Architecture Billings as a Leading Indicator of Construction

ANALYSIS OF THE RELATIONSHIP BETWEEN A BILLINGS INDEX AND CONSTRUCTION SPENDING.

By Kermit Baker and Diego Saltes

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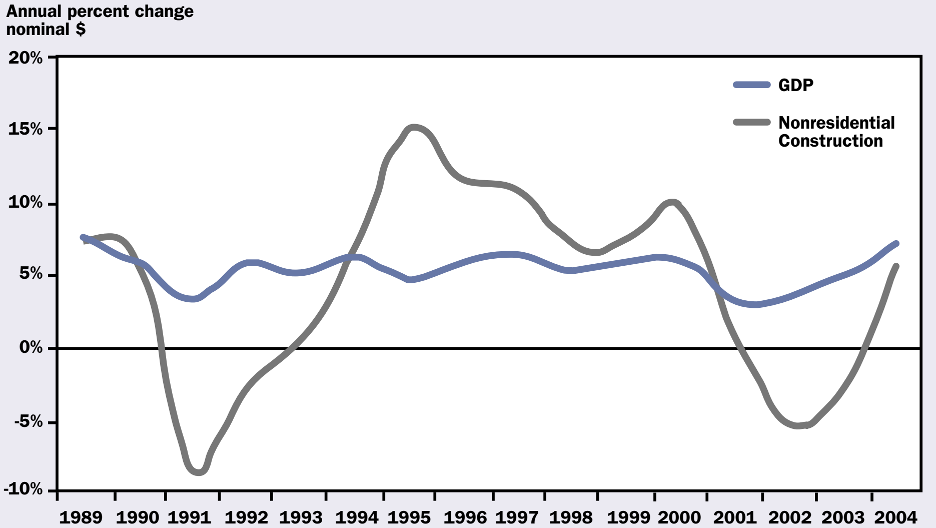
Due to the size and cyclicality of construction, a premium is placed on accurately predicting nonresidential construction trends, particularly at turning points in the construction cycle. Given that construction decisions are made by hundreds of thousands of businesses, nonprofit institutions, and government organizations, it is extremely difficult to get comprehensive information on building plans. However, since architects design the overwhelming majority of nonresidential construction projects, gathering information on billings at architecture firms provides leading information on future construction trends. Statistical analysis demonstrates that information provided by architecture firms on trends in their billings is highly correlated with the eventual nonresidential construction activity, with leads of up to one year.

The U.S. nonresidential construction industry is one of the larger sectors of our economy.[1] Construction spending for nonresidential buildings totaled more than $330 billion in 2004, according to data from the U.S. Census Bureau, with about 45 percent coming from the more volatile commercial and industrial sectors and 55 percent from the typically more stable institutional building categories.

[1]Nonresidential construction for this analysis is defined to include the following categories from the U.S. Census Bureau's Value of Construction Put in Place in the United States data series (C-30): lodging, office, commercial, manufacturing, health care, educational, religious, public safety, amusement and recreation, transportation, and communication. The first four categories on this list are defined as "commercial/industrial" construction, with the remaining defined as "institutional" construction.

FIGURE 1

NONRESIDENTIAL CONSTRUCTION: ONE OF THE MOST CYCLICAL SECTORS OF THE ECONOMY



Note: data presented as % change in nominal dollars because no commonly accepted deflator exists for nonresidential construction spending.
Sources: U.S. Census Bureau, Construction Spending Put in Place; and Bureau of Economic Analysis

While a large segment of the overall economy, nonresidential construction is also a very volatile sector. When the economy is strong, construction spending on nonresidential buildings generally accelerates faster than the broader economy. Likewise, when the economy is weak, most types of construction decline faster than the overall economy (Figure 1). Forecasting a volatile industry like nonresidential construction can be particularly challenging, where a considerable premium is placed on accurately identifying turning points. The purpose of this paper is to demonstrate how billings at U.S. architecture firms provide a leading indicator for construction activity in nonresidential buildings, particularly for the more cyclical commercial and industrial sector.

