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Part 3: Real Assets

Chapter 14: Real Estate as an Investment

Real estate has been a very large and important portion of wealth for thousands of years. Even as recently as a century ago, real estate dominated institutional portfolios and was classified as property. During recent decades, the preeminence of real estate has yielded to the growing importance of intangible assets. Yet real estate remains a valuable part of any well-diversified portfolio.

The transition of real estate from dominating traditional institutional-quality investments to being an alternative investment raises important issues in terms of how to evaluate real estate on a forward-looking basis. This chapter provides an overview of the attributes, asset allocation, categories, and return drivers of real estate. The chapter concludes with a discussion of the four-quadrant model, which is a graphical representation of a real estate system.

14.1 Attributes of Real Estate

Real estate—and any other asset, for that matter—should be included in a portfolio until the marginal benefits of additional investment equal the marginal costs of additional investment. An optimized portfolio is achieved when additional investments in each asset and asset class are equally attractive. In other words, exposure to each type of real estate investment, and to real estate overall, should

be added until the net benefits have diminished to the point that allocations to other investments are equally attractive.

14.1.1 Five Potential Advantages of Real Estate

What are the aspects of real estate that make it attractive or unattractive relative to other asset classes? There are five common attributes that encourage the inclusion of real estate in an investment portfolio:

1. Its potential to offer absolute returns
2. Its potential to hedge against unexpected inflation
3. Its potential to provide diversification against stocks and bonds
4. Its potential to provide steady cash inflows
5. Its potential to provide income tax advantages

These potential advantages, the first three of which are related to portfolio risk, do not necessarily come without costs. In particular, to the extent that markets are competitive and efficient, market prices of real estate will tend to adjust, such that any relative advantages to real estate will be offset by lower expected returns.

This list of potential advantages to real estate investment is not comprehensive. For example, another motivation would be to own all or part of a trophy property that offers name recognition, prestige, marketing potential, and enhanced reputation to the owner. One example would be a large high-quality office property in a prominent location. Another potential advantage is that real estate typically allows investors to use a high degree of leverage.

14.1.2 Three Potential Disadvantages of Real Estate

There are also aspects of real estate that can discourage its inclusion in an investment portfolio:

1. Its heterogeneity
2. Its lumpiness, which may prevent investors from creating optimal portfolios
3. Its illiquidity, which may reduce the opportunity to rebalance and sell assets at fair market prices in a short period

Real estate is a highly heterogeneous asset. Not only are the physical features of the individual properties unique in terms of location, use, and design, but varying lease structures can lead to large differences in income streams. This heterogeneity is particularly troublesome as it relates to the due diligence process.

Accordingly, due diligence of real estate investments can require specialized analysis and managerial skill.

The second potential disadvantage of real estate is lumpiness, including the indivisibility of direct ownership. Lumpiness describes a situation in which assets cannot be easily and inexpensively bought and sold in sizes or quantities that meet the preferences of both buyers and sellers. Listed equities of large companies are not lumpy, because purchases and sales can be easily made in the desired size by altering the number of shares in the transaction. Direct real estate ownership may be difficult to trade in sizes or quantities desired by a market participant. While growth in real estate investment trusts (REITs) and in a number of alternative real estate investment vehicles has led to divisible investment opportunities at an indirect ownership level, investors at the single-property level are still faced with the choice of either buying the entire asset or not. The inherent indivisible nature of individual real estate assets leads to problems with respect to high unit costs (i.e., large investment sizes) and relatively high transaction costs, including those transactions involving joint ventures.

The final major disadvantage relates to the liquidity of real estate. As a private, non-exchange-traded asset with both high unit and high transaction costs, real estate can be highly illiquid, especially when compared to traditional securities. Important implications of illiquidity are its effects on reported returns, extended holding periods, and the ability to transact at reasonable valuations when either demand or supply evaporates.

All three of these characteristics complicate performance measurement and evaluation of real estate investments. The goal of each investor is to find the level and composition of real estate exposure that optimizes the portfolio's intended return-risk profile when considering all benefits and costs.

14.2 Asset Allocation

This section discusses major methods of categorizing real estate and differentiating among real estate investments—the understanding of which leads to two important outcomes. First, a better understanding of the breadth of real estate investment opportunities helps refine an asset allocator's decision as to how much capital to allocate to real estate. Second, a nuanced understanding of the different categories of real estate facilitates the decision of how to allocate funds within the real estate portfolio.

14.2.1 Heterogeneity within Subcategories

Not only is real estate heterogeneous among subcategories, but it can also be highly heterogeneous *within* its subcategories. Although categorization and subcategorization of real estate may serve a useful role in asset allocation and analysis, care must be taken to avoid development of an oversimplified view of real estate. Although assets within various real estate categories and subcategories typically share general characteristics, there may be instances in which tremendous differences in their economic nature exist.

For example, consider two office buildings that are similar in size, construction, and location. The first office building has a 20-year, non-cancellable lease with a large well-capitalized and well-hedged corporation. The lease essentially locks in the rental revenues for the entire property for the next two decades. In this case, the annual income of the property will be similar to that of a corporate bond, and the value of the property to the investor will tend to fluctuate in response to the same factors affecting the value of a corporate bond issued by the tenant (i.e., riskless interest rate changes and changes in the credit spread on the debt of the tenant). The principal difference affecting income and valuation between the two is that while many commercial real estate leases allow for periodic rent increases through contractual escalator clauses, coupon payments on outstanding corporate bonds are not inflation-adjusted.

