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A different way to review the Chicago Fed National Activity Index

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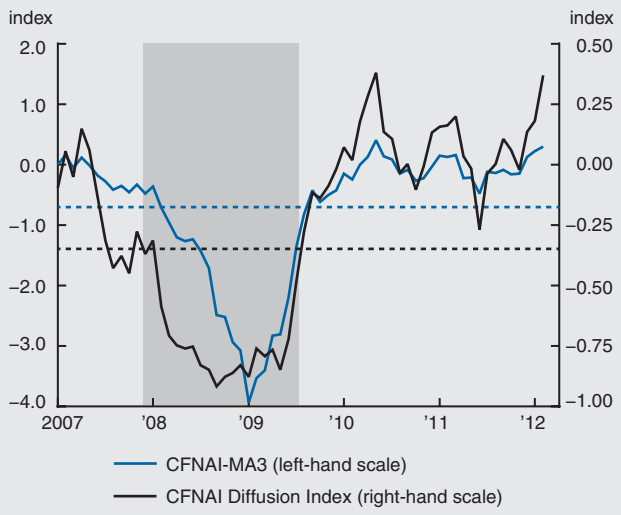
This article analyzes the recent sources of strength and weakness in the Chicago Fed National Activity Index (CFNAI), using a new measure that is often a leading indicator of the index's movements.

The Chicago Fed National Activity Index is a monthly index of U.S. economic activity constructed as a weighted average of 85 economic indicators classified into four groups: production and income; employment, unemployment, and hours; personal consumption and housing; and sales, orders, and inventories.[1] It is designed as a coincident indicator of national economic activity.

1. CFNAI and CFNAI Diffusion Index



NOTES: Data are through February 2012. This figure depicts the three-month moving averages of the Chicago Fed National Activity Index (CFNAI-MA3) and the CFNAI Diffusion Index; for further details, see note 5. The shading indicates an official period of recession as identified by the National Bureau of Economic Research. The blue and black dashed lines represent thresholds derived for the CFNAI-MA3 and the CFNAI Diffusion Index, respectively, indicating an increasing likelihood that a recession has begun (values below) or ended (values above). The thresholds are −0.7 for the CFNAI-MA3 and −0.35 for the CFNAI Diffusion Index, and they are derived according to the methodologies described in Evans, Liu, and Pham-Kanter (2002) and Berge and Jordà (2011), respectively.

In this *Chicago Fed Letter*, we describe a diffusion index[2] constructed from the weights given to each of the underlying indicators of the CFNAI. We find that this diffusion index is often a leading indicator of the CFNAI's movements. Thus we use this index to help explain the recent sources of strength and weakness in the CFNAI and discuss its likely implications for growth in economic activity in 2012.