The AIA Work-on-the-Boards Survey and the Architectural Billings Index

Beginning in late 1995, the American Institute of Architects (AIA) assembled a panel of architecture firms to participate in an ongoing national survey to measure their business conditions. The principal purpose was to develop a database of national and regional business trends at architecture firms so that an individual firm would have a better sense of how business at that firm compared with its peers.

Architects are well positioned to report on the direction of the construction industry. Although decisions to build nonresidential structures are made by hundreds of thousands of private businesses, nonprofit institutions, and government agencies, the first comprehensive indication of planned development typically shows up on an architect's drafting board. Surveys conducted by the AIA of its member firms[2] and information from McGraw-Hill Construction indicate that about 75 percent of nonresidential buildings are designed by architects. A greater share of nonresidential activity is reviewed and approved by architects but without complete design involvement.

Constructing the Architectural Billings Index

The AIA Work-on-the-Boards survey is conducted monthly across a national panel of architecture firms. Currently, about 300 architecture firms actively participate in this program. Firms included in this survey provide architectural services as their principal design service offered. Firms may also provide engineering, interior design, landscape architecture, planning, urban design, or related services. Most firms also provide pre-design or construction-phase services (e.g., construction management) in addition to their architectural design services.

Firms that participate in the survey provide the AIA with information on key firm characteristics, such as annual billings, construction sectors served, and number of employees. On the first business day of each month, participating firms are e-mailed a link to an electronic questionnaire. That questionnaire asks respondents to report firm billings for the just-completed month as compared to the previous month, as well as inquiries for new work over the same period. If a firm does not bill monthly, it is requested to estimate the work that will be billed for that period.

Computing the Index

Firms are asked to report whether billings during the previous month significantly increased (five percent or more), remained about the same, or significantly decreased

[2]See, for example, The American Institute of Architects, 2003

(five percent or more). The Architectural Billings Index (ABI) is computed as a diffusion index, with the monthly score calculated as the percent of firms reporting a significant increase plus half the percent of firms reporting no change. Comparisons are always to the previous month. Diffusion indexes, centered at a score of 50, frequently are used to measure change in economic activity.[3]

If an equal share of firms report an increase as report a decrease, the score for that month will be 50. A score above 50 indicates that firms in aggregate are reporting an increase in activity that month compared to the previous month, while a score below 50 indicates that firms are reporting a decrease in activity.

Certain months of the year—December is typically one of them—are slower at architecture firms due to holidays, weather, and other factors. Other months may show almost uniformly stronger business conditions for just the opposite reasons. To allow for meaningful comparisons among months, the monthly responses are seasonally adjusted using the Census Bureau's X-12 program. The seasonal adjustment process regulates the ABI score each month based on typical scores for that month in prior years. So, for example, even though December scores may be weaker than November scores, the seasonal adjustment process compares this weakness to prior years to determine if the decline is stronger or weaker than it has been previously.

Relationship of the ABI to Construction Activity

Since architecture firms design the overwhelming majority of nonresidential buildings in the United States, we would expect a relatively consistent relationship between architectural design activities and nonresidential building construction. A recent AIA survey of architecture firms determined that the average time between the award of a design contract and the award of a construction contract for that facility was about a year.[4]

However, there is considerable variation from project to project. According to the aforementioned survey, for commercial/industrial projects, the design phase up through contract award was less than six months for 40 percent of the projects, while for more than a quarter of projects this period extended beyond a year. Size and complexity of a project are key reasons for variation in design time, but three other factors also influence design time. Client decision making—and whether these decisions need single or multiple approvals—frequently influences the length of the design phase. Financing and funding for the project also can be a factor. Finally, regulatory approvals—land entitlement, special use permits, zoning, environmental issues, and historical considerations—also influence the length of the design phase.

