Data InSight

GUIDING BUSINESS ANALYTICS IN COMMERCIAL REAL ESTATE

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Absorption Forecasts for Houston's Office Market Due to Reduced Job Growth with the Oil Downturn

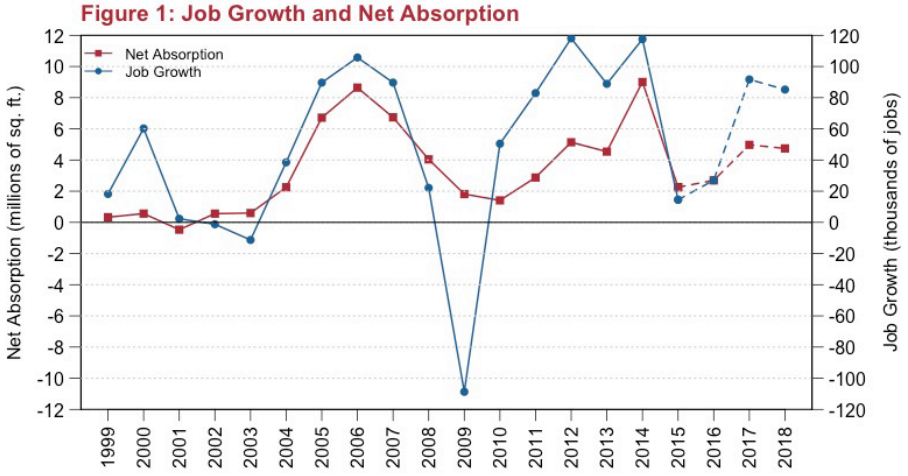
Executive Summary

The deeper and longer lasting pullbacks in the oil industry are now anticipated to have a more substantial impact on Houston's economy than initially expected. However, the current oil downturn remains fundamentally different from that of the 1980s. Houston is not simultaneously experiencing a banking crisis, commercial real estate is not overbuilt, and the outlook for job growth (while hampered) remains positive. With a strong national economy, Houston will continue to grow but at a slower pace than the rapid growth that followed the Great Recession.

Nevertheless, demand for office space in Houston will likely be weaker in coming years given the reduced workforce in Houston's energy sector and its related service industries. To what extent will Houston's office market slow down given the prolonged pullback in the oil industry? Here, we use use recent job forecasts by the Greater Houston Partnership and Institute for Regional Forecasting of the University of Houston to make quantitative predictions of how net absorption of office space will change from 2016 to 2018 with shifts in job growth arising from the oil downturn.

Forecasts for Houston's job growth from 2016 to 2018 remain positive, ranging from 20,000 to 97,000. Our analyses show that such increases in job growth are accompanied by increases in the net absorption of office space. Specifically, job growth (Dec to Dec, year over year growth) explains 47% of variation in annual net absorption of Houston's office space. As detailed below, four different scenarios occur for job growth from 2016 - 2018 depending on whether the recovery from the oil downturn is a V-shaped recovery, a U-shaped recovery, backwards checkmark recovery, or a damaged oil industry not recovering. For the most likely scenario aligned with a U-shaped recovery, we forecast office absorption to be 2.7, 5.0, and 4.7 million sq. ft. in 2016, 2017, and 2018 respectively (Figure 1). These values are on par with Houston's long term average net absorption of 3.4 million sq. ft. per year. Thus, even though Houston's economy will slow some with the oil industry, demand for office space will remain on average in 2016 and then move to above average levels in 2017 and 2018.

Figure 1: Job Growth and Net Absorption



Data InSight is a monthly business-to-community (B2C) whitepaper series that uses data analytics to look at current and historical trends in commercial real estate (CRE). Indeed, like many other industries, CRE is undergoing a revolution in the volume, velocity, and variety of data being generated. At NAI Partners, we are embracing this data revolution through data science --- the process of using the scientific method and statistics to extract knowledge from data. Complementing its full CRE platform and more than 500 years of combined broker and professional experience, NAI Partners offers a data analytics consulting service to guide its clients in their business intelligence and decision making in CRE.

