Have you ever watched the excavation that precedes a tall building? It seems to take forever. Then, when the digging is finally done, construction rockets upward in no time. For the past few months, I’ve been watching a crew excavate the site of a new condo tower on Seattle’s First Hill. It’s on a route I walk three times a week, so I’ve had a ring-side seat. And here’s the thing that finally dawned on me, after years of not really thinking about these holes in the urban ground: what’s all the excavation for? It’s for parking. Underground parking. In most cities and in most soil conditions, the giant holes are only there to satisfy off-street parking rules, and to do that, you need a deep, deep hole. A hole like this one.

Digging these holes is astronomically expensive. They’re real-life money holes. The crew I’ve been watching has been laboring away for weeks, deploying enormous machinery and keeping a fleet of dump trucks in constant motion. They’ve undoubtedly spent millions of dollars removing rock and dirt. One Portland developer told me that each successive layer of excavation—each floor down in the garage—costs two to three times as much as the previous one.

Such costs are one reason housing is so expensive nowadays. A one-bedroom apartment in the city of Seattle rents for upwards of $1,300 on average. In Portland, rents are approaching $1,300 and, in Vancouver, BC, $1,400.

City requirements for off-street parking spaces jack up rents. They jack it up a lot at the bottom of the housing ladder. Proportionally speaking, the bigger the quota and the smaller the apartment, the larger the rent hike. For one-bedroom apartments with two parking places, as is required in places including Bothell and Federal Way, Washington, as much as one-third of the rent may actually pay for parking. A flotilla of studies supports that claim, and I’ll summarize them in this article, but first, a case study of residential real estate development may illuminate how critical parking is to the affordability of housing.

A Housing Dream (in which you are a developer)

Imagine you’re starting business as a developer of housing.
You take a loan from a bank and buy a city lot zoned multifamily. You sit down with your architect and start laying it out for apartments. The more apartments, the more housing you can provide, and the more money you can make. So the architect fills the lot with housing, right out to the city-required “set-back” boundaries near the edges of your property. She builds it as tall as the legal height limit for that zone too. You can erect 50 one-bedroom apartments, she announces, each of about 550 square feet. You do some figuring and realize you can earn a 7 percent return on investment while charging $800 a month in rent. That’s not a screamingly profitable venture, but it’ll do. And you’re sure that price will be popular with tenants, which will keep the building full. A schematic diagram of the development looks like this:

But there’s a problem, the architect points out. She reminds you that your city requires you to provide off-street parking on the property for each of the apartments you build. Cities such as Kent and Yakima, Washington, and Nampa and Meridian, Idaho, require two spaces per unit, but fortunately yours only requires one. You say, “That’s OK. We’ll put it underground.” The architect makes you a new drawing. It looks like this:

She tells you that the access ramps to the underground garage will subtract six apartments, and your general contractor estimates that excavating will cost $55,000 per parking space—almost as much as the $60,000 you’ve budgeted to build each apartment. To make a 7 percent return on investment, you’ll have to raise the rent up to $1,300 a month on the remaining units. Will the market support that price? You’re not sure. They’re one-bedroom apartments, after all. Worse, the floor space of your garage won’t even fit one slot per apartment. You’ll have 44 apartments and parking for 33 cars or 0.75 spaces per unit. You’ll either have to apply to the city for a waiver from the usual one-space-per-unit parking code—a risky and time-consuming process—or give up more apartments on the ground floor to add more parking. That’ll push rent even higher.
You contemplate whether to dig a second subterranean level in the garage, but the deeper you go, the contractor explains, the more expensive it gets. In fact, the cost grows geometrically. Unfortunately, your architect says, you can’t just dig enough space for 11 more cars. You have to do an entire additional level, at a cost that might approach $100,000 a slot. Then you’ll have 66 spaces, the total construction cost of which would be substantially greater than the cost of building the apartments. Obviously, going deeper won’t work.

“What if we shrink the building and do a surface lot in the back?” you ask the architect. She lays it out for you, like this:

You’re now considering a building with 30 apartments, plus 19 spaces behind. That’s only 0.6 parking spaces apiece, so you’ll still be in trouble with the city. To get one space per apartment, you’ll need to drop down to 25 apartments or fewer and raise the rent again. Your architect says it’s hard to fit the stairs and halls into the building with so few units. (You might have to lower your aesthetic standards and do a parking-court yard building.) Even if you can get a city waiver to put in just 19 spaces, you calculate, you’ll still have to charge rent of $1,200 a month. Will you be able to keep the apartments full at $1,200 a month? You’re not sure.

