7 Alternative Urban Shapes and Utopias

Could a city be designed and managed like a machine or a factory or around a social order different from markets? In the previous chapters I have expressed the view that cities grow mostly according to a self-organizing principle created by markets. I have recommended limiting the role of planners to fixing street rights-of-way and designing transport systems that serve the shape and densities created by markets. In this chapter, I explore the possible validity of an opposite view.

Can a rational argument be made for planners to deliberately modify through regulations the shape of cities that otherwise would be created by markets?

Should planners regulate land use to serve an objective that they set themselves? This objective could be aesthetic (like forcing the use of a traditional regional design style of architecture) or utilitarian (like setting by regulation a pattern of development and densities that would ensure the financial viability of a preferred public transport mode).

And finally, would it be desirable for a benevolent planner to design all aspects of a new city based on clearly expressed rational principles, the way machines or factories are designed?

The Search for an Objective Function That Could Guide Design

The main challenge in both cases—modifying existing cities or creating new ones—is to find the rational principle that will justify the shape modification or guide the design. While it is usually rather simple to define a rational objective to design an object that has a well-known and specific purpose, it is much more difficult to do so when designing a city whose objective is difficult to define.

Indeed, a city is very different from typical designed objects. Let us use a bridge as an example of a designed object. A bridge has a well-defined purpose that can be easily quantified. For instance, the span of the bridge will be 100 meters, it should handle four lanes of traffic, the vehicles will run at a maximum speed of 110 km/h, and the weight of each vehicle will not exceed 44 tons. A bridge engineer

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will be able to propose several designs that meet these clearly quantified objective criteria, with variances that minimize construction cost or make the design more aesthetically pleasing. The final design selected will respond to objective criteria that everybody agrees on. Differences in opinion will likely exist for variables not included in the objective criteria, for example, some may prefer a more elegant but costlier bridge over a cheaper but less pleasing design.

It would be difficult to apply an equivalent set of specifications to a city, because a city doesn't have a clear function that can be described by numbers, unlike a bridge, a washing machine, or a phone. Further, as discussed before, a city's main quality resides in its ability to evolve rapidly and to react to the outside world. A bridge, a washing machine, and a phone are not designed to evolve. When their design becomes obsolete, the bridge is demolished and the washing machine and phone are discarded and their materials hopefully recycled. The smartphones designed by Apple are famous for their design excellence, but nobody expects an iPhone 7 to evolve by itself into an iPhone 8. We just discard our old iPhones when an iPhone 8 appears on the market. The excellence of the design of iPhone 7 is only temporary, until a better design emerges that results in the abandonment of the previous model. History tells us that some cities have been discarded by their inhabitants: for example, Fatehpur Sikri in sixteenth-century India; more recently, 60 Russian cities abandoned by government fiat in the twenty-first century; or even a city like Detroit, so hopelessly mismanaged that it has been abandoned by its most mobile inhabitants. However, most of the time it is expected that cities will survive, even when they are tossed around by external shocks. "Fluctuat nec mergitur" is the motto of the City of Paris. It roughly translates as "it is tossed around but does not sink." This motto is the closest thing to an objective function for a city. However, this pseudoobjective function would certainly not be able to guide a designer of cities who is deciding the layout of streets and the height of buildings. A function that would be limited to requiring constant adaptation to external unpredictable forces is no longer an objective function. A city has to be submitted to a Darwinian evolutionary process, negating the very concept of design with a known finality.

In his book, *Antifragile*,[1] Nassim Nicholas Taleb introduces the concept of institutions and systems that can increase their resilience precisely when they are subjected to unpredictable random shocks. Taleb argues that by trying to protect systems from shocks, we fragilize them and eventually contribute to their destruction. Taleb's insight can be applied to cities. The failure of Mumbai's cotton mills, described in chapter 3, could be attributed to the government fragilizing the city—rather than taking measures to adapt to change and external shocks. Trying to protect a city (or a country) from external shocks by building a protective wall around it is a fool's errand. Cities are thriving by multiplying exchanges with the

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world: Cut them off from the world and they will waste away. Herbert Spencer illustrates this principle in a flippant way: "The ultimate result of shielding men from the effects of folly, is to fill the world with fools."[2]

Unfortunately, urban planners have not been discouraged by the extreme difficulty of defining a function that will guide city design. Attempts to codify these objective functions—and to justify attempts to design a city—are typically done through initial blueprints or ongoing regulations.

The Search for the Objective Function of a City

We have seen in chapter 3 that, in the 1950s, Chinese planners' attempts at using the angle of the sun over the horizon to define "rationally" the distance between buildings resulted in a silly outcome, with urban residential densities fixed solely by latitude rather than by the complex interaction of land prices, transport technology, topography, history, income, and cultural preferences.

Planners who choose to dismiss the market forces that have shaped cities for centuries must replace them with a credible objective function. It is not a simple task, as we will see. In this chapter, I identify the objective functions that are currently used or have been used in the past to modify or replace the city shape that would have resulted from market outcomes. I will concentrate on four kinds of objective functions currently used to justify planners' intervention in the spatial development of cities:

- aesthetics as the objective function (e.g., Paris historical preservation),
- limiting externalities or public interest as objective functions (e.g., New York zoning regulations),
- containing urban expansion as the objective function, and
- aspirations as objective functions (e.g., sustainability, livability, and resilience).

After identifying the design objective function and the way it is applied (whether through initial plans or ongoing regulations), I then test the outcome to compare it to the objective. To be of any use in guiding city design, an objective function must be expressed clearly, and the outcome has to be measurable.

Aesthetics as Objective Function: Paris Historical Preservation

Most of Paris's[3] land use regulations are explicitly aimed at preserving the aesthetic of historical Paris. The last large transformation of Paris started in 1854 with the urban surgery conducted by Baron Haussmann and ended during the Universal Exhibitions of the Fin de Siècle that gave Paris the Eiffel Tower (1889) and the Grand and Petit Palais (1900).

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This period of rapid urban transformation was followed by a public consensus on the need for historical preservation of what had been built so far and an aversion to additional transformation of the Paris urban landscape. The only changes to the Paris skyline occurred during the last part of the twentieth century. These modern era changes were limited to the construction of four isolated state-sponsored "monuments" rather than large-scale urban development: the destruction and periodic redesign and rebuilding of les Halles (1971–2016), the Tour Montparnasse (1973; the only skyscraper in Paris), the Pompidou Museum (1977), and the Bibliothèque Nationale de France (1988). In addition, some increase in height and limited and very controlled development was tolerated in the Paris fringe, like part of the fifteenth arrondissement. These few minor changes to Paris skyline were generally received with scorn by public opinion and the press. A popular consensus seemed to have emerged supporting the maintenance of the status quo in the appearance of the Paris streetscape.

The Objective of Most of the Paris Land Use Regulations Is to Maintain a Fin de Siècle Landscape

To preserve the landscape of fin de siècle Paris, the municipality created a set of elaborate regulations that maintains the continuity of facade and perspectives of historical Paris even for buildings that are newly built and have no historical significance. However, contrary to many zoning regulations in other cities, the regulations are not so much concerned with preventing internal land use changes but are instead largely focused on the appearance and alignment of buildings facing the streets.

Since the beginning of the twentieth century, Parisians have decided that the main virtue and attraction of Paris was to stay identical through time. Regulations dictate the height of buildings, the alignment and material of roofs, traditional street facades, and anything that could change the appearance of Paris streets. In reality, Paris is changing continuously, but only within its historical facades as the use of a building or even part of a building easily can be changed from residential to commercial and back again. The building envelope is frozen, but within this envelope land use changes are often rapid. Paris is like a set of boxes; the boxes do not change but their content does. This immobility concerns only Paris municipality, limited by the extent of Paris Boulevard Peripherique, itself following the lines of fortifications during the siege of the city during the Franco-Prussian war of 1870. The population of Paris municipality represents only about 18 percent of the Paris metropolitan population.

The economic growth of Paris has been possible, in spite of the freezing of the built envelope of historical Paris, due to the rapid growth of suburban Paris.

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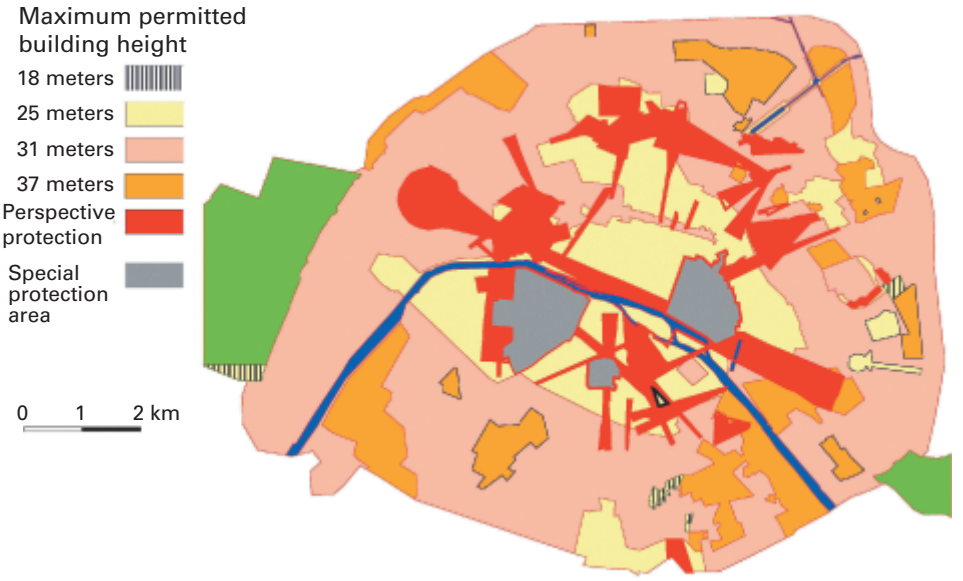

Figure 7.1
Map of regulatory heights within Paris municipality.

Suburban Paris is much less regulated, and the government has actively promoted and subsidized some high-density developments, like La Defense business district and the five "new cities" within commuting distance of central Paris that are served by an elaborate system of rapid rail transit and highways.

Let us focus now on the height restrictions that have the most impact on the shape of Paris and on real estate prices. Figure 7.1 displays the permissible maximum heights of buildings in the Paris municipality.[4] The range of permissible heights varies from 18 meters to 37 meters. The highest permissible buildings therefore have about 10 floors and are mostly located in the periphery of the municipal area. The height regulations impose short buildings in the most ancient areas of Paris, like the Marais and the sixth arrondissement. These areas, where floor space is the most restricted by regulations, are also among the most accessible areas of Paris because of their centrality and the convergence of an elaborate system of public regional transport. In this sense, Paris regulations completely contradict expected market forces: They prevent the increase of floor space in areas of high demand and force densification in peripheral areas and outside the municipal limits where demand is low. However, Paris regulations do not pretend to alleviate traditional externalities like congestion or to increase economic growth. They are explicitly aimed at maintaining intact an aesthetic, historical, and prestigious cityscape. In that, they indisputably succeed.

