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# Natural Vacancy Rates in Major Texas Office Markets

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## Abstract

This study presents estimates of natural vacancy rates for five major Texas office markets. Using quarterly data for office vacancy rates and office rents, natural vacancy rates for Austin, Dallas, Fort Worth, Houston and San Antonio were determined to be between 17 and 22.3 percent. In all five office markets, office rents increased substantially when actual vacancy rates fell below the estimated natural vacancy rates during the 1988–2001 sample period.


## Introduction

The stock of vacant real estate properties available for sale or rent plays an important role in matching supply and demand for real properties. The role is similar to the inventory of goods available for sale in manufacturing and trade industries or the unemployment rate in labor markets.

In the office market, there are two main reasons for keeping a stock of office units: meeting uncertain demand for office space and rent adjustments. Because office construction is a lengthy process, office owners hold vacant office space to react to short-run fluctuations in office demand.

Vacant office space also allows office owners to maximize expected returns on their investments by responding to profit opportunities in office markets. Because office rent contracts are mostly long-term contracts, holding vacant space allows landlords to reduce the supply of office space at a time when the office market is weaker than expected and lease properties later, when the market is expected to be stronger.

An inventory of vacant real properties serves the dual purpose of matching supply and demand for real properties and adjusting rent. Because holding vacant inventories is costly, it has long been realized in real estate markets that an optimal vacancy rate (vacant real property divided by inventory of real property) exists, achieving both purposes at a minimum cost or a maximum profit. This desired or optimal vacancy rate is called the *natural vacancy rate* and, since its description by Black and Winnick (1953), it has become an important concept in the real estate economic literature.

According to the theory of natural vacancy rates, the exact value of the actual vacancy rate does not determine whether any given real estate market is in equilibrium. Rather, it is the difference or the gap between the actual and natural vacancy rates that determines the deviation from an equilibrium in rent-inventory adjustment.

In any real estate market, rents increase (decrease) when actual vacancy rates are below (above) their natural vacancy rates. Because vacant real properties are the difference between the supply and the demand for real properties, the theory of natural vacancy rate, which relates changes in rents to the stock of vacant properties, has been considered an important theory of rent determination.

Empirical investigation of natural vacancy theory and the relationship between rents and vacancy rates has been conducted primarily for residential real estate markets (Rosen and Smith, 1983; Harris 1991). The concept has been extended and applied to office markets by Shilling, Sirmans, and Corgel (1987, 1992); Wheaton and Torto (1988); Frew and Jud (1988); Shilton and Tandy (1993); and Grenadier (1995). These empirical studies found the theory of natural vacancy rates an important analytical framework for a better understanding of office market dynamics. Empirical estimation of natural vacancy rates in office markets has been conducted mostly for major cities in the United States.

Texas has major multitenant office markets. Houston is the fourth largest U.S. city in terms of population. San Antonio and Dallas rank eighth and ninth, respectively. Together with Austin and Fort Worth, these cities account for 25 percent of Texas' population. This study estimates natural vacancy rates in these major Texas office markets. The study finds that natural vacancy rates for the five major Texas office markets range from 17 to 22.3 percent and that in all five markets office rents increased substantially when actual vacancy rates fell below the estimated natural vacancy rates.

## Empirical Framework

In its simplest form, the theory of natural vacancy rates asserts that changes in real rent depend on the vacancy rate and that rent-vacancy relationship can be expressed as:

$$(1) \qquad DRRENT_t = \alpha - \beta VACR_t$$

where $DRRENT_t$ is the rate of change in real rents ($DRRENT_t = RRENT_t - RRENT_{t-1}$) and $VACR_t$ is the vacancy rate in period $t$.[1] Equation (1) includes two terms to be estimated: a positive constant term $\alpha$, and a negative $\beta$, the coefficient of $VACR_t$. Equation (1) asserts that changes in rents are negatively associated with vacancy rates — that is, when vacancy rates are larger (smaller) changes in rents are smaller (larger).

The natural vacancy rate is the vacancy rate below which rents begin to increase if supply and demand are in balance. This rate can be calculated by setting $DRRENT_t$ in equation (1) to zero and solving the equation:

$0 = \alpha - \beta VACR_t$ or $VACR_t = \text{Natural Vacancy Rate} = \alpha/\beta$.

