

# Chicago Fed Letter

## Economic trends and the Chicago Fed National Activity Index

by Scott Brave, senior associate economist

This article discusses an experimental methodology for the Chicago Fed National Activity Index—a monthly index designed to gauge overall economic activity and inflationary pressure. The goal is to see how well it accounts for recent structural changes in the U.S. economy.

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; personal consumption and housing; employment, unemployment, and hours; and sales, orders, and inventories.<sup>1</sup> Recent structural changes in several sectors of the U.S. economy raise the possibility that the current index methodology is not reflecting the recent contributions of its individual series to average economic growth as accurately as my colleagues and I at the Chicago Fed would like. In this *Chicago Fed Letter*, I examine this prospect and report the results of an experi-

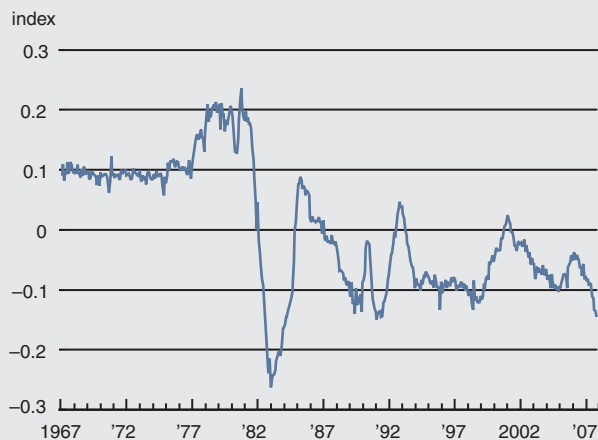
mental estimation methodology to account for these concerns. I find that, on average, over the full sample period, 1967–2007, the difference between the two CFNAI methodologies is small, but varies substantially during shorter periods of time (see figure 1).

### Current methodology

The CFNAI is an example of a “Goldilocks” index—a term often used in the popular press. 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 standard deviation of one. In the Goldilocks terminology, this means that a zero 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, as 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, which smoothes these month-to-month variations over time in order to provide a more consistent picture of variations in economic growth around trend. When the value of this index reaches 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.

### 1. CFNAI, difference between methodologies



Current CFNAI minus experimental CFNAI

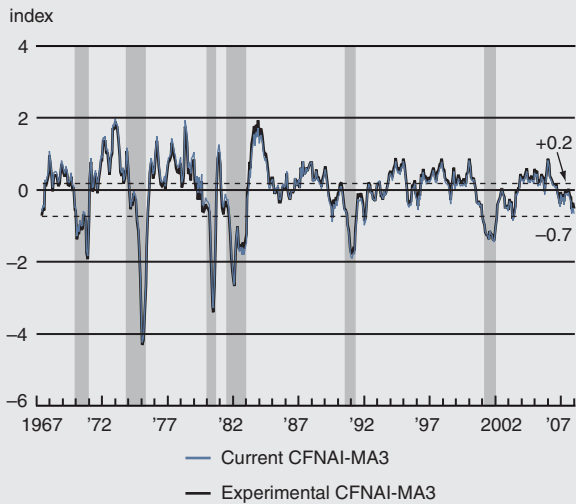
Mean: 0.00

Median: -0.02

Standard deviation: 0.11

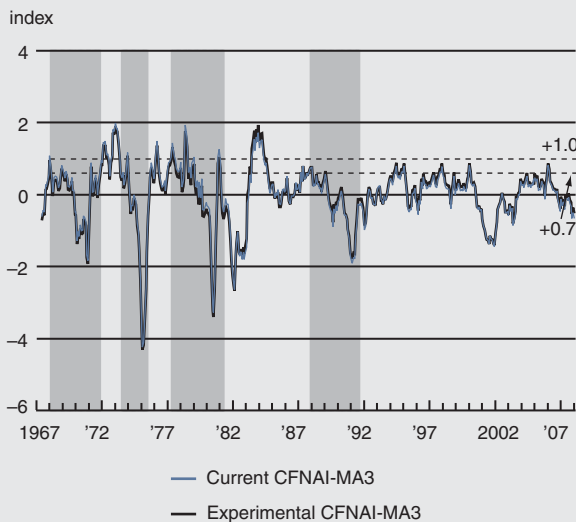
NOTE: CFNAI means Chicago Fed National Activity Index.

