Land economics, housing markets, and development finance

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Land economics

Buy land, they aren't making it anymore

—Mark Twain

What makes land valuable?

- Most land is not very valuable
- Some valuable land is valuable because of intrinsic features of the land
  - Natural resources
  - Harbors
  - Views
- But most valuable land is valuable because of what it is close to

What makes land valuable: urbanity

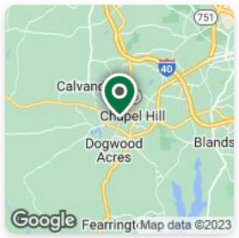
- The most valuable land is in urban areas, close to other things
- This determines the price of land, more than anything else

What makes land valuable: example 1

FOR SALE - ACTIVE

107 E Main St, Carrboro, NC 27510

$370,000	—	—	**2,614**
Est. $2,636/mo **Get pre-approved**	Beds	Baths	Sq Ft (Lot)

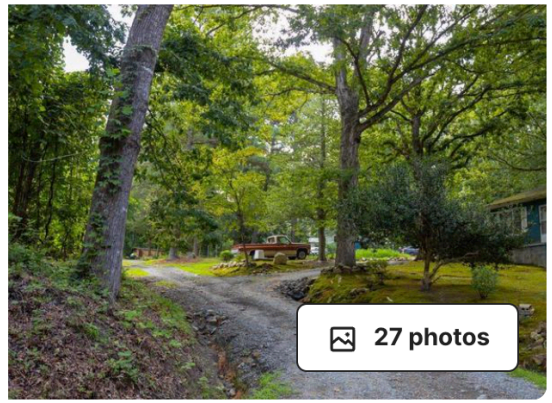


Go tour this home

SUNDAY	MONDAY	TUESDAY
12 NOV	13 NOV	14 NOV

$370,000 for 2,600 square feet = $6.2m/acre

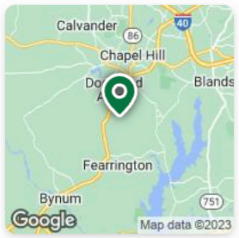
What makes land valuable: example 2



FOR SALE - ACTIVE

188 Cherokee Dr, Chapel Hill, NC 27517

$100,000	—	—	1.15
Est. $713/mo **Get pre-approved**	Beds	Baths	Acres (Lot)



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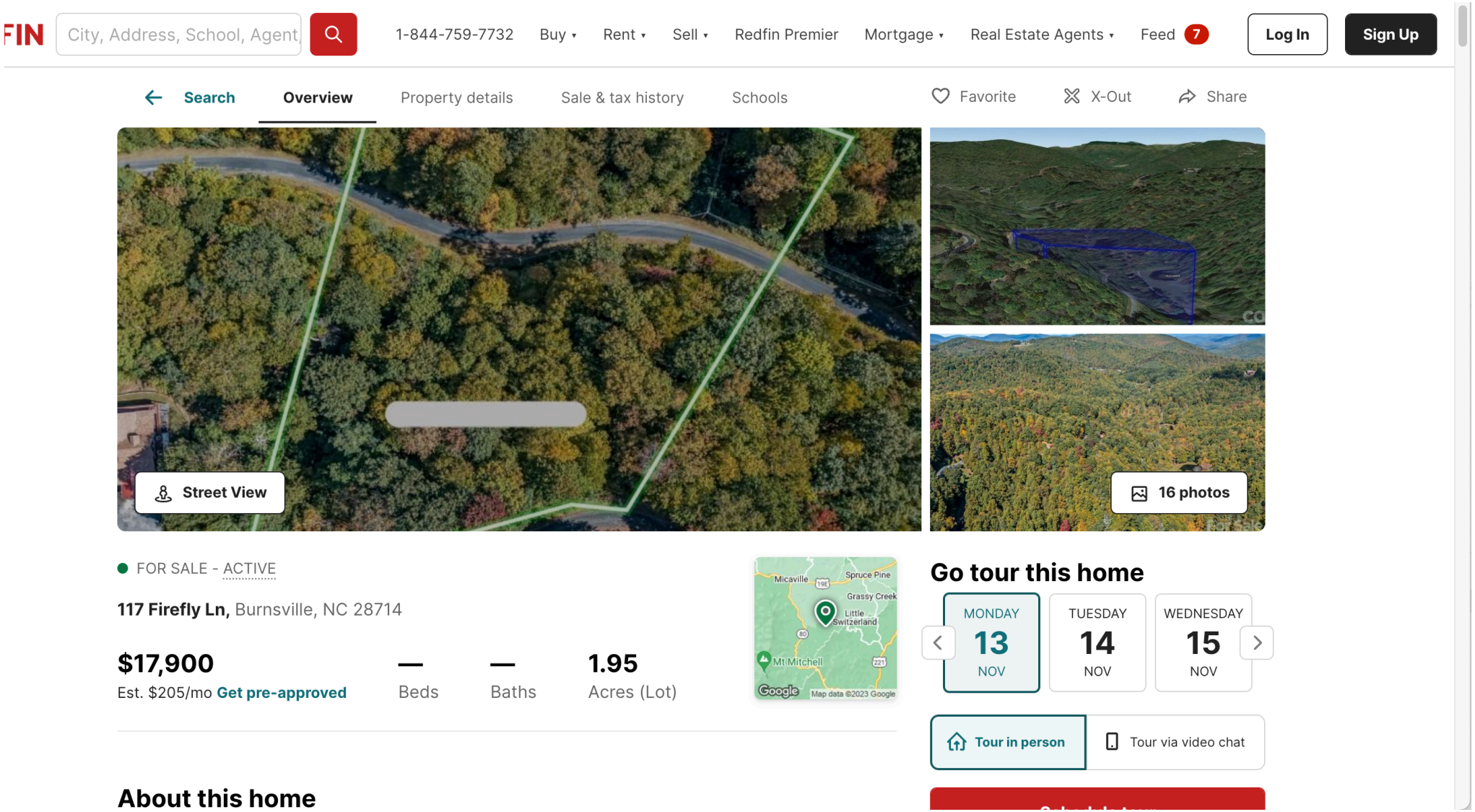
$100,000 for 1.15 acres = $87,000/acre

