Urban Economics

Lecture 4: Urban Sprawl and Land-Use Controls

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Outline

- **In this lecture, we analyze the effects of some market failures and the effects of policies designed to correct for these market failures**
  - Here the market failures are related to and cause urban sprawl, i.e. the spatial expansion of urban areas
- **The analysis is conducted using the monocentric city model**
- **The lecture will follow Brueckner's Chapter 4**

Market failure

- **A market failure arises when the decentralized activities of economic actors fail to achieve the optimal outcome from society's point of view**
  - A polluting factory does not take into the account the damage that pollution creates, and thus, pollutes too much
  - Similarly, an individual driver does not consider the detrimental effect that driving has on local air quality or the time cost s/he exerts to other drivers during rush hour
  - Both are examples of negative externalities (or spillovers)
- **Are there market failures in the economic process that determines the spatial size of cities?**

Market failure related to open-space amenities

- **What if people enjoy open-space benefits from farmland?**
- **The landowner rents the land to a developer whenever the developer outbids the farmer, i.e. $r > r_A$**
- **However, the society represented by a "social planner" would want the landowner to consider the open-space benefit *b* in the decision-making**
  - The social planner would want the land converted into urban use only if urban rent would compensate for both the lost agriculture-rent and the lost open-space benefit, i.e. $r > r_A + b$
  - From the planner's point of view, the boundary of the city should be set at distance x where $r = r_A + b$

Socially optimal city in the presence of an open-space amenity

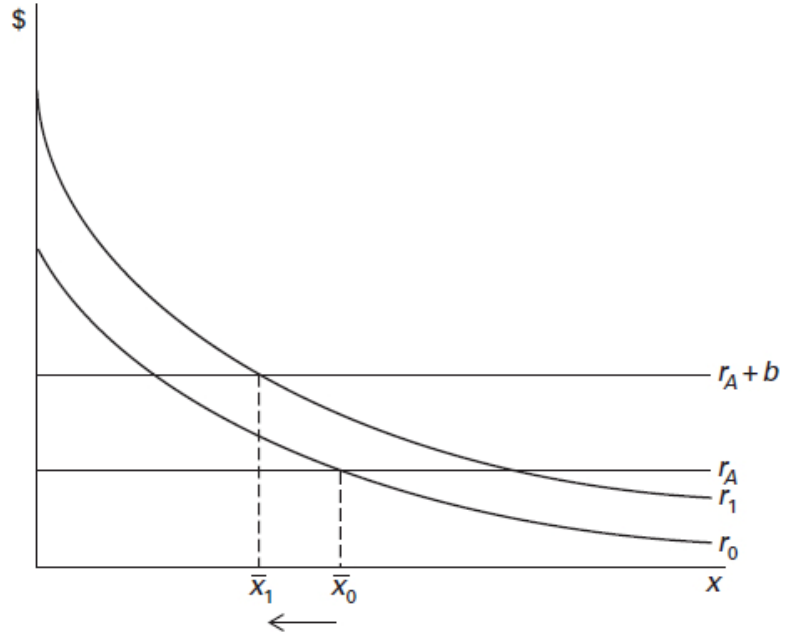


Figure 4.1

Open space externality.

- The socially optimal city would emerge if the agricultural rent would be $r_A + b$, instead of r_A
- This situation is depicted in the figure and is the same as analyzed before
- In the presence of an open-space amenity, the socially optimal city is spatially smaller than the city generated by the free-market equilibrium

How to reach the socially optimal size?