Motivation

Since the oil downturn began over a year ago, sentiment has shifted to the realization that the longer term imbalance in the supply and demand of oil will have a more substantial impact on Houston's oil industry and its overall economy. In fact, the current downturn in oil is as series as that of the 2008-2009 downturn of the Great Recession, but differs in that the overall U.S. economy remains strong. Rather than a V-shaped recovery beginning in early 2016, the oil downturn will likely have a U-shaped recovery not beginning until mid to late 2016. The prolonged trough of a U-shaped recovery increases the time period for the oil industry's pullback to spread through Houston's economy. Yet, the current oil downturn remains fundamentally different from that of the 1980s. Houston is not simultaneously experiencing banking and credit crises, commercial real estate is not overbuilt, and the outlook for job growth remains positive. With a strong national economy, Houston's economy will continue to push forward just at a slower pace.

As the oil downturn begins to ripple through the Houston economy, how will market demand for office space change? In commercial real estate, demand is measured by net absorption, the change in occupied space in units of square feet (sq. ft.) of rentable building area (RBA) from one time period to another. Positive net absorption occurs when there is an increase in occupied space, while negative net absorption occurs when there is a decrease in occupied space. Here, we use changes in job growth in Houston arising from the oil downturn as an economic indicator to forecast demand for office space. Specifically, we use recent job forecasts by the Greater Houston Partnership and Institute for Regional Forecasting of the University of Houston to make quantitative predictions of how net absorption of office space will change in coming years with shifts in job growth.

Forecasts of Job Growth Under Four Scenarios of Recovery from the Oil Downturn

Houston's two most prominent economists that forecast job growth are Mr. Patrick Jankowski of the Greater Houston Partnership and Dr. Robert Gilmer, formerly of the Dallas Federal Reserve Bank and current Director of the Institute of Regional Forecasting at the University of Houston. Mr. Jankowski indicates that, while Houston will continue to lose jobs in sectors of energy, manufacturing, and wholesale trade, job growth will occur in health care, construction, government, hotels/bars/restaurants, retail, professional and technical services, and some other areas. He forecasts a net gain of 21,900 new jobs in 2016, with 2015 finishing with 30,000 new jobs. Dr. Gilmer forecasts job growth in 2015 to wrap up at 14,500 new jobs, but his forecasts for job growth in 2016 and beyond vary depending on which of four different scenarios play out for the recovery of Houston's oil industry from its current downturn. Forecasts of both Jankowski and Gilmer assume a stable, strong national economy.

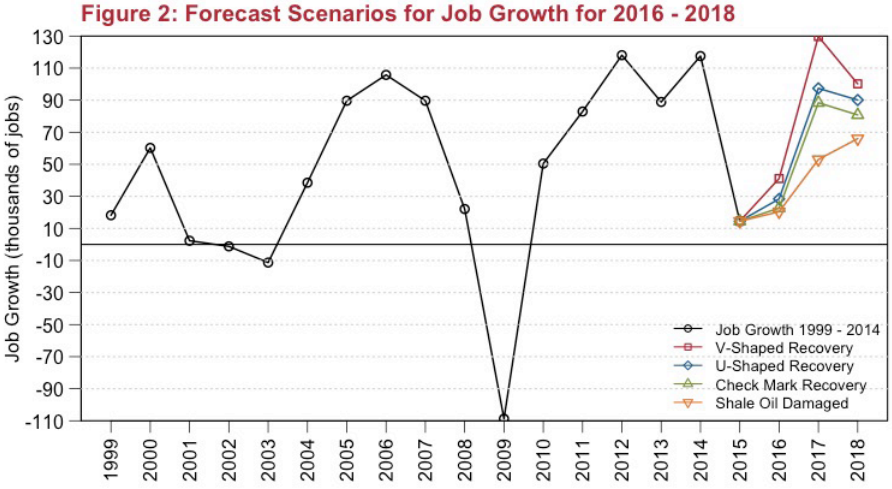
Figure 2 shows Dr. Gilmer's forecasts for job growth under four scenarios of recovery from the downturn in the oil industry, namely a V-shaped recovery, a U-shaped recovery, a backwards checkmark recovery, and a damaged oil industry not recovering. Under a V-shaped recovery, the oil market begins to turn around in early 2016, with active rig counts returning to 2014 peak levels of 2000 in 2019 and energy jobs growing 2.5% per year, ultimately gaining 7.6% more jobs than prior to layoffs. The V-shaped recovery has job growth from 2016 - 2018 at 41,100, 129,700 and 100,200 new jobs per year (Figure 2). Dr. Gilmer places a 10% probability on a V-shaped recovery.

