CHAPTER 2
BASIC REAL ESTATE ECONOMICS

INTRODUCTION

Urban real estate markets may be peculiar and idiosyncratic in a number of respects, but they still obey some basic economic principles: the principles of demand and supply. In what follows, we are going to elaborate on some basic/generic demand and supply concepts and demonstrate how they determine market prices. The premise is that supply and demand frameworks provide basic analytical tools for conceptualizing the workings of urban real estate markets. As one of the readings by a down-to-earth practitioner suggests, these simple principles have been ignored by the real estate industry in favor of boilerplate analysis or simple hunch and intuition (Featherstone, 1986). Hunch and intuition may be useful when they are based on a solid understanding of how markets generate opportunities and constraints. However, such an approach may be very misleading when it is based on a myopic interpretation of market conditions.

Within this context, this chapter covers the basic economic principles that govern the functioning of urban real estate markets. As such, it first reviews the fundamental concepts of demand, supply, prices, and price adjustments, then expands on how they apply to real estate, and finally elaborates on their relevance to market analysis.

REAL ESTATE DEMAND

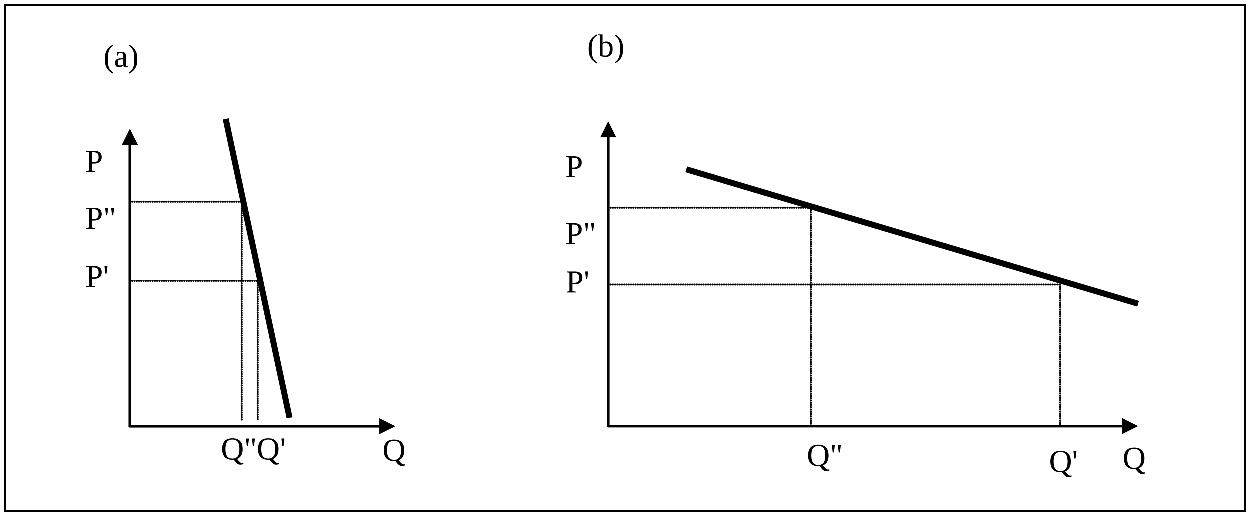
In this section, we first discuss the traditional economic definition of demand and distinguish between different demand concepts, such as, *effective demand*, *ex ante* vs *ex post* demand, and *pent-up* demand. Subsequently, we focus on the price elasticity of demand, and elaborate on the difference between actual price effects and expected price effects. After a discussion of the exogenous determinants of real estate demand, we conclude the section with a review of the various absorption concepts that are commonly used to measure marginal changes in real estate demand.

REAL ESTATE DEMAND CONCEPTS

Following conventional economic theory, the demand for real estate space can be defined as the quantity of space or number of units demanded at various prices. In this sense, it is more appropriate to think of demand as a schedule as shown in Figure 2.1, rather than a single quantity. Figure 2.1 demonstrates the fundamental law of demand, which states that the quantity demanded declines with price or, in real estate terms, that a lower amount of space or number of units is demanded at higher prices.

Embedded in the demand definition is the concept of *effective market demand*, that is, the demand that is backed up by purchasing power. In some cases, in real estate analysis we may need to focus on *desired* or *ex-ante* demand. This refers to the aggregate desired quantity of a good *before* consumers interact with the marketplace. After interacting with the marketplace, however, *realized* or *ex-post* demand may be different from the *ex-ante* demand for various reasons, such as supply constraints. The not-yet-realized demand is often referred to as *pent-up demand*.

Figure 2.1 Fundamental Law of Demand



DEMAND SENSITIVITY TO PRICE/RENT CHANGES: PRICE ELASTICITY OF DEMAND

An important trait of the demand curve is the sensitivity of quantity demanded to price changes. This sensitivity is summarized by the concept of the *price elasticity* of demand ε_D. This is calculated as the ratio of the percent change in quantity demanded over the percent change in prices. The price elasticity simply shows by what percent the quantity demanded will decrease in response to 1% increase in price. For example, a hypothetical estimate of the price elasticity of housing of –0.5 would suggest that the number of housing units demanded will decrease by 0.5% if the average price of housing increases by 1%. In general, if the price elasticity is less than one demand is considered to be inelastic. An inelastic demand schedule implies that demand is insensitive to price increases or, that large price increases induce relatively small decreases in the quantity demanded as in Figure 2.1 (a).

$$\varepsilon_D = \frac{\Delta Q/Q \text{ [percentage change in quantity demanded]}}{\Delta P/P \text{ [percentage change in price]}} \qquad (2.1)$$

$|\varepsilon_D| > 1$ [demand is price elastic]

$|\varepsilon_D| = 1$ [demand is unit elastic]

$|\varepsilon_D| < 1$ [demand is price inelastic]

On average, real estate demand is price inelastic. If the price elasticity is equal to one then demand is considered to be unit elastic, and refers to the case in which a percentage increase in price induces exactly the same percentage decrease in the quantity demanded. Finally, demand is considered to be elastic if its price elasticity is greater than one. An elastic demand schedule implies that small increases in price induce large decreases in the amount of space or number of units demanded as in Figure 2.1 (b).

The price elasticity of demand is determined by the availability of *substitutes*. For example, a product with few substitutes, such as luxury housing, should have a less elastic demand than a product with plenty of substitutes, such as middle-income housing. Similarly, the demand schedule for a submarket must be more price elastic than the demand schedule for the whole metropolitan area since there are many substitutes for the former (other sub-markets) but hardly any substitutes for the latter. To better understand this argument consider that most of the companies housed in a metropolitan area serve the local population and businesses. Thus, while these firms can move from one submarket to another submarket and still be able to serve their local clientele, they can not do so if they move to a different metropolitan area.

Why is the concept of the price elasticity of demand relevant for real estate analysis at the macro or micro level? At the macro level, it can help gauge the impact of changes in market prices or rents on demand and more specifically, on the amount of space and/or number of units demanded. At the micro level, it can help investors and developers assess the impact of price increases on revenues.

Developers and investors would always prefer to face inelastic project demands because if prices/rents increase, revenues increase as well, as demand/absorption does not decrease enough to eliminate the gains from rent increases. In other words, if the price of real estate, *P*, goes up, the quantity demanded, *Q*, goes down but, still revenue, *P*Q*, increases because *Q* decreases considerably less than *P* increases (Kau and Sirmans, 1985).

Impact of Actual Price Changes vs Expected Price Changes

In analyzing the effect of price changes, it is important to distinguish between *actual* price increases and *expected* price increases. As discussed earlier, if actual prices increase quantity demanded is impacted negatively to a lesser or a greater extent, depending on the price elasticity of demand. In graphic terms, this impact can be traced by moving *along* the demand curve since price, *P*, is an *endogenous* determinant of demand (see Figure 2.1). Are there any scenarios under which this fundamental law of demand may *appear* not to apply? For example, some market analysts observing increasing housing demand during periods of rising prices may be tempted to conclude that the law of demand is being violated. One could also make the same argument alluding to periods during which both office rents and absorption are increasing.

Although these phenomena *appear* to violate the law of demand, they are perfectly consistent with economic theory. In the cases discussed above, increases in demand are not triggered by the *actual* price increases but by the *expectation* of further increases in the future (assuming that no other changes that would trigger an increase in demand are taking place in the marketplace). To further elaborate on this issue let's consider a market in which housing prices rise initially due to massive immigration of households in the area and the resultant increase in the demand for housing. These initial increases in housing prices may ignite in the minds of housing buyers expectations of further price increases in the future. Such a scenario is quite likely since empirical studies have shown that real estate investors behave "myopically", or in other words, tend to extrapolate recent market developments and price movements into the future (Sivitanidou and Sivitanides, 1999). If that is the case, what will be the likely impact of these expectations for higher housing prices on single-family housing demand? Would it be the same as the impact of *actual* price increases?

The answer to the above question is no for the following reason. In the case of the single-family market, while *actual* price increases may discourage some households from realizing their plans to buy a house because they can no longer afford it, *expectations of further* price increases in the future may motivate some other households to accelerate their decision to enter the market before prices climb at even higher levels. Similarly, in the case of the office market, expected rent increases may motivate office firms to engage in the so-called "banking of office space", that is, lease more space than they currently need for future use. Therefore, under the assumption of reasonably behaving households and firms, *expected* price or rent increases may result in an *increase* in demand for housing or office space, which is opposite of the effect *actual* price increases would have. Such a behavior explains the phenomenon of increasing demand during periods of increasing prices or rents. The effect of expectations for higher prices represents, therefore, a *shift* of (and not movement *along*) the demand curve. In this fashion, *expected* price changes are *exogenous* determinants of demand.

EXOGENOUS DETERMINANTS OF REAL ESTATE DEMAND

So far, we discussed the role of the endogenous determinants of real estate demand, that is, actual prices and rents. As the previous discussion has indicated, however, quantity demanded does not depend only on prices, but also on other non-price or *exogenous* (as they are typically referred to) factors, that can induce shifts of the demand schedule (see Figure 2.2).[7] These exogenous determinants are of equal or even greater importance to real estate analysts. Competent forecasts of these factors can be very helpful in assessing real estate market prospects, evaluating project viability, and identifying real estate development and investment opportunities. The exogenous drivers of the demand for real estate can be classified into the following four categories:

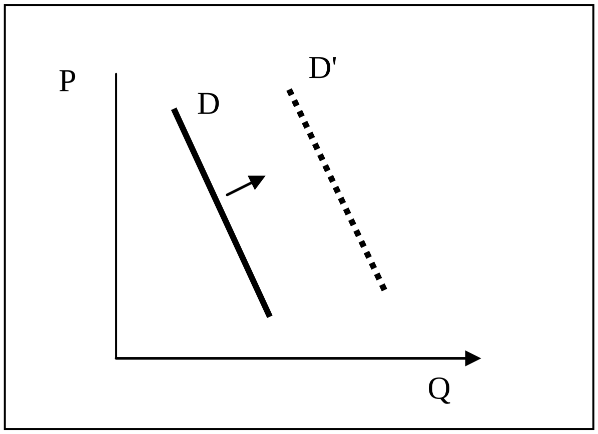
- Market Size (Population, Employment)
- Income/Wealth
- Prices of Substitutes
- Expectations

Market size variables that drive the demand for real estate include population, employment, or output, depending on the property type under consideration. For example, in the case of housing and retail the relevant exogenous determinant is the number of households, while in the case of office space the most relevant market-size variable is office employment. In the case of industrial space demand, the relevant size variables include output, as well as warehouse and distribution employment (Wheaton and Torto, 1990). The effect of market size on real estate demand is positive, that is, for the same price level and

[7] The strict meaning of the term "exogenous" from an econometric point of view is discussed in Chapter 7.

larger market size a greater quantity of real estate will be demanded in terms of either square footage or number of units.

Figure 2.2 Demand Shift



Income/wealth affects directly the demand for retail and residential real estate in the sense that, keeping prices constant, as income increases more households can afford to buy a house and a greater dollar amount is available for retail spending. Therefore, increases in real income or wealth should be associated with increases in the number of housing units and the square footage of retail space demanded.

Demand for office and industrial space may also be indirectly affected by income movements. For example, as income increases the demand for office services may increase to the point that local office firms may need to hire more employees and expand their office space usage in order to accommodate this increased demand. So eventually, income increases may lead to shifts in demand for office space through their effect on office employment. Similarly, increased consumption of goods due to increases in income may motivate wholesalers and retailers to increase their storage/distribution space, thereby inducing shifts in the demand for warehouse/distribution space.

The price of substitutes could also induce shifts in the demand for real estate. For example, for a given level of single-family housing prices, increases in apartment rents are likely to induce a shift of the demand curve for single family-housing to the right. Such a shift is likely to occur because as renting becomes more expensive relative to owning a house some renters may find home-ownership more attractive. Similarly, in the office market, as rents in the class A market rise some firms may be forced to seek space in the class B market where rents are more affordable. In such a case, the demand schedule for class B space will shift to the right in order to reflect the greater amount of office space demanded in response to rent increases in the class A market.

