A Coincident Index for Texas Residential Construction

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Abstract

A coincident index is estimated monthly since 1990 to measure the residential construction cycle in Texas. The index is based on the movements in three direct measures of residential construction activity: real contract values, real wages paid and the number of jobs. While each of these indicators are reflective of residential construction activity, the timing and direction of their changes can differ from month to month and over the course of the cycle. The coincident index is calculated using a dynamic Kalman filter designed to measure the underlying time-dependent comovement in the component series. The coincident index shows that the timing

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of the residential construction cycle differs from the Texas business cycle and the U.S. residential construction cycle. The index should be a useful tool for analysts seeking to understand the current direction of Texas residential construction activity.

**Introduction**

The recent boom and bust in home prices and residential construction and its impact on the global financial crisis has highlighted the need for up-to-date indicators that can help analyze the residential construction sector. While various measures of residential construction are available, what is needed is a comprehensive measure of the direction of this important sector because various indicators can at any point in time move in different directions. Historically the residential construction sector has played an important role in the U.S. business cycle as exemplified by the use of residential building permits in the Conference Board U.S. Leading Index.

While the timing of the residential construction cycle may not always match the overall business cycle, its size and volatility make it an important sector in the overall economy’s growth. This is true at the regional level as well.

A coincident index seeks to measure the underlying comovement among various broad measures of an economy or sector that is consistent with an underlying time-dependent business cycle. The index can be used to define precise peaks and troughs in the cycle and thus the timing and length of expansions and recessions. Indices are constructed from variables that represent broad measures of the economy or sectors of interest but come from different sources or measure different types of activity such as labor, capital, consumption or production. For example, while real gross domestic product (RGDP) is a broad measure of economic activity, the Conference Board estimates a U.S. coincident index that includes measures such as employment, income, production and sales. The underlying comovement of these variables is likely to better represent the business cycle than simply the movements in RGDP.
Research on business cycle indices has expanded through the years to regional economies. Such widespread acceptance of indices is explained by their recognized ability to measure the overall direction and timing of broad movements in the overall economy or in specific sectors. This is especially critical in the absence of a timely measure of state and local gross state product (GSP) and the lack of high quality historical time series. Regional coincident indicators have done a good job of providing a timely and accurate overall picture of the current state of the local economy.

To date there is no reliable summary indicator to measure the residential construction cycle at a regional level. A methodology is applied to calculate a single underlying unobserved variable that represents the coincident index. The approach allows the data to define the component weights that best define the underlying comovement in the component variables.

There is no single indicator that best estimates the timing and length of the broad upswings and downturns in residential construction in Texas. Even real residential construction contract values by themselves do not capture the underlying state of the sector as contracts can be canceled, and the timing of the construction activity can vary between when the contract is signed and when the actual building activity occurs.

**Coincident Economic Indicators Overview**

Cyclical indicators have been used for many years as tools to understand the aggregate national economy and more recently the regional economy of U.S. states and sectors. The National Bureau of Economic Research (NBER) published the first cyclical indicators in 1938, based on work done by Wesley Mitchell and Arthur Burns (1938). In 1996, the preparation and publication of the cyclical indicators was transferred to the Conference Board from the NBER and Bureau of Economic Analysis (BEA) and are still estimated by the board. The cyclical indicators include the composite indicators: leading, coincident and

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3The Harvard ABC curves popular in the 1920s are an even earlier construction of leading indicators as discussed by Paul Samuelson (1987).
lagging. Unlike the leading indicator, which moves ahead of the business cycle, a coincident moves in tandem with the business cycle while the lagging moves behind it.

The main motivation for the construction of composite indexes of economic activity is the belief that there is no single proven and accepted cause of all observed business cycles. If different recessions are affected by different factors, it is likely that no one indicator will perform best over all the peaks and troughs. To increase the probability of getting true signals and reduce the chance of false ones, an array of indicators is chosen from a wide range of economic sectors and processes to construct an index that measures the average behavior of a group of economic time series that show similar timing at business cycle turns but represent a cross-section of activities or sectors of the economy. Another reason for constructing composite indicators is that measurement errors can be reduced by combining the series.