- **One way is to use the price system in the form of a tax on developed land (development tax)**
  - Suppose that the landowner must pay a tax of b to the government on each hectare of developed land that s/he rents to a developer
  - Then the net after-tax income for the landowner from developed land would be $r - b$
  - The landowner would switch land to urban use only if $r - b \geq r_A$
  - At the edge of the city, we have $r - b = r_A$ or $r = r_A + b$, which is the condition that determines the edge of the socially optimal city

Market failure related to traffic congestion

- **Congestion externality arises because the presence of a single extra car on a congested road slows down all the other drivers**
  - Since these congestion costs are borne by other drivers, no individual driver has an incentive to take them into account
  - The total social cost of an extra car entering the road is the private cost incurred by the extra driver plus the externality damage done to other drivers in the form of higher time costs
  - Each driver's extra cost may be small, but summing these costs over all affected drivers may produce a non-negligible total impact

Congestion charge

- **One solution is to charge the commuters a congestion toll or charge that is equal to the monetary value of the congestion costs they impose on others**
- **Let's assume that such a congestion toll is introduced**
- **What implications does this have for the urban spatial structure?**
- **The result is that the city shrinks**
  - Because commuting costs increase, urban residents choose to make shorter trips and prefer living closer to the CBD
  - This same result was obtained earlier when analyzing the effects of increasing commuting costs

Socially optimal city in the presence of congestion

- **Again, the city that emerged as the free-market equilibrium was too large, taking-up too much space**
- **Socially optimal city takes-up less space and people commute shorter distances on average**
- **Traffic may exert other types of externalities, such as pollution, and the congestion toll may serve as a (partial) solution to this problem as well**
  - But in general, you would want to target each externality directly
- **We will analyze congestion tolls more carefully later**

Urban growth boundary (UGB)

- **Both the development tax and the congestion charge led to a decrease in the cities' geographic size**
- **An alternative instrument to achieve this is an urban growth boundary (UGB)**
- **Instead of addressing the root cause of sprawl (like open-space or congestion externality), it addresses the symptom (excessive spatial expansion) by directly restricting land use**
- **In terms of the model, UGB imposes an upper limit on the distance to city's edge**

Effects of UGB

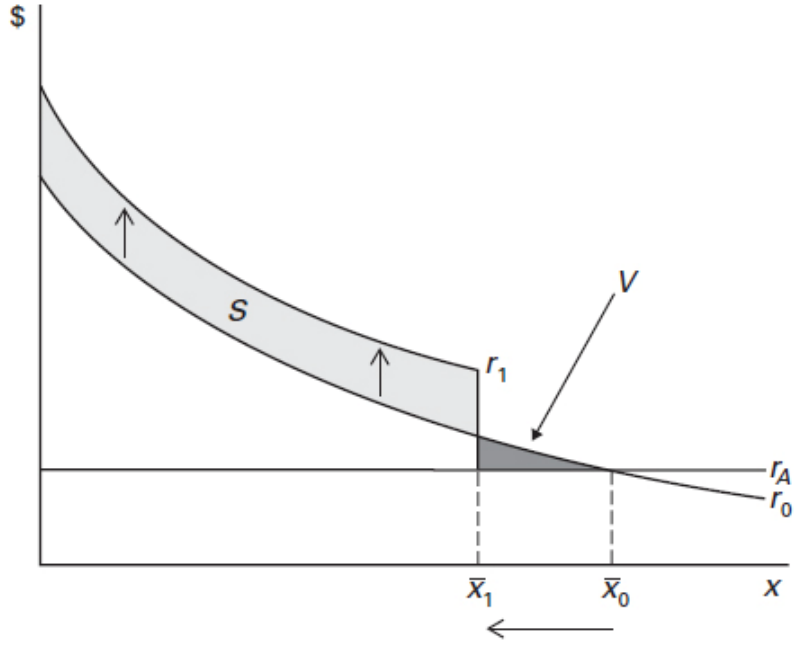


Figure 4.2

UGB enriches landowners.

