Data InSight
GUIDING BUSINESS ANALYTICS IN COMMERCIAL REAL ESTATE

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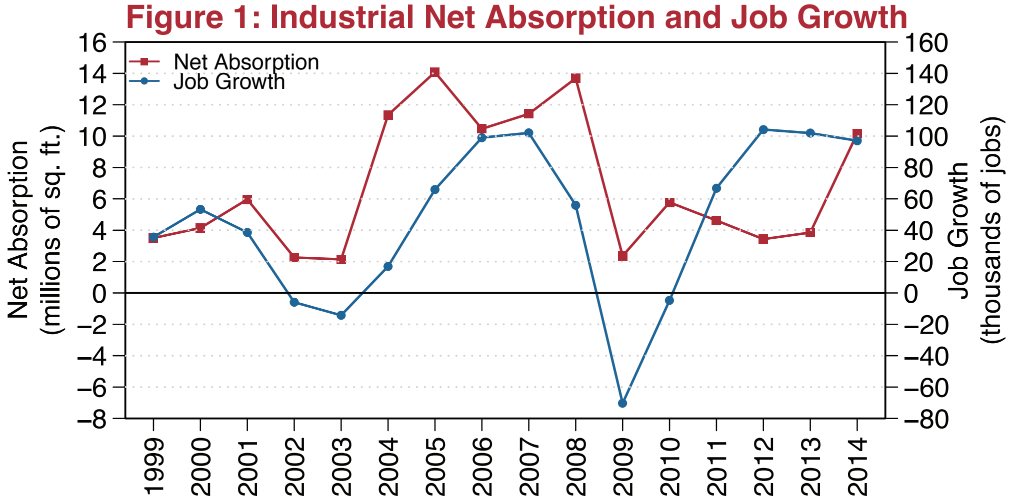
New Job Forecast Suggests Lower But Quickly Rebounding Demand for Industrial Real Estate

Executive Summary

With vacancy rates at 4.8%, the supply of industrial real estate is at its lowest since 1999. Coupled with the high demand of 2014 and Q1 2015, the fundamentals suggest a strong outlook for industrial real estate. However, demand, as measured by net absorption, may shift with pullbacks in the oil industry and a slowing Houston economy. Prior forecasts for job growth in Houston in 2015 have been recently downgraded from >40,000 to <15,000, but rebounding in 2016 and/or 2017 to 60,000 to 100,000 new jobs. Here, we use these new job forecasts as an economic indicator to predict how demand for industrial real estate may evolve in 2015, 2016, and 2017.

Statistical analyses show a significant, but weak relationship in which job growth increased net absorption. Job growth only explained 26% of variation in absorption (Figure 1), which is not surprising given the diverse array of industrial products (e.g., warehouse, distribution, flex, manufacturing) that may vary contrarily with economic factors. Nevertheless, the regression analysis indicates that a change of 10,000 jobs equates with a 6.7% change in net absorption. From the regression analyses, we predict that overall industrial absorption in 2015 will be about 4.4 million sq. ft. with an 80% prediction interval of 2 - 10 million sq. ft. (i.e., 8 out of 10 times absorption will be in this range for this level of job growth). By 2017, absorption will pick up to 7 million sq. ft. with job growth. Thus, while job growth will decline in 2015 compared to 2014, absorption is not likely to turn negative and will rebound to more positive values in 2017 if not 2016.

Figure 1: Industrial Net Absorption and Job Growth



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

Currently, the fundamentals of supply and demand suggest a strong outlook for industrial real estate. Supply is at a 15-year low, with overall vacancy rates at 4.8%. In Q1 2015, there was 4.6% vacancy of all warehouse space combined and 7.1% vacancy of all flex space, both statistically lower than their historic Q1 averages of 6.0 and 12.7%. Demand, on the other hand, is measured by net absorption. Net absorption is the change in occupied space (increases minus decreases) from one time period to another, reported in units of square feet (sq. ft.) of rentable building area (RBA). Positive net absorption occurs when there is an increase in occupied space, whereas negative net absorption arises when there is a decrease in occupied space. Demand for industrial space has remained strong and positive in Houston, despite some large fluctuations from year to year (Figure 1). Demand in 2014 was near 10 million sq. ft., and Q1 2015 saw strong demand with over 3.5 million sq. ft. of net absorption.

