DETERMINANTS OF INDUSTRIAL REAL ESTATE DEMAND

AMB Industrial Absorption Indicator (AMB IAI)
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July 3, 2002

Abstract

Industrial real estate has been one of the least studied property types (Rabianski and Black). Part of the reason may be that past studies have had difficulty in predicting demand. It has been suggested that some of the difficulties are likely due to the sector's non-cyclical nature, the preponderance of owner occupied structures, the diversity of sub-property types (manufacturing, warehouse and R&D) and varied users within these sub-property types. For office, multifamily and retail, the relationships between demand and employment and demographics are intuitive and statistically significant (Rabianski and Black, Shilton, Wheaton and Torto 1997, Mansour and Christensen). Traditional indicators of industrial demand have included manufacturing, warehouse and distribution employment, gross domestic product, population, inventories and freight flows.

We have developed a new approach for predicting industrial demand, which we call the AMB Industrial Absorption Indicator (AMB IAI). The primary input to our model is the Federal Reserve Board's Index of Manufacturing Output (IMO), a leading indicator of industrial demand (net absorption). Herein, we analyze the predictive power of this new approach and formulate a forecast of industrial absorption. In Appendix A, we compare this new indicator with traditional industrial indicators.

A New Model

AMB has done extensive research on the trends impacting demand for industrial space. Some of the more pronounced trends affecting demand dynamics include globalization, airfreight, information technology/supply chain management and outsourcing/third party logistics. These are broad-based trends that affect the long-term dynamics and viability of the industry, markets, submarkets and individual industrial assets. Such trends are important inputs to AMB's capital deployment decisions.

Therefore, given the drawbacks of the current indicators described in Appendix A, we have conceptualized a more comprehensive model for industrial demand: the AMB Industrial Absorption Indicator (AMB IAI). The model is described as follows:

Demand for Industrial Space$_t$ = f(Manufacturing Output$_{t-1}$)
Where Manufacturing Output = f(Employment, Productivity) and
Productivity = f(Investment, Technology)

The Federal Reserve Board of Governors releases the Index of Manufacturing Output on a monthly basis. The IMO is the Index of Industrial Production, less its mining and utility components. The IMO is quantity-based, measuring the changes in quantity produced, thus eliminating the issues associated with value or weight as described in Appendix A.

Manufacturing output, as measured by the IMO, is also intuitively appealing, as we believe it to be a proxy for the entire supply chain. Goods manufactured in the U.S. often times have raw materials or intermediate manufactures assembled in foreign countries; therefore the Index is a partial proxy for the type of imports that are more important for industrial real estate (not retail). Further, the manufacturing industry still accounts for about 1/6 of the U.S. economy. On the backend of the manufacturing process, goods produced are distributed through wholesale and retail channels to businesses and consumers and are often exported. Therefore, we conclude that manufacturing output is a proxy for the entire supply chain. Although several authors have stated the need to analyze each property sub-type separately (Chai 1997 and Rabianski and Black), we find that AMB's index describes the overall industrial market better than Warehouse, Manufacturing or R&D separately. This is even further evidence of manufacturing output's value as a proxy for the entire supply chain.