You try other configurations, such as devoting part of the first floor to parking. This option gives you nine indoor spaces (nowhere near enough to meet your parking quota) and sacrifices five apartments. Out of curiosity, you calculate that if you could charge $250 a month for each of the parking spots, you’d make up for the five lost apartments. That would let you leave rent at $800 for the apartments, same as in the no-parking scenario. But you doubt you can rent the slots for $250 a month, because parking is abundant in the neighborhood.

The whole situation is aggravating, because the area surrounding your building has vast, untapped reservoirs of parking: surface lots at grocery stores and movie theaters, underground spaces at shopping complexes and office buildings, and idle spots at nearby apartments. Each category of parking has its own rhythm of filling and emptying: the theater lots, for example, fill during the evenings, especially on Friday and Saturday nights, but remain empty during daylight and after the late show. Overnight, when your tenants’ cars will most likely
be at home, the office buildings' garages are usually empty. And, of course, there are hundreds of curb spaces within six blocks of your building, though neighbors' 

vehement territoriality about “their” spaces would make it impolitic to mention those in an appeal to the city for a parking waiver. Odds are that your tenants could secure whatever parking they wanted for much less than $250 a month per spot. You could even rent a group of overnight spaces at a nearby garage and sublet them to tenants, but such innovative solutions are not a legal substitute for on-site parking in your city.

You're stuck with no good options: a long and risky waiver application, underground parking with extremely high rents, or a half-sized building with high rent and slots out back. You now understand why architects, in moments of dark humor, change their discipline’s mantra of “form follows function” to “form follows parking.” And you’re starting to understand how parking requirements are such an enormous barrier to affordable housing.

Five Rent Raisers (in which I hear the ghost of Econ past)

This case study, based on scenario analysis by the Portland Bureau of Planning and Sustainability that uses state-of-the-art real-estate planning tools, illustrates the way parking requirements raise the price of housing. It also hints at how they elevate the rent for everyone, even people who do not own cars or use parking spaces. But let's be more precise. How do parking requirements raise rents? They do it in five ways, some of which affect all of the housing market and some of which only affect parts of it.

1. More Costly Housing. Parking quotas drive up construction costs. (“But supply and demand, not cost, set prices,” I hear my Econ 101 professor Hirschel Kasper pointing out. “Raising costs doesn’t raise prices.” “Yes,” I respond in my head, “but costs limit what goes to market, as you often said.” He nods approval.) High parking costs for construction effectively exclude new, less-expensive apartments from the market. There’s no way you can legally build your no-parking $800-a-month apartments, nor can anyone else, anywhere in town. The whole apartment market will be missing its bottom end. (It’s already missing most of its granny flats and rooming houses, as I argue in my new book Unlocking Home.)

Todd Litman of the Victoria Transport Policy Institute has modeled a typical affordable housing development and concluded that including one parking space per dwelling raises the cost of each rental unit by 12.5 percent; adding a second parking space doubles that to 25 percent.

2. Less Housing. Parking quotas constrain the supply of dwelling units, particularly of modest, economical ones, which causes their price to rise. (Dr. Kasper affirms: “Supply and demand, not cost . . . ”) You may end up building only 25 apartments, rather than 50. The same goes for every other builder in the city. Fewer new apartments mean more competition for all apartments. Rents go up.

3. Building Conversions Blocked. Parking quotas often make it prohibitively expensive to adapt buildings for other uses. Developers cannot convert vacant warehouses into lofts, or aging office blocks into condos, unless they somehow shoehorn floors of parking into the historic structures. (Again, Dr. Kasper intones, “when supply is constrained, prices rise.”) This effect may keep fewer apartments off the market than does effect 2 (above), but in older cities, it can still keep thousands of apartments from getting built.

4. Dispersed Housing. By suppressing the number of apartments on each city lot (see 2 and 3), quotas force housing demand to spread outward across the landscape. In a word: sprawl, which raises travel distances and commuting expenses. Instead of 50 apartments on your in-city lot and many others like it, there may be only 25. Apartment hunters will have to go farther afield, increasing their cost of living, if not their rent.

