Supplemental Market Analysis by Property Type

Chapter 30: Market Analysis by Property Type

30.1.1 Introduction: What do we want to know from market analysis?

Developers are the chronological start of the food chain. **Developers need to expect the value of completed development to exceed the cost by a sufficient margin** that new development or retrofitting an existing building has a reasonable payoff, including returns for properties that will be retained. In order to estimate completed value they will need to start with **expected rents**. Other factors matter that are deductions from expected rent, such as expected vacancy rates, expected operating expenses and the cost of capital using equity and debt required market yields, but the proforma starts with rent and vacancy expectations. Investors also need to run a proforma to estimate expected returns and once again, rents and vacancy rates matter. Other players in the food chain: appraisers, lenders, leasing agents, brokers, property, and asset managers also want to understand probable rents as this affects the feasibility and sustainability of the asset. Rents drive value. Rents pay expenses and service the debt, and are the focus of market analysis.

There are many nuances that may also affect total returns, ultimately from the expected net operating income and expected value creation, including creative marketing, a better than average mix of tenants, more efficient management and building operating systems that keep tenants happier and lower vacancy and turnover.

Tenant relations also matter. Landlords with larger portfolios and the same tenant in several locations have stronger bargaining power when a tenant wants to be in several locations. A landlord can negotiate package deals that create a win-win scenario for both the landlord and tenant. Fast growing tenants that want several locations, or have strong drawing power, may also have a stronger negotiating position. Since higher-credit longer term leases are the backbone for securing debt financing, such tenants can secure lower lease rates. These nuances are important, but beyond the scope of this chapter which will focus on the drivers of rents and vacancy rates.

Again, we want to know what current rents are and where they might be headed. Earlier in the book we discussed how to measure rents, adjust for tenant concessions, and tenant improvements, and the differences between asking rents, contract rents and effective rents. A discounted cash flow analysis, DCF, that is used to support mortgage decisions and equity investment decisions starts with rents and a proforma. When engaged in market analysis, the starting point is what affects rents and values, the capitalized value of net operating income that starts with rent.

30.1.2 Introduction: When do we want to know it?

Property managers want to know where rents are now and where they are headed over the next few quarters or years. This is because it impacts rent setting and negotiation terms now, as well as decisions on the length of a lease. Landlords do not want leases to expire when markets are expected to be soft, but tenant representatives in behalf of tenants, might want to think about ideal times for a lease to expire providing maximum negotiating leverage. Mortgage lenders want to know where rents are headed over the longer term, especially over the course of the

mortgage term. They are also concerned with tenant quality, especially credit. Investors want to know where rents are headed over the expected holding period of the investment. The point is that sometimes we want to focus on the short-term outlook and sometimes we wish to focus on the longer term.

The importance of price trends also depends on who is engaged in such analysis. For asset managers, quarterly returns can easily be dominated by estimated changes in price, even though over the long run, income is generally the largest source of return. Say a property has a quarterly return of $12,500 (net operating income) and is worth about $1 million dollars. That is 1.25% quarterly and 5% annualized. Now, assume the same property is affected by recent increases in mortgage rates and capitalization rates. If capitalization rates move up from 5% to 5.5% the property value has declined by about 9%. Proof: $50,000 divided by 5% is $1 million and $50,000 divided by 5.5% is $909,091 a decline of 9.1%. This change in value will swamp the 1.25% income return in the quarter in which it occurs. Long term price trends are likely more important than short term price trends, if one is not refinancing at the time or needing to sell a property. In such cases, when refinancing, the short-term outlook matters and current solvency. If a tenant was given a year of free rent on a ten-year lease and we are only six months into the lease, that may bode well for long term value but not for immediate refinancing. Again, sometimes the near-term outlook matters the most and sometimes the longer-term outlook matters the most, depending on whether you are engaged in operational decisions or buy/hold/sell decisions or simply a long-term investor or lender.

30.1.3 Keep in mind there is the **space market** and the **asset market**

This chapter focuses primarily on the space market and rents, but whenever prices are discussed, we must recall that they are set in the asset market. Yield requirements and the weighted cost of capital matter in the asset market while they only affect rents in a lagged and indirect manner. It is possible that new supply is induced even when rents are not increasing at all, if yield requirements have lowered sufficiently to make it feasible to build new space and have value exceed costs. It is also possible that no new construction or property upgrades are likely, when yield requirements have increased. Supply is very sensitive to the capital markets while demand is mostly a result of the local, regional and national economy and localized demographic trends.

Supply may also be sensitive to the supply constraints in the market, both physical and human constraints that are regulatory or legal in nature. Supply constrained markets aka “inelastic supply” markets will tend to exhibit much larger price movements in response to changes in demand versus relatively elastic markets where it is easier to secure entitlement and quickly add new supply. Most coastal markets tend to be supply constrained while most inland markets are less constrained.

Obsolescence can also play a part in inducing new supply or property upgrades. For example, robotics has allowed larger and larger warehouses to be efficiently operated using forklifts that can extend several racks upward. This has made the old warehouses with lower ceilings less efficient, obsolete, and rents have fallen on such space over time. The economic life of buildings can be affected by technology. We should be careful not to presume long lives (over 30 years)

on most commercial real estate without upgrades and keep a close eye on how technology is changing the need for and use of space. For example, the work from home trend of the early 2020's has resulted in more conference collaboration space and less individual office space in the typical office building. Overall, it has reduced the demand for space and also induced more housing that includes work space.

30.1.4 How large is the geography of the market?

The geographic size of the space market for any given property type is a function of the boundaries within which a typical renter would consider as substitutable. For housing this may be a neighborhood within the same school district, if these factors dominate the locational preferences of a typical buyer. For an office tenant, this may be the entire central business district or a suburban cluster of office buildings.

Another way to define the relevant market is based upon peer comparable properties. Pick any individual building and use, and ask "where and how far away are the peer properties that tenants would consider?" This adds the elements of quality and location, design and features that may enter the definition of the relevant market. Clearly such markets will overlap and it becomes somewhat arbitrary where to draw the line, but political districts and physical features such as highways, waterways, preservation land and parks all might be used to describe the physical boundary.

For the asset market the relevant geography of properties that a typical buyer would consider is much broader, possibly crossing regional borders, states, provinces and even countries. Buyers of a certain type of property might consider economic growth trends, access via airports and the quantity and liquidity of the localized markets in defining where they may look for acquisitions. There is also an individual bias towards areas where properties are already owned as a result of existing business relationships and local operating staff.

30.1.5 Everything Matters

While we generally analyze real estate markets chronologically from short run to long run, we must be cognizant of all the forces impacting demand and supply for the relevant property type and market. Here the main point is that everything matters and it is important for an analyst of the market to pay attention to the big picture macro trends as well as the very localized trends. It is also important to pay attention to where we are with respect to cycles.

Real estate markets tend to follow economic cycles. This is a result of the lag between values exceeding cost to create and the time required to permit and build real estate. It is also a result of longer-term leases that are often correlated with the booms and bust cycles of the capital markets overshooting equilibrium supply and then undersupplying real estate in some cases.[1]

[1] For examples of cycle analysis and monitoring see Mueller, A.G., Mueller, G.R., (2016) Real Estate Market Cycle Lengths & Magnitudes, Real Estate Review, Fall, 3-16. Mueller, G. R., Peiser, R.C. (2015). International Real Estate Office Market Cycles Real Estate Finance, 32(1), 21-30. Evans, R.D., Mueller, G.R. (2015) Five Property Types' Real Estate Cycles as Markov Chains, International Real Estate Review 18(1), 27-60, or prior work by W. Boorn and S.

Understanding where a particular property type is within the cycle is helpful for determining confidence in the direction and magnitude of rental trends.

Below is a table that briefly lays out some of the types of influences on demand/supply that will help determine where rents are headed, starting with the most macro and working towards the most micro or localized factors.

