

# Chicago Fed Letter

## The Chicago Fed National Activity Index and business cycles

by Scott Brave, business economist

This article discusses how the Chicago Fed National Activity Index—a monthly index designed to gauge economic activity and related inflationary pressures—can be used as an indicator of business cycle turning points.

The Chicago Fed National Activity Index (CFNAI) is a monthly index of U.S. economic activity constructed to summarize variation in 85 data series classified into four groups: production and income; employment, unemployment, and hours; personal consumption and housing; and sales, orders, and inventories.<sup>1</sup> The index is designed as a coincident indicator of national economic activity and serves as a leading indicator of activity-related inflationary pressures. In this

*Chicago Fed Letter*, I reexamine the relationship between the CFNAI and business cycle turning points.

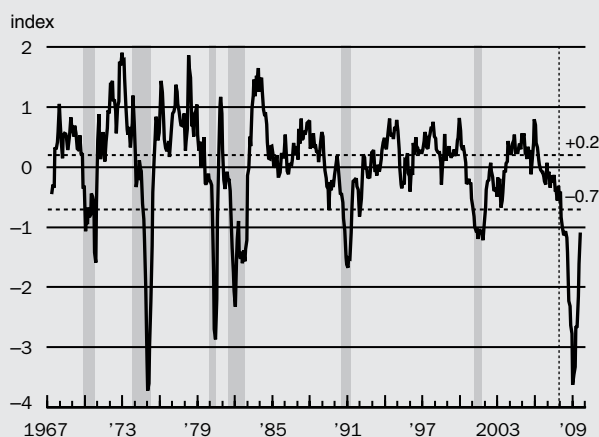
value of the index is “just right,” in that the economy is proceeding along its historical growth path. A negative value of the index is “cold,” in that growth is below average, while a positive value is “hot,” in that it is above average.

The CFNAI can be very volatile, since many of the monthly series that make up the index vary significantly from month to month. For this reason, the focus is often given to the three-month moving average of the index, i.e., the CFNAI-MA3 (figure 1), which smoothes the month-to-month variations over time in order to provide a more consistent picture of variations in economic growth around trend. When the values of this index reach certain levels that have been identified in previous research as “too hot,” the likelihood of an inflationary period rises; when it gets “too cold,” the likelihood of a recession rises.<sup>2</sup>

### Historical performance

Here, I focus on those levels of the three-month moving average index that are typical of economic activity during recessions as identified by the National Bureau of Economic Research (NBER). These “threshold values” identify large deviations of the CFNAI-MA3 from its mean of zero given its standard deviation of one. For instance, a CFNAI-MA3 value below  $-0.7$ , or greater than two-thirds of one standard deviation from its mean, is defined as

### 1. CFNAI-MA3 and business cycles

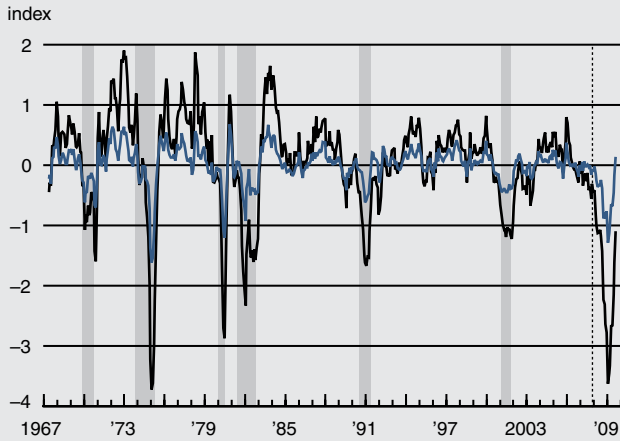


NOTES: CFNAI-MA3 is the Chicago Fed National Activity Index's three-month moving average. Shading indicates official periods of recession as identified by the National Bureau of Economic Research; the dashed vertical line indicates the most recent business cycle peak. A CFNAI-MA3 value below  $-0.70$  following a period of economic expansion indicates an increasing likelihood that a recession has begun. A CFNAI-MA3 value above  $+0.20$  following a period of economic contraction indicates a significant likelihood that a recession has ended.

