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Urban Policy Sustainability through a Value-Added Densification Tool: The Case of the South Boston Area

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Abstract: Over the past decade, urban density has been growing faster than ever, forcing high-density expansion. The aim of this study is to verify whether urban density is accepted as a sustainable value-added quality, internalized in the willingness to pay on a buildable per square feet basis. To explore the relationship between land prices and densification processes, this study focused on a low-density area, which recently went through a densification policy process with the approval of a new zoning tool. The study analyzes land price trends on a 144-Acre of area, located in the South Boston Submarket, identified as the Dorchester Ave Area. I analyzed land transactions in this area between 2012 and 2021. I also examined land price variations before and after the approval of a densification plan in correlation with the overall trend of the real estate market in that area. The results suggest that density is a value-added feature that affects land prices. Indeed, a higher density leads to higher values per buildable square feet. Densification policies have a strong positive impact on land transaction prices. Community and developers valued density with a greater willingness to pay, internalizing the economic, social, and environmental sustainability benefits. This phenomenon should be taken into consideration by local public authorities implementing their zoning tools.

Keywords: urban regeneration process; land price; Floor Area Ratio (FAR); urban density; land use regulation policy

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1. Introduction

Over the past decade, the percentage of the world's population living in cities has increased by approximately 50 basis points. According to the UNCTAD Handbook of Statistics, 51.6% of the population lived in urban areas in 2010, while the share of the urban population increased to 56.2% by 2020 [1]. Furthermore, more than 70% of the world's population is expected to live in cities by 2050, exponentially increasing urban densification and high-rise landscapes [2].

Recent 2020 census data confirmed that over the past decade, high-density urban areas in the United States have grown faster than ever, establishing themselves as highly polarizing contexts where high-density areas command high-density expansion. In this global context, in which urban areas are growing at a faster rate than the population growth trend [3], it is crucial to identify how the increase in density can affect developable areas in terms of social, environmental, and economic sustainability. Further, considering the ongoing request for sustainability transitions targeted by the European Community, making urban developments and cities inclusive, resilient, and sustainable is one of the main goals of the 2030 Agenda, which recognizes the important role of cities [4,5].

This global transformation is closely related to the increased economic development of the city, where urbanization and densification play an essential role in urban socio-economy vitality [2]. By increasing the potential for more sustainable lifestyles and lower greenhouse gas emissions, urban density is accepted as a key feature of the sustainable urban form [6,7]. Higher sustainable growth has been proved to be related to high-density developments. This assumption is supported by the fact that compact forms optimize the use of resources, decreasing the use of land [8]. In denser cities (where distances between workplaces, public facilities, and residences are condensed) people, energy, and good flow are reduced, and consequently fewer resources and greenhouse gas emissions are produced [9–11]. In light of the above, many studies confirmed that improving the urban land use efficiency and implementing rational densification are both effective tools for sustainable urbanization [12–14].

In this context, the densification strategies activated by urban regeneration policies play an essential role in determining not only the forms of urban development (and the segregation of incompatible land uses and control of density) but consequently also in terms of sustainability.

According to the 2018 U.S. Census Bureau, which is the last available data, Boston is representative of a high-density area with 14,073 people per square mile. The Greater Boston Area is the 4th most densely populated region in the United States, after the New York Metro Area, the Greater Los Angeles, and the South Florida Metro Area. In these highly dense urban areas, Real Estate property values have increased exponentially during the past decade, confirming public acceptance of the density value.

This study focuses on an approximately 144-Acre land, located in the South Boston Submarket, identified as Dorchester Ave Area. Here I investigated how the local densification policy approved in 2016 influenced land values based on FAR. Furthermore, the potential correlations between the variation in land value with the real estate market trends in the same local area were investigated to exclude any possible inference. The sample includes 105 land transactions that occurred in the last decade (2012–2021) in the Dorchester Ave Area, Boston (MA) USA. To verify the correlation between the zoning tool and land prices, I divided the sample into two groups. One group includes all the transactions that took place before the local planning approval, and the second group includes all the land sold after its approval. I tested these two groups to verify if the average annual increase in land prices was related to the approval of the densification policy that occurred in 2016. In addition to this, I collected residential multifamily transactions that occurred over the same timeframe period (2012–2021) and in the same area. This was done to test if the increase in land price could be correlated and influenced by the general trend of the local real estate market. From this, I have extracted an annual index that represents the increase in residential trend over the observed period. Finally, I performed a multivariate regression to test the possible correlation between the increase in land price and the trend in multifamily prices.