What makes land valuable: example 3

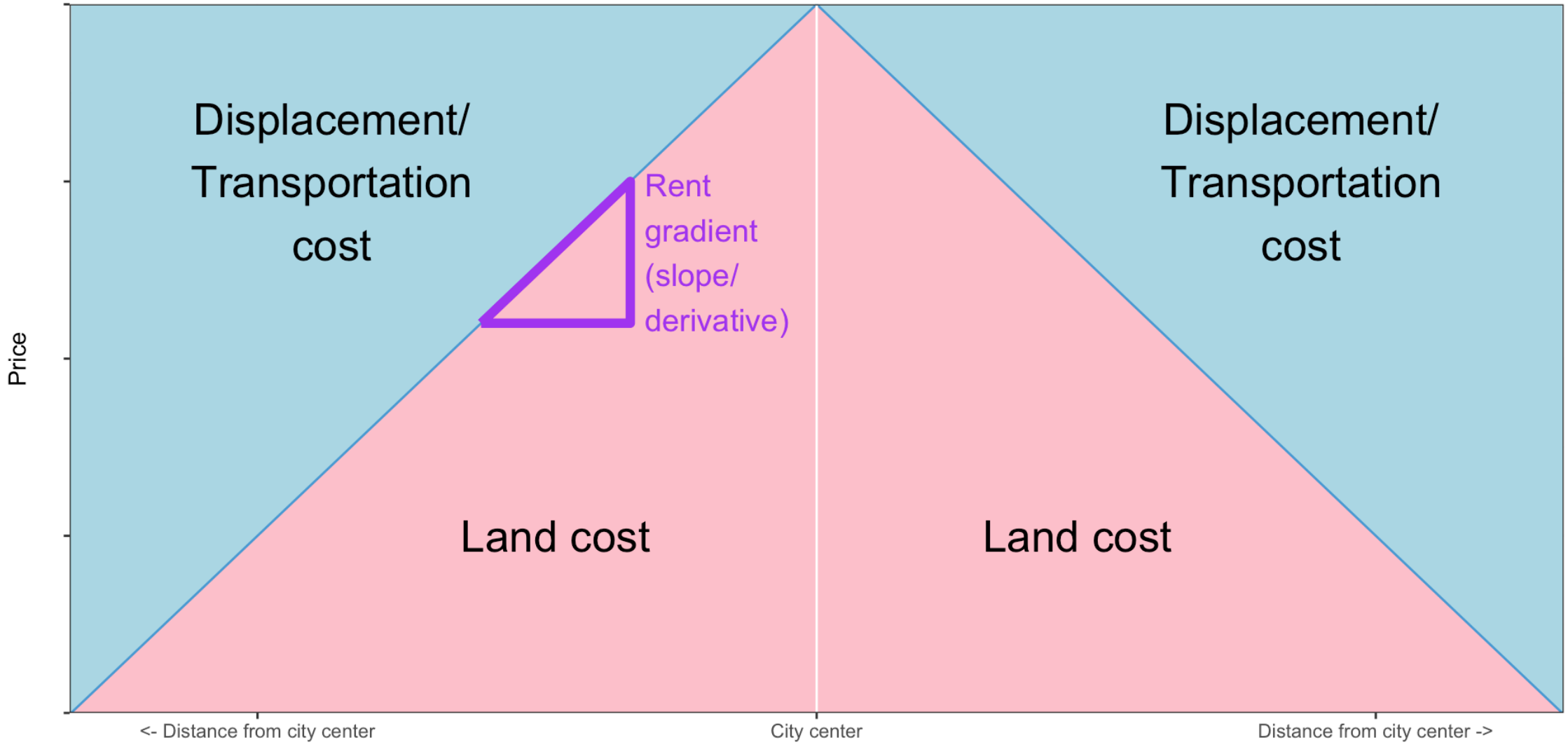


$17,900 for 1.95 acres = $9,200/acre

The monocentric city model

- The monocentric city model is a stylized model of land prices
- It considers a hypothetical city with a single city center where everyone works
- The city is laid out on a *tabula rasa* (Latin for blank slate)—no geographic/topographic features
- Also known as the *bid-rent curve*, Alonso model, or Alonso-Mills-Muth model