Chart 1: The AMB IAI Is A Leading Indicator Of Industrial Demand

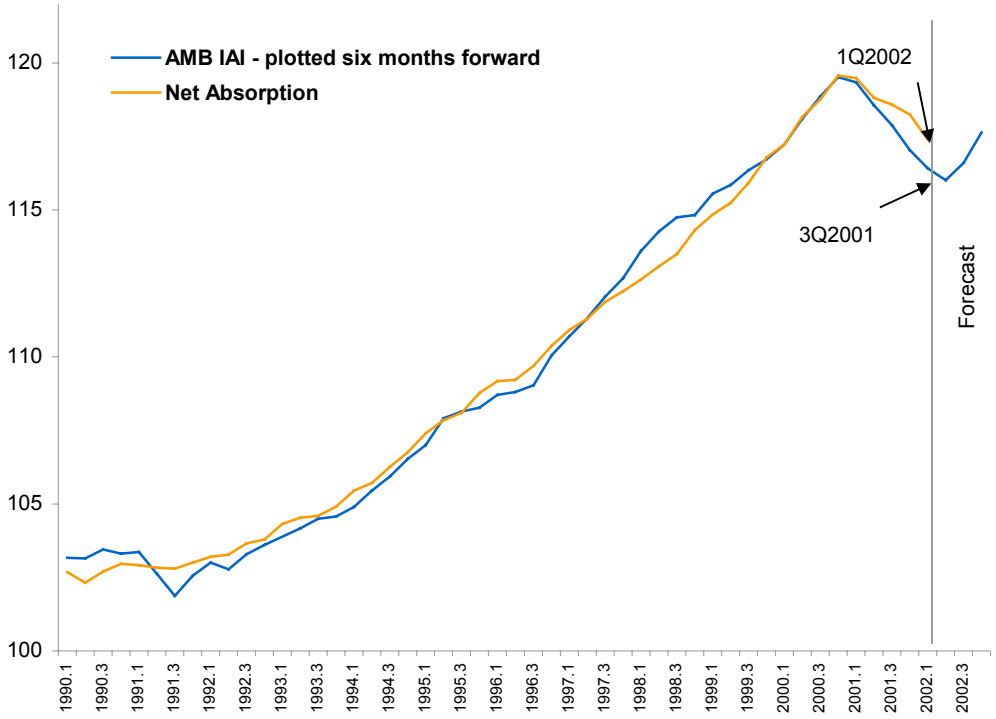

Chart 1 shows the relationship between the AMB IAI, lagged six months, and an index of actual industrial net absorption. It is apparent that the AMB IAI very accurately estimates industrial net absorption six months into the future. Due to the lag factor, our model is able to forecast industrial demand with actual (in sample) values of manufacturing output. The results of our regression are presented in Appendix C.

Our model is able to explain 99% of the past variation in industrial demand from the last 52 quarters. The model implies there will be (38) million square feet of net absorption in the second quarter, followed by 57 million square feet of positive net absorption in the third quarter of 2002.