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Height restrictions are common to many cities. However, it is rare for a large capital city to restrict building to a maximum of 10 floors and even fewer floors in its most central area. What is even more uncommon is to have restrictions not only on building height measured from the street level but also in some areas measured from the sea level. This is the case in some areas of Paris shown in red in figure 7.1. These special regulatory areas, named "fuseaux de Protection" (perspective protection), are very specific to Paris and require some explanation.

These red areas are special protection areas where the altitude from sea level of the top of buildings is restricted as opposed to the height of buildings measured from the level of the streets in the yellow areas of figure 7.1. These special zones are established to protect the perspective view from different parts of the city toward landmark monuments (Hôtel des Invalides, Sacré-Coeur de Montmartre, Notre-Dame de Paris, Panthéon, etc.). In these special protection zones, the permissible height as measured from the street level varies continuously, depending on the location of the building in the zone and depending on the topography.

The example shown in figure 7.2 illustrates this point. Between A, on the edge of the Seine river, and B, the monument whose perspective view is to be protected, the maximum allowable height of buildings is determined by an oblique plane passing through A and B and shown as the line AB. The heights of A and B that define the line AB are not measured from local street levels but from altitude from sea level. The topography of Paris is hilly; consequently, the permissible height of buildings between A and B will vary as a function of street levels. On the graph, we see that because of the different altitudes of streets levels the height of buildings may vary from 17 to 25 meters. The enforcement of such rules requires an extremely detailed survey of the entire area. However, the regulations as formulated are highly effective at preserving perspective viewpoints for the main monuments of Paris.

This perspective protection constitutes an enormous constraint on the development of the central area of Paris. Imagine what midtown New York would look like if regulations required that St. Patrick Cathedral had to be visible from Central Park and from Washington Square!

The Objectives and Cost of Height Regulations in Paris

When evaluating regulations, two aspects should be investigated: first, whether the objectives of the regulation are met and, second, the benefits and costs to the city. Let us see how this applies to the control of building heights in Paris.

The objectives of Paris height regulations are very clear: they are purely based on aesthetic protection of historical Paris. The objectives are not limited to the protection of individual monuments but extend to the protection of monumental perspectives in the tradition of French classical seventeenth-century architecture.

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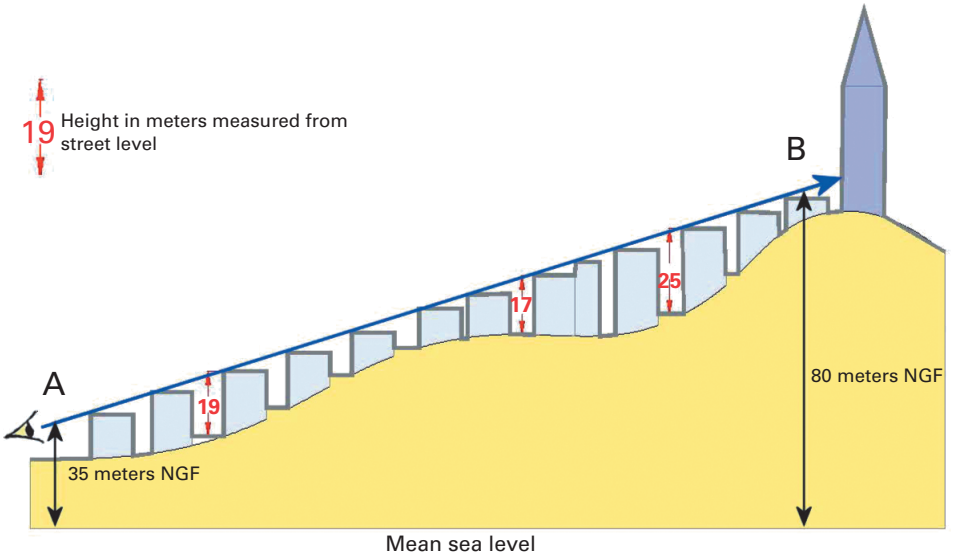

Figure 7.2
Regulation of altitudes of the tops of buildings in areas of protection. Meter NGF (Nivellement General de la France) measured from sea level.

The geometry, at time complicated to establish, is also clear and creates a regulatory envelope defined by an array of points whose Cartesian coordinates are well defined by their altitudes from sea level, as established by the general survey map of the country. Do the regulations achieve their declared objectives? Clearly, yes. The objective is the regulatory geometry itself. One could argue whether the perspective from a specific location of Paris adequately protects a monument like the Sacré Coeur of Montmartre, for instance, but these are only details. The objectives are certainly consistent with the formulation of the regulations.

What Are the Benefits of the Height Regulations?

The benefits of draconian heritage conservation are obvious; Paris is a city that attracts many visitors. In 2015, Paris was the most visited city in the world. The preservation of the perspective on the monuments and streets of Paris are certainly a part of the attraction. The well-preserved historical settings and carefully maintained extensive urban perspectives are an excellent background for the luxury goods for which Paris is famous: fashion, art, and gastronomy. In this sense, the benefits are much larger than the simple tourist revenue: They establish Paris as a desirable location for headquarters of luxury brands. The aesthetics of its large parks and avenues enhance the quality of life of the people who can afford to live

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and work there. The high benefits of maintaining Paris streets as they were at the time of the Impressionists implies that what modern architects could design to replace them would be inferior in aesthetic quality compared to what architects achieved in the nineteenth century. It is rather humbling for modern architects, but probably true.

And What Are the Costs?

What costs are implied by these regulations? Obviously, the regulatory heights create an envelope that severely limits the construction of new floor space in Paris, and they do so precisely in the area where there is most demand and where an extensive network of public transport converges. In addition, the quality of life enhancement provided by the regulations makes Paris even more attractive. The regulations clearly work against market forces: the floor area in the location generating the most demand for both firms and households is not allowed to grow. The supply of floor space limited by regulations pushes real estate prices higher as the economy of the city keeps growing. The obvious impact of the regulations is on real estate prices, resulting in a reduction in floor consumption per household—we have seen in chapter 4, that "apartments" of 9 square meters were renting for US$750 per month in 2014.

The scarcity, combined with the environmental quality, induced by regulations has created a continuous process of gentrification. Traditionally, the arrondissements[5] located in the western and southern parts of the city were considered bourgeois, while the arrondissements to the east and north were considered working class. In 2016, the entire area within Paris municipality is becoming bourgeois. The distinction is now between type of bourgeoisie: "old bourgeois" like the sixteenth arrondissement or "bourgeois-bohemian" like the nineteenth or twentieth. This massive gentrification is a direct result of the land use regulations that restrict the construction of additional floor space while making Paris more attractive. Middle- and low-income households who were traditionally living in the eastern and northern arrondissements are obliged to progressively move out toward the suburbs outside the municipal boundary, limiting their access to transportation and jobs in the city center. The municipality of Paris is attempting to slow down gentrification by purchasing apartments in old buildings and renting them below their market value to middle-income households. However, the impact of such rearguard action against gentrification is very limited because of its high cost.

The restrictions on building height in Paris have therefore contributed to shaping the city in a way that was not part of the regulations' objectives. Paradoxically, regulations, aimed at freezing the building envelope of the city as it was at the

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end of the nineteenth century, have resulted in two large spatial changes. The first one is an exile of the middle class and lower-middle class to outside the municipal boundary, and the second is a spread of many jobs toward the periphery. The population in Paris municipality peaked in 1921 at 2.9 million people. In 2014 it was 2.2 million. The number of jobs in Paris municipality has also decreased.

How Are the Regulations "Redesigning" the Paris Metropolitan Area?

How can a major world capital like Paris survive without the possibility of vertical expansion that has characterized other large cities, such as São Paulo, New York, London, Shanghai, and Seoul? The government has deliberately built a new CBD—La Defense—outside the Paris municipal boundary, 10 kilometers to the west of the traditional Paris CBD to absorb the demand for new office space that could not be accommodated in the center of Paris because of the height regulations. In addition, the government also created five new cities on the periphery to concentrate public facilities serving the suburbs and to attract commercial growth along public transport axes. All these new mini-CBDs have been linked by rapid transit to the capital subway network. Figure 7.3 shows the spatial trend in job location in the Paris metropolitan area, away from Paris municipality and around suburban transport nodes. Between 1996 and 2006 Paris municipality lost 1,700 jobs while 221,000 new jobs were created in the immediate periphery, most of them within 5 kilometers of the Paris municipal boundary, as shown in figure 7.3.

If there had been no limits to building heights, or rather if the height limits had been like the ones imposed on New York, London, Shanghai, or Seoul, there would have been more office and residential floor space built in Paris. While the free market creates a dispersion of jobs in the periphery and an increase in real estate value in the center in many large cities, the Paris height regulations accelerated and increased this market-driven trend.

It is ironic that Paris historical preservation regulations aim at preserving a type of land use that other regulations would forbid outside the historical Paris perimeter! For instance, local land use regulations would prevent any developer from reproducing the pattern of streets, building heights, and site coverage found in the most expensive neighborhoods of historical Paris, like Le Marais or the St Germain des Pres area.

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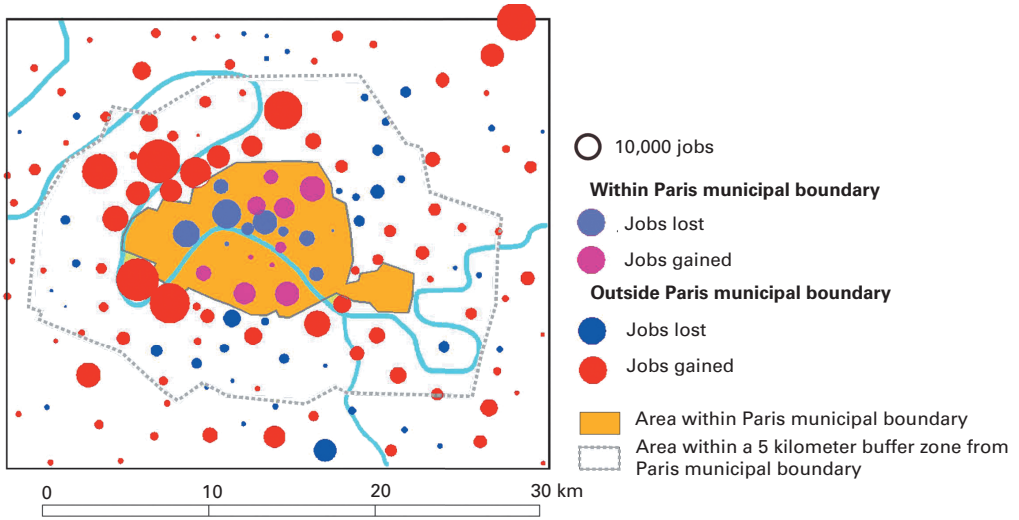

Figure 7.3
Jobs gained and lost in the Paris municipal area and immediate suburbs, between 1996 and 2006. *Source*: Chambre régionale de commerce et d'industrie, Institut national de la statistique et des études économiques, Institut d'aménagement et d'urbanisme de d'Île-de-France, 2008.

A Final Assessment: Are the Regulations Protecting Historical Paris "Bad" or "Excessive"?

Paris is a special case, where land use regulations are mostly guided by the desire for historical preservation and special priority is given to monumental perspective effects that restrict the heights of buildings. For the development of the city, these are extreme constraints that are very costly for firms and for households. However, they create a quality of life that is unique and is reflected by the very high real estate prices.