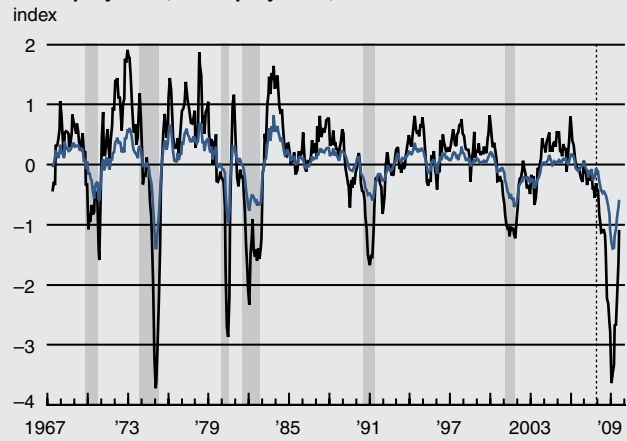
The CFNAI is an example of a “Goldilocks” index. In essence, this means that the information in various data series on national economic activity is combined in a way to reflect deviations around a trend rate of economic growth. Accordingly, the CFNAI is normalized to have a mean of zero and a standard deviation of one. In the Goldilocks terminology, this means that a zero

## 2. Four categories of the CFNAI-MA3

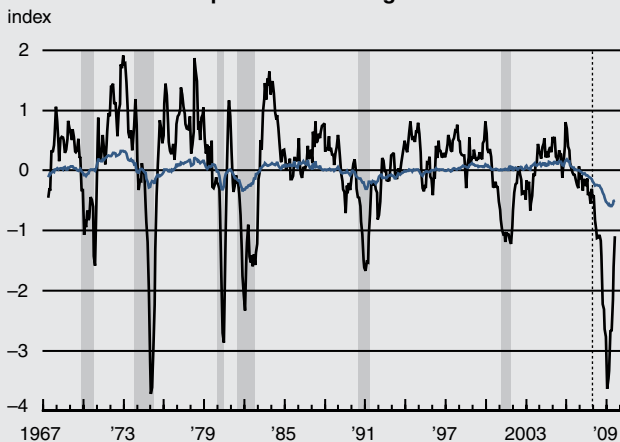
### A. Production and income



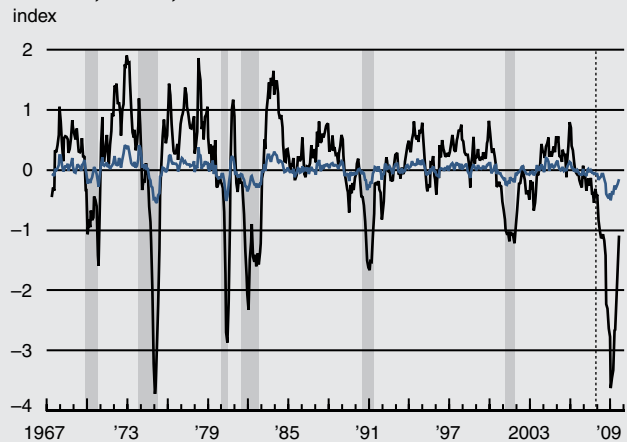
### B. Employment, unemployment, and hours



### C. Personal consumption and housing



### D. Sales, orders, and inventories



— CFNAI-MA3 category      — CFNAI-MA3

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indicating a significant likelihood that a recession has begun. Similarly, a recession is indicated to have likely ended based on the CFNAI-MA3 returning to a level of +0.2 after having crossed the  $-0.7$  threshold.