Table 30.1 Global to Local Trend Analysis

Examples of Global to Local Trends That May Impact Rents and Values		
Global/Macro Trends	**Province/State/Regional Trends**	**Local/Micro Trends**
Global economic growth rates especially nearby countries and key trade partners	Tax incentives, grants, and tax credits for particular types of development or improvements such as green buildings and features	Demographic trends: births, deaths, and net migration into or out of the metropolitan area
Exchange rates that may affect demand from particular countries by making real estate cheaper or more expensive to them	Regional economic drivers and resources, either natural or human	Employment trends and surpluses or shortages
Trade policies and tariffs, economic sanctions, wars, and protectionism	Transportation systems and improvements, how people move. This could include hyperloops or high-speed trains or regional trains.	Education and skills: Local universities and innovation
Oil and natural gas prices	Retail spending trends and the supply chain patterns	Friendly or adverse business environment
Technology breakthroughs such as transit, batteries, computer chips, artificial intelligence software		Land supply and availability, time to secure permits and entitlement, NIMBY environment.
Capital availability and relative yields on different asset types		Local transit systems, above ground and underground trains, especially new nodes connecting systems, trolleys, and buses.
Country deficits, debt limits & influences on interest rates		

Pyhrr "Real Estate Valuation" (1994) The Effect of Market and Property Cycles" The Journal of Real Estate Research, 9:4, p. 455-485.

Federal regulations and Incentives for specific property types		
Net immigration trends and policies towards immigration		

Some examples of the factors listed above:

1) Oil prices rise significantly: Until such time as we mostly drive electric or hydrogen cars, this suggests gas prices will rise and that will lower demand for locations further away from work, school and other amenities in favor of closer and likely denser locations. This is true for offices, retail, warehouses and residential in all markets. Cities with an economic base tied closely with oil may also see relatively faster growth as the higher prices spur more investment in oil production. This would benefit markets like Houston, Aberdeen, Calgary, Abu Dhabi.
2) The Chinese Yuan rises significantly relative to the US dollar: This will help US cities that export goods to China as US goods will now be cheaper. It may also help warehouse demand at port cities, and it will enhance the appetite of Chinese investors for buying US real estate as prices will become lower when converted from dollars to yuan. In favored markets, typically larger west coast US cities like LA and San Francisco or in Hawaii, such demand will likely be focused.
3) A new ultra-high speed train links up San Francisco, Los Angeles, San Diego with some stops in between: This may allow the substitution of train rides for plane rides, lowering demand for parking near airports and increasing the relative appeal of locations near train stops. It may also decrease demand from more expensive locations to less expensive locations, assuming commuting by train becomes possible.
4) A local city passes a temporary law that eliminates property taxes on any property converted from office to residential for 20 years: This will create a value boost and increase the feasibility of conversion from office to residential or mixed use. It may have the effect of lowering residential rents for a while, if there is enough conversion (an increase in supply), and may also impact the value of existing buildings by keeping their rents lower than otherwise.

30.1.6 Short term dynamics and long-term fundamentals

Because real estate is a long-lived asset and we generally add less than 2 percent to the aggregate inventory of any property type in a given year, even when building is brisk, changes in demand will quickly induce changes in vacancy and rent levels in either direction. That is, an increase in demand will result in less vacancy and higher rents. A decrease in demand will result in higher vacancy and lower rents. Given that leases typically run from one to several years, there will always be a lag between the direction of rents for new leases versus existing buildings with seasoned leases. Changes in rents are best gauged by examining recent leases as opposed to seasoned leases. As changes in rents trickle down into the net operating income, we observe

changes in rates of returns or yields and values. Since, supply responds to changes in yields, and it takes from one to several years to add new supply, this is a longer run response to the market. If yields have declined and we observe no new construction, it may take several years for a market to reach normal equilibrium where returns are acceptable, after a decrease in supply.

For all property types we have a typical pattern of how rents and prices change over time. The adjustments may vary in length depending on the property type and the elasticity of supply in that market, but the patterns remain the same. Let us start with what might possibly happen in the immediate term:

1) Demand can increase, say from growth in the local economic base and new employment in the area. Demand can be affected by macro factors, such as lower interest rates increasing space demand for housing, or micro factors that are purely localized like a new plant opening to build batteries.
2) Demand can decrease, say from demographic trends or migration patterns caused by economic factors or the aging of the population.
3) Supply can increase too much (overshoot) such as when a large-scale development takes too long to build and by the time they come to market, the demand is no longer there and they have excess units available.
4) Supply might decrease, such as when a new highway takes out an existing neighborhood of apartments, or a hurricane or rain storm induces a flood that wipes out numerous buildings.

We will analyze the pattern of changes in the market from short run to long run for each of the above.

1) Demand increases
    a. In the short run (under a year) vacancy will reduce. A waiting list of tenants might occur. Landlords noting the lack of vacancy will next raise rents, increasing rates of return on existing property.
    b. Competitors will try and dissipate what they observe as excess returns by improving similar but lower quality property, aka "value add" development or by building new units. The speed of reaction depends on the elasticity of local supply. Some markets require years for permitting or simply have very little space available, while others are very responsive.[2] For example, markets like New York City are challenging because of density, while markets like San Francisco are challenging because of geography and political regulatory hurdles. Less restrictive markets like those in Texas are more likely to respond faster with new construction.

[2] See for example the Wharton Regulatory Index that estimates how difficult it is to add new supply. NBER WORKING PAPER SERIES, "THE LOCAL RESIDENTIAL LAND USE REGULATORY ENVIRONMENT ACROSS U.S. HOUSING MARKETS: EVIDENCE FROM A NEW WHARTON INDEX" Joseph Gyourko, Jonathan Hartley, Jacob Krimmel. Working Paper 26573 http://www.nber.org/papers/w26573 NATIONAL BUREAU OF ECONOMIC RESEARCH 1050 Massachusetts Avenue Cambridge, MA 02138 December 2019

c. Over time more supply will be added to the market bringing down excess returns towards equilibrium level returns and vacancy will return to normal. The speed of adjustment by the market may be as short as three years and as long as a dozen or more years, depending on the difficulty of adding new supply.

2) Demand decreases
    a. In the short run, vacancy increases above equilibrium (vacancy with no pressures on rent in either direction is normal).
    b. Eventually landlords provide rental concessions, like free rent or they simply lower rents, resulting is lower rates of return.
    c. If the rates of return are so low as to jeopardize cash flow and solvency (the ability to make all operational payments and financing costs) then normal maintenance and repairs may be reduced, accelerating the deterioration of property inducing faster real depreciation. Properties with higher leverage are more likely to suffer from solvency concerns and distress. If financial distress results in a sale at lower prices, then new landlord will sometimes lower rents with their new lower costs basis requiring less rent to provide acceptable returns.
    d. No new building occurs, in that market for that property type, and landlords that can maintain the property simply wait it out, assuming a positive long run forecast for the local economy.
    e. Eventually some property slips out of this submarket and competes at a lower quality tier or becomes converted to other more productive uses.
    f. Rates of return eventually come back to equilibrium. This may take several years to occur.
3) Supply overshoots: The pattern will be the same as if demand decreases.
4) Supply is reduced: The pattern will be the same as if demand increases.

Key point: Vacancy and rents are short run equilibrating mechanisms and rates of return are long run signals that induce or hinder appetites to bring on new supply. They are also early warning signals about future price trends. A similar indirect indicator as vacancy rates is sublease space available and rates, particularly in the office market where subleasing is common. If sublease rates climb significantly, vacancy rates will subsequently climb and later rents will soften.

Note that normal equilibrium vacancy depends on the local market and property type. Larger space markets like industrial bulk warehouses are lumpy, just like high rise office buildings. Multifamily tends to run lower vacancy rates, typically under 95% in healthy markets, while office vacancy rates tend to run higher figures, often exceeding 10%. Retail vacancy rates vary, but are generally in the single digits. Industrial property is also typically occupied at more than 90% but again, but losing a single tenant vacancy can have a large impact on an industrial park.

30.2 Introduction to traditional and a few niche property types

While the dynamics discussed above apply to all property types, it is helpful to review the significant drivers of demand for various property types, and some of the typical property attributes noting that these change over time. We will run through the major property types, often referred to as the major food groups. Then we will add several more specialized property types. The four largest commercial real estate property types are multifamily housing, office, retail, and industrial. The fifth largest private sector property type is lodging. Then we have a bevy of niche property types such as self-storage, data centers, biotech or life science, and surface parking lots. Other specialties exist, such as senior housing, student housing, and nano-tech but the reader has sufficient examples with what is provided here to do their own research. There are also manufacturing properties that are typically user occupied and owned due to their uniqueness, and so while they represent a major property type just as schools, prisons, police, and government buildings do, there is seldom much market activity in such properties. Properties that are unique are difficult to re-use, should an occupant run into financial distress, and that is why few investors would want to buy overly specialized and unique property.