To quote the American economist Steve Malpezzi, "regulations per se are neither good nor bad. What matters is the cost and benefit of a specific regulation under specific market conditions."[6] I will add another criterion to judge regulations: Do they meet their declared objectives? The worst regulations are those that have a high cost while not meeting their objectives.

The declared objectives of the Paris building heights regulations are extremely clear: maintaining Paris city center as it looked at the time of the Impressionists. There is no pretense, as in many other regulations, that preventing the transformation of existing buildings would prevent congestion or would protect the environment. There is a clear honesty in the regulations and their outcome. Parisians complain about the high cost of housing and the tiny size of apartments. However,

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I believe that no mayor could ever be elected in Paris if she or he proposed to do away with the current height restrictions. In the case of Paris, it would be possible to calculate the cost of height regulations but much more complex to calculate the benefits that are mostly aesthetic. Every Parisian is aware of these nonquantifiable benefits and, so far, is willing to pay their costs. However, the gentrification that progressively will prevent low- and middle-income households from living in the municipal boundary is a much more serious social problem. No amount of social housing with below-market rents, as promoted by the municipality, could reverse meaningfully the gentrification trend.

In this book, I have often compared markets versus design. In Paris, the opposition between the two concepts is clear. There is a very large market demand for floor space in Paris municipality. Current regulations impose a design that prevents floor space supply to respond to this demand. But the regulatory tool used to design the city is transparent, and its objective clearly formulated.

My final conclusion on Paris building height regulations is that they are very costly, but they successfully do exactly what they are supposed to do. In this case therefore, there is no reason to pass a technical judgment on the regulations. The maintenance or relaxation of the regulations belongs to the political domain. Do Parisians feel that they are paying too high a price for these regulations or that the price they pay is well worth it? This can be expressed freely during municipal elections. The job of the planner is to explain the cost of regulations, not to approve or disapprove of them.

Limiting Externalities or Public Interest as Objective Functions: New York Zoning Regulations

New York built its first skyscraper in 1888, at about the time that Paris's golden construction age was about to end. While Paris was opting to freeze its historical skyline, New York, mostly in Manhattan, embarked on vertical expansion that continues today at an accelerating pace. The emergence of skyscrapers in New York was not due to the implementation of an inspired urban planner's vision, like the Plan Voisin that Le Corbusier proposed for Paris in 1920 (as discussed in chapter 3), but instead was the product of market forces. Although the individual builders and architects that built the skyscrapers were certainly creative, inspired, and talented, they only responded with great competence to their clients' demands for buildings that provided a high concentration of office space on a small lot.

The high price of land in the Wall Street area and the difficulty of expanding (except to the north) were powerful incentives to explore ways to stack large areas of office space vertically. The management of large companies needed many accountants and "scriveners," whose collated work would feed aggregated data

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to executives, enabling them to make timely business decisions. The circulation of information was done nearly entirely through ledgers and documents written on paper that had to be physically carried from the various departments to management and back. The high-rise building was particularly appropriate for facilitating this type of communication.

While the construction of skyscrapers was induced by market forces, changes in technology, like the invention of steel frame construction and elevators, allowed it to happen. In addition, no developer could have built a very tall building without the availability of generous credit from banks. All these preconditions, technological and financial, were met in New York at the end of the nineteenth century.

Skyscrapers were initially conceived exclusively for office buildings; it was only much later that the skyscraper was considered fit for residential use. Today in New York, out of 17 skyscrapers built or under construction between 2010 and 2016, eight are either mixed use or entirely residential. In addition, a few older skyscrapers in the Wall Street area recently have been converted to residential use.

The story and evolution of the skyscraper would constitute a book by itself, and no book written on the subject is as complete and interesting as Jason Barr's "*Building the Skyline*" published in 2016.[7] In his book, Barr, a professor of economics at Rutgers University, provides a comprehensive history of the emergence of skyscrapers in New York, the regulations that followed, and the dialectic that established itself among regulations, developers, economics, and skyscraper design. Although Barr's book focuses exclusively on Manhattan, it is one of the most comprehensive books on the interaction among design, markets, regulations, and technology in the development of cities. The sequence and content of New York land use regulations described in the following paragraphs is largely based on my interpretation of Jason Barr's insights, together with my own insights from working for the Urban Design Group of the New York City Planning Commission in 1968–1969 in the Mayor Lindsay administration.

The first skyscraper built, a modest 12 floors, caused wonderment but also worries. We would now call it a disruptive technology in that era. The negative effects on neighbors were evident: the skyscraper obstructed direct sunlight to adjacent buildings. At the end of the nineteenth century, artificial light was expensive. A tall new building casting a shadow on other shorter office buildings generated a cost that could be quickly evaluated in terms of an increase in artificial lighting costs. It was natural that citizens asked the local government to step in and regulate the dimensions of skyscrapers to decrease the clear negative externalities they caused on the neighborhood.

New York land use regulations concerning the buildings' "bulk"[8] started appearing at the beginning of the twentieth century because of the proliferation of ever taller skyscrapers. The comprehensive zoning plan of 1916 aimed to regu-

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late the size of buildings by putting restrictions on buildings' bulk (i.e., altering the shapes of buildings to decrease their impact on neighbors). These restrictions varied, depending on the use of the zone where the buildings were located. The regulations were mostly entirely concerned with correcting the negative externalities created by the shadow of tall buildings, and to a lesser extent, sidewalk congestion. The regulations of 1916 related the heights of buildings to the width of street but gave height "bonuses" to developers providing setbacks from the street. However, many exceptions existed, such as if a skyscraper's footprint was no larger than 25 percent of the plot it occupied and if it was set back from the street, its height was not limited.

As observed by Jason Barr when commenting on the 1916 plan, "the plan represented the outcome of negotiations between the real estate industry, business owners, city planners, and government officials."[9] This is still the way new regulations are established in New York, as illustrated by the development of the Hudson Yard project on the west side of Manhattan in 2016. The success of New York as one of the major business centers of the world, maintained for more than a century, is based on this conversation between real estate developers and urban planners. However, as we will see, since 1964, complex regulation overlays and lengthy change approval processes have been applied in such a way that, to quote Jason Barr again, "large public buildings like new subways or new zoning regulations seem impossible today. A severe status quo bias has set in as we resist and fear large-scale changes that were embraced to build New York into the world's greatest metropolis."

The Turning Point in 1961: Planners Using Regulations to "Design" the City

The regulations of 1916 limiting the bulk of buildings were clearly aimed at decreasing obvious negative externalities caused by the shadows cast by tall buildings. Over the years, many amendments were made to the original regulations, but the objectives remained the same: reducing negative externalities caused by the height of buildings.

A turning point occurred in 1961 when a new zoning plan was published. The objectives of the new plan were explicitly aimed at modifying the shape of the city, and were no longer limited to decreasing negative externalities. Increasingly, planners used regulations to substitute their design for market forces in shaping cities. To be able to shape the city, the city's urban planners declared that they were acting in the public interest, which is far too vague a concept to be an objective for guiding human-made design. The notion of public interest is subjective and cannot be quantified as was possible when regulations aimed at reducing the impact of shadows cast by buildings.

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Under the new 1961 zoning, planners were using regulations to achieve those new "design quality" objectives. The "shaping" objective is clearly acknowledged on the current New York City Urban Planning website with a topic named "Introduction & Shaping New York City through Zoning, 1961 to the Present."[10] The prime objective of zoning has become shaping the city, that is, "quality urban design" or possibly optimizing land use. It is an enormous departure from the original objective of zoning, but it seems that at the time nobody noticed the implications for the city.

In a democratically elected city administration, planners cannot simply impose the design they prefer on the developers of private buildings. However, in a very dynamic and innovative city like New York, where change is a constant necessity, it becomes possible to impose a city planners' design on a private developer by setting regulations that would allow an increase in floor area only on condition of modifying the design of a building and its use according to the wishes of the planners.

For instance, let us imagine that a city's planners think that a plaza open to the public but built on private land would make the city more pleasant and is therefore desirable. Expropriating the land required to create the plaza is out of the question. However, if a zoning regulation has been set to limit the floor area of the building, the city could then allow an increase in floor area above the current legal limit, on the condition that the new larger building meets the design requirement (a plaza open to the public) highly desired by planners. The developer is presented with a choice: be limited to the current floor space allowed by zoning, or build a plaza and be given a floor area "bonus" that will increase the buildable floor space of the land parcel.

If the developer thinks that the bonus is worth it (e.g., allows the developer to make additional profit), the regulations will then have created an open plaza, whose dimension and design can be decided by city planners and not by the developer. A new city amenity has been created at apparently no cost to the taxpayers. We will see below that it is not the case.

This system of design through regulation may provide leverage to planners only if two conditions are met: first, the building for which it is applied is in a location where there is a high demand for new commercial or residential floor space; second, the planners' design request may not be so extravagantly costly to the developer that no new building would be financially possible when the conditions are met. We are back to Jason Barr's remark that in New York, regulators and developers must consult each other so that the constraints imposed by the former do not bankrupt the latter. The more constraining the regulations are that limit the size of existing buildings, the more leverage the planners will have to design the city through regulations.

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So planners who want to have regulatory leverage to impose their design on developers should have a clear strategy. First, limit the use and bulk of building as close as possible to the current one to prevent "free" addition of floor space; second, provide a generous increase in buildable floor area compared to the area allowed by regulations in exchange for land use change and any other design attribute that the planners might desire. Zoning regulations that would allow much more floor area than the area of existing buildings and flexibility in land use would provide no leverage for planners to request design features that the developers are unwilling to provide. By contrast, a regulatory-induced shortage of floor space increases the price of floor space and therefore increases the leverage of planners over developers.

Where draconian limits on floor space expansion in areas of high demand are imposed, planners have then the leverage to "design" the city by providing floor area bonuses in exchange for desired land use change. For instance, planners can impose the inclusion on private land of plaza and open spaces, whose design they may specify. They may also impose the addition of a certain type of land use, for instance, shops on the ground floor, or "affordable housing" whose characteristic and number they can specify, as described in chapter 6. Here we are very far from correcting the clear negative externalities that justified the first New York zoning regulations of 1916!

Planners' Attempts to Shape Private Buildings Have a Cost

Any modification in the design of a building has a cost, and potentially a benefit, although no money is exchanged. The design changes imposed by zoning would be justified if the benefits are higher than the costs.

Three cases are possible: the planners' imposed design increases the value of the building more than its cost; the design does not increase the value of the building but provides benefits to others; and finally, the design does not provide benefits for anyone. If the addition of a design feature, like a public plaza, would increase the market value of a building, it is most probable that the developer would have already included it in the initial design. If the plaza does not increase the value of a building but improves the street experience of passers-by, then the city is asking the building's users—households or firms—to pay through increased rents for a benefit accruing to the city's general population. It concentrates the cost of a public facility on a few citizens. The planners' imposed design therefore always increases the cost of new buildings and therefore most probably decreases the quantity of floor that would have been built if the design constraints did not exist.