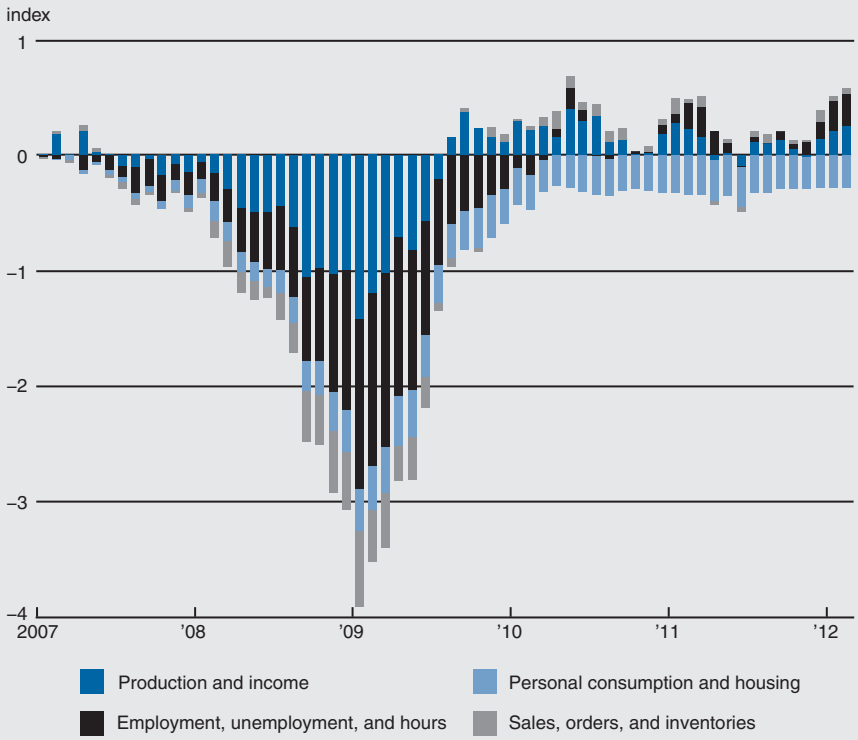
CFNAI and economic activity in 2011

The CFNAI is an example of a "Goldilocks" index. Essentially, this means that the information in various data series on national economic activity is combined in such 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 value of the index is "just right," suggesting that the economy is proceeding along its long-term historical growth path. A negative value of the index is "cold," in that it suggests growth is below average, while a positive value is "hot," in that it suggests growth is above average.

The CFNAI can be very volatile, since many of the series that make up the index vary significantly from month to month. For this reason, we focus on the three-month moving average of the index, i.e., the CFNAI-MA3 (the blue line in 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 its long-term trend. This smoothed version of the index has an excellent track record in identifying business cycle turning points as well as the buildup of inflationary pressures from growth in economic activity significantly above its trend rate.[3]

The modest recovery from the deep recession that lasted from December 2007 through June 2009 continued in 2011, according to the CFNAI. However, as figure 1 demonstrates, the recovery was

2. Contributions to CFNAI, by indicator categories



NOTES: Data are through February 2012. This figure depicts the contributions of each of the four broad categories of indicators that make up the Chicago Fed National Activity Index (CFNAI) shown as three-month moving averages.

not without considerable volatility. The CFNAI-MA3 began last year indicating economic growth slightly above its long-run trend, and maintained this position throughout the first quarter of 2011. The second quarter saw steep declines in the index as it plummeted to its lowest level since late 2009, although it remained above the threshold (–0.7) historically indicating the economy has entered a recession. The CFNAI-MA3 then gradually improved during the third and fourth quarters, ending 2011 just above its long-run trend.

The production and income category drove much of the movement in the CFNAI over the course of 2011 (see figure 2). This category's contribution was strongly positive during the first quarter, but dropped steeply in April and was largely neutral over the second quarter. It then rebounded during the summer months and by year's end had returned to its March 2011 level. These movements largely reflected the dynamics of manufacturing industrial production and capacity utilization[4]—which suffered early in the year from the supply chain disruptions associated with Japan's natural disasters in March, but had rebounded by year's end.

The employment, unemployment, and hours category also contributed to the volatility in the CFNAI over the course of 2011. During the first quarter's strong showing, the support came largely from above-average gains in payroll employment. But after April, job gains slowed considerably and initial claims for unemployment insurance (UI) rose as well. The result was a drop in this category's contribution to the CFNAI to just below zero by the end of the second quarter. By the end of the third quarter, however, job gains had begun to climb steadily; such gains combined with a declining unemployment rate and decreasing initial UI claims had raised this category's contribution above zero through the end of the year.

The contribution of the sales, orders, and inventories category to the CFNAI throughout 2011 largely mirrored that of the production and income category. In contrast, the final category, personal consumption and housing, continued to make strong negative contributions to the CFNAI for the fourth consecutive year. This category did, however, experience a slight upward trend from May 2011 through the end of last year based on improving housing starts and permits numbers that, with the exception of August, were above 600,000 annualized units per month.