## 2. 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. 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.

## 3. CFNAI-MA3 and inflation cycles



NOTES: CFNAI-MA3 is the Chicago Fed National Activity Index's three-month moving average. Shading represents periods of substantial inflation increases. A CFNAI-MA3 value above  $+0.70$  more than two years into an economic expansion indicates an increasing likelihood that a period of sustained increasing inflation has begun. A CFNAI-MA3 value above  $+1.00$  more than two years into an economic expansion indicates a substantial likelihood that a period of sustained increasing inflation has begun.

### Potential problems with the index

Clearly, for a zero value of the CFNAI to accurately depict trend growth, the average rates of growth in the underlying series must be accurately accounted for. For instance, a failure to adjust for a change in the average growth rate of a significant number of series can cloud the meaning of the CFNAI-MA3, as the

level of the index will be biased by the degree to which one under- or overestimates the level of trend growth. Every series in the CFNAI has been transformed in such a way as to remove previously identified trends; however, the nature of a growing economy is such that the emergence of new trends is highly probable. These changes occur over a considerable amount of time, and it can often take even longer before there exists sufficient evidence to confirm them. Therefore, the CFNAI methodology must be periodically reexamined to keep it in line with changing economic conditions. Here, I point out two issues that may be affecting the calculation of the index.

Recent research has shown the emergence of several aspects of structural change in U.S. labor markets. This effect has potentially filtered into the CFNAI through the payroll survey of establishments, which is the source of many of the employment indicators that are used. While it was common to see monthly gains

in nonfarm payroll employment exceed 150,000 during the late 1990s, recent gains are on average much smaller, i.e., around 100,000. Instead of signaling a decline in labor markets, economists have noted that lower trend growth in employment may be a reflection of changing labor force demographics and steadily declining labor force participation rates

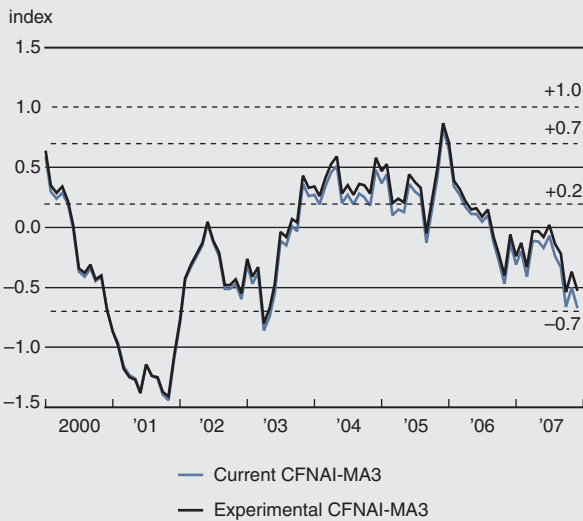
over the decade.<sup>2</sup> Similarly, the boom in residential investment during much of the previous decade has ended, and construction has declined substantially since early 2006. This fact is most readily apparent in the housing starts and permits data that underlie the consumption and housing category of indicators in the CFNAI, as both of these series are demonstrating average rates of growth that are much lower than in the previous decade.