Within any given property type category, like residential multifamily, there are additional property sub-categories like student housing, independent senior housing, assisted living, hospice, timeshares, and single-family rentals. The same is true for all property types. We also tend to categorize buildings by quality using labels such as A, B, C etc. or stars or by age or even by design or height. For example, we have open ceiling offices or apartments with exposed vent tubing known as lofts. The newest office designs we might categorize as A+ or 5 stars. These quality tiers are correlated with rents and help the market understand the locational and functional attributes of a property, how it competes in the market and what type of rent it is likely to secure.

We should also note that whether we are considering specialized property types or the big four or five, we have entered an era of **blurred lines**. Mixed use property has been promoted for decades as one way to help minimize transportation costs and pollution with the notion that some people will live and work and shop close by or in the same building complex, instead of commuting between geographically distinct zones of homogeneous uses. A natural extension of this trend, with an underlying environmental concern and with the impetus of a COVID based acceleration of working from home, is a blurring of the lines between uses. Today most residential use units must also function as an office or study, some of the time, if not all the time. Hotels also function as a third place to work with more work spaces built into the designs in recent years. Within retail centers we may find offices today and even mini-warehouses that provide last mile warehousing. The point is that property today is more multi-purpose, flexible and less distinct as single purpose spaces.

Technological changes can have profound impacts on the demand for particular buildings and cities that are not as obvious at first. For example, if autonomous cars become a reality and the car ownership rate declines in favor of shared transit options, this will reduce the need for parking in all buildings. It will also increase the need for safe drop off spaces within, adjacent to or under buildings. Buildings with nice drop off space, near amenities but with insufficient

onsite parking may suddenly become more appealing. Buildings with excess parking may wish they had designed the parking garage to be convertible to other uses. Another example are the changes observed over time in warehouses. Warehouses have become larger, much taller with higher ceilings and with more attuned to an automated world.

30.2.1 Multi-Family Housing

Total rental demand is estimated based upon total population and household size projections, the portion of the market that desires and can afford ownership given the regulatory environment, and other factors that may impact homeownership rates such as inflation, interest rates and demographic trends. That is the less affordable is ownership the more appealing is renting and vice versa, so both markets must be considered simultaneously. We need to have a specific time period in mind, such as the next year, five years or ten years over which we project unit demand. The goal is to estimate the number of net rental households for a given geographic area as follows:

1. Estimate total population growth considering births, deaths, and net immigration into or out of a region. Positive net migration into a market tends to portend a growing market with a vigorous economic base.
2. Divide this population estimate, for the relevant time period, by household size considering probable recessions and demographic trends. Household sizes will vary by country and market, but in the US has been trending down and as of 2023 was about 2.5 persons per household. This equals total households (with a qualifier that some markets have significant homelessness) which might be considered. The US homelessness rate was about .017% as of 2022, which may be too low for any adjustments, however, in Washington DC the rate approaches 1% and so that might be considered high enough to make an adjustment, reducing demand by that amount.
3. Add to this some estimate of housing units lost to real depreciation and obsolescence including normal attrition for changes in use, public improvements, and roads. Typically, this is about .75% to 1.5% per year. To use 1% assumes an economic life of 100 years. Some residential units certainly last much longer if they are maintained.
4. This will equal total housing unit demand over the relevant time period, but it includes owned units and that must be subtracted.
5. Estimate the owner-occupied portion of this to derive renter demand. Note that credit access, housing policies to encourage or discourage ownership, existing household debt including student loans and credit debt, housing investment appeal and general affordability will influence the homeownership rate going forward. The home ownership rate in the US has trended in the mid 65% range, plus or minus a few percent for many years, although it tends to run lower in more expensive markets like San Francisco (44% or so) and higher in less expensive markets like Allentown, Pennsylvania (73%). We also observe high home ownership rates in Ex-Soviet countries where the conversion to capitalist markets resulted in converting all occupied apartments into owned units. Romania, Hungary, Slovakia are above 90% owned units, Russia and Singapore are near 88%. The Netherlands is near 69%, and

the UK is 63%, while Hong Kong is 22%.[3] As a default, use the historical or current ownership rate. The total households not assumed to be owners will equal the rental demand, with one more adjustment to derive the unit demand total. We note that tax laws also matter, so any changes in tax advantages to own or rent will affect the proportion trying to rent going forward. For example, limits on the ability to deduct property taxes or mortgage write offs might have some affect on the home ownership rate when these laws change since the after-tax costs matters as well as the before tax costs.

6. Last, after adjusting out the owned portion of demand, take this rental portion and add sufficient units for the equilibrium vacancy rate required for normal market operation, by dividing the total rental household demand above by the normal occupancy rate. Relying on the historical vacancy rate for the particular market is a good starting assumption, but trends should be considered.
7. The balance will be new multifamily rental demand. We may also divide the unit demand into Single Family Rentals and Multifamily Rentals if we have data on the allocation and trend of each of these market segments.

Where will the data come from? Much of the data required for the estimation of demand comes from government sources, such as the US Census or in the UK from the Office of National Statistics. Local government agencies will also often have good data. There will also be many fee-based vendors where data can be assembled. A good starting point will be the trade associations for multifamily housing such as the National Multi-Housing Council in the US.

An Example: Using San Diego as an example, there is net out migration in San Diego each year and this trend is expected to continue. Close to 10,000 more people leave the metro market each year than come into the market. At the same time, the birth less death rate (natural increase in population) adds net population of about double the net number that are leaving, so that the net increase in population runs around 12,714 per year. The multifamily vacancy rate is 3.9% and we will assume that this figure is stable. 33% of all rental units are single family units and we assume that is stable. The 2023 home ownership rate is 52% which we will apply to derive our rental demand. We will ignore adjustments for homelessness that would decrease demand and depreciation that would increase demand, assuming this nets out. We use the following data to estimate the net number of new units required by the market each year over a seven-year time span.

San Diego Metro	**2023**	**2030**
Total Population	3,543,540	3,786,510
Ave. Household Size	2.73	2.73
Total Households	1,298,000	1,387,000
Net New Households Over 7 Years		89,000

[3] Sources include the US Census, FRED St. Louis Fed, and Statistica.com.

Percentage Likely to Rent based on the current homeownership rate		48%
Rental Households 2023-2030		42,720
Adjust for a normal vacancy rate of 3.9% = 42,720/(1-.039)		44,454
Portion to be captured by SFR		14,670
Portion to be captured by MF rentals		29,784
MF Unit Demand Growth Per Year		4,255
SFR Unit Demand Growth Per Year		2,096

Considering physical attributes and segmenting the market: Developers and investors do not serve the market, as a whole. Rather, they tend to specialize in particular sub-types of property. For a housing developer, the figures above would simply be a starting point that may steer them towards or away from a particular market or impact the timing of the decision to enter a market. For example, if a developer specialized in Micro-units that averaged under 650 square feet of living area (approximately under 65 square meters) they would next need to examine what portion of the market would be potential tenants and what portion of the market is now serving this segment via micro-units. This would require an analysis of the typical tenants in such units and if these were mostly childless singles, then the next step would be to examine what portion of the market this represents. It could be that only 5% of the current stock of rental housing is a more affordable, non-subsidized, micro-unit, and yet 10% of the net new demand are candidates for such housing. This would be 425 units per year using the figures above.

Other physical attributes may play a role in determining if the market presents solid opportunities. For example, analysis of existing micro-units in various markets may suggest that high amenity common areas with large kitchens and social areas do better than lower cost no frill units. This type of more in-depth market research is essential for successful investing or developing.

Supply also matters: Once a developer or investor determines that a market and property type is of interest, the last question is whether there is sufficient supply coming on line now, and if so, are there any significant flaws in the newly competitive products? Most of the time in most markets it will be known what is coming on line in the next few years. This is a result of the lengthy entitlement process, open public hearings often required, and the business media outlets that constantly search out new stories on potential developments. Assume once again, a micro-unit housing developer finds out three different competitors plan to add a total of 400 micro-units per year for each of the next few years. This could absorb most of the expected demand of 425 units per year. At the same time, further research suggests that one of the locations is right next to a train track (not a stop but simply near the train tracks), and with no parking. The noise factor and lack of parking may make renting some of the units more difficult. Another developer is providing no-amenity units, which are slightly cheaper, but not as appealing as the high amenity units our developer is contemplating. The conclusion will be that there is enough demand and sufficient flaws in the new supply to make room for a new development.