As Summer months of 2015 transitioned into the Fall hope of a V-shaped recovery faded into U-Shaped recovery. Under a U-shaped recovery, the downturn in the oil industry has a longer trough than the V-shaped recovery, not beginning to turn around until mid to late 2016. For the U-shaped recovery, rig count returns to 1800 in 2019 with a 1.8% annual growth in energy jobs. The U-shaped recovery has job growth from 2016 - 2018 at 28,400, 97,400, and 90,100 new jobs per year (Figure 2). Dr. Gilmer places a 50% chance that the oil industry sees a U-shaped recovery.

Under a backwards checkmark recovery, rig counts remain flat throughout 2016 and the oil industry recovers very slowly through 2019 but eventually nearing 1800 active rigs. However, energy jobs never fully return and are in fact 5.3% below 2014 peaks in 2019. The backward checkmark shaped recovery has job growth from 2016 - 2018 at 22,700, 88,400, and 80,800 new jobs per year (Figure 2). Dr. Gilmer places a 25% chance on this backwards checkmark recovery.

The last scenario is a damaged U.S. oil industry in which Saudi Arabia won, nearly putting the U.S. fracking oil industry out of business. Rig count slowly returns to just 1250 in 2019 and energy employment in Houston remains at levels of the trough, about 13% lower than energy jobs at the peak in 2014. Job growth from 2016 - 2018 is 20,400, 53,000, and 66,000 (Figure 2). Dr. Gilmer puts a 15% chance on a permanently damaged U.S. oil industry.

Figure 2: Forecast Scenarios for Job Growth for 2016 - 2018



Job Growth Predicts Net Absorption in the Office Market

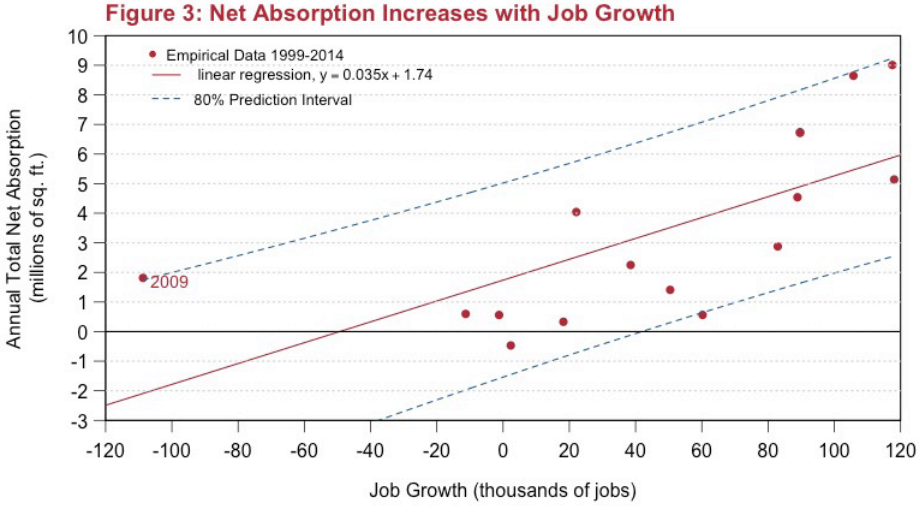
Job growth is a strong economic predictor of net absorption in Houston's office market (Figure 2). Demand for office space as measured by net absorption does increase with job growth (Figure 2). The explanatory variable of job growth (December to December, year over year change) on the *x*-axis is scaled in thousands of jobs per year. The response variable of total net absorption on the *y*-axis is scaled in millions of square feet per year for Class A and B space combined. The solid red circles are the empirical data points for 1999 - 2014, for which the one extreme point of 2009 corresponds with the the Great Recession.

The solid red line in Figure 1 is the linear regression model of the statistical relationship between job growth and net absorption, of the form $y=mx+b$. Specifically, $y=0.035x+1.74$, where y is net absorption, x is job growth, m is the slope of the line, and b is the y-intercept. The coefficient of determination (r^2) indicates how well the data fit this linear statistical model. In this case, $r^2 = 0.47$, that is 47% of variation in net absorption is explained by job growth. This is a fairly large percentage given the many factors simultaneously occurring in economics and commercial real estate which could obscure any such relationship. Yet, at the same time, that leaves 53% of variation in net absorption explained by other factors.

The slope of the line, $m = 0.0353$, describes how y changes as x increases, that is an increase by 1 unit of the x variable increases the y variable by how much. Accounting for the y-axis scaled in millions and the x-axis in thousands, the slope of 0.0353 means that on average 35.3 sq. ft. of net absorption occur for every one new job. The 95% confidence interval for this slope is 13.8 to 56.7 sq. ft. of net absorption per job. The dashed blue lines are the 80% prediction intervals (upper and lower bounds) for net absorption. That is, there is an 80% probability that absorption will be in this range for a given level of job growth.