### An experimental methodology

To investigate the degree of potential bias in the CFNAI due to these two issues, I recently conducted a test of the method used to remove trends from the underlying data series. Currently, a previously identified stationary transformation is applied to each series. Then, each series is normalized by subtracting its mean and dividing by its standard deviation, where these statistics are calculated using the entire sample of available data.<sup>3</sup> As an example, for nonfarm payroll employment, the first difference of the natural log transformation is initially applied, and next the series is normalized by its sample mean and standard deviation. The test I conducted centered on the use of a 120-month moving average normalization for each transformed series. That is, for each month in my sample I normalized every transformed series by subtracting its mean calculated using only the data for the prior 120 months and dividing by the standard deviation of the resulting series. The advantage of normalizing each series in such a way is that, contrary to the current method, it allows for very slow moving changes in trend growth, i.e., around a decade in length. I chose a decade as the time reference to reflect the approximate average length of a business cycle during the period for which the CFNAI is calculated.

I performed this exercise for each of the four categories of indicators that make up the index, using the data available for the December 2007 CFNAI (released in January 2008). From March 1967 through December 2007, I observe small differences in each category between the current and experimental methodologies. On average, the difference between the current method and

#### 4. Recent CFNAI-MA3 and relevant thresholds



NOTES: CFNAI-MA3 is the Chicago Fed National Activity Index's three-month moving average. 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. A CFNAI-MA3 value above  $+0.70$  more than two years into an economic expansion indicates an increasing likelihood that a period of sustained increasing inflation has begun. A CFNAI-MA3 value above  $+1.00$  more than two years into an economic expansion indicates a substantial likelihood that a period of sustained increasing inflation has begun.

the 120-month moving average method is essentially zero for consumption and housing; 0.01 for production and income; 0.01 for sales, orders, and inventories; and 0.02 for employment, unemployment, and hours. Variation around these means is also limited, as the standard deviations are 0.02 for sales, orders, and inventories; 0.03 for production and income; 0.04 for consumption and housing; and 0.05 for employment, unemployment, and hours.

However, the story changes for shorter time periods. For instance, focusing on recent data, I find that the current methodology consistently calculates lower values for employment-related indicators and higher values for housing-related indicators since 2003. In contrast, I find very little difference in the other categories during this period. This result offers some evidence of structural change in labor and housing markets over the last two decades, as historical trend rates of growth appear to have fluctuated in the series that are used to capture these sectors of the economy.

The CFNAI is a weighted average of the values of each category of indicators. Not surprisingly, then, when I compare

the CFNAI by methodology, I do not find large discrepancies between the two methods. Over the entire sample period, the average difference between the current and experimental methods for the CFNAI is essentially zero, while the standard deviation is only 11% of the index's constructed standard deviation. However, as figure 1 demonstrates, over shorter time periods the differences are more substantial. For instance, the "Great Moderation" is visibly evident as the two methodologies diverge during the late 1970s and early 1980s, when substantial structural

changes occurred across multiple sectors of the U.S. economy.<sup>4</sup> More recent values of the CFNAI also have begun to differ substantially, as the differences I observe between methodologies for employment-related indicators have become greater than those for housing-related indicators.

At this level of discrepancy, the choice of methodology is unlikely to seriously alter the interpretation of the CFNAI-MA3. In fact, I find insignificant differences between the two methods in identifying recessions and inflationary periods using the CFNAI-MA3 as shown in figures 2 and 3, respectively. Previous research has indicated that CFNAI-MA3 values less than or equal to  $-0.7$  after a period of economic expansion often coincide with recession periods as identified by the National Bureau of Economic Research.<sup>5</sup> I find that both methods are nearly equally predictive in identifying recessions in this fashion. The same is true for the  $+0.2$  value that serves as a signal for the end of a recession. Similarly, previous research has shown that inflationary periods often coincide with values greater than or equal to  $+0.7$  more than two years into an economic expansion.<sup>6</sup> Here, once

again, both methods are nearly equally predictive in identifying these periods, as well as high-risk inflation periods associated with values greater than or equal to  $+1.0$ .