30.2.2 Office

Office demand is a function of professional employment growth and the portion and time that such professionals wish to spend in an office versus working at home or in alternative locations, such as coffee shops and libraries.[4]

Which jobs are professional employment? In the US we use the US Census NAIC (North American Industry Classification System) classifications to estimate the office using jobs. See https://www.census.gov/naics/. The most general list is provided below, with an estimate of the percentage of those jobs which historically require office space. Localized BLS NAIC data trends, when provided by NAIC sector, can then be used to estimate future office demand.

Sector	**Definition**	**Percentage Office**
11	Agriculture, Forestry, Fishing and Hunting	2.5%
21	Mining, Quarrying, and Oil and Gas	25%
22	Utilities	33%
23	Construction	5%
31-33	Manufacturing	5%
42	Wholesale Trade	75%
44-45	Retail Trade	10%
48-49	Transportation and Warehousing	10%
51	Information	100%
52	Finance and Insurance	100%
53	Real Estate and Rental and Leasing	100%
54	Professional, Scientific, and Technical	90%
55	Management of Companies and Enterprises	100%
56	Administrative and Support and Waste	66%
61	Educational Services	85%
62	Health Care and Social Assistance	80%
71	Arts, Entertainment, and Recreation	95%
72	Accommodation and Food Services	15%
81	Other Services (except Public	50%
92	Public Administration	100%

Approximately 50% to 65% of the total employment in industrialized countries are considered "white collar" office-based jobs.[5] Below is an example of the forecast for jobs in a metro like San Diego from the local economic agency over the next five years, summed at the bottom. Note that this does not account for excess space in the current market, so if the current market has 4 million square feet of excess space, beyond normal vacancy, then no new office space is needed for the next two years.

[4] Office jobs generally include BLS NAIC categories from https://www.census.gov/naics/
[5] This figure has been increasing over time and was closer to 50/50 in the early 1960s.

Sector	Definition	Percentage Office Approximate	Expected Job Growth Next Five Years	Office Jobs	Space Required at an average 120 sq ft per worker
11	Agriculture, Forestry, Fishing and Hunting	2%	(1,250)	(25)	(3,000)
21	Mining, Quarrying, and Oil and Gas Extraction	25%	(3,000)	(750)	(90,000)
22	Utilities	33%	1,200	396	47,520
23	Construction	5%	3,200	160	19,200
31-33	Manufacturing	5%	(28,000)	(1,400)	(168,000)
42	Wholesale Trade	75%	7,400	5,550	666,000
44-45	Retail Trade	10%	1,700	170	20,400
48-49	Transportation and Warehousing	10%	8,500	850	102,000
51	Information	100%	14,000	14,000	1,680,000
52	Finance and Insurance	100%	1,750	1,750	210,000
53	Real Estate and Rental and Leasing	100%	1,450	1,450	174,000
54	Professional, Scientific, and Technical Services	90%	9,900	8,910	1,069,200
55	Management of Companies and Enterprises	100%	2,750	2,750	330,000
56	Administrative and Support and Waste Management and Remediation Services	66%	8,600	5,676	681,120
61	Educational Services	85%	3,000	2,550	306,000
62	Health Care and Social Assistance	80%	25,000	20,000	2,400,000
71	Arts, Entertainment, and Recreation	95%	(4,600)	(4,370)	(524,400)
72	Accommodation and Food Services	15%	8,000	1,200	144,000
81	Other Services (except Public Administration)	50%	5,500	2,750	330,000
92	Public Administration	100%	22,000	22,000	2,640,000
	Office Space Needed Over Five Years	**Sum**	87,100	83,617	10,034,040
	Average Office Space Needed Per Year		17,420	16,723	2,006,808

A simple aggregate type model can also work, albeit somewhat crudely. Begin with an estimate of aggregate future employment growth in the region, often provided by the state, province, or local level economic agencies like the Bureau of Employment and multiply it times an average market office share. The next step again is to take the average square footage (or square meters) occupied by typical office workers. This is not personal space, but the sum of the total office space and all amenities and conference rooms divided by the number of workers utilizing the space. Calculating space per worker is a bit challenging as it has been trending down for decades.

In the 1960's private offices were in vogue and no one shared office space. The typical office space per worker was 250 square feet or so, and the utilization rate or time spent at one's own personal desk was less than 40%. The other time was spent in conference spaces, common areas, out to lunch, on calls with clients or colleagues, traveling and so forth. The percentage of white-collar workers was much less than today and few of us worked from home on a regular basis. Since that time, we have seen several technological changes that enabled more efficient use of space. Today it is common to allow some workers to connect from home or elsewhere and to use hybrid models that allow for scheduled time at home, the office or elsewhere.

Office space in the 1960's also utilized a hierarchy whereby the higher one's position in the firm, the larger the office. Several levels of different sized spaces were not very substitutable, creating space utilization friction, when staff turnover occurred. A vice president would not move into a senior vice president's office, nor would a sales rep move into a vice president's space. Today space is not only more standardized, but sharing space is common and the space is less personalized. A laptop simply docks at any desk and the employee is connected to all they need. Sharing space or "hot desking" has resulted in some firms going from 40% desk utilization rates to over 90% utilization rates, thereby allowing a firm to downsize the space needed.

Hybrid work models are now common, where workers come into the office less than full time and where some work only four days a week. For example, three days a week particular office teams gather at the central office and otherwise they work at home. Pre-Covid, about 12% of all professionals were able to work full time at home or in third places of their choosing. As of 2023 that number was estimated to be 20% plus[6], yet most professionals now claim to be able to work some of the time at home. There are many arguments against full time working at home, including but limited to the need to onboard new staff, the need to mentor, train, collaborate and brainstorm, work on team projects and simply allow for serendipitous innovation.

Combining the impact of technology, the shift for some to working outside the office, the standardization of spaces that reduce space friction and we understand why the space per worker has continuously declined. Some firms are now well under 100 square feet per worker (less than 10 square meters) on newer leases, and the average for the market in the US is about 160 square feet on leases signed in 2023. Each market has its own average and while one might expect this to be fewer square feet in expensive markets, this is not the case. New York City has a higher

[6] Sources of such figures include Gensler (Architects) and workplace consultants, such as Leading Authority on the Future of Work - Global Workplace Analytics.

average square feet per person and the reasons may be that these are highly paid professionals (lawyers and investment bankers) and that back-room workers are simply located outside of the central business districts in less expensive markets. Using recent leases within the metro market of interest is likely the best initial data for office space per worker estimates. We can summarize office space demand as:

New Office Space Demand = Net New Office Employees * Square Feet Per Worker

From any new demand expected in each market, based on employment trends, there may be current excess space that must be subtracted. Excess space is that space beyond natural or normal longer-term equilibrium vacancy space which the market will normally provide, typically in the 10% range for US office markets.

Office Example: Assume the current local market has a total employment growth projected over the following year of 2,500 total employees. The regional office employment as a percentage of the total is 55%; and that existing data shows an average of 210 square feet per office worker. There is also a current vacancy of 10%, thus there appears to be no excess space at the current time. No other new projects are under construction, but a few projects have been announced. How much new office demand is likely over the next year?

2,500 new employees x .55 x 210 = net new demand = 288,750 square feet

There are several more questions in a thorough office market analysis. The first is where is this demand likely to be most attracted? The answer might be in the Central Business District (CBD) or downtown or possibly in one of several suburbs. If 80% of the demand is moving to the suburbs and the vast majority of this is moving north then the answer might be that there will be demand for about 231,000 square feet in the suburbs and only about 50,000 in the CBD. For the suburban market 200,000 or better is enough square footage to consider a new building, but in most CBD markets, 50,000 is about 10% of the minimum demand before we would see justification for a new building with the high land cost. This is an example of the influence of the lumpy nature of the supply side of the market.