Overall ABI

For this analysis, we computed the correlation between the monthly ABI (computed as a three-month moving average) and the annual percent change in nonresidential construction spending on a monthly basis compared to the same month a year earlier.[5] Year-over-year changes in construction spending were used to measure the underlying growth trend in the construction industry and were found to be a better indicator than month-to-month percent changes, which are much more volatile.

The lags on a one-month-increment basis were tested for the concurrent relationship beginning in November 1995 (lag 0) and 20 subsequent monthly lags thereafter. The five-month lag was identified as having the best relationship between the ABI and construction activity in the nonresidential construction sector, factoring in the correlation and accuracy at turning points between the two series.

Figure 2 shows that nonresidential construction activity generally moved in tandem with the five-month lagged version of the ABI. During the tail end of the 1990's nonresidential construction expansion, the two series generally moved in a coordinated fashion, with both series exhibiting considerable and apparently random volatility. The ABI moved below 50 in February 2001 for the first time, save for two months in mid-1997, and six months later nonresidential construction spending also moved negative. The ABI reached its cyclical trough in November 2001 with a value of 43.6, and the cyclical trough in nonresidential construction spending was reached eight months later in July 2002 with a decline of 12.1 percent over the same month a year earlier.

Coming out of the 2001-2003 nonresidential construction recession, the ABI recovered faster than did construction activity, but it turned out to be a false recovery, as the ABI was above 50 for three months and then fell below 50 for 15 months. For this cycle, at least, the ABI was more accurate in anticipating the downturn in nonresidential construction than in anticipating the upturn. We will need to track the relationship through additional cycles to see if this pattern holds. Table 1 shows that the correlation between the five-month lagged ABI and nonresidential construction spending activity is

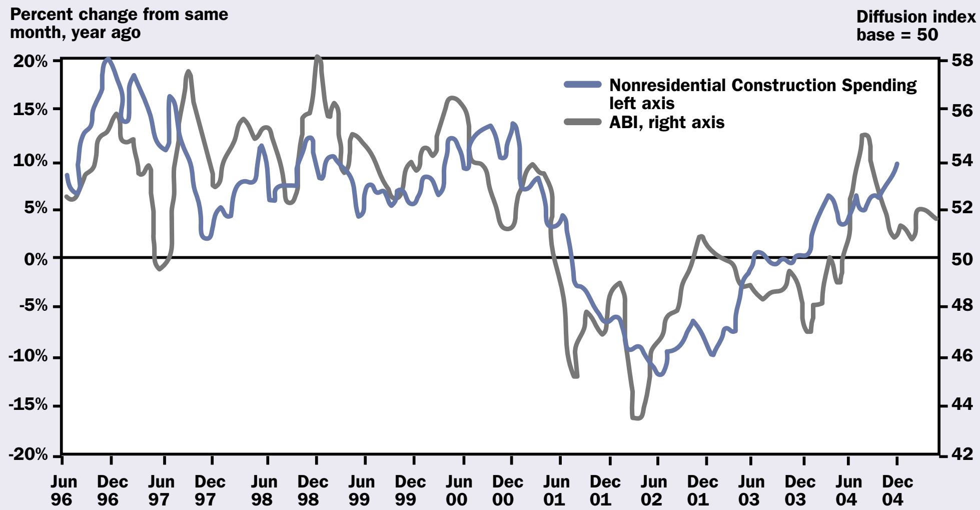
[3]See, for example, Ore, 2002.

[4]A discussion of the results of this survey is presented in Baker, 2004.

[5]The ABI is computed as a three-month moving average to reduce the random variation in monthly architecture firm billings. While this smoothing procedure does reduce the lead in the ABI over construction spending data, our analysis demonstrated that smoothing produced a better fit between the ABI and the construction spending series.

FIGURE 2

ABI AND NONRESIDENTIAL CONSTRUCTION SPENDING



Sources: U.S. Census Bureau, Construction Spending Put in Place; and The American Institute of Architects Work-on-the-Boards Survey

0.74 for the June 1996-December 2004 period using a running three-month moving average for the ABI.[6] R-squared for this relationship is 0.55, with a coefficient for the ABI that is significantly different from zero and well in excess of the 99.9 percent confidence level. The interpretation is that the ABI alone explains 55 percent of the future variation in nonresidential construction spending levels.