The findings of the current study will help understand the dynamics of urban densification policies and their effects on real estate market trends. Land Value trends on a volume basis can be interpreted as public acceptance (in terms of willingness-to-pay) of urban density as the well-accepted valued quality of sustainability. The results can assist policymakers in implementing urban tools that support the sustainability of their programmatic choices. To my knowledge, this is the first attempt to test whether Land Values on price per square foot of Gross Floor Area are affected by urban densification policies.

Limitations of the current research are mainly related to the application to a single study area. However, as specified in Section 4, the characteristics of the selected district and of the selected timeframe have been selected to avoid potential temporal and spatial bias and to ensure as much reliability for my conclusion as possible. Definitively further research studies need to focus on extending and including additional comparative case areas.

Future studies, applying similar methodology, could focus on comparative analysis between different areas that are going under densification process through urban policies.

There are five sections in this study. Following the introduction in Section 1, Section 2 details related literature review, and Section 3 presents the case study, Section 4 designs materials and methodology including research design and search strategy. Section 5 deals with the results obtained and presents the discussion focusing on the concepts of density and real estate market trends perspectives. Section 6 discusses the conclusion, limitations, and future research direction.

2. Literature Review

Land-use regulation policies can exercise control on urban development with different tools. Each country applies a unique set of regulations, which affects the local economy differently. Urban regeneration offers an opportunity to improve land-use efficiency and sustainability, while regulation policies tend to emphasize the intensive use of urban land during the regeneration process. The most effective policy tools are enforced through the application of overlapping zoning laws to establish land-use guidelines, or density regulations processes, such as building height restrictions, minimum size rules, and Floor Area Ratio regulations. These regulations include density bonus, development right transfer, and Floor Area Ratio flow (FAR), which is the ratio between a building's floor area, indicated in this paper as Gross Floor Area (GLA) and the size of the land on which the property is located, referred as Buildable Land Area (BLA) [15]. As mentioned, the policy tools have a direct impact on soil consumption, transportation costs, human capital concentration, and the growth of employment in denser cities, influencing the levels of sustainability [16,17].

Extensive studies have been implemented to analyze how these regulatory policies affect socio-economic urban growth, urban resilience, and real estate housing prices. Despite the critical role that land values play in shaping urban pattern developments, land values have often been analyzed in the literature only in relation to its relationship to proximity to the city center. Indeed, in these area urban density and real estate prices are higher, due to increased aggregate demand for residential spaces [18].

In this context, Real Estate prices are above average in Central Business Centers—CBDs—where urban density is the highest, indicating that there is perceived added-value in denser central locations [6,18–20]. Empirical studies of differences in land values between urban and suburban areas have been developed since the 1960s [21–23]. However, all these studies describe land values variation in relation to the proximity of the high-density urban center and do not explore trends in value land associated with variation of the density policy in the same urban area.

Several studies have confirmed that land values are strongly related to urban growth and are directly related to their proximity to the CBDs, according to theories on urban economy [6,18,24–29]. Therefore, land values and built-up density are closely related and influenced by land-use policies in urban areas, which play a critical role in controlling urban growth [30,31]. The literature clearly found that up-zoning strategies, used by public authorities, "double-functioned as value capture instruments" by changing land-use configuration, increasing public benefits value capture, and improving urban efficiency and sustainability [32]. Land values can therefore be perceived as an indicator of the level of urban development and local economic growth and sustainability [33]. Is this public added value also captured by land value on a dollar per square feet (SF) of Gross Floor Area basis, in terms of public services and benefits? Where the Gross Floor Area (GLA) is the gross area of a building that can be built on a developable lot, measured in Square Feet (SF). In other words, does the increase in potential density (which obviously causes an increase in land values on a dollar per square feet basis of land) add value on a volumetric basis? Is density an added value in terms of sustainability and resilience in urban redevelopment processes?

As mentioned, several studies have been performed to estimate the relationship between land values and the actual allowed zoning density. These studies confirmed that higher density commands for higher land prices by implementing hedonic approaches. As expected, they also found that lots with lower FAR were significantly cheaper than those with higher density [34]. This study confirmed the intuitive economic theory that the greater the potential development volume, the greater the value of the land.