Equation (1) has been criticized on several grounds. One criticism has been that this specification can generate negative vacancy rates, which are implausible. This problem can be overcome by replacing the difference term ($DRRENT_t$) with a

percentage term ($GRRRENT_t = DRRENT_t / RRENT_{t-1}$), and thus using the growth rate of office rent rather than rent differences. Formally:

(2) $GRRRENT_t = \alpha - \beta VACR_t$

Equation (2) asserts that the growth rate of real rent rather than changes in real rents as shown in equation (1) is determined by vacancy rates.

Another criticism of equation (1) is that this specification assumes that rent is determined by office vacancy rates, but office vacancy rates can in fact be determined by rents — causality runs in both directions. This problem can be handled by developing a system approach for estimating vacancy rates by specifying the following equations:

(3) $DRRENT_t = \alpha - \beta VACR_t$
$VACR_t = \varphi - \phi DRRENT_t$

In specification (3), office rents and office vacancy rates are determined simultaneously.

Yet another criticism of equation (1) is that office rents may be influenced by volatility in vacancy rates. This criticism can be addressed by adding the variance of vacancy rates as a variable in equation (1) or in the first equation in system (3).[2]

## Empirical Results

The data sets used in this study are made up of quarterly observations on vacancy rates, office inventories and rent per square foot from the first quarter of 1988 through the third quarter of 2001, a total of 55 quarterly observations for the five major Texas metropolitan areas.[3] Consumer price indexes for Houston and Dallas compiled by the Dallas Fed are used to deflate rent data and calculate office rents in real terms.

As discussed previously, it is more appropriate to employ a system approach to the process of rent-vacancy adjustments because causality can run in both directions. For this reason, the following system is specified for estimating natural vacancy rates:

(4) Rent Equation $DRRENT_t = \alpha - \beta VACR_t + \mu DRRENT_{t-1}$
Vacancy Equation $VACR_t = \varphi - \phi DRRENT_t + \gamma VACR_{t-1}$

Lags in the dependent variables are introduced in each equation to address the econometric problem of identification of equations, but they also have important economic interpretations. If the estimated coefficients of the lags are large and statistically significant, they suggest that the rents or vacancy rates were driven by their past histories rather than by changes in vacancy rates or rents.

The following system of equations was also estimated because it has been argued that growth rates, rather than differences in rents, should be used:

(5) Rent Equation $GRRENT_t = \alpha - \beta VACR_t + \mu GRRENT_{t-1}$
Vacancy Equation $VACR_t = \varphi - \phi GRRENT_t + \gamma VACR_{t-1}$

Table 1 presents the estimated rent and vacancy equations for major Texas office markets represented by specification (4). Table 2 presents the estimated natural vacancy rates for major Texas office markets using systems (4) and (5). The results in Table 2 show that the estimated vacancy rates are not sensitive to model specification. Differences (as in system 4) or percentages (as in system 5) yield similar vacancy rates.

In the remainder of this section, empirical results are discussed for the five major Texas office markets.

***Austin: Natural vacancy rate = 22.3 percent***

The office vacancy rate in Austin fell from a high of 39.1 percent in first quarter 1988 to a low of 3.3 percent in third quarter 2000 (Figure 1). The estimated natural vacancy rate of 22.3 percent was experienced by Austin's office market in second quarter 1991 (Figure 1). The response of office rents to the decline in office vacancies was immediate because office rents began to increase in third quarter 1991 (Figure 1).

Austin's vacancy equation shows that vacancy rates were mainly driven by inventory rather than by rents because the estimated coefficient of the lagged vacancy rate is statistically significant while the estimated coefficient of $DRRENT_t$ is small and not significant. Rents were not important for a long time because of a high vacancy rate (39.1 percent in 1988). Comparing $R^2$ for the rent and vacancy equations shows that vacancy rates were mostly driven by past magnitudes (that is, by office inventory).

***Dallas: Natural vacancy rate = 21.4 percent***

The office vacancy rate in Dallas fell from a high of 28.3 percent in second quarter 1988 to a low of 14.1 percent in fourth quarter 1997 (Figure 2). The estimated natural vacancy rate of 21.4 percent was experienced by Dallas' office market in first quarter 1995 (Figure 2). The response of office rents to the fall in office vacancies was immediate because office rents began to increase in first quarter 1995 (Figure 2).

The vacancy equation for Dallas shows that vacancy rates were driven by inventory rather than by rents because the estimated coefficient of the lagged vacancy rate is statistically significant while the estimated coefficient of $DRRENT_t$ is small and not significant. Rents were not important for a long time because of a high vacancy rate (28.3 percent) in the early 1990s.