Finally, *consumer or firm expectations* may induce shifts in demand for the different types of real estate. For example, as discussed earlier, expectations of higher prices or rents in the future may result in increases in the number of housing units demanded or the amount of office space demanded. Similarly, growth expectations on the part of firms may also induce shifts in the demand for commercial real estate. For example, an office firm in a market that is growing rapidly may require a greater amount of space in anticipation of future expansion than an identical firm would require in a stable market that does not foresee any expansion potential.

MEASURING CHANGES IN REAL ESTATE DEMAND: ABSORPTION CONCEPTS

Given the durability of real estate, marginal shifts in demand are more important than aggregate demand from a real estate development point of view. Real estate analysts use several proxies/indicators of such changes in demand, most of which are absorption measures. Properly used or misused proxies of marginal changes in space demand include *gross absorption*, *net absorption*, and *average or normal absorption*.

Gross absorption is defined as the total amount of space involved in all leases signed during a particular period. Notice that physical occupancy of the space associated with a particular lease contract may take place months after the contract is signed. Is gross absorption a good measure of marginal changes in real estate demand? For example, if gross absorption in a market is going up does this mean that the market is healthy? The answer is no because gross absorption does not account for space vacated. In other words, gross absorption measures all leasing activity, which may simply represent movements of tenants from one building to the other. As such, it does not really indicate anything about changes in aggregate demand for real estate. In fact, if the space vacated were greater than the space leased, which implies a decrease in total amount of occupied space and a weakening market, the positive gross absorption measure would be very misleading. Therefore, real estate analysts should not pay too much attention to this measure. If net absorption is known then gross absorption may worth some consideration because it can provide some information regarding the extent of turnover in the market.

GROSS ABSORPTION (GA_T)

Gross absorption is defined as the sum of all square footage (*S*) involved in all leases, *n*, signed during a particular time period t:

$$GA_t = \sum_{i=1}^{n} S_i \qquad (2.2)$$

Net absorption is defined as the change in a market's occupied stock and is calculated using formula (2.3). By definition, net absorption measures changes in aggregate demand for real estate and is definitely a much better indicator than gross absorption because it accounts for vacated space. Thus, net absorption can take negative values if the occupied stock of a market decreases, or in other words, if the space vacated during a period is greater than the space leased.

NET ABSORPTION (AB_T)

Net absorption is defined as the change in a market's *occupied stock* during a particular time period. It can be calculated using (2.3), where *OS* denotes occupied stock:

$$AB_t = OS_t - OS_{t-1} \quad (2.3)$$

Note that:

$OS_t = S_t (1-V_t)$ and $OS_{t-1} = S_{t-1} (1-V_{t-1})$,

where *S* is the market's total stock (occupied plus vacant) and *V* is the vacancy rate.

Before evaluating net absorption, it is important to understand its determinants. Since it represents change in demand, its determinants include prices/rents, changes in market size (e.g. population, employment etc.), changes in income/wealth, and expectations for prices or employment growth. According to the law of demand, prices/rents should have a negative effect on net absorption while, as discussed earlier, market size, income, and expectations of price increases or employment growth should have a positive effect.

WHAT DETERMINES NET ABSORPTION?

	Effect
Prices/Rents	-
Changes in market size (e.g., population, employment)	+
Changes in income/wealth	+
Expectations for changes in prices or employment	+

Given the different factors that may boost net absorption this measure should be interpreted with extreme caution. For example, increasing absorption may not necessarily reflect a rapidly growing employment base, but simply pent-up demand, that is, demand from previous years that remained unrealized due to supply constraints or high rents. If that is the case, developers should think twice before plunging into a construction frenzy. Similarly, increasing absorption may simply be due to expectations of future rent increases, which may induce firms to lease today more space than they currently need for future use. In fact, if such “banking” of space is the major cause of increases in absorption during a period, subsequent periods may see decreasing absorption, despite strong employment growth, because firms would have already leased the space needed to accommodate additional employees.

The lesson that comes out of this discussion is that it is not enough to know whether net absorption is strong or what direction is moving in order to accurately assess the strength of the market and its prospects. It is more important to know why it is strong and why it is increasing or decreasing. Is it due to changes in rents? Employment, population or income growth? Or simply due to expectations?

Normal or average absorption is simply an estimate of the average net absorption usually over a long historical period, if the available data allow it. Some real estate analysts are fascinated with the concept of average or normal absorption, but such a measure could be extremely misleading when used for forecasting purposes. As historical data for office and industrial net absorption show, this indicator moves along a wide spectrum of positive and negative levels. Thus, net absorption over a given forecasting period may fluctuate a lot, depending on how its several drivers will move. Therefore, an estimate of an average absorption over a number of years in the past is by no means an indicator of the absorption levels that will be achieved in the years ahead.

To understand how misleading average absorption can be when used as a basis for developing forecasts consider this example from the Houston office market. For this example, we will assume that the year of analysis is 1986 and that we want to generate absorption forecasts for the period 1987-1990. According to CBRE/Torto Wheaton Research historical data that start from 1980, the average office net absorption during the period 1980-1986 it was 5.7 million square feet. As Figure 2.3 indicates, this average was driven up primarily by very high absorption of about 15 and 10 million square feet in 1981 and 1982, respectively. In 1986, the hypothetical year of analysis, net absorption in Houston was negative 1.6 million square feet.

Within this context, a typical forecast for the Houston office market in 1986, using the concept of average absorption would look like the one presented in Table 2.1. In particular, given the negative performance of the market in 1986, the analyst would most likely predict a below-average absorption in 1987, such as 2 million square feet or so, and then apply the average absorption for the remaining years of the forecast. As Table 2.1 and Figure 2.3 show, in reality the market in 1987 did not absorb 2 million square feet of additional space. On the contrary, it registered a negative net absorption of 1.4 million square feet. During the subsequent years, the market registered positive net absorption, ranging between 1.9 and 3.6 million square feet, which was considerably lower than the predicted 5.7 million square feet per year.

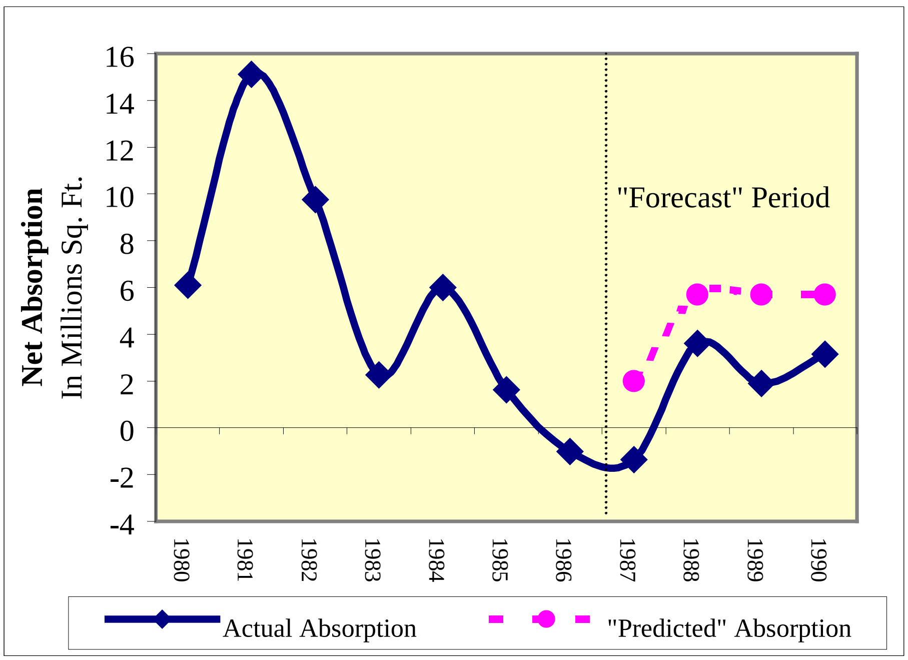
In sum, using the concept of the average absorption, the analyst would considerably overestimate future net absorption and provide a severely misleading picture regarding the prospects of the Houston office market over the period 1987-1990. Such a forecast could easily mislead an investor or developer about the feasibility or viability of a new office development in the market. To understand the magnitude of the error involved, consider that the cumulative net absorption of 19.1 million square feet, predicted over the whole period of the forecast using the average absorption is 261% higher than the actual cumulative net absorption of 7.3 million square feet.

Table 2.1

Example from the Houston Office Market:
Developing Forecasts Using Normal or Average Absorption

Year	Historic Net Absorption (Million Sq. Ft.)	"Predicted" Net Absorption (Million Sq. Ft.)	"Actual" Net Absorption (Million Sq. Ft.)
1984	6.0		
1985	1.6		
1986	-1.0		
1987		2.0	?
1988		5.7	?
1989		5.7	?
1990		5.7	?

Figure 2.3. "Predicted" vs Actual Absorption



Source of actual absorption: CBRE/Torto Wheaton Research

THE SUPPLY OF REAL ESTATE

In this section, we discuss first the different real estate supply concepts and then focus on the behavior of new construction, which is the most important component of the supply side from a market-analysis point of view. In particular, we discuss the fundamental law of supply, the price elasticity of supply, and the various factors that drive real estate development and investment decisions.

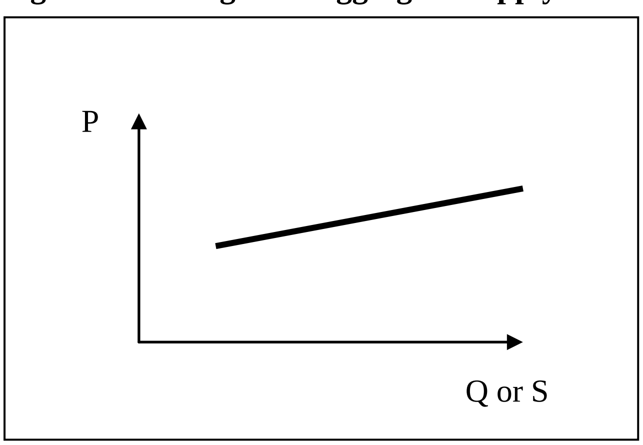
REAL ESTATE SUPPLY CONCEPTS

The term real estate supply refers in general to a schedule that describes the quantity of commercial space or housing units supplied at various prices. Discussed in more detail in a subsequent section, the supply curve is typically portrayed as an upward sloping curve reflecting the fundamental law of supply, which states that greater quantity is supplied at higher prices. When dealing with real estate, it is useful to distinguish between three broader supply concepts: the *long-run aggregate supply*, *the short-run aggregate supply*, and *new construction*. Although, all three concepts are often mentioned in discussions of the supply side of real estate markets, they are not all equally useful when it comes to producing period-by-period forecasts of movements in a market's inventory.

The Long-Run Aggregate Supply: Is it Relevant?

The *long-run aggregate supply* depicts the relationship between long-run prices or rents and the total number of units or square footage supplied over the long-run (see Figure 2.4 below). The concept of long-run aggregate supply is not very useful for market analysis purposes because it is difficult to operationalize. It is being used, however, in long-run cross-market analyses as well as in theoretical studies focusing on the long-run behavior of real estate.

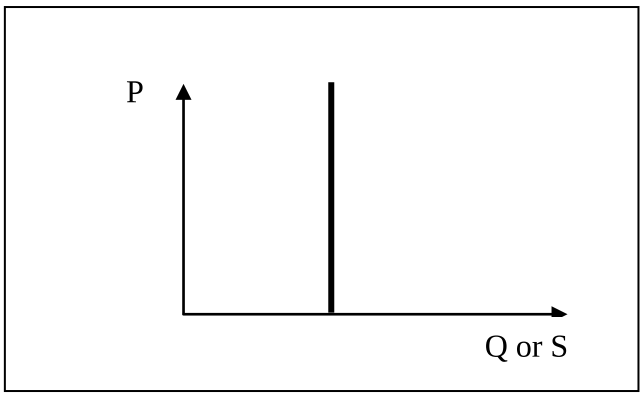
Figure 2.4. Long-Run Aggregate Supply



The Short-Run Aggregate Supply

The short-run aggregate supply refers to a market's total stock at a given point in time. Since in the short-run the real estate stock is fixed, the short-run aggregate supply is represented in the price-quantity space by a vertical line, as in Figure 2.5. This concept is very useful in understanding short-run adjustments in real estate markets because it communicates one of their most important behavioral characteristics. The fixity of the real estate stock in the short-run is due to the construction lag, that is, the time needed to plan and develop a building. The construction lag is considered to be at least 6-12 months for residential and industrial, and at least 18-24 months for office and retail. Given this construction lag the short-run supply of real estate is insensitive to prices/rent changes or, in economic terms, is completely price inelastic. So, if for example, a 20% increase in office rents takes place in a market tomorrow the total office space stock will remain the same for quite a while before it responds to this strong rent increase.