Other investigations have been performed that analyze the economic fundamentals of urban density and its correlation with houses prices variations [25]. However, to my knowledge, no specific studies have been implemented to verify how land values can be influenced by densification policies based on SF of GFA basis. This paper investigates the relationship between the variation of unit price land based on SF of GFA and the implementation of the urban density regulation policy that increased the permitted FAR in a neighborhood of South Boston. Is the land price variation related to urban density policies? Do land prices internalize the increased sustainability of denser areas in terms of value?

This correlation could extract the value of the positive effect that a densification policy generates in the developable lots, due to the positive effects of new generated externalities such as the increase in municipal services and public areas, in house affordability limits, in socioeconomic sustainability, and in community resilience. In a context where urban density is exponentially increasing, it is crucial to better understand the trends in the real estate land market to identify the leverage points that densification policies can have on land values. In this scenario, urban density policy can therefore become increasingly important "in achieving such goals as environmental sustainability or acting as an incentive to promote regeneration development" [35–37].

3. The Case of the South Boston Area

According to the United States Census Bureau, 80.7% of the US population lives within an urban area. Between 2000 and 2010, the urban land area in the U.S. increased by 15% and is expected to double more by 2060, reflecting the potential trend of urban densification processes. Further, 89% of the U.S. population and 68% of the world population are expected to live in urban areas by 2050 [38,39]. More than 300 urban areas in the U.S. have populations above 100,000. New York City is the largest with 8.3 million inhabitants, and Boston is the 4th most densely populated region.

With the uncontrolled expansion of urban scale, a large number of vacant or industrial areas have been converted and redeveloped, increasing the Gross Domestic Product (GDP) but also affecting the environmental sustainability of these areas, decreasing quality of life of the inhabitants, and increasing traffic congestion and environmental pollution [33,40]. In order to prevent or at least limit these negative externalities, the Commonwealth of Massachusetts and the Boston Planning & Development Agency (BPDA) (a public development agency that serves as the municipal planning and development agency for the City of Boston) decided to implement a bottom-up planning process for the South Boston Development Plan's drafting (hereinafter referred to as "the Plan"). The engagement and involvement of the local community played a crucial role in the Plan development, which has recently become mandatory for a sustainable, resilient, and inclusive development process. Indeed, a socially inclusive technique in the urban regeneration process, such as bottom-up approaches, can be used by authorities and communities as a basis for developing sustainable masterplans [41–43].

Boston is a growing city. According to US Census data, Boston grew 9.3 percent between the 2010 and 2020 counts, and it is expected to increase by 10%, up to approximately 710,000 inhabitants by 2030. Further, more than a third of this population growth is anticipated in the Seaport, the South End, Downtown, East Boston, and Dorchester [44]. Growth at this scale needs to be planned and managed, in order to ensure a healthy city and quality of life in all its neighborhoods. Shifts in household size and composition result from population growth. Bostonians have recently changed the way they live, work, play, and get around. The Dorchester Avenue Corridor from Andrew Square to Broadway Station (Figure 1) is a low-density 144 acres area, where a development process began in the mid-19th century and is currently suffering from a depopulation process. The Plan Area is bounded by railroad tracks to the west, Old Colony Avenue to the east, and the Broadway and Andrew Square MBTA stations to the north and south. The area is currently under market pressure as the City expands to accommodate the growing residential and employment population of Boston.