***Fort Worth: Natural vacancy rate = 17.6 percent***

Fort Worth's office vacancy rate fell from a high of 25.8 percent in third quarter 1988 to a low of 10.9 percent in fourth quarter 1997 (Figure 3). The estimated natural vacancy rate of 17.5 percent was experienced by Fort Worth's office market in second quarter 1996 (Figure 3). Office rents began to increase in fourth quarter 1996 in response to decreasing vacancy rates (Figure 3).

The vacancy equation for Fort Worth shows that the vacancy rates in Fort Worth's office markets were driven by changes in rents as well as its own lags (that is, inventory of vacant office space).

***Houston: Natural vacancy rate = 21.2 percent***

The office vacancy rate in Houston fell from a high of 30.3 percent in first quarter 1988 to a low of 10.7 percent in fourth quarter 1998 (Figure 4). The estimated natural vacancy rate of 21.2 percent was experienced by Houston's office market in second quarter 1993 (Figure 4). After falling below the natural vacancy rate, the vacancy rate tended to increase again. This explains the delayed response of rents to vacancy rates. The response of office rents to actual vacancy rates falling below the natural vacancy rate was not immediate; rents began to increase in early 1997 (Figure 4). See the Appendix for more information on the Houston office market.

***San Antonio: Natural vacancy rate =17 percent***

The office vacancy rate in San Antonio fell from 29.5 percent in fourth quarter 1989 to 9.1 percent in third quarter 1997 and since then has increased to 12.4 percent in 2001 (Figure 5). The estimated natural vacancy rate of 17 percent occurred in San Antonio's office market in second quarter 1994 (Figure 5).

The natural vacancy rate for San Antonio's office market was the lowest among the five major Texas office markets (Table 2). This means that more demand for office space was needed to increase office rents. The response of office rents to actual vacancy rates falling below the natural vacancy rate was immediate but gradual (Figure 5).

The vacancy equation for San Antonio shows that the vacancy rates in San Antonio's office markets were driven mainly by changes in the inventory of vacant office space as shown by the estimated coefficient of the lagged vacancy rates.

## Conclusion

Changes in real rents have been associated with the deviation of actual vacancy rates from natural vacancy rates during the sample period in all five Texas office markets studied. The theory of natural vacancy rates and estimated vacancy rates offer a better understanding of the dynamics of office markets in the past as well as an analysis of current market conditions in the markets studied.

## Table 1. Estimated Rent and Vacancy Equations for Major Texas Office Markets

**Austin**

$DRRENT_t = 0.598^* - 2.689^*VACR_t - 0.880^*DRRENT_{t-1}$ $R^2 = 0.41$ DW = 2.07
(4.57) (3.36) (5.39)

$VACR_t = -0.010 - 0.003DRRENT_t + 0.914^*VACR_{t-1}$ $R^2 = 0.98$ DW = 2.05
(1.70) (1.42) (27.97)

**Dallas**

$DRRENT_t = 0.635^* - 3.038^*VACR_t - 0.087DRRENT_{t-1}$ $R^2 = 0.20$ DW = 1.73
(3.39) (3.49) (0.63)

$VACR_t = -0.011 - 0.004DRRENT_t + 0.939^*VACR_{t-1}$ $R^2 = 0.98$ DW = 1.93
(1.49) (1.28) (27.32)

**Fort Worth**

$DRRENT_t = 0.665^* - 3.786^*VACR_t - 0.139DRRENT_{t-1}$ $R^2 = 0.35$ DW = 1.70
(5.33) (5.45) (1.22)

$VACR_t = 0.023^* - 0.026^*DRRENT_t + 0.865^*VACR_{t-1}$ $R^2 = 0.94$ DW = 1.95
(3.38) (3.85) (23.97)

**Houston**

$DRRENT_t = 0.235^* - 1.082^*VACR_t + 0.400^*DRRENT_{t-1}$ $R^2 = 0.36$ DW = 2.07
(2.29) (2.13) (3.23)

$VACR_t = 0.008 - 0.004DRRENT_t + 0.945^*VACR_{t-1}$ $R^2 = 0.99$ DW = 2.03
(1.64) (0.86) (39.23)

**San Antonio**

$DRENT_t = 0.488^* - 2.872^*VACR_t - 0.041DRRENT_{t-1}$ $R^2 = 0.14$ DW = 2.00
(2.47) (2.813) (0.295)

$VACR_t = 0.002 - 0.002DRRENT_t + 0.973^*VACR_{t-1}$ $R^2 = 0.98$ DW = 2.02
(0.49) (0.86) (52.72)

*denotes significant at 5 percent significance level.