Chart 2: The ISM Index Is A Leading Indicator Of Manufacturing Output

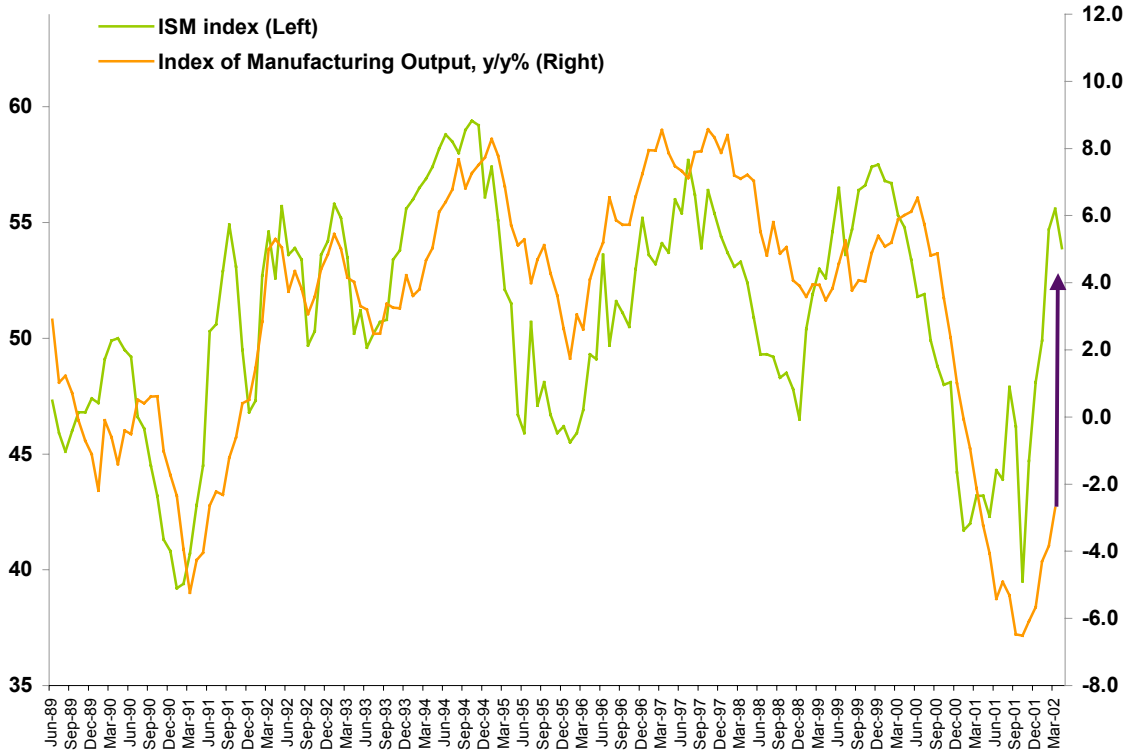

Chart 2 depicts the relationship between the ISM index and the IMO. Utilizing this relationship, we built a regression model to forecast the IMO, which, in turn, allows us to forecast industrial demand even further forward. We expect that the IMO will grow by 1.3% (yoy) in the second quarter, then by 6.1% in the third quarter. This is a level of growth not seen since the second quarter of 2000 (three quarters prior to the official start of the recession). Based on our model, we expect rapidly accelerating growth in industrial space demand through the first quarter of 2003.

In summary, manufacturing output avoids many of the problems identified with the traditional indicators (see Appendix A). It encompasses employment of those individuals who actually produce, store and move the goods (not simply "manufacturing employees"), their productivity and investment in capital (rents and inventories) and technology. Furthermore, because the IMO is a leading indicator of demand, short-term forecasts can be made with actual current monthly data. The alternative methods described in Appendix A usually require a forecast of the independent variables (e.g. wholesale trade employment) in order to forecast industrial demand.

The primary drawback of the model is that it is primarily applicable as a macro level indicator, as manufacturing output data at the metropolitan level does not currently exist.

SUMMARY

We find the AMB Industrial Absorption Indicator resolves most of the issues associated with traditional industrial demand indicators and also has superior historical predictive powers.

The AMB IAI reading for 1Q02 is 117.6 (January 1990=103.2), up from 116.0 at year-end. This reading implies 57 million square feet of net absorption in the third quarter of 2002.

The index signaled the downturn in the industrial market between July and September of 2000 when it peaked at 119.4. The upturn was initially signaled between December 2001 and February of 2002, when the index hit 116.0 and continued upward.

Appendix A: Background of traditional measures and explanatory comparison with AMB IAI:

Industrial demand has traditionally been one of the most difficult property types to forecast. "Office employment"[1] is a strong indicator of office demand, and household formation, population growth and household income have been reliable indicators of multifamily and retail demand. There have been no such indicators for industrial real estate.

Early studies attempted to equate production of industrial space as a capital investment decision (Wheaton, Torto 1990). The primary sources of demand in these models were manufacturing and distribution employment. The use of "industrial" employment as a proxy for demand is essentially the same framework used in office space models. This is still the most widely used approach and is utilized in virtually every commercial industrial forecast available today. The benefit is that the data is timely, cost effective and available at the metropolitan level. However, there are numerous limitations with this approach:

1. Manufacturing employment is not well correlated with demand for industrial space. During the 13-year period covered in our study, manufacturing employment decreased by 13.7%, while occupied industrial stock increased by 18.5%. This is also reflected in the relatively low correlation presented in Table 1.

2. Employment measures neglect productivity gains within the industry. Logistics and supply chain management have had a tremendous impact on productivity in the industry. In fact, McKinsey Global Institute recently found that wholesale and retail trade accounted for 55% of the "excess productivity" that occurred in the "new economy" between 1995 and 2000.

3. All manufacturing-related firms are classified as one code. For instance, all 38,000 employees of the Coca Cola Company are classified as manufacturing employees, while most of these employees actually work in non-manufacturing roles and in offices. Rabianski and Black found that 69% of wholesale trade employees are actually located in office space. This ratio also varies by company, industry and metropolitan area. Alternatively, many employees actually engaged in warehouse and distribution activities are broadly classified as retail.