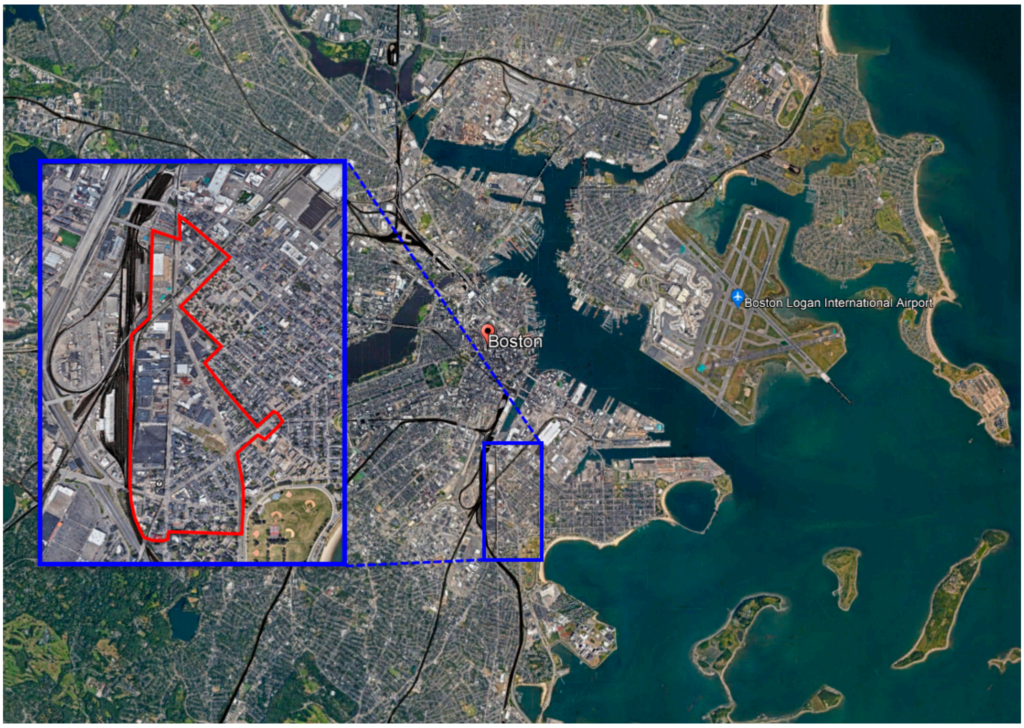

Figure 1. Aerial image of 144-Acre Dorchester Ave Area's boundary (in red). Source: Google Earth Elaboration.

The process of changing the zoning tool was a multi-year study culminating in 2016, when the BPDA released the Plan, which updated the zoning density in the area, aligning with the community's vision and creating predictable conditions for future development. To manage the impacts of greater density and achieve a unique character for the Area, considerations for lot coverage, setbacks, building height, and other urban design guidelines have been incorporated into the zoning limits of the Area. The Plan proposed to create a district to be built around the concept of increased height and density above baseline zoning regulations in exchange for a range of explicit public benefits and requirements that the local community can enjoy [45].

In this process, the local community has prioritized a density bonus zoning tool to achieve public benefits, which was then used to create additional value for private development. A density bonus is a zoning tool that allows developers to build more height and floor space than otherwise allowed by "as-of-right" zoning in exchange for providing defined public benefits, such as a larger percentage of affordable housing units, open space, affordable retail, or innovation space. As a result of this planning process, the Plan increased the local density from a previously approved 2.0 FAR, allowing for bonus heights up to 300 feet. Considering the setback requirements, the building floor plate and lot coverage limitations set by the Plan, the achievable redevelopment gross area has been increased to 4.7 FAR, more than doubling the pre-existing density.

4. Materials and Methods

The aim of the study is to measure the relationship between urban density variation and land price trends on a Dollar per SF of GFA basis. To do so, I identified a restricted Area in Boston, called Dorchester Area, which went through a densification zoning process in 2016. As described in Section 3, the approved Plan increased the permitted FAR allowing higher and denser developments. I collected time series of land transactions that occurred in this restricted Area before and after Plan's approval. The selected time frame starts in 2012 and ends in 2021. To verify if densification approval affected lands' prices, I split the sample into two groups, one including the transactions before Plan's approval and the second one including the sales after approval in 2016, as detailed in the following section. I overcame potential temporal and spatial bias driven by cross-sectional data [46] between the two groups, sampling land transactions only in a small neighborhood area and over two short-length periods.

Furthermore, I wanted to verify if the increase in land value, after 2016, has been driven only by densification policy or whether it is affected by general RE market conditions. In order to do this, I collected residential transactions in the same area and over the same period to build a local residential market index trend. Thereafter, I verified possible correlations between land price variations and general Real Estate market trends through regression analysis.

4.1. Data

The overall sample includes 105 land transactions that occurred in the last decade (2012–2021) in a 144 Acre area called Dorchester Ave Area, Boston (MA) USA (Figure 1). The collected data have been sampled from Massachusetts Land Records, Registry of Deeds, and includes the address of the asset, the recording date of transaction, the book and page of the deed, the sale price, and the grantor and grantee. For each transaction, I verified its lot size (Buildable Land Area—BLA_i), consulting the Assessing Online Section of the City of Boston website and then downloading the parcel's property card. To estimate the potential density of each parcel, I verified if the parcel was improved or vacant according to the Property card. Property cards report for each parcel ID if the parcel is vacant or improved, and if so, the Gross Floor Area (GFA_i) of the existing improvements are reported. Furthermore, I verified if the Boston Planning & Development Agency reported redevelopment plans for each recorded parcel. If redevelopment plans were presented at the time of the transaction, I used the proposed GFA to calculate the potential FAR of the sold parcel. For each land sale, I calculated the unit transaction price per SF of GFA.