- If the UGB is set as in the figure, it will have the same effect on urban structure as a development tax (when the tax is set so that the spatial size of city is the same)
- Urban land rent will increase as the now geographically smaller city has to fit its population into a smaller area

UGB vs. congestion toll

- **UGB reaches the same goal as the development tax as they both target the open-space externality**
- **However, it will not reach the same goal when the underlying problem is traffic congestion**
  - The UGB will decrease city size, but it will densify the city throughout, not cause a clear population shift toward the CBD
  - The congestion toll achieves this by directly targeting commuting costs

Political economy of UGB

- **Sometimes it is argued that the motive for UGB's is not to address market failures, but instead increase land prices**
- **According to this view, urban landowners have an incentive to restrict housing supply and they have political influence**
  - This will drive-up the price of land conferring capital gains to landowners, while increasing housing costs for renters
- **In the model, the landowners live outside the city (absentee landlords)**
  - This is of course unrealistic, but the message of the analysis does not change if the landowners live in the city themselves (e.g. homeowners)

Political economy of UGB

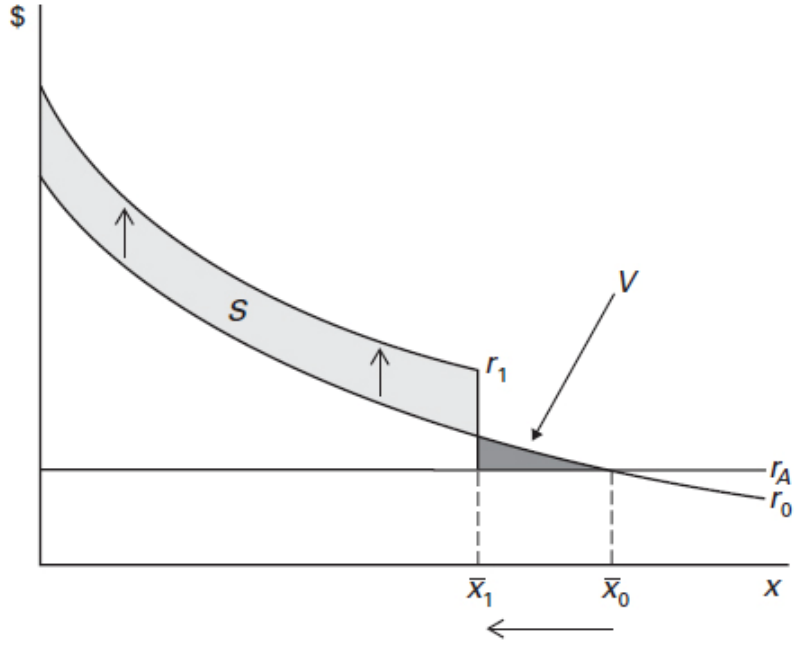


Figure 4.2

UGB enriches landowners.

- Due to the UGB, land prices in the city shift up from r_0 to r_1
- The additional rental income is the area S
- The UGB also force some of the land from urban to agricultural use leading to decrease in rental income from (area V)
- From the figure we can see that as long as $S > V$, the restriction is in the landowners' interests

Political economy of UGB

- **In this case, there are no open-space benefits, and the residents of the city are worse off, and the society is worse off as well**
- **If landowners have sufficient political power, a UGB may be introduced even in this case**
- **A more realistic model would have both renters and homeowners living in the city**
- **The homeowners would have similar incentives as landowners in this simpler model**

Building height and density restrictions

- **In addition to a UGB, cities implement many other types of building regulations**
- **One example is building height restrictions that may be either explicit or implicit**
  - Example: no building in the District of Columbia part of the Washington metro area can be taller than the U.S Capitol
  - In Paris, there are very few very tall buildings in the central city
  - The same is true in Helsinki
  - Also, London has several height restrictions designed to protect views to historic monuments and buildings