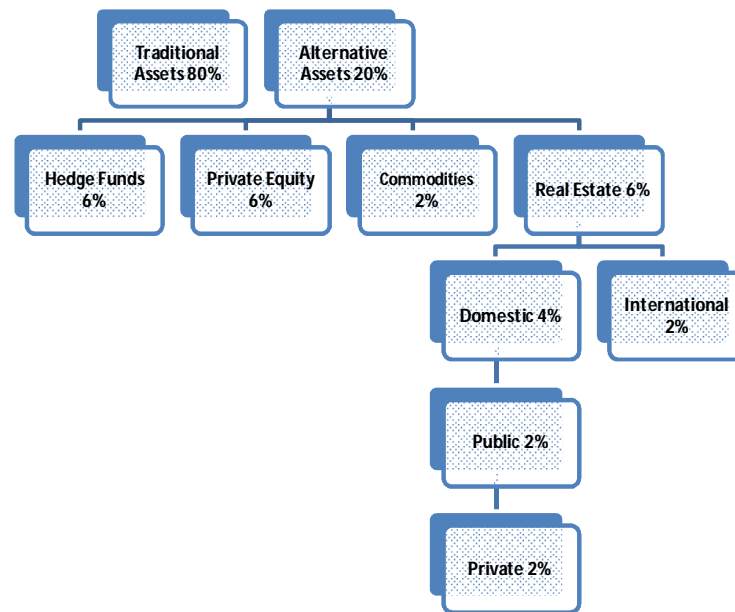
The second office building in the example is vacant. Both buildings are located in a geographic area with an economy strongly linked to oil prices. The value of this empty real estate asset will be especially sensitive to the supply of and demand for office space in the local real estate market. Thus, the value of this property will be driven by the forces that affect the region's economy—in this case, oil prices. The vacant property's value may behave more like equity prices in general and like oil stock prices in particular. However, if the building begins to attract tenants with long-term, non-cancellable leases, the property's fundamental economic nature may transition from being more like an oil stock to being more like a corporate bond. (The value of the first building will become increasingly driven by the difference in local market fundamentals relative to those implied by the current lease terms as the maturity date approaches.)

This example shows that assets within a specific type of real estate (e.g., private commercial real estate) may behave like debt or equity securities depending on the characteristics of the individual properties. Furthermore, a particular property may experience dramatic changes in its investment characteristics due to a specific event, such as the signing or termination of a very long-term, non-cancellable lease.

14.2.2 Top-Down Asset Allocation

Asset allocation approaches differ by the extent to which the process is focused on top-down allocation versus bottom-up allocation. **Top-down asset allocation** emphasizes allocation based on the analysis of the macro environment and risk premiums, and their expected impact on general categories or types of portfolio investments. Exhibit 14.1 illustrates the concept of target asset allocation using one set of potential categories and weights. To the extent that the allocation illustrated in Exhibit 14.1 is based on general portfolio objectives, the asset allocation process is a top-down asset allocation. Section 14.3 provides numerous distinctions that can be used to place real estate into different categories.

Exhibit 14.1: Asset allocation



For example, an asset allocator would typically be concerned about the return, risk, liquidity, and even tax implications of the overall portfolio. In the case of liquidity, a top-down asset allocator takes into account the concern for liquidity when selecting portfolio weights, along with a preference for a higher return and other perceptions as to how each category serves the overall portfolio objectives. Thus, in considering liquidity, a pure top-down asset allocator would determine the weights for each category based in part on an analysis of the liquidity of each category of real estate and the extent to which illiquidity offers a risk premium relative to the portfolio's needs for liquidity. Therefore, if the asset allocator's investment policy mandates that the illiquid portion of the portfolio should not

exceed some particular level, the asset allocator will have to find the optimal allocation to various categories of real estate subject to this constraint. As a result, this liquidity concern and other general portfolio objectives may cause the asset allocator to make allocations at each level that ultimately determine the feasible and desirable portfolio allocation to domestic, publicly traded equity real estate investment products. It should be noted that further details regarding asset allocation could be illustrated in Exhibit 14.1. For example, in the category of publicly traded domestic real estate equity, the asset allocator may further divide the category by property type (office buildings, industrial centers, data centers, retail, residential, health-care facilities, self-storage facilities, and hotels) and by investment management type (in-house vs. external, active vs. indexed). Furthermore, other categorizations could be used, along with greater refinement of the level of detail (e.g., international vs. domestic could be broken into finer distinctions based on geographical profiles or demographic trends).

14.2.3 Bottom-Up Asset Allocation

Bottom-up asset allocation refers to an emphasis on the relative attractiveness of individual investment opportunities as the primary driving factor of the asset allocation process. The underlying analysis is typically supported by rigorous fundamental analysis. The asset allocator may determine that some subcategories of real estate, particular properties, or publicly traded real estate managers offer exceptionally attractive investment opportunities, whereas other categories, properties, or manager portfolio characteristics are unattractive. To the extent that these analyses of individual opportunities or subcategories exert the dominant effect on the ultimate asset allocation, the asset allocation would reflect a bottom-up strategy.

For example, an asset allocator may have internal staff and established relationships with outside managers that lead the allocator to believe that particular subcategories present the portfolio with attractive opportunities relative to the wider asset class. The asset allocator may favor some opportunities on extensive experience and knowledge, while avoiding potentially attractive opportunities in subcategories in which the allocator has a limited perceived edge. To the extent that individual asset selection exerts a major effect on the ultimate asset allocations among major categories, the asset allocation process is considered to be bottom-up.

Most asset allocation methods are a mix of top-down and bottom-up, in that allocations among major categories tend to be driven by general portfolio objectives and macro analysis, whereas allocations within subcategories are typically driven by the allocator's perceptions of the opportunities available.