As advanced in the previous Section, I wanted to verify any potential correlation between land price trends and general RE market trend. To test this, I additionally collected 398 transactions of residential multifamily that occurred in the same timeframe period and in the same geographical area (Figure 1). The same sources that were used to collect land transactions were also used to sample multifamily sales. I consulted the Massachusetts Registry of Deed searching by property, document, date, and location. For each multifamily transaction, I reported the following data: address of the asset, recording date of transaction, book and page of the deed, sale price, grantor, grantee, GFA. For each multifamily sale, I calculated the transaction price per SF of existing Gross Floor Area ($/SF of GFA).

4.2. Method

As mentioned in the previous section, the collected land transactions reported the overall price for each sale in US Dollars. In order to estimate the price on a SF of GFA basis, I needed to calculate the allowed GFA for each transaction (*i*) as follow:

$$\text{GFA}_i = \text{FAR}_i \times \text{BLA}_i \tag{1}$$

For each transaction, I reported the following information: the date of sale, the Buildable Land Area in square feet (BLA_i), the FAR_i, and the sale price in US Dollar ($). Given the above-mentioned data, I calculated, applying Formula (1), the Land Price on GFA basis ($/SF) for each land transaction, indicated as P_{Li}.

I divided the overall sample into two groups (Figure 2):

- Group_B: This group included all the transaction that occurred Before Plan Approval, over a period of time between 2012 and 2015.
- Group_A: This group included all the transaction that occurred After Plan Approval, over a period of time between 2016 and 2021.

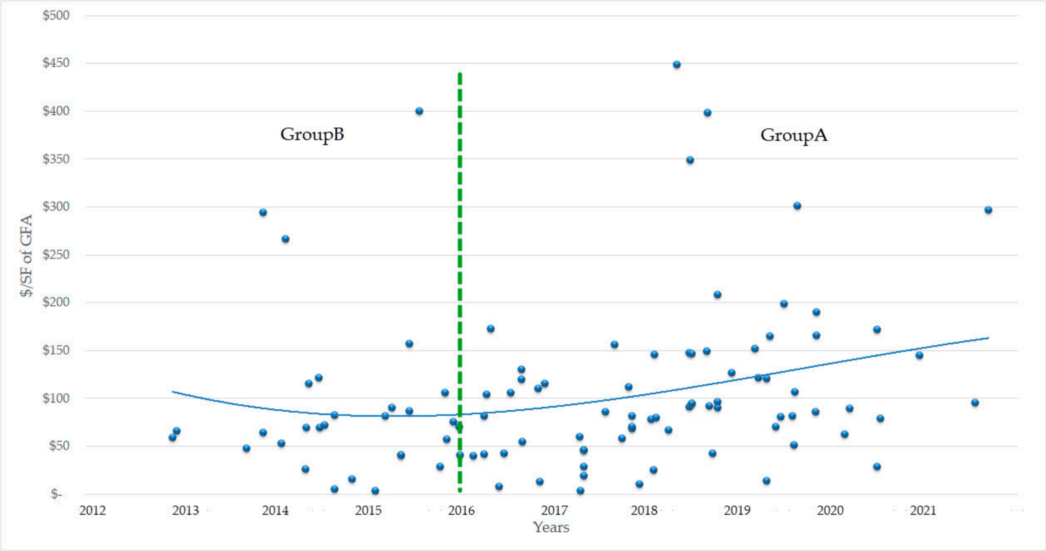

Figure 2. Land transaction Prices distribution. The dashed line divided the data into the two groups (Group_B and Group_A).

I tested the mean difference of Land Prices (P_{Li}) between the two groups to verify if there is a significant difference in land prices before and after zoning change approval. Furthermore, in order to capture the historical price trend between 2012 and 2021, I calculated an annual index normalizing the average annual land transaction prices both for land transaction (I_{Li}) and for residential transaction as well (I_{Ri}) data as follow:

$$I_i = \frac{(100 \times AUP_i)}{AUP_{2012}} \tag{2}$$

where, i indicate the year, I_i is the annual price Index calculated for each year between year ($_i$) 2012 and year 2021, AUP_Y is the Annual Average Unit Price reported on a SF of GFA basis (for land transaction) or on an existing SF (for residential transactions) basis, and AUP_{2012} is the Annual Average Unit Price in 2012 for land or for residential sales.