Historically, both thresholds have performed fairly well with respect to the recession timing as determined by the NBER (figure 1). The  $-0.7$  threshold has correctly predicted a recession month with 86% accuracy since 1967, identifying the beginning of a recession within three months on average; the  $+0.2$  threshold has correctly predicted the end of each recession since

1967 within eight months on average, with no false positive signals. However, the performance of the latter threshold has varied significantly over time, with the 1990–91 and 2001 recessions ending 18 months on average before  $+0.2$  was reached.

Given the subpar performance of the index in identifying the end of the two most recent recessions, it may be useful to consider alternative definitions of the likelihood of a recession's end. I propose here two such alternatives. These alternatives seek to make use of auxiliary information on U.S. recessions since 1967 and unify information

contained in the CFNAI-MA3 on business cycle turning points around a single threshold value of  $-0.7$ .

The first alternative relies on the fact that since 1967 all recessions have lasted for a minimum of six months. Using this information, a new threshold can be constructed where the end of a recession is signaled when the three-month moving average index attains a value greater than  $-0.7$  at least seven months after an NBER-defined recession has begun. Using this definition, the CFNAI correctly predicts the end of each recession since 1967 within one month on average, and all six of

the false positive signals from this definition are contained in the two recessions of the 1970s.

Another alternative is to base the definition of the likelihood of a recession's end on the CFNAI-MA3 attaining a value greater than  $-0.7$  following the point in time during an NBER recession when it first fell below this threshold. This alternative removes any potential error in identifying a recession's likely ending point from incorrectly identifying

August of this year, the CFNAI-MA3 has increased by nearly 2.5 standard deviations. Despite this steady improvement, at  $-1.09$  as of the September 28, 2009, release, the index continues to be below the  $-0.7$  threshold. Substantial economic slack exists in the U.S. economy as evidenced by the fact that the three-month moving average remains just slightly more than one standard deviation below its mean. However, the index now indicates a level of economic activity above the

the index is clear, since it took this category a substantially longer period of time to return to trend.

In contrast, the contributions of the production and income (panel A) and sales, orders, and inventories (panel D) categories tend to turn negative more quickly during a recession and turn positive once the recovery begins. That said, the contribution of the personal consumption and housing category (panel C) demonstrates substantial variability in its behavior during recessions (sometimes leading, sometimes lagging); and in the case of the 2001 recession, it shows no discernible impact.

## Taking a closer look at the categories of indicators that make up the index can be helpful in explaining the ongoing weakness in the economy in relation to past recessions.

its beginning. By this definition, the CFNAI also correctly predicts the end of each recession within one month on average, with four false positive signals that all occur during the 1969–70 recession. Thus, both of these alternatives more accurately describe the timing of recessions since 1980.

The monthly release of the CFNAI is a benefit that can be exploited in real time to determine business cycle turning points. For instance, with regard to the current recession, the index correctly identified December 2007 as the start date in its March 24, 2008, release, nearly eight months before the official declaration by the NBER. However, using the index as an indicator of a recession's end in real time is more difficult. The real-time use of both my alternative threshold definitions presupposes that the recession has already been identified by the NBER. Given the length of a typical recession and the performance of the index in identifying the beginning of a recession, this concern should be minimal.

### CFNAI indicator categories

The history of the index shown in figure 1 demonstrates that the current recession marks the steepest decline in economic activity since the 1973–75 recession, and possibly the longest since the 1981–82 recession, depending on its official end. From January through

trough of the two most recent recessions prior to the current one.

Taking a closer look at the categories of indicators<sup>3</sup> that make up the index can be helpful in explaining the ongoing weakness in the economy in relation to past recessions. It is well known that the recoveries from the 1990–91 and 2001 recessions were muted in part because of the sluggish response of the labor market. This points out a potential weakness in the relationship between the CFNAI-MA3 and business cycle turning points.<sup>4</sup> Recessions are typically defined based on widespread changes in economic activity. However, when individual sectors of the economy diverge sharply from the rest, this information can provide further insight into the nature of a recession and the subsequent recovery. Therefore, looking just at the CFNAI-MA3 may obscure potentially useful information.

