1.16 RESEARCH BRIEF

Revising AIER's Business-Cycle Conditions Model

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Updates to our model will help us identify turning points in the economy

It's been said that the only constant in life is change. That idea certainly holds true for economies. Research at AIER is based on sound economic theory and backed by empirical analysis. The same combination of theory and empirical study is the foundation of our Business-Cycle Conditions model. In simple terms, our model is a set of economic indicators combined in a way that anticipates turning points in a business cycle. We stress that our use of the statistical indicators is only one of the tools available to help forecast the near-future, cyclical trend of business activity.

A business cycle consists of an economic expansion and a recession. A recession is a period between a peak and a trough in economic activity, and an expansion is a period between a trough and a peak. During a recession, a significant decline in economic activity spreads across the economy and can last from a few months to a year or more. Similarly, during an expansion, economic activity rises substantially, spreads across the economy, and typically lasts for several years. For information on why business cycles occur, see the classic "Cause and Control of the Business Cycle" by Col. E.C. Harwood, AIER's founder (https://www.aier.org/research/cause-and-control-business-cycle).

Originally developed more than 50 years ago, our Business-Cycle Conditions model has amassed an enviable track record of identifying turning points in the business cycle. Over the many decades that our model has been in use, we periodically review how well it is working and, when necessary, update it. Last year we began such a review.

Among the many forces that can lead to changes in an economy are improved technologies, demographic or political shifts, policy changes, new regulations, trade pacts, and cultural preferences. It's not hard to recall a wide range of major changes in all those areas over the course of the past few business cycles.

Goal: Continue to pinpoint turning points

As we began to review our business-cycle conditions model, we carefully studied the history of business-cycle research, both inside and outside of AIER. That review and a check on the track record of our model led us to our first realization and goal. The work done here at AIER was admirable and sound, so our first goal was to retain the broad structure and spirit of the model. Specifically, the goal of our model would continue to be identifying turning points in the economy. We would maintain the overall structure and the commitment to data and scientific analysis.

Second, we would employ the latest quantitative techniques, but we also would continue the tradition and practice of engaging AIER economists in a qualitative capacity, thereby preserving the "human element" of data analysis.

Third, we would continue to use a diffusion index methodology for the final model. A diffusion index measures breadth and is sensitive to the number of indicators that are rising, falling, and remaining stable. The model is not intended to estimate growth rates or to produce a specific numerical forecast. Rather, it anticipates whether a turning point is near.

Fourth, we would seek to ensure that the individual indicators used in the final model would be broadly diversified and representative of as many different aspects of the economy as prudently possible.

Finally, of course, we would seek to improve the accuracy of the overall model in anticipating both peaks and troughs in economic activity.