14.3 Categories of Real Estate

This section describes the main characteristics of various real estate assets, beginning with four especially common categories that can be used to differentiate real estate:

1. Equity versus debt
2. Domestic versus international
3. Residential versus commercial
4. Private versus public

Each of these categories is briefly discussed in the following four sections, followed by discussions of other methods of categorizing real estate.

14.3.1 Equity versus Debt

The traditional method of distinguishing between equity claims and debt claims is to use the legal distinction between a residual claim and a fixed claim. A mortgage is a debt instrument collateralized by real estate, and real estate debt is typically defined as including all mortgages. Note, however, that mortgages with substantial credit risk can behave more like equity, and equity ownership of properties with very long-term leases can behave like debt. The value of a mortgage is more closely associated with the value of the real estate than the profitability of the borrower.

14.3.2 Domestic versus International

One of the primary motivations to real estate investing is diversification. International investing (i.e., cross-border investing) in general—and international real estate investing in particular—are regarded as offering substantially improved diversification. However, the heterogeneity of most real estate and the unique nature of many real estate investments make international real estate investing more problematic than international investing in traditional assets. Other challenges include lack of knowledge and experience regarding foreign real estate markets, lack of relationships with foreign real estate managers, time and expense of travel for due diligence, liquidity concerns, political risk (particularly in emerging markets), risk management of foreign currency exposures, and taxation differences. For these reasons, a large share of international real estate investing is done through shares of listed property companies (LPCs), including REITs, in foreign countries. The continuing emergence of derivative products related to real estate investments in particular nations or regions is an important potential

opportunity for exploiting the benefits of international diversification without the challenges of direct international investment.

The extent of appropriate international investing depends on the locale of the asset allocator. A UK asset allocator or an asset allocator in another country with a very large economy may be able to achieve moderate levels of diversification without foreign real estate investing. However, an asset allocator in a nation with a small or emerging economy may experience high levels of idiosyncratic risk in the absence of foreign investments.

14.3.3 Residential versus Commercial

One of the most important drivers of the characteristics of a real estate investment is the nature of the real estate assets underlying the investment. A broad distinction, especially in mortgages, is residential real estate versus commercial real estate.

Housing or residential real estate properties: Residential real estate includes many property types, such as single-family homes, town houses, condominiums, and manufactured housing. The housing or residential real estate sector is traditionally defined as including owner-occupied housing rather than large apartment complexes. According to the Federal Reserve, the aggregate value of all U.S. homes amounted to approximately \$20.7 trillion at the end of 2014, representing an important portion of household wealth. In the UK, housing values totaled £5.2 trillion as of January 2014, up from £3.6 trillion in 2003 (Savills 2014).

Within residential real estate, the institutional investor is primarily concerned with investing in mortgages backed by housing and residential real estate. Ownership in these instruments is usually established through pools of mortgages. The global residential mortgage market had total balances outstanding of \$25.7 trillion at the end of 2013 (Market Reports Online 2015). According to data from the Federal Reserve and MarketResearch.com, residential mortgages accounted for approximately

- \$12 trillion in the United States (end of 2014),
- \$2.5 trillion in Japan (2013),
- \$1.6 trillion in the UK (2013),
- \$1.4 trillion in Germany (2013),
- \$1.2 trillion in France (2013).

Commercial real estate properties: Commercial real estate properties include the following property sectors: office buildings, industrial centers, data centers, retail (malls and shopping centers, also referred to as “strips”), apartments, health-care facilities (medical office buildings and assisted-living

centers), self-storage facilities, and hotels. Small properties may be directly and solely owned by a single investor. Alternatively, collections of numerous smaller properties and large commercial properties may be managed by a real estate company, such as a publicly listed REIT, or through private equity real estate funds, which, in turn, are owned by several institutional investors as limited partners. Within commercial real estate, the institutional investor can access opportunities through either debt or equity investments. The volume of transactions fluctuate significantly depending on the stage of the business cycle, but it is generally high enough to support large investments by institutional investors. For example, the commercial real estate investments in 2013 and early 2014 averaged about \$100 billion in the U.S., \$75 billion in Europe, Middle East and Africa and \$180 billion in Asia-Pacific (Deloitte (2015)).

For the most part, residential and commercial real estate require very distinct methods of financial analysis. For example, the credit risk of mortgages on residential real estate is typically analyzed with a focus on the creditworthiness of the borrower. Mortgages on commercial real estate tend to focus on the analysis of the net cash flows from the property.

14.3.4 Private versus Public

Exposure to the real estate market, especially the equity side, can be achieved via private and public ownership. **Private real estate equity** investment involves the direct or indirect acquisition and management of actual physical properties that are not traded on an exchange. **Public real estate investment** entails the buying of shares of real estate investment companies and investing in other indirect exchange-traded forms of real estate (including futures and options on real estate indices and exchange-traded funds linked to real estate).

Private real estate is also known as physical, direct, or non-exchange-traded real estate. Private real estate may take the form of equity through direct ownership of the property or debt via mortgage claims on the property. The private real estate market comprises several segments: housing or residential real estate properties, commercial real estate properties, farmland, and timberland. The relative advantages of investing in the private side of real estate equity are that investors or investment managers have the ability to choose specific properties, exert direct control on their investments, and enjoy the potential for tax-timing benefits.