Figure 2.5. Short-Run Aggregate Supply



New Construction

New construction is by far the most important supply concept when analyzing real estate markets, because of the long life of real estate assets. To better understand the importance of new construction in forecasting movements in a market's real estate inventory, it is helpful to review the s*tock-flow identity*, which describes how a market's total real estate stock, *S*, is determined at any given point in time, *t:*

$$S_t = S_{t-1}(1-d) + C_t \quad or \quad S_t = S_{t-1}(1-d) + aPRM_{t-n} \qquad (2.4)$$

where:
S_t : real estate stock at time *t*
d : depreciation rate
C_t : space completed at time *t*
PRM : space permitted at time *t-n*
a : percent of permits completed
n : time between permit issuance and project completion

The stock flow identity simply states that the stock at time *t*, is equal to the stock of the previous period, S_{t-1}, minus the depreciated stock, dS_{t-1}, plus completions during period *t*, C_t. The depreciation rate, *d*, refers to three types of depreciation: *physical*, *functional* and *economic*. Physical depreciation refers to the physical aging and deterioration of the building. Functional depreciation refers to the functional obsolescence of an existing building compared to new buildings that provide new services or similar services more efficiently. Such efficiency advantages may be due to better layout, design, technological infrastructure and equipment, etc. Economic depreciation refers to economic obsolescence due to external or environmental factors that negatively affect the income-earning capacity of the property. Economic and functional depreciation of a market's stock is difficult to measure. Physical depreciation may be relatively easier to measure, but there have been no systematic surveys across the different property types.

When a property becomes obsolete, the question of redevelopment may arise. The fundamental redevelopment rule is that the difference between the Residual Land Value (RLV) of the new building and the RLV of the existing structure should be equal or greater than the redevelopment cost. This condition is expressed below, first more generally and then more analytically:

$$RLV_{new} - RLV_{existing} \geq Redevelopment\ Cost \quad (2.5)$$

$$(P_{new} - C_{new}) * FAR_{new} - P_{existing} * FAR_{existing} \geq Redevelopment\ Cost \quad (2.6)$$

where:
P : price
C : construction cost
FAR : floor-area ratio

As the stock-flow identity indicates, the marginal change in a market's stock at any period depends on the amount of *new construction* and depreciation. As such, new construction is the important supply concept in understanding how real estate markets move and adjust through time, and, certainly, the most important supply variable from a market-analysis perspective. What do we mean with the term new construction? The term new construction refers to completions, or otherwise, the total square footage in all new buildings that have been given a certificate of occupancy or passed the final inspection under the building permit during the period under consideration.

It should be noted that project completion represents the last of three major stages of the development process. In analyzing the supply side of real estate markets, it is important to understand these different stages and the so-called "pipeline effect". The real estate development process includes the following three basic stages:

a) building permit
b) start of construction
c) completion

Permits refer to building permits issued based on *approved plans*. *Starts* refer to the beginning of construction and they are identified by inspection records. *Completion* refers to the end of construction and receipt of the certificate of occupancy.

In sum, from the conception of a real estate development project to its completion there are at least three intervening stages during which a project may drop out of the process. We could think of this process as a "pipeline" with leaks at any of these stages. For example, not all projects get a building permit; neither all projects that get a building permit do actually start. Finally, not all projects that start are completed. The percentage of permits that become starts and the percentage of starts that become completions may vary under different market conditions. For example, in soft markets these percentages may tend to be lower, while in tight markets they may tend to be higher. Given the considerable time that intervenes between project start and project completion, new construction is *forecastable* to a considerable extent in the short-run. Data on starts and permits can be found in the Construction Report Series, C-40 published by the U.S. Department of Commerce.

The Pipeline Effect

Permits refer to the building permits issued based on *approved plans*. Not all permitted projects enter the construction phase.

↓

Starts account for the beginning of construction. They are identified by inspection records. Not all projects that break ground are eventually completed.

↓

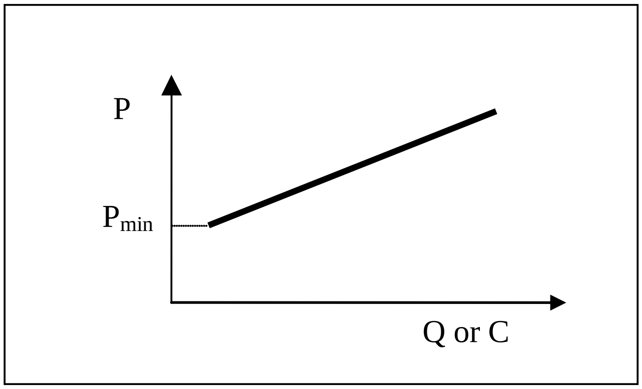
New Construction accounts for *completions*. A building is completed when it has a certificate of occupancy or passed final inspection under the building permit.

Note that the percentage of permits that become starts, and the percentage of starts that become completions may vary through time, depending on market conditions.

NEW CONSTRUCTION BEHAVIOR

The new construction schedule obeys the fundamental law of supply. Thus, all else being equal, the higher the property prices are the higher the quantity of the new space supplied in the market. Assuming a linear supply schedule this basic supply law is represented graphically in Figure 2.6 and described mathematically by the expression $Q_S = -c + dP$. As this figure shows, the new construction schedule is characterized by a minimum price level, P_{min}, representing the asset price threshold below which developers cannot cover their development costs and make a reasonable profit. Thus, when property prices are below this threshold no amount of space will be developed. Residential developers utilize this threshold very often in their efforts to determine how affordable a development can be to specific consumer segments in the market.

Figure 2.6. New Construction (Completions)



The responsiveness of new construction to asset price or rent changes is captured by the elasticity of supply, ε_S, which is largely determined by the cost and availability of factors of production. The more costly these factors are the less price elastic the supply is. A price elasticity of new construction of 1.5, for example, suggests that a 1% increase in property prices will induce a 1.5% increase in new construction. Thus, the price elasticity of supply is very useful in grasping the magnitude of the effect of changes in prices on new construction. Consider for example the case that real estate analysts anticipate that a new government policy will raise housing prices by 10%. Then the elasticity figure of 1.5 would suggest that this new policy would stimulate a 15% increase in new construction. New construction is on average very price elastic, that is $\varepsilon_S >>> 1$. This is especially true in office markets where development is very lumpy.

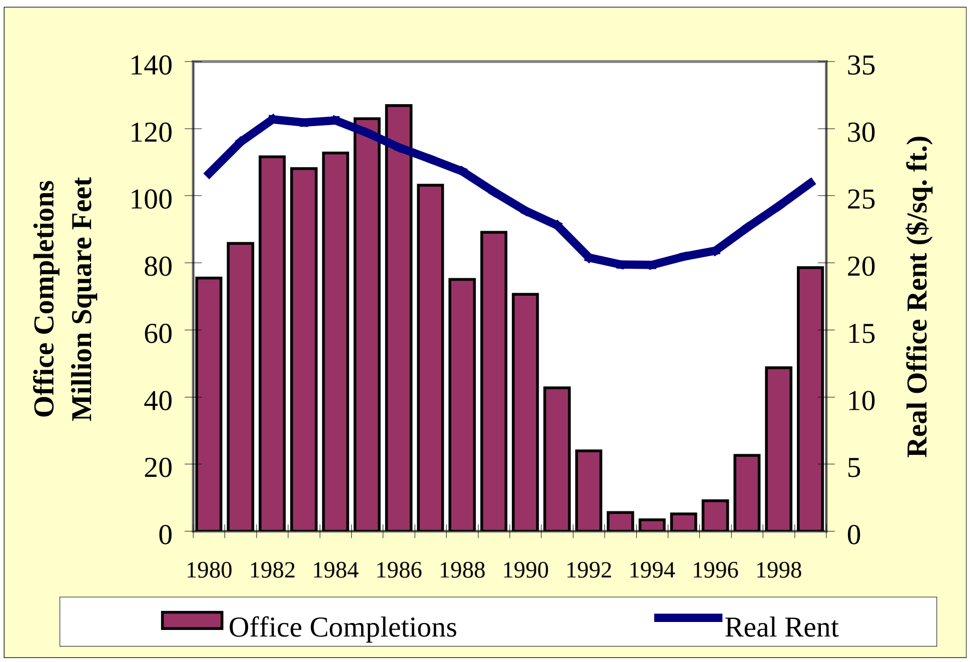
$$\varepsilon_S = \frac{\Delta Q/Q \text{ [percentage change in quantity supplied]}}{\Delta P/P \text{ [percentage change in property price]}} \quad (2.7)$$

The most illustrative, perhaps, example of the high price elasticity of new construction can be drawn from the national office market. As illustrated in Figure 2.7, which depicts movements in office completions and real rents, during the 1980s, huge increases in construction investment took place all over the nation due to sharp increases in rents and (presumably) climbing asset values in the late 1970s and early 1980s. It should be noted that the excessive construction of the 1980's has been also attributed to a number of other factors, such as abundant capital availability, tax breaks etc.

Construction activity peaked in 1986, but seven years later (in the early 1990s) dropped down to almost zero, as property values collapsed below development costs and as increased uncertainty started settling in. This increased uncertainty was triggered by both the already deteriorated market conditions and the recession that hit the national economy in 1991.

As Figure 2.7 shows, office construction continued at high levels during the 1980s despite declining real rents and very high vacancy rates. What motivated investors to continue building under such poor market conditions? Did investors form optimistic expectations in the 1980s based on office employment growth? This is not so clear from Figure 2.8 that contrasts office completions and office employment growth, because one needs to control for rents/asset values and uncertainty.[8] As Figure 2.9 shows, because of the massive construction, the market became seriously oversupplied as the vacancy rate shot above 14% by 1984 and stayed above it for over a decade peaking in 1991 at 19.1%. To understand how massive the response of new construction was in the 1980s consider that during that period more space was build than all three previous decades together.

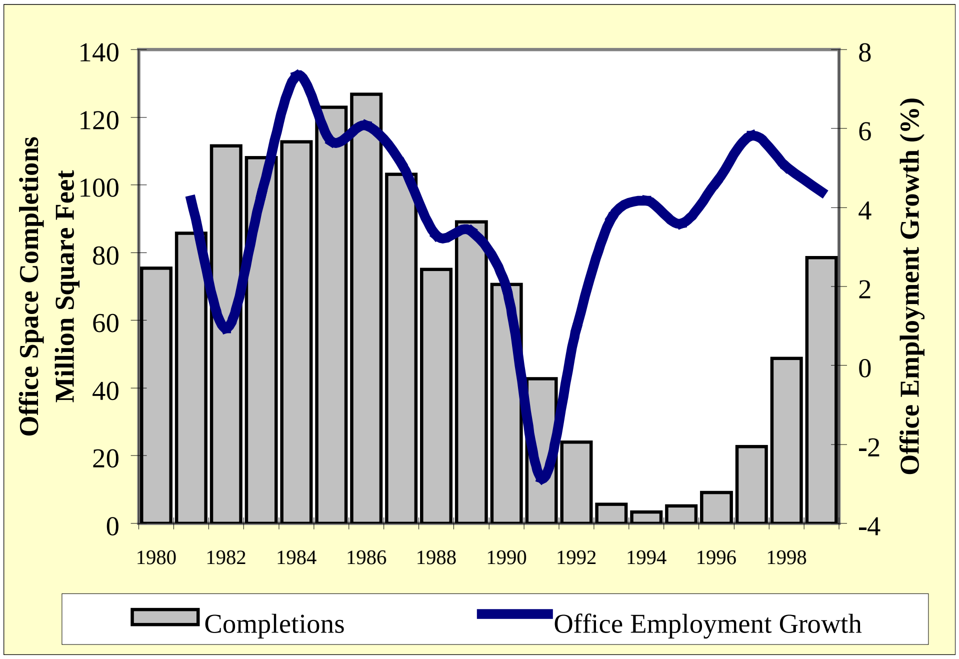
Figure 2.7 Office Completions and Real Rents



Source: CB Richard Ellis/Torto Wheaton Research

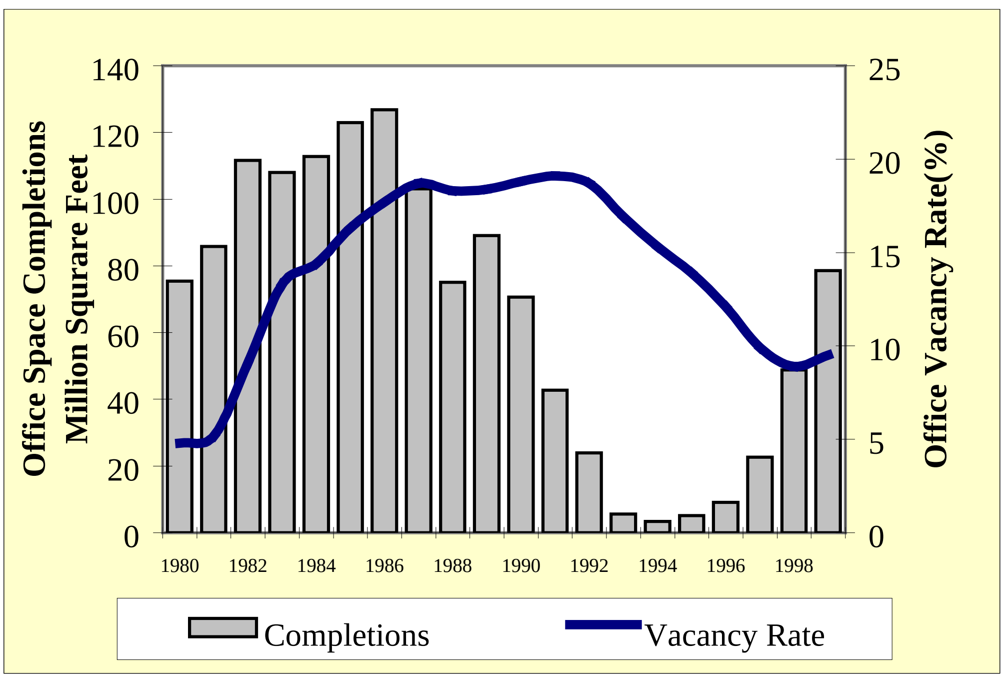
[8] The completion figures presented represent the sum of completions in 31 markets covered by CBRE/Torto Wheaton Research.