One can improve office market analysis by using more granular data, that is, breaking down the employment trends by industry segment and then using appropriate office percentages and space trends based on historical data for that segment.[7]

30.2.3 Retail

Retail is among the most dynamic of all the real estate property types. Like office we have observed huge disruptions and transformations, as well as changes in the types of space offered. E-commerce has been part of this transformation and omni-channel retailing via a variety of shopping paths is now commonplace. Delivery services and supply chain speed has impacted the type of retail space needed. Once thought of as a place to sell goods, retail space today is frequently occupied by services such as fitness centers, entertainment facilities, restaurants and

[7] NAICs data is generally used to break down employment segments. NAIC stands for National Industry Specific Employment and Wage Estimates. See https://www.bls.gov/oes/current/oessrci.htm.

tenants that once resided in office buildings. Because of the trend towards tenants that sell no physical goods, it is difficult to use simple metrics like space per capita to gauge whether retail space is too low, adequate, or too high. If retail sales per square foot or meter are adequate or support indirect retail sales from other warehousing operations, we will continue to see retail prosper. In some cases, retail property is also a warehouse, and this is one successful strategy used by Walmart and others. This is part of that blurred line aspect of defining property by one use.

We can characterize retail property as follows, noting that terms will vary around the globe, and that in many European and Asian cities, small clustered retailers are akin to a neighborhood shopping center. This is based upon definitions from BOMA, the Building Owners Management Association, and the authors own surveys. Among these, the most stable retail developments are the neighborhood centers that have grocers as anchor tenants. Power centers have been shrinking and being converted into alternative uses for several years, as they are most vulnerable to e-commerce competition. Regional and Super Regional malls have also morphed into adding grocers and restaurants, so again the lines are being blurred between types.

Retail Property Type	Key Tenants	Typical Size	Drawing Distance
Strip	Convenience	10k to 30k	.5 to 1 mile
Neighborhood	Grocer, Drugstore	30k to 120k	2 to 5 miles
Lifestyle	Restaurants, Clothes	80k to 250k	To 10 miles
Power Center	Category killer big boxes	3 to 6 boxes @ 20k-80k each	To 15 miles
Regional Mall	1 or 2 Department Stores	.5 m <1 million sq ft	To 10 miles
Super Regional Mall	2 to 5 Department Stores	>1 million sq ft	To 20 miles
Outlet	Discount Solo Brands	>1 million sq ft	To 50 miles

In general, retail sales within a market are a function of population growth and household income growth. If a market has a population growing at 1.5% per year and nominal income growth of 3% per year, then we would expect annual sales to grow at approximately 4.5%. We note that the 4.5% includes inflation, and so to do this in real terms we would net out inflation. As a default model, nominal retail sales should grow at the rate of population growth plus expected inflation, plus some percentage increase if there is real economic growth occurring in the region of interest. Recent history on real economic growth may be the best easy to use short term

indicator. This is usually modest as real economic growth has been about 2% per year for the last decade or so in the US.[8] With a real growth rate of 2% and an inflation rate of 2.5%, the model could be restated as: population growth rate plus inflation plus real growth = 1.5%+2.5%+2.0% = 6.0% expected sales growth although only 3.5% is real and the rest is inflation.

At the micro level, to estimate a property's expected income growth requires an analysis of their sales trends and profit margins. Retail tenants' ability to pay rent depends on their level of sales, per unit of space, and profit margin. The portion available for rent will typically equal 10% to 15% of the profit margin, with the balance going to labor, administration, marketing, and the tenants own residual profit. An approximate potential rent model can be calculated as follows:

Annual Potential Rent Per Square Foot = Sales Per Square Foot * Average Profit Margin*10% to 15%

For tenants with lower profit margins, such as a large-scale grocer, the portion available for rent will be closer to the 10% level, while high profit margin businesses can sometimes pay more than 10% for rent. For example, if an anchor tenant is a large grocer store, and we have data suggesting that they sell $2,000 per square foot per year and have a 12% profit margin, then they can pay:

$2,000 *.12 * .10 = $24 per year per square foot in rent

If the tenant is a small coffee shop and they sell about $2000 per square foot per year and have a 50% profit margin, then they can pay at least:

$2,000 * .50 * .10 = $100 per year per square foot in rent, possibly as much as $150 per year

When analyzing whether a market needs more retail space, the key question is first whether the population is growing and the economic base of the relevant market. The next question is whether the market has adequate supply for expected growth, and that is indicated by existing vacancy rates and rental rate trends. This simplistic view is clearly insufficient to make decisions on development opportunities or property repositioning. Tenant mix and drawing power, adequate parking, access and even line of sight views from roads all play a role in the success of any retail center. It is not sufficient to simply sell goods from retail centers, unless satisfying immediate needs such as food. Future successful retailers need to provide experiences, education and entertainment in order to thrive, otherwise orders will be placed by ecommerce and supplied mostly from warehouses or big box retailers acting simultaneously as warehouses.

While it may be common sense, other indicators of demand for space would be observing low vacancy rates and increasing rents that exceed inflation. Accelerating vacancy rates and requests for rent reductions provide immediate and obvious indications that retail space demand is dropping.

[8] From 2010 through 2021 the US economy grew in real terms by 2.0% per year. See https;//www.globaldata.com

The retail industry is somewhat concentrated and that is why super scale conferences, such as the ICSC (International Council of Shopping Centers) conference in Las Vegas is so large. On the supply side we have major retail owners with many malls and retail centers. Among these are the Simon Property Group with hundreds of shopping malls, General Growth Properties, Developers Diversified, Kimco Realty, Centro Properties, Macerich, CBL, The Inland Real Estate Group, Westfield LLC, Regency Centers and several others. The top 25 owners likely control more than 50% of the retail space. On the demand side, the top retail tenants like Walmart, Costco, Kroger Co., Walgreens, CVS, Target, Sam's Club, and others control a great deal of the retail leased space. The top 100 tenants have 65% of the total space, and the top 500 tenants have 85% of the space. Even Amazon is now opening retail space. With an industry filled with dominant retail space suppliers and dominant retail demand, it is no wonder that many leases are negotiated over multiple sites at once at large conferences.

30.2.4 Industrial

Industrial property consists of two types: manufacturing and warehousing. Warehousing can be further segmented into bulk, large centralized automated warehouses, and then smaller metro serving warehouses as well as last mile warehouses, called micro-fulfillment centers. The manufacturing property is generally owner occupied as it is always custom built. Manufacturing firms need to control their own space and quickly adapt it to their needs without constraints. The uniqueness of such space makes it unappealing to investors since a tenant defaulting on a lease would be difficult to replace. For this reason, when we talk about marketable industrial space, it is generally warehousing. The industrial warehouse market is about twice the size of the office market in square footage or meters, and seems to be growing while the office market is contracting, as of 2023.

Warehouse space demand is very much aligned with imports and exports, retail sales and the need to store goods prior to delivery to the customer or for returns, a significant portion of the space demand. E-Commerce has been a huge driver of warehouse demand. As a percentage of all retail sales, excluding restaurant, autos and gas, e-commerce now exceeds 18% and it continues to grow. In the US E-Commerce has been growing at a rate of about 16% annually since 2011.[9] E-commerce is defined here as sales of goods and services through digital channels. E-commerce sales include internet sales of retailers that operate solely online, plus the online sales of brick-and-mortar brands. Not included in these e-commerce sales is revenue from online travel services, financial brokers, and ticket sales agencies. Thus, e-commerce sales enhance warehouse demand but lower the demand of brick and mortar retail space. This helps explain why the footprints of most retailers has continued to shrink over time.

Once again, we have blurred lines in property types as some retailers have started to use big box space as both retail and warehouse space. This will make it more difficult to model warehouse space demand in the future. Essentially warehouse demand can be related to

[9] See U.S. Census Bureau Quarterly E-Commerce Reports.

population, household wealth, retail sales and the portion of retail captured by e-commerce, but modeling accurate demand directly is difficult.