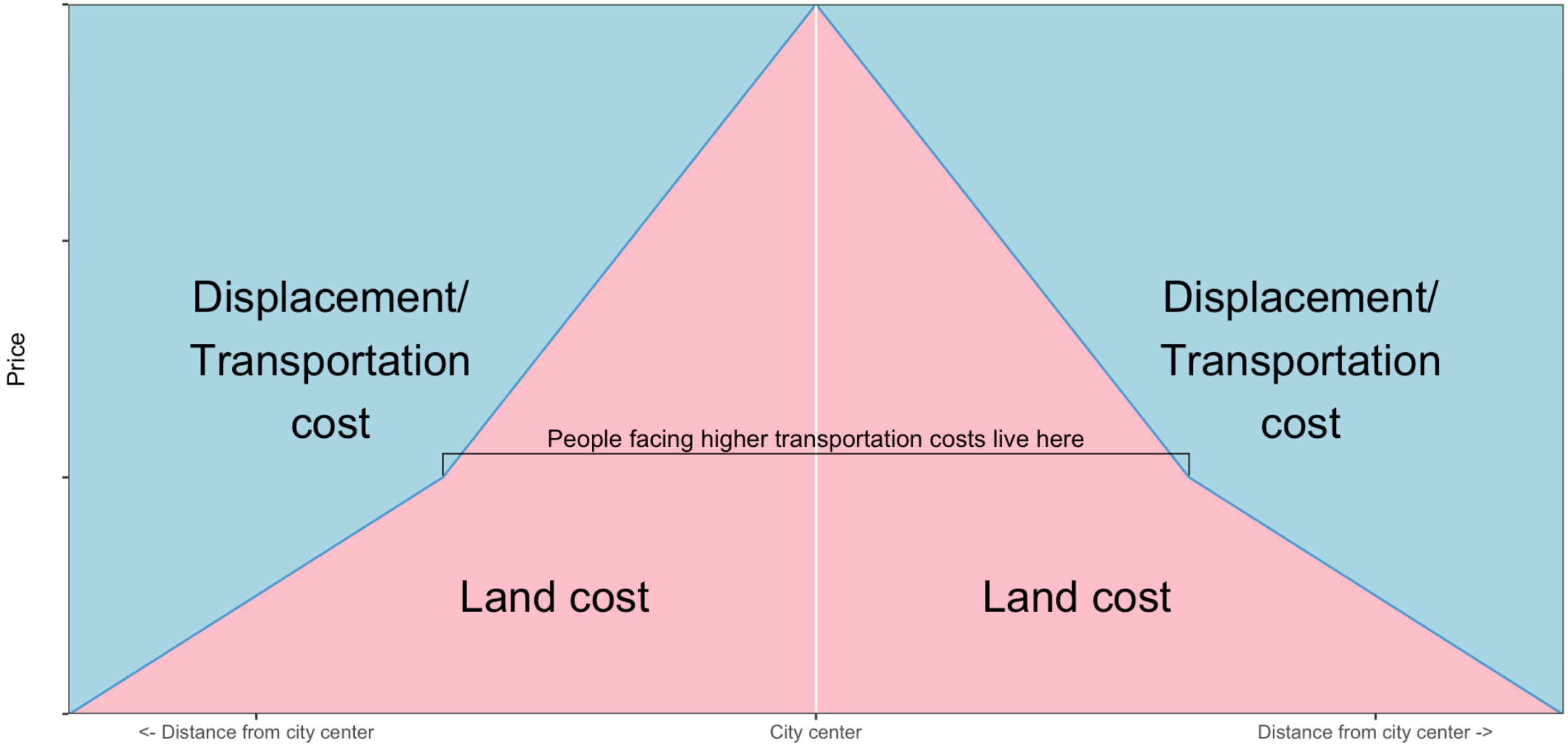
The monocentric city model: theory



Differing transportation costs

- If different people face different transportation costs, the people with the highest transportation costs will choose to live at the center
- Transportation costs include time, too
- People with a high *value of time* will work harder to minimize transport costs than others
  - We'll return to the concept of value of time when we talk about transportation engineering

Differing transportation costs: theory



Differing transportation costs: food for thought

- Why do wealthy people often live in the suburbs in the US? 🤔

Land-intensive land uses

Substitution of capital for land

Why are there tall buildings in Manhattan, NYC, but not Edison, NJ?

Manhattan, NYC, © Anthony Quintano

Edison, NJ, © Tom W. Sulcer

Substitution of capital for land: theory

- The value of *land* is very high at the center of the city, but what people are (usually) buying is *space*
- We can increase the *space* per unit *land* by building up
- But building up is expensive, so it only happens in high-land-cost areas
- In lower cost areas, it's cheaper to just buy more land