Public real estate is a financial claim in the form of equity, debt, funds, or derivative positions, and may be a claim on either underlying private real estate positions or underlying public real estate positions. Public real estate is also known as securitized, financial, indirect, or exchange-traded real estate. Thus, public real estate enables the ownership of private real estate through one or more

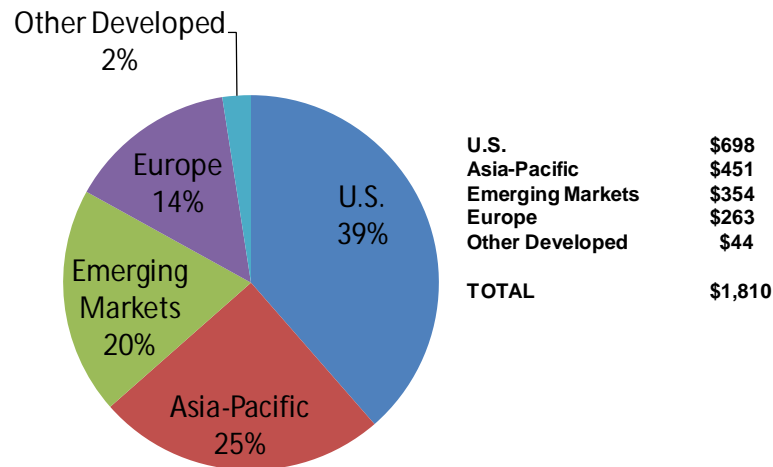
levels of contracts designed to facilitate real estate ownership, reduce costs, or increase liquidity relative to direct ownership. For example, securitization—particularly in the form of commercial mortgage-backed securities (CMBS)—has substantially increased the liquidity and accessibility of real estate investments, while allowing structured investments based on specific institutional investor return-risk profile targets.

REITs are securitized pools of real estate that constitute an important form of public real estate especially in the United States, which has the largest market in the world, followed by Australia, France, the United Kingdom, and Japan. The relative advantages of investing in public commercial real estate (as opposed to private) include liquidity, greater investor access, relatively low transaction costs, the potential for better corporate governance structures, and the transparency brought by required SEC filings and pricing in public capital markets (Idzorek, Barad, and Meier 2007).

One of the most important characteristics of REITs is that, due to the trust structure, income distributed by a REIT to its shareholders is taxed not at the REIT level but at the investor level after it flows through the REIT. In order to enjoy this tax status in the United States, REITs are subject to two main restrictions: (1) 75% of the income that they receive must be derived from real estate activities, and (2) the REIT is legally obligated to pay out 90% of its taxable income in the form of dividends. Other restrictions relate to the ownership structure of the REIT. As long as a REIT is in compliance with the relevant restrictions, it may deduct dividends from its income when determining its corporate tax liability (i.e., it pays corporate income taxes only on retained taxable income). REITs enjoy similar tax efficiencies in other parts of the world—for example, in the UK and in Germany.

In the United States, REITs can invest both in the private real estate market (equity REITs) and in real estate-based debt (mortgage REITs), though, practically speaking, each specific REIT tends to manage its portfolio by focusing nearly exclusively on either equity ownership (including the use of joint ventures) or debt (including derivatives). Generally, if a REIT has 50% or more of its assets in the private real estate equity market, it is viewed as an equity REIT; if over 50% of its assets are invested in real estate debt, it is viewed as a mortgage REIT. This distinction is important in return analyses. For example, unlike equity REITs, mortgage REITs tend to move in line with other rate-sensitive securities due to their underlying asset base. Equity REITs dominate the REIT sector, in terms of both number available and market capitalization. In the United States, as of the end of 2015, equity REITs, as proxied by the FTSE NAREIT All Equity REITs Index, had a market capitalization of \$882 billion, whereas mortgage REITs (the FTSE NAREIT Mortgage REITs Index) had a market cap of \$52.5 billion. And globally, as of September 30, 2015, Cohen and Steers put the total market capitalization for real estate securities at \$1.8 trillion across 487 companies (see Exhibit 14.2).

Exhibit 14.2: Global Real Estate Securities Market by Region on September 30, 2015; Market Capitalization in US\$ billions



Sources: Cohen & Steers, FTSE, FactSet, and Standard & Poor's

14.3.5 Real Estate Categorization by Market

Institutional investors often categorize private commercial real estate equity investments by the size of the real estate market in which the property is located. Real estate assets are said to trade in the **primary real estate market** if the geographic location of the real estate is in a major metropolitan area of the world, with numerous large real estate properties or a healthy growth rate in real estate projects. Primary real estate markets tend to have easily recognizable names. Using the United States for illustration, examples range from cities such as Orlando, Florida, to specific metropolitan areas, such as Manhattan in New York City. Large institutional investors focus on investments in these primary markets. **Secondary real estate markets** include moderately sized communities as well as suburban areas of primary markets. **Tertiary real estate markets** tend to have less recognizable names, smaller populations, and smaller real estate projects.

14.3.6 Risk and Return Classifications

From the perspective of an asset allocator, the most useful categorization approach of real estate should center on the most important characteristics of the portfolio. The primary characteristics of a portfolio are risk and return. Therefore, asset allocators should consider including a categorization approach that focuses on the risk and return profiles of the assets.

Chapter 16 discusses a classification of real estate that includes three types: core, value added, and opportunistic. These three categories assist the analysis of real estate and asset allocation decisions by grouping together real estate products that possess similar risk and return properties. The heterogeneity of real estate within each subcategory may lead an asset allocator to focus on distinguishing investments based on their risk and return, perhaps using the core, value-added, and opportunistic categories to classify them.

14.3.7 The Focus on Private Commercial Real Estate

Most of the focus in Chapters 15 through 18 is on private commercial (i.e., income-producing) real estate rather than on public real estate, residential real estate, or commercial mortgages. There are three reasons for this:

1. Most commercial real estate throughout the world is privately held rather than publicly traded.
2. Most of the equity of residential real estate is held by the occupier of the property rather than by an institutional investor.
3. The pricing of the equity claims to private commercial real estate drives the pricing of the credit risk in the pricing of commercial mortgages. In other words, real estate debt may be viewed through the structural model as being well explained through an understanding of the risks of the equity in the same property.