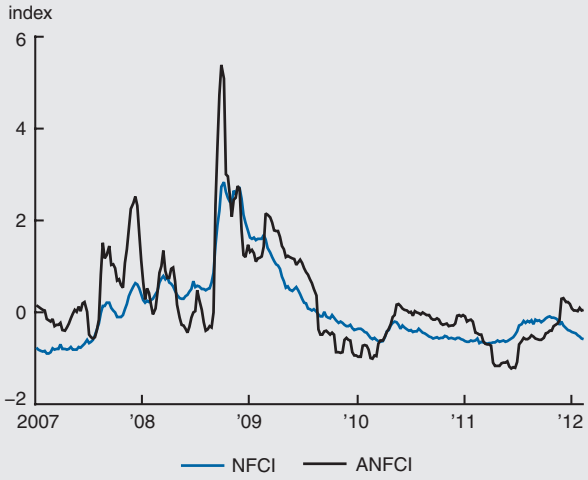
Looking ahead through 2012

The movements of the CFNAI in early 2012 suggest that growth in economic activity continues to edge further above its long-run trend. Given the unevenness of the recovery to date, it is worthwhile to reexamine the current sources of strength and weakness in the CFNAI and compare them with the developments of the past two years. To summarize this information, we have developed a new metric based on the magnitude of the weight given to each of the underlying indicators in the CFNAI. The construction of this "CFNAI Diffusion Index" is detailed in the accompanying note, and the new measure is also plotted in figure 1.[5]

We track the general trend in improvement and deterioration in the underlying indicators of the CFNAI by tracing the movements of the CFNAI Diffusion Index between –1 and +1. If all of the underlying indicators in a given month are below their long-run averages, this index will equal –1; and if all of the indicators are above their long-run averages, it will equal +1. This is useful in that we can observe the momentum of the CFNAI as its underlying indicators shift above and below their long-run averages over time.

The CFNAI Diffusion Index's usefulness as a leading indicator of the CFNAI's movements can be seen in figure 1. After dipping into recessionary territory in late 2007, the CFNAI Diffusion Index bottomed out at –0.92 in September 2008—four months before the CFNAI-MA3 reached its lowest point of the most recent recession. After signaling a recovery was under way in mid-2009 (one month ahead of the CFNAI-MA3), the CFNAI Diffusion Index has been

3. Financial conditions and CFNAI



NOTES: Data are through March 23, 2012. This figure displays the recent history of the Chicago Fed's National Financial Conditions Index (NFCI) and adjusted NFCI (ANFCI). Values of the NFCI above zero indicate financial conditions that are tighter than average, while values below zero indicate financial conditions that are looser than average. A zero value for the ANFCI indicates a typical level for financial conditions given the contemporaneous value of the three-month moving average of the Chicago Fed National Activity Index (CFNAI-MA3) and three-month total inflation as measured by U.S. Bureau of Economic Analysis's Personal Consumption Expenditures Price Index. ANFCI values above zero then indicate financial conditions that are tighter than would typically be suggested by contemporaneous economic conditions, and values below zero indicate the opposite.

above zero three times since; two of these occasions corresponded with periods where the CFNAI-MA3 was also above its long-run trend. In each of these two instances, the CFNAI Diffusion Index provided a leading signal of the CFNAI-MA3 rising above zero, reaching this level itself one to two months before the CFNAI-MA3.

An exception occurred in mid to late 2011. Early in 2011, the CFNAI Diffusion Index was markedly positive before dropping very steeply in the second quarter. However, even at its lowest point of the year, it too remained above its recessionary threshold (–0.35).[6] The CFNAI-MA3 stayed below zero for nearly the remainder of 2011, but the CFNAI Diffusion Index rebounded, spending all but one month in the second half of the year above zero. In contrast, the most recent rise of the CFNAI-MA3 coincided with a substantial increase in the CFNAI Diffusion Index above zero.

One could view the recent behavior of the CFNAI Diffusion Index as reflecting the temporary nature of the weakness in economic activity in the first half of 2011. As the production-related indicators in the CFNAI rebounded in late 2011, the CFNAI-MA3 caught up to the improvement in the CFNAI Diffusion Index. Interestingly, both the CFNAI-MA3 and the CFNAI Diffusion Index in early 2012 are now at their highest respective levels since May 2010—the high point of the recovery to date according to both measures.

The peak in the CFNAI-MA3 in the spring of 2010 was short-lived, as growth in the second half of the year slowed considerably. Both the CFNAI-MA3 and the CFNAI Diffusion Index swiftly fell into negative territory during the final six months of 2010. One potential explanation is the possible aftereffects of the unexpected tightening in financial conditions that occurred over the course of 2010. Consider figure 3, which depicts the Chicago Fed's National Financial Conditions Index (NFCI) and adjusted National Financial Conditions Index (ANFCI). These measures of financial activity are constructed similarly to the CFNAI.[7] Positive values of the NFCI denote financial conditions that are tighter than on average, and positive values of the ANFCI denote financial conditions that are tighter than would typically be suggested by the CFNAI-MA3.[8]

Both the NFCI and ANFCI remained negative in 2011; however, as in 2010, they also increased considerably in the second half of the year, indicating a tightening in financial conditions. While considerable improvement in the NFCI in recent months has been observed, the ANFCI in early 2012 moved above zero, reaching its highest point since late 2009, before moving back to near zero in recent weeks. This development is an indication that the improvement in financial conditions did not keep pace with the improvement in economic activity early in the year. As such, financial conditions may have served as a slight drag on economic activity. Continued improvement in the ANFCI would thus be a good sign for growth in the remainder of 2012.