Example: protected view's in London

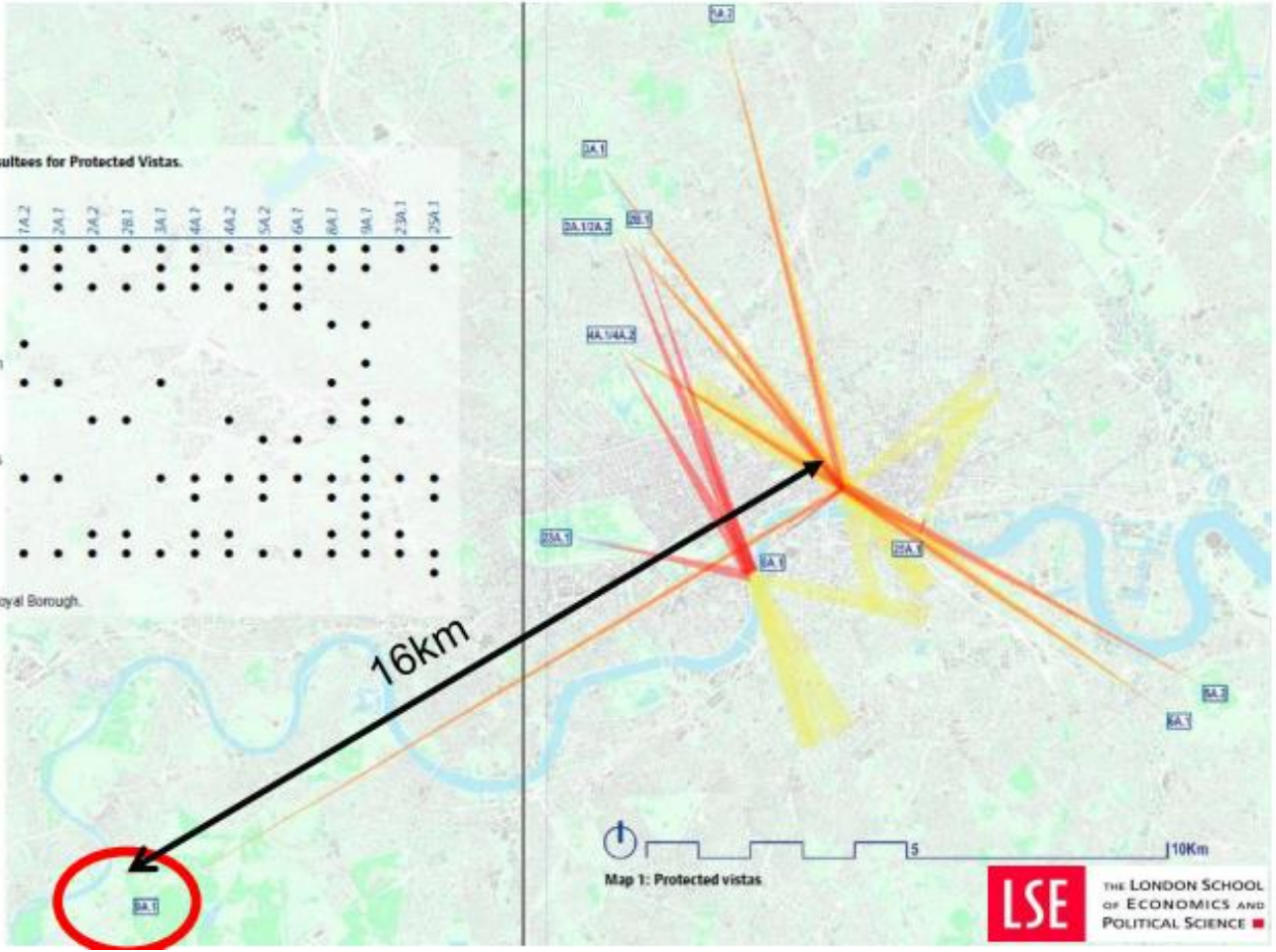
Table 2 – Statutory Consultees for Protected Vistas.

Viewing Location	1A.2	2A.1	2A.2	2B.1	3A.1	4A.1	4A.2	5A.2	6A.1	8A.1	9A.1	23A.1	25A.1
GLA	•	•	•	•	•	•	•	•	•	•	•	•	•
City of London	•	•			•	•		•	•	•	•		•
LB Camden		•	•	•	•	•	•	•	•				
LB Greenwich								•	•				
LB Hackney										•	•		
LB Haringey	•												
LB Hammersmith & Fulham											•		
LB Islington	•	•			•					•			
RB Kensington & Chelsea											•		
LB Lambeth			•	•			•			•	•	•	
LB Lewisham								•	•				
LB Richmond upon Thames											•		
LB Southwark	•	•			•	•	•	•	•	•	•	•	•
LB Tower Hamlets						•		•		•	•		•
LB Wandsworth											•		
City of Westminster			•	•		•	•			•	•	•	
English Heritage	•	•	•	•	•	•	•	•	•	•	•	•	•
Historic Royal Palaces													•

LB London Borough; **RB** Royal Borough.

