lower Manhattan between 1995 and 2006, with 12,865 residential units created at a cost of $92,000 per unit (CBC 2022). The Furman Institute also provides a visualization of proposed conversion properties in NYC (NYU Furman Center 2023).
2. All present values of government tax revenues are computed using the Treasury yield curve as the discount rate.
3. During the development phase and prior to the completion of lease-up, we assume that the property continues to be taxed as an office. The tax is calculated as the effective rate of 1.9 percent multiplied by the asset's market value, which we establish as the acquisition value of $38.9 million. This results in a property tax bill of $738,466 for the initial four years.
4. Note that the 2027 property tax, a fixed percent of the apartment building's market value, is $3.32 million or 1.4 percent of the new apartment market valuation. The market value, in turn, is affected by the property tax. This circular dependence is resolved by finding a fixed point. For this fixed-point computation we exclude the property tax abatement for green buildings from the NOI calculation since the green abatement is temporary.
5. The Elliman report can be found at Miller Samuel Real Estate Appraisers & Consultants (2023). The green rent premium number is based on a study by Cushman & Wakefield (Albers 2022). Green building premiums have also been documented for office properties; see Eichholtz, Kok, and Quigley (2010).

References

Aksoy, Cevat G., Jose M. Barrero, Nicholas Bloom, Steven J. Davis, Mathias Dolls, and Pablo Zarate. 2022. "Working from Home Around the World." Working Paper 30446, National Bureau of Economic Research, Cambridge, MA.

Albers, Jacob. 2022. "Green Is Good: The Impact of Sustainability on Real Estate Investment." Cushman & Wakefield, Bethesda, MD.

Chen, Lu, and Mary Le. 2022. "Key Takeaways from the 4th Quarter Housing Affordability Update." Moody's Analytics, Atlanta, GA.

Citizens Budget Commission (CBC). 2022. "The Potential for Office-to-Residential Conversions: Lessons from 421-g." Citizens Budget Commission, New York, NY.

Douglas Elliman Real Estate. 2023. "Elliman Report: May 2023, Manhattan, Brooklyn and Queens Rentals." Douglas Elliman Real Estate, Miami, FL.

Eichholtz, Piet, Nils Kok, and John M. Quigley. 2010. "Doing Well by Doing Good? Green Office Buildings." *American Economic Review* 100 (5): 2492–509.

Gupta, Arpit, Vrinda Mittal, Jonas Peeters, and Stijn Van Nieuwerburgh. 2022. "Flattening the Curve: Pandemic Induced Revaluation of Urban Real Estate." *Journal of Financial Economics* 146 (2): 594–636.

Gupta, Arpit, Vrinda Mittal, and Stijn Van Nieuwerburgh. 2023. "Work from Home and the Office Real Estate Apocalypse." Working Paper 30526, National Bureau of Economic Research, Cambridge, MA.

Kramer, Anita, Nolan Eyre, and Morgan Maloney. 2023. "Behind the Façade: The Feasibility of Converting Commercial Real Estate to Multifamily." Knowledge Finder, Center for Real Estate Economics and Capital Markets, National Multifamily Housing Council, Washington, DC.

Leung, Jessica. 2018. "Decarbonizing U.S. Buildings." Center for Climate and Energy Solutions, Arlington, VA.

Miller Samuel Real Estate Appraisers & Consultants. 2023. "Elliman Report September 2023 Manhattan, Brooklyn, & Queens Rentals." Douglas Elliman Real Estate, New York, NY.

New York City Department of City Planning. 2023. "New York City: Office Adaptive Reuse Study." Office Adaptive Reuse Task Force, New York City Department of City Planning, New York, NY.

New York City Department of City Planning. n.d. "PLUTO and MapPLUTO." NYC Department of City Planning, New York, NY.

NYC Mayor's Office of Climate and Environmental Justice. 2022. "NYC Greenhouse Gas Inventories: Inventory of New York City Greenhouse Gas Emissions." NYC Mayor's Office of Climate and Environmental Justice, New York, NY.

