YOUR GRANDFATHER'S ECONOMICS MAY HELP YOURS
LOOKING AT THE DETAILS AND USING LEADING BAROMETERS TO ASSESS BUSINESS CYCLE TURNS

Denver NABE Chapter Meeting

6 June 2017

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Chief Economist & Managing Director

American Chemistry Council

Agenda

1. NABE developments

2. Looking at the details

3. Leading indicators to signal business cycle turns

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National Association for Business Economics

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Upcoming NABE Events

Conferences

Economic Measurement Seminar
16-17 July
Washington, DC

Transfer Pricing Symposium
17-19 July
Washington, DC

60th NABE Annual Meeting
29 September – 2 October
Boston, MA

2nd Annual NABE Tech Economics Conference
28-30 October
San Francisco, CA

CBE Courses

Time-Series Analysis and Forecasting
27-29 June
Denver, CO

Writing Skills for Business Economists & Analysts
18 July
Washington, DC

**Communication & Presentation Skills
for Business Economists & Analysts**
19-20 July
Washington, DC

Machine Learning & Big Data for Economists
26-27 July
Washington, DC

Applied Econometrics
6-9 August
Washington, DC

Looking at the Details

Gross Output: Another Way of Looking at the US Economy

- GDP ($19.7 trillion) focuses on final demand; the end of the supply chain
- Quarterly gross output (GO) by industry ($42.5 trillion) is very useful in understanding the US economy's structure of production and status of the business cycle
- Gross output offers a more comprehensive view of total economic activity along the entire supply chain, from primary sectors to secondary (or intermediate) sectors, to final sectors and ultimately to the final consumer
- Gross output is more sensitive to the business cycle
- Data are in nominal dollars and are largely based on the BEA quarterly gross output by industry data (see www.bea.gov/iTable/index_industry_gdpIndy.cfm)
- Adjustments were made to wholesale and retail trade to better reflect gross output rather than BEA's value-added concept
- Note that 1st quarter data are provisional

US Economic Sector Gross Output Heat Map
(Y/Y Growth)

	1Q 13	2Q 13	3Q 13	4Q 13	1Q 14	2Q 14	3Q 14	4Q 14	1Q 15	2Q 15	3Q 15	4Q 15	1Q 16	2Q 16	3Q 16	4Q 16	1Q 17	2Q 17	3Q 17	4Q 17	1Q 18
Gross Output - All industries	2.7%	3.3%	3.5%	3.5%	4.1%	5.1%	5.0%	3.8%	1.1%	0.5%	-0.1%	-0.5%	0.5%	0.9%	1.7%	3.3%	5.5%	4.9%	4.9%	6.0%	5.5%
Private Industries	3.0%	3.7%	3.9%	3.9%	4.4%	5.5%	5.2%	3.9%	1.0%	0.3%	-0.3%	-0.8%	0.3%	0.8%	1.7%	3.5%	5.8%	5.1%	5.2%	6.2%	5.7%
Agriculture, Forestry, Fishing & Hunting	11.2%	8.3%	8.7%	2.3%	-2.1%	5.7%	1.8%	5.4%	-5.5%	-12.2%	-8.3%	-11.1%	-4.0%	-2.7%	-6.6%	-4.3%	-2.3%	-3.3%	-1.2%	0.5%	0.2%
Mining	-0.5%	10.6%	17.0%	8.2%	14.9%	16.6%	7.6%	2.1%	-25.0%	-31.4%	-36.9%	-38.8%	-35.6%	-29.4%	-16.8%	1.0%	36.2%	30.1%	24.7%	31.2%	16.9%
Utilities	5.8%	9.1%	4.3%	9.2%	18.8%	9.1%	6.4%	3.7%	-4.3%	-6.3%	-2.5%	-9.0%	-11.7%	-4.9%	0.1%	3.0%	3.8%	7.0%	-0.2%	4.2%	4.4%
Construction	3.7%	5.7%	8.4%	8.3%	9.5%	10.1%	8.5%	8.8%	8.0%	10.0%	9.9%	7.7%	9.5%	5.4%	4.6%	6.2%	3.7%	1.5%	0.7%	2.5%	3.4%
Manufacturing	2.3%	1.8%	2.1%	2.4%	2.7%	3.3%	2.2%	-1.7%	-5.9%	-5.6%	-6.3%	-5.5%	-4.4%	-3.7%	-2.6%	0.8%	5.0%	4.8%	5.8%	7.3%	7.2%
Durable Goods	2.6%	2.0%	3.4%	4.2%	4.3%	3.6%	6.0%	2.5%	0.5%	0.2%	-1.4%	-1.7%	-2.5%	-3.1%	-3.0%	-0.5%	2.9%	4.4%	5.4%	7.1%	7.1%
Non-Durable Goods	2.1%	1.6%	1.0%	0.9%	1.4%	3.1%	-1.0%	-5.3%	-11.6%	-10.9%	-10.8%	-9.1%	-6.3%	-4.4%	-2.2%	2.2%	7.1%	5.2%	6.2%	7.4%	7.4%
Wholesale Trade	3.2%	2.6%	2.8%	3.6%	2.5%	5.0%	4.8%	1.8%	-3.1%	-4.4%	-5.4%	-5.6%	-3.6%	-2.1%	-0.3%	3.7%	8.9%	6.4%	7.3%	8.6%	6.7%
Retail Trade	3.7%	4.1%	3.3%	3.2%	2.3%	4.7%	4.5%	4.2%	2.4%	1.6%	2.0%	1.7%	2.5%	2.3%	2.1%	3.7%	5.1%	4.0%	4.3%	5.5%	4.4%
Transportation and Warehousing	3.1%	3.2%	3.9%	3.2%	4.4%	6.3%	6.9%	8.1%	3.9%	1.3%	0.6%	-2.8%	-1.8%	-2.1%	-1.6%	0.8%	3.2%	5.5%	3.6%	3.7%	3.5%
Information	3.9%	3.3%	4.6%	3.6%	5.5%	5.9%	4.8%	4.8%	3.9%	4.5%	4.0%	4.9%	5.4%	3.6%	4.7%	3.1%	3.2%	4.6%	4.6%	5.7%	5.1%
Finance and Insurance	4.0%	6.7%	4.3%	5.9%	5.5%	7.0%	8.0%	6.2%	6.6%	6.8%	5.0%	4.4%	2.4%	2.4%	5.2%	3.8%	6.9%	7.1%	5.8%	7.2%	5.7%
Real estate and Rental & Leasing	3.9%	4.8%	5.4%	4.6%	6.9%	6.9%	7.0%	6.8%	5.0%	3.9%	3.2%	3.1%	4.0%	4.9%	5.3%	5.3%	5.5%	4.9%	4.5%	5.1%	6.8%
Professional and Business Services	0.1%	3.7%	4.1%	3.9%	7.0%	5.4%	6.3%	6.9%	6.4%	5.6%	4.6%	2.9%	3.1%	3.8%	3.7%	4.2%	4.5%	4.1%	3.8%	4.7%	5.2%
Professional, Scientific & Technical Services	-1.1%	1.3%	3.5%	4.3%	4.2%	4.8%	6.1%	6.2%	5.9%	4.7%	3.8%	2.2%	4.3%	3.6%	2.7%	4.5%	2.7%	3.1%	2.6%	2.9%	3.8%
Management of Companies and Enterprises	4.1%	9.3%	7.0%	0.5%	10.9%	4.1%	4.9%	6.9%	6.9%	7.7%	4.7%	3.8%	-1.4%	2.5%	3.2%	-1.2%	3.3%	0.8%	1.4%	5.7%	5.7%
Administrative and Waste Management Services	0.3%	5.6%	3.4%	5.6%	10.7%	7.8%	7.7%	8.4%	7.1%	6.1%	6.6%	3.8%	3.8%	5.1%	6.3%	7.3%	9.4%	8.7%	8.2%	8.1%	7.8%
Educational Services	1.0%	2.7%	3.3%	3.6%	3.4%	3.3%	3.3%	3.5%	3.5%	3.7%	3.5%	4.0%	3.8%	3.9%	2.8%	2.3%	3.1%	3.3%	6.2%	5.8%	6.5%
Health Care and Social Assistance	1.6%	2.8%	3.0%	3.4%	2.3%	3.2%	5.0%	5.5%	7.1%	6.5%	6.2%	4.9%	5.1%	5.5%	4.0%	5.1%	5.9%	4.8%	5.8%	5.3%	5.0%
Arts, Entertainment & Recreation	4.5%	2.7%	3.9%	5.3%	7.5%	5.9%	5.0%	5.3%	5.4%	7.9%	6.4%	5.6%	3.4%	2.4%	5.4%	8.1%	6.8%	9.4%	9.9%	4.0%	4.2%
Food and Hospitality	5.1%	3.5%	3.5%	4.4%	3.4%	7.0%	8.1%	8.7%	9.2%	8.3%	6.9%	5.9%	5.9%	5.2%	5.1%	4.4%	4.9%	3.2%	2.3%	1.5%	0.4%
Other Services	2.7%	2.3%	2.7%	1.7%	5.2%	6.1%	7.4%	7.8%	4.6%	4.5%	2.1%	1.2%	4.7%	3.2%	5.5%	6.0%	5.3%	6.3%	6.5%	7.3%	7.4%
Government	-0.2%	-0.1%	-0.4%	-0.2%	1.0%	1.7%	2.8%	2.5%	1.9%	2.3%	1.8%	2.4%	2.1%	2.0%	2.2%	1.8%	2.8%	2.6%	2.8%	3.8%	3.9%
Federal	-3.6%	-4.3%	-5.7%	-5.0%	-1.8%	-0.8%	1.5%	0.2%	0.4%	0.9%	-0.7%	1.2%	0.3%	0.3%	1.1%	0.4%	0.6%	0.8%	1.1%	2.6%	3.3%
State and Local	1.6%	2.1%	2.3%	2.2%	2.4%	3.0%	3.4%	3.6%	2.7%	3.0%	2.9%	3.0%	2.9%	2.8%	2.8%	2.5%	3.8%	3.4%	3.5%	4.3%	4.1%
Addenda:																					
Business-to-Business (B2) Spending	3.3%	4.5%	4.6%	4.2%	5.0%	6.0%	5.4%	3.5%	-0.6%	-1.7%	-2.4%	-2.8%	-1.4%	-0.7%	0.6%	3.0%	6.3%	5.5%	5.7%	7.5%	6.8%
Non-Goods (Services) Sectosr	2.7%	3.4%	3.4%	3.6%	4.2%	5.2%	5.5%	4.8%	3.2%	2.6%	2.0%	1.4%	2.0%	2.2%	2.9%	3.9%	5.4%	4.7%	4.7%	5.5%	5.1%
Goods Sectors	2.6%	3.0%	3.8%	2.9%	3.4%	4.7%	2.7%	-0.9%	-7.7%	-8.7%	-9.4%	-8.9%	-6.8%	-5.6%	-3.9%	0.5%	6.1%	5.7%	6.4%	8.3%	7.4%