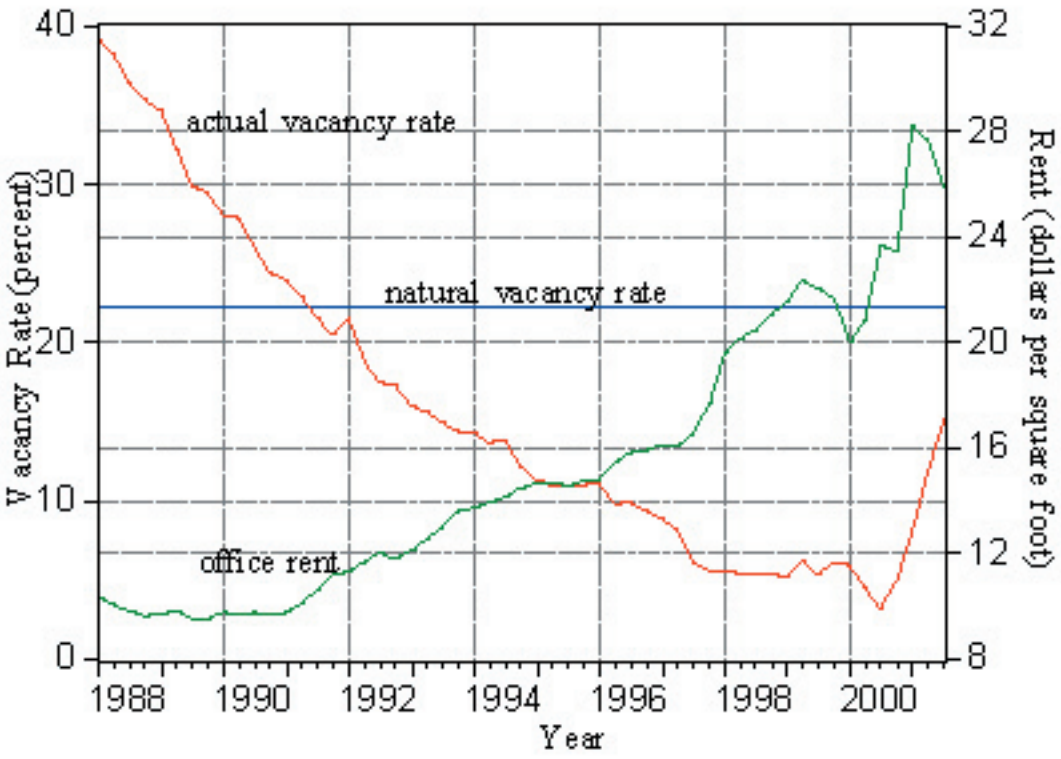
Source: Real Estate Center at Texas A&M University

## Table 2. Estimates of Natural Vacancy Rates for Major Texas Office Markets

| Metro Area | System of Equations 4 (in percent) | System of Equations 5 (in percent) |
|---|---|---|
| Austin | 22.3 | 22.8 |
| Dallas | 21.4 | 21.2 |
| Fort Worth | 17.5 | 17.7 |
| Houston | 21.2 | 21.7 |
| San Antonio | 17.0 | 17.5 |