Further, as said, I also wanted to verify if the increase in land value, after 2016, is driven only by densification policy or if it is affected by general RE market conditions. Clarifying, I wanted to verify if the exponentially increased value in land transactions is correlated to general real estate market trends in the area or if this increased trend has been affected only by the approved density up-zoning Plan.

To this end, I compared the historical trend of the Land Price Index (I_{Li}) and Residential Price Index (I_{Ri}) as presented in Figure 4 and as calculated with Formula (2).

Lastly, I analyzed Land Price trend over the ten-year period on a SF of GFA basis (P_{Li}) applying the following regression analysis:

$$lnP_{Li} = \text{a} + \text{b}I_{Ri} + \text{d}FAR_L + \text{f}BA_i + \varepsilon_i \tag{3}$$

where lnP_{Li} represents the logarithm of the land prices per SF of GFA, I_{Ri} is the residential price index calculated for year (i) by Formula (2). The variable FAR_L represents the permitted FAR on the sold parcel (L), which identify the potential urban density for each sold parcel. Lastly, BA_i is an independent binary variable, which identifies whether the sale for the land occurred before (=1) or after (=0) the redevelopment zoning Plan approval. Finally, ε_i is the error term.

5. Results and Discussion

The descriptive statistics are summarized in Table 1 both for Land and for Multifamily transactions. I collected 105 Land Transactions that occurred between 2012 and 2021, with a mean of $111.44/SF of GFA, a Median of $81.08/SF of GFA, a Mode of $40.08/SF of GFA, a Standard Deviation of $10.71/SF of GFA, a Minimum recorded sale price of $2.12/SF of GFA and a Maximum recorded sale price of $653.73/SF of GFA. As mentioned above, I divided the sample into two groups: Group$_{B}$ and Group$_{A}$ (see statistic in Table 1). There was an increase in the average annual number of transactions before and after the approval of the Plan, 8.75 average annual land sales before 2016 and 10.83 after up-zoning tool approval. Additionally, the mean land price prior to the approval was $87.11/SF of GFA and after it increased to $124.13/SF of GFA, revealing a 42.5% increase in value.

Table 1. Descriptive statistics for the entire simple and for the two Groups of Land Transaction Prices ($/SF of GFA) and for Multifamily Transaction Prices ($/SF of GFA).

Use Type	**Land Transactions ($/SF of GFA)**			**Multifamily Transaction ($/SF of GFA)**
Prices	**All Sales**	**Group$_{B}$**	**Group$_{A}$**	**All Sales**
N. Observations	105	36	69	398
Average N. Observations per Year	10.00	8.75	10.83	40.25
Mean	$111.44	$87.11	$124.13	$573.231
Median	$81.08	$68.99	$91.80	$540.91
Mode	$40.08	$40.089	$45.58	$700
Std. Dev.	$10.71	$13.75	$14.48	$351.54
Minimum	$2.12	$2.52	$2.12	$30.25
Maximum	$653.73	$399.54	$653.73	$2067.38

The results confirmed that Group$_{A}$ has a higher mean, median and mode with a higher number of observations occurring in this period after approval of the Plan. Considering that the distribution of the sample (verified with Shapiro-Wilk Test) is not normal, I applied a non-parametric test (Kruskal-Wallis H test) to verify if the differences between the two groups were significant. The test rejected the null hypothesis of equals means (p-value 0.00616, significance level 0.05). According to Kruskal-Wallis H test there is a significant difference in the dependent variable between the different groups ($\chi^2 = 4.93$, $p = 0.026$), with a mean rank score of 43.86 for Group$_{B}$, and 57.77 for Group$_{A}$. The Post-Hoc Mann-Whitney test using a Bonferroni corrected alpha of 0.05 indicated that the mean rank of the following pair is significantly different: x1–x2, confirming my assumptions (Figure 3).

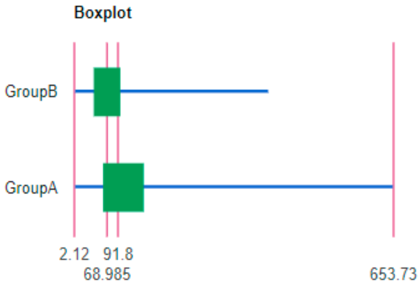

Figure 3. Average Land Transaction Prices in the two groups (Group$_{B}$ and Group$_{A}$).

The test confirmed that the two groups had significance different means, suggesting that the densification zoning tool affected the prices of the lands and that the value of the density has been captured by the increased price on a SF of GFA basis of the transactions which occurred after the approval of the Plan.