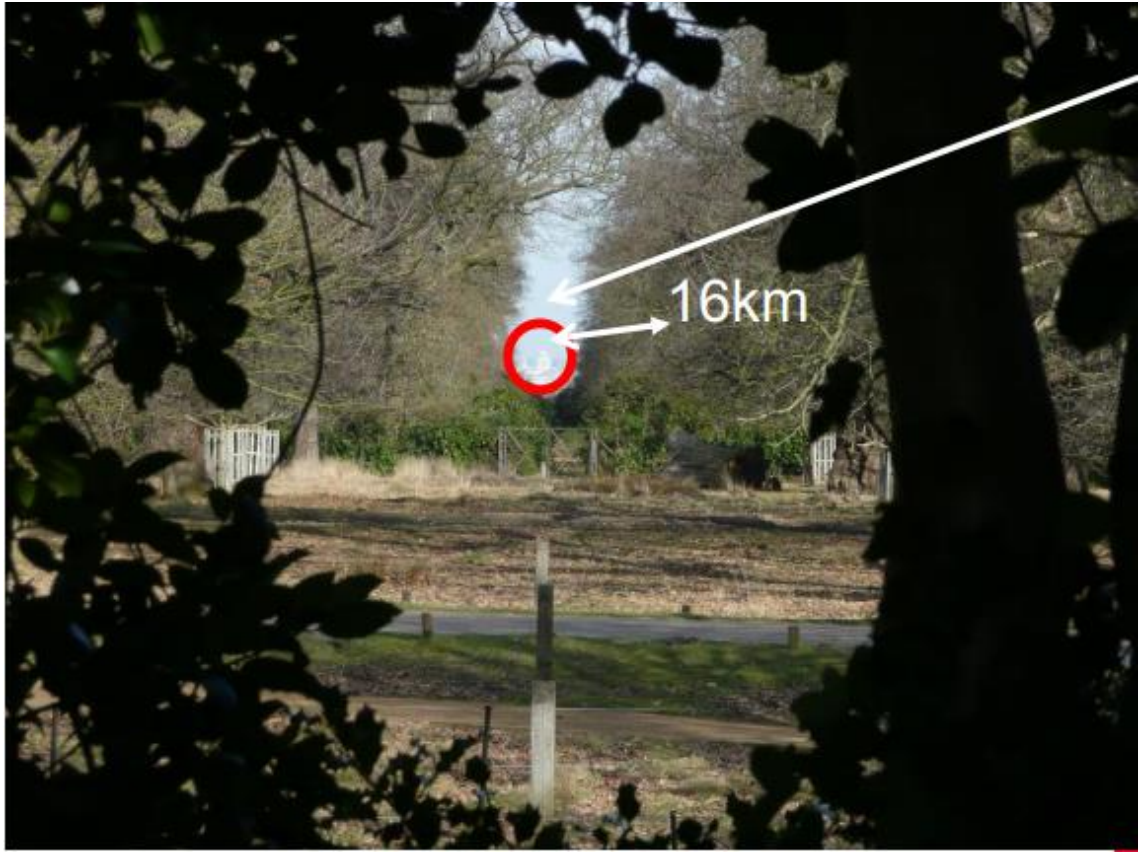
16km

Source: London View Management Framework (2012)



Source: Prof. Christian Hilber's Inaugural Lecture, LSE 21 March 2017

Protected view from King Henry VIII' Mound (Richmond Park)