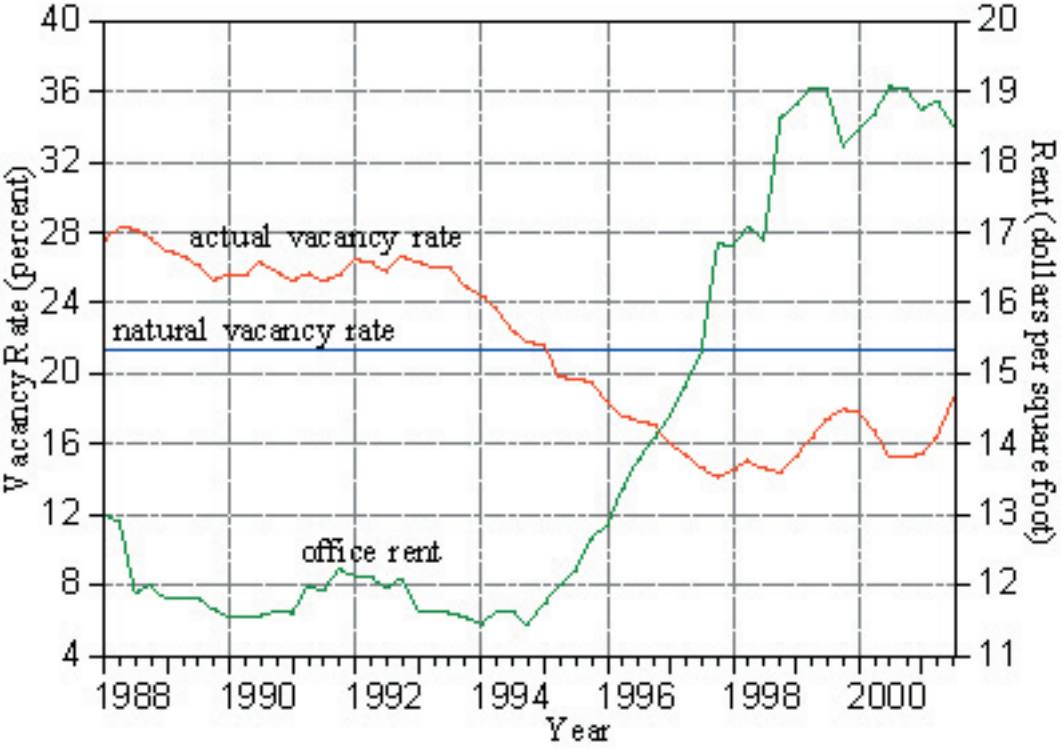
Source: Real Estate Center at Texas A&M University