However, as confirmed by the scatterplot (Figure 2) and in the boxplot (Figure 3), in 2016, there was no evidence of a drastic bump in value. The increase in values was smoothly distributed in the period right immediately preceding the approval and continues in subsequent years. The increase was spread through the years due to the long process that led to the Plan approval. Furthermore, private investors in RE market frequently anticipate the public move playing checkmate, partially assuming the urban planning risk. In the second part of this study, considering that the increase in value did not occur in a single step in year 2016 but was spread through preceding and succeeding years, I decided to verify the sample as one single group.

In the next step, I verified if the increase in land value (on a SF of GFA basis) was primarily related with the increase in allowed density or if there was a possible correlation with the real estate market trend in the same local area during the selected decade. In other words, I wanted to verify whether the residential market had, after the approval of the Plan, the same exponential increase that the land sale market had. To compare the land transactions with the multifamily sales that occurred in the same period time and in the same restricted area, I collected 398 multifamily transactions that occurred between 2012 and 2021, with a means of $573.23/SF of GFA, a Median of $ 540.91/SF of GFA, a Mode $ 700/SF of GFA, a Standard Deviation of $ 351.54/SF of GFA, a Minimum recorded sale price of $ 30.25/SF of GFA and a Maximum recorded sale price of $ 2067.38/SF of GFA (see descriptive statistics in Table 1).

In order to capture the historical price trends in land sale group and in multifamily group, I designed a histogram figure (Figure 4) with normalized annual transaction prices for both Land (Index $= I_{Li}$) and Residential (Index = I_{Ri}), as previously calculated with Formula (2).

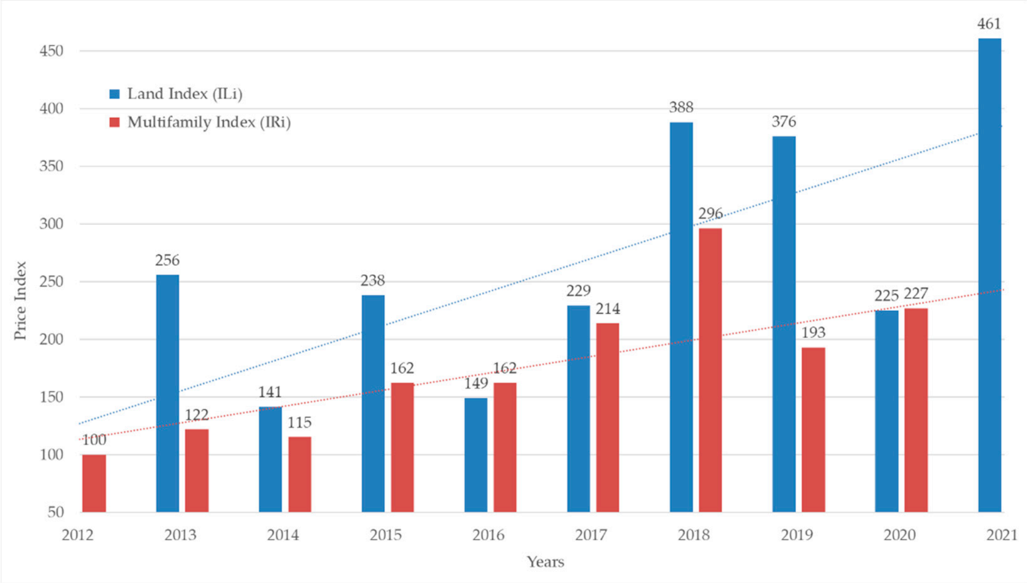

Figure 4. Land (I_{Li}) and Multifamily (I_{Ri}) Transaction Price Indexes (base: 2012).

Clearly, land prices tended to increase faster than the multifamily price index, implying that land transactions were highly affected by the zoning change, which increased the allowed density (FAR) in the area. As shown in Figure 4, the linear tendency of the multifamily Price index has a lower slope, and the slope of the Land Price Index is greater than the multifamily index, increasing faster. This seems to confirm that the land market prices increased faster and higher in the area than other real estate prices, due to the approval of the densification Plan. Land and Multifamily Transaction Price Index trends (Figure 4) suggest that land prices increased faster than residential prices, with a delta D_i (4) that grows exponentially after 2016.

$$D_i = \frac{(I_{Li} - I_{Ri})}{I_{Li}} \tag{4}$$

To test the above hypothesis, I verified correlation of Price Indexes by applying the regression Formula (3) to reject or non-reject graphical and intuitive outcomes. The results of the regression analysis are presented in Table 2, as follow:

Table 2. Regression results.