US Retail Sector Gross Output Heat Map
(Y/Y Growth)

	1Q 13	2Q 13	3Q 13	4Q 13	1Q 14	2Q 14	3Q 14	4Q 14	1Q 15	2Q 15	3Q 15	4Q 15	1Q 16	2Q 16	3Q 16	4Q 16	1Q 17	2Q 17	3Q 17	4Q 17	1Q 18
Retail Stores	3.2%	3.9%	3.3%	3.0%	1.9%	4.3%	4.0%	3.6%	1.7%	1.0%	1.2%	1.0%	1.7%	1.1%	1.0%	2.7%	4.2%	3.3%	3.5%	4.8%	3.7%
Motor Vehicle and Parts Dealers	7.8%	9.0%	8.2%	7.3%	4.1%	7.3%	6.7%	7.0%	8.7%	7.0%	7.0%	6.9%	5.0%	1.8%	3.4%	5.1%	4.9%	5.2%	3.7%	4.4%	3.6%
Furniture and Home Furnishings Stores	3.2%	3.5%	6.0%	5.3%	1.7%	5.9%	4.7%	5.6%	7.3%	7.3%	7.2%	6.5%	5.4%	2.9%	2.9%	1.8%	4.0%	4.4%	4.2%	7.3%	4.7%
Electronics and Appliance Stores	2.9%	1.5%	1.7%	0.4%	-1.4%	-1.3%	0.3%	3.3%	0.3%	1.8%	-0.5%	-4.8%	-4.1%	-5.4%	-4.5%	-5.6%	-2.2%	0.1%	-1.9%	3.8%	2.2%
Building Material/Garden Equipment and Supplies Dealers	3.1%	9.9%	8.4%	5.0%	2.6%	6.3%	5.2%	7.2%	5.5%	1.9%	4.4%	5.7%	9.5%	5.2%	3.7%	4.5%	5.8%	7.6%	9.7%	8.9%	5.4%
Food and Beverage Stores	2.4%	1.4%	2.0%	2.7%	3.3%	4.6%	4.7%	4.8%	4.0%	2.8%	2.0%	1.1%	1.1%	2.2%	1.9%	2.7%	2.9%	2.2%	2.6%	3.6%	3.3%
Health and Personal Care Stores	0.8%	1.7%	4.4%	5.7%	4.3%	7.2%	6.7%	6.2%	7.2%	4.1%	4.8%	5.4%	5.1%	6.5%	4.2%	1.0%	0.2%	0.4%	0.8%	2.6%	1.1%
Gasoline Stations	1.3%	0.2%	-3.9%	-4.1%	-1.7%	0.8%	-1.0%	-6.3%	-21.0%	-17.2%	-16.2%	-16.6%	-11.1%	-8.4%	-6.7%	4.2%	16.5%	5.4%	6.5%	9.8%	8.2%
Clothing and Clothing Accessories Stores	1.8%	3.7%	1.9%	2.5%	1.0%	2.1%	2.6%	3.2%	3.2%	2.9%	2.6%	0.2%	0.7%	-0.3%	0.2%	1.3%	0.7%	1.2%	1.2%	2.2%	2.8%
Sporting Goods, Hobby, Book, and Music Stores	3.7%	-0.3%	2.0%	2.9%	-4.8%	0.4%	3.4%	3.9%	3.8%	2.7%	1.5%	1.5%	4.5%	5.4%	0.3%	-3.2%	-2.4%	-5.9%	-4.5%	-1.6%	-4.0%
General Merchandise Stores	1.2%	1.9%	1.8%	2.0%	1.0%	2.7%	2.7%	2.6%	2.2%	0.6%	1.0%	1.0%	0.2%	0.5%	-1.0%	-0.6%	1.3%	1.5%	3.1%	4.1%	3.0%
Other Retailers	-0.1%	3.2%	2.8%	2.8%	2.1%	1.8%	4.0%	4.4%	4.4%	4.2%	3.5%	0.4%	2.8%	5.8%	4.3%	7.9%	6.4%	2.2%	3.2%	4.0%	4.5%
Non-Store Retailers	8.7%	5.9%	3.9%	4.8%	6.0%	8.8%	9.7%	9.6%	8.8%	7.5%	8.4%	8.1%	8.9%	12.5%	11.3%	12.5%	12.1%	9.8%	9.8%	10.4%	9.7%

US Wholesale Sector Gross Output Heat Map
(Y/Y Growth)