Thus, in our remaining four chapters focusing on real estate, the material emphasizes the risk and returns of equity ownership of private commercial properties, whether owned directly or held through limited partnerships.

14.4 Return Drivers of Real Estate

Real estate returns are generally perceived as being fundamentally different from the returns of other assets. For example, real estate is generally believed to offer substantial inflation protection and distinct diversification benefits. These distinctions are often justified based on historical tendencies, derived through empirical analysis of past prices and returns.

An understanding of the inflation-protection potential of real estate requires a distinction between anticipated inflation and unanticipated inflation. The **anticipated inflation rate** is the expected rate of change in overall price levels. Expectations vary across market participants and are generally unobservable. Accordingly, indications of anticipated inflation are often based on surveys of consensus estimates, derived from past inflation, or inferred from other market information, such as interest rates.

To the extent that a market is informationally efficient, the level of anticipated inflation should already be incorporated in the price and, thus, the expected rate of return on various assets. For example, the **Fisher effect** states that nominal interest rates equal the combination of real interest rates and a premium for anticipated inflation (while other models include the effect of expected taxation):

$$\text{Nominal Interest Rate (ex ante)} = \text{Real Interest Rate (ex ante)} + \text{Anticipated Inflation}$$

The net result is that every asset in an informationally efficient market provides identical protection from anticipated inflation, since every asset's price adjusts to compensate the buyer for anticipated inflation. Thus, stable or previously anticipated inflation rates should not be a return driver, or determinant, by themselves.

The more challenging issue is that of unanticipated inflation. **Unanticipated inflation** is the realized rate of inflation minus anticipated inflation:

$$\text{Unanticipated Inflation} = \text{Realized Inflation Rate} - \text{Anticipated Inflation}$$

The effect of unanticipated inflation on an investment's realized return is crucial, and the risk of unanticipated inflation is an important consideration in risk analysis. Realized inflation in a particular period exerts its primary effect through its role in modifying future expectations of inflation. Because changes in expected inflation can exert substantial effects on prices, realized inflation can be an important driver of most real estate returns. In other words, deviation in realized inflation rates relative to previously anticipated inflation rates (i.e., unanticipated inflation) can be a very important return driver due to its role in changing

anticipations of future inflation rates. Volatility of the inflation rate is another source of risk related to inflation. Finally, unanticipated inflation can have differential effects on relative prices, which represents another source of risk. For example, higher unanticipated inflation may lead to an immediate rise in labor costs while having a muted effect on certain real estate properties.

The sensitivity of various real estate investments to unanticipated inflation may be analyzed through empirical analyses of past returns or a fundamental analysis of the investment's sources of risk and return. A challenge in empirical analysis of the effects of unanticipated inflation is in developing an objective and accurate estimate of the consensus-expected inflation rate. An estimate of the anticipated inflation rate is necessary to estimate the unanticipated inflation rate as the difference between the realized and expected inflation rates.

Another challenge is that there are typically different rates of anticipated inflation over different time horizons. Changes in anticipation of inflation over various time horizons could each be expected to exert different effects on various real estate investments. Furthermore, realized rates of inflation may be studied over various time intervals. Thus, the price reaction and inflation protection offered by an investment should be expected to differ based on whether the realized inflation signals a long-term change in expected inflation or a more transient shift in inflation anticipation.

Inflation may have different effects on different types of properties. Inflation may hurt the value of bond-like properties that have long-term leases at fixed rates. Though properties are often valued on a pre-tax basis and before financing costs (interest), investors in real estate equity that are leveraged with adjustable-rate mortgages may also suffer from higher financing costs during times of inflation. Likewise, higher/lower inflation can benefit/harm owners of leveraged properties that are financed with fixed-rate debt. Properties with lease structures that may benefit from high inflation include those with short-term leases or leases in which payments contractually rise with the rate of inflation. In fact, many leases governing long-term commercial real estate leases in the United States contain an **escalator clause**, which periodically adjusts lease payments based on some agreed upon measure of inflation.

The following factors also influence real estate returns: the state of the economy, demographics, interest rate level, the tax treatment of real estate income and financing costs, and trends. The next section examines the impact that some of these factors may have on the real estate market, the asset market, and the development (construction) industry in the framework of the four-quadrant model.

14.5 The Four-Quadrant Model

In this section, which draws from Geltner, Miller, Clayton, and Eichholtz (2014), we describe the **four-quadrant model** of DiPasquale and Wheaton (1992), which allows for the simultaneous assessment of the long-run equilibrium within and between the real estate space and asset markets. A **real estate system** consists of three components: the market for real estate space, the asset market, and the construction industry. The four-quadrant model is a graphic representation of the dynamics of a real estate system; hence, it is also referred to as a systems dynamic model.

Exhibit 14.3 shows the four quadrants of the model. The two right-hand quadrants correspond to the property market for the use of space, while the two left-hand quadrants characterize the asset market for the ownership of real estate. The four-quadrant model and the real estate system can be explained as follows:

1. **Property market rent:** This is the equilibrium rental rate and is determined through the interaction of supply of space and demand for space. It is typically assumed that the supply of space is fixed in the short run. Demand, on the other hand, is a function of economic conditions as well as the characteristics of the property. This appears in the northeast quadrant.
2. **Asset market value:** The equilibrium rent of the previous step determines the income that a property generates. Assuming relatively fixed income in the short to medium term, the market value of the property can be calculated as the present value of future cash flows. Given the required capitalization rate of a property, its market value will be equal to net operating income divided by the capitalization rate. Rental income is a major determinant of net operating income, and the current economic condition and the rate of return available on other investments are the major determinants of the capitalization rate required by an investor's other investments. This appears in the northwest quadrants
3. **Construction activities:** Given the equilibrium value of properties determined above, the construction industry will compare the market value to construction costs. This will be one of the factors that will determine the level of construction activities in the economy. Of course, other variables—such as the availability of credit, economic conditions, and demography—will affect construction activities as well. This appears in the southwest quadrant.
4. **Property market:** The construction activities of the previous item determine how the supply will change, eventually affecting the supply space, which was assumed to be fixed in the short-run. This means, that

while the supply is fixed in the short-run, the level of rental income will spill over into construction industry, which with some time lag affect the supply of space. This appears in the southeast quadrant.