How the new model stacks up

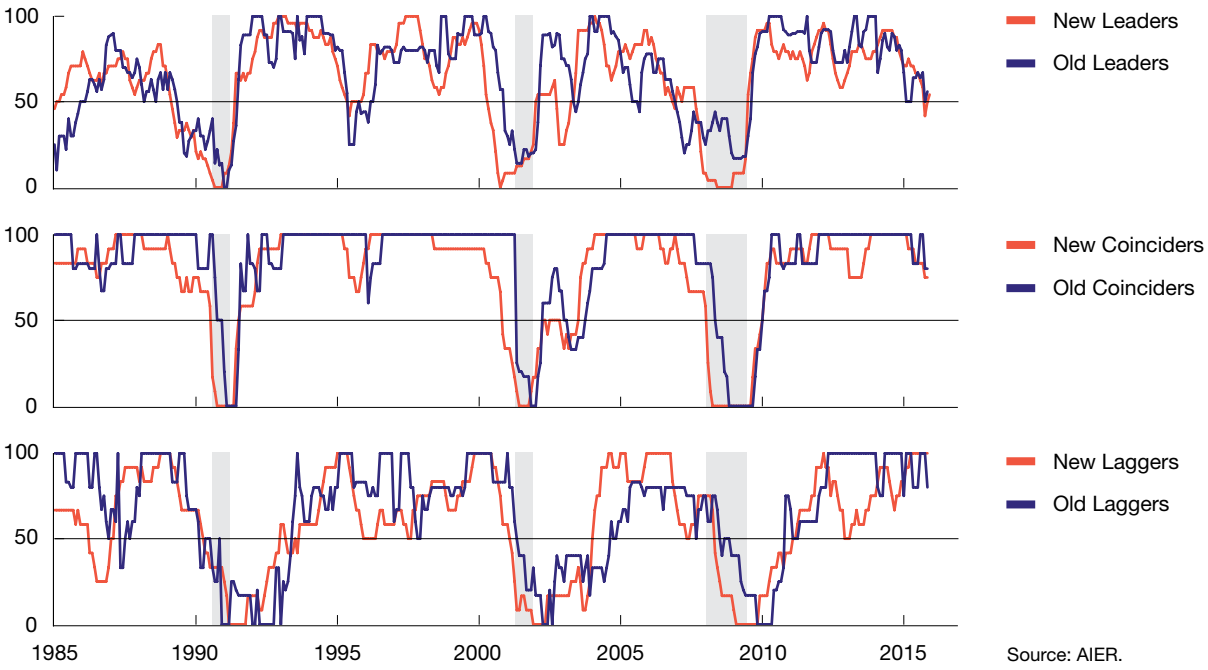
In the past, when the Leaders' diffusion index fell below 50, AIER would interpret that as a signal of broadening weakness in the economy. However, it was not automatically assumed that a turning point had been reached and that a recession was imminent. Rather, we interpreted it as a warning that we might be entering "choppy waters," and we would observe all the signals available to us. The final determination of a turning point and impending recession was still a human judgment. The same will be true in the new model. That subjective judgment makes it impossible to do a retrospective analysis using the new model to say exactly when a recession "call" would have been made in the past. We can, however, compare the new, purely quantitative model with the old model to get an indication of how things might have been different using the previous method (Chart 1).

What we changed in the model and why

In broad terms, we reviewed and enhanced three areas. First, the individual economic indicators used in the model: There are 24 indicators in total – 12 Leaders (indicators that peak and trough ahead of a turning point in the broader economy), six Coincidders (indicators that peak and trough at roughly the same time as the broader economy), and six Laggers (indicators that peak and trough after a turning point in the broader economy). After statistically testing the individual indicators for efficacy, we determined that five Leaders, one Coincider, and two Laggers were no longer effective. We replaced eight, or one-third of the 24 indicators in the model (Table 1). For example, we dropped from the Leaders the Index of Manufacturers' Prices and we added retail sales. This reflects changes in the structure of the U.S. economy, where the manufacturing sector has declined in importance and the retail sector has grown. This example underscores the need to review the model periodically to reflect changes in the economy.

In selecting new indicators, AIER reviewed the most popular and well-known business-cycle theories, such as Endogenous Business-Cycle Theory, the Real Business-Cycle Theory, and Keynesian Theory, as well our own historical work in business-cycle theory. Studying those

Chart 1. Comparing the new and old models



Source: AIER.

Table 1. New vs. old Business-Cycle Conditions indicators

Leading	Indicator status
New orders for consumer goods	Retained
New orders for core capital goods	Retained
New housing permits	Retained
New manufacturing and trade sales to inventories	Retained
Index of common stock prices	Retained
Average workweek in manufacturing	Retained
Initial claims for unemployment insurance	Retained
M1 money supply	Dropped
Yield curve index	Dropped
Index of manufacturers' prices	Dropped
Vendor performance	Dropped
Change in consumer debt	Dropped
Debit balances in margin accounts	Added
Treasury yield spread	Added
Retail sales	Added
Heavy truck sales	Added
Consumer sentiment - expectations	Added
Coinciding	**Indicator status**
Nonagricultural employment	Retained
Index of industrial production	Retained
Personal income less transfer payments	Retained
Manufacturing and trade sales	Retained
Civilian employment population ratio	Retained
Gross domestic product	Dropped
Consumer confidence - current situation	Added
Lagging	**Indicator status**
Average duration of unemployment	Retained
Manufacturing and trade inventories	Retained
Commercial and industrial loans	Retained
Composite of short-term interest rates	Retained
Ratio of consumer debt to personal income	Dropped
Change in manufacturing unit labor cost	Dropped
Private nonresidential construction	Added
CPI except food and energy	Added

business-cycle theories and past recessions, we looked at 12 economic categories for potential business-cycle indicators: (1) consumer spending, (2) housing, (3) business investment, (4) international trade, (5) government spending and fiscal policy, (6) monetary policy, money, banking, and credit, (7) prices and inflation, (8) capital markets, (9) the business sector – corporations and small businesses, (10) labor, wages, hours, demographics, and immigration, (11) manufacturing and trade (including production, utilization, sales, orders, and inventories), and (12) consumer and business sentiment.