	1Q 13	2Q 13	3Q 13	4Q 13	1Q 14	2Q 14	3Q 14	4Q 14	1Q 15	2Q 15	3Q 15	4Q 15	1Q 16	2Q 16	3Q 16	4Q 16	1Q 17	2Q 17	3Q 17	4Q 17	1Q 18
Wholesale Trade	3.2%	2.6%	2.8%	3.6%	2.5%	5.0%	4.8%	1.8%	-3.1%	-4.4%	-5.4%	-5.6%	-3.6%	-2.1%	-0.3%	3.7%	8.9%	6.4%	7.3%	8.6%	6.7%
Durable Goods	2.5%	3.2%	3.4%	3.0%	1.1%	3.7%	5.0%	4.9%	2.5%	-0.9%	-2.4%	-3.7%	-2.5%	-0.8%	0.0%	2.6%	7.0%	6.8%	8.3%	9.9%	7.8%
Motor Vehicle and Motor Vehicle Parts and Supplies	1.3%	3.3%	0.2%	4.1%	1.1%	3.8%	5.3%	3.0%	5.9%	4.8%	3.1%	1.3%	-0.3%	-3.3%	-3.0%	3.6%	9.2%	8.8%	11.6%	11.7%	7.4%
Furniture and Home Furnishings	0.6%	6.4%	8.4%	8.6%	9.3%	4.8%	5.5%	9.4%	5.3%	4.3%	2.5%	3.3%	2.4%	4.2%	5.7%	6.4%	5.2%	0.0%	-1.1%	-4.1%	-2.4%
Lumber and Other Construction Materials	11.0%	11.8%	12.7%	9.9%	1.9%	6.7%	7.6%	8.0%	8.3%	4.8%	3.9%	5.5%	8.9%	6.3%	5.2%	5.5%	8.6%	7.9%	8.9%	11.7%	5.5%
Professional and Commercial Equipment and Supplies	2.9%	2.3%	5.6%	1.9%	0.2%	3.3%	2.0%	5.5%	5.2%	1.4%	2.2%	1.3%	0.6%	3.2%	3.2%	2.9%	5.8%	4.2%	5.8%	5.7%	5.0%
Computer and Computer Peripheral Equipment and Software	1.1%	2.4%	6.8%	1.8%	0.5%	2.2%	0.1%	4.5%	4.8%	-0.2%	1.3%	-0.7%	-4.9%	-2.8%	-3.2%	-4.3%	1.5%	4.3%	7.1%	5.2%	7.2%
Metals and Minerals, Except Petroleum	-5.9%	-5.2%	-2.2%	-1.6%	-0.5%	3.9%	12.9%	9.6%	-1.9%	-11.2%	-21.3%	-24.7%	-20.1%	-14.0%	-7.7%	2.2%	14.8%	18.2%	18.6%	16.9%	14.0%
Electrical and Electronic Goods	9.8%	9.1%	5.7%	4.9%	1.2%	4.1%	5.1%	8.6%	7.7%	4.2%	1.5%	-2.2%	-1.2%	-1.3%	1.8%	3.0%	4.9%	8.3%	8.2%	9.9%	10.7%
Hardware, and Plumbing and Heating Equipment and Supplies	3.3%	4.9%	5.1%	5.3%	3.7%	4.7%	6.7%	9.5%	5.3%	5.0%	4.0%	0.7%	5.0%	2.4%	3.8%	4.3%	2.7%	3.5%	0.8%	5.6%	5.9%
Machinery, Equipment, and Supplies	0.6%	1.9%	3.2%	5.3%	2.6%	4.1%	6.4%	3.8%	-1.7%	-5.8%	-6.5%	-7.7%	-4.4%	-0.7%	-2.8%	0.1%	5.4%	4.8%	8.3%	14.2%	10.2%
Miscellaneous Durable Goods	-2.1%	-2.3%	-3.5%	-4.5%	-2.0%	1.9%	4.6%	-6.6%	-14.6%	-16.8%	-17.8%	-13.6%	-9.1%	1.0%	1.1%	7.0%	17.4%	8.1%	10.3%	14.6%	5.2%
Nondurable Goods	3.9%	2.0%	2.3%	4.1%	3.8%	6.2%	4.6%	-1.1%	-8.0%	-7.6%	-8.1%	-7.5%	-4.7%	-3.3%	-0.6%	4.8%	10.9%	5.9%	6.4%	7.3%	5.7%
Paper and Paper Products	1.6%	2.7%	1.1%	3.2%	4.4%	4.8%	6.4%	1.3%	0.6%	0.7%	-2.3%	1.0%	1.3%	-1.3%	0.2%	-1.7%	-1.8%	1.8%	0.6%	2.9%	1.6%
Drugs and Druggists' Sundries	3.2%	5.6%	7.6%	4.9%	6.8%	11.0%	11.9%	13.8%	13.8%	11.5%	12.3%	10.5%	7.5%	6.4%	5.3%	6.5%	5.0%	5.6%	5.1%	4.6%	5.2%
Apparel, Piece Goods, and Notions	9.1%	1.4%	5.3%	6.5%	1.7%	5.7%	4.9%	3.5%	1.3%	0.7%	2.5%	2.7%	1.4%	-0.2%	-2.6%	-4.1%	-5.7%	-8.3%	-5.6%	-1.7%	0.6%
Grocery and Related Products	3.1%	4.6%	4.4%	3.8%	3.0%	5.4%	7.4%	7.9%	5.8%	3.1%	2.8%	0.5%	1.2%	-1.0%	-1.9%	-1.1%	0.9%	4.5%	2.7%	3.5%	0.9%
Farm Product Raw Materials	16.7%	12.5%	-0.5%	-2.7%	-1.1%	1.4%	-11.6%	-12.1%	-13.7%	-17.3%	-9.5%	-14.0%	-15.8%	-12.5%	-1.2%	2.9%	8.9%	4.4%	-3.4%	-1.6%	-3.0%
Chemicals and Allied Products	2.4%	-1.1%	3.2%	2.9%	4.8%	6.9%	3.0%	-0.7%	-6.8%	-9.6%	-8.5%	-8.9%	-7.7%	-5.0%	-3.4%	4.8%	10.4%	5.5%	8.2%	8.9%	7.7%
Petroleum and Petroleum Products	-0.2%	-5.7%	-1.2%	7.9%	8.4%	9.3%	5.5%	-14.4%	-35.7%	-30.9%	-35.8%	-32.8%	-27.0%	-15.7%	-5.4%	17.1%	54.6%	18.0%	22.9%	22.6%	17.7%
Beer, Wine, and Distilled Alcoholic Beverages	7.4%	7.1%	7.2%	4.9%	1.7%	1.6%	-1.2%	0.1%	1.3%	2.6%	7.1%	5.8%	6.1%	2.6%	-1.4%	1.5%	1.0%	4.2%	3.3%	2.4%	1.6%
Miscellaneous Nondurable Goods	5.1%	4.5%	-1.9%	-1.9%	-7.3%	-3.1%	1.0%	2.2%	3.4%	2.0%	0.6%	-2.2%	1.8%	0.4%	2.2%	2.1%	2.5%	-0.7%	3.5%	4.6%	1.6%

US Durable Goods Manufacturing Gross Output Heat Map
(Y/Y Growth)