5. Billing Non-parkers. Parking quotas shift the cost of storing vehicles from those vehicles’ owners into the rent of non-owners. By flooding the market for parking, quotas make it impossible to recoup the full cost of parking by charging its users. (Dr. Kasper agrees: “Supply increases, prices drop.”) You can’t charge $250 a slot, because the neighborhood is awash in mandatory parking stalls. Fortunately for you, the same parking quotas that have flooded the parking market are starving the apartment market, making it possible to charge higher rents. This effect does not raise the rent on average beyond what effects 1, 2, and 3 do, but it does shift the cost of storing vehicles from car owners to non-owners. Even tenants who do not use parking pay for it.

A forthcoming Sightline analysis will likely reach similar conclusions. If preliminary results hold up, it will show that, at actual apartment and condominium projects in Seattle, the cost of parking is as much as 35 percent of monthly rent. The cost of parking, furthermore, exceeds its market price almost everywhere in King County, so even tenants who do not own cars end up paying for parking through their rent.

These five effects interact and reinforce one another. They knock the bottom off of the apartment market, pushing working-class people to double up or commute longer distances. They raise the rent for everyone, driving up the cost of living while lowering the price of parking. And they shift parking costs to those who don’t use it.

Two Proofs (for extra credit)

Together, these five mechanisms raise housing prices. How much? It’s hard to say exactly. No two dwellings are exactly the same, so rigorously distinguishing the effects of parking requirements—as opposed to the many other variables like “look” and “neighborhood”—on
housing prices is what Dr. Kasper would have termed an extra credit problem. Fortunately, studies from Oakland and Los Angeles have earned at least part of the credit.

In 1961, Oakland introduced a quota of one space per new apartment. Immediately, as housing economist Brian Bertha has documented (see page 143), the construction cost per apartment jumped by 18 percent and typical apartment buildings shrank: the number of units per new building fell by 30 percent. Developers built fewer, larger apartments, and the rent rose.

A newer proof comes from urban planning professor Michael Manville of Cornell University. He described in the *Journal of the American Planning Association* what happened in downtown Los Angeles after 1999 when the city enacted an adaptive reuse ordinance (ARO). Manville writes, “The ARO exempted qualifying buildings from minimum parking requirements. Although developers could not remove any existing parking, they were under no obligation to add any. New ground-up residential construction in the downtown, however, was still subject to the city’s parking requirements.” Quickly, the deregulation of parking yielded more than 6,000 new apartments and condominiums, some of them in previously dilapidated historic office buildings that dated from the Art Deco era. Meanwhile, new developments were erecting thousands of other dwellings in the same neighborhoods. The side-by-side existence of ARO buildings with new buildings gave Manville a natural experiment to study. The findings, as Manville summarized them:

> When parking requirements are removed, developers provide more housing and less parking, and also . . .
> developers provide different types of housing: housing in older buildings, in previously disinvested areas, and housing marketed toward non-drivers. This latter category of housing tends to sell for less than housing with parking spaces.

Manville’s research confirms in detail everything you’d expect from your own time as an imaginary housing developer. Minimum parking requirements do not jack the rent up much in the kinds of pricey buildings where the developer would have installed an abundance of parking anyway. The richest renters and condo owners expect parking spots of their own, on-site, and plenty of them. What minimum parking requirements do is force more-modest buildings to squeeze out living space in favor of parking space.

Across all of the ARO rental projects, the average amount of parking installed was 1.2 spaces per unit. That’s more than the waived quota of one space. Does that mean that the parking quotas didn’t matter? No. High-end buildings pulled up the average. (Remember, this is in high-rent, downtown, auto-centric Los Angeles, often in restored historic buildings.) Meanwhile, many ARO buildings provided fewer than one space per unit, and some provided none. It all depended on the developer and what the building’s structure would accommodate cost-effectively.

**A Market to Park It (in which developers act like you)**

What’s more, half of the parking spaces developers provided to tenants were at neighboring or nearby properties. In fact, at 16 of the 57 ARO buildings, all the parking was off-site. These developers did what you wanted to do for your 50-unit building: they secured tenant parking not by pouring concrete but by sipping coffee with the owners of nearby garages.