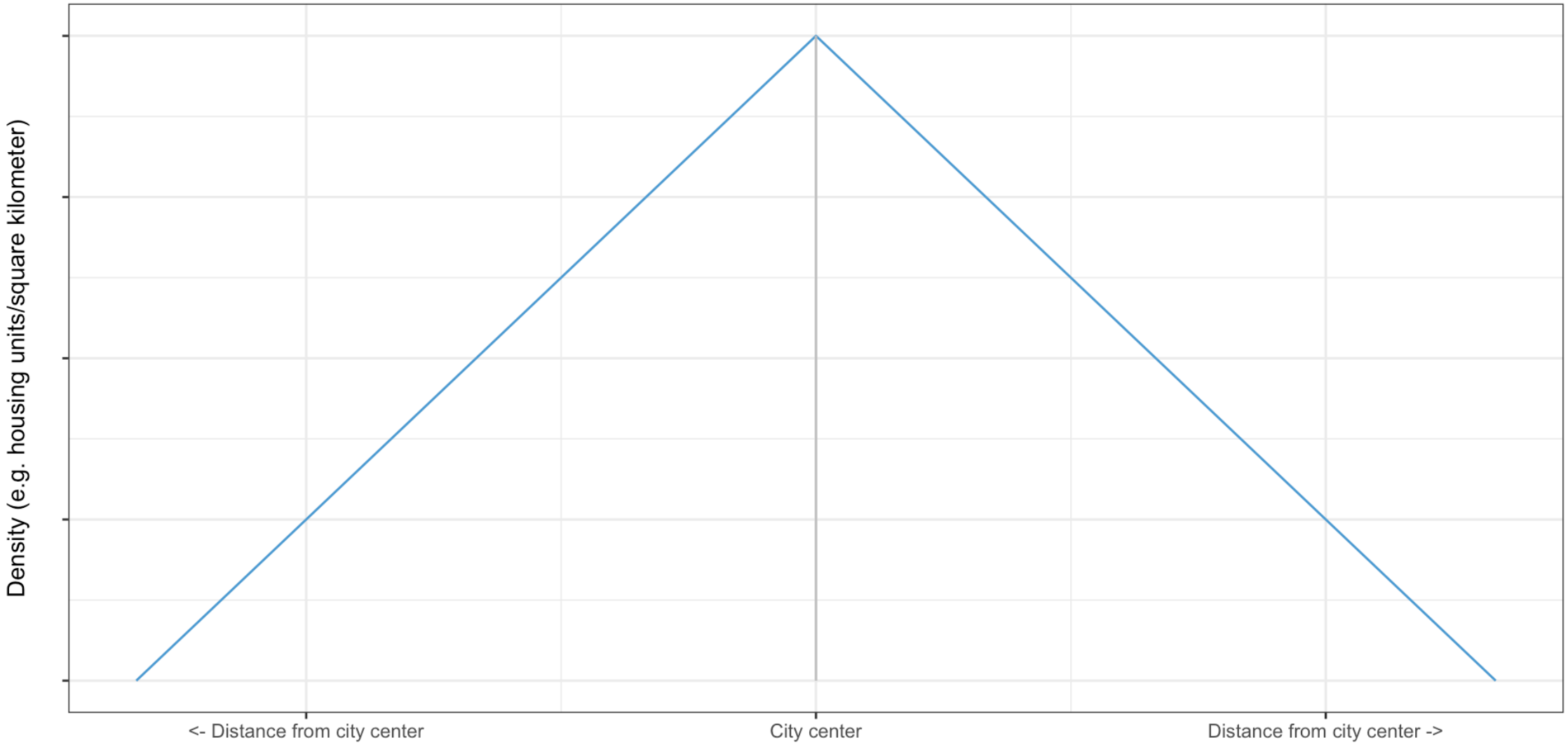
Notwithstanding this…

University Tower, Durham, NC, © Ildar Sagdejev

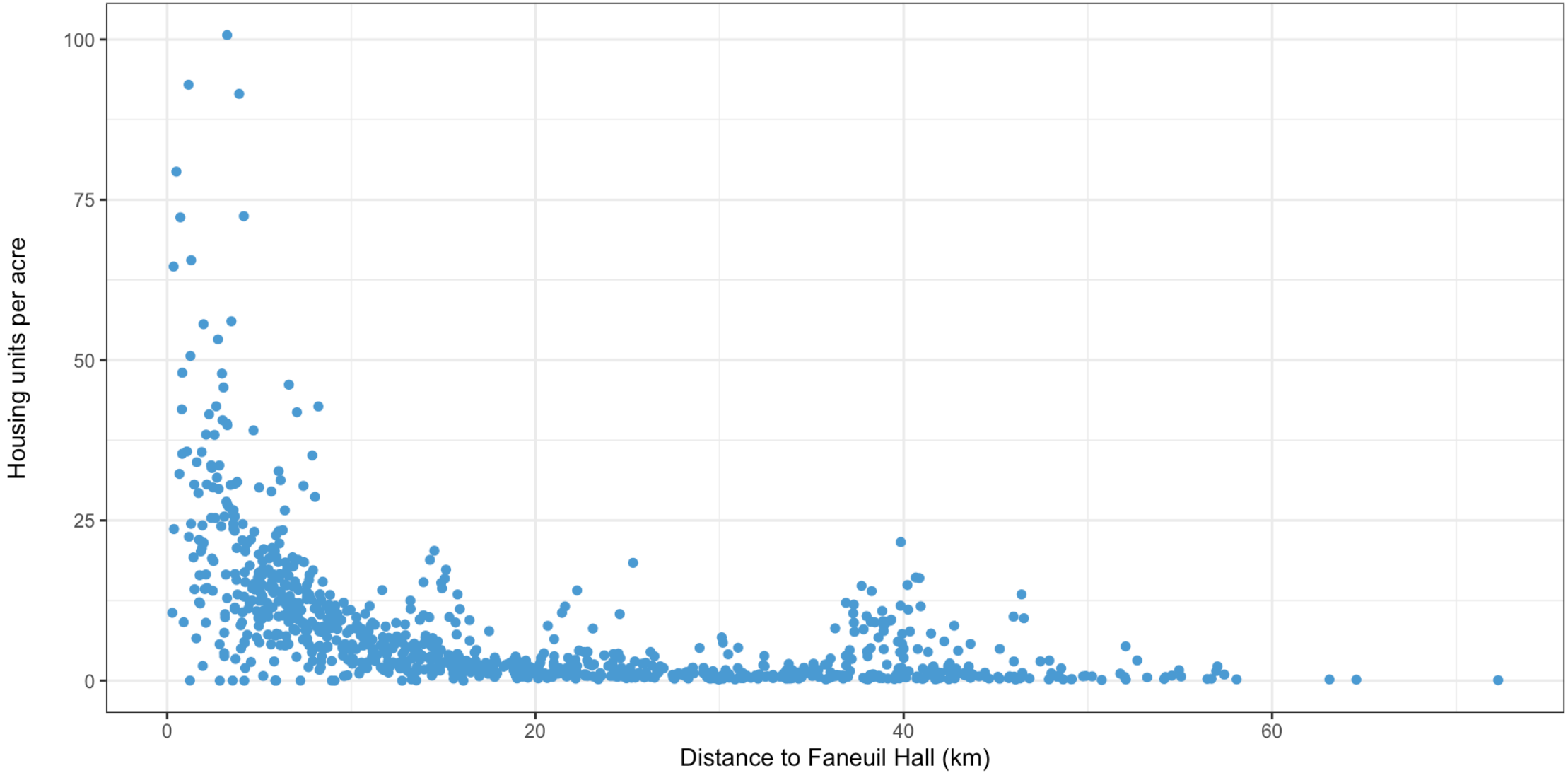
Density gradients

- The further you go from the city center, the less it makes sense to substitute capital for land, and the more low-density, low-value land uses you see (e.g. lawns)
- This is known as a *density gradient*