**Figure 1. Office Vacancy Rates and Office Rent Rates in Austin**



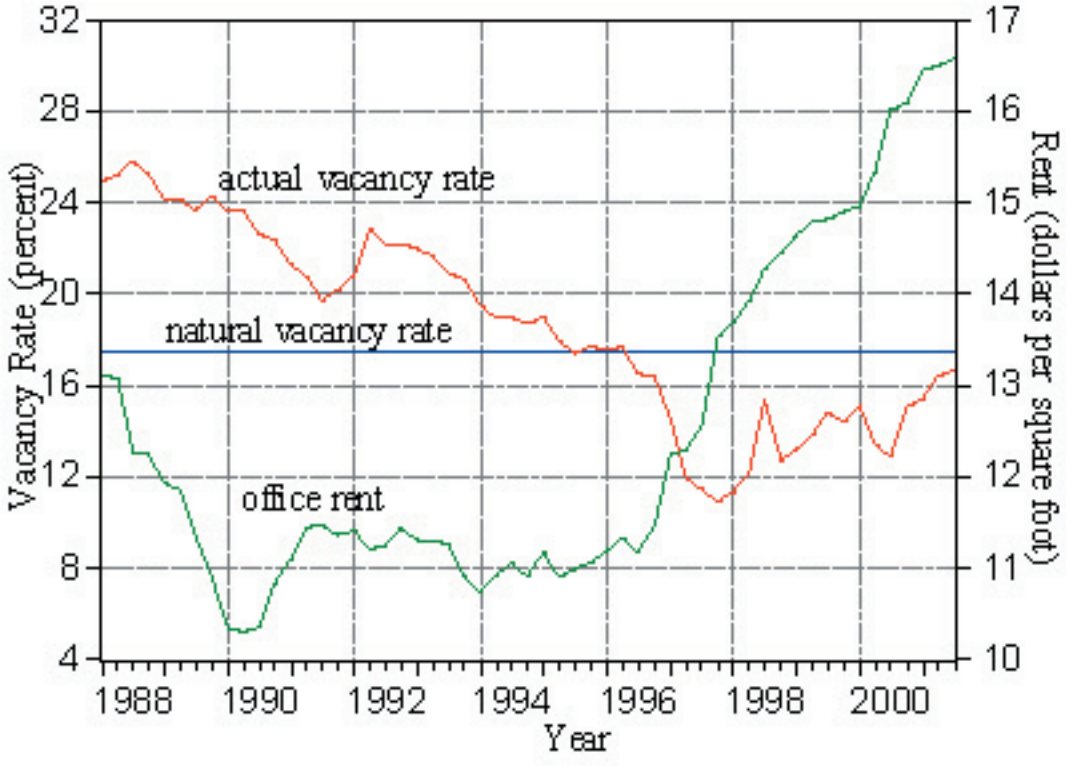

Source: Real Estate Center at Texas A&M University

**Figure 2. Office Vacancy Rates and Office Rent Rates in Dallas**



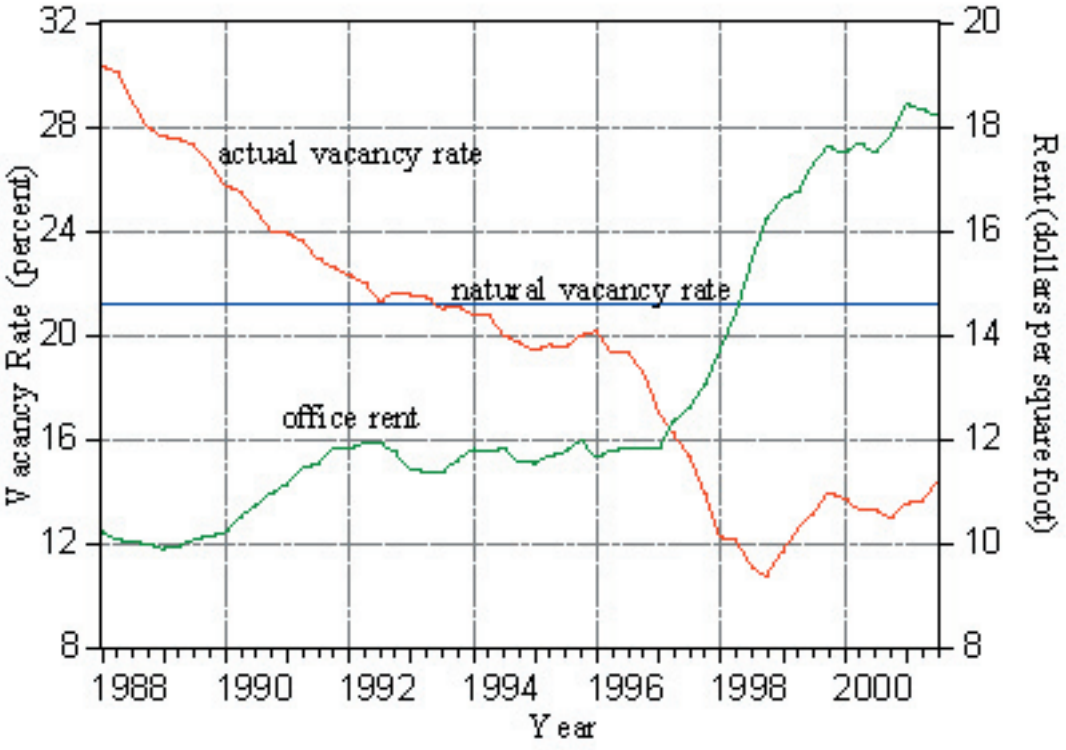

Source: Real Estate Center at Texas A&M University

**Figure 3. Office Vacancy Rates and Office Rent Rates in Fort Worth**



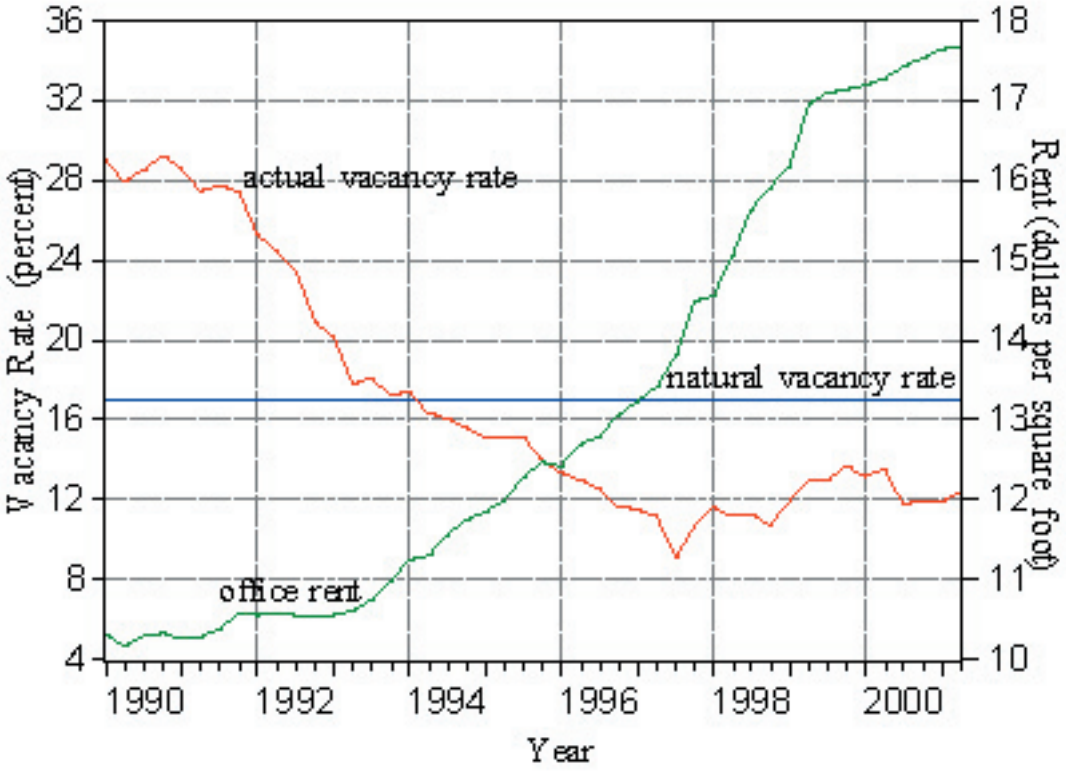

Source: Real Estate Center at Texas A&M University

**Figure 4. Office Vacancy Rates and Office Rent Rates in Houston**




Source: Real Estate Center at Texas A&M University

**Figure 5. Office Vacancy Rates and Office Rent Rates in San Antonio**




Source: Real Estate Center at Texas A&M University

# Appendix

These results are consistent with other information about Houston's economy, which was rapidly expanding during the late 1970s and early 1980s, primarily because of a booming oilfield sector. However, by the early 1980s, the price of oil had started to collapse, and the supply of office space in Houston began to far exceed demand. For example, between 1981 and 1986, the amount of vacant suburban office space in Houston increased from four million square feet to 36 million square feet, with the occupancy rate falling from 94 percent to 71 percent. During the same time, 85 million square feet of new office space was being added to the stock. This widening disparity between office space supply and demand through the mid-1980s occurred for several reasons.

First, credit was in great supply during the early 1980s, with banks and savings and loans (S&Ls) eager to lend money. As loans in the oil and agriculture sectors began to perform poorly, S&L deregulation allowed lenders to shift even more of their assets into commercial real estate loans. Furthermore, loan officers were generally compensated based on the level of front-end fees and the number of deals they originated, creating a further incentive to lend.