The y-intercept, $b = 1.74$, describes how much absorption occurs when job growth is zero. Even with low to near zero job growth, Houston still tends to experience

Figure 3: Net Absorption Increases with Job Growth



net absorption of about 1.74 million sq. ft. The 95% confidence interval for y-intercept is 0.13 to 3.35 million sq. ft. This aspect of net absorption becomes more important for estimates of job growth that approach values of zero.

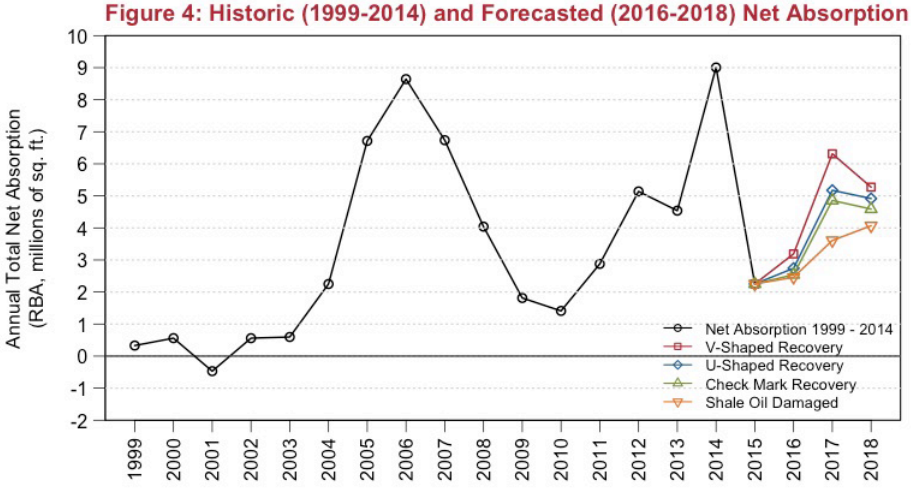
2015 Forecast for Job Growth and Net Absorption

We can evaluate the statistical model of Figure 3 using 2015 numbers to date for job growth and net absorption of office space. Note, the statistical model is only for data from 1999 - 2014. Houston's job growth through October 2015 is about 3,400 jobs, with November and December job growth likely to bring Houston in line with the 14,500 new jobs forecasted by Dr. Gilmer. With 14,500 new jobs, the prediction is for 2.252 million sq. ft. of positive net absorption in 2015, with an 80% prediction interval of -0.996 to 5.499 million sq. ft. That is, there is an 80% probability that net absorption will be between -1.0 to 5.5 million sq. ft. for 14,500 new jobs. As of early December 2015, there has been 2.1 million sq. ft. of net absorption. Not only does this value of net absorption fall within the 80% prediction interval, but it is very close to the actual predicted value of 2.3 million sq. ft. This gives us additional confidence for this statistical model to forecast net absorption of office space.

Office Absorption for Different Scenarios of Houston's Recovery from the Oil Downturn

Based on recently released job forecasts for Houston, we make quantitative predictions of how net absorption in the office market will change with job growth in Houston. We forecast net absorption in 2016, 2017 and 2018 based on job growth under a a V-shaped recovery, a U-shaped recovery, backwards checkmark recovery, and a damaged oil industry. Figure 4 shows historic net absorption of office space from 1999 - 2014, which has a mean of 3.4 million sq. ft. and then the forecasted net absorption from 2016 - 2018. The different scenarios of oil recovery suggest similar levels of net absorption in 2016,

Figure 4: Historic (1999-2014) and Forecasted (2016-2018) Net Absorption



ranging from 2.4 to 2.7 million sq. ft., with the exception of the V-shaped recovery at 3.2 million sq. ft. Most differences in net absorption due to job growth and the oil recovery manifest in 2017 and then to a lesser extent in 2018.

Under a V-shaped recovery (red line, Figure 4), net absorption is predicted to be 3.189 million sq. ft. in 2016 (80% prediction interval -0.028 to 6.407 million sq. ft.), followed by 6.313 million sq. ft. in 2017 (80% prediction interval 2.913 to 9.712 million sq. ft.), and 5.272 million sq. ft. in 2018 (80% prediction interval 2.0 to 8.565 million sq. ft.). This is the most optimistic scenario for demand for office space given the downturn in oil, but it is now recognized to be the least likely scenario to occur, given additional oil pullbacks seen following the summer months.