Density gradient, theoetically

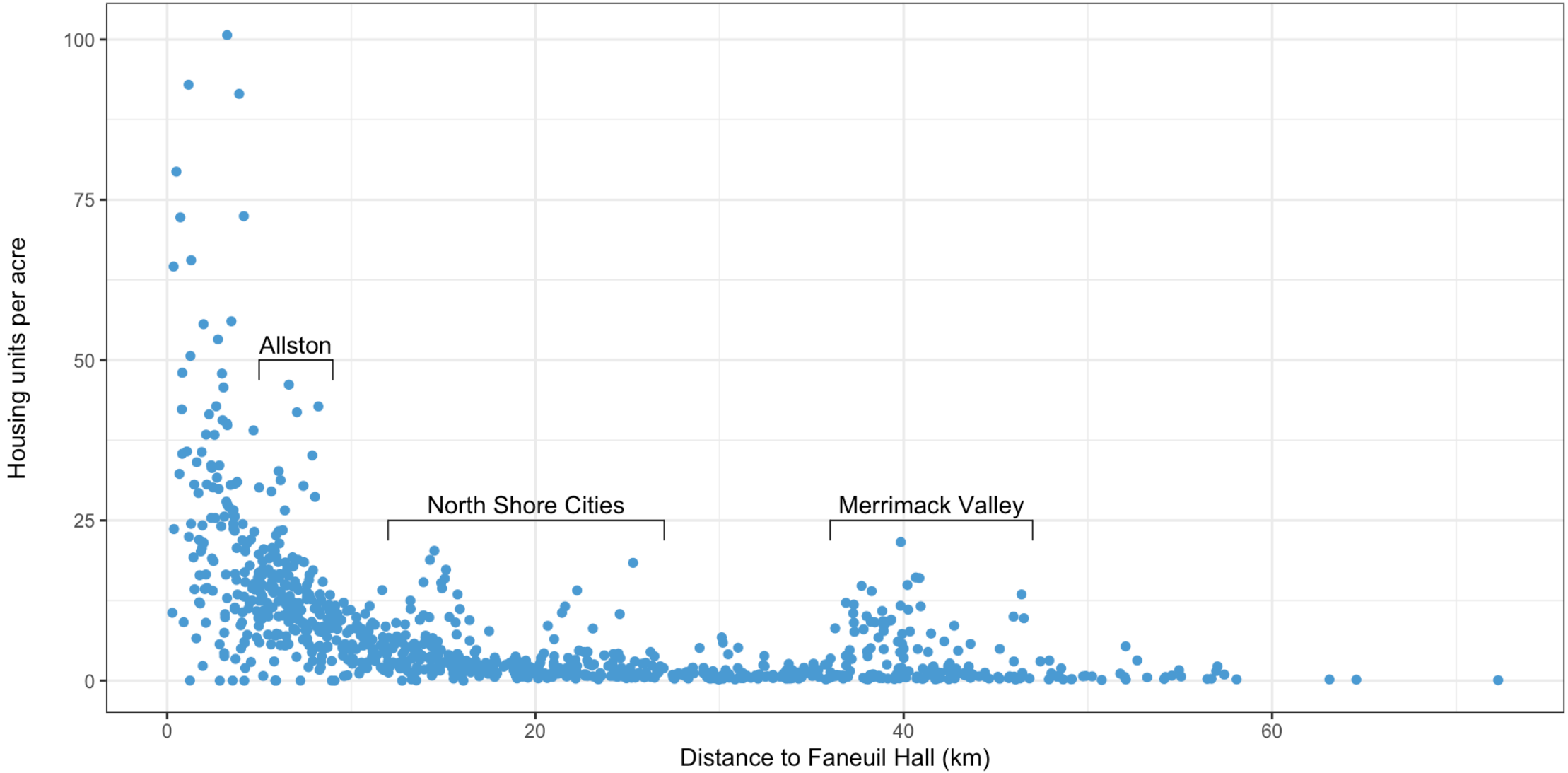


Density gradient, in real life



Density gradient, Greater Boston, MA (2020 decennial census)

Density gradient, in real life: exceptions