Next, we conducted statistical testing to quantitatively verify how well each measure performed. Our tests covered two time periods: 1950–2014 and 1983–2014. The primary reason for using two periods was to balance the benefit of the larger number of cycles in the longer period with the empirical reality that business-cycle behavior appears to have changed in recent decades (See our Research Brief, "The Changing Nature of Recessions," (https://www.aier.org/research/changing-nature-recessions-0).

In addition to the statistical testing, the chosen series had to have timely, complete, and statistically adequate data from a reliable source. We evaluated the series according to both its behavior and the relevance and validity of the underlying macroeconomic theory.

Interpreting the model results

The next significant change in the model is the role of AIER economists in producing and interpreting it. In the previous process, AIER researchers reviewed each indicator and qualitatively evaluated the trend. In this evaluation each researcher asked if the most recent data point represented a continuation of a trend or a turning point. The qualitative assessments of each researcher were then combined in the final index. Because it was qualitative, each researcher might judge the difference in month-to-month changes differently. "Noise" in the economy makes such an assessment more difficult than a straightforward mathematical evaluation of whether the December number is larger or smaller than the November number.

In the new process, trends are assessed quantitatively and their meaning is then interpreted. Our testing has shown that in general, the quantitative assessment in the new model tends to be somewhat conservative in identifying a signal. We will apply our qualitative assessment to the meaning of data, not to whether the month-to-month difference is due to noise or economic conditions. This is an important change. By moving qualitative assessment outside of the model, we believe the results will be more scientific. This will make the analysis of AIER research economists critical to fully understanding the implications of the model results.

A new calculation

Finally, we have slightly altered the diffusion index calculation to conform with a more conventional and widely used methodology. The primary difference in the methodology is that in the prior calculation, indicators that were evaluated as stable (not trending upward or downward) were excluded from the index. In the new calculation, stable indicators are included in the calculation of the final index.

The new model will uphold our standards

Darwin studied the principles of evolution in the Galapagos Islands. Just as living creatures adapt to the changing environment, so, too, must economists, economic theory, and economic models. AIER remains committed to the scientific approach to analysis and to the long history of business-cycle research at the institute. This update to our Business-Cycle Conditions model remains true to both. We are confident these enhancements will live up to the high standards and record of success of the former model.

New Business-Cycle Conditions Model: Indicator Descriptions

*new indicators

Leading

1. **Debit balances in margin accounts*** Margin loans at broker/dealers. Debit balances in margin accounts tend to increase when investors have a positive outlook on corporate profits and the economy. Source: New York Stock Exchange.

2. **Treasury yield spread*** The difference between the 10-year and the 1-year Treasury note yield. Spreads tend to widen as an economy strengthens. Source: Federal Reserve Board.

3. **Retail sales*** Sales at retail and food-service establishments deflated (adjusted for inflation) by the Consumer Price Index. Sales at retail and food service establishments are a key component of total consumer spending. Source: Bureau of Labor Statistics, U.S. Census Bureau.

4. **New orders for consumer goods** Manufacturers' new orders for consumer goods and materials (adjusted for inflation). Consists of all new orders for goods used primarily by consumers (less food and energy). Placing such orders tends to precede production of consumer goods. Source: The Conference Board.

5. **New orders for core capital goods** New orders for nondefense capital goods excluding aircraft (deflated by the producer price index) measures the value of new orders received by manufacturers in nondefense and non-aircraft capital goods industries. Orders tend to lead to machinery production and production of goods that machinery produces. Source: U.S. Census Bureau.

6. **New housing permits** Permits issued for new private housing unit construction tend to lead to construction expenditures. Source: U.S. Census Bureau.