Warehouse space demand is required to break down bulk shipments into smaller mixed product shipments. Warehousing space demand is dependent on the modes of transportation required in the supply chain. For this reason, we will have large bulk receiving and shipping warehouses near airports, sea and water ports, train lines, and central highways. Prior research has focused on manufacturing goods produced as a major source of space demand. [10] The IMO (Index of Manufacturing Output) and the ISMPMI (Institute for Supply Chain Management Purchasing Managers Index) have been shown to correlate with and lead aggregated US warehouse demand, but imports, exports and the level of ecommerce has also driven space demand. Mueller and Laposa (1994), with later contributions by Mueller and Mueller (2007), developed the Path of Goods Movement (POGM) theory for studying warehouse space demand.[11] The theory suggests that industrial demand for space is highly correlated with the location of distribution markets on the path that goods flow from sources (manufacturers) to destinations (population centers). Using occupied stock measures of markets along the POGM versus those that are not, they found that cities on the POGM had higher than the U.S. average occupied-stock-per-person ratios, while cities that were not on the path of goods movement had lower ratios.

One way to try and determine if a metro market is a bulk warehouse delivery center is to examine the amount of warehouse space per capita. For the US as a whole we observe markets with less than 50 square feet of warehouse space per capital up to over 150 square feet of space per capital, with an average of about 85 square feet. This is using only bulk warehousing statistics (bulk defined as buildings over 100,000 square feet) divided by the population. Thus, if we observe a metro that has 120 square feet per capital in warehousing it is likely near transportation nodes (connections between different forms of transit, train, planes and trucks via highways), such as Chicago or Atlanta. If we observe 50 to 60 square feet per capital of space, then it is likely serving only the local region and not a major distribution node. One trend to watch is the increasing use of excess airport runways or smaller and specialized airports for fast transit of goods. For example, FedEx uses Memphis, Tennessee as a super-hub. Amazon uses an excess runway in Northern Kentucky/Cincinnati as a hub in the US and Leipzig/Halle in Germany. Those markets with more space per capital than average are part of the critical path of goods supply chain described above.

We can expect e-commerce to continue to grow and with it, warehouse space demand, both bulk and last mile. Finally, given the challenge of predicting the demand for future

[10] See "Industrial Space Demand", January 2011, NAIOP White Paper by Randy Anderson and Hany Guirguis.
[11] See Glenn Mueller and Steve Laposa, "The Path of Goods Movement", Real Estate Finance, 11(2), 1994, pp.42-50 and "Warehouse demand and the path of goods movement" J. Real Estate Portfolio Management, 13 (1) (2007), pp. 45-56.

warehouse space, one should always monitor vacancy rates for various types of warehouses and rental trends.

30.2.5 Lodging

In the United States, the tourism industry is currently the third largest retail industry, behind automotive and food stores. Some local economies are very much dependent on tourism and business conferences, i.e. Orlando, FL, Las Vegas, NV, Honolulu, HI, New Orleans, LA, Florence, Italy, Venice, Italy, while others have a heavy tourist component in their local economy, like, Paris, France, Washington D.C., San Diego, CA, Rome, Italy, Istanbul, Turkey, and the list goes on. About one fourth of all travel is vacation related, while one fifth is personal or family related. The balance is business or convention oriented.

By definition, a lodge, hotel or Inn is any fee-based sleeping accommodation away from home. Lodges may also include food, entertainment, and a variety of services and activities. Most larger scale hotels are branded, that is, connected with a major well-known chain that accommodates reservations, promotions and purchasing. At the other end of the scale in size, home rentals and Bed and Breakfast Inns (B&B) have prospered and now compete for longer term stays. This is a result of web-based applications that have made it easier to match renters with rooms or homes for rent, and to manage access, for example, VRBO and AIRBnB. Aside from these extremes in scale, we also delineate the market by categories such as budget or economy, limited service, hostels, full service, luxury resort, and conference center hotels. Some hotels also provide excellent work environments and cater to the business traveler that needs a work station or desk. See for example, CitizenM, a chain of efficient lower cost, but well-located hotels for the work-related traveler.[12]

Demand for lodging has paralleled the increase in travel for both pleasure and work over the last seventy years. The average real price per passenger mile via airlines has gone from $27.62 US dollars in 1950 to less than 8 cents today.[13] Travel demand can be broken down as domestic or international, for holiday or visits to friends and relatives, or for business purposes. After the COVID pandemic of 2020 through early 2023, hotel business rebounded rapidly.[14]

One of the dominant sources of travel industry data is Smith Travel Research (STR) now owned by CoStar.[15] It is not that easy to get pure real estate data from sites leased to hotels as often the site and the hotel are sold as a package deal. Valuation often includes business value and real estate value. Historically, and noting the possibility of some issue with pure real estate analysis, separate from the business, cap rates for hospitality property have run higher than any other large property type. In fact, hotel cap rates have been running double those observed for

[12] See https://citizenM.com
[13] See www.air-transport.org and the Air Traffic Association of America
[14] In the US hotel occupancy in April of 2020 averaged 24%, compared to 66% in April of 2022.
[15] About STR | Confidential, Accurate and Actionable Data Benchmarking

multifamily rental properties. This may reflect the risk of short-term leases (one day to a month) within the business model, and now the possibility of government shut downs during pandemics.

Among the most important market metrics are average occupancy levels, average daily room rate or "rack rate", and average revenue per room per night "RevPar". Occupancy levels in the hotel industry normally run 60% to 85%, although some supply constrained markets like Hawaii consistently tend to run in the 90% range. The rack rate and RevPar tends to be fairly correlated or the same for budget no frills hotels, but for luxury hotels and resorts the figures can be quite different. The RevPar figure includes charges and fees for other services including dining, services within the hotel, audio visual and conference room fees. Hotels where the rack rate and RevPar are similar must normally achieve higher occupancy levels in order to break even. A new budget hotel may need 80% or higher occupancy levels in order to be considered financially successful, while a luxury resort may need 65% to 70% as long as the RevPar total is high enough from restaurants and other sources of income that may derive from both guests and non-guest visitors. Aside from tracking these figures, the industry can be divided up into the business traveler dependent more on conferences, the business traveler that must travel as part of their work, and the vacation traveler. Conference bookings and trends can be monitored as these are often known months and years in advance from local tourist boards. Business travel is normally correlated with the overall economy, GDP, and vacation travel seems related to the trends in the relative costs of travel (gas, train and air costs).

30.2.6 Self Storage Centers

George Carlin, a famous and cynical comedian, said in 2007 "the whole meaning of life is to find a place to keep your stuff", and he found it incredible that a whole industry existed as a place to keep your stuff.[16] As of 2023 there was over 1.65 billion square feet of self-storage space (over 50,000 facilities) just in the USA, with about 50 million square feet being added each year. One in three Americans use self-storage space, paying an average of $135 per month for a 10 by 10-foot space, with huge variations by metro. [17] Self-storage developments once occurred in odd spaces behind other buildings where the parcel was too small or too inaccessible for most other uses, but it has developed into a major industry with major REITs engaged in self-storage rental property. Today, some developers focus on retrofitting obsolete big boxes (40,000 square foot or larger buildings with high ceilings) that were once used for Targets or K-Marts or other retailers, and this has become a major source of new inventory. Because self-storage requires less parking, there are also out lots, adjoining parcels that can be rented or sold off for other development opportunities.

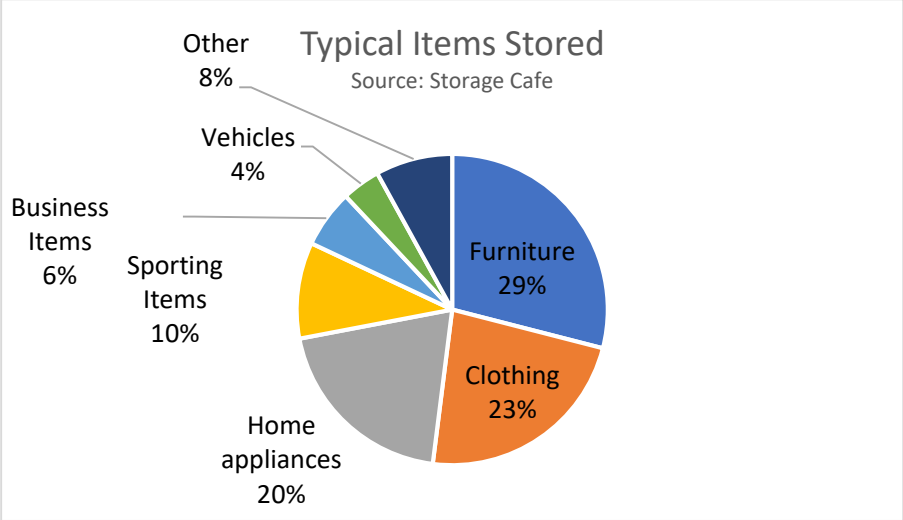
Typical self-storage units today are located in or near urban centers, have humidity controls to keep the air dry allowing for longer term storage. Some are air conditioned and unit size varies. All modern units have security cameras and monitoring. Most allow for remote management, providing access via a phone app and automated rent collection. Aside from rent

[16] See george carlin "Stuff" - Bing video

[17] According to Storagecafe.com

collection, default on rental contracts results in forgoing the contents of the storage unit which are typically auctioned off.