Some developers did not assign individual spots. They used a pooled parking system. Just as airlines overbook flights, statistically confident that a few passengers won’t show up, pooled parking takes advantage of probabilities: at any given time, some cars will be away.

Some developers put in tandem spaces, where two cars nose into the same slot, one behind the other. Others looked into parking lifts, contraptions that double the capacity of each place by stacking cars.
Developers in 20 of the buildings unbundled parking charges from rent: they leased them separately. Residents could take an apartment without parking. Or they could take two spaces. Or three. In some buildings, they could rent one space on-site and another off-site. They could adjust month by month, depending on their needs. In short, they could participate in an actual, functioning market for car storage.

Compared with the new non-ARO buildings in the same area, Manville found that ARO buildings had about 0.3 fewer spaces per dwelling total, and half of it was off-site—illegal for the new-built structures. In the ARO rental units, each additional parking space (again, many of them off-site) raised the rent by about 6 percent or $85 a month. No one can build parking spaces in downtown Los Angeles for as little as $85 a month, but the availability of abundant off-site parking—the legacy of decades of parking quotas—pushed parking’s price below its cost. (Dr. Kasper again.)

**Reading the Meter (in which I guess)**

The research hints at the rent increases caused by some of the “rent raisers” above: 6 percent higher rent per parking space in Los Angeles, 12.5 percent in Litman’s model, up to 35 percent in the forthcoming Sightline analysis.

But none of them captures the most powerful rent raisers: numbers 2 and 3, in which parking minimums constrain apartment supply and thereby push up rents across the entire city. Detecting and measuring that effect would be exceedingly difficult, because it is incremental and market-wide. Still, anything that so constrains the number of apartments—30 percent in Oakland, for example, or enough that a narrow parking exemption for adaptive reuse of buildings in downtown Los Angeles could induce the rapid-fire construction of 6,000 new units—surely has enormous impacts on rent. If parking minimums in Northwest cities have reduced the number of in-town apartments by 30 percent, the resulting average rent hike must be giant. A quarter? A third? More? It’s impact on sprawl must be similarly big.

Los Angeles’s ARO experience illustrates another important lesson: deregulating parking eliminates neither on-site parking nor its construction. It simply allows developers and residents to come up with innovative solutions to the age-old question of where to park. It lets millions of individual actors making daily decisions about alternatives and costs determine how much parking gets built, rather than expecting city councils and a few officials in planning departments to decide how much parking to build based on nonexistent theory or divine revelation. Parking deregulation lets residents decide how much they’re willing to pay to park, how far they’re willing to walk to park, and ultimately how much it’s worth to them to own a car that needs parking.
As the cost of parking disentangles itself from the price of housing, ending parking quotas will bring rents down, especially for those with few or no cars and for people looking for modest dwellings. Developers, for their part, will be free to build the least-expensive parking spaces but stop before the cost skyrockets, as when they’d need to start excavating craterous, multi-million-dollar holes in the ground.

*Thanks to the Portland Bureau of Planning and Sustainability for permission to publish its diagrams and to Hirschel Kasper for teaching me economics.*

**Comments**

**benschon says:**
August 22, 2013 at 11:28 am

Another way to think of it is that mandatory parking imposes a 6% (at least) tax on renters, whether or not they own cars. This tax is used to benefit neighboring owners’ ability to park for free at the curb.

**Oregon Mamacita says:**
August 26, 2013 at 9:48 am

Developers are always looking for ways to increase their profits. Why should new developments externalize their costs? Density brings a host of problems that advocates of so-called smart growth ignore - noise, crowded streets etc. 75% of renters have cars.

Once again, this argument ignores Econ 101 - the market sets rental rates. Such a basic economic principal. And, if you look at real estate developers as an industry, thinking about 2008, you can only conclude that real estate developers, as a group, are not smart economists. Just not smart. There was a house bubble in PDX in 2008, followed by a condo bubble in 2008, soon to be followed by a small, pricey apartment bust in 2014.