Density gradient, Greater Boston, MA (2020 decennial census)

Putting numbers on those prices

The closed city model

The open city model

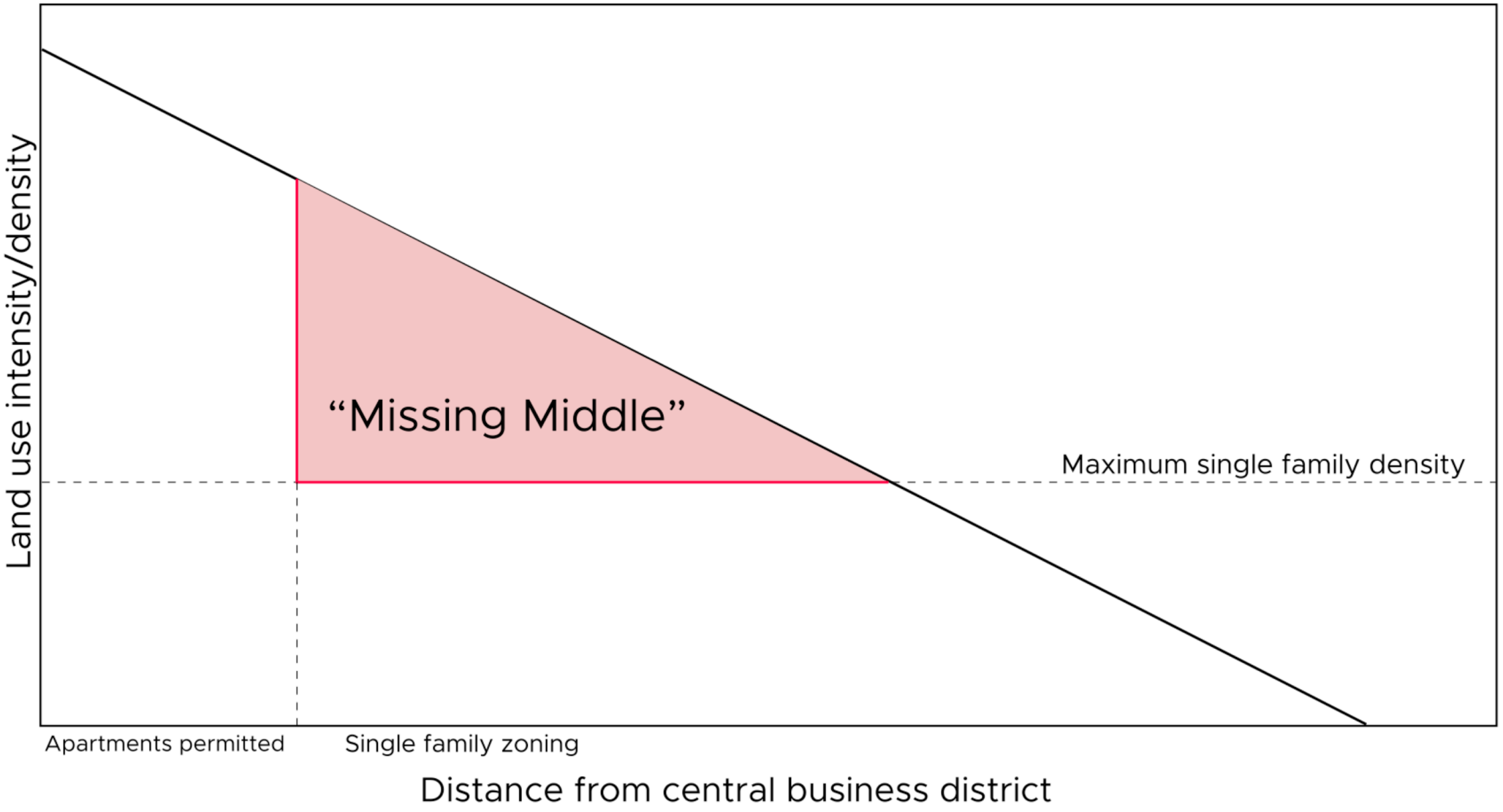
Which model is right?