Data and Methodology

**Coincident Data and Methodology**

To determine which series would be included in the construction of the coincident indicator for the Texas residential construction sector, broad measures of the sector that reflected the timing of when the activity took place were sought. Building a residential dwelling is a process that takes on average from four to six months from when the building permit is issued to the time the residential building is finished. Building permit information includes the contract values of the residence being built because it is required for the permit. One problem with a broad measure like residential contract values is that the contract is issued and thus measured months before the house is built. During the construction process, labor and capital is utilized in various degrees until the house is completed.

While capital usage is difficult to measure, the Bureau of Labor Statistics (BLS) has several different measures of labor that can be used to measure the intensity and timing of residential construction activity, including employment in residential building construction and total wages paid. Employment is
reported monthly, while wages are reported quarterly. Employment and total wages paid often move differently and can turn down with notably different timing. Total wages paid is equal to employment times hours worked times the hourly wage. The hourly wage varies with productivity because, in theory, workers are paid their marginal product of labor. One influence impacting the marginal product of labor is capital usage — because the more capital used, such as heavy equipment, the more output each worker will have. In this sense, the usage of total wages paid at least indirectly helps account for capital usage. Because employment does not differentiate between part-time and full-time workers and hours worked in general, total wages paid can account for this. While real total wages paid will fluctuate with hours worked and worker productivity, its weakness is that it is not available on a monthly basis. Using both series gives a better picture of the timing and magnitude of construction activity.

The real value of residential construction contracts, which are a good measure of the value of construction but not necessarily the correct timing of the activity, are also used. In the dynamic Kalman filter the analyst much choose the series that sets the timing of the index. Because employees are working while construction is taking place this measure is used to set the timing of the index. Leads of real residential construction contracts are tried until the statistically optimal timing can be determined. To deflate the nominal values of total wages paid in residential building construction and of contract values, an estimate of the Texas Consumer Price Index (CPI) is employed. The Texas CPI is estimated from an interpolation procedure of the bi-monthly CPI data for Dallas-Fort Worth and the Houston-Galveston-Brazoria areas for all urban consumers with the base period 1982–84. It consists of seasonally adjusting both CPIs to later interpolate the series that are measured every other month to estimate a monthly data CPI series that represents Texas. All three series are available for the period from 1990 to 2014. Prior to 1990, the data for employment and wages are based on the Standard Industrial Classification System and thus are not consistent with the North American Industrial Classification.
System data used here. Information on the series used to estimate the coincident index is presented in Table 1.

<table>
<thead>
<tr>
<th>Series</th>
<th>Name</th>
<th>Transformation</th>
<th>Source</th>
<th>Availability</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Contract Values</td>
<td>RVAL</td>
<td>Log First Differences</td>
<td>McGraw-Hill Construction</td>
<td>Monthly, third week following month end</td>
<td>Deflated by Texas Shelter CPI-U</td>
</tr>
<tr>
<td>Residential Construction Employment</td>
<td>EMP</td>
<td>Log First Differences</td>
<td>BLS</td>
<td>Monthly, released quarterly, six months after end of reporting quarter</td>
<td></td>
</tr>
<tr>
<td>Residential Construction Wages</td>
<td>WGS</td>
<td>Log First Differences</td>
<td>BLS</td>
<td>Quarterly, six months after the end of reporting quarter</td>
<td>Deflated by Texas All CIP-U</td>
</tr>
</tbody>
</table>

Note: All series are seasonally adjusted.
Source: Real Estate Center at Texas A&M University

Coincident Results and Evaluation

The following criteria are used to select the specification for the coincident model for residential construction in Texas:

1. The estimated index should be consistent with experts’ knowledge of the state’s history of residential construction.

2. The index should reflect broad patterns of persistent increase followed by persistent decline that clearly mark periods of expansion and recession. These patterns should be more evident in the index than in any single input series and should, in general, be consistent with the swings in the series.

3. Characteristics of the index such as (a) smoothness, (b) timing of turning points and (c) contribution of coincident indicators should be robust to minor changes in its specification or in the addition of new observations.