	Dependent Variable: Land Price Index (lnP_{Li})					
	Coeff.	**Std. Err.**	**t**	**P > |t|**	**[95% Conf. Interval]**	
I_{Ri}	3.656449065	0.62708469	5.83086962	0.1980	2.410445144	4.902452986
FAR_L	0.003457077	0.002665691	1.296878283	0.0007	−0.001839594	0.008753748
BA_i	−0.337565251	0.298890715	−1.129393567	0.2618	−0.931454735	0.256324234
_cons (a)	3.85205×10^{-7}	1.10163×10^{-7}	3.496675045	0.0000	1.66313×10^{-7}	6.04098×10^{-7}

According to the regression analysis performed (Table 2), there is low evidence against the null hypothesis in favor of the alternative among two of the included independent variables: I_{Ri} and BA_i. This result confirms the graphical and intuitive assumptions on non-correlations with multifamily prices trends and drastic changes in value before and after Plan approval. In other words, the null hypothesis states that none of these two predictor variables (I_{Ri} and BA_i) have a statistically significant relationship with the response variable (lnP_{Li}). These results validate the above stated assumptions. Firstly, the land sale prices are not correlated with the real estate market trends, that in this regression is represented by the residential Index (I_{Ri}). Furthermore, there is no fractured bump in 2016, and the increase is smoothed and dilated during the period just before and after approval. As expected, the dummy variable BA_i has a negative sign, confirming the upward trend of land values.

Finally, the model endorses the additional hypothesis that the land values are correlated with a positive coefficient's sign to the FAR independent variable (FAR_L) (p-Value = 0.0007). This validates the assumption that land prices on a GFA basis are higher for parcels with higher density, where higher buildable volumes are allowed: parcels with higher density have a higher price per buildable SF. This result confirms that in the CBD of metropolitan cities density is a value-added [6], and economies of scale do not influence price negotiations. This outcome reveals that densification policies have a high positive impact on land transaction prices. The increase in public benefits (such as municipal services, public are-as, house affordability limits, socio-economic sustainability, and community resilience) has a positive influence on price negotiations, overcoming the benefits of economies of scale. In this case, the densification tool as an up-zoning strategy (which was successfully used by the Bostonian public authority as value capture instrument) was able to capture both an increase in value in land transactions and in public benefits achievements.

6. Conclusions

This article investigates the relationship between the up zoning of densification tools and the capture of the value of the urban territory. Urban density is growing faster than ever, and policy makers have implemented zoning tools to meet community density requirements and trying to respond to European Sustainable targets set by European Policies [47]. Land use regulation tools on urban development density are effective tools for government to control urban land values and contribute to urban growth and public benefit offsets. Urban regeneration offers an opportunity to improve land use efficiency and sustainability, and regulatory policies tend to emphasize the intensive use of urban land during the regeneration process. Densification is known to play an essential role in the vitality and sustainability of the urban socio-economy, if planned thoroughly [12,13,48,49].

In this context, the applied densification strategy initiated by the local urban regeneration policy has played an essential role in controlling density and therefore, as a consequence, in the impacts the impacts on urban sustainability. Through densification, zoning authorities aim to counteract negative effects of urban sprawl in terms of land-use inefficiency and correlated environmental issues [49,50]. In this case study, a 144-acre low-density area located in the South Boston submarket, the policy maker was able to acquire public value with an increasing zoning plan through a 2016-approved densification policy through the implementation of public benefits as well as private value. This study confirmed that urban density is accepted as an assessed sustainable quality, reflected in the local community's willingness to pay on a building basis per square meter. In the study case, higher densities led to higher values per buildable square meter of gross floor area. This finding underscores that density is a value-added feature, able to capture the sustainable outcomes. These sustainable economic, social and environmental benefits, created by densification policies, have been recognized by higher unit-prices. In this case, the City, cooperating actively with the local community with a bottom-up approach, has played an essential role in capturing public benefits that have been internalized by land values.

The evidence that emerges from my model should be taken into consideration by the local public authorities that implement their zoning tools, supporting their programmatic choices with a view to sustainability. Future research on the role of zoning tools in achieving urban sustainability is crucial. The analysis of land price trends in different local areas could be important to understand how densification zoning tools can influence urban sustainability in different urban contexts and urban forms.

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