Despite such strong fundamentals, there are some headwinds which may stifle the industrial market, primarily the slowing economy in Houston and Texas arising from pullbacks in the oil industry. West Texas Intermediate (WTI) broke above $60 per barrel in May 2015, up from lows in the $40s in March but still down from nearly $100 a year ago. U.S. rig counts are at 905 in early May 2015, down from 1854 a year ago; Texas rig counts are at 380, down from 892 a year ago. While low oil prices will stimulate the economies of most states[1], with an anticipated 0.67% bump in gross domestic product (GDP)[2], states like Texas with a prominent energy sector will experience slower economies and job growth. For Texas, the drop in oil from $100 to $80 per barrel likely stimulated state and local economies, while the sustained drop from $80 - $50 will hamper their economies, as most breakeven points for shale oil are $50 - $60 per barrel[2,3].

Prior economic forecasts for Houston and Texas are being downgraded. Dr. Keith Phillips of the Federal Reserve Bank of Dallas has lowered his forecast for state job growth from 1-2% to 0.5-1.5%, that is 59,000 to 176,000 new jobs in 2015. Likewise, Dr. Bill Gilmer of the University of Houston's Institute for Regional forecasting has just downgraded Houston's job growth to <15,000 in 2015, compared with prior forecasts ranging from 43,000 to 63,000. Nevertheless, employment in Houston and Texas is still forecasted to grow, but substantially slower than previous estimates, and less than Houston's historic average of about 48,000.

To what extent will the downturn in oil and the economy influence commercial real estate in Houston. In last month's *Data InSight* (Vol 1, Issue 2), we showed that job growth was predictive of and explained about 50% of variation in office absorption. Here, we ask whether job growth is at all predictive of how demand for industrial real estate may vary in 2015, 2016, and 2017. What do forecasts for Houston's job growth in 2015, 2016, 2017 suggest for absorption of industrial real estate in coming years?

Job Growth Helps to Explain Absorption in Industrial Real Estate

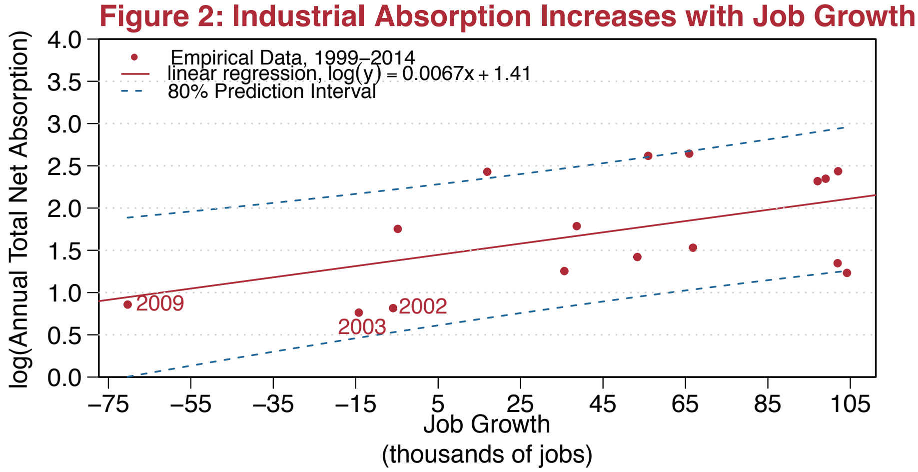
Without proper statistical analyses, false impressions and conclusions can be drawn by over-interpreting data solely based on their graphical visualization (e.g., Figure 1). Figure 2 shows appropriate statistical analyses of the relationship between job growth and net absorption. The explanatory variable is job growth, which is plotted on the *x*-axis and is scaled in 1,000s of jobs per year. The response variable is total net absorption of industrial space, which is plotted on the *y*-axis. (Note, for statistical reasons, the *y*-axis is actually the logarithm of absorption in millions of square feet of RBA per year.) The solid red circles are the empirical data points for 1999 - 2014. Three of those data points are labeled by their years, namely 2002, 2003 and 2009, which represent net absorption following the recession/dot-com/Enron crises of 2001 - 2002 and the Great Recession of 2008 - 2009.