Now that we have discussed the overall logic of the model, below we provide a more detailed analysis of the four-quadrant model.

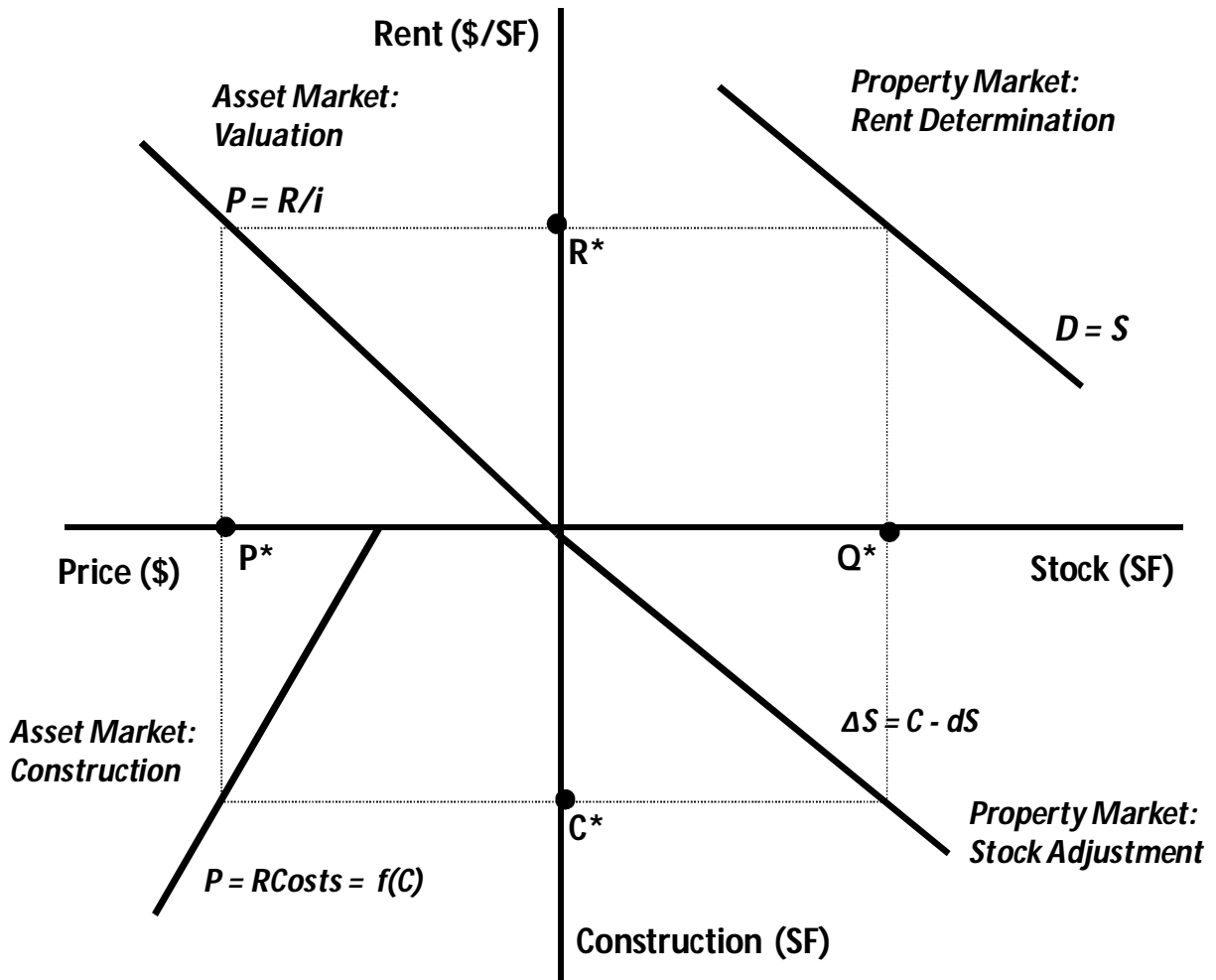
The northeast (NE) quadrant has two axes: rent (which is measured in \$ per unit of space, such as square feet) and the stock of space (measured in the same units of space). This quadrant describes how rents in the space market are established. In equilibrium, the demand for space, the downward-sloping line D , is equal to the stock of space, S . Assuming that the stock of space is fixed—a plausible assumption for the short run—rents must be determined so that the space demand is exactly equal to the stock of space. Demand is a function of rent and conditions in the economy. Rent (R^*) is found by plotting a level of stock of space on the x -axis up to the demand line and over to the y -axis. In the short run, rents are determined in the NE quadrant.

The northwest (NW) quadrant has two axes: rent (\$) and price (\$ per square feet). The ray starting off out of the origin represents the ratio of rent to price for real estate assets. The ratio of net operating income to price is known as the capitalization rate (i). Here we use the rental income as a proxy for net operating income. Generally, the capitalization rate is taken as exogenous and is a function of the following four variables: the expected growth in rents, the risks related to the income stream from rents, the long-term interest rate in the economy, and the tax code treatment of real estate income. A higher (lower) capitalization rate is represented by a clockwise (counterclockwise) rotation in the ray. The NW quadrant takes the rent level (R^*) from the NE quadrant and establishes a price for real estate assets (P^*) based on the capitalization rate (i). That is, given a required income yield and given the income generated by a property, we can value the property as Rent/Capitalization rate.