Even though the correlation between architecture firm billings and construction activity is high, one might have even expected it to be even higher. Since architecture firms design the overwhelming majority of buildings, why is business activity at architecture firms not an almost perfect predictor of future construction activity? There are at least five reasons why this relationship was not found to be stronger.

The first is that we are using only a sampling of national architecture firms in this analysis. Even though we take efforts to ensure that the panel is representative of architecture firms nationally, using a sample of firms will

[6]All the analyses of the ABI presented in this paper begin in November 1995. Figure 2 begins with June 1996 because of lagging the ABI five months and computing a three-month moving average.

TABLE 1

SUMMARY OF REGRESSION/LAG ANALYSISBASED ON YEAR-OVER-YEAR PERCENT CHANGES IN CONSTRUCTION ACTIVITY AND THREE-MONTH MOVING AVERAGES OF THE ABI.

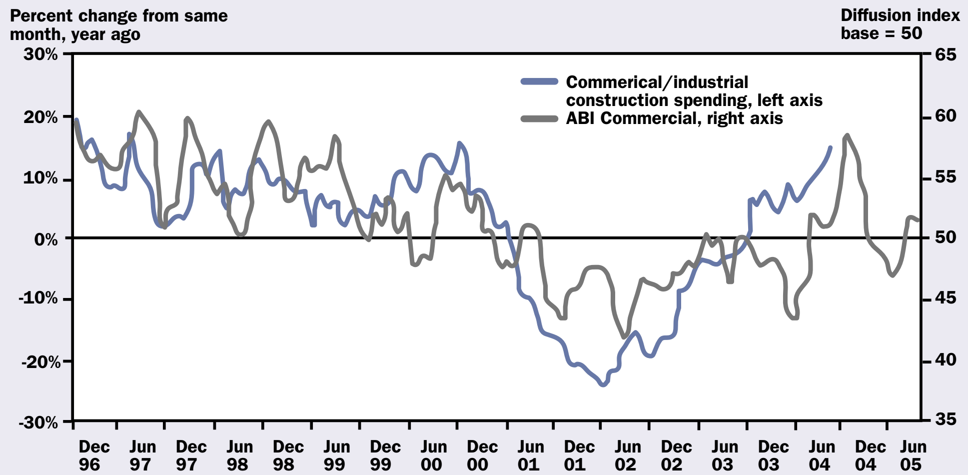
Indicator	Predictor of	Best Lag	Correlation	R-Squared	Intercept	ABI Coefficient
ABI - Overall	Total nonres. construction spending	5 mos.	0.74	0.55	-0.86 (-10.47)	0.0174 (11.07)
Sectors						
ABI - Commercial	Commercial/industrial construction spending	11 mos.	0.69	0.47	-0.87 (-9.01)	0.0172 (9.24)
ABI - Institutional	Institutional construction spending	5 mos.	0.36	0.13	-0.21 (-2.80)	0.0057 (3.82)
Regions						
Northeast	Nonres. construction contract awards - Northeast	16 mos.	0.51	0.26	-0.60 (-5.13)	0.0125 (5.59)
Midwest	Nonres. construction contract awards - Midwest	17 mos.	0.45	0.20	-0.52 (-4.43)	0.0103 (4.76)
South	Nonres. construction contract awards - South	14 mos.	0.51	0.26	-0.71 (-5.34)	0.0141 (5.66)
West	Nonres. construction contract awards - West	3 mos.	0.35	0.12	-0.49 (-3.44)	0.0110 (3.83)

Note: t-statistics in parentheses.

Sources: Construction spending from the U.S. Census Bureau, Construction Put in Place (C-30), and construction contract awards from McGraw-Hill Construction Analytics.