Figure 2.8   Office Completions and Office Employment Growth



Source: Economy.com, CB Richard Ellis/Torto Wheaton Research

Figure 2.9 Office Space Completions and Vacancy Rate



Source: CB Richard Ellis/Torto Wheaton Research

What Determines New Construction?

As indicated earlier, new construction is the sum of the square footage in all individual projects completed within the period of reference in the market under consideration. The major motivation for the development of every speculative commercial real estate project or housing development is profit. Within this context, the major determinants or exogenous shifters of the new construction schedule of a market are the factors that determine project profitability and the uncertainty associated with it. These include in particular:

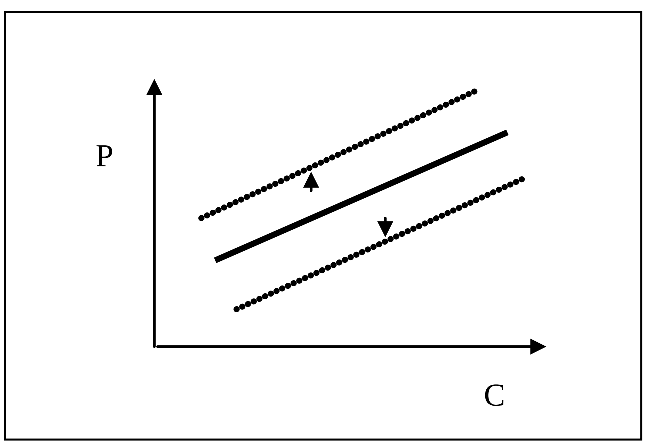
- *availability and cost of factors of production*
- *expectations* regarding future real estate demand and prices, and
- perceived *market risk*

The *factors of production* required to complete any real estate development project include:

- capital
- labor
- land
- building materials

The cost of these factors affects *negatively* the amount of new space developed in a market. In particular, the higher the cost of capital, labor, land and building materials the higher the cost of the project, the smaller the profit and the lesser the motivation of investors and developers to provide new space. Thus, an increase in the cost of any of these factors should induce a downward shift of the new construction schedule since a smaller amount of space will be provided at the same price level (Figure 2.10).

Figure 2.10 Effects of Exogenous Shifters on New Construction



It should be noted that the cost of the factors required for the development of a real estate project differs across the nation's metropolitan real estate markets. For example, labor costs in Boston maybe higher than in Los Angeles because of the scarcity of labor in the former. Similarly, land prices in large metropolitan areas, such as Chicago or Los Angeles, are considerably higher than land prices in small metropolitan areas, such as Tucson or Cleveland.

On the revenue side, the most important inputs in assessing project viability are *expectations regarding the strength of demand and rents/prices*. In theory, such expectations can be:

- *Myopic*, where $\hat{P}_{t+1} = P_t$, if it is assumed that current demand/price levels or increases (whatever is relevant from the investor's or developer's point of view) will continue into the future in the same exact manner

- *Adaptive*, where $\hat{P}_{t+1} = P_t + d$, if developers and investors form their expectations by applying an adjustment, d, to current values of the variables they are interested in based on past mistakes

- *Rational*, where $\hat{P}_{t+1} = P_{t+1}$, if developers and investors based on all available relevant information can predict correctly how the market responds to exogenous shocks once they occur (DiPasquale and Wheaton, 1996)

In reality, as many empirical studies of the real estate market suggest, real estate investors and developers form their expectations myopically. Expectations of growth in demand, rents, and/or prices should have a *positive* effect on new construction (thereby inducing an upward shift of the supply curve), as they may encourage developers and investors to build a greater number of housing units or square footage of commercial space.

Every speculative investment, and especially those involving long gestation periods like real estate development, involves some uncertainty, which the investor needs to factor in before he/she commits capital on a specific project. Within this context, new construction levels should also be affected by *market risk* or the perceived uncertainty of a market in supporting profitable development of a particular property type. According to conventional investment theory, investors facing higher risk require higher returns, which in an efficient asset market should be reflected in lower prices. Since lower property market prices would tend to discourage new development, risk and uncertainty should have a negative effect on new construction.

Another approach to the relationship between uncertainty and new construction involves the theory of irreversible investments. According to the "traditional" investment rule an investment occurs when asset price, P, is greater than or equal to investment cost or development cost, I. The "modern" investment rule postulates that investment will occur when asset price, P, is greater than ωI, where ω is the option value multiple and it is function of uncertainty, among others (see Dixit and Pindyck, 1994). This rule basically suggests that higher uncertainty increases the opportunity cost of investing now, thereby raising the threshold asset price required by investors/developers before making an irreversible investment, such as the development of real estate. Thus, for a given asset price an increase in risk should result to lower real estate construction. Sitivanidou and Sivitanides (2000) tested this hypothesis in the case of office-commercial construction and found that the influence of uncertainty is statistically significant but weak compared to the influences of the other determinants of new construction. In any case, one could argue that, all else being equal, markets with more volatile economies should have less construction.

The concept of market risk is helpful in understanding part of the variations in construction levels either across markets or within the same market through time. In cross-market comparisons, this risk is typically measured by the volatility of critical market indicators, such as demand or its major drivers, and rents or prices. For example, an investor may evaluate the risk of an office market relative to another by comparing the respective volatility indicators for such variables as local office employment, and/or office rental rates. Perceptions of risk either across markets or through time may be also shaped by indicators of market strength. For example, a market maybe considered more risky in periods during which the vacancy rate is in the high teens compared to periods during which the vacancy rate is below 10%.

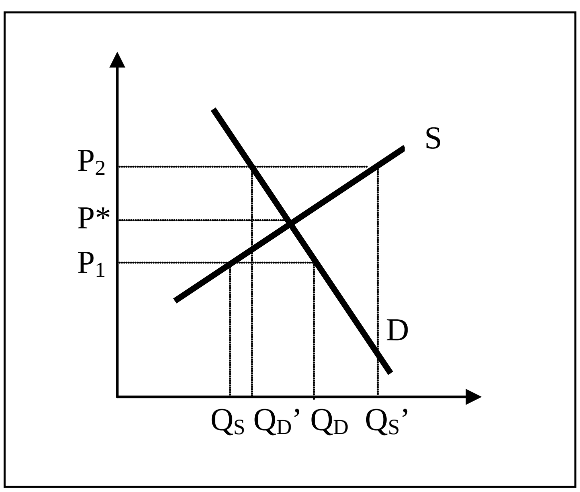
REAL ESTATE PRICE ADJUSTMENTS

Rents and prices play a very important role in real estate as they do in any other market. Furthermore, rents and prices are two of the most (if not the most) important inputs that market analysis needs to provide for the assessment of the financial feasibility and viability of a project. That is why it is very important to understand how market rents and prices are determined and what mechanism drives their movements.

PRICE DETERMINATION MECHANISM

As in the case of any other market, real estate rents/prices are determined through the interaction of supply and demand or sellers and buyers in the marketplace. Figure 2.11 shows that graphically the market rent/price is determined as the intersection of the demand and the supply curves. This intersection point represents the rent/price at which the number of willing buyers/tenants equals the number of willing landlords/sellers. In mathematical terms this is the price at which $Q_D = Q_S$. To understand why this price level should eventually prevail as the equilibrium market price consider the following:

Figure 2.11. Market Price Determination

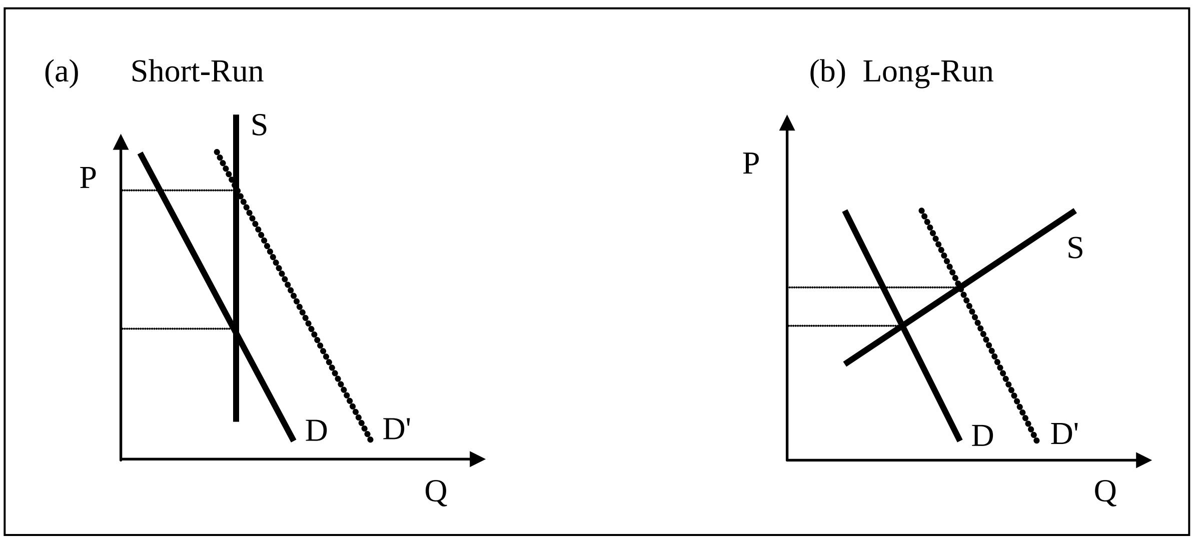


- Suppose that the market price is at P_1, which is below the equilibrium level. At this point the number of units demanded, Q_D, is greater than the number of units supplied, Q_S. In such a case, the excess demand will drive prices up so that some buyers will drop out of the market and some additional sellers motivated by the higher prices will enter the market. Once prices reach P* (at which $Q_D = Q_S$) buyers will have no incentive to drive prices further up.
- If the market price is at P_2, which is above the equilibrium level, the number of units demanded, Q_D', will be smaller than the number of units supplied, Q_S', and sellers experiencing low interest in their properties will be motivated to reduce prices in order to attract buyers. Prices should continue falling until $Q_D' = Q_S'$ at which point no seller will be motivated to reduce the price of its offering.

LONG-RUN VS SHORT-RUN CHANGES

To understand the basic price dynamics associated with the simple supply-demand framework and how they apply to the real estate market let's look, for example, what will happen to the Phoenix apartment market if the area experiences significant immigration of middle-income households. In doing so it is extremely important for market analysis purposes to differentiate between the short- and long-run rental price impacts of such demand shifts.

Figure 2.12. Short-Run vs Long-Run Price Changes



First of all the massive immigration of households in the Phoenix market will induce an upward shift of the demand curve as more housing will be demanded for the same price level. The impact of this shift on prices in the short-run will be different from its long-run effect. In particular, housing price increases or rent inflation in the short-run will be greater than in the long-run. The reason is that in the short-run the existing residential stock in Phoenix is fixed, as indicated by the vertical line in Figure 2.12 (a), due to the construction lag. In the long-run, however, developers will have the time to respond to the increase in demand and the initial increase in prices by building new housing units. Thus, in the long-run the residential stock in Phoenix will rise to the level defined by the intersection of the demand curve, *D'*, and the long-run housing supply curve, S (see Figure 2.12 (b)). At that point, demand will equal supply and investors will have no motive to provide any more units unless prices or rents change again due to another exogenous demand shock.

As Figure 2.12 shows, the extent of long-run price increase as a result of this demand shift will depend on the *slope or elasticity* of the supply curve. The more responsive, or in economic terms, the more elastic the supply curve is to price increases the smaller its slope and the smaller the long-run price increase due to an increase in demand. If the supply is perfectly elastic (which implies a horizontal supply curve), then the long price effect will be zero. Thus, as indicated by Figure 2.12, the short-run price increase should always be greater than the long-run price increase unless the long-run supply of real estate is perfectly inelastic (vertical line), which is extremely unlikely.