	1Q 13	2Q 13	3Q 13	4Q 13	1Q 14	2Q 14	3Q 14	4Q 14	1Q 15	2Q 15	3Q 15	4Q 15	1Q 16	2Q 16	3Q 16	4Q 16	1Q 17	2Q 17	3Q 17	4Q 17	1Q 18	2Q 18	3Q 18	4Q 18
Wood Products	15.5%	14.2%	12.7%	11.0%	10.4%	8.4%	6.4%	4.7%	1.2%	0.6%	0.6%	1.0%	0.5%	2.5%	4.5%	6.1%	9.9%	8.9%	7.5%	10.3%	7.2%	7.0%	7.1%	3.0%
Non-Metallic Mineral Products	6.5%	6.8%	7.2%	7.3%	10.0%	8.2%	6.0%	4.1%	-1.0%	-0.4%	1.1%	3.0%	4.9%	5.4%	5.4%	5.2%	6.0%	6.2%	6.3%	6.6%	5.2%	5.1%	4.9%	4.4%
Primary Metals	-6.5%	-2.3%	0.9%	0.5%	3.4%	2.3%	0.1%	-4.6%	-12.6%	-15.9%	-16.4%	-13.5%	-13.1%	-6.7%	-1.6%	2.9%	16.3%	14.2%	12.3%	8.0%	5.0%	4.6%	4.3%	5.4%
Iron and Steel Mills	-7.2%	-4.8%	-2.5%	-1.4%	8.9%	3.9%	-2.6%	-8.5%	-23.1%	-22.6%	-19.1%	-13.8%	-12.4%	-6.3%	-0.9%	3.3%	22.0%	19.8%	15.2%	5.3%	0.3%	-1.1%	-0.7%	5.1%
Ferrous Foundries	-2.5%	-2.9%	-1.1%	0.9%	0.5%	8.0%	11.1%	6.0%	-2.3%	-11.0%	-10.9%	-11.3%	-12.5%	-10.9%	-13.1%	-13.0%	-5.5%	-4.2%	-2.3%	2.9%	2.6%	4.2%	5.4%	3.3%
Aluminum & Other Nonferrous Metals	-6.3%	0.9%	5.7%	2.8%	-2.6%	-0.6%	1.5%	-1.8%	-0.6%	-8.4%	-14.3%	-13.6%	-13.8%	-6.5%	-0.3%	5.4%	14.3%	11.6%	11.7%	11.8%	10.5%	11.0%	9.6%	6.1%
Fabricated Metal Products	1.1%	1.2%	1.9%	2.8%	5.3%	4.7%	3.5%	2.0%	0.3%	-0.6%	-1.2%	-1.3%	-4.5%	-3.4%	-1.8%	-0.1%	3.6%	4.4%	4.5%	6.6%	8.1%	7.8%	7.7%	5.2%
Machinery	2.3%	-2.9%	-4.2%	-0.9%	-1.5%	1.4%	10.8%	-0.6%	-2.5%	-2.8%	-8.2%	-5.2%	-5.9%	-8.7%	-9.3%	-4.8%	0.2%	5.0%	7.9%	9.1%	8.3%	7.9%	6.9%	5.1%
Farm Machinery	16.8%	2.0%	-1.3%	38.8%	0.8%	-0.9%	67.1%	-42.3%	-27.1%	-10.9%	-32.3%	13.1%	-2.3%	-7.8%	-16.5%	-6.4%	4.5%	6.3%	15.5%	18.2%	16.1%	10.5%	3.6%
Construction Machinery	6.3%	-7.4%	-32.3%	-28.1%	-13.5%	-1.7%	8.7%	28.1%	14.8%	-0.8%	-7.3%	-30.9%	-37.1%	-30.0%	-32.5%	-21.6%	-3.8%	0.4%	16.3%	17.6%	15.4%	14.9%	12.0%	7.4%
Mining & Oilfield Machinery	5.9%	-5.0%	-3.1%	-1.9%	-3.1%	5.8%	3.8%	-4.2%	-9.5%	-25.3%	-31.5%	-33.0%	-38.0%	-59.9%	-52.0%	-53.4%	-35.3%	20.2%	17.3%	38.1%	15.3%	11.3%	6.3%	5.7%
Industrial Machinery	7.6%	-4.3%	3.6%	-1.9%	1.1%	4.0%	3.6%	-12.7%	-22.0%	-2.0%	-5.4%	20.5%	30.0%	4.7%	0.2%	-0.3%	0.9%	3.6%	6.1%	4.5%	2.5%	2.2%	2.1%	3.6%
Photographic Equipment	-9.0%	-3.1%	1.5%	-6.2%	-10.8%	-18.9%	-16.0%	-3.8%	-3.4%	11.5%	8.8%	9.1%	14.7%	7.4%	6.0%	-3.0%	-2.2%	2.2%	-4.8%	-10.2%	-5.5%	-8.1%	1.2%	11.1%
HVAC & Refrigeration equipment	5.0%	3.5%	3.7%	1.1%	0.3%	-2.5%	-2.9%	-1.5%	0.5%	2.8%	6.1%	5.8%	4.4%	-2.6%	-1.4%	-1.8%	2.3%	5.5%	0.6%	4.2%	2.0%	3.9%	6.0%	2.6%
Metalworking Machinery	2.3%	-1.9%	4.7%	5.2%	3.2%	4.1%	1.2%	4.6%	-0.5%	-1.7%	3.6%	0.7%	8.6%	8.7%	5.1%	10.5%	7.9%	9.3%	9.8%	7.5%	11.8%	13.0%	11.9%	10.1%
Turbines, Generators & Other Power Equipment	-11.3%	-11.8%	-7.4%	-11.3%	-11.3%	-5.5%	21.5%	22.6%	18.8%	6.9%	-8.8%	-19.8%	-16.0%	-13.0%	-13.8%	1.4%	-1.2%	5.8%	14.9%	14.0%	13.8%	9.0%	4.8%	3.4%
Material Handling Equipment	-5.0%	-9.6%	-7.4%	-4.7%	1.9%	6.9%	6.4%	0.2%	-7.7%	-4.6%	-2.3%	5.0%	15.1%	10.3%	7.0%	5.9%	5.2%	6.8%	7.1%	7.0%	7.4%	7.2%	8.6%	8.1%
Other Machinery	3.1%	2.5%	1.9%	2.1%	4.3%	5.3%	6.0%	4.0%	0.1%	-1.0%	-1.8%	-0.7%	-5.2%	-5.6%	-4.6%	-3.2%	1.5%	2.3%	3.9%	5.3%	4.9%	5.9%	5.5%	4.1%
Computers & Electronics	-1.5%	-2.0%	5.2%	4.1%	1.9%	0.8%	0.0%	-2.4%	-0.7%	-0.2%	0.1%	0.9%	-2.6%	-1.5%	0.6%	2.6%	7.8%	8.3%	11.5%	16.5%	15.5%	14.9%	8.0%	0.7%
Computers, Storage Devices & Peripherals	-9.9%	-8.6%	3.9%	5.6%	1.7%	6.3%	-9.0%	-18.2%	-9.5%	-12.6%	1.3%	3.5%	-6.3%	-8.0%	-10.7%	-7.8%	-0.8%	-3.1%	1.1%	-5.1%	-8.3%	-5.5%	-8.7%	-2.6%