[1] Office employment is often defined as the aggregation of various sub-sectors of employment, usually from the service sector.

For our correlation study, we analyze growth in total employment, manufacturing employment, wholesale trade employment and transportation/utility employment. AMB has long considered total employment the best employment-based measure of demand, and has utilized it in various econometric models for the last two years. This is primarily because of the issues of classification and productivity mentioned above. It is also intuitively appealing because each new job created (regardless of industry) will produce and consume a variety of goods and services at both the business and household levels. The durable and non-durable portion of this added component of the supply chain would be served via industrial space.

Mueller and Laposa identify the "path of goods" as an indicator of high densities of industrial space relative to population. They hypothesize that high-density areas are those in which distribution is an export industry; therefore, they recommend population growth over industrial employment growth as a better measure of demand ($R^2 = .43$). Although population growth has some of the intuitive benefits of total employment, the argument is not as compelling. A new job is both a business level producer and consumer, and is a more important residential consumer. Further, Hughes (1994) points out that much industrial property is not population serving. Hughes goes on to show a very low correlation between population growth and industrial demand in five major markets. This is consistent with our findings in Table 1.

Published work on the role of inventories is scarce, although we are aware of at least one organization that utilizes this methodology. Inventories are intuitively appealing, yet they too suffer from a significant drawback. Specifically, inventories are typically measured by value. However, Wheaton and Torto point out that measures of value are misleading, since the U.S. has shifted to the production of higher value goods. Conversely, measures of weight can be misleading, as most bulk goods never enter a warehouse. From Table 1 it is apparent that inventories are not very accurate in predicting industrial demand ($r=.23$).

Finally, Mansour and Christensen attempted to implement a working model of the conceptual "path of goods" framework introduced by Mueller and Laposa. They propose utilizing freight shipments as a proxy for inventories. Their findings are "mixed," with further research suggested. The primary weaknesses of this model are in the independence, cost and scope of the database. The reported correlation between freight flows and occupied industrial stock is actually negative, and the R^2 of the national model is negative – which implies that the model lacks explanatory power.

Table 1 provides a comparison of quarterly correlation of IMO and the traditional indicators, both lagged two quarters with industrial demand. Therefore, because the Federal Reserve Board's Index of Manufacturing Output has been a superior historical indicator, we utilize this variable in the construction of the AMB IAI.

Table 1: 1989.1 – 2002.1 Quarterly Correlation with Industrial Demand

Manufacturing Output	0.88
Employment Based Measures	
Total Employment (non-agricultural)	0.80
Wholesale Trade	0.79
Manufacturing	0.75
Transportation/Utilities	0.66
Business Inventories	0.23
Real GDP	0.18
Population	0.06

All variables as yoy% change
All indicators lagged two quarters

Sources:
Demand: Year over year change in Occupied Stock, from Torto Wheaton Research's datadisk product, sum of 54 markets.
Manufacturing Output: Federal Reserve Board's Index of Manufacturing
Employment Measures: Bureau of Labor Statistics (Form 790)
Business Inventories: U.S. Census Bureau
Real GDP: Bureau of Economic Analysis
Population: U.S. Census Bureau

Appendix B: Regression Output

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	73.88606	0.558058	132.3984	0.0000
IPMF(-2)	0.297611	0.004607	64.60548	0.0000
R-squared	0.988397	Mean dependent var		109.4665
Adjusted R-squared	0.988160	S.D. dependent var		5.914378
S.E. of regression	0.643562	Akaike info criterion		1.994829
Sum squared resid	20.29442	Schwarz criterion		2.070587
Log likelihood	-48.86814	F-statistic		4173.868
Durbin-Watson stat	0.281768	Prob(F-statistic)		0.000000

Sources:
Dependent Variable: Index of quarterly net absorption/stock
IPMF: Index of Manufacturing Output, lagged two quarters.

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