Source: Prof. Christian Hilber's Inaugural Lecture, LSE 21 March 2017

Protected view from Westminster Pier to St Paul's Cathedral

https://upload.wikimedia.org/wikipedia/commons/c/c4/London_protected_views_map.svg

Helsinki skyline

Helsinki skyline

Floor area ratio restriction

- **Technically, height restrictions specify a limit on a building's floor area ratio (FAR)**
  - $FAR = \frac{square\ meters\ of\ floor\ space\ in\ the\ building}{lot\ area}$
- **If a building covers the whole lot area, floor space of each floor would equal the lot area**
- **A FAR restriction of 8 would then limit the height of the building to 8 stories**
- **If the building only takes up half of the lot, the implicit height restriction would be 16**

Effects of FAR restriction

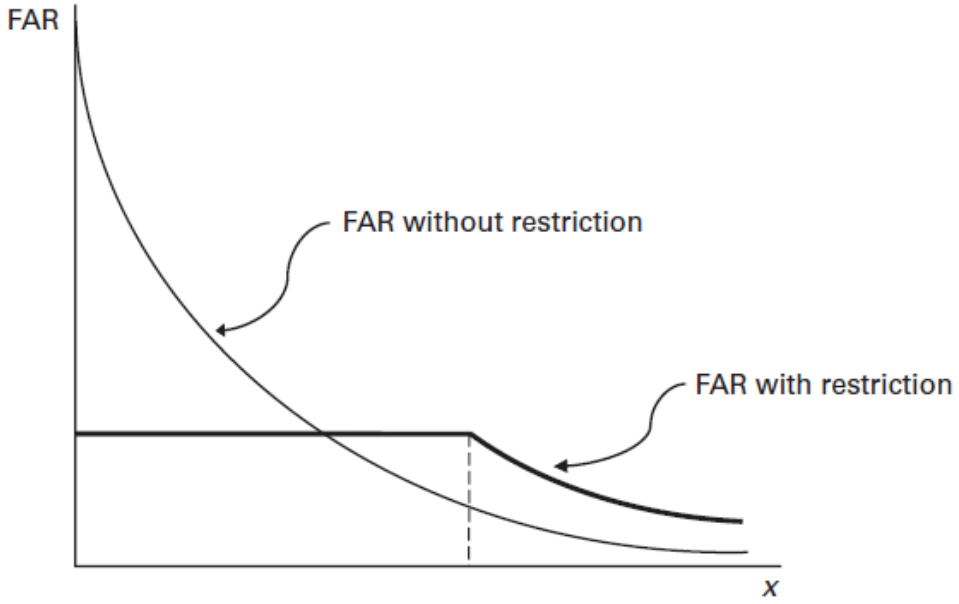


Figure 4.3

Effect of building-height restrictions.

- From the figure, we can see the FAR in different parts of the city with and without the restriction
- Height restrictions are binding in central part of the city where buildings would be taller without the limit
- But building height increases in the outer parts of the city
- The city also expands spatially

Effects of FAR restriction

- **The spatial expansion of the city is natural because the height limit reduces the land's ability to accommodate all the residents**
  - The city must expand to fit its population (which is fixed in this analysis)
- **Thus, the FAR restriction causes urban sprawl!**

Effects of FAR restriction

- **The FAR restriction increases the price per square meter of housing (*p*) in all locations**
  - This happens because there are fewer dwellings in central parts of the city, and they become relatively more scarce
  - Some households need to find housing somewhere else, which increases the demand for housing elsewhere causing the housing price to increase there as well
  - Higher housing price leads consumers to reduce dwelling sizes
- **Increase in *p* in more remote locations, will increase land rent *r* in these locations**
  - Leads to taller buildings and higher FAR

Why implement FAR or other density restrictions?