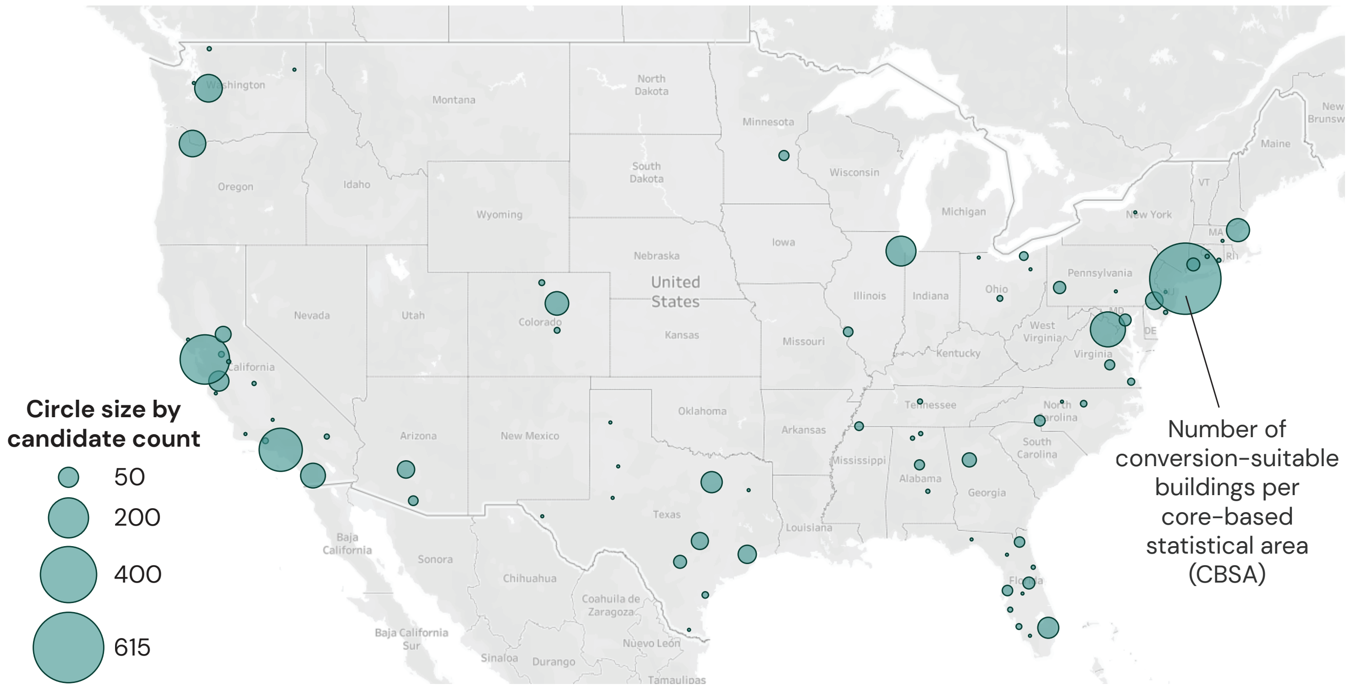
NYU Furman Center. 2023. "Implications and Geography of Office to Housing Conversions." *The Stoop* (blog), New York University, New York, NY. March 23, 2023.

Van Nieuwerburgh, Stijn. 2023. "The Remote Work Revolution: Impact on Real Estate Values and the Urban Environment: 2023 AREUEA Presidential Address." *Real Estate Economics* 51 (1), 7–48.

ADVISORY COUNCIL

The conversion of brown office buildings to green apartments can contribute toward a solution to three pressing issues: oversupply of offices in a hybrid-and-remote-work world, shortage of housing, and excessive greenhouse gas emissions. We propose a set of criteria to identify commercial office properties that are physically suitable for conversion, yielding about 9 percent of all office buildings across the United States. We present a pro-forma real estate model that identifies parameters under which these conversions are financially viable. We highlight several policy levers available to federal, state, and local governments that could accelerate the conversion and that may be necessary should policymakers desire to create affordable housing. We highlight the role the Inflation Reduction Act could play in making more conversions financially viable.

National candidates



Source: CompStak; authors' calculations.

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