Second, Houston had a vast amount of developable land and a lack of zoning. Unfortunately, such an unrestricted environment caused a host of inexperienced individuals to attempt new office development.

Third, the Tax Act of 1981 brought about overdevelopment by offering real estate investors large tax savings. The "syndication" of new office projects became commonplace. Syndications facilitated the pooling of money, drawing funds from large groups of individual investors. In this way, the contributions of many investors could be aggregated to acquire and develop real estate. As a result of generous depreciation allowances, wealthy individuals could easily shelter much of their income from taxes by taking large write-offs in excess of their original investments. Many office buildings constructed in the early to mid-1980s were built strictly to generate tax benefits for investors and fees to developers.

Fourth, there was a general sentiment in Houston during the early 1980s that oil prices would continue to increase, fueling further speculation in real estate. By 1984, many prudent developers realized that the Houston office market was becoming overbuilt; however, less sophisticated developers failed to see the signals.

The Tax Reform Act of 1986 was the final blow. This new law immediately eliminated all of the tax benefits upon which developers and investors had become dependent. Coupled with Houston's loss of 187,000 upstream oilfield jobs by the end of 1987, the effect on the city's office market was devastating. Although new office construction ceased, Houston was left with more than 40 million square feet of vacant office space by 1987.

Corporate mergers and consolidations began in the late 1980s, further reducing the need for office space. Poor economic conditions drove Houston companies to reduce expenses, worsening the situation. By 1988, 80 percent of Houston office properties were owned by lenders. However, diversification in Houston's economy away from the oilfield sector and into medical, high-tech and aerospace industries was starting to pay dividends.