7. **Manufacturing and trade sales-to-inventories ratio** Manufacturing and trade sales divided by inventories (adjusted for inflation). Trade includes wholesale and retail. The ratio measures the balance between sales and inventories. Faster inventory growth relative to sales suggests an imbalance within the manufacturing sector. Source: Bureau of Economic Analysis.

8. **Heavy truck unit sales*** Sales of trucks weighing more than 14,000 lbs. Heavy trucks transport goods to market, and heavy truck sales indicate demand for shipping. Source: Bureau of Economic Analysis.

9. **Index of common stock prices** S&P 500 price index deflated by the CPI. The index is constructed using monthly averages of daily indexes of closing prices from Standard & Poor's 500 composite index. Changes in stock prices reflect changes in investors' opinions of profit prospects. Sources: Bureau of Labor Statistics, Standard & Poor's.

10. **Average workweek in manufacturing** Average weekly hours of manufacturing production and nonsupervisory workers is the total of paid labor-hours of manufacturing production workers divided by the number of workers. Employers tend to reduce the workweek of their labor force before they reduce the size of their workforce. Source: Bureau of Labor Statistics.

11. **Initial claims for unemployment insurance** The weekly average of first-time claims for state unemployment insurance. Initial claims, which are inverted for analysis, measure the average number of people who file first-time claims each week in a given month. A decline in general business activity leads to layoffs. Source: Department of Labor.

12. **Consumer sentiment*** Survey of consumer expectations about personal finances and economic outlook. Improvements in consumer sentiment lead to consumer spending. Source: University of Michigan.

Coinciding

1. **Nonagricultural employment** Total number of nonfarm employees on the payrolls of all establishments, except agriculture. Labor is used in the production of goods and services and employment is the main source of household income and purchasing power. Source: Bureau of Labor Statistics.

2. **Index of industrial production** Industrial production includes final products for consumers and businesses, nonindustrial supplies, and materials. Although the industries covered account for about 25 percent of gross domestic product, they account for a large share of the cyclical movements in business activity. Source: Federal Reserve Board.

3. **Personal income less transfer payments** Personal income includes wages, salaries, dividends, interest, and rental income. Transfer payments include Medicare, Medicaid, Social Security, and unemployment insurance. Transfer payments are counter-cyclical. Personal income less transfer payments is deflated by the personal consumption expenditures index. Personal income is the main component of consumer purchasing power. Source: Bureau of Economic Analysis.

4. **Manufacturing and trade sales** Trade includes wholesale and retail trade. Source: Bureau of Economic Analysis.

5. **Civilian employment population ratio** Total nonfarm employment divided by the noninstitutionalized population, 16 years and older. A rising ratio may indicate tightness in the labor market. Source: Bureau of Labor Statistics.

6. **Consumer confidence*** Survey of consumer confidence in business outlook and job availability. Source: The Conference Board.

Lagging

1. **Average duration of unemployment** Average number of weeks of unemployment. Reflects the average time that the unemployed have been looking for work and is an indication of tightness in the labor market. Changes in this series are inversely related to business fluctuations, so the series is inverted for analysis. Source: Bureau of Labor Statistics.

2. **Manufacturing and trade inventories** Trade includes wholesale and retail trade and is the aggregate dollar book-value of inventories of materials, goods in process, and finished goods stocked by the manufacturing, wholesale, and retail sectors. It peaks after the economy begins to slow, as sales fall short of projections. Source: Bureau of Economic Analysis.

3. **Commercial and industrial loans** Measures the number of short-term business loans and commercial paper issued. (Deflated by the personal consumption expenditures index.) Declining profits usually increase the demand for loans. Source: The Conference Board.

4. **Private nonresidential construction*** Private nonresidential construction deflated by the producer price index for final-demand, private capital equipment. Private nonresidential construction consists of storefronts and production facilities. An increase in nonresidential construction occurs in response to stronger demand. Sources: Bureau of Labor Statistics, U.S. Census Bureau.

5. **CPI ex. food and energy*** Consumer Price Index excluding food and energy. Prices increase in response to higher demand. Food and energy prices are excluded because they are volatile. Source: Bureau of Labor Statistics.

6. **Composite of short-term interest rates** Average of yield on one-month nonfinancial and one-month financial commercial paper. Rising interest rates reflect a rising demand for capital. Source: Federal Reserve Board.

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