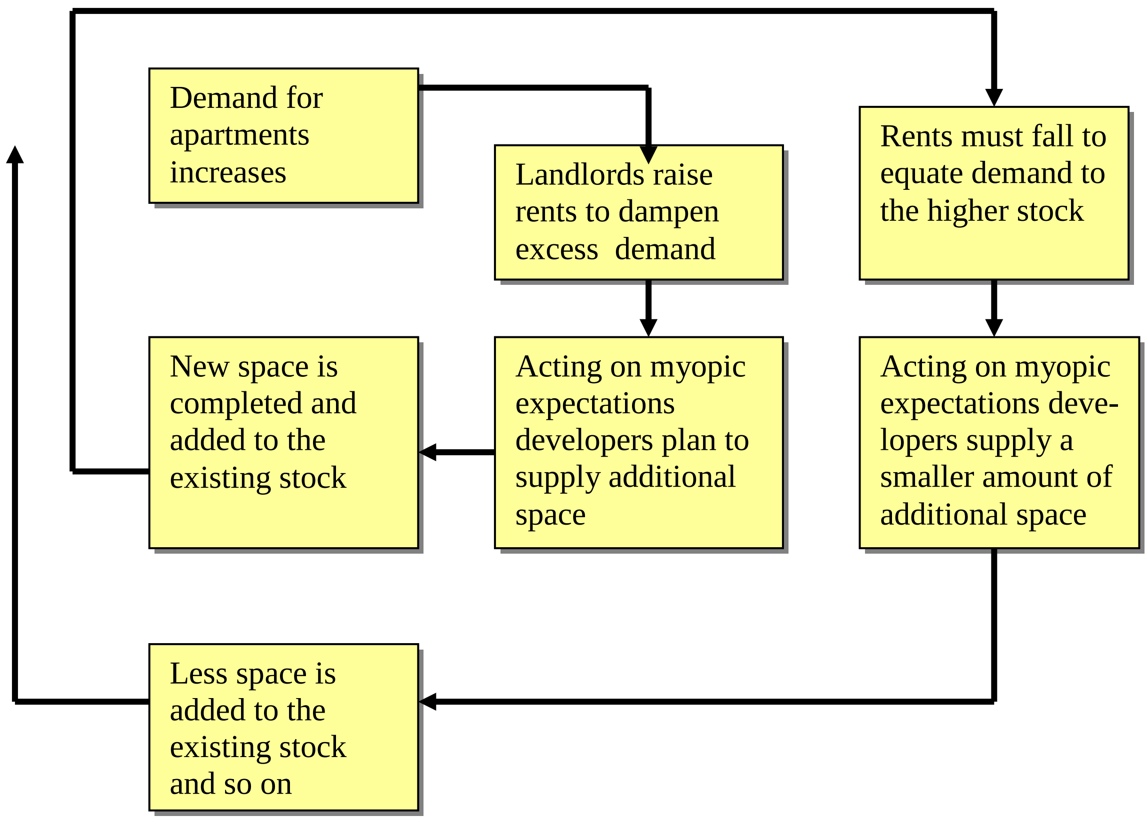
THE SIMPLE STOCK-FLOW MODEL: A FORECASTING TOOL

But how does the market move from the short-run effect described by Figure 2.12(a) to the long-run equilibrium state described by Figure 2.12(b)? Supply and price/rent adjustments in real estate markets are very slow due to the long gestation period of development projects, long tenant search processes, and a host of other market inefficiencies. Thus, the demand shift in the Phoenix apartment market will bring about a series of price and supply adjustments, which may take several years before they bring the market to its new equilibrium state. Given the medium-term planning horizon of most real estate development projects, short-run and medium-term changes are of primary interest from a market-analysis perspective. For this reason, it is important to trace how the market moves from (a) to (b) and what are the specific time paths of short-run changes in rents, new construction, and the apartment stock in response to the original demand shock.

One of the most powerful analytical and forecasting tools that can help market analysts trace the short-run time paths of price, rent, and supply adjustments is the so-called stock-flow model. The fundamental premise of the simplest version of the stock flow model is that at any point in time, rents must adjust so that demand equals the existing stock. Such a simple principle sets the stage for identifying and forecasting time paths for not only rents or prices but also new construction (DiPasquale and Wheaton, 1996).

To better demonstrate the basics of the stock-flow model let us see what adjustments in rents, supply, and demand will follow the initial surge in apartment demand in the Phoenix metropolitan area. As indicated in Figure 2.13, since new apartment buildings can not be build instantly, the increase in apartment demand will motivate landlords to raise rents in order to dampen excess demand. Residential developers, acting on myopic expectations, respond to these rent increases by planning to supply more space. As new space is completed and added to the existing stock rents must fall to equate demand with the new stock. As rents and prices decline, but still remain above their long-run equilibrium level, residential developers continue to plan new units but at a lower rate because of reduced profits. As the new units are completed and the stock increases, rents and prices have to fall further and so on. Figure 2.14 portrays this process graphically.

Figure 2.13. The Simple Stock Flow Model

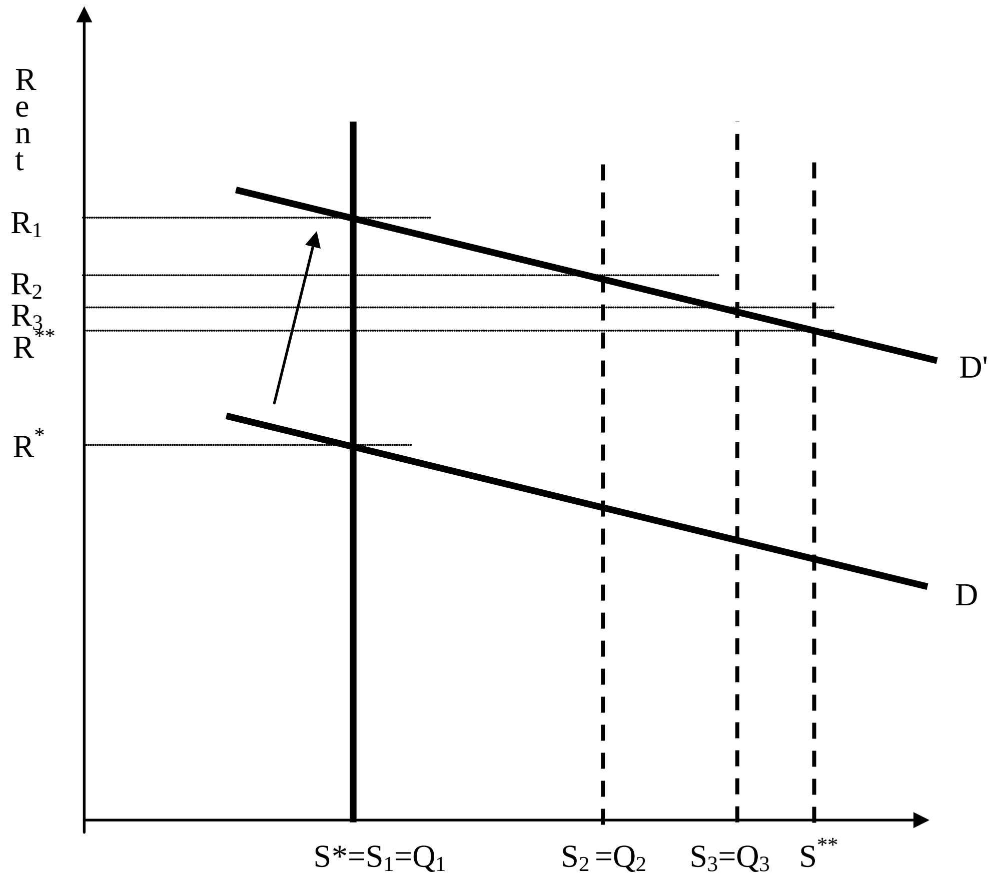


To better comprehend the price dynamics implied by the simple stock-flow model let us review its basic equations and the short-run and long-run equilibrium conditions as they apply to the housing market. As indicated in Box 2.1, the model is described by four equations and three equilibrium conditions.

Equation (2.8) describes apartment demand as a function of population (*POP*), income (*I*), and rents (*R*). Equation (2.9) is the stock flow equation that postulates that aggregate supply, or the stock in each period, S_t, equals the stock of the previous period, S_{t-1}, minus the depreciated stock, δS_{t-1}, plus that period's completions, C_t. Equation (2.10) describes completions as a function of rents, the cost of capital (*c*), and other exogenous shifters (*X*).

Finally, Equation (2.11) describes the market rent, which according to the equilibrium condition (2.12) must be such so that at each period demand equals supply. As such, is derived by incorporating (2.10) in (2.9), equating the resulting equation with demand (2.8) and solving for the rent that clears the market. Therefore, by definition the rent equation must include all the exogenous variables included in (2.8) and (2.9). However, since completions at time t, C_t, and, therefore, stock, S_t, are determined by lagged values of rents and other

Figure 2.14 The Stock-Flow Model in a Demand-Supply Framework



Note: According to the simple stock flow model, during each period apartment rents must adjust so that demand equals the existing stock

BOX 2.1 STOCK FLOW MODEL EQUATIONS

$D_t = f\,[\,POP_t, I_t, R_t\,]$ (2.8)

$S_t = S_{t-1}(1-\delta) + C_t$ (2.9)

$C_t = f\,[\,R_{t-1}, c_{t-1}, X_{t-1}\,]$ (2.10)

$R_t = f\,[\,POP_t, I_t, S_{t-1}, c_{t-1}, X_{t-1}\,]$ or $R_t = f\,[\,POP_t, I_t, S_t\,]$ (2.11)

Equilibrium Conditions

$D_t = S_t$ (2.12)

$\Delta S_t = S_t - S_{t-1} = 0$ (2.13)

$\Delta R_t = R_t - R_{t-1} = 0$ (2.14)

exogenous factors, S_t can directly enter the rent equation, instead of its exogenous determinants. It should be emphasized that the rent equation represents a transformation of the equilibrium condition (2.12) that accounts for the behavioral equations describing demand and completions, as well as, the stock flow identity.

The short-run movements in demand, supply and rents are guided by the three equilibrium conditions (2.12-2.14). Equilibrium condition (2.12) describes the basic premise of the model that at each point in time rents adjust to equate real estate demand, D_t, with supply, S_t. This process is described in Figure 2.14, which depicts short-run movements in a market's stock and rents.

To understand this process consider that the stock and rents are originally at their equilibrium levels, S^* and R^*, respectively. In period 1 it is assumed that demand shifts upwardly from D to D' due to a positive exogenous shock. Given the construction lag, the stock can not respond immediately to this change. Within this framework, the stock in the short-run is considered fixed. Thus, immediately after the demand shift the quantity supplied is still $S^*=Q_1$ but R* is no longer the rent level that equates demand with supply because on the shifted demand schedule Q_1 is demanded at a higher rent level R_1. Therefore, during period 1 market rents have to rise to R_1 in order to equate demand with supply. However, as long as the long-run supply curve is not perfectly inelastic (i.e. is not a vertical line) or demand is not perfectly elastic (i.e., a horizontal line), R_1 will not be the new long-run equilibrium rent, R**; in fact it will always be greater than R**.

By combining (2.9) and equilibrium condition (2.13), which states that $\Delta S_t = S_t - S_{t-1}$ should equal zero, it can be shown that for (2.13) to hold, R** must be such that completions, C_t, equal the depreciated stock, or equivalently, $C_t = \delta S_t$.[9] This would ensure that the change in stock is equal to zero. Thus, since R_1 is greater than R** completions in period 2 will be greater than depreciation and the stock will increase to Q_2. As a result, market rents need to decrease further to R_2 in order to equate demand to the increased supply. However, as R_2 is still above R** the area's apartment stock should continue to increase in subsequent periods until it reaches its long-run equilibrium level, S**. As a result, rents should continue to fall until they reach, R**, which will equate the long-run equilibrium stock, S** with demand. At this point, all three equilibrium conditions are satisfied. In particular, demand equals supply, the change in stock is zero (as by definition R** must produce $C_t = \delta S_t$,) and rent change, $R_t - R_{t-1}$, is zero since with stable stock and demand there is no need for rents to change.

Critique of the Simple Stock-Flow Model

Two points need to be discussed with respect to the simple stock-flow model just described. The first relates to the question of how cycles can be generated in the context of this model, while the second relates to the question of how good it is in describing the workings of the different real estate markets.

Focusing on the first issue, it can be argued that if we assume no over-reaction on the part of supply to the initial price/rent increases, then a one-time shock can not create a

[9] From (2.9) $S_t - S_{t-1} = C_t - \delta S_{t-1}$ and from (2.13) at equilibrium this should equal to zero, that is, $C_t - \delta S_{t-1} = 0$. For the latter condition to hold C_t must be equal to δS_{t-1}. Notice that at equilibrium $S_{t-1} = S_t$ and therefore $C_t = \delta S_t$ should hold for the inventory to remain constant.

cyclical pattern within the context of the stock-flow model. As illustrated in Figure 2.14, in such a case, the stock will be gradually rising and prices/rents will be gradually falling until they stabilize at their new long-run equilibrium level.