Consider figure 2, which charts the contributions to the CFNAI-MA3 from each of its four categories of indicators. One can see notable differences in them over the business cycle. For instance, the contribution of the employment, unemployment, and hours category (panel B) tends to lag the CFNAI-MA3 as a whole. This category's greatest negative contribution to the index is generally made near the end of a recession. Also, in the case of the 1990–91 and 2001 recessions, the impact of the jobless recovery on

These observations are in line with well-documented business cycle facts. For instance, it is well known that the labor market tends to be a lagging indicator of the business cycle. Furthermore, the casual definition of a recession as two quarters of negative real gross domestic product growth conforms well to the fact that production and income indicators tend to decline at the onset of recessions. Finally, the behavior of the sales, orders, and inventories category reflects the fact that declining sales and orders that accompany a recession are typically followed by liquidations of inventories, only to have firms build them up again when demand improves.

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Behavior that deviates from these norms can, thus, be illustrative of the type of recession and recovery to be expected. For instance, the contribution from the personal consumption and housing category reached an all-time low during the current recession, with the beginning of the decline in this category preceding the recession by over a year. The extent of the decline, reflecting the struggles of the residential housing market after home prices began to fall sharply in 2006, is unprecedented in the index's history. As of the September 28, 2009, release, despite some recent improvement in residential housing indicators, the contribution to the CFNAI-MA3 from this category was still  $-0.50$ . Given the persistence of this component, it is likely to be a drag on economic activity for some time to come.

That said, looking at the employment, unemployment, and hours category offers some hope for the beginning of a recovery. The negative contribution of this category bottomed out in February 2009. Based on its behavior during past recessions, this often has served as an early signal of a recovery. However, such a signal has not always been accurate. For instance, during

the 1981–82 recession this category exhibited a W-like pattern, rising and falling more than once before the end of the recession. In addition, the amount of resource slack indicated by the category's August 2009 contribution of  $-0.58$  also suggests further skepticism about a full recovery is warranted.

Still, in recent months, contributions from both the production and income and the sales, orders, and inventories categories have also improved considerably. The contributions of both groups bottomed out at the CFNAI-MA3's most recent trough of January 2009. In the past, a neutral contribution of these groups during a recession has been an early sign of a recovery. As of the September 28, 2009, release, the contribution of the production and income category had turned slightly positive, while the sales, orders, and inventories category remained slightly negative. Thus, it appears likely that recovery from the current recession had not yet reached full swing as of August 2009, but early signs of recovery are apparent.

### Conclusion

The CFNAI has historically performed well in relation to NBER recession dates. However, its accuracy in determining

the ends of recent recessions has been subpar. Adjusting the way the three-month moving average index is interpreted based on alternative definitions of the likelihood of a recession's end can help to improve its performance in this regard. Furthermore, individual inspection of the four categories of indicators that make up the index can provide additional information on the nature of a recession and the subsequent recovery. Applying these methods to the current recession offers some signs of a recovery.

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<sup>1</sup> Additional information on the construction of the CFNAI can be found at [www.chicagofed.org/cfnai](http://www.chicagofed.org/cfnai).

<sup>2</sup> See Charles L. Evans, Chin Te Liu, and Genevieve Pham-Kanter, 2002, "The 2001 recession and the Chicago Fed National Activity Index: Identifying business cycle turning points," *Economic Perspectives*, Federal Reserve Bank of Chicago, Vol. 26, No. 3, Third Quarter, pp. 26–43.

<sup>3</sup> The four indicator categories discussed here were made publicly available with the September 28, 2009, release at [www.chicagofed.org/cfnai](http://www.chicagofed.org/cfnai).

<sup>4</sup> See Mary Daly, Bart Hobijn, and Joyce Kwok, 2009, "Jobless recovery redux?," *FRBSF Economic Letter*, Federal Reserve Bank of San Francisco, No. 2009-18, June 5, available at [www.frbsf.org/publications/economics/letter/2009/el2009-18.html](http://www.frbsf.org/publications/economics/letter/2009/el2009-18.html).