The estimation period for the coincident index is January 1990 to November 2014. The dynamic Kalman filter due to Stock and Watson (1989) is used to estimate the coincident index.
Using the Stock and Watson methodology produces an index that is stationary over time as its key purpose is to extract business cycle movements from the component series regardless of the potentially differing trends in these series. It is customary to add in a trend to the series to make the index more comparable to other time series. The trend in the composite index of coincident indicators for residential construction is set equal to the trend in real contract values (Figure 1). The periods of economic contraction as defined by the coincident index are shaded. The coincident index moves smoothly upward during expansion and downward during contraction, thus minimizing the number of false business signals of business cycle turning points. The index provides a smooth and clear signal of the state of residential construction from the three input variables (Figure 2).

The Real Estate Center at Texas A&M University identified the turning points of Texas residential business construction independent of this index. These turning points serve as a benchmark to evaluate the performance of the residential construction coincident index (Table 2). Center researchers applied the same methodology as the NBER dating committee for the U.S. economy that consists of identifying economic activity based on a range of indicators while at the same time defining contractions and expansions based on their knowledge of and expertise within the residential market in Texas. They identified three troughs and two peaks in the Texas residential construction business cycle between January 1970 and March 2014. The Texas residential coincident index matched the designated turning points for the peak achieved between September 2006 and January 2007 and the trough between April and June 2011 (Figure 1). No other peaks and troughs were identified by the coincident index besides the aforementioned from October 1990 to March 2014. The coincident index performs well, replicating the features of the Texas residential construction business cycle for the sample period.

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The Texas coincident index estimated by the Dallas Federal Reserve has matched the designated turning points for the state’s economy and is widely used as the major reference for the regional business cycle (Table 3). The Texas residential construction index did not conform with the timing of the turning points in the overall Texas economy. For example, residential construction did not register a downturn in 2001, but it did register a slowdown two years later in 2003 (Figure 3). These differences reflect the differences between the aggregate economies business cycle and residential construction. In particular, they show how residential investment can lead the business cycle, whereas a fall in residential investment can be a foreteller of a recession, as was observed during 2007.

The differences also indicate that the 2001 technology downturn did not affect residential construction in Texas. The same methodology was applied to estimate a residential construction coincident index for

Table 2. Chronology of Texas Residential Construction Business Cycle

<table>
<thead>
<tr>
<th>Peak Date</th>
<th>Trough Date</th>
<th>Months Contraction, Peak to Trough</th>
<th>Months Expansion, Trough to Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 1979</td>
<td>August 1982</td>
<td>36</td>
<td>—</td>
</tr>
<tr>
<td>May 1984</td>
<td>March 1989</td>
<td>59</td>
<td>22</td>
</tr>
<tr>
<td>January 2007</td>
<td>June 2011</td>
<td>54</td>
<td>215</td>
</tr>
</tbody>
</table>

Source: Real Estate Center at Texas A&M University

Table 3. Chronology of U.S. and Texas Business Cycles

<table>
<thead>
<tr>
<th>Peak Date</th>
<th>Trough Date</th>
<th>Months Contraction, Peak to Trough</th>
<th>Months Expansion, Trough to Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>December 1969</td>
<td>November 1970</td>
<td>11</td>
<td>106</td>
</tr>
<tr>
<td>November 1973</td>
<td>March 1975</td>
<td>16</td>
<td>36</td>
</tr>
<tr>
<td>January 1980</td>
<td>July 1980</td>
<td>6</td>
<td>58</td>
</tr>
<tr>
<td>July 1981</td>
<td>November 1982</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td>July 1990</td>
<td>March 1991</td>
<td>8</td>
<td>92</td>
</tr>
<tr>
<td>March 2001</td>
<td>November 2001</td>
<td>8</td>
<td>120</td>
</tr>
<tr>
<td>December 2007</td>
<td>June 2009</td>
<td>18</td>
<td>73</td>
</tr>
<tr>
<td>Texas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>February 1982</td>
<td>March 1983</td>
<td>14</td>
<td>—</td>
</tr>
<tr>
<td>October 1985</td>
<td>January 1987</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>March 2001</td>
<td>June 2003</td>
<td>28</td>
<td>171</td>
</tr>
<tr>
<td>June 2008</td>
<td>November 2009</td>
<td>18</td>
<td>61</td>
</tr>
</tbody>
</table>