FIGURE 3

ABI COMMERCIAL AND COMMERCIAL/INDUSTRIAL CONSTRUCTION SPENDING



Sources: U.S. Census Bureau, Construction Spending Put in Place; and The American Institute of Architects Work-on-the-Boards Survey

inevitably introduce some degree of volatility that is not representative of national activity and therefore not captured in construction activity.

Also, the design period is not fixed across time. When economic conditions are strong, clients often pressure architecture firms to accelerate the design phase. When the economy is weaker, clients may temporarily stop or slow work to wait for economic conditions to improve.

Third, there is a broad cross-section of building types covered in the overall ABI calculations. The composition of building types being designed may change over the business cycle. At some points, commercial/industrial design may account for a disproportionate share of activity at architecture firms, and, at another time, institutional building may account for a larger-than-usual share.

Fourth, not all billings at architecture firms translate directly into construction activity. The majority of billings—almost 80 percent according to the most recent AIA survey of architecture firms—derive from design phase activities, but architecture firms also are increasingly involved in planning and pre-design activities, as well as construction and post-construction services. Billings from these other services will probably not correlate well with nonresidential construction spending, or at least not with the same lag that we see for design services.

Finally, the scale of buildings may shift with economic conditions. Usually, as an economic recovery begins, there is a larger share of smaller buildings under design. This may be because local economies are not yet strong enough to support more space and because smaller buildings usually can be designed and constructed faster to take advantage of improving conditions.

Construction Sector Indicators: Commercial/Industrial and Institutional Buildings

Since the relationship of architecture firm billings and construction activity varies by building type, we created sector-specific indices for the major building sectors. For the commercial/industrial sector, the correlation was highest when the Commercial ABI led commercial/industrial construction activity by 11 months, which yielded a correlation coefficient of 0.69 and an R-squared of 0.47. This is shown in Figure 3.

Institutional building—encompassing education, health care, religious, public safety, amusement and recreation, transportation facilities, and communication facilities—is the most important building category for U.S. architecture firms, since it typically generates about 50 percent of total revenue on average. However, since it encompasses a broad range of building types and reflects diversity in its client base (e.g., state and local governments, federal government, educational institutions, health-care providers, other nonprofit institutions, and amusement companies) that respond to a wide range of economic signals, the construction cycle within this category can be quite varied.

Each of the building types within the broader institutional construction category has a somewhat different relationship between design activity and construction. As can be seen in Figure 4, there is not a pronounced cycle to institutional construction spending as compared to commercial/industrial construction spending. This lack of variation limits the potential of identifying a leading indicator that captures the construction cycle of this sector and limits the value of a leading indicator, even if one could be identified.

Regional Indicators

The regional architectural billings indices report business conditions at firms based on their location. The four regional indices correspond to the U.S. Census Bureau's regions. Activity at a firm is assigned to its region regardless of the location of a project. Individual contacts at firms are asked to report billings activity for their particular location only and not for the entire firm (if that firm has multiple locations). However, most projects at a given firm location correspond to the region in which that office is located. This is true even for larger architecture firms that generally have multiple offices, each serving separate geographical areas.

The regional ABIs are computed from the change in total billings for all firms located in a given region. The U.S. Commerce Department does not report construction-spending activity by regions monthly, so for this analysis we used regional information on nonresidential construction contract awards supplied by McGraw-Hill Construction. Due to the different data source, the analysis of the regional ABIs versus the McGraw-Hill Construction regional data series is likely to yield different results from the analyses presented earlier using Census Bureau figures at the national level. Moreover, the correlations are lower on average at the regional level, no doubt due to smaller samples of firms in each region, which produces more volatility in billings activity. In addition, the regional relationships are further affected by the fact that changes in ongoing monthly architecture firm billings are correlated with one-time contract awards from the McGraw-Hill Construction data, rather than with the continuous flow of spending going into construction projects, which characterizes the Census Bureau's methodology.

Summary, Conclusions and Further Research

The analysis presented here demonstrates that the Architectural Billings Index is a useful leading indicator of future levels of nonresidential construction activity. When used in a single-variable regression model to explain variation in construction spending, both the overall ABI and the Commercial ABI performed well.