Communications Equipment	5.3%	4.7%	1.6%	-4.8%	-8.0%	-11.9%	-11.6%	-15.5%	-11.8%	-9.7%	-9.5%	-2.0%	-9.0%	-4.8%	-0.3%	-0.6%	5.3%	2.9%	1.6%	9.6%	10.1%	10.8%	10.3%	3.2%
Audio and Video Equipment	-3.4%	-10.6%	6.3%	1.9%	15.7%	21.9%	-0.3%	-25.2%	-40.5%	-18.6%	23.9%	52.5%	84.3%	41.2%	-5.9%	6.1%	3.2%	17.9%	13.4%	15.3%	14.5%	8.3%	8.2%
Electronic Components	0.5%	1.6%	10.4%	12.4%	10.6%	6.4%	7.2%	3.9%	8.3%	7.4%	-0.3%	-2.1%	-8.6%	-6.5%	0.0%	6.2%	14.2%	18.8%	24.2%	29.6%	28.4%	24.9%	10.4%	-3.4%
Search and Navigation Equipment	-3.3%	-4.0%	-2.6%	-1.7%	-5.0%	-2.9%	-2.6%	-2.8%	-3.4%	1.6%	3.5%	4.1%	4.5%	1.7%	2.5%	1.8%	7.9%	7.9%	6.1%	9.7%	7.1%	7.3%	7.7%	4.9%
Electromedical, Measuring, and Control Instruments	-2.4%	-4.7%	6.4%	2.3%	1.0%	0.6%	1.0%	1.2%	-2.1%	-1.9%	1.0%	1.8%	3.1%	4.7%	4.3%	2.7%	4.2%	2.6%	6.3%	12.1%	12.7%	13.4%	8.4%	4.3%
Other Electronics	-14.9%	-13.6%	-9.6%	-2.9%	-0.3%	8.5%	16.1%	19.4%	43.7%	34.9%	23.8%	14.0%	-1.8%	-3.7%	-3.0%	-0.7%	2.2%	2.5%	1.6%	-0.4%	-1.3%	-2.0%	-2.2%	-2.0%
Electrical Equipment, Appliances & Components	0.7%	0.2%	0.7%	-0.5%	-0.9%	0.0%	4.9%	5.5%	3.8%	1.4%	-2.0%	-4.5%	-8.1%	-6.6%	-5.5%	-2.5%	2.0%	2.6%	1.4%	2.1%	2.9%	3.6%	5.1%	4.8%
Electric Lighting Equipment	-11.1%	-9.7%	9.5%	16.3%	7.3%	6.3%	-0.9%	-3.5%	-1.8%	2.2%	7.1%	6.4%	7.4%	5.6%	1.0%	-2.1%	0.5%	2.3%	-2.8%	-2.7%	-4.1%	-4.6%	1.0%	3.2%
Household Appliances	2.1%	-1.8%	-3.5%	-4.6%	-3.4%	1.7%	9.0%	13.6%	11.3%	8.9%	2.4%	-0.8%	-3.9%	-8.2%	-7.1%	-5.3%	-6.0%	-4.5%	-5.9%	-7.3%	-4.2%	-1.2%	1.0%	3.8%
Electrical Equipment	-0.2%	-0.3%	2.8%	3.6%	3.6%	0.9%	3.3%	2.4%	-1.3%	-4.6%	-7.1%	-10.0%	-12.3%	-9.1%	-9.8%	-6.4%	-3.8%	-5.1%	-6.2%	-5.5%	-1.9%	1.6%	5.6%	5.5%
Batteries	-5.5%	-1.7%	-5.6%	-3.7%	6.5%	6.0%	19.6%	12.7%	4.9%	3.9%	-5.5%	-1.8%	-3.8%	-5.6%	-4.0%	-7.5%	-3.9%	-2.1%	1.3%	3.8%	1.7%	3.5%	2.2%	3.3%
Other Electrical	6.2%	5.0%	0.0%	-5.8%	-7.7%	-4.6%	2.6%	5.8%	6.7%	2.6%	-0.9%	-5.1%	-11.7%	-7.4%	-3.3%	3.7%	13.6%	14.1%	12.5%	13.7%	12.1%	9.4%	8.1%	5.4%
Transportation equipment	6.8%	6.0%	6.9%	8.6%	8.5%	6.8%	11.5%	7.9%	6.1%	6.3%	3.8%	0.3%	1.1%	-2.5%	-4.1%	-1.2%	-1.0%	1.4%	1.7%	3.7%	4.7%	4.7%	4.9%	3.9%
Light Vehicles	13.6%	3.7%	9.7%	17.8%	7.3%	11.2%	17.3%	9.4%	9.0%	10.5%	6.9%	2.3%	5.2%	5.2%	-7.3%	-2.9%	-4.4%	-0.1%	1.9%	4.5%	5.2%	6.7%	2.9%
Medium- and Heavy-Duty Trucks	-10.0%	-2.4%	7.2%	2.4%	0.2%	-5.9%	6.7%	12.4%	16.8%	18.8%	8.7%	-0.7%	-8.7%	-16.0%	-22.7%	-20.0%	-12.2%	2.6%	20.7%	26.3%	24.9%	15.9%	9.1%	7.9%
Motor Vehicle Parts	5.8%	6.8%	4.0%	6.2%	10.3%	7.8%	12.2%	8.8%	5.3%	4.6%	4.3%	2.7%	6.6%	6.3%	4.8%	6.9%	4.5%	4.6%	3.3%	4.4%	4.9%	4.7%	5.0%	3.0%
Aerospace	2.0%	9.8%	9.8%	4.3%	12.2%	4.9%	8.1%	4.3%	3.7%	4.1%	-0.9%	-4.0%	-9.1%	-9.3%	-9.5%	-9.0%	-5.5%	-3.2%	0.6%	1.5%	1.8%	1.4%	0.1%	6.6%
Ships and Boats	7.0%	9.5%	0.9%	1.0%	7.3%	-6.7%	-2.9%	2.9%	-8.3%	4.9%	8.3%	3.8%	15.8%	4.4%	7.3%	6.8%	-0.6%	6.0%	-2.1%	-2.3%	2.4%	1.2%	3.0%	1.9%
Other Transportation	9.2%	3.3%	2.4%	4.8%	0.0%	4.1%	6.5%	9.7%	8.9%	-2.2%	-0.5%	-6.1%	-10.0%	-2.0%	-8.7%	-2.3%	7.5%	3.6%	6.7%	8.9%	6.2%	9.5%	9.6%	3.9%
Furniture & Related Products	1.6%	2.7%	2.8%	2.7%	1.0%	0.3%	1.9%	5.3%	3.6%	6.2%	7.6%	4.4%	7.8%	3.8%	1.4%	2.7%	2.0%	2.1%	3.3%	3.3%	3.2%	4.3%	3.4%	2.7%
Miscellaneous Durable Goods	4.3%	4.8%	5.3%	3.7%	-0.3%	-3.4%	-4.3%	-2.8%	-0.2%	0.4%	1.0%	1.9%	-2.1%	-0.1%	-3.3%	-5.5%	-2.1%	-1.6%	2.8%	6.7%	7.0%	7.0%	5.6%	3.9%