Note: The coincident index from the Dallas Federal Reserve does not identify an economic downturn for Texas during the 1970s.
Sources: National Bureau of Economic Research (NBER) and Dallas Federal Reserve
the United States to compare the national residential construction cycle with Texas’. Both coincident indexes are presented in Figure 4. A difference in timing and magnitude between them is observed, as in 2000 and 2001, when the U.S. coincident index reflects a mild recession compared with the Texas index, which represents more of a slowdown. Also, between 2006 and 2010, residential construction in Texas recorded a downturn later than the nation, while recovering earlier than the nation (Figure 5). This confirms past findings regarding the heterogeneity of business cycles in both timing and magnitude at different levels of disaggregation, where differences are present not only from national to regional but from aggregate to industry or sector.

To enhance the information from the residential construction coincident index, the probability of recession is estimated. The methodology uses changes in the index to compute the probability of recession. Once the model’s probability exceeds a given threshold, say 95 percent, the analyst can be very certain that a downturn in the residential construction sector has begun. Choosing the critical value involves a trade-off between the number of false signals and the number of recessions that develop. The higher the critical value, the smaller the number of false signals but the larger the number of nonidentified recessions and vice versa.

Applying the methodology to the monthly growth rate in the Texas residential construction coincident index from October 1990 to November 2014 produced the probability of recessions shown in Figure 6. The estimations clearly highlight the contraction and expansion captured by the residential coincident index during that period. For the single prolonged recession over the period, the probability of recession rose above 90 percent in April of 2007 and ended in June of 2011, as the Texas housing sector felt the effects of the national housing bubble and the Great Recession. It also captures the temporary effect in 2010 of the federal homebuyer tax-credit program, which did not lead the construction sector out of recession. This recession period matches the recession defined by the Real Estate Center and is longer
than the recession defined for the Texas economy by the Dallas Federal Reserve Texas coincident index from August 2008 to November 2009.

Throughout most of the expansion period, the probability of recession remained close to zero. Exceptions were mid-1995 and the start of 1997 when a single, monthly, relatively large decline was observed in the residential coincident index, causing the probability of recession to increase above 95 percent in a single month. In addition, from December 2002 to the first of half of 2003, the probability of recession increased above 50 percent but never rose above 81 percent. During that period, the coincident index declined during two consecutive months only one time. Even though the Texas economy registered a recession from April 2001 to June 2003 as defined by the Texas coincident index, the residential construction sector registered a slowdown but did not weaken enough to be classified as a recession.

Thus, in terms of defining recessions, the methodology for estimating the probability of a recession shows the ability of the residential coincident index in signaling the timing of a downturn in construction activity in Texas. For expansions, the index identified the trough that signaled the timing of the recovery in residential construction and was characterized by a fall in the probability of a recession.

To evaluate the performance of the estimated coincident index, another index is estimated that incorporates the Kim and Nelson (1998) procedure. The appeal of the Kim and Nelson methodology is that it is a nonlinear model that treats recessions and expansions asymmetrically. They estimate a dynamic factor model in which a single latent factor has a mean that follows a latent Hamilton (1989) Markov regime switching process. Thus, it potentially encompasses features of the business cycle identified by Burns and Mitchell (1946), which tracks the comovement among economic variables through booms and busts as well as the nonlinearity in its evolution of the turning points of the business cycle. However, some studies have shown that the more complicated models like this do not replicate
business cycle features better than the simpler linear models and have been found to lack robustness with respect to the sample period and to a change in the data.

This procedure is less attractive to use because it does not allow for use of different frequencies of data (for example, monthly and quarterly) at the same time. To convert quarterly residential construction wages into a monthly series, a procedure for the interpolation of quarterly to monthly data is utilized. Another issue with this approach is that it does not allow for the use of different lengths in the time series. That is, if one or more series are published in a more timely manner, the initial methodology will allow estimation of the coincident index up to where the series are available even if one or more series are of shorter length, while the second will estimate the coincident index to the point at which data are available for all series.