By 1989, interest in Houston office properties by life insurance companies and pension funds revived. By 1990, net absorption in office space was a positive four million square feet, up from 2.5 million square feet in 1989. Houston had experienced ten consecutive quarters of positive economic growth. Although asking rental rates were increasing, they were not yet high enough to justify new construction. Foreign ownership of office properties in Houston had contracted from 39 percent in 1987 to 22 percent in 1990.

By 1991, the national recession was hurting the Northeast United States. Although Houston was one of the top cities in job growth, analysts in other parts of the country were refusing to believe that Houston's rebound was real. Domestic and foreign investment in Houston began to increase marginally because of the hiring that occurred in the oilfield sector to restore the damaged oilfields in Kuwait. Overall, U.S. construction spending decreased 9 percent in 1991 while Houston showed an increase of 28 percent.

Although office rents showed a moderate increase by 1992, new office construction was confined to build-to-suit properties for specific users. Primary office tenants were still attempting to reduce space needs to cut expenses. This increased the amount of sublease space available on the market, hampering recovery in office occupancy rates during 1993.

By 1994, Houston had become the third leading U.S. city for corporate relocations. The office glut had become a blessing in disguise. High-quality space was available at reasonable prices, making Houston extremely attractive to companies seeking to cut expenses by relocating.

The amount of sublease space grew fourfold in 1995 because of continued layoffs and restructuring at the city's biggest corporations, most of which were located in the central business district (CBD). Overall office vacancy was stable during most of 1995 at just under 20 percent. However, Class A occupancy in the CBD was strong at 90 percent.

By the beginning of 1997, tenants began to realize that the supply of available office space was decreasing. Rents increased substantially, and large blocks of contiguous space were becoming scarce. The net number of jobs created in Houston more than doubled in 1997. Net absorption of Class A space alone exceeded seven million square feet.

Houston's 1998 unemployment rate dropped to a 15-year low of 4.1 percent. Class A office space occupancy in the largest business centers increased to 95 percent. Rents had increased sufficiently to support new speculative office space, with 1.3 million square feet of new construction occurring in 1998. Oilfield-related companies were continuing to consoli-

date their operations, benefiting Houston. By the end of 1998, however, the global credit crunch and a strong dollar began to have a negative effect.

By 1999, lower crude oil prices were putting a damper on the oilfield sector. However, Houston's diversification into the tech, power and medical sectors tempered the impact on the city's economy. Furthermore, a movement to improve the downtown area was progressing. In the previous three years, Houston had generated more new business than any U.S. city.

Increases in the price of natural gas helped buoy the Houston economy in 2000. Predictions were for a shortage of office space downtown because of the rapid growth of Enron and other energy companies. About 3.2 million square feet of office space was under construction in 2000 with 85 percent of it preleased.

The following year, 2001, started off strong, with lenders showing restraint in financing new office construction. Four office buildings were under construction in the CBD, totaling about 3.3 million square feet. Sixty-nine percent of new construction was preleased. Job growth was strong, and most of the sublease space had been absorbed. Houston was one of only three U.S. markets that showed positive office absorption in 2001. Energy firms accounted for 63 percent of space leased in 2001.

By the end of 2001, two catastrophic events had occurred. The terrorist attacks of Sept. 11 caused many companies to take a wait-and-see attitude toward new hiring and expansion. The collapse of Enron shook the local economy as well. Although these events, coupled with a national economic slowdown, have dampened Houston's office market, the cost of doing business remains inexpensive compared with most other major U.S. cities. Thus, the current outlook is for some softening of rental rates and increased vacancies in the months ahead but no major negative turndown.

# Notes

[1]Real rent is the contract rent divided by an index for inflation such as the consumer price index. For instance, if contract rents in 1991 and 1992 were $14 and $16 per square foot and if corresponding consumer price indexes were 110 and 112 then DRRENT is calculated as follows:

| | 1991 | 1992 |
|---|---|---|
| Rent/Square Foot | $ 14 | $ 16 |
| Consumer Price Index | 110 | 112 |
| Rent in real term | $ 12.73 | $ 14.29 |
| DRRENT in 1992 | | 14.29–12.73 = $1.56 |

[2]Includes the variance of the variables in equations (5) and (6) but their estimated coefficients were not found statistically significant.

[3]Office data set for Austin, Dallas, Fort Worth and Houston was provided by Torto Wheaton Research Company and includes vacancy rates, office inventories, and rents per square foot. Data for San Antonio were provided by Coldwell Banker.

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