For the overall nonresidential construction-spending model, the estimated equation is:

$$\text{NonRes} = -0.86 + 0.0174 * \text{ABI}$$
$$(<0.001)\ (<0.001)$$

Table 1 shows that R-squared for this single-variable model equation is 0.55, indicating that over half of the observed variation in total nonresidential construction spending over the period studied from mid-1996 thru 2004 is explained by the overall ABI when lagged by five months.

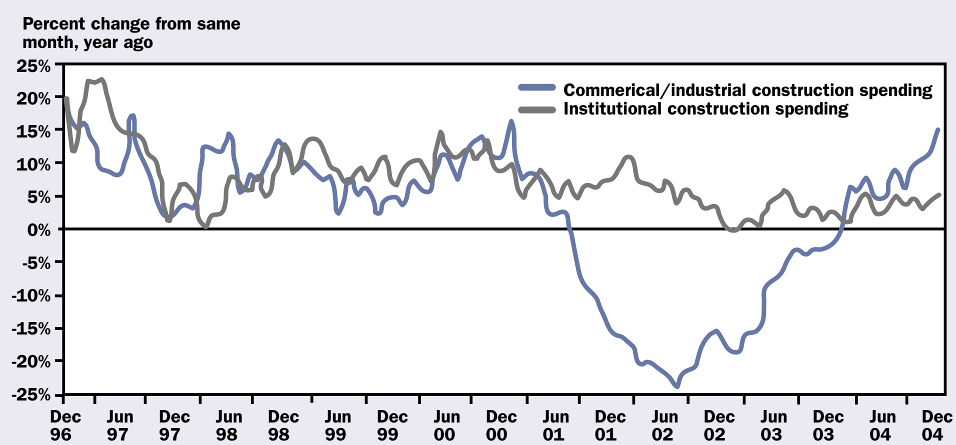
Results from the Commercial ABI are almost as good, with the estimated coefficient exhibiting a comparable level of significance, and the overall single-variable model generating an R-squared of 0.47. Preliminary indications are that the ABI not only helps to predict overall levels of construction activity, but also helps to predict turning points in the nonresidential construction cycle.

However, further analysis on this indicator is warranted. The ABI has been conducted for less than a decade, and it coincides with a period where there were few key turning points in nonresidential construction activity. The latter half of the 1990s was a period of sustained growth in nonresidential construction, followed by the 2000-2003 period, where nonresidential construction was in an extended recession. Evaluating the performance of the ABI over a longer period, with more frequent business cycles would be helpful in better understanding its performance.

Secondly, opportunities exist to develop more sub-indices using the same approach. For example, the institutional sector as currently defined is probably too heterogeneous for a single leading indicator. More detailed information on trends in architecture buildings for educational facilities, health care facilities, or justice facilities, for example, would probably provide information for a more accurate series of leading indicators.

FIGURE 4

COMMERCIAL/INDUSTRIAL CONSTRUCTION SPENDING MORE CYCLICAL THAN INSTITUTIONAL



The same is true for regional versions of an architectural billings index. Our current database on billings at firms according to their regional location yielded disappointing results, no doubt due to smaller sample sizes of firms in each region and also because architecture firms do not work exclusively on projects within the regions in which their offices are located. A further complication is that the Census Bureau does not report monthly construction spending data by region. The regional results reported in Table 1 are based on analysis done with the McGraw-Hill Construction contract awards data. It would be expected that ongoing monthly architecture firm billings would not be as highly correlated with one-time contract awards as with the continuous flow of spending going into construction projects, which characterizes the Census Bureau's data.

Also, integrating this leading indicator into more formal structural forecasting models of nonresidential construction activity could dramatically improve the performance of these models. Traditional models that factor in demand, supply, and macroeconomic variables should be considerably enhanced by this indicator, which provides an accurate short-term trending feature as well as an early identification of turning points, features that are lacking in most traditional models.

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