Considering the workings of the stock-flow model, it can be argued that cycles can be generated by either frequent demand shocks at either direction (positive or negative) or a highly price-elastic supply. For example, repeated positive demand shocks may generate a cyclical pattern in rents and construction as both variables would rise significantly initially, once the demand increase takes place, and fall down in subsequent periods as the stock increases gradually in response to the price increases. The high price elasticity of supply may also generate a cyclical pattern because it triggers excessive construction in response to the strong initial price/rent increases.

The specific time-path of the rents and construction in the case that supply over-reacts can be traced through the stock-flow model as follows. Under this scenario, the initial increase in demand triggers an increase in rents and prices, but now developers and investors over-react initiating an excessive amount of new space. As a result, the amount of new completions is so high that the stock increases above its long-run equilibrium level. This in turn causes rents/prices to decline below their long-run level in order to equate the excessive stock with existing demand. As rents and prices decline below their long-run level, construction does do. As it has been shown, the long-run completion rate should equal the depreciation rate. Thus, when the stock overshoots the completion rate needs to decrease below the depreciation rate. Given the durability of real estate, this makes sense because that is the only way the existing stock can decrease. Thus, depending on how low prices or rents will fall, construction will become zero or less than depreciation and the existing stock will start decreasing. As the stock decreases, rents and prices need to rise to equate the new lower stock level with demand. The stock will continue to decrease until rents and prices reach the level at which new construction equals depreciation and aggregate demand equals aggregate supply. At this rent/price level the stock will stabilize at its long-run equilibrium level eliminating the need for any further rent and price adjustments.

The second issue regarding the simple stock-flow model relates to the question of how good this model is in describing the workings of the different real estate markets. As discussed earlier, the simple stock flow model views adjustments in real estate markets as a series of short-run price equilibria, that are realized through successive rent and price adjustments that equalize demand with supply. While such a proposition is elegant in its conception, it may not be applicable to all real estate markets because of varying degrees of inefficiencies that prevent swift market adjustments. Such a conceptual construct is best applicable to markets with relatively low and rather stable vacancy rates. Such markets are relatively efficient, as they are characterized by shorter-term leases that do not prevent rents and demand from adjusting quickly to new equilibrating levels, not overly long construction lags, and information efficiencies that facilitate quick adjustment of rents to changes in market conditions. Within this context, the simple stock-flow model may be more successful in tracking short-run price adjustments in residential markets.

The simple stock-flow model does not apply to markets, such as the office market, which is characterized by a high degree of inefficiencies, and, as a result, sustain high and volatile vacancy rates.[10] These markets may be in constant disequilibrium, a situation that violates the fundamental assumption of the simple stock-flow model that rents at each period adjust to equalize demand with the existing stock. Within this context, the following section focuses on disequilibrium concepts and elaborates on two basic questions:

- How can we assess the extent of market disequilibrium?
- How should the stock-flow model be modified to account for such a situation?

ASSESSING DEMAND-SUPPLY IMBALANCES

DEMAND-SUPPLY INTERACTIONS: MARKET INEFFICIENCIES

At any point in time, the real estate market may not be at a demand-supply equilibrium because of frequent exogenous shocks and a number of inefficiencies that prevent demand, supply, and rents or prices to adjust quickly to these shocks. These market inefficiencies include:

- *Lack of information*: Real estate is highly heterogeneous in terms of both quality and locational attributes. Thus, timely market and project-specific information required for the evaluation of specific transactions is rarely readily available and its collection is rather costly and time consuming. These information inefficiencies force tenants and buyers to engage in lengthy searches and prevent quick adjustment of demand to price changes.
- *Construction lags*: Construction lags that last from several months to several years, depending on property type, prevent speedy adjustment of supply to demand and price changes.
- *Long-term leases*: Long-term leases, with terms ranging mostly from 3 to 10 years, prevent speedy adjustment of *existing* rates (not rates associated with new lease transactions) to changes in supply and demand, and hamper timely adjustments of space consumption to changes in *market* rates (as reflected in the latest lease transactions).

These inefficiencies characterize all property types, but at varying degrees. For example, information inefficiencies are more severe in the retail and apartment market, construction lags are longer in the office and retail market, and lease contracts are much shorter in the case of apartments.

ASSESSING THE EXTENT OF DISEQUILIBRIUM: POPULAR/SIMPLISTIC MEASURES

The term disequilibrium refers to the state of a market characterized by supply-demand imbalances, or alternatively, by excess demand or excess supply. Within the context of the conventional definition of market equilibrium one could argue that the market is truly oversupplied when rents or prices are declining and truly undersupplied when rents or prices

[10] The persistence of high vacancy rates is an indication that rents or prices do not clear the market reasonably fast and it is inconsistent with the basic assumption of the simple stock-flow model (DiPasquale and Wheaton, 1996).

are rising (R). There are two popular and simplistic approaches often used for assessing the extent of supply-demand imbalances characterizing real estate markets:

(1) Analysis of trends in the difference between completions, *C*, and net absorption, *AB*
(2) Analysis of trends in the nominal vacancy rate

Construction Minus Net Absorption (*C-AB*)

As indicated by (2.15) below, the difference between completions, *C*, and net absorption, *AB*, reflects the change in a market's vacant stock, *if depreciation is very small*. Thus, if *C-AB* is positive it implies that completions exceed net absorption and the market's vacant stock is rising. On the contrary, if it is negative it implies that net absorption exceeds completions and the market's vacant stock is declining.

What does *C-AB* really represent?

$$C_t - AB_t = C_t - (OS_t - OS_{t-1}) \qquad [\text{As } AB_t = (OS_t - OS_{t-1})]$$

$$= C_t - [(1-V_t)S_t - (1-V_{t-1})S_{t-1}] \qquad [\text{As } OS_t = (1-V_t)S_t \text{ and } OS_{t-1} = (1-V_{t-1})S_{t-1}]$$

$$= V_t S_t - V_{t-1}S_{t-1} + C_t - S_t + S_{t-1}$$

$$= [V_t S_t - V_{t-1}S_{t-1}] + dS_{t-1}$$

[As, from the stock-flow identity,

$$S_t = S_{t-1}(1-d) + C_t$$

$$\Rightarrow \quad C_t - S_t = -S_{t-1}(1-d)$$

$$C_t - S_t + S_{t-1} = dS_{t-1}$$

Therefore:

$$C_t - AB_t = [V_t S_t - V_{t-1}S_{t-1}] + dS_{t-1} \qquad (2.15)$$

So, if dS_{t-1} is small, construction minus net absorption simply represents changes in a market's vacant stock.

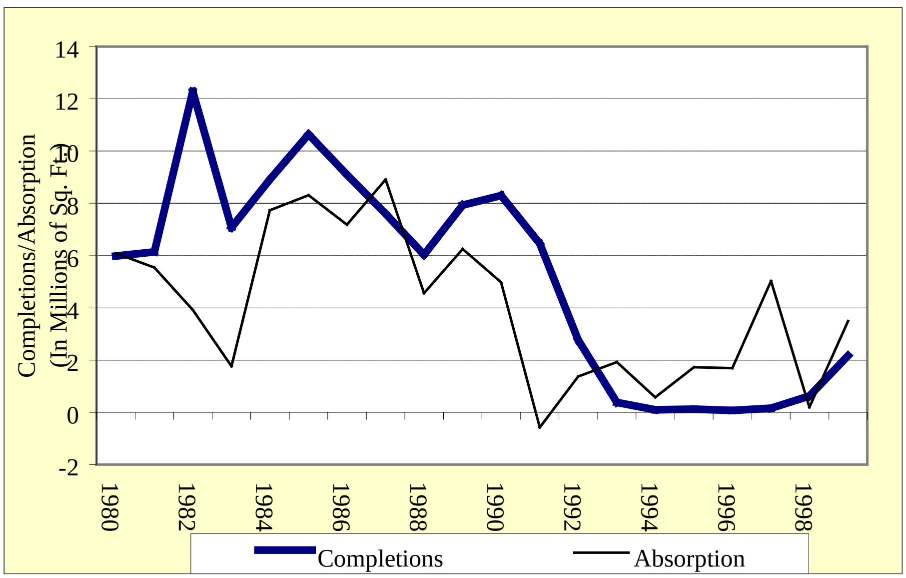
If *C-AB* is positive, the market's vacant stock is rising
If *C-AB* is negative, the market's vacant stock is declining

Is *C-AB* a good indicator of market strength?

Notation:
C : new construction
AB : net absorption
V : vacancy rate
S : stock (occupied plus vacant)
OS : occupied stock
d : depreciation rate

Historically, positive and/or increasing *C-AB* have signified troubled times in the real estate industry. Let's look for example at the case of the Los Angeles office market. As Figures 2.15 and 2.16 illustrate, tracing the time path of *C-AB* does help track periods of increasing vacant stock in the market. However, *C-AB* is not a very good measure of disequilibrium. First of all it provides indications about trends in vacant stock levels and not necessarily about vacancy rates, which are more relevant (but not adequate) in evaluating the tightness of the market. For example, it can be shown that if *C-AB* is less than [V_{t-1} $(C-dS_{t-1})$] the market's vacant stock will increase, while the vacancy rate will decrease. Second, it does not set the stage for looking at changes in rents, as the traditional rent adjustment model incorporates the vacancy rate and not the vacant stock. Finally, if such measure is looked in isolation it could be misleading. For example, the vacant stock may be decreasing due to strong absorption, *AB*, which, in turn, may be primarily due to *decreasing rents*.

Figure 2.15 Los Angeles :Office Completions vs Net Absorption

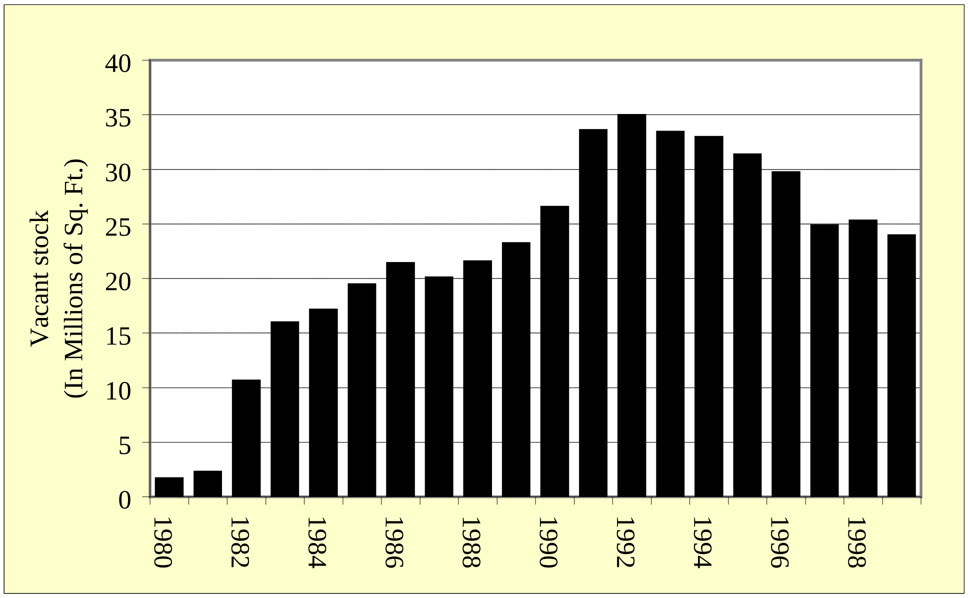


Source: CB Richard Ellis/Torto Wheaton Research

Nominal Vacancy Rate (*V*)

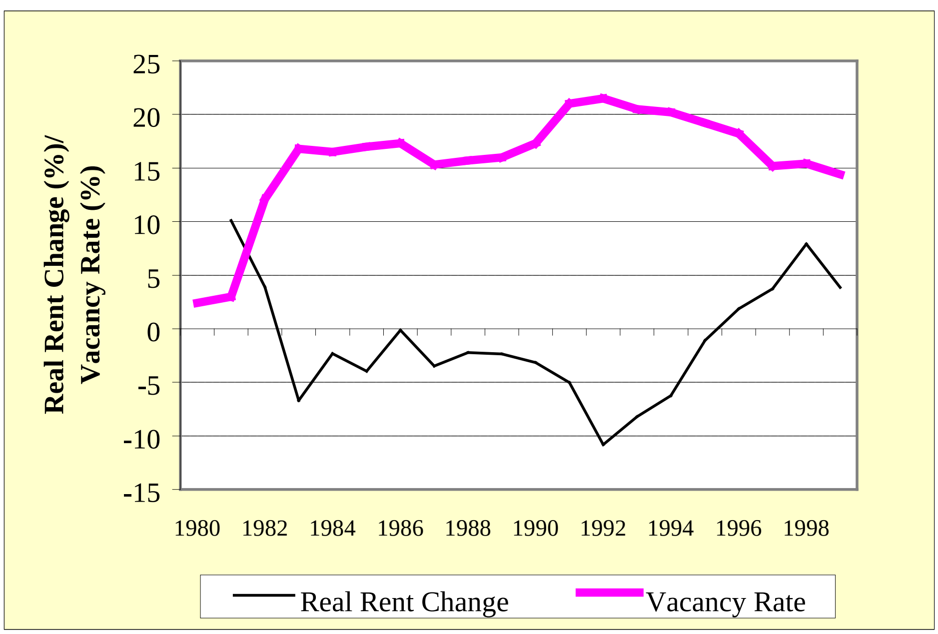
The second popular methodology is simply looking at trends in the nominal vacancy rate (the ratio of the vacant stock over the total stock) and make inferences with respect to likely movements in rents. This methodology is again questionable because it does not provide a measure of the extent of disequilibrium and solely looking at movements in the vacancy rate (outside of the context of the structural vacancy rate theory) can not set the stage for making inferences with respect to movements in rents. For example, looking at historical vacancy rate movements and real rent changes in the Los Angeles office market, portrayed in Figure 2.17, it becomes clear that decreasing vacancy rates *do not necessarily* imply increasing rents or vice versa. In particular, in 1981 and 1982, the office vacancy rate in Los Angeles was rising, yet real rents were rising too. Furthermore, from 1992 until 1995, the office vacancy rate was declining, yet real rents kept decreasing too.