By using FAR regulations to impose restrictions on the flow of additional floor area that can be built in a city, planners are de facto creating a new currency, consisting of bonus additional floor space that they will use to purchase from developers the urban design feature they desire—plazas, affordable housing, or

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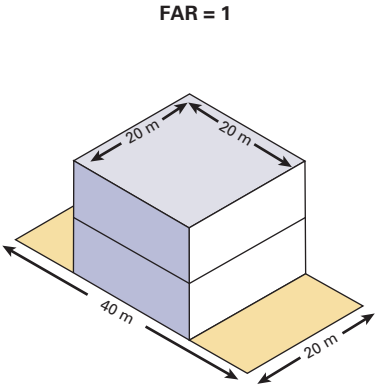
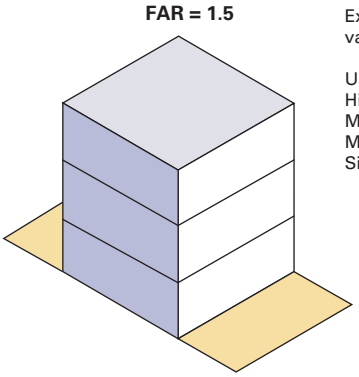


Lot area: 800 square meters
Number of floors: 2
Area per floor: 400 square meters
Total floor area: 800 square meters
Plot coverage: 50 percent
FAR: 1



Lot area: 800 square meters
Number of floors: 3
Area per floor: 400 square meters
Total floor area: 1,200 square meters
Plot coverage: 50 percent
FAR: 1.5

Examples of FAR values in various cities

	FAR
US cities' suburbs	0.3
Historical Paris	3.5
Manhattan residential	4–10
Manhattan office buildings	15
Singapore highest FAR	25

Figure 7.4
How floor area ratio (FAR) is calculated.

anything else. The higher the scarcity of floor space, the higher is the value of the bonus FAR currency, and therefore the higher the design variations planners can purchase from developers (figure 7.4). The FAR bonus will have a high exchange value only if the regulations are sufficiently restrictive to maintain a scarcity of floor space. If the supply of floor space were completely elastic, then the value of "bonus FAR currency" would lose its value, and eventually fall to zero. Planners would then lose all leverage over developers. Thus the practice of incentive bonus FARs requires maintaining a tight supply of floor space over an entire city that increases the price of commercial and residential floor space for all firms and households. As we have seen in chapter 6, the few so-called affordable housing units created by inclusive zoning FAR bonuses distributed through lottery does not justify increasing the price of housing and commercial space for everybody else.

The Origin of Incentive Zoning: The Seagram Building in Manhattan

The Seagram Building was built in 1958 in New York, just before incentive zoning of 1961 was invented. It was designed by the German-American architect Ludwig Mies van der Rohe to meet his client's demand for a prestigious corporate headquarters representative of the International Style, the post-World War II offshoot of the Bauhaus movement. The skyscraper of 38 floors included an open plaza,

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facing Park Avenue at the center of midtown Manhattan. The quality of the design of the skyscraper and its plaza made the Seagram building an icon for good urban design and became a textbook example of enlightened corporate architecture. This was exactly what the owner of the Seagram building wanted to achieve and the reason they hired Mies van der Rohe as its architect.

By pure luck, my first job in the United States in January 1968 was located in the office of the architect Philip Johnson at the top floor of the Seagram Building, and I can testify that working in such a building and taking my lunch break on the plaza was an extraordinary experience. The Seagram had a well-deserved reputation of exemplary urban design. It also created a new category of land use: privately owned public space.

New York urban planners thought that by using clever regulations, they could replicate Mies van der Rohe's excellent design, and that it would be desirable to do so. Obviously, they could not mandate developers to replicate it, but they could create regulatory incentives to reproduce the plaza and create new privately owned public spaces at no cost to taxpayer money.

City planners decided to use the regulatory tool of FAR bonuses as an incentive to incite developers to build plazas similar to the one found in front of the Seagram Building. Originally, new regulations stipulated that for every square foot of urban plaza created, developers could get 10 square feet of saleable space in addition to the floor area they were entitled to under current zoning. The maximum floor area bonus obtainable, though, was limited to an additional 20 percent of the permissible floor area under current zoning.

The regulatory incentive set by planners did work. Several new skyscrapers were recessed from the street and provided public open space in front of the building. However, the attractiveness of the open space provided never matched the one offered by the Seagram building. For instance, on Sixth Avenue, between 47th and 50th streets, three consecutive plazas were built. But because they were next to each other on the same side of the avenue, they didn't provide the feeling of an open plaza but just a widening of the avenue. In addition, because the plazas were designed mostly to obtain an additional floor bonus, not to improve the quality of the building, the design of the plazas—streetscape, flowerbeds, and steps—seemed to be placed to discourage use rather than to serve as a pedestrian attraction. Indeed, privately owned public space has a number of considerations: it may be subject to lawsuits by users, and it must be privately maintained and policed, creating a potential liability and a sizable additional maintenance cost. Making the plaza unattractive to "vagrants" and even to passers-by somewhat decreases the potential for liability and the cost of maintenance. Subsequently, New York urban planners tried to tighten rules and expand the detailed specifications for the design of plazas in the pursuit of more effective privately owned

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public spaces. However, it is difficult to get good urban design just by regulation. The website of New York City Department of City Planning recognizes as much when it mentions that "the open spaces created by incentive zoning provisions have not always been useful or attractive."[11]

Do these "not always useful or attractive" plazas have a cost? After all, they were created by a few paragraphs added to the zoning code, clearly not a significant expense for the city budget. However, any architectural or urban design feature created through incentive zoning has a cost to the developer that is eventually passed on to the user. If the developers thought that these features would add to the value of a building, they would not have required an incentive to create them. For instance, the plaza of the Seagram building was built without incentive, because it added value to the building and its cost was considered less than the value it added. Commonly, developers add height to the lobby of prestigious office buildings and cover the walls with marble without requiring incentive. They do that because the additional cost is less than the value added. Incentive zoning adds two types of cost to the floor space built in a city. First, the capital cost and the recurring maintenance cost of the feature added because of the incentive, a cost borne mostly by the buildings' users, owners, or tenants. The second type of cost is borne by all the city's inhabitants and workers and results from the intentional shortage of floor space (due to restrictive regulations) that must be created for the incentive to work. Therefore, New Yorkers pay for the cost of these "not always useful or attractive" plazas. Let us not forget that incentive zoning can work only by creating a general shortage of floor space and releasing it slowly only for buildings that have features that planners would consider useful and attractive.

Did planners learn from this failure? Not really. In November 2011, to celebrate the fiftieth anniversary of the 1961 zoning resolution, the New York City Department of City Planning organized a conference "to cultivate new thinking about zoning as a governmental tool that may be used to address major economic, social, environmental, and physical challenges."[12] The various presentations described how zoning could make the city more "competitive, equitable, and sustainable." We are far from the use of regulations to correct tall buildings' negative externalities: shadows and sidewalk overcrowding. I challenge any planner to explain how severely restricting the bulk of buildings and releasing it piecemeal for some preferred usage and dimensions would make the city more competitive, equitable, and sustainable—even if quantitative indicators could be developed for these objectives. Adding new fuzzy objectives to zoning regulations will only add more complicated restrictions on the use of land and floor space.

Let us not forget that zoning can only restrict buildings' dimensions and types of use. When added to zoning, floor area bonuses act as a bribe to add building elements or usage that would not happen otherwise. By definition, the design

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through regulations promoted by floor area bonuses cannot be innovative, as they always promote the replication of an architectural feature or a usage from an existing building that particularly pleased urban planners. The Seagram Building plaza was innovative—it was built at the initiative of the architect. The plazas in front of the Sixth Avenue Midtown buildings were just bad copies of a past innovation. The practice of floor area ratio bonuses is to urban design innovation what a "paint by number" canvas is to painting by artists!

By contrast, architectural and urban design innovations can be only created by individuals working alone or in groups who do things in a new way, or even by some architects who break the rules and get away with it.

Do Additional Floor Bonuses Decrease the Credibility of FAR Regulations?

FAR bonuses—rewarding architectural features that urban planners value—negates the very justifications for regulations that restrict FARs. The restrictions put on FAR were originally aimed at limiting negative externalities created by the shadows of tall buildings.

Let us consider the case of several blocks where the FAR is fixed at 15 by the zoning plan—as it is the case in large areas of midtown Manhattan. In some blocks, the FAR may be increased to 18, for buildings having a feature that urban planners consider attractive, whether this feature is a plaza, a theater, or some affordable housing units. We cannot but conclude that the FAR value of 15 was arbitrary in the first place, as none of the added feature are likely to correct the negative externality caused by a higher building. The regulations restricting FAR to a level much below the demand for floor space in the area are therefore only an instrument of coercion, creating an artificial scarcity that will oblige developers to include features that planners deem to be an improvement on city quality.

One could still argue that an added plaza would provide much needed space for pedestrians, whose number would increase with the additional floor space built because of the bonus. This argument does not hold up to scrutiny. At the standard FAR of 15, the sidewalk of a building using the same lot area as the Seagram building will have an area of 913 square meters, or 1.12 square meters of sidewalk space for 100 square meters of office space. If the building gets a bonus and the FAR increases by 20 percent and a plaza similar to the Seagram is added, the area of total pedestrian space available—sidewalk and plaza—become 3.35 square meters per 100 square meters of office space. If we assume that the number of employees in an office building is proportional to its floor area, it means that an increase of 20 percent of the floor area would triple the area available to pedestrians at the street level. Clearly, if the concern is the space available to pedestrians around the building, the plaza is overdesigned.

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No matter how pleasant the Seagram Plaza is, it is not costless. For a given floor area, leaving a large open plaza increases the number of floors and decreases the usable floor area on each floor. In the Seagram building, the area used for elevators and utility shafts occupies 31 percent of the area of a typical floor. If the Seagram had no plaza and occupied the entire site, like some neighborhood buildings do, the entire floor area could fit in 11 floors only, and the elevators and utility shaft would occupy only 7 percent of the total floor area, increasing significantly the saleable area. In other words, the plaza makes the construction of the floor space significantly more expensive.

The lavishness of the Seagram Building—use of travertine in corridors and lobby and bronze on the facade in addition to the vast plaza—was a deliberate decision made by its owner. For the Seagram Company, the prestige building sheltering its New York headquarters had a value for the brand beyond the potential market value of the building or the value of its rents. Planners who wanted to generalize this quality in all office buildings significantly increased the cost of office buildings in New York. FAR bonuses are therefore not innocent and costless.

We have seen that multiplying plazas does not necessarily increase the livability of the city. We cannot regulate good design. On the contrary, we should rely on private initiative and the imagination of individual architects to provide new types of Seagram buildings. The Rockefeller Center in New York is also a magnificent example of urban design and Art Deco building, but it would be absurd to draft regulations so that new buildings would get a bonus if they copy the layout of Rockefeller Center. New York is full of attractive buildings like the Woolworth or the Chrysler building, or the Flat Iron building; none of them was built because of regulatory incentives.