US Non-Durable Goods Manufacturing Gross Output Heat Map
(Y/Y Growth)

	1Q 13	2Q 13	3Q 13	4Q 13	1Q 14	2Q 14	3Q 14	4Q 14	1Q 15	2Q 15	3Q 15	4Q 15	1Q 16	2Q 16	3Q 16	4Q 16	1Q 17	2Q 17	3Q 17	4Q 17	1Q 18
Food Products	4.6%	3.6%	3.0%	2.1%	4.8%	5.1%	3.4%	3.3%	-1.5%	-3.0%	-1.8%	-3.1%	-1.1%	0.4%	0.4%	1.9%	4.2%	6.2%	6.1%	4.4%	2.9%
Grain & Oilseed Milling	12.5%	2.7%	-1.7%	-2.7%	-4.6%	-3.7%	-6.0%	-8.3%	-10.9%	-8.5%	-7.5%	-7.9%	-4.1%	-2.5%	-1.7%	0.8%	3.2%	2.6%	4.3%	3.3%	3.9%
Dairy Products	-0.4%	5.9%	7.4%	3.5%	17.0%	14.0%	7.1%	8.5%	-9.7%	-11.6%	-9.4%	-8.7%	-1.6%	-2.2%	-0.1%	1.0%	6.0%	7.4%	3.6%	1.1%	-2.5%
Meat, Poultry, and Seafood Products	1.8%	2.0%	5.0%	6.1%	7.6%	8.8%	7.7%	5.9%	2.5%	-1.9%	-3.4%	-6.8%	-5.6%	-2.3%	-2.9%	0.0%	3.5%	7.2%	8.3%	5.3%	3.2%
Other Food Products	5.6%	4.3%	1.8%	0.7%	2.1%	2.3%	2.1%	3.4%	1.7%	1.1%	3.8%	2.9%	2.9%	3.8%	3.2%	3.6%	4.4%	6.2%	6.0%	5.2%	4.2%
Beverages	4.8%	4.0%	6.5%	4.8%	3.6%	3.2%	1.4%	2.9%	4.0%	3.5%	4.2%	3.8%	4.6%	5.1%	5.9%	0.7%	-0.6%	-4.2%	-8.7%	-6.6%	-6.1%
Tobacco	-1.0%	2.9%	-0.6%	-1.7%	-9.6%	-13.3%	-7.5%	1.6%	15.2%	17.0%	5.9%	7.9%	-1.3%	-6.0%	2.8%	3.7%	10.5%	12.1%	10.4%	-0.3%	6.6%
Textile Mills	1.3%	4.8%	6.3%	6.5%	0.8%	0.4%	-0.7%	-3.7%	-2.0%	-3.3%	-2.3%	-1.0%	-2.7%	-1.7%	-2.4%	0.5%	5.1%	4.5%	5.4%	3.7%	1.5%
Textile Products	-2.7%	1.0%	5.5%	12.3%	8.4%	12.4%	12.2%	6.9%	9.4%	1.0%	-0.3%	-2.4%	-2.2%	2.0%	0.6%	3.1%	3.3%	2.6%	1.7%	3.3%	4.2%
Apparel	0.1%	2.7%	-2.9%	-5.2%	-9.0%	-6.7%	-6.3%	2.4%	2.1%	-2.9%	2.4%	-1.3%	1.0%	8.8%	4.7%	2.3%	7.0%	4.4%	3.5%	6.1%	5.2%
Leather & Allied Products	1.4%	-0.8%	4.1%	5.8%	-1.7%	-0.2%	0.4%	3.5%	3.7%	2.4%	-1.2%	-11.3%	-13.1%	-12.5%	-10.0%	-1.5%	2.0%	1.3%	1.3%	-2.0%	-4.5%
Paper & Products	4.3%	3.3%	3.2%	1.3%	-2.0%	1.1%	1.1%	2.0%	1.4%	-1.3%	-1.9%	-1.0%	0.6%	0.1%	-0.6%	-0.1%	0.9%	2.0%	4.7%	5.4%	5.2%
Pulp, Paper & Paperboard Mills	2.5%	2.8%	3.5%	0.9%	0.1%	1.4%	-1.3%	-1.5%	-1.1%	-3.7%	-4.3%	-2.4%	-3.8%	-2.9%	-1.5%	-1.6%	-0.2%	0.9%	2.1%	2.1%	1.8%
Paperboard Containers	8.8%	10.0%	8.2%	4.4%	-2.5%	2.7%	7.4%	9.1%	5.7%	0.7%	-2.1%	-0.9%	6.6%	2.9%	0.7%	2.1%	3.8%	3.5%	4.3%	5.4%	3.7%
Other Paper Products	2.3%	-3.5%	-3.4%	-1.5%	-5.1%	-1.4%	-2.8%	-0.6%	0.8%	0.7%	3.0%	1.4%	0.9%	1.5%	-0.7%	-0.5%	-1.3%	1.7%	9.7%	11.2%	13.8%
Printing	4.3%	0.6%	-2.1%	-2.7%	-3.1%	-1.4%	0.3%	0.4%	0.6%	1.1%	1.4%	2.0%	0.2%	-1.2%	-1.7%	-3.8%	-4.9%	-7.6%	-7.8%	-4.5%	-1.9%
Petroleum and coal products	2.0%	0.0%	-2.4%	-1.9%	-3.5%	1.6%	-8.0%	-21.8%	-36.6%	-31.9%	-38.1%	-35.4%	-33.1%	-25.9%	-13.6%	9.4%	41.6%	19.0%	22.8%	24.6%	18.6%
Petroleum Refineries	2.4%	0.5%	-2.4%	-1.6%	-3.1%	2.0%	-8.4%	-23.0%	-38.4%	-33.7%	-40.1%	-37.6%	-35.7%	-28.1%	-14.5%	10.4%	45.5%	20.0%	23.4%	25.0%	18.8%
Paving, Roofing & Other products	-3.3%	-7.8%	-1.9%	-7.0%	-9.8%	-4.7%	-2.1%	1.3%	-2.9%	0.0%	-6.0%	-4.1%	-3.3%	-0.7%	-4.8%	0.9%	10.9%	10.1%	17.5%	21.0%	16.4%
Pharmaceuticals	-8.6%	-5.1%	3.1%	6.8%	8.1%	11.9%	5.6%	3.0%	5.3%	4.9%	17.7%	19.7%	17.7%	15.3%	4.7%	6.0%	6.2%	6.7%	10.9%	12.1%	10.1%
Chemicals (excluding pharmaceuticals)	1.1%	1.6%	0.7%	-0.2%	3.9%	1.7%	-2.0%	-5.1%	-11.5%	-12.4%	-10.4%	-8.8%	-4.8%	-3.5%	-3.2%	-3.0%	-3.8%	-0.9%	0.1%	4.0%	10.4%
Basic Chemicals	1.5%	0.9%	0.5%	-0.3%	1.9%	-1.0%	-4.5%	-7.7%	-15.8%	-16.4%	-15.2%	-12.9%	-8.2%	-7.3%	-7.1%	-6.7%	-5.7%	-1.1%	0.3%	4.6%	10.4%
Inorganics	-4.6%	-6.0%	-5.6%	-4.2%	-4.1%	-3.0%	-2.4%	-2.4%	0.0%	-0.8%	-1.9%	-3.5%	-6.2%	-5.6%	-6.2%	-4.0%	-4.5%	-4.1%	-1.2%	-1.5%	9.8%
Petrochemicals & Organics	2.7%	2.1%	1.0%	-0.7%	0.7%	-2.8%	-6.6%	-10.0%	-19.7%	-20.1%	-18.3%	-15.9%	-10.6%	-9.8%	-10.4%	-10.4%	-7.5%	-0.5%	3.6%	8.3%	15.1%
Synthetic Materials	2.2%	2.1%	2.5%	2.4%	7.1%	3.5%	-1.1%	-5.7%	-15.3%	-16.5%	-15.5%	-11.9%	-4.7%	-3.7%	-1.5%	-1.4%	-3.1%	-0.8%	-4.2%	1.6%	3.2%
Specialty Chemicals	0.8%	1.5%	4.2%	4.9%	3.7%	5.0%	3.1%	2.7%	0.8%	-1.4%	0.0%	-1.3%	1.0%	1.9%	0.7%	1.6%	2.1%	4.5%	7.4%	8.9%	12.0%
Coatings & Adhesives	0.5%	1.6%	7.7%	9.3%	4.5%	8.5%	5.3%	5.8%	3.3%	-0.8%	2.7%	0.1%	5.9%	7.8%	4.9%	6.8%	3.8%	5.7%	7.0%	7.4%	10.1%
Other Specialty Chemicals	0.9%	1.4%	1.6%	1.6%	3.1%	2.3%	1.3%	0.3%	-1.2%	-1.9%	-2.3%	-2.4%	-3.1%	-3.1%	-3.0%	-3.0%	0.6%	3.4%	7.8%	10.2%	13.7%
Agricultural Chemicals	23.2%	26.5%	-1.8%	-13.3%	-4.2%	-6.0%	-13.7%	-15.7%	-10.9%	-11.5%	1.9%	-0.4%	-0.1%	2.9%	3.7%	2.3%	-9.9%	-14.6%	-18.4%	-9.2%	-2.2%
Consumer Chemistry	-10.2%	-5.9%	-0.7%	3.5%	19.2%	16.2%	10.6%	4.6%	-4.7%	-6.7%	-6.2%	-3.1%	0.2%	2.7%	4.1%	3.4%	-0.3%	0.4%	0.7%	3.0%	13.7%
Plastics & Rubber Products	3.8%	3.5%	3.1%	3.4%	2.4%	4.4%	4.1%	4.3%	3.1%	0.8%	0.8%	-1.3%	0.2%	1.3%	1.3%	2.2%	1.1%	0.2%	-0.8%	0.8%	1.8%