Remember, if developers could leave out toilets they would. The market sets the rents. Not Alan Shoup.
Lori says:
August 22, 2013 at 4:21 pm

This all seems so logical, like it should be pretty obvious. But, I have to admit that it never really occurred to me that the reason I had low rent in my old apartment was about parking, or lack thereof. It was a 1907 building with no parking whatsoever. I always thought my friend who lived up the block paid more in rent for her shiny new kitchen. But the fact that her 1990's building had 2 full floors of parking underneath likely had a bigger impact on rent.
p.s. I recognized that big hole in the ground instantly!

Reply

Erik says:
August 22, 2013 at 8:51 am

You don't need to excavate the whole area to place footings. Imagine if that were true for something easy to visualize... a bridge. There are pilings every few hundred feet and beams that span between them. Buildings are erected in much the same way. A much cheaper method for construction is possible if you're only constructing a building above ground with no / limited basement areas.

Reply

TRP says:
August 23, 2013 at 8:53 am

Those deep excavations have foundations at the bottom. If underground parking was not required, then foundation engineers would design different foundations (driven piles, drilled shafts, etc.) closer to the original ground elevation instead. Rarely is a deep excavation necessary for foundation construction.

Reply

Charles Siegel says:
August 23, 2013 at 9:17 am

Wrong.

“Yes,” I respond in my head, “but costs limit what goes to market, as you often said.” He nods approval.

Parking requirements act as an indirect price floor, due to limiting the supply that can come to market. That’s ‘Econ 101.

Lori says:
August 22, 2013 at 4:24 pm

Wait a minute – I did not mean to imply that parking quotas are logical! Your argument for how they impact rents is logical.

Reply
So how is it that they built apartment buildings without those big holes under them a century ago, and those buildings haven’t fallen down after facing the winds for 100 years?

And how is it that they build apartment buildings without those big holes under them today - in places where they don’t have a parking requirement?

norse says:
August 23, 2013 at 8:55 am

Thank you - first interesting article on sightline in a while.
I’ll add that parking alone is not an overriding factor; other than the pressure exerted by the lakes, reducing available real estate, concentration of high-income jobs, horrible traffic infrastructure and the most costly permit process are limiting the supply of available housing and driving prices in the PNW.
It’s interesting to look at the price for new construction - I’ve had occasion to recently go through the math for obtaining a lot at land-only prices and building a new house there. Even going to the low end of what I’d consider acceptable, new construction cost for a single family home + land price came out at twice the price of a comparable lot with an existing home nearby. Sad, but it’s what we voted ourselves into.

Dan says:
August 23, 2013 at 1:51 pm

Hmmm. Not sure this is completely accurate. There are numerous, multi-story apartments that have gone up around my neighborhood (inner NE Portland). None of them provide parking for the 30+ new households/building moving in. None of them are affordable. There are no “vast, untapped reservoirs of parking” within blocks of my place that you mention in your article. All of these new apartments are priced above other rentals in the area driving up rental prices. So, by that measure, for inner NE Portland your argument is wrong.
Removing off street parking requirements does not keep housing prices low. It just makes it harder to find a parking space near my place and more lucrative for developers to build apartment. It’s almost like a little gift to developers. They get to make even more money off of the crappy apartment building with no parking that they just threw together. Pretty sure supply and demand set the rents, not parking requirements.

That said, I fully support the concept of density and infill to reduce sprawl. I like the concept of encouraging more public transportation and bike riding as alternatives to driving. Fact is, people have and need cars. Increasing alternative transportation options not ignoring the real, hard fact that it is difficult to live without a car is what will help most.

drs says:
August 27, 2013 at 8:28 pm

If you’re living in inner Portland there’s a good chance you don’t need a car, in which case why should you pay the $15-50,000 for a parking space for one?

* Pretty sure supply and demand set the rents, not parking requirements*
But parking requirements sets the supply.

“50% reduction in housing units and increased sprawl by providing some parking for the 30+ units that was a vacant lot before? Hmmmm. Just doesn’t feel like a sincere argument to me.”

A parking lot space needs 30 square meters. A modest two-bedroom apartment might be 60 square meters. Even a rather modest requirement of one space per 2BR unit — 1 or more per bedroom is common — cripples your maximum possible density. Without parking you can build as high as you want. With parking, 1/3 of the space must be given over to parking if you have one story housing. The ultimate limit, with a narrow tower of housing in a parking lot, is equivalent to two stories of housing over the whole area. Higher parking requirements are worse. Multilevel parking lets you get around that, but adds to the cost, as mentioned.