Figure 2.16 Los Angeles: Office Vacant Stock



Source: CB Richard Ellis/Torto Wheaton Research

Figure 2.17 Los Angeles: Real Rent Change and Office Vacancy Rate



Source: CB Richard Ellis/Torto Wheaton Research

ADVANCED MEASURES/METHODOLOGIES

Nominal vs Structural Vacancy Rate (*V-V**)

A more conceptually sound methodology for assessing the extent of market disequilibrium is to look at changes in [V_t - V^*], that is, changes in the nominal vacancy, V_t, rate compared to the market's structural vacancy rate, V^*. But what is the structural vacancy rate, and why is it important to look at the deviation of a market's nominal vacancy rate from this rate?

A number of analysts (Rosen and Smith, 1983), in trying to explain what the structural vacancy rate is, have made reference to the concept of the natural or frictional unemployment rate, which is considered as the minimum required rate to satisfy the search needs of employers and job seekers. In a similar way, the structural vacancy rate can be thought of as that portion of the stock that is desirable to remain vacant for two reasons. First, to satisfy landlords' profit maximizing objectives that dictate that the marginal benefit (MB) of leaving a unit vacant is greater or equal to its marginal cost (MC). The marginal benefit of leaving a unit vacant is the potential rent increase that may take place during the period the unit remains vacant, while the marginal cost is the forgone market rent plus the interest that would be earned from this forgone rent. The second reason for which it would be desirable to have a portion of the existing stock vacant is to facilitate tenant search. At any point in time, there are firms or households looking for space to rent and their need to search the market can be best accommodated if some of the stock is vacant.

It is important to look at the difference between the nominal and the structural vacancy rate for two reasons. First, it is this difference that reveals the true extent of excess vacant space in the market. Second, it is this difference that will provide clues about the direction of real estate rents in a disequilibrium situation. Although a different modeling approach (discussed in the next section) has been recently presented by Wheaton and Torto (1994), the concept of the structural vacancy rate still remains very appealing and is widely accepted in the academic and professional real estate community. The expanded stock-flow model provides an appropriate setting for better illustrating the relationship between the structural vacancy rate and rent changes in commercial real estate markets.

The Stock-Flow Model with Vacancy

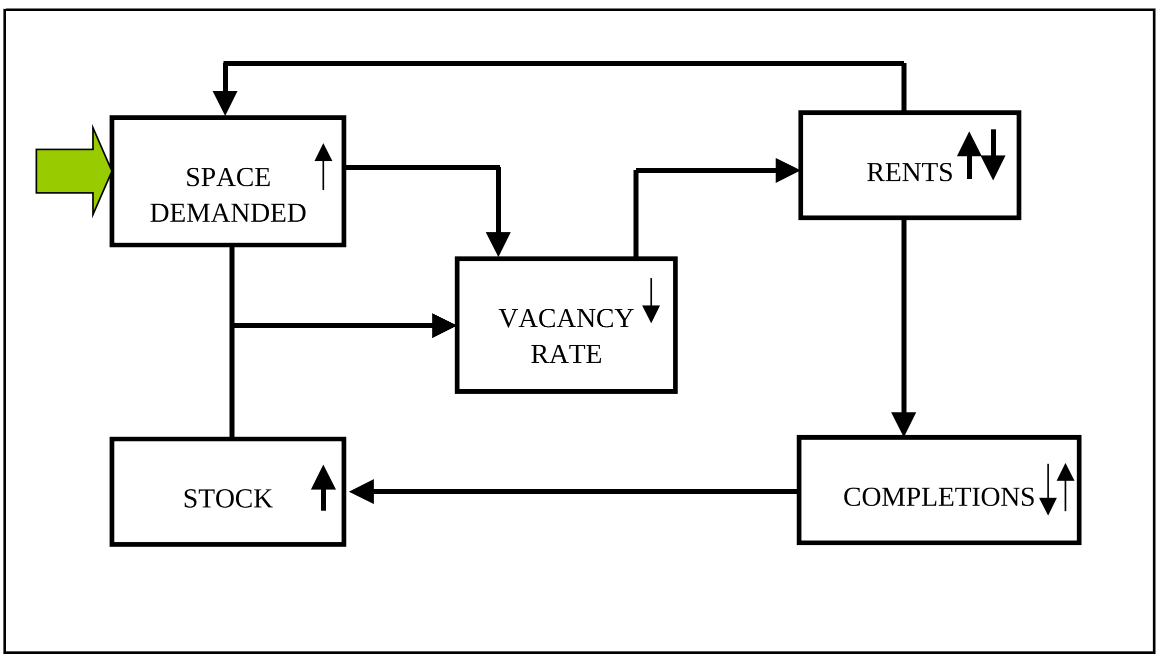
The role of the structural vacancy rate in the functioning of the real estate market can be better understood within the context of the stock-flow model. The simple model discussed earlier, however, is not appropriate in describing the disequilibrium dynamics of real estate markets, since by definition demand equals supply during each period of analysis. Nevertheless, it can be easily modified to account for market disequilibrium by simply incorporating vacancy in the model. Figure 2.18 traces the effects of an exogenous increase in demand within the framework of such an expanded stock-flow model. Given the fixity of real estate shock in the short-run, the immediate effect of this increase in demand will be a decrease in the vacancy rate. As the figure indicates, the effect of vacancy decreases on rents could be either positive or negative.

The basic proposition is that rents increase only if the vacancy rate, V_t, is below the market's structural vacancy rate, V^*, and decrease when V_t is above V^*. For example, let's consider two office markets A and B, where the nominal vacancy rate decreases to 12% and 8%, respectively, as a result of office employment growth and positive net absorption. To demonstrate how the difference between the nominal vacancy rate and the structural vacancy rate V^* can help assess the degree of disequilibrium let's assume that the structural vacancy rate in both markets is 10%. In that case [V_A-V^*] would be equal to 2% indicating that market A is oversupplied and that a decrease in rents should be expected. In the case of market B, [V_B - V^*] would be equal to –2% indicating that there is excess demand and that an increase in rents should be expected. Thus although, the vacancy rate decreased in both markets, rents are likely to move in different directions because of the different position of each area's vacancy rate relative to the structural vacancy rate.

The dynamics of the rent-vacancy adjustments within the context of the structural vacancy concept can be better understood using a simplified graphic representation of the rent-vacancy cycle as it is presented in Figure 2.19. To begin with, let's assume that the market is at its structural or equilibrium vacancy rate, V^*, and that demand increases as a result of an exogenous economic shock.

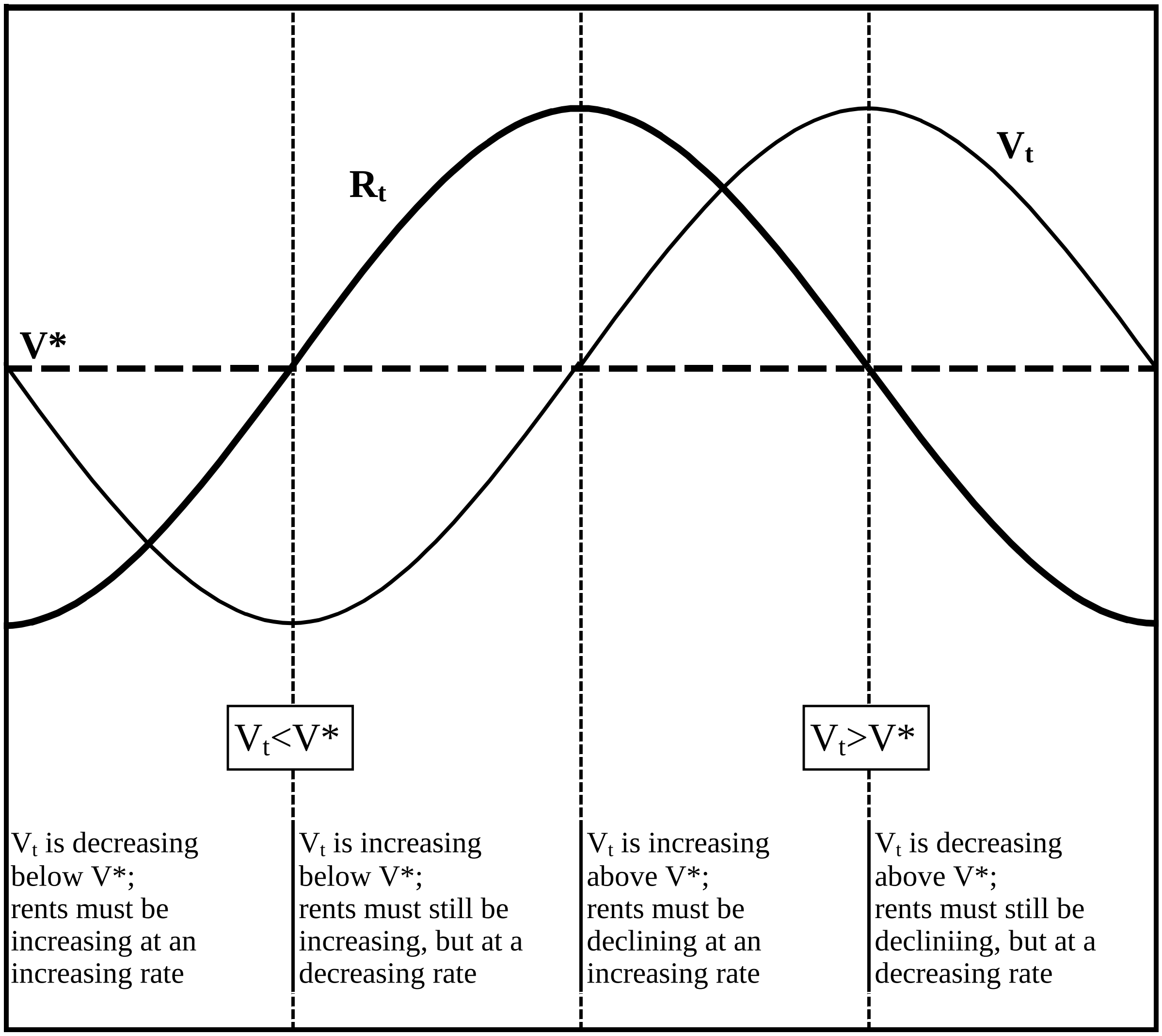
- Once demand increases, the vacancy rate, V_t, will start *decreasing below* its equilibrium level V^*
- As the vacancy rate, V_t, decreases below its equilibrium level, V^*, rents start increasing at an increasing rate
- New construction responds to these rent increases and as a result the vacancy rate reaches a minimum and starts increasing

Figure 2.18 The Stock-Flow Model with Vacancy



If $V_t > V^*$ ➔ Rents decrease
If $V_t < V^*$ ➔ Rents increase

Figure 2.19 Rent-Vacancy Adjustments and the Structural Vacancy Rate



- As the vacancy rate, V_t, is *increasing* but is still *below its equilibrium* level, *V**, rents will continue to *increase* but at a slower rate. Rents reach their maximum level as the nominal vacancy rate rises back to its equilibrium level.
- As the vacancy rate, V_t, continues to *increase above its equilibrium* level, V*-- most likely because of over-shooting of construction-- rents are *declining* at an increasing rate
- As rents start declining, construction starts declining too. As a result the vacancy rate, V_t, reaches a maximum and starts *decreasing* but as long as it is *still above its equilibrium* level, *V**, rents continue to *decrease,* but at a decreasing rate.

This vacancy-rent adjustment process is described by the traditional rent adjustment equation below:

$$\Delta R = a\,(V^* - V_t) \qquad (2.16)$$

where

ΔR : percent change in rental rates
a : speed of adjustment
V_t : nominal vacancy rate at time t
V^* : equilibrium or structural vacancy rate

Structural Vacancy Rate Influences

A key question that has been raised in the literature with respect to the natural vacancy rate is whether it is constant or varies through time (Wheaton and Torto, 1988; Sivitanides, 1997). To better understand whether the structural or equilibrium vacancy rate is constant or variable through time we need to understand its determinants. If these determinants tend to vary considerably through time then the structural or equilibrium vacancy rate should as well. Most recent theoretical work on this issue postulates that the equilibrium vacancy rate is determined by landlord and tenant search processes.