The red line in Figure 2 is the linear regression model of the statistical relationship between job growth and the log of absorption, of the form $\log(y)=mx+b$ (see Methodology below). Linear regression analysis shows that there is a positive statistical relationship between job growth and annual net absorption of industrial real estate. Job growth does indeed have some predictive power of net absorption of industrial space. Specifically, $\log(y)=0.0067x+1.41$, where $\log(y)$ is the logarithm of net absorption in millions of sq. ft., x is job growth, m is the slope of the line, and b is the y-intercept. The dashed blue lines are 80% prediction intervals (upper and lower bounds) for the log of net absorption. That is, 8 out of 10 times (0.80 probability) the log of absorption is predicted to be in this range for the predicted job growth (red line). (Note, we can back transform the log of absorption to get actual measures of absorption through exponentiation [i.e., $\exp(\log(y))$].)

The regression analysis reveals that job growth does contribute to net absorption of industrial space. The coefficient of determination (r^2) tells us how well the real data fit the statistical abstraction. In this case, $r^2 = 0.264$, that is only 26.4% of variation in net absorption is explained by job growth. This is a reasonable, but modestly low percentage, given that many factors simultaneously influence economics and commercial real estate which can shape demand for industrial space beyond job growth. Moreover, unlike office space, which is simply made up of Class A, B, and C space, there is a diverse array of industrial products (e.g., warehouse, distribution, flex, manufacturing) that may vary contrarily with economic factors.

The slope of the line, $m = 0.0067$ (rise over run, if you recall from high school algebra), describes how we expect y to change as x increases, that is an increase by 1 unit of the x variable increases the y variable by how much. For statistical reasons (see Methodology below), the y variable of absorption was log transformed (log millions sq. ft. RBA).

Figure 2: Industrial Absorption Increases with Job Growth



Because the *y*-axis is in log units, the slope of 0.0067 can be multiplied by 100 to estimate a percent change in absorption for a given change in job growth. Specifically, an increase of 1,000 new jobs results in a 0.67% percent change in the average annual net absorption. Or, a change of 10,000 new jobs equates with a 6.7% change in absorption.

Predictions for Industrial Absorption in 2015, 2016, and 2017

We can use the linear regression equation of Figure 2 to predict net absorption based on job forecasts. Dr. Bill Gilmer, Director of the University of Houston's Institute for Regional Forecasting, has revised his forecasts for Houston's job growth in 2015, 2016, and 2017 based on two scenarios of recovery from the pullback in oil, namely a quick or a slow recovery (Table 1). Under the scenario of a quick recovery, job growth remains positive but low (~13,000) in 2015, and then increases to 61,300 new jobs in 2016 and 87,900 in 2017. Under the scenario of a slow recovery, job growth remains positive but low in both 2015 and 2016, and does not pick back up until 2017. Though less than the 100,000 new jobs created in each of 2012, 2013, and 2014, forecasts for Houston's job growth remain positive, and by 2016 or 2017 greater than the historic average of 48,000 new jobs per year.

Table 1 shows the predicted values of net absorption and their 80% prediction intervals based on the regression analyses of Figure 2. The prediction intervals in Table 1 are wide due to the small amount of variation in net absorption explained by job growth (i.e., $r^2 = 0.264$). Nevertheless, it does give some indication of how absorption may vary in coming years. We predict that overall industrial absorption in 2015 will be about 4.4 million square feet with an 80% prediction interval of 2 - 10 million sq. ft.; that is, 8 out of 10 times (0.80 probability), absorption will be in this range for this level of job growth. By 2017, job growth returns to and exceeds its historic average leading absorption to pick up to 7 million sq. ft., with 80% prediction interval of 3 - 17 million sq. ft.