Assume a can opener

- *All models are wrong, but some are useful*

— George Box

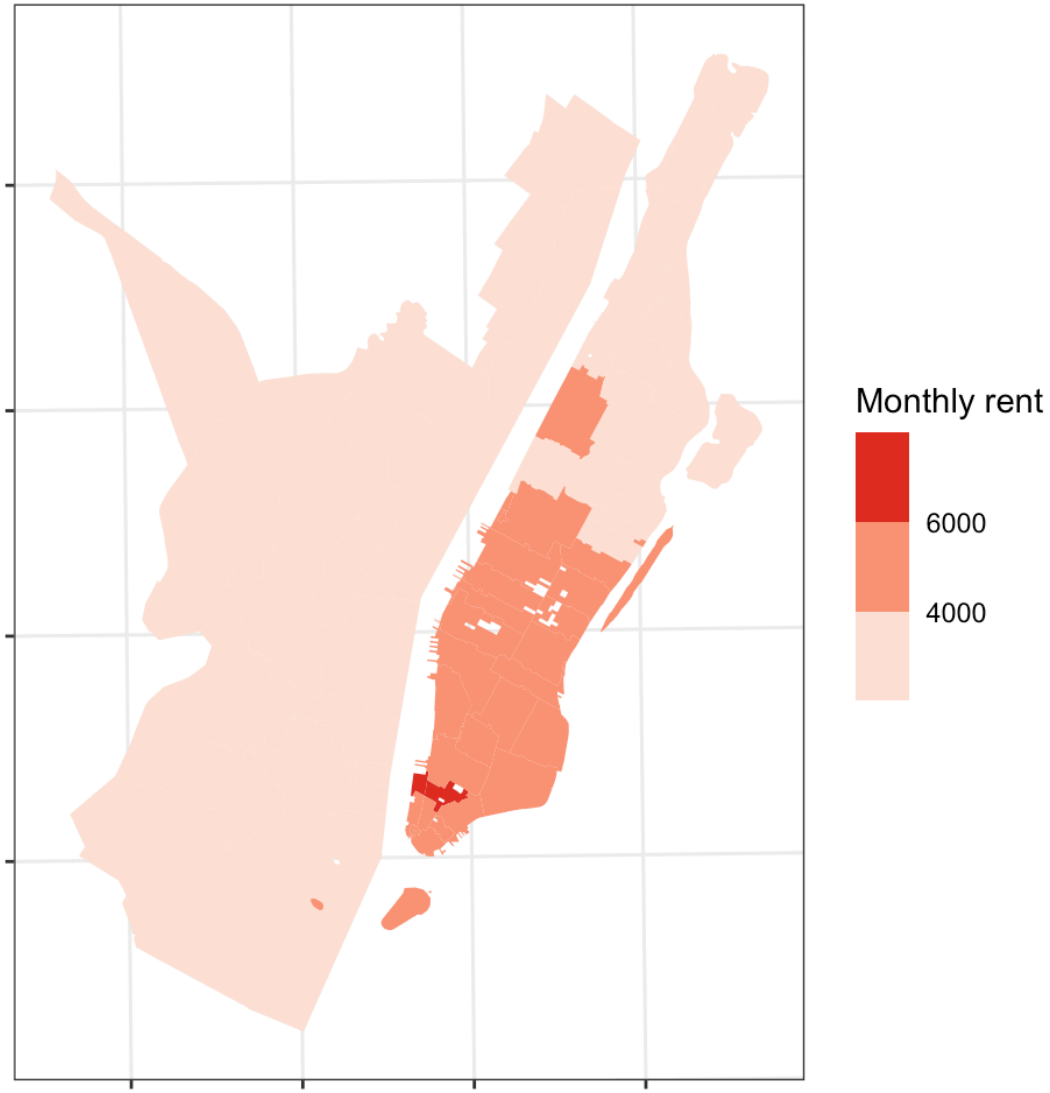
The monocentric city model and zoning



The monocentric city model and zoning: question

The monocentric city model and transportation

The monocentric city model and transportation: example



Monthly rent by ZIP code, Manhattan and Jersey City/Hoboken (Data: Zillow)

The time value of money

The time value of money: theory

Discount rates

- The discount rate will vary by project, and is a measure of both the *time value of money/opportunity cost* and the *risk*—a riskier (i.e. less sure to be profitable) project will have a higher discount rate

The time value of marshmallows

- Are kids who “fail” the marshmallow test (one marshmallow now or two in 15 minutes) really irrational, or do they just have a high marshmallow discount rate? 🤔

Discounted cash flow

The *present value* of money received x years in the future is

$$\frac{1}{(1+r)^x}d$$

where r is is the discount rate and d is the amount to be received *(Miles, Netherton, and Schmitz 2015)*