In the four-quadrant model, the price of the real estate asset is determined by moving first from the vertical axis (rent level) in the NE quadrant over to the ray in the NW quadrant, and then down to the price level on the horizontal axis. Continuing moving in a counterclockwise manner, the next quadrant (southwest, or SW) is the section of the asset market where the construction of new real estate assets is determined. Here, the line $f(C)$ represents the replacement costs ($RCosts$) of real estate. Construction costs increase with greater construction activity, and therefore the curve moves in a southwesterly direction, intersecting the price axis at the minimum dollar value per unit of space required to generate construction activity.¹ The level of new construction is established where asset prices equal

replacement costs. This is determined by a move to the SW quadrant where the replacement cost curve determines the level of construction given the price of real estate assets from the NW quadrant. Higher levels of construction would be unprofitable, whereas lower levels would generate excess profits. Therefore, real estate prices (P) equal construction costs ($RCosts$), both of which are a function of the construction level (C).

Exhibit 14.3: The Four-Quadrant Model



Source: DiPasquale and Wheaton (1992)

In the southeast (SE) quadrant, the long-run stock of space is created by the annual flow of new construction. The change in the stock of space in a certain period (ΔS) is equal to new construction (C) minus the depreciation rate (d , which represents losses from the stock) times the stock (S). The ray emanating from the origin corresponds to that level of the stock of space (on the x-axis) that requires a level of annual construction for replacement just equal to that value on the y-axis.

At that level, the stock of space will remain constant over time, given that depreciation will be exactly equal to new completions. Therefore, Δ is equal to zero and $C = dS$.

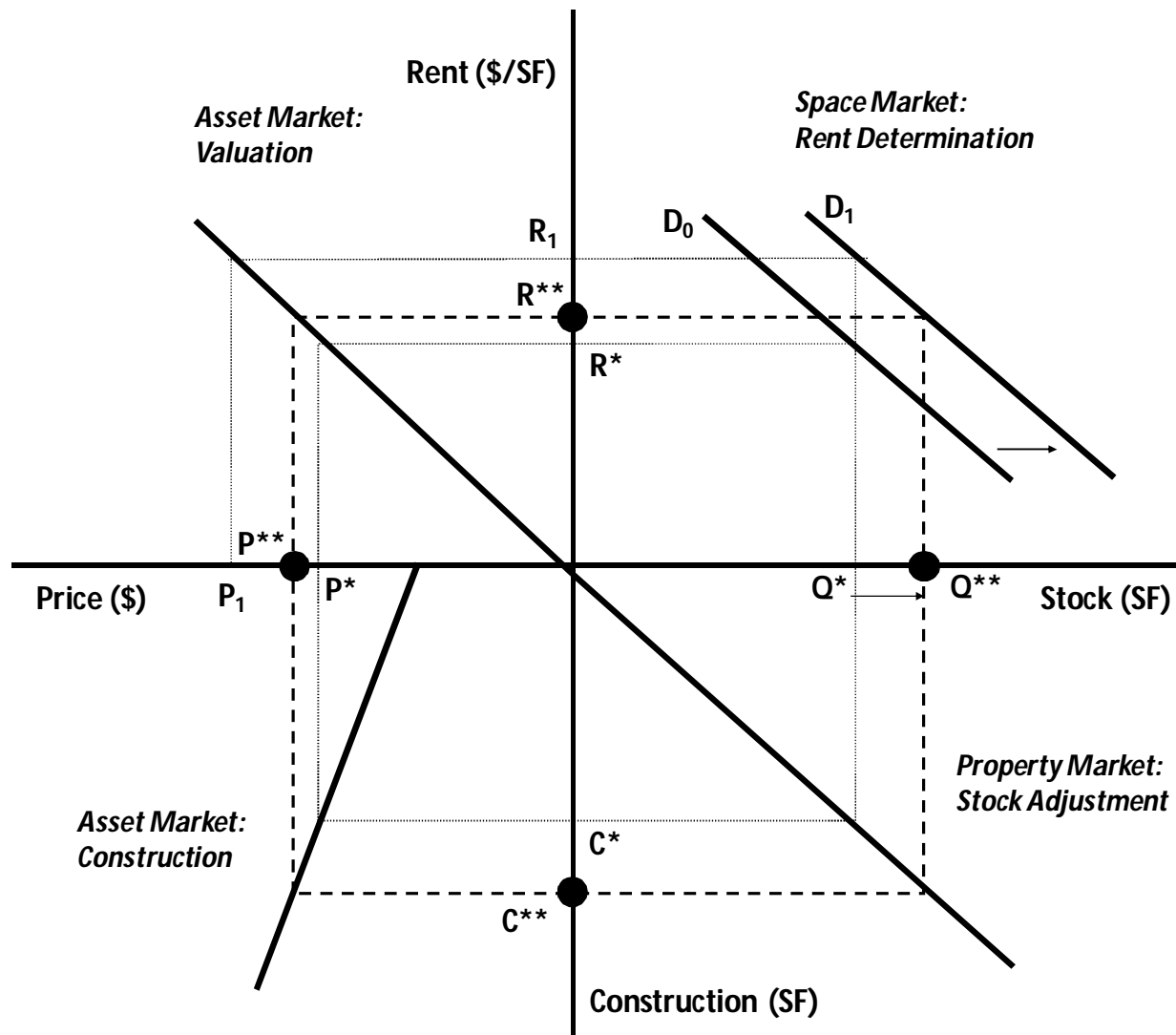
14.5.1 An Illustration of the Four-Quadrant Model: Explaining Real Estate Market Booms and Busts