Note that none of the predictions nor their 80% intervals overlap with and include values for negative net absorption. Net absorption for 2015 and possibly 2016 may be lower than prior banner years of 2014 and 2004-2008, but they are not predicted to be dismal. While job growth will decline in 2015 compared to 2014, absorption is not likely to turn negative, and should rebound to more positive values in 2017 if not 2016. In fact, based on low job growth, net absorption is predicted to be 4.4 million sq. ft. in 2015, but we are already at 3.7 million sq. ft. just from Q1 2015. Again, this reflects the fact the job growth only explains 26% of net absorption, leading to the wide 80% prediction intervals which can mean that predicted values such as 4.4 million sq. ft. can be even be under-estimates.

Variation in Demand for Different Industrial Products

We examined demand through net absorption for all industrial products combined. However, demand may differ among industrial products, including flex, distribution, manufacturing, and warehouse spaces. For example, demand for manufacturing space may not necessarily parallel demand for flex or warehouse space. Table 2 presents correlations in net absorption between these different industrial products. Recall, correlation does not equate with causation.

Correlation coefficients can range from +1.0 to -1.0. A value of 0 indicates no correlation. A positive value indicates that as one variable increases so does the other variable, while a negative value indicates that as one variable increases, the other variable decreases. Values between 0 and 0.3 (0 and -0.3) are considered *weak* positive (negative) correlations. Values between 0.3 and 0.7 (-0.3 and -0.7) are considered *moderate* positive (negative) correlations. And, values between 0.7 and 1.0 (-0.7 and -1.0) are considered *strong* positive (negative) correlations. Table 2 presents the correlation coefficients that are statistical greater different from no correlation (value of 0), that is a significant positive or negative correlation.

Several key points emerge from the correlation analyses in Table 2. Overall, demand for different industrial products are largely unrelated to one another. There are some weak to moderate positive correlations between warehouse space and each of flex, distribution, and manufacturing, but otherwise demand for different building types do not coincide. This is not all that surprising, given the differences in how these industrial products are used. This is important to recognize as market reports and other indicators of the industrial sector combine or segregate the supply and demand of various industrial products.

Table 1. Predictive analytics of total net absorption based on forecasts of job growth for two scenarios of the Houston recovery from the oil downturn, that is quick and slow recoveries. Job growth comes from Dr. Bill Gilmer, University of Houston Institute for Regional Forecasting.

Year	Economic Recovery	Job Growth	Predicted Net Absorption (millions sq. ft.)	80% Prediction Interval (millions sq. ft.)
2015	Quick	12,900	4.478	1.954 to 10.261
	Slow	13,400	4.493	1.961 to 10.292
2016	Quick	61,300	6.180	2.721 to 14.039
	Slow	15,600	4.559	1.993 to 10.43
2017	Quick	87,900	7.378	3.201 to 17.003
	Slow	109,700	8.530	3.622 to 20.087

Table 2. Correlation matrix for the demand of various industrial products. Demand was measured as total net absorption and the industrial products included building types of flex, distribution, manufacturing, and warehouse space.

	Flex	Distribution	Manufacturing	Warehouse
Flex	1.000			
Distribution	n.s.	1.000		
Manufacturing	n.s.	n.s.	1.000	
Warehouse	0.285*	0.335*	0.400*	1.000

** statistically significant, $p < 0.05$*
n.s. = not significant

Uncertainty in the Predictive Analytics of Net Absorption

We have conducted predictive analytics of net absorption of industrial space based on job growth. We project that if job growth is around 13,000, then net absorption of industrial space in 2015 will be on the order 4.4 million sq. ft. Any such projection, however, includes error and noise, and is associated with a prediction interval within which realized values are likely to reside. In this case, we used an 80% prediction interval for 4.4 million sq. ft. of absorption, which spans 2 - 10 million sq. ft. Four key factors may contribute to deviation within and outside this span.