Micromanaging Land Use through Zoning

Since 1961, planners in New York City, in their enthusiasm for using zoning to make the city more "competitive, equitable, and sustainable," have engaged in micromanaging land use by superimposing layers of regulations that are going much further than designing plazas on private land. One of the most extreme cases of a zoning micromanagement rule I have ever seen is named the "Joint Living-Work Quarters for Artists." This rule is an overlay in the M1-5A and M1-5B zoning districts in SoHo/NoHo in New York City. While the current land use in the area is mostly commercial and residential, it is still zoned Manufacturing. Indeed, at the end of the nineteenth century, the neighborhood was used mostly by garment industry sweatshops. The "Joint Living-Work Quarters for Artists" rule stipulates that only artists may live in these areas zoned manufacturing but only if they occupy a joint living-work quarters. Here is the wording of this extraordinary

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zoning regulation: "Section 12-10 of the New York City Zoning Resolution refers to individual lofts in Soho and Noho as 'arranged and designed for use by … not more than four nonrelated artists," including "adequate working space reserved for [each] artist." An artist is further described "under Sections 275-6 of Article 7.B of the Multiple Dwelling Law, an 'artist' is defined—for the purpose of qualifying for joint living-working quarters." The text further defines the purpose of the zone: "The SoHo Zoning Resolution permits fine artists working on a professional level who demonstrate a need for a live/work loft to reside in specific lofts zoned for manufacturing. Artist certification provides the document that equates the person named therein with a light manufacturer."

To reside and work in the area zoned for manufacturing, an artist must obtain an "Artist Certification" that is issued by the Director of Artist Certification at the NYC Department of Cultural Affairs. If readers are interested, they can apply and fill in the form on the New York City Government website.[13]

As zoning was invented to protect citizens from negative externalities, one would assume that a special artist zoning category created in a manufacturing area would aim at isolating artists from the rest of the population, the way a tannery or a lead smelter would be put into a special zone. It could be argued that artists may create negative externalities because of the bohemian life they are assumed to lead. However, this not the case. The rule was created to protect artists' housing and working space against nonartists who would compete with them for renting or buying the same floor space. The argument of the planners is that art is a vital part of New York cultural and economic life and needs protection.

Indeed, originally, artists found it convenient to occupy illegally lofts abandoned long ago by the manufacturing sector in the Soho/NoHo area. The city regulators, made aware of this zoning violation, had the good sense to not expel the artists for zoning violations. But instead of amending the zoning by allowing a new type of mixed work/residential use that obviously did not create any nuisance to neighbors, the city planners created a new type of zoning rule that excluded nonartists.

An artist, however, usually does not have a city-issued license, like a barber, a plumber, or a mortician. To be able to enforce the new zoning resolution, the city therefore had to create an artist certification, not to restrict the exercise of the profession but to allow the zoning law to be enforced. The total area in SoHo/NoHo area zoned M1-5A and M1-5B that is restricted to artists is only 58 hectares (figure 7.5). Outside this area, New York artists must compete in the open market to find a work/living space area.

To have a legal lease or purchase a loft in the SoHo/NoHo manufacturing area where "Joint Living-Work Quarters for Artists" is authorized, artists must apply to the department of cultural affairs to obtain a certification as an artist, which

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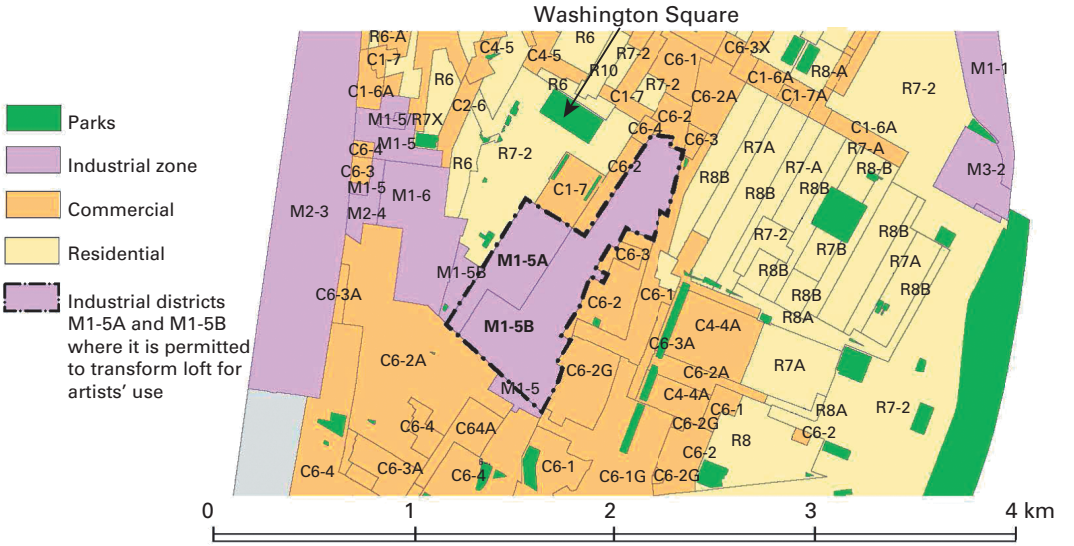

Figure 7.5
M1-5A and M1-5B manufacturing districts in SoHo/NoHo, Manhattan. *Source*: NYC Zoning District Map data containing the neighborhood south of Washington Square: M1-5A and M1-5B. Districts used with the permission of the New York City Department of City Planning. All rights reserved.

should include a portfolio for a visual artist, or scores and tapes for a musician! A municipal employee, after reviewing the portfolio or the musical score, will then decide whether the artist deserves a loft. One can imagine Jackson Pollock or Andy Warhol dutifully sending a portfolio, hoping for an approval by the Department of Cultural Affairs! And after being refused the qualification of artist by the city (apparently about 45 percent of applications are refused) moving to Omaha, Nebraska, to the loss of New York City.

I am telling this long story about this bizarre zoning category not to make fun of the NYC Planning Department but to show to what extreme zoning boards can err by excess of zeal in their desire to design city land use to its smallest detail. It is also an obvious example in which the zoning rule is unlikely to have any impact on the zoning objective of promoting art in New York City.

In addition, the "Joint Living-Work Quarters for Artists" zoning rule has a cost. The M1-5A and M1-5B zoning district in SoHo/NoHo is located in one of the most desirable retail and residential neighborhoods of New York, and there is high demand for residential quarters in these areas. Developers wanting to renovate buildings in the area must take into account the restriction that will limit the potential buyers or renters to registered artists. Furthermore, given the complex housing affordability

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problems faced by New York City, with around 60,000 homeless people living in shelters in 2016, it is astonishing to learn that municipal employees will spend time looking at artists' portfolios to decide whether they deserve to be able to rent a loft.

Abusive Separation of Functions Aimed at Slowing Down and Increasing the Cost of Land Use Changes

The new zoning plan of 1961 aimed at separating functions more thoroughly, and this separation has been increasing ever since. The three types of use districts—residential, commercial, and industrial—of the 1916 plan have been subdivided in the 1961 plan. Subsequent revisions created a multiplicity of new zones, each one subdivided into subzones with their own bulk requirements and potential for bonuses increasing the floor area. For example, the general commercial district is now subdivided into 72 specific zoning districts, themselves modified by overlays that further define what can be built. The multiplication of zoning types allowed closely reflects the existing land use of each block. A slight change in projected use by a developer would then require a variance or a zoning change, which could be exchanged for a new design feature requested from the developers.

For instance, the areas zoned commercial are subdivided into eight types of district named C1 to C8, each one limiting the type of commercial activity that could take place in them. However, each zone is divided into subdistricts, for instance district zone C4 is subdivided into 17 subcategories, each with different FAR limits and requirements and the possibility of additional FAR bonuses (figure 7.6). For a given land parcel, the amount of floor area that can be built is not completely apparent without calculations and assumptions about the possibility of FAR bonuses. For instance, a slight zoning change from C4-4 to C4-4A would increase FAR by 18 percent. District C4-6 would qualify for a 20 percent FAR bonus if a public plaza is built on the lot, but would lose this qualification if the district become a C4-6A district instead.

As the market price of urban land in Manhattan is established by the area of floor space that can be built on it, the value of a parcel of land is de facto dependent on the designation of its zoning. For instance, in New York, the price of a parcel of land is evaluated in dollar per allowed buildable square foot, not in dollar per square foot of land. Therefore, a slight zoning change could change the price of land instantly. This assumes that the FAR restrictions impose a limit below market demand. That seems to be the case in most of New York, and it is consistent with the incentive that planners have for restricting FAR below demand to maintain maximum leverage for incentive zoning.

Looking at the multiplication of zoning district designations, one cannot avoid thinking that the differences between two zones are often largely arbitrary and

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subject to change. Planners have the power to change the value of urban land at whim. This is precisely what gives power to zoning boards. Looking at the variations in FAR just for the C4 commercial districts (figure 7.6), it is difficult to perceive a clear objective in the differentiation, unless the objective is opacity.

One of the Objectives of New York Zoning Is to Slow Down Changes Caused by Markets

The distinctions between permitted commercial uses in different commercial zones are extremely detailed, and it is difficult to understand the reason for their complexity, except to maintain control or to slow down land use changes. Here is a partial declaration of objective from the New York City Department of City Planning:

> Numerous zoning districts are mapped in the City's diverse neighborhoods to preserve their varying density and character. These limits help give shape to neighborhoods and predictability to their future. The City continues to adapt the Zoning Resolution as the land use patterns in the City change through private and public actions.[14]

The following example concerning a zoning change illustrates the high cost of maintaining regulatory fetters to prevent even small land use changes. A public hearing at the city planning commission in 2014 agreed to change the zoning of an existing shopping center in Queens from C2-2 to C4-1. Under C2-2, the shopping center was limited to such uses as hardware store or athletic goods store. But under the new C4-1 change, it became possible to allow shops selling furniture and appliances retail uses, which were not permitted previously! The city planning commission agreed unanimously to the change, while the land use lawyer that had argued the case in front of the commission declared that the change "would provide greater leasing flexibility and enhance the future economic viability of the shopping center." Indeed! It is difficult to understand the type of concern for the public good that incited planners to restrict the sale of appliances in a commercial area that allows hardware stores.

C4 Commercial districts

	C4-1	C4-2 C4-3	C4-2A C4-3A	C4-4A C4-4 C4-5	C4-4L C4-5A	C4-4D	C4-5D	C4-5X	C4-6	C4-6A	C4-7	C4-7A
Commercial FAR	1.0	3.4	3.0	3.4	4.0	3.4	4.2	4.0	3.4	3.4	10.0 (5)	10.0
Residential FAR	1.25	0.78–2.43 (1), (4)	3.0 (4)	0.87–3.44 (4)	4.0 (4)	6.02 (4)	4.2 (4)	5.0 (4)	10.0 (4) (5)	10.0 (4)	10.0 (4) (5)	10.0 (4)
Residential district equivalent	R5	R6	R6A	R7	R7A	R8A	R7D	R7X	R10	R10A	R10	R10A

(1) 3.0 FAR permitted on wide streets outside the Manhattan Core under Quality Housing Program.
(2) 7.2 FAR permitted on wide streets outside the Manhattan Core under Quality Housing Program.
(3) 4.0 FAR permitted on wide streets outside the Manhattan Core under Quality Housing Program.
(4) Increase in FAR with Inclusionary Housing Program bonus.
(5) FAR bonus up to 20 percent for a public plaza.

Figure 7.6
FAR values for the commercial zone C4 and its subdivisions.