Conclusion

Recent readings of the CFNAI offer some optimism for economic growth in 2012. Production- and employment-related indicators have rebounded significantly from mid-2011. However, the housing market continues to be a substantial drag on the index; and sales, orders, and inventories indicators have yet to demonstrate sustained strength. That said, recent trends in the CFNAI Diffusion Index are suggestive of economic growth slightly above its long-term trend in 2012, which would mark another year of recovery as well as an improvement from 2011. As part of our continuing efforts to track economic activity, we will be making the CFNAI Diffusion Index available in future CFNAI releases.

[1] Additional information on the construction of the CFNAI can be found at www.chicagofed.org/cfnai.

[2] A diffusion index measures the degree to which a change in a composite index is

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"diffused," or spread out, among the latter index's components. That is, a diffusion index breaks down a composite index, and analyzes its components separately to determine the degree to which they are moving in agreement with the dominant direction of the composite index.

[3] See James H. Stock and Mark W. Watson, 1999, "Forecasting inflation," *Journal of Monetary Economics*, Vol. 44, No. 2, October, pp. 293–335; Jonas D. M. Fisher, 2000, "Forecasting inflation with a lot of data," *Chicago Fed Letter*, Federal Reserve Bank of Chicago, No. 151, March; 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, Third Quarter, pp. 26–43; Scott Brave, 2009, "The Chicago Fed National Activity Index and business cycles," *Chicago Fed Letter*, Federal Reserve Bank of Chicago, No. 268, November; and Scott Brave and R. Andrew Butters, 2010, "Chicago Fed National Activity Index turns ten—Analyzing its first decade of performance," *Chicago Fed Letter*, Federal Reserve Bank of Chicago, No. 273, April.

[4] Capacity utilization is calculated as the actual output produced with installed equipment divided by the potential output that could be produced with it if used to its full capacity.

[5] The CFNAI Diffusion Index is calculated in the following way:

$$CFNAI_{Diff} = \frac{\sum |w_{+}| - \sum |w_{-}|}{\sum |w|}.$$

In other words, it is the sum of the absolute values of the weights for the underlying indicators whose contribution to the CFNAI is positive in a given month less the sum of the absolute values of the weights for those indicators whose contribution is negative or neutral in a given month, expressed as a proportion of the total sum of the absolute values of the weights. By construction, the sum of the absolute values of the CFNAI weights is one, so that the numerator in the expression is necessarily the CFNAI Diffusion Index. To make this measure comparable to the CFNAI-MA3, we take its three-month moving average as shown figure 1. This measure is slightly different than the typical diffusion index, which generally uses the number of positive versus negative and neutral indicators instead to get a sense of the dominant direction of a composite index. We also tried constructing this more standard diffusion index with the CFNAI indicators, but found it to be an inferior leading indicator of the CFNAI.

[6] This threshold was calculated using the techniques described in Travis J. Berge and Òscar Jordà, 2011, "Evaluating the classification of economic activity into recessions and expansions," *American Economic Journal: Macroeconomics*, Vol. 3, No. 2, April, pp. 246–277. The CFNAI Diffusion Index signals the beginnings and ends of recessions on average one month earlier than the CFNAI-MA3.

[7] For more information on the NFCI and ANFCI, go to www.chicagofed.org/nfci.

[8] An adjustment is also made for the contemporaneous level of total inflation as measured by the U.S. Bureau of Economic Analysis's Personal Consumption Expenditures Price Index. For more details, see Scott Brave and R. Andrew Butters, 2011, "Monitoring financial stability: A financial conditions index approach," *Economic Perspectives*, Federal Reserve Bank of Chicago, Vol. 35, First Quarter, pp. 22–43.