US Gross Output Diffusion Index
(% of 119 Sectors/Industries Expanding)
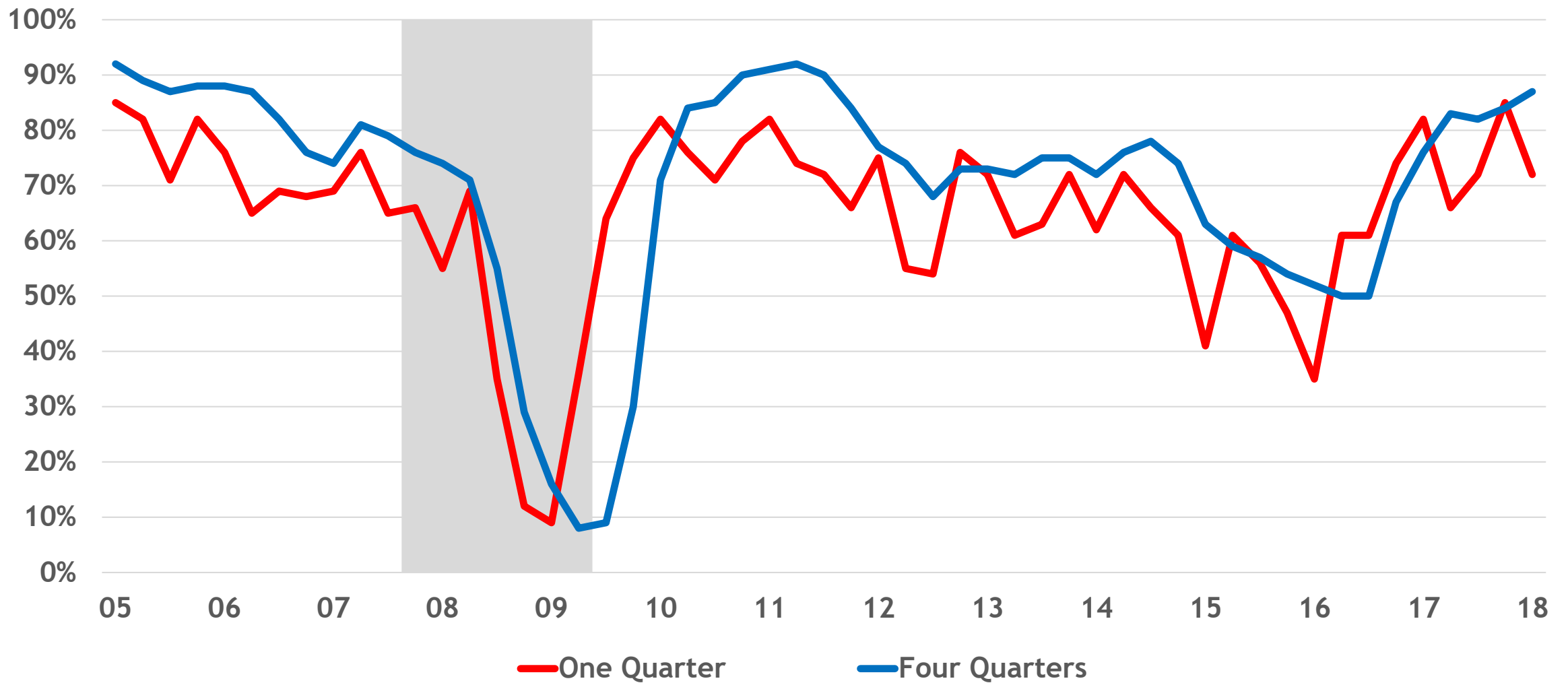
Using Leading Indicators to Signal Business Cycle Turns

Major Forecasting Techniques (I)

- Qualitative Forecasts
  - Survey Techniques
    - Surveys of business executives' capital and other spending plans (McGraw-Hill, Conference Board, etc.)
    - Surveys of plans for inventory changes and sales expectations (McGraw-Hill ISM, etc.)
    - Surveys of consumer spending plans (Conference Board, University of Michigan, etc.)
  - Opinion Polls
    - Executive/expert polling (i.e., Delphi method)
    - Sales force polling
    - Consumer intentions polling

Major Forecasting Techniques (II)

- Smoothing Techniques/Time Series Analysis
  - Simple Moving Averages
  - Exponential Smoothing
  - Auto Regressive Integrated Moving Average (ARIMA) Models
  - Vector Auto-regression (VAR) Models
- Econometric Models
  - Single Equation Models (demand functions, cost functions, etc.)
  - Multiple Equation Models
  - Systems of Simultaneous Equations (linking demand, supply, price, etc.)
- Input-Output Forecasting
- Barometric Methods

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Definition of Business Cycles

"Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in <u>business enterprises</u>: a cycle consists of expansions occurring at about the same time in many economic <u>activities</u>, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle; this sequence of changes is recurrent but not periodic; in duration business cycles vary from more than one year to ten or twelve years; they are not divisible into shorter cycles of similar character with amplitudes approximating their own."

Burns and Mitchell, 1946

Business Cycle Chronologies

The "two quarters of declining GDP" is not an adequate definition, nor a proper criterion for a recession. In fact, the 2001 recession was not marked by two successive declines in quarterly GDP.

The historical dates of US business cycle peaks and troughs are based on the consensus of the dates of the peaks and troughs in the broad measures of GDP as well as industrial output, employment, personal income (less transfer payments) and business sales. These properly mark the start- and end-dates of recessions. That is, the peaks and troughs.

The Dating Committee of the National Bureau of Economic Research (NBER) is the arbiter of peaks and troughs, and maintains an up-to-date list of business cycle dates, which is available at www.nber.org.

On Business Cycles and Forecasting

Sir Alexander Kirkland "Alec" Cairncross: "A trend is a trend is a trend, the question is, will it bend? Will it alter its course through some unforeseen force and come to a premature end?"

Peter Navarro: "...for its arguably the case that the business cycle is one of the single most important determinants of corporate profitability and stock price performance."

In 2017 Barclay's analyst Scott Davis looked at the worst-performing industrial stocks and one of three characteristics that can be traced to CEO missteps was they mismanage the business cycle and costs

Cycles Matter: Can You Guess the Industry?
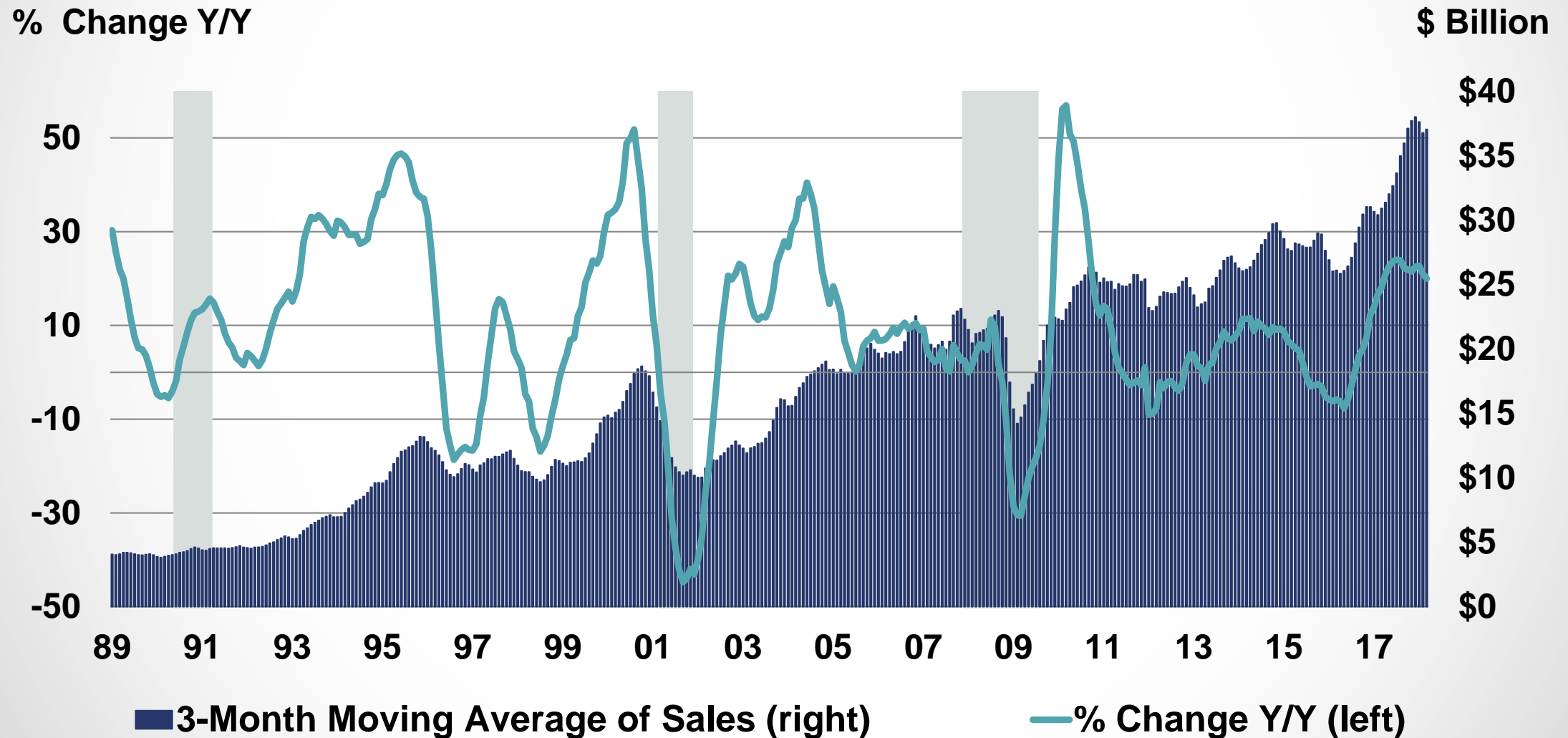
What are Leading Indicators?