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Complex Zoning and Land Price Formation

A specialized trade website relates that it took 16 years for a large New York developer to transform from industrial to residential the zoning category of a lot he had purchased on the East Side of Manhattan. In 2018, a new 140-meter-high residential tower has been built on the lot. This delay in adapting zoning to demand raises two issues. First, it increases the cost of building. During the 16 years, the capital used to purchase the land was frozen, and the buildings had obsolete land use. In addition, the legal overhead of obtaining the zoning change was certainly not negligible. Second, because the time and cost involved in getting a zoning change could not have been known with precision by either the developer or the land seller, it would have been difficult to establish a land price. Each side was taking a risk. The seller's risk was underpricing the land if the zoning change could have been obtained quickly. The buyer's risk was to overpay for the land in case the zoning change, if ever obtained, took longer than he thought. These risks and costs in holding underused properties are eventually reflected in New York real estate prices.

The ability to change land prices by slightly modifying zoning district categories creates a major problem when pricing land. Only a very specialized zoning lawyer would be able to evaluate the total area of floor space that could be built on a given parcel of land in New York City, given the many possibilities of zoning changes, development rights transfers, bonuses of all sorts, the potential of using 421-a (a property tax exemption), and so forth. This creates an asymmetry of information that is extremely detrimental to the good functioning of markets. Because of the complexity of the zoning code, a creative zoning lawyer is far more likely to increase the profitability of a future building than a creative architect or engineer. The incentive zoning paradigm that was supposed to improve urban design through clever regulations might in the long run have the opposite effect.

We should not forget that most of the beloved New York buildings still standing now, from the Woolworth building to the Seagram tower, were built without the "help" of modern zoning. A *New York Times*' article written in 2016 and relying on a detailed database notes that 40 percent of the existing buildings in Manhattan could not be built today because they contradict some land use zoning rules.[15] Many of these buildings are clustered together in the most expensive parts of Manhattan. Therefore, not meeting land use regulations does not seem to decrease their value, which would tend to demonstrate that zoning rules do not correct any perceivable negative externalities.

What advantages did the multiplicity of zoning categories and corresponding bulk add to the New York streetscape since 1961? One could compare the opacity of New York current zoning with the transparency established by the planners who conceived and surveyed the Manhattan grid in 1811. The existence of the grid

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and its survey markers immediately established clarity in the value of buildable land for the entire island of Manhattan. The value of land parcels facing avenues, on side streets, and at blocks corners could immediately be evaluated, with the same information available to the seller and the buyer clearly apparent on the plan. By contrast, the value of two adjacent land parcels, one zoned M1-5B and the other C6-2 on the zoning map of figure 7.5, is impossible to assess without the help of highly specialized zoning lawyers. I am sure that whoever established the distinction between the two zones had a rationale for doing so, but this rationale is not explicit, has a very high cost to New Yorkers, and is possibly as futile as the special zoning category for artists.

Urban Design Should Be Site Specific, Not Defined through Regulations

I am not suggesting here that planners should not impose any conditions on developers when significant land use changes are envisaged. But the modification required to the design of a building must be focused on the tangible negative externalities that it may generate. Shadows cast by buildings are not an important issue any more in high-density cities. Air conditioning and cheap artificial light have taken care of that. The demand for the transformation of office buildings into residential buildings in the Wall Street area demonstrates that fact. In high-demand areas, high FARs should be a right guaranteed to individuals.

However, tall buildings may generate urban design problems at their junction with the street. A redesign of the public space may be required because of the pedestrian traffic tall buildings may generate. For instance, the entrances of traditionally designed subway stations may obstruct sidewalks in high-density areas. Clearly, in such a case, design coordination between urban planners and the design of a very tall office building is to the advantage of all parties. The most creative urban design solutions are always site specific. No regulation can provide an optimum solution for every case. Instead of relying on bonus FAR to obtain a design change, it would be better if the city urban planners had a fund that could be used specifically to improve and adapt the design of streets and parks to the changing city land use. In a certain way, the use of FAR bonuses in incentive zoning is a barter system. It would be better to use a monetary instrument like an impact fee to replace this barter system. City urban planners would then be able to use the urban design fund that the impact fees would generate to redesign and adjust the design of public space. Location-specific design modifications could be required on the ground floor or mezzanine of buildings to link seamlessly with the new public realm features. This method is used routinely in Singapore and Hong Kong to increase the pedestrian areas to link private buildings with the street and with public transport.

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The tendency today is in the opposite direction. The trend is to increasing the use of barter through incentive zoning, while decreasing the city's financial resources with the bizarre practice of providing the 421-a property tax exemption to large buildings[16] in addition to floor area bonuses. Tax exemption and floor area bonuses are given in exchange for something the city wants: plaza, arcades, or affordable housing. The use of tax exemptions reduces the city's resources. Consequently, the city has to resort to draconian zoning to barter zoning changes with developers in order to obtain a simple urban design feature like an underground connection to a subway station.

Some examples of site-specific design features have already been used in New York for large projects like Hudson Yards and the Vanderbilt Corridor, which address directly the issue of pedestrian access to transit close to large new buildings. New York has also a history of "transit bonuses"[17] that use FAR increases to induce private developers to pay for improvement to subway stations. These cases illustrate legitimate "design" dialogue between developers and urban planners to solve site-specific accessibility issues raised by increasing densities. I regret only that the currency used is always an increase to FAR rather than a site-specific impact fee on the increased office floor area that caused the negative externality.

New York Zoning Objectives: Slowing Down Unavoidable Change

As mentioned, New York's current zoning regulations have in fact two implicit objectives: shaping the city to the preference of urban planners and slowing down the land use changes that markets demand. Achieving these objectives through regulations has a cost that is paid by all New Yorkers in the form of higher rents and chronic housing shortages.

Because New York has a vibrant democratic government, the attempt to slow down land use change must have a constituency that represents a significant part of public opinion. Indeed, NIMBYism[18] is common to all large cities. People resist change. Any land use change, even if it is as benign as the disappearance of a corner grocery store, seems to be an unacceptable evolution to people who have lived in a neighborhood for a long time. In contrast, a city's mayor is well aware that citizens expect more jobs, housing, and the establishment of abundant retail and services, which require large and rapid land use changes. New York's planning department has managed this contradictory mandate by devising an extremely complex zoning system that has a well-oiled mechanism to permit change but makes change slow and costly. In this way, they satisfy both sides of their constituency, the side that wants no change and the one that wants new jobs and housing.

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Containing Urban Expansion as an Objective Function

Paris and New York zoning plans illustrate how planners try to modify the shape of cities through regulations that constrain firm and household demands for floor space. Paris planners' zoning efforts resulted in the effective conservation of urban heritage and the acceleration of the dispersion of economic activity and population to the suburbs. In New York, planners successfully created new privately paid urban design features, some privately produced "affordable housing units," and a slowing down of the pace of land use change.

These two examples are very city specific and are not necessarily part of a general urban policy trend advocated by planners. By contrast, the policy variously called "containment," "compact cities," "smart growth," or "anti-sprawl," have been advocated in many cities around the world. I will use the word "containment" to characterize these policies. Containment policy advocates place physical restrictions on the expansion of cities, which is yet another attempt to design cities through regulations.

Containment Is a Recent Reversal of Two Centuries of Urban Expansion Policies

Containment is a policy that dates to the fin de siècle twentieth century and developed momentum at the beginning of the twenty-first century. Planners' support for containment has several origins. There was always a concern among planners that the gradual "encroachment" of urban areas on agricultural land would eventually result in food shortage—a concern currently embraced by the Chinese government. Hence, the necessity to slow down the spatial growth of urban areas by increasing the densities of cities.

The agricultural land shortage argument for containment was further reinforced by petroleum price volatility that occurred at the junction of the twentieth and twenty-first centuries. Households living in suburban developments relying on individual car transport cost were adversely affected by the unpredictability of gasoline prices. Households having shorter commuting trips or able to use public transport were much less vulnerable to these transport cost variations. The desirability of shorter commuting distances and therefore higher densities was added to the objective of saving agricultural land. Transport planners, involved in the development of public transport, joined the containment movement as public transport cannot operate efficiently in low-density suburbs. The large subsidies reducing the fare paid by public transport users have to become even larger when serving low-density areas.

At the beginning of the twenty-first century, the emergence of the gradual consensus on the serious threat caused by global warming gave an additional

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impetus to the containment movement, as urban transport is responsible for a large part of CO_2 emissions—about 20 percent of US GHG emissions in 2014.

All these concerns are based on real issues. My skepticism about the policy of urban containment does not reflect a rejection of the potential issues described above. I think that containment is simply the wrong solution for preserving food supply, improving mobility, and decreasing the production of GHGs. Not only is containment policy unable to solve these issues, but its systematic implementation can have serious consequences for housing affordability and for the welfare of urban households in general. I will argue these points in the following paragraphs.

Containment is a sharp reversal from urban planning doctrines of the nineteenth century and of most of the twentieth, when affluent cities were eager to expand and carefully planned their expansion. In the nineteenth century, large planned expansion of cities like Barcelona and New York were considered a sign of modernity and sophistication. Whether theoreticians advocated low-density suburban development like Ebenezer Howard's Garden Cities or the denser skyscrapers in the park of Le Corbusier, nobody doubted that the urbanized areas of cities had to expand. And expand they did. Levittown, a more modest version of the Howard design, together with its many imitators in the United States and Western Europe, provided a large part of the new urban housing stock affordable to a rapidly expanding middle class. These rapid suburban expansions lowered the high (and deadly) densities in the London of Dickens, the Paris of Zola, and the Chicago of Theodore Dreiser.

Distortion in Land Markets Could Result in Excessive Development of Urban Land

Containment policy assumes that land markets overallocate land to urban use at the expense of agricultural use or open space. Thus, cities use more land than what would be required, resulting in inefficient transport, pollution, and losses of valuable agricultural land. Planners in favor of containment advocate setting physical boundaries to prevent cities from expanding beyond what they deem is the right amount of land to be allocated to urban expansion. Greenbelts and urban growth boundaries set the physical limits of suburban expansion, ensuring that they do not exceed the preset "right amount" of land.

Eminent urban economists like Jan Brueckner and David Fansler, in a paper published in 1983,[19] already mentioned the "emotionally charged indictment of sprawl" (sprawl is the opposite of containment):

> The economist's view of urban expansion stands in stark contrast to this emotionally-charged indictment of sprawl. Economists believe that urban spatial size is determined by

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an orderly market process which correctly allocates land between urban and agricultural uses. The model underlying this view … suggests that urban spatial size is determined in a straightforward way by a number of exogenous variables.

Urban economists, however, do not deny that some of the exogenous variables, like the price of transport or of agricultural land might be at times distorted, and that these possible distortions may have an impact on the quantity of land used by cities. Urban economists have therefore identified the many factors that could distort urban land markets, such as the inability to price road congestion; the subsidies given to infrastructure and fuel prices; the abusive use of eminent domain underpricing rural land; and finally, the land use regulations that force households and firms to use more land than they need—minimum lot sizes, maximum densities, and maximum FARs.