- **With housing more expensive and dwellings smaller, the height restriction makes the urban residents worse off**
- **For this to be desirable from a society's point of view, there must be some offsetting benefits**
  - For example, aesthetic benefits from preserving the historic character of central cities or preserving the city's skyline
  - What else? Also, are the benefits large enough to offset consumer losses?
- **Bottom line: restrictions, preservation etc. policies usually come with a cost to residents**

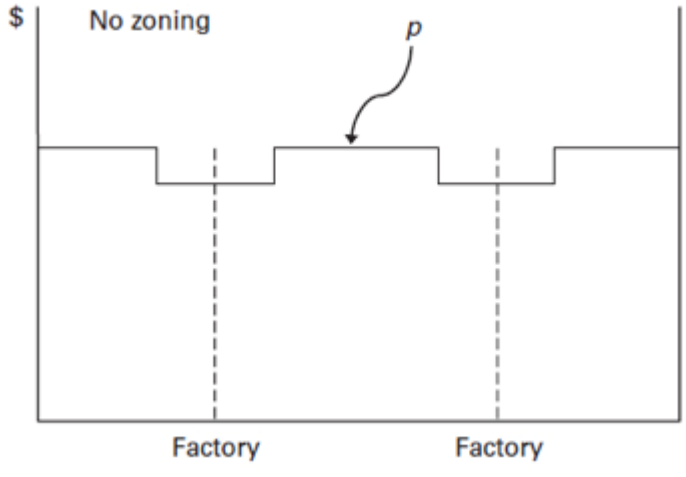
Other density restrictions

- **One popular restriction on density is the minimum lot size requirement**
  - Requires lots for single-family houses to be no smaller, than some threshold value
  - Limits the number of people per square meter, thus constraining density
  - Has similar effect on the spatial size of the city as height restrictions
- **In an open-city case with different income groups, this can also be used to keep the poor out of the city/municipality**

Zoning

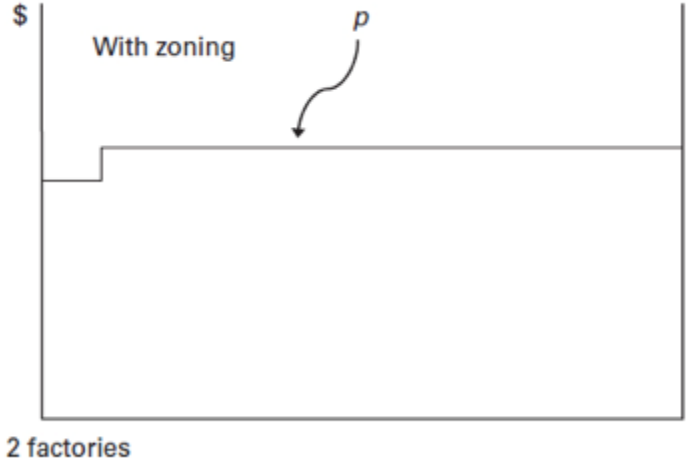
- **Zoning laws usually specify the type of land use allowed in a particular area (residential, commercial, industrial etc.)**
  - Idea is to separate different land uses with the goal of limiting the impact of negative externalities
  - E.g. polluting/noisy factories are not allowed to locate near residential or shopping areas
  - Large apartment buildings that cause congestion are not allowed to be build amid detached single-family houses

Location of factories



- Consider the location of two polluting factories in a city located in an island
- The housing price p is lower near the vicinity of the factories so that the households are not hurt by the nuisance
- However, landowners are hurt because land rent r is lower near the factories
- When the factories are located in separate locations, the land rent losses are large

Location of factories under zoning



- A well implement zoning law would require the two factories to locate in a place that would minimize the externality and the land rent losses
- In this island case, the location would be on the edge of the island
- With the factories located next to one another at the city's edge, the negative externality is reduced by 75 percent
- Highly simplified example, but illustrates to basic principle that can be applied to more realistic settings

Recap

- **Some market failures may cause cities to expand more than they should**
  - Open-space externalities and traffic congestion
- **The over-expansion can be addressed by price-based remedies**
  - A development tax in the case of open-space externalities and a congestion toll in the case of traffic externalities
- **Also, quantity-based remedies are available, e.g. UGB**
- **Policy-makers should recognize that excessively tight limits on urban expansion or density may reduce overall welfare**