The most likely scenario for oil recovery is the U-shaped recovery, beginning to rebound in mid to late 2016. Under a U-shaped recovery (blue line, Figure 4), net absorption is predicted to be 2.742 million sq. ft. in 2016 (80% prediction interval -0.485 to 5.968 million sq. ft.), followed by 5.174 million sq. ft. in 2017 (80% prediction interval 1.889 to 8.459 million sq. ft.), and 4.917 million sq. ft. in 2018 (80% prediction interval 1.659 to 8.183 million sq. ft.). This is the most optimistic scenario for demand for office space in coming years given the different likelihoods of oil recovery in Houston.

The second most likely scenario to manifest in oil recovery is the backward checkmark recovery. This scenario is quite similar to the U-shaped recovery in terms of the influence of job growth on net absorption, with net absorption just slightly lower than the U-shaped scenario (green line, Figure 4). Specifically, net absorption is predicted to be 2.541 million sq. ft. in 2016 (80% prediction interval -0.693 to 5.774 million sq. ft.), followed by 4.856 million sq. ft. in 2017 (80% prediction interval 1.594 to 8.119 million sq. ft.), and 4.589 million sq. ft. in 2018 (80% prediction interval 1.342 to 7.836 million sq. ft.).

Under a damaged oil industry (orange line, Figure 4), net absorption differs most from the other scenarios in the year 2017 with a substantially lower net absorption. Net absorption is predicted to be 2.5 million sq. ft. in 2016 (80% prediction interval -0.777 to 5.700 million sq. ft.), followed by 3.609 million sq. ft. in 2017 (80% prediction interval 0.392 to 6.826 million sq. ft.), and 4.068 million sq. ft. in 2018 (80% prediction interval 0.842 to 7.293 million sq. ft.).

Caveats and Uncertainty in Absorption Forecasts

We have assumed 80% prediction intervals. This is a probability of 0.80, which means that, while we are 80% certain, 2 out of 10 cases may fall outside this prediction interval given the noise associated with the data. If this were NBA free throws, we would likely bet on the shooter at 80% to win the game, but in two instances we would lose our bet. In predictive analytics, it is important to note whether the new values of the predictor variable (job growth) is within the range of the original data on which the projections are based. Extrapolation far outside the original data range can lead to unreliable predictions. In our case, job growth of original data ranges from -110,000 to +115,000. Most forecasted job numbers are well within this data range, which increases the likelihood of a reliable prediction. However, some caution is warranted for net absorption predictions based on V-shaped recovery for 2017, as it is an extrapolation outside of the original data range.

Methodology

Commercial real estate data on office space were obtained from CoStar in December 2015. Data for Class A and B buildings were combined for office space. Job and employment data were obtained from the Federal Reserve Bank of Dallas, based on Dec-Dec year over year changes in job growth. The statistical analyses and data visualization were performed using the R software and programming language:

R Core Team (2014). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org/.

We used linear regression to examine the predictive effects of annual changes in employment (Dec to Dec year over year change) on annual total net absorption (direct plus sublease) from 1999 - 2014. Assumptions of linear regression that could render a biased statistical model were tested. None of the assumptions were violated, including statistical outliers in absorption, overly influential points in job growth, statistical outliers in employment, normality in absorption, unequal variance, heteroscadascity, and serially correlated residuals (nonwhite noise error). There was a statistically significant, positive relationship between job growth and total net absorption for office space (F^1,14=12.4, p=0.0034, r^2=0.47).

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Dr. J. Nathaniel Holland is a research scientist with 20 years of experience in using the scientific method to extract information from complex multi-dimensional data. He joined NAI Partners in 2014 as Chief Research and Data Scientist. At NAI Partners, Nat leverages his sharp intellectual curiosity with his skills in statistical modeling to guide data-driven business decisions in commercial real estate. Like many data scientists in the private sector, Nat joined NAI Partners following a career in academia. Prior to taking up data analytics at NAI Partners, he held professorial and research positions at Rice University, University of Houston, and the University of Arizona between the years of 2001 and 2014. Nat is the author of more than 50 scientific publications, and he has been an invited expert speaker for more than 60 presentations. Trained as a quantitative ecologist, he holds a Ph.D. from the University of Miami, a M.S. from the University of Georgia, and a B.S. from Ferrum College.

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