These distortions could indeed result in an excessive expansion of urban land, and removing them would make expanding cities more efficient and the area they occupy closer to an economic optimum. For instance, Brueckner, in a paper titled "Urban Sprawl: Lessons from Urban Economics,"[20] provides an analysis of the possible causes for land market distortions and identifies practical remedies. For each possible cause of distortion, a theoretical model can be built that calculates the impact of the distortion on urban land consumption. For instance, in a country that subsidizes gasoline, an economist can calculate the impact of the subsidy on a city built-up area and the reduction in urbanized land that would result from removing the subsidy. The calculation would be part of a theoretical model that considers other parameters, such as population growth, household incomes, the cost of commuting time, and the price of agricultural land. The optimum equilibrium area of land for expansion depends on the value of many variables that are specific to the city studied.

For these reasons, economists never recommend an urban optimum density corresponding to a permanent equilibrium, as this density might change when model inputs like household incomes and transport price and speed change over time. However, by correcting distortions, such as removing fuel subsidies and pricing pollution and congestion, a city is more likely to get closer to an ever-changing optimum built-up area.

Brueckner argues that first correcting the distortions and then relying on markets to find a new equilibrium is a much more efficient way to improve urban land efficiency than trying to correct distortions by arbitrarily reducing the area of urban expansion through regulations like greenbelts and urban growth boundaries. He warns that reducing arbitrarily the urban area generated by distorted market forces might reduce urban welfare significantly, without addressing the negative effects created by the distortions.

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Many urban economists have argued against containment policy, pointing to its social cost and its unconvincing environmental advantages. Edward L. Glaeser and Matthew E. Kahn write:[21]

> Sprawl has been associated with significant improvements in quality of living, and the environmental impacts of sprawl have been offset by technological change. Finally, we suggest that the primary social problem associated with sprawl is the fact that some people are left behind because they do not earn enough to afford the cars that this form of living requires.

For Glaeser and Khan, the main problem caused by sprawl is the potential lack of mobility that it creates for households at the bottom of the income scale. Obviously, densification through containment will not alleviate the situation of the poor, as it would likely increase housing prices.

Other economists have analyzed the extent of the urban area of specific cities that have been constrained by greenbelts. For instance, Martial Echenique, a British economist, modeled three urban regions in England, including London and the Wider South East Region,[22] all constrained by green-belts. Echenique's model analyzed three options: containment (i.e., continuation of green-belt policy); dispersed development; and contiguous market-driven expansion. His conclusions are unambiguous:

> The current planning policy strategies for land use and transport have virtually no impact on the major long-term increases in resource and energy consumption. They generally tend to increase costs and reduce economic competitiveness. The relatively small differences between options are overwhelmed by the impacts of socioeconomic change and population growth.

I have also quoted (in chapter 6) the work of Kate Barker and Paul Cheshire on the large social cost of London's greenbelt and its lack of evident environmental benefits.

Despite the overwhelming evidence that the preferred tools used by planners to constrain urban expansion are socially costly and do not provide any of the environmental and economic benefits expected, containment is still a widely advocated urban policy.

An Example of the Rationalization for Containment

More recently, containment policy seems to have been initiated and supported mostly by international institutions that gave a voice and designed a pseudotheoretical framework to better articulate the various antigrowth and NIMBY grassroots movements emerging from cities themselves. For instance, the World Bank, the Organisation for Economic Co-operation and Development (OECD), the

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World Resource Institute, UN Habitat, and the Sierra Club have all advocated compact cities and containment with various degrees of stridency.

I am not arguing that these institutions should not be concerned with an uneconomic use of urban land, as this is indeed often a serious problem. I suggest that they should address market distortions by advocating the improvement of the pricing of what is poorly priced (like transport and parking) or is still mostly unpriced (e.g., congestion, pollution, emissions of GHGs). By skipping the economic analysis that should be carried out in each individual city and in essence implying that all cities overexpand and that higher densities are always better than lower densities, they are providing a terrible disservice to their urban audience. Their systematic advocacy for constraining urban land supply results in inflated land prices, exacerbated housing shortages that particularly affect the poor, and in general stalled creation of many social amenities that require affordable urban land.

Compact City Policies: A Comparative Assessment,[23] an OECD report published in 2012, best summarizes the institutional rationale for containment. This report is representative of arguments found in many documents issued by other institutions advocating containment. The main diagnosis developed in the report is that, first, urban population is growing rapidly in developing countries and, second, that in cities where the urban built-up area is growing faster than the urban population, action is required to limit urban extension to make cities more compact.

The diagnosis to determine whether a city is consuming too much land is therefore quite simple in this analysis. If the rate of growth of urban land is larger than the rate of growth of population, the city consumes too much land, and containment should become the main feature of its development policy.

The OECD report goes further in its recommendation for containment:

> Throughout its long history, the compact city concept has evolved and enlarged its scope and policy objectives. From a simple urban containment policy **to protect the local natural environment or agricultural land from urban encroachment**, it has gradually acquired new policy objectives: **energy savings, quality of life and livability**, etc.

Containment—because of its many supposed side benefits—has become a quasireligious dogma. Planners continue to affiliate other benefits to the practice of containment, even when true causal links do not exist. The OECD report argues that the population of compact cities is closer to agricultural areas and therefore, "nearby farming encourages local food consumption and reduces the distance travelled by food, which also helps reduce CO_2 emissions."

We are getting farther and farther from the models developed by economists and closer to New Age mantras! It is ironic that Amsterdam, which is the iconic city for containment advocates, is located in a country that is the second largest

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world agricultural exporter after the United States! Obviously, all the food produced around Amsterdam is not entirely consumed by its inhabitants.

There are many ways in which advocating for containment could be counterproductive, even in one of containment's biggest claims: that containment could lower global warming. Two examples:

- One could imagine a city where photovoltaic panels on roofs linked to batteries would provide most of the power needed for residential consumption and urban transport. In such a city, high density and multistory housing should be forbidden as they would be unable to produce the photovoltaic energy required per household.
- Today urban transport might often be inefficient in using energy and consequently might be contributing excessively to global warming. However, the obvious solution is to follow Brueckner's advice, and to remove market distortions through better pricing of transport (rather than add additional distortions through containment). This in turn would stimulate technology change that would make urban transport use more low carbon energy.

Do the Built-Up Areas of Most Cities Expand at a Faster Rate Than Their Populations?

We have seen that economically successful cities need space to expand. Their success attracts more households and firms, and each of the newcomers adds to the floor space and land consumed by the city. In countries where the ratio between urban and total population is still low, like China and India, the need for urban spatial expansion is even higher than it is in countries where a large part of population is already urbanized, as in Latin America. As mentioned in the preceding chapters, urban households' rising incomes create more demand for floor space and land. The size of households decreases, but they consume more floor space per capita. Higher-income households create a demand for more commercial and cultural facilities, therefore more floor space and more urban land. The standard urban model, described in chapter 4, suggests that cities with increasing incomes and a low rate of urbanized population would need large areas to expand as the quantity of urbanized land per capita is bound to increase. In chapter 4, we have seen the example of Tianjin, China, where over 12 years the consumption of land per person had increased by 34 percent, the population increased by 22 percent, while the built-up area increased by 63 percent.

The recent work conducted by my NYU colleague Solly Angel with the Urban Expansion Project[24] at the Marron Institute confirms the predictions of the standard urban model in most of the world's cities. As part of this work, Angel and his team have published an *Atlas of Urban Expansion* showing how the populations

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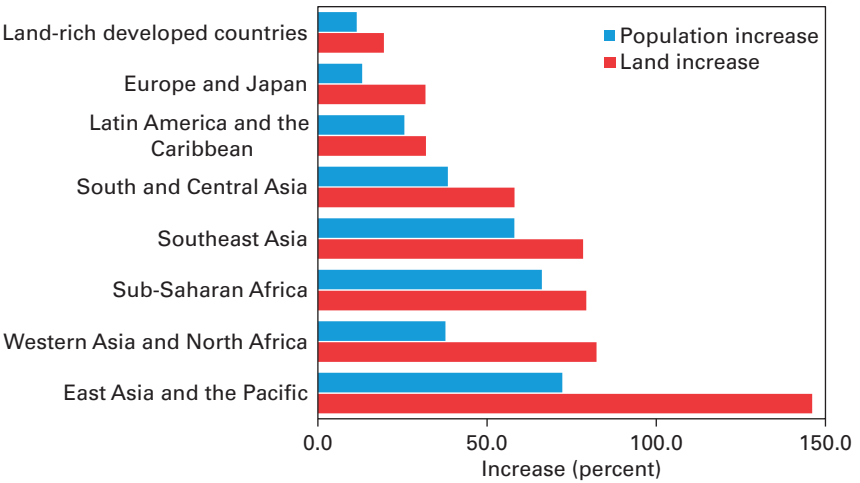

Figure 7.7
Average increase in population and built-up area in a sample of 200 cities between 2000 and 2013, by region. *Sources*: *Atlas of Urban Expansion 2016*, Marron Institute, New York University; UN Habitat, Lincoln Institute of Land Policy.

and built-up areas of a sample of cities of 100,000 people or more have grown during the past 25 years (1990–2014). The *Atlas of Urban Expansion—2016 Edition*[25] focuses on the land converted to urban use over the past 14 years in a global representative sample of 200 cities. The results by region provided by the Atlas are summarized in figure 7.7. In the cities of every region, on average the urban built-up area has grown faster than the population, resulting in an increase in the consumption of land per person over the period of study. In the East Asia region, where cities and income developed the fastest, the average increase in urban land has been twice as large as the increase in population, resulting in an average increase in land consumption per person of about 30 percent.

Implications of Containment Policy

Containment policy has only one measurable indicator: the difference between the rate of growth of the population and of the built-up area. If this difference is positive, containment is successful; if the difference is negative, it is not successful.

Containment policy, therefore, implies that as a city develops, its current built-up density should stay constant or increase—so that the population growth rate would be equal to or higher than the built-up area growth rate. In other words, a decrease in land consumption per person is always better than an increase.

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This implies that the allocation of land for urban expansion is no longer related to income, cost of transport, and price of agricultural land, but simply mechanically linked to the rate of growth of the population.

Let us review where and when variations of average urban densities occur.

Is It Possible for Urban Populations to Grow at the Same Pace as the Built-Up Area?

The need for containment, according to its advocates, is demonstrated when the growth rate of a city's build-up area is growing faster than its population. Cities that adopt a containment policy should therefore try to limit the land area they use for expansion in a given period in such a way that within time interval t_1 to t_2 the ratio between the population and the built-up area remain equal to a constant K, as shown in equation 7.1.

So if the city's population grows by 10 percent in the interval between t_1 and t_2, then the built-up area also will be limited to growing by 10 percent or less.

However, the whole purpose of cities is to increase the welfare of the population. This welfare is expressed in terms of increased income, and therefore in increased residential floor space consumed. With increased income households consume more floor space used by community facilities like school and neighborhood parks and amenities like commerce and services.

Even in very affluent cities like New York, London, and Paris, planners are concerned about housing overcrowding, too few affordable dwelling units, too small schools with too large class sizes, and lack of community facilities and neighborhood open space. Most urban citizens consider that the creation of new libraries, museums, theaters, and concert halls is highly desirable. New services emerge, like indoor gyms. As incomes increase, firms also tend to consume more floor space per worker. Sweatshops are replaced by spacious factories. Office buildings include more meeting rooms and more office space per worker.