The estimated coincident indexes from both models are presented in Figure 7. The Kim and Nelson index seems to lag Stock and Watson, not matching the turning points determined by the Real Estate Center by almost 12 months for the peak while matching the trough in June 2011 (Table 4). The asymmetry feature of the regime-switching is prevalent in the more accurate matching of the trough vs. the peak that lags behind the predetermined turning point. The differences in both indexes and the matching of the turning points is due to the role of residential employment in the Kim and Nelson index compared with the Stock and Watson index. As mentioned earlier, wages would be a better coincident indicator of actual residential construction activity than employment. Overall, estimates of the turning points generated by the Kim and Nelson model are less sharp and agree less with the Real Estate Center dates than the Stock and Watson model (Figure 7). When comparing the probability of recession identified by the methodologies, the Kim and Nelson index presents more false signals of the probability of recession than the Stock and Watson methodology (Figure 8). Thus, the Stock and Watson model seems to outperform the Kim and Nelson model to define expansions and recessions for residential construction in the state of Texas.
Conclusion

A coincident index for residential construction in Texas is estimated since 1990. This coincident index was constructed with real residential construction contract values and residential construction employment and wages. It demonstrated in this short period its ability to indicate broad directional changes in residential construction in a timely manner. Its estimates of the turning points are sharper and agree much more closely with dates determined by experts at the Real Estate Center.

The Texas residential construction index defines one brief slowdown in residential construction from 2001 to 2002 and a steep, long recession from 2007 to 2011. The index shows that the residential construction cycle differs in timing from the Texas business cycle and the U.S. residential construction cycle. Although the index performed well since 1990, this is a relatively short period by which to judge the coincident business cycle indicator. Currently, with data through December 2014, the index is signaling a healthy expansion in Texas residential construction activity with a very low probability that the sector is entering a downturn. The usefulness of this indicator to signal directional changes in Texas residential construction will be monitored in real time in the future.

Table 4. Chronology of Texas Residential Construction Business Cycle by Coincident Index

<table>
<thead>
<tr>
<th>Peak Date</th>
<th>Trough Date</th>
<th>Months Contraction, Peak to Trough</th>
<th>Months Expansion, Trough to Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock and Watson, September 2006</td>
<td>April 2011</td>
<td>55</td>
<td>192</td>
</tr>
<tr>
<td>Kim and Nelson, July 2007</td>
<td>June 2011</td>
<td>48</td>
<td>202</td>
</tr>
</tbody>
</table>

Note: Index starts in October 1990.
Source: Real Estate Center at Texas A&M University

Cañas and Phillips are with the Dallas Federal Reserve and Dr. Torres (lторres@mays.tamu.edu) is a research economist with the Real Estate Center at Texas A&M University.
References


Notes: Shaded areas represent a recession in Texas residential construction. Retrended with real contract values.

Source: Real Estate Center at Texas A&M University
Figure 2. Components of Texas Residential Construction Coincident Index  
(Index 1990: IV = 100)

Source: Real Estate Center at Texas A&M University
Figure 3. Texas Residential Construction Coincident Index and Texas Business Cycle
(Month-to-Month % Annualized, Seasonally Adjusted)

Notes: Shaded areas represent Texas recessions as defined by Yücel and Thompson, and Phillips Texas coincident index.

Source: Real Estate Center at Texas A&M University
Figure 4. Texas and U.S. Residential Construction Coincident Index  
(Index 1990: 10 = 100)

Notes: Shaded areas represent a recession in Texas residential construction. Both coincident indexes are retrended with real contract values.

Source: Real Estate Center at Texas A&M University
Figure 5. Texas and U.S. Residential Construction Coincident Index (Month-to-Month % Annualized, Seasonally Adjusted)

Source: Real Estate Center at Texas A&M University
Figure 6. Texas Residential Construction Coincident Index and Neftci Probability of Recession (Month-to-Month % Annualized, Seasonally Adjusted)
Note: Shaded areas represent a recession in Texas residential construction.

Source: Real Estate Center at Texas A&M University
Figure 8. Texas Residential Construction Coincident Index
Neftci Probability of Recession

Probability (%)

Source: Real Estate Center at Texas A&M University

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