Let us assume that the real estate market is experiencing a boom, and that demand for space surges unexpectedly (for example, due to an unanticipated increase in employment, production, or the number of households). In Exhibit 14.4, this is represented by a shift to the right in the demand curve for rents in the NE quadrant (from D_0 to D_1). In the short run, rents rise from R^* to R_1 (the rent level that relates the original stock of space Q^* to the new demand function D_1), and real estate prices increase from P^* to P_1 in the asset market (NW quadrant), as there is no time for new space to be constructed in response to the unexpected increase in demand. However, this is not a long-run equilibrium. After a year or two, new space is developed, and rents decrease from R_1 to R^{**} (and real estate prices from P^* to P^{**}), which is nonetheless still above the initial equilibrium rent of R^* (and the initial equilibrium real estate prices, P^*). This occurs because the long-run marginal cost function of the real estate market is outward-sloping (SW quadrant). Furthermore, notice that $Q^{**} > Q^*$, and thus the long-run equilibrium quantity of space is higher than it was at the original level of demand for rental space. This result will hold as long as the demand for rents exhibits at least some price elasticity.

We have just observed that, in the short run, an unexpected increase in demand for rental space (NE quadrant) leads to an increase in rents, given that the level of real estate space is fixed. These higher rents then cause a rise in real estate prices (NW quadrant), which, in turn, stimulates new construction (SW quadrant). In the long run, this leads to a greater stock of real estate space (SE quadrant). The slopes of the different curves determine the size of the changes in these four variables. For instance, if construction were very inelastic with respect to real estate prices, then the new levels of rents and asset prices would be much higher than before, and new construction and the level of stock of space would have expanded only slightly.

Shifts in the demand for real estate assets may result from a number of factors, such as changes in short-term or long-term interest rates, the tax treatment of real estate, and the availability of construction financing, as pointed out by DiPasquale and Wheaton (1992).

Exhibit 14.4: The Four-Quadrant Model: Booms in the Real Estate Market



If interest rates in the rest of the economy rise (fall), then the existing yield from real estate becomes low (high) relative to fixed-income securities, and investors will wish to shift their funds from (into) the real estate sector. Similarly, if the risk characteristics of real estate are perceived to have changed, then the existing yield from real estate may also become insufficient (or more than necessary) to get investors to purchase real estate assets relative to other assets. Finally, changes in how real estate income is treated in the U.S. tax code can also greatly impact the demand to invest in real estate. Favorable depreciation rules for real estate (e.g., short tax life and accelerated depreciation schedule) increase the after-tax yield generated by real estate, which increase the demand to hold real estate assets. Reductions in long-term interest rates, decreases in the perceived risk

of real estate, and generous depreciation or other favorable changes in the tax treatment of real estate will cause a reduction in the income that investors require from real estate.

These changes can also be examined using the four-quadrant model. As noted by DiPasquale and Wheaton (1992), higher interest rates, greater perceived risk, and adverse tax changes rotate the ray in a clockwise manner. Given a level of rent from the property market, a reduction in the current yield or capitalization rate for real estate raises asset prices and in the SW quadrant, expands construction. Eventually this increases the stock of space (in the SE quadrant), which then lowers rents in the property market for space (NE quadrant). A new equilibrium requires that the initial and finishing rent levels be equal to each other. This new equilibrium results in a new solution that is lower and more rectangular than the original. In the new equilibrium, asset prices must be higher and rents lower, while the long-term stock and its supporting level of construction must be greater. If rents were not lower, the stock would have to be the same (or lower) and this would be inconsistent with higher asset prices and greater construction. If asset prices were not higher, rents would be lower, and this would be inconsistent with the reduced stock (and less construction) which lower asset prices would generate.

As we have seen, the four-quadrant model is a useful tool for analyzing the short-run and long-run equilibrium, as well as its potential perturbations, in the property market (rent determination), the asset market (valuation and construction), and the property market (stock adjustment).

14.6 Conclusion

This chapter has reviewed the attributes, asset allocation, categories, and return drivers of real estate. It also presented the four-quadrant model, which allows the simultaneous assessment of the long-run equilibrium within and between the real estate space and asset markets, and provides a graphic representation of the dynamics of a real estate system.

The next four chapters will help us gain a deeper understanding of real estate as an investment in a number of fronts. Chapter 15 examines real estate indices and performance evaluation. The chapter discusses the two main approaches to indexation (appraisal-based and transaction-based), and focuses on the consequences and remedies of data smoothing in real estate. Chapter 16 examines investment styles (core, value added, and opportunistic, the main approach to categorizing investments within the category of private commercial real estate equity), portfolio allocation, and the challenges of using real estate derivatives to hedge market risk in real estate markets. Chapter 17 presents the

main characteristics of unlisted (open-end funds and closed-end funds) and listed real estate products (REITs and ETFs based on real estate indices), as well as the extent to which analysis of publicly traded real estate securities may be used to provide information on the risks and returns of private real estate. Finally, Chapter 18 examines international real estate investments, examining their potential opportunities (mainly enhanced returns, diversification benefits, potential tax advantages, and leverage), as well as the main challenges when going international (lack of local knowledge, agency costs, regulatory restrictions on foreign ownership, higher transaction costs, complex taxation, and exchange rate risk, among others).

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Notes

1. The ray would be almost vertical if construction could be supplied at any level with almost the same costs. However, land scarcity, bottlenecks, and so on, lead to an inelastic (i.e., insensitive) supply and, hence, to a ray that is more horizontal.