First, this is a probability of 0.80. This means that, while we are 80% certain, 2 of 10 cases would fall outside this prediction interval given the noise associated with the statistical analysis. 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. Second, and possibly most critical, the limited and low correlation between different types of industrial products (e.g., flex, distribution, manufacturing, warehouse) contributed to job growth only explaining 26% of variation in absorption when all industrial products are combined. This also contributed to the wide 80% prediction intervals.

Third, 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 -70,000 to +105,000. Most of the forecasted job numbers (Table 1) are well within this range of data used for the analyses. Hence, we are not extrapolating, which increases the likelihood of a reliable prediction. However, some caution is warranted for net absorption predictions based on the 109,000 job forecast of 2017, as it is outside of the original data range.

Fourth, the distribution of jobs among various industries within Houston is assumed not to deviate too drastically between the forecasts of 2015 - 2017 and the prior 16 years on which the statistical analyses were based. Yet, Drs. Gilmer and Perdue's analyses[4] do show a bias in potential job growth toward downstream refining, petrochemical business, and construction. So, some jobs in industrial space and hence demand for industrial spaces may fall, while others may pick up.

Methodology

Commercial real estate data were obtained from CoStar following Q1 2015. Here, we analyze total net absorption for all industrial buildings combined. Job and employment data were obtained from the Texas Workforce Commission and the Federal Reserve Bank of Dallas. 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/.

Absorption and Job Growth

For all industrial products combined, we used linear regression to examine the predictive effects of annual changes in employment (i.e., job growth) on annual total net absorption (direct plus sublease) from 1999 - 2014. We tested the assumptions of linear regression that could render a biased statistical model. None of the following assumptions were violated: statistical outliers in absorption, overly influential points in job growth, statistical outliers in employment, unequal variance, heteroscadascity, and serially correlated residuals (nonwhite noise error). However, the Shapiro-Wilk (W) test did indicate a minor but statistically significant deviation of net absorption from a normal distribution ($W = 0.8652$, $p = 0.02299$). With the slight deviation from normality, there was a marginal statistical effect of job growth increasing net absorption of industrial space ($F_{1,14}$=3.13, p=0.099, r^2=0.183). The slope of this regression line was 0.036, equating with 36 sq. ft. of total net absorption for one job. However, with a log transformation of net absorption, the Shapiro-Wilk (W) test indicated no significant deviation of net absorption from a normal distribution ($W = 0.91$, $p = 0.116$). In turn, the previously marginally significant result shifted to significant ($F_{1,14}$=5.02, p=0.042, r^2=0.264).

Correlation Analyses

We used Spearman's non-parametric rank correlation to examine whether the demand for different industrial products, as measured by total net absorption, varied with one another, namely distribution, flex, manufacturing, and warehouse space. Does demand for one product increase or decrease with demand for other products. We used the non-parametric correlation metric because absorption for each of these four industrial products deviated from a normal distribution.

Notes

1. Brown, P.A and M.K. Yucel. The Shale Gas and Tight Oil Boom: U.S. States' Economic Gains and Vulnerabilities. http://www.cfr.org/united-states/shale-gas-tight-oil-boom-us-states-economic-gains-vulnerabilities/p31568

2. Peter Linneman, Chief Economist, NAI Global; Webinar March 19, 2015.

3. Keith Phillips, Sr. Economist and Research Officer, Federal Reserve Bank of Dallas, San Antonio Branch; Seminar, The Houston Economic Club, March 24, 2015.

4. R.W. Gilmer and A.W. Perdue. "Houston and Low Oil Prices: An Update on the Economic Outlook", March 18, 2015, http://www.bauer.uh.edu/centers/irf/houston-updates.php

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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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