Consequently, as incomes increase, the consumption of total floor space per person also increases. This increase is not due to extravagant consumption but to

Equation 7.1

Containment policy often implies that the following condition be met:

$$\frac{P_2}{P_1} = \frac{A_2}{A_1} = K, \tag{7.1}$$

where P_1 and P_2 are the population at times t_1 and t_2, respectively; and A_1 and A_2 are the built-up areas at time t_1 and t_2, respectively.

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the very raison d'être of cities. Even the stricter containment advocates would agree with the desirability of increasing total urban floor space per person as population and incomes increase.

However, new increased floor areas need to be built over land. Evaluating the quantity of land that this new floor space will require is what separates containment planning from market-driven planning. Under containment, the built-up area of a city should not increase faster than its population. Under the market-driven approach that I advocated in the preceding chapter, it is the price of land that determines the amount of land consumed per person, and by extension how much land should be developed.

Market-driven land development allocates the new floor space to be built in new development zones (greenfields), or by adding new floor space to existing built-up areas, either by replacing existing buildings by taller ones or by using more intensively already developed land (for instance, by building "granny flats" in backyards). The allocation of new floor space between greenfields and existing built-up area is determined by land prices and construction costs. The height of a building is determined by land prices in various locations.

Containment-driven land development from the start puts an upper limit to the area of greenfield that can be developed. Putting a limit on greenfield development increases the price of land in the entire city, and therefore would tend to favor taller buildings in both the existing built-up areas and the greenfield development.

Let us explore the spatial consequences on the development of a city when containment planning, rather than market prices, is used to allocate land for urban extension. It is possible to calculate the change in building height, or rather in FAR that would be required to accommodate an increase if floor area consumption when the conditions of equation 7.1 are strictly met (equation 7.2).

Therefore, to satisfy a containment policy, where the built-up area is constrained to grow at the same rate as the population, the built-up floor area ratio between time t_1 and t_2 should grow at the same rate as floor area consumed per capita during the same period. For instance, if the floor area per person grows by 30 percent, then the average floor area ratio has also to grow by 30 percent to allow the built-up area to grow at the same rate as the population—as required by the containment policy. If the average floor area ratio grows at a slower pace than the floor area per capita, then the total built-up area will grow faster than the population and the goal of the containment policy will not be met.

The imposed parity between the rate of growth of the population and the built-up area has an unintended impact on the shape of the city and in particular on its density profile.

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Equation 7.2

A city total built-up area A can be defined as a function of its population P, of the floor area consumed per capita Flc and of the built-up floor area ratio Far:

$$A = \frac{Flc}{Far}.$$

The built-up floor area ratio (A) is the ratio between the total floor area of a city (Far)—aggregating all floor area, residential, commercial and industrial—and the total built-up area (Flc)—including private lots, roads, and small parks, as defined in chapter 3.

To assess the impact of containment policy on a city shape, assume that the floor area per capita will increase between t_1 and t_2, reflecting improved housing and more amenities, but that the rate of increase of the built-up area will be strictly controlled by containment policy to be equal to the rate of increase of the population. We will then determine the gross floor area ratio of the city at time $\boldsymbol{t_2}$ as the dependent variable.

Between t_1 and time t_2 then to satisfy equation 7.1, we should have

$$\frac{Far_{t1}}{Flc_{t1}} \cdot \frac{Flc_{t2}}{Far_{t2}} = 1,$$

and therefore,

$$\frac{Flc_{t1}}{Flc_{t2}} = \frac{Far_{t1}}{Far_{t2}}. \tag{7.2}$$

Imagine a city whose mayor decides to adopt a containment policy. The city's current built-up area is equal to S. The projected rate of growth of the population g will allow this area S to grow by an additional area $P = S \cdot g$.

Because the population density should remain constant to maintain the containment requirement, any increase in floor consumption should be provided by a proportional increase in the FAR.

The average floor area ratio within S will not be able to grow much, as it would require the demolition of existing buildings to replace them with taller ones. This is a slow process. The bulk of the new FAR will have therefore to be built within the perimeter of P using a FAR much higher than the one within S, as the area of P is fixed in advance by the policy. This would result in densities being higher in the periphery P than in the more central area S, contradicting all empirical and theoretical evidence we have discussed in chapters 3 and 4 for the standard urban model.

When containment policy is applied to a city, the main result is to increase both land and floor prices. The growth of floor space consumption envisaged in the scenario above would not really take place. With increasing land and floor prices,

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the increase in residential floor area per person will likely not happen; neither would the construction of pre-K schools or the new restaurants that increases in household incomes would have made possible.

Cities whose land supply is constrained by topography, like San Francisco, New York, Hong Kong, Vancouver, Sydney, and Auckland, all have high price—income ratios (as have we have seen in chapter 6). The containment policy, when it is enforced, has the same impact as topographic constraints.

This spatial outcome is not surprising. We have seen that the FAR of a building is not subject to design but is a real estate outcome. Buildings have high FARs where the unit price of land is expensive compared to the unit cost of construction, and it is low when the opposite is true. Proponents of containment, arbitrarily constraining the land area to be developed, are acting like planners in a command economy.

In market-driven cities, as we have seen in chapter 4, high densities and high land values are found in the highly accessible city center, while lower densities and lower land values are found in the periphery. Containment policy, if strictly applied, would result in a reverse density gradient compared to the standard urban model.

Cities with reverse density gradients do exist, for instance, Moscow in 1990 and Johannesburg under apartheid. All such cities were built without land markets. Interestingly, the density profile of Portland, Oregon (a city renowned for its "Urban Growth Boundary" containment strategy) that I measured in 1990, also shows an increase in density toward its periphery.

Is an Increase in Land Consumption a Sign of Wasteful Use?

Supporters of containment policy are concerned about an excessive use of urban land per person. However, to my knowledge, no containment policy advocate has ever defined what area per person would constitute an efficient consumption of land. Urban land consumption per person varies widely from one city to another, often by more than an order of magnitude. Figure 7.8 shows the change in average urban land consumption per person in cities grouped by regions between 2000 and 2014. In all regions, the consumption per person has increased significantly.

Other Objective Functions: Is Sustainability an Objective Function for a City?

Currently, the planning profession and the popular press are formulating guiding principles for the development of cities expressed as a single qualifier that is variously expressed as cities should be "sustainable," "resilient," and "livable." Practi-

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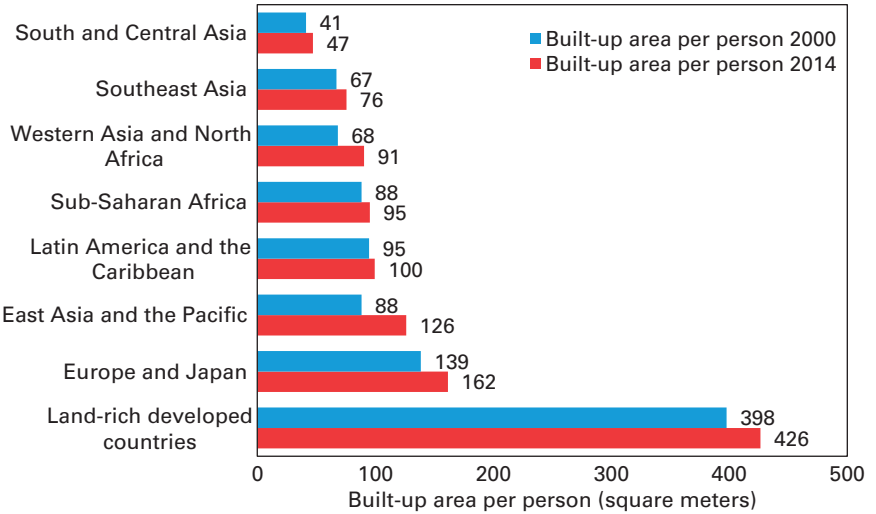

Figure 7.8
Urban land consumption per person between 2000 and 2014, by region. *Sources*: *Atlas of Urban Expansion 2016*, Marron Institute, New York University; UN Habitat, Lincoln Institute of Land Policy.

cally every urban planning department in universities all around the world has added "Sustainable" to their title. For instance, Oxford University offers a Master of Science in Sustainable Urban Development.

Is sustainable development different from just development? And could being sustainable guide the design of cities better than market mechanisms can?

In 2015, the United Nations proposed 17 Sustainable Development Goals, listed in figure 7.9, that must be achieved by 2030. It is difficult to disagree with any of these goals. Then, could they be used as the starting point to develop an objective function to design a city? The only goal mentioning cities explicitly is goal 11: Sustainable Cities and Communities. This Sustainable Development Goal seems to be an unfortunate kind of circular reference and is clearly unable to guide us. Let us then select two goals that might be applicable to cities, goal 1 (No Poverty) and goal 7 (Affordable and Clean Energy). Let us try to develop quantitative objectives to clarify these goals when applied to cities.

Countries with rapidly developing economies, like China and India, are running into the dilemma of choosing between the goals of No Poverty and Affordable and Clean Energy. So far it seems that they have opted to privilege No Poverty combined with Affordable Energy while postponing the Clean Energy component. Indeed, the available technology does not yet allow most poor countries with abundant coal resources to have affordable clean energy.

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United Nations Sustainable Development Goals

1. No poverty
2. Zero hunger
3. Good health and well-being
4. Quality education
5. Gender equality
6. Clean water and sanitation
7. Affordable and clean energy
8. Decent work and economic growth
9. Industry, innovation, and infrastructure
10. Reduced inequalities
11. Sustainable cities and communities
12. Responsible consumption and production
13. Climate action
14. Life below water
15. Life on land
16. Peace, justice, and strong institutions
17. Partnership for the goals

Figure 7.9
UN Sustainable Development Goals.

Neither the Chinese or Indian government is willing to wait for affordable clean energy technology to start increasing their electricity production. Have they been right in their prioritization? Nobody knows. The environmental cost of their policy is obviously high, but keeping millions of people in poverty while waiting for cheaper renewable energy might have an even higher social cost. There is no objective function as there is for the design of bridges.

The choice between affordable and clean energy is purely political. Reducing poverty now using affordable polluting energy or waiting for the availability of affordable clean energy to reduce poverty in the future is a typical trade-off that politicians must make. There is no computable optimum, only choices.

Conclusions

The Problem with Designing New Cities

We may use science to predict what might happen. We are unable to scientifically define what should happen. This is the main problem with urban planners wanting to substitute their judgment for the self-organization of markets. They become messianic, like the proponents of containment. Their proposals are based on dogma: compact is better than not compact, bicycles are better than motorized transport. Planners, like economists, should just tell politicians "if you do this,

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that will likely happen." They should provide several options. The choice among options is political or possibly ideological. It is not the place of planners to make this choice. Planners may have personal preferences for a type of city—personally, I prefer to live in dense cities like New York and Hong Kong—but my personal preferences are irrelevant when providing technical advice to a mayor. A quotation[26] from Yuval Harari should guide planners when giving technical advice to mayors:

> Science can explain what exists in the world, how things work, and what might be in the future. By definition, it has no pretensions to knowing what should be in the future. Only religions and ideologies seek to answer such questions.

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