During the past decade, we have approached both the recession and inflation thresholds, offering a good opportunity to critique the most recent interpretations of the index. Figure 4 shows the CFNAI-MA3 since January 2000. Under the current methodology, the CFNAI-MA3 crossed the inflation threshold of  $+0.7$  in December 2005, only to return below it in the following month. Under the experimental methodology, the CFNAI-MA3 remained above this threshold for two consecutive months. Thus, the experimental methodology would have placed a slightly higher level of concern on a potential rise in inflationary pressures from economic activity during 2006, but not much more than the current method.

In terms of recessions, both the current and experimental CFNAI-MA3 correctly indicated the 2001 recession. However, under the current methodology, the index failed to achieve the  $+0.2$  threshold level immediately following the 2001 recession. Instead, it briefly returned below the recession threshold of  $-0.7$  in April and

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*Chicago Fed Letter* is published monthly by the Research Department of the Federal Reserve Bank of Chicago. The views expressed are the authors' and are not necessarily those of the Federal Reserve Bank of Chicago or the Federal Reserve System.

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ISSN 0895-0164

May of 2003, signaling a prolonged sluggish recovery that in fact occurred. This same type of signal was observed following the 1990–91 recession in December 1991 and January 1992, and has come to be associated with a slower recovery period than past recessions, particularly in the labor market, i.e., a “jobless recovery.” Using the experimental methodology, only April 2003 was below this threshold, suggesting very slight differences between the methods in the predicted recovery time for the 2001 recession and its most recent predecessor.

The current methodology also showed CFNAI-MA3 values in October and December of 2007 that were roughly 0.03 above the recession threshold of  $-0.7$ , suggesting that a recession was becoming more likely. However, after adjusting for changes in trends in labor and housing

markets, the experimental methodology was roughly 0.17 from this threshold in those months, suggesting less concern. In this respect, the current period demonstrates that during times of changing trends, the methodology used to interpret the index may matter more. Recently weak employment and housing numbers that are currently driving the index appear to have very different effects depending on how these changing trends are accounted for. Therefore, it may be important to keep in mind these differences over the coming year when interpreting the CFNAI-MA3.

### Conclusion

I find some evidence that recent structural changes in labor and housing markets are currently making an impact on the calculation of the CFNAI and the

interpretation of the CFNAI-MA3. In spite of this fact, the historical interpretation of the overall index remains very similar under both the experimental method for dealing with this problem and the current methodology. The thresholds currently used to indicate the likelihood of a recession or sustained inflationary period apply equally well to each methodology. However, as recent values of the index indicate, during periods of structural change the differences between methodologies can be substantial enough to alter these inferences. For this reason, my colleagues and I at the Chicago Fed will continue to monitor the behavior of the index and its component series in order to determine whether it will be necessary to change the CFNAI methodology to preserve the usefulness of the index as a cyclical indicator.

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

<sup>2</sup> Riccardo DiCecio, Kristie M. Engemann, Michael T. Owyang, and Christopher H. Wheeler, 2008, “Changing trends in the labor force: A survey,” *Review*, Federal Reserve Bank of St. Louis, Vol. 90, No. 1, January/February, pp. 47–62; Daniel Aaronson, Kyung-Hong Park, and Daniel Sullivan, 2006, “The decline in teen labor force participation,” *Economic Perspectives*,

Federal Reserve Bank of Chicago, Vol. 30, No. 1, First Quarter, pp. 2–18.

<sup>3</sup> See the technical report at [www.chicagofed.org/cfnai](http://www.chicagofed.org/cfnai) for more detailed information on the current construction of the CFNAI.

<sup>4</sup> The Great Moderation is a recent economic phenomenon—from approximately 1980 to the present—when volatility dramatically decreased for changes in economic activity, consumption, and inflation.

<sup>5</sup> 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>6</sup> Jonas D. M. Fisher, 2000, “Forecasting inflation with a lot of data,” *Chicago Fed Letter*, Federal Reserve Bank of Chicago, No. 151, March.