Surveys suggest that the biggest reason for needing to rent a self-storage unit are a result of downsizing, followed by moving, not having enough space at home, storing documents or inventories for business, and changes in household size.[18] Demand seems to be mostly a function of the number of households nearby and the density of the population that makes land expensive. As of 2020 the per capita self-storage space available in the US was 5.9 square feet. Among the items most stored are:



According to CoStar data as of mid-2023, the average Self-Storage facility sold for an average of just over $100 dollars per square foot with a cap rate of just over 5% for prime well-located facilities.

Current self-storage space, outside of one's home or apartment, is about 5 square feet per capita in the US as of 2023. It is not clear how much storage space demand will exist in the future, but to the extent we feel the need to store our stuff, the per capital demand seems to be growing every year.

30.1.2 Bio-tech or Life Science

Experts from Grand View Research, Inc. project reported that the biotechnology industry will grow into a $2.4 trillion market by 2028. Some of the exciting trends in this growing industry are personalized medicine, genome editing, and synthetic biology aside from vaccine development and production. The growth rate of this industry is one of the fastest in the world, running near 14% a year according to Grand View Research.[19]

[18] Source: Storage Café 2022

[19] See Biotechnology Market Size & Growth Trends Report, 2030 (grandviewresearch.com)

Bio-tech or life science facilities are a type of specialized industrial space that allow for testing, research and development or clean manufacturing. For example, DNA analysis machine production or testing machines, or vaccine production would all be examples of the types of uses of such space. An example of a bio-tech type tenant would be Illumina, Illumina | Sequencing and array-based solutions for genetic research. An example of a vaccine producer would be AstraZeneca, Bristol-Myers Squibb, Abbott Laboratories, Pfizer, Amgen, Merck KGaA, Johnson and Johnson, Novartis, Lonza to name a few. The buildings that are well positioned for bio-tech tenants will be very specialized. They tend to have high ceilings from 14 to 18 feet, sometimes higher, flexible ceiling structures with power access, fire safety, ultra clean air filtration systems that change the air several times more rapidly than in a traditional office building, and back up redundant power systems. Contamination protection is part of the essential design of the building system, along with decontamination rooms and changing rooms for workers who wear special protective garments to keep human pollution inside the garment. Humans are among the most polluting organisms in the building and this is why more and more robotics are being used within biotech production facilities. Robots don't sweat, cough, smoke, flake skin cells or otherwise spoil clean production sites so they are being used more and more for interior lab research and manufacturing. Interior surfaces of bio-tech buildings must not be porous or absorb any particulates and so finishing materials must be super smooth and cleanable. Temperature, humidity and air pressure controls are also important in some facilities as precise measurements require consistent temperatures.

Among the states where most biotech jobs are located are Massachusetts, California, North Carolina and Maryland, New York, and New Jersey although many other states have significant biotech workers. According to BioSpace.com the best regions for biotech jobs are, as of 2022:

1. Boston, MA
2. San Francisco, CA
3. Los Angeles and San Diego, CA
4. Chicago, IL
5. Seattle, WA
6. Philadelphia, PA
7. Maryland and Washington DC Region
8. New York and New Jersey

The catalysts for bio-tech growth are primarily access to major university research facilities that help to both spawn new innovative products and processes, but also provide the highly skilled labor for bio-tech firms. As such the top ranked universities for life sciences include some of the following, which correlates with the location of many bio-tech firms.

University	Country
Harvard University	United States
University of Cambridge	United Kingdom
Massachusetts Institute of Technology	United States
University of Oxford	United Kingdom

Princeton University	United States
California Institute of Technology	United States
Stanford University	United States
Yale University	United States
University of California, Berkeley	United States
Johns Hopkins University	United States
Tsinghua University	China
ETH Zurich	Switzerland
Imperial College London	United Kingdom
Cornell University	United States
University of California, San Diego	United States
University of Washington	United States
University of California, Los Angeles	United States
Peking University	China
Wageningen University & Research	Netherlands
UCL	United Kingdom
University of Pennsylvania	United States
National University of Singapore	Singapore
University of Toronto	Canada
Columbia University	United States
The University of Chicago	United States

Most developers and investors of Life Science buildings specialize in this property type and so relationships with Bio-tech firms drive most new development on a build to suite basis. There are some exceptions. IQHQ and ARE, as examples, develop some speculative Bio-tech facilities along with some pre-leased portion of new projects. [20]

30.1.5 Data Storage Facilities

Everyone has heard of storing data and files in "the cloud". What that means is to store digital information offsite, general in "servers" which are computers dedicated to storing and retrieving information. These servers can be in the closet of a home or a business, but more often digital storage space is simply rented out from third parties, eliminating the need to continually maintain and update such machines. The advantage of using third parties is a result of scalability should changing capacity requirements on the fly be needed, and also the benefits of secure buildings with substantial power feed redundancy, air temperature and humidity controls and in

[20] See https://iqhqreit.com/ Also see https://www.are.com/ for Alexandria Real Estate.

many cases cheaper power sources. Servers are very power hungry machines and they utilize substantial electricity while generating significant heat as a by-product. This is why many data storage facilities are often located in the cheapest electricity regions, such as Idaho and Washington state, and it is helpful to be in cooler climates or near cool water used to air condition the facilities. When the speed of response time to the servers and back to the user is critical, i.e. milliseconds then the servers are more likely to be located near the users. These data storage facilities are mostly filled with heat producing electric consuming servers on racks. On a cubic foot basis, they are by far the most productive and expensive space to rent among all the various real estate property types.[21]

Cloud based data storage is now a vital part of the global economy, and it is growing at geometric rates as a result of the propensity to now attach every important object from light bulbs to temperature sensors to all computers to the internet. We can expect annual growth rates to continue in the double digits for the foreseeable future. The size of the cloud computing market is expected to exceed $800 billion US dollars by 2026.[22]

While companies and individuals may contract directly (privately) with firms like Equinix, Digital Realty Trust, NTT, QTS Realty Trust, CyrusOne, Telehouse, and Cyxtera, most users will contract with firms like Amazon, Dell, HP, Google Drive, Dropbox, Microsoft Azure, TeraBox and other large-scale vendors that provide a user interface for storing files.[23] Dropbox is the most utilized cloud storage for individuals with over 700 million users as of 2020.[24]

The key to successful development, investment and management in data storage seems to be either developing relationships with the large vendors or working with larger firms that want private secure storage of files, finding good sites with cheap power and being able to provide secure energy backup so that the system never goes down. The benefits of such development is having tenants that need almost no parking and are not fussy about amenities and views.

30.1.7 Surface Parking Lots

Office towers, retail and residential buildings, museums, convention centers, and arenas crowd urban areas. But what was there before those buildings? Probably surface parking lots and older obsolete buildings. The humble surface parking lot is often the predecessor to most new structures. Surface parking lots are an excellent way to hold otherwise vacant sites, earn some cash flow from parking, and maintaining maximum option value on the site for more productive uses when market conditions warrant new development.

There are only two types of parking structures, surface lots and multiple layered covered garages. Covered garages are far more expensive to develop and more difficult to convert to a new, higher and better use, since the new returns must also compensate for the lost revenues. Here we focus on the surface parking lots that can be described as "options that pay dividends".

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[21] As of 2023 a 4 foot cube sized space filled with servers might rent for $4,000 US dollars a month.

[22] See https://www.cloudwards.net/cloud-computing-statistics/ The size of the data storage market has been doubling every three years since 2010.

[23] See https://www.equinix.com/, and https://us.nttdata.com/en as examples.