Landlord's Perspective. From a landlord's point of view, willingness to hold vacant units or expedite lease-up time should depend on two factors:

1) *Expectations for demand and rental growth*. Expectations of strong demand and rent growth in the future would motivate landlords to hold vacant space in order to take advantage of the anticipated rent increases. Such a behavior should contribute to a greater amount of vacant space in the market and, therefore, to a higher equilibrium vacancy rate. Thus, the effect of such expectations on the structural vacancy rate should be positive. Assuming a myopic approach on the part of landlords, expectations for demand and rent growth should be driven by such market strength indicators as recent absorption, completions, and/or employment growth rates (see Sivitanides, 1997).

2) *Costs of holding vacant space*. These include the forgone rental income, $R*V$, that would be earned if the vacant units, V, were leased at the market rent, R, and the interest, $i*R$, that would be earned on that income (Hendershott and Haurin, 1988). Thus, during periods of higher market rents, and interest rates landlord's costs of holding vacant space should be higher. Therefore, all else being equal, during such periods the structural vacancy rate should be lower as landlords should be motivated to hold less vacant space.

Tenant's Perspective. The structural vacancy rate should be also affected by two major features of tenant search processes that may very well vary through time and across markets. Drawing from the discussion of tenant search processes presented by Sivitanidou (2002), these features and the factors that may influence them can be summarized as follows:

1) *The length of the search.* Lengthier tenant searches should prolong average lease-up time in the market, thereby contributing to a higher structural vacancy rate. The length of tenant search may depend on a number of factors including:

- *Idiosyncratic tastes/space requirements.* Tenants with idiosyncratic tastes/space requirements may on average engage in lengthier search, as a random visit to a unit is less likely to produce a match. In this sense, markets with a more *diverse or heterogeneous tenant* base may be characterized by a higher structural vacancy rate.
- *Stock heterogeneity.* The more heterogeneous the existing stock for a property type is in terms of quality, the less likely is that a random visit by a tenant will produce a match. Thus, this factor should contribute to longer tenant search and higher structural vacancy rate.
- *Spatial heterogeneity.* Given that tenants/buyers are not indifferent to the locational attributes of the property they will be purchasing or renting, spatial heterogeneity should have the same positive effect on the length of the search, and therefore, on the structural vacancy rate, as the stock heterogeneity. Spatial heterogeneity should be greater in more dispersed markets.
- *Information inefficiencies.* All else being equal the more the information available on the properties and the space available for renting or sale the shorter a tenant's search might be and the lower the market's structural vacancy rate. For example, the larger and most popular investment markets may have greater informational efficiencies than smaller markets that are rarely considered by institutional investors.

Structural Vacancy Influences	**Effect**
Landlord's Perspective	
Expectations for demand and rental growth	+
Costs of holding vacant space	-
Forgone market rent (*R*)	-
Forgone interest earnings from forgone rent (*i*R*)	-
Tenant's Perspective	
Length of the search	+
Idiosyncratic tenant tastes/tenant diversity	+
Stock heterogeneity	+
Spatial heterogeneity/dispersion	+
Information Inefficiencies	+
Cost of the search	-

2) *The cost of the search*. Search costs should be adversely related to the length of the search, and the structural vacancy rate, as they would motivate tenants to end their search sooner than later. In this sense, markets or time periods with higher search costs should be characterized by a lower structural vacancy rate. Stock heterogeneity and spatial heterogeneity/dispersion should also contribute to higher search costs per visit due to greater information needs, transportation costs, etc.

Prevailing Rent vs Implicit Equilibrium Rent (*R-R**)

Latest work on rental adjustments in commercial real estate markets has introduced the proposition that adjustments in real rents occur rather as a mechanism of moving towards an implicit equilibrium rent, R*, rather than towards bringing that nominal vacancy rate at its structural or equilibrium level (Wheaton and Torto, 1994). This proposition does not really contradict the concept of the natural or structural vacancy rate, since for any equilibrium value of rental rates there should be a corresponding equilibrium value for the vacancy rate. A number of studies on imperfect markets have shown that such equilibrium vacancy rate should be higher than zero. This proposition is strongly supported by a wealth of historical data on vacancy rates for commercial real estate markets that indicate that observed vacancy rates rarely fall below 5%.

According to Wheaton and Torto (1994) the implicit equilibrium rent, R^*, is determined by lease-up time, which in turn should be driven by tenant flows as reflected in space absorption, A, and the market vacancy rate, V. Given the sluggishness by which real estate markets respond to exogenous shocks, the rental adjustment process towards such an equilibrium rent is described by (2.17), where α represents the speed by which prevailing rents move towards the equilibrium rent.

$$R_t - R_{t-1} = \alpha \, [\, R^*(A_{t-1}, V_{t-1}) - R_{t-1} \,] \qquad (2.17)$$

The equilibrium rent should be higher with higher tenant flows and lower vacancies because they reduce lease-up time and motivate landlords to require higher rents. If historical data are available for observed rental rates, absorption, and vacancy rates the parameters of equation (2.17) can be estimated, thereby allowing the calculation of R^*. The estimated R^* can provide valuable insights with respect to the disequilibrium state of the market. For example, if the difference $R\text{-}R^*$ is positive and of considerable magnitude it would suggest that prevailing rents are considerably above their equilibrium value and that considerable decreases are very likely to take place in the future in order to restore equilibrium. On the contrary if $R\text{-}R^*$ is negative it would signify a soft market in which prevailing rents would need to rise in order to reach their implicit equilibrium values (Sivitanidou, 2002).

Drawing from Sivitanidou (2002), and Wheaton and Torto (1994), the influences on market's implicit equilibrium rent can be identified within the context of their direct or indirect effect on lease-up time. When considering indirect influences on lease-up time the focus is on factors that may have an effect on the matching rate between properties and searching tenants, as well as search costs. The more specific influences on a market's implicit equilibrium rent are summarized below:

1) *Demand growth*. For a given vacancy rate, stronger demand growth, due perhaps to stronger employment, income, population, or output growth should reduce lease-up time and exert upward pressures on a market's equilibrium rent.
2) *Idiosyncratic space requirements/Tenant diversity.* All else equal, idiosyncratic tenant tastes/space requirements may contribute to a lower matching rate and lower realized demand, as a random visit to a unit is less likely to produce a match. Thus, greater tenant diversity should contribute to a lower equilibrium rent. Sivitanidou (2002) presents empirical evidence that is consistent with a negative effect of office tenant diversity on equilibrium rents.
3) *Stock heterogeneity*. The more heterogeneous a market's existing stock is in terms of quality, the lower the matching rate and the longer the lease-up time, since a random visit by a tenant is less likely to produce a match. At the same time, however, higher stock heterogeneity may increase the cost of search (due to greater information requirements) and motivate tenants to be less demanding, thereby facilitating the matching process. Because of the opposing influences of this factor on the matching rate, its effect on the equilibrium rent could be either positive or negative, depending on which of the two influences prevails.
4) *Spatial heterogeneity.* Spatial heterogeneity is relevant in tenant search processes since tenants/buyers are not indifferent to the locational attributes of the properties they rent or purchase. Spatial heterogeneity, reflected perhaps in the number and diversity of an area's submarkets, should have similar opposing influences on implicit equilibrium rents as stock heterogeneity. Thus, the direction of its effect can not be inferred *a priori*. Empirical evidence presented by Sivitanidou (2002) is consistent with a positive effect of this factor on the equilibrium rent, suggesting that its effect on search costs is greater than its direct effect on the matching rate.
5) *Information Inefficiencies.* On one hand, all else being equal, greater information inefficiencies may contribute to higher search costs, thereby motivating tenants to be less demanding and facilitating the matching process. On the other hand, information inefficiencies may render search processes by tenants and landlords less efficient, thereby contributing to a lower matching rate. Given these opposing effects of information inefficiencies on the matching rate its effect on a market's implicit equilibrium rent can not be determined a priori.

Equilibrium Rent Influences	**Effect**
Expectations for demand growth	+
Idiosyncratic tenant tastes/tenant diversity	-
Stock heterogeneity	-/+
Spatial heterogeneity/dispersion	-/+
Information Inefficiencies	-/+

CHAPTER SUMMARY

In this chapter, we examined the basic economic concepts of demand, supply, and price adjustments and discussed how they relate to the real estate market. We have also discussed concepts of disequilibrium and ways of assessing a real estate market's extent of disequilibrium.

Demand for real estate property or space does obey the fundamental law of demand and its broader drivers (shifters) include:

- market size (population, households, employment, or output, determined by metropolitan growth processes)
- income/wealth (determined by metropolitan growth processes)
- relative prices
- expectations regarding prices and growth (myopic or adaptive)

The most important real estate supply concept from a market-analysis point of view is new construction, which follows the fundamental law of supply. Its major drivers include:

- the cost and availability of production inputs (land, capital, labor, building materials)
- expectations regarding demand/rents/prices (myopic or adaptive)
- uncertainty and risk (volatility of local economy and real estate market)

Real estate price adjustments are very slow due a host of inefficiencies that stem largely from three major factors: a) information inefficiencies, b) long-term rental contacts that hinder swift rental and demand adjustments, and c) long construction lags that force very slow supply adjustments. The expanded stock-flow model that includes vacancies can help understand and simulate short-run movements of real estate markets in response to exogenous shocks.

Due to frequent exogenous demand shocks and slow adjustment processes, real estate markets are in disequilibrium more than often. Within this context, when analyzing real estate markets at a given point in time it is important to assess the state and degree of disequilibrium that may be prevailing in the market and its implications regarding future movements in rents and vacancy rates. Simplistic methodologies used to gain insights with respect to a market's state of disequilibrium include examination of the difference between construction and absorption, as well as analysis of vacancy rate trends, while more advanced methodologies include comparison of the nominal vacancy rate to the market's structural vacancy rate and/or comparison of the prevailing rent to the market's equilibrium rent.

QUESTIONS

Demand

1) What are the major determinants of the demand for real estate?
2) What will happen to the demand for single-family housing if wages decrease?
3) What impact, if any, did the defense cuts that hit Southern California have on office space demand?

4) Is Gross Absorption a good measure of market activity? Explain.
5) Is Net Absorption a better measure of market activity than Gross Absorption? Explain.
6) Why caution is needed when examining Net Absorption trends?
7) What are the broader factors that affect Net Absorption and what is the direction of their effect?
8) Explain the concept of the price elasticity of demand in the case of single-family housing.

Supply

1) Refer to the various concepts of real estate supply and discuss which ones are more relevant for market analysis and why.
2) Provide and discuss the stock-flow identity and explain why it is useful when analyzing real estate markets.
3) What are the major determinants of new construction and what is their expected effect?
4) Discuss the "pipeline effect", which is often used when referring to real estate supply.

Price Adjustments

1) Explain why short-term price increases in real estate markets in response to positive demand shocks should be greater than long-run increases.
2) Discuss the workings of the simple and expanded stock-flow model.
3) Are nominal vacancy rates good measures of market disequilibrium? Explain.
4) What is the structural vacancy rate?
5) Why is it important to look at the deviation of a market's structural rate, V^*, from its nominal vacancy rate, V?
6) Is the structural vacancy rate constant through time? Explain.
7) Discuss factors that may contribute to variations in the structural vacancy rate through time or across markets and their expected effect.
8) Discuss the more recently developed alternative approach to explaining rent movements in real estate markets.

Question for Discussion

Consider a developer that specializes in the development of medium-rise office-commercial structures that traditionally house small, client-oriented professionals (e.g., doctors, lawyers, architects). Desperate to re-enter the development game after the real estate recession of the early 1990s, this developer closely monitors trends in a small suburban office market with plenty of land available for development. This market has seen a tremendous growth in employment and rental rates in the first half of the eighties. As a result of myopic behavior, however, completions skyrocketed, and the market soon became glutted. During the early 1990s, this market glut was evident in vacancy rates well above the area's *structural vacancy rate*. Recent estimates of the latter during 1993-1995 suggest it has stabilized at about ***10%.***

A recent market report presented the following series of selected data on the state of this office market in 1994 and 1995:

	1994.1	*1994.2*	*1995.1*	*1995.2*
Total Stock (million sq. ft.)	*20.500*	*20.700*	*20.750*	*20.900*
Gross Absorption (million sq. ft.)		*0.280*	*0.730*	*0.650*
Nominal Vacancy Rate (%)	*17.2%*	*17.6%*	*16.5%*	*15.0%*

Drawing from the data above, the report asserts that:

> ". . .rising gross absorption and falling vacancies are encouraging signs. . .better times lie ahead. . . *Development* [emphasis added] opportunities in this market are good. . . prospective developers may want to start securing land if they want to take advantage of the reversal of vacancy trends in early 1995. . ."

(i) Do you agree with this report's conclusions? Explain clearly your answer.

(ii) Based on the data provided, compute an alternative absorption measure. Explain differences between this measure and gross absorption.

(iii) How can you explain movements in this alternative measure during the time period in question? Refer to additional data you may need to examine.

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