So if you could build 4 story housing without parking, but are capped at effective 2 story with cheap parking, that’s 50% reduction.

Plus green space tends to be the first thing to go. That’s potential parking!

Reply
In cities like Seattle there are no vast reservoirs of untapped onstreet parking. Without requirements for parking spaces to go with apartments, where are the cars going to be parked? This article sounds like yet another anti-car diatribe. Cars are a mobility device, providing social and physical mobility. I suppose a city could incentivize people not to have cars - provide some sort of a spiff if they agree not to own or use a car. The article also misunderstands economics - that big excavation under buildings is, literally, a sunk cost, amortized over the life of the building. The designed life of civic structures in the US is 40 years. So that apocryphal $55,000 cost per parking space (I don't believe it) comes out to $1375 per year, or $115 per month. Which, not surprisingly, is about what people are asked to pay for a parking space in an apartment building.

Reply

Ian Stude says:
August 26, 2013 at 10:28 am

If I'm reading the article correctly, $55,000 per parking space is the construction cost, not the amortized cost over the life of the building (or the loan). Assuming a 30 year loan at 4.5% interest, the monthly payment on a $55,000 parking space would be closer $275/mo.

Reply

Matt BK says:
August 28, 2013 at 2:37 pm

But the market should work in this case too - if there is enough of a demand for parking (i.e., people willing to pay more rent in order to have a spot), developers will build it.

Reply

Michael Toomim says:
September 1, 2013 at 4:10 pm

If there's a demand for parking, the market will fill it, at market rates.

Maybe you didn't read the article thoroughly -- Alan pretty clearly lays out how the market provides parking in the section “A Market to Park It (in which developers act like you).”

Reply

Oregon Mamacita says:
August 26, 2013 at 9:49 am

Sorry, condo bust was 2010.

Reply

Gerald Fittipaldi says:
August 26, 2013 at 10:02 am

I'm surprised that the article contains no mention of car sharing as a means of reducing demand for parking spaces. A recent study in San Francisco examined residential projects of 50 units or more. When on-site car sharing and unbundled parking were combined, average vehicle ownership per household was only 0.76. By comparison, where buildings had neither car sharing nor unbundled parking, car sharing only, and unbundled parking only, the vehicle ownership rates per household were 1.03, 1.09 and 1.13, respectively. In effect, providing on-site car sharing and unbundled parking resulted in a TWENTY-FIVE PERCENT decrease in the number of parking spaces needed to accommodate the demand for parking.

The above study is cited on page 18 of Contemporary Approaches to Parking Pricing: A Primer by USDOT/FHWA. Here's a link to the full document: http://bit.ly/15ceeDQ

Reply

Alan Durning says:
September 1, 2013 at 6:43 pm

http://daily.sightline.org/2013/08/22/apartment-blockers/
Jeff Petry says:
August 27, 2013 at 8:20 am

Going with a “Like” for my econ advisor, Professor Kaspar

Reply

Anon says:
September 1, 2013 at 3:21 pm

Your arguments are sound, but you omit consideration of the unintended consequences of not having parking built beneath every building. Imagine if you will all the buildings were like your first example. Maximum apartments, zero parking.

Now, it is unreasonable to believe that every tenant will be without a car, so some percentage will own cars. If no building has underground parking, where do the cars go? Well, first they would clog the streets. Second, people would try to locate alternatives (such as neighboring shopping or office complexes). But there is a limit to how far someone is willing to walk just to get to their car before they decide to move out and go somewhere they can park their car closer to home.

The result is that rents with no parking fall because no one who owns a car wishes to live there, so there is less demand, so the rents are lower.

Rents increase when their is underground parking because renters with cars see having nearby parking (underground) as a perk they are willing to pay more for, and so demand increases, and rents increase as a result.

Not building parking will lower rents, yes, but because of lowered demand for the units.

Reply

drs says:
September 4, 2013 at 4:24 pm

Rents would also be lower because the apartments would be cheaper to build. Developer profit could stay the same, or probably go up, because they’re not being forced to build wasteful unprofitable levels of parking.

Reply

Tim N says:
September 1, 2013 at 4:45 pm

Does building up cost as much? What about a scenario where parking is on the ground floor (and 2nd floor if necessary) and all the living units are built on top of that?

Reply