[24] See https://www.cloudwards.net/cloud-computing-statistics/

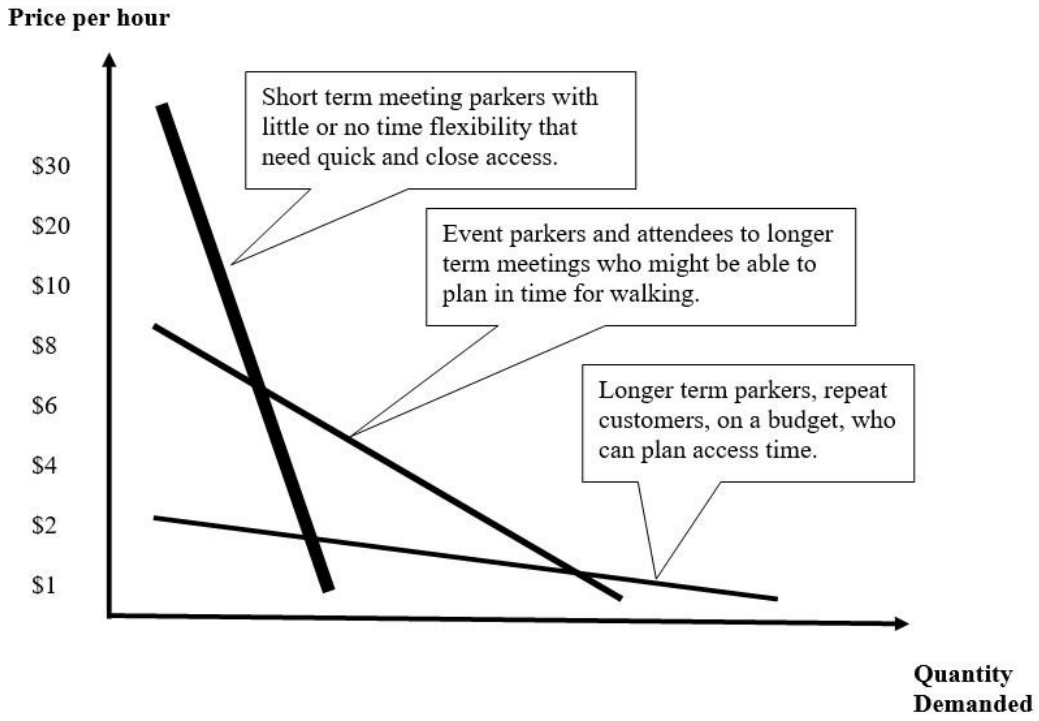
We also note that the location and demand for parking may shift dramatically over the next decade as autonomous cars come to fruition and at that point, we will need more drop off lanes next to all buildings, and parking may shift to more fringe locations.

There are three market segments requiring parking for human driven cars:

1) Workers who want parking on a frequent basis. This market segment can be further divided into the professionals who are unwilling to walk more than a few minutes or to go outside and face uncertain weather and the lower income staff who are willing to face uncertain weather and walk a few or several blocks in order to save on parking rates. The first group can be viewed as one with inelastic demand who will pay any price for convenience. The latter group is very price sensitive and amenable to shuttles and public transportation options should these be efficient alternatives.
2) Visitors who come to urban sites for business meetings, to dine out or shop. These are short term parkers who may need parking for only a few hours. Given the short term nature of this parking demand, or the fact that bags might need to be carried after shopping, convenience is essential and the parking must be very close to the desired target location. The price for this type of parking is usually very high per hour, but might be subsidized by retailers and restaurants.
3) Entertainment oriented or business event attendees that require short term parking for an evening or a few days. Event parkers, where a great concentration of cars are aiming at a specific location, pay for parking according to a time and convenience distributed supply. Lots close to the event tend to be considerably more expensive than those that require a shuttle or a long walk. Prices will vary considerably for such myriad demand.

   We illustrate parking demand elasticity below:

Parking Lot Pricing Demand Illustrated



There are significant economies of scale in the operation of parking lots. Advertising, signage, management, revenue collection from a myriad of lots and garages all tend to have a scale economy that suggests advantages from centralized ownership or at least management. Thus, the highest bidders for parking lot properties are likely to be those who already own and operate other parking lots in the same area. Fragmented operation tends to be extremely inefficient given the difficulty of securing stable trained and reliable lot operators.

Given the high option value of owning surface lots, we see that parking lots tend to sell for cap rates that are among the lowest of all property types. Recall the Gordon Growth model where total yield is approximately equal to the going in cap rate plus the growth rate of these net revenues. If the expected growth rate of the revenue stream is 6% and the required yield is 10% (unlevered) then the going in cap rate will be as low as 4%. Given a site with very high option value in the near term, the going in cap rate will be even lower. The point is that the option value is as important as the current yield on sites with near term potential for development. For sites with no possibility of conversion the current yield will be closer to the long term required total yield. Most successful surface parking lot investors will concentrate on sites that have high option values.

30.2 Chapter Summary

Rents and values are the most important outcomes from market analysis. Everything matters in terms of what may influence rents, from the macro global level to the local level. An astute analyst will watch economic trends and try and ask how does that affect the property market? For example, a new high speed train stop will raise the possibilities for nearby development and potential rents, as access is enhanced. The work-from-home movement has lowered the need for as much office space, and enhanced the possibility of converting old office buildings into residential buildings. For every economic driver that seems to forbode a negative impact on the market, there is also likely a positive.

We should keep in mind the short-term indicators of market trends. These are sublease rates for the office market, vacancy rates for all property types, occupancy levels especially for the hotel market, asking rents versus contract rents as examples. Values are driven by not just rents and operating expenses but also the capital market, so if yields are declining values are increasing, independent of the rent level. If loan to value ratios for mortgages are tightening (more restrictive underwriting) then more equity is required and the weighted cost of capital is becoming higher which in turn lowers values. Both the space market and capital markets must be monitored.

Supply is a longer-term response to any economic factor influencing the market. Supply requires time. The more difficult it is to add supply and the longer it takes the more we would describe such a market as inelastic. Inelastic markets tend to exhibit greater movements in rent in response to changes in demand. If demand has decreased it takes longer for supply to become reduced as real estate is a long-lived asset. It may take several years for an oversupply from either overbuilding or a permanent and significant decrease in demand to reach equilibrium as some properties fall into lower quality submarkets.

Every property type has its own primary drivers of demand and rents, although demographics and the general economy matter for all of them. At the same time, we are observing more mixed use and multipurpose property where the lines of delineation are blurred. For example, hotels that serve as good work places, apartments that double as daytime offices, offices within a retail center, night time warehousing and distribution from a daytime retail store.

We have learned that a pandemic can shut down entire property types (fitness, theaters, restaurants, hotels) and that some metro areas are more vulnerable to such events. We have also witnessed an evolution of retail towards more services, and offices that provide more conferencing space. Among the newest types of properties where we can expect continue growth are data storage centers, and bio-tech or life science facilities. In some cases, occupant needs have evolved such that older buildings are obsolete. This is why it is important to understand the physical specifications of those buildings considered state of the art as well as the drivers of tenant demand in general. This is why real estate is so exciting. It is impossible to know too much about design, social, workplace, cultural and economic and trends.

Key Terms

Asset market

Blurred lines with respect to property types

Bulk warehousing

Demand elasticity

Equilibrium vacancy rate

Hybrid work models

Life Science buildings

Micro-unit (multifamily housing)

Rack Rate

RevPar

Space market

Space per worker

Submarket

Supply elasticity

Study Questions

1) Why is it important to follow and understand trends in both the asset and the space markets in order to know whether we are likely to see more supply coming into the real estate market or not?
2) How large would you estimate is a typical apartment market geographically and what would drive the size larger or further from those places residents want to be near?
3) How large would you estimate is a super-regional mall market? Or a convenience store?
4) Describe from short run to long run how the apartment market would respond to a change in demand caused by a major employer opening up in the east quadrant of a medium sized city?
5) How would the market respond if a speculative developer overshoots the market and provides too much office space? Describe the process from short run to long run.
6) How does space per capital help us determine if a metropolitan market is a major supplier of bulk break point warehousing?
7) How might we determine affordable rents for a tenant with a profit margin of 25% and sales each year of $500 US dollars per square foot?
8) Describe physically bio-tech or life science buildings?
9) Describe the important features of a data storage center?
10) Why do we say surface parking lots are an option that pays dividends?