Discounted cash flow: risk

Discounted cash flow: no risk

Discounted cash flow: over three years

Predatory lending

Discount rates from the consumer side: interest

- We usually think about discount rates on the supplier side
- But on the consumer side, interest rates are the same thing
- When you borrow money, the interest rate measures how much more you'll have to pay back in the future
- This is because that future payment you will make is worth less than that amount of money now
- You're basically swapping your future money for money today, and because of the time value of money you need to pay more in the future to make it worth it to the bank to swap for your money today

Loan terminology

- Principal: the actual money borrowed
- Interest: the money you pay to account for the time value of money
- APR: annual percentage rate, the annualized interest rate (e.g., for a loan paid monthly, this would be 12 times the monthly interest rate)

History of mortgages in the US

- Before the Depression, most mortgages had short terms and were interest-only
  - That is, if you borrowed $5,000 to buy a home, you would pay only the interest on that for a few years, and the full $5,000 would be due at the end
- During and after the Depression, the Federal Housing Administration introduced the 30-year self-amortizing mortgage
- In a self-amortizing mortgage, you pay back some principal each month, in addition to interest
- As you pay more principal, there is less left, so you pay less interest
- At the end of your loan period, you have paid off all the principal

Mortgages in the news

Getting a mortgage/secured loan

- A *secured loan* is one where there is some *collateral* securing the mortgage—i.e. that the bank could reposses/foreclose if you don't pay
- Vehicle and home loans the most common examples
- You make a *down payment* and then get a loan for the remainder
- Down payment percentages are ideally 20% but often much lower
- When lower than 20% you usually have to pay mortgage insurance
  - This insures the bank, not you

Mortgage math: monthly payment

Monthly payment: Excel syntax

Overall cost of a mortgage

Principal portion of payment

Interest portion of payment

Amortization schedule

- What we've just created is an *amortization schedule*

Extra payments

- Most lenders let you make extra payments without penalty
- These contribute 100% to principal
- This effectively “fast-forwards” your loan to the point where the principal would be that low
- Your loan then ends earlier
- Let’s calculate how much we save by making a $10,000 extra payment after the first year (about 2.5 payments worth)
- Add a column with the remaining principal balance
  - Either sum or use `=CUMPRINC(0.062 / 12, 360, 400000, 1, period, 0)`
- How much does this save you?
- Should you do this? It depends on how your discount rate compares to the interest rate on your loan

Predatory lending and payday loans

Payday loans: interest rate

Development finance

- In order for anything to get built, someone has to build it
- In almost all cases, that's a private developer
  - About 0.8% of housing units are publicly owned (Urban Institute and Census data)
- For a private developer to build anything, they have to make money doing it

How much money

- How much money they need to make is based on *opportunity cost*
- They need to make enough money building it that their return on investment is the same or better than anything else they could do with the money
- This needs to account for risk—building things is a lot riskier than investing in Treasury bills or even stock market index funds

Sources of money

- Debt financing: the developer borrows money, like we've seen above
- Equity financing: the developer or someone else contributes money in exchange for owning a share of the finished property
- At different points in the project, levels of risk differ, so interest rates differ
- Developers will generally layer multiple funding sources—loans, equity, possibly tax credits

How much is a project worth?

- What a project is worth is based on how much income it will generate
  - Either through rentals or property sales
- The number usually used is the *net operating income* or NOI—the annual income minus expenses

Components of net operating income

- Potential gross rent: rent times number of units (+)
- Miscellaneous income—parking, cell towers, etc. (+)
- Maintenance (-)
- Management/administration (-)
- Capital improvements, sometimes—roof, HVAC, etc. (-)
- Property taxes (-)
- Nonpayment (-)
- Vacancy (-)
  - Healthy rental housing vacancy rate is around 5% to avoid a game of musical chairs

Allston Christmas

70% of Boston leases begin on September 1 © Que165 on Reddit

Calculating net operating income

- Suppose as a class we're considering buying that parking lot in Carrboro and putting a three-story, six-unit apartment building on it
- Let's figure out if this "pencils out"

Calculating net operating income: the pro forma

Calculating net operating costs: vacancy and nonpayment

Calculating net operating income: miscellaneous income

- Let’s assume we don’t have any of this (less common with smaller buildings)

Calculating net operating income: maintenance

Calculating net operating income: taxes

Calculating net operating income: insurance

Calculating net operating income: management

Calculating net operating income: capital improvements

- Capital improvements are generally *not* a part of net operating income, but added separately when calculating total value
- Our building is brand new, so we shouldn't need capital improvements for a while
- We'll return to this in a moment

Net operating income: add it all up

So how much is the building worth?

Discounted cash flow analysis

Discounted cash flow analysis: rates

Discounted cash flow analysis: year 1

Discounted cash flow analysis: year 2

The last year

The present value

Components of construction cost

Land cost

- Let’s assume we pay full price for the land–$370,000
- Add this to your Excel sheet in a new column

Construction cost

Other costs

Net present value

The *pro forma*

- The spreadsheet we've created is called a *pro forma*
- This is what developers use to make decisions about projects
- The one we made is simpler than one an actual developer would use, but the key components are all there

Net present value: higher rent

Net present value: lower discount rate

Construction and permitting delays

References

Miles, Mike E, Laurence M Netherton, and Adrienne Schmitz. 2015. *Real Estate Development: Principles and Process*. Washington, DC: Urban Land Institute.