- Leading indicators generally give early signals (by 6-9 months) of turning points in business (or industry) activity
- They are based on actual indicators of economic activity (and economic rationale) rather than models
- Potential leading indicators:
    - Early stage indicators (new orders, construction approvals, etc.)
    - Rapidly responsive indicators that react to changes in activity (average hours worked, profits, inventories, etc.)
    - Expectation-sensitive indicators (equity prices, commodity prices, etc.)
    - Prime mover indicators relating to monetary policy (money supply, etc.)

Timing and Business Cycle Leading Indicators
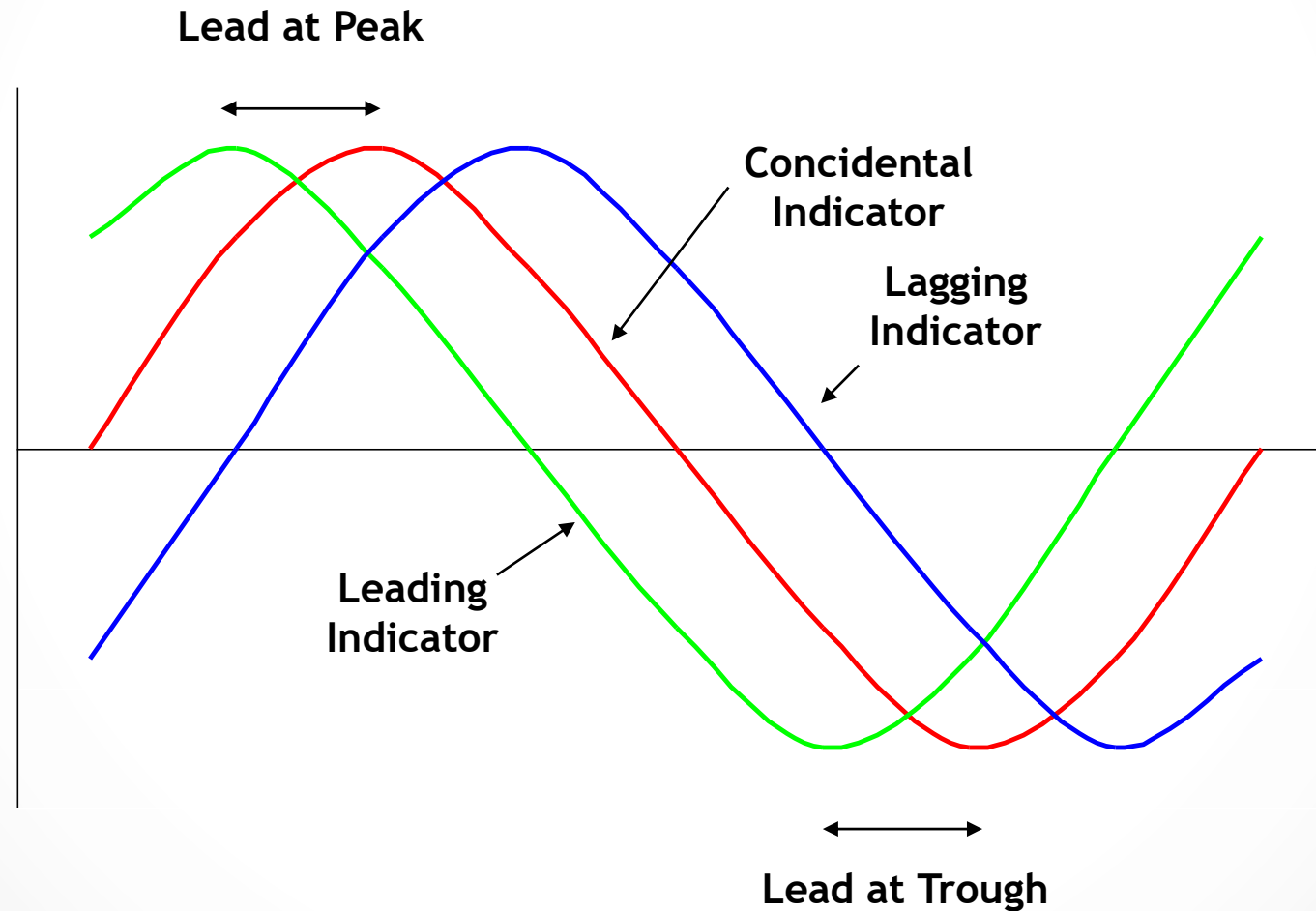
What Makes a Good Leading Indicator?

- **Economic Relevance:**
  - Economic significance: Importance to the economic process being measured and evaluated (is it collected and processed in a statistically acceptable manner)
  - Breadth of coverage: Broader measures are preferred
- **Practical Considerations:**
  - Frequency: Monthly
  - Currency: Early availability of data (should be fresh)
  - Revisions: Should not be subject to frequent revisions
  - Length: Longer time series with no breaks are preferred
  - Conformity: Measure of the degree to which it moves consistently leads business activity over time (evaluated by the number of false signals and missed turning points)
  - Smoothness: Magnitude of irregular fluctuations (should move reliably with general business activity and not fluctuate erratically from month to month)

Using Leading Indicators

- Smooth the data out – use a three-month moving average (3 MMA) for both leading indicator and your measure of business activity
- Leading indicators must make economic sense
  - Supply chain sequence
  - Ordering sequence (orders and order backlogs always lead shipments, permits always lead starts, etc.)
  - Don't ignore pressure indicators (ratios, differences, rate of change, etc.)
- Major leading indicator systems:
  - Conference Board (www.conference-board.org)
  - Economic Cycle Research Institute (www.businesscycle.com)
  - OECD (www.oecd.org)
  - American Institute for Economic Research (www.aier.org)
  - Some District Federal Reserve Banks (see www.philadelphiafed.org for example)
  - USGS Metals and Non-Metallic Minerals Indicators (www.usgs.gov)
  - American Chemistry Council (see www.americanchemistry.com/jobs/CAB)
- Remember these suggest turning points
- Also, watch commodity prices, the yield curve, and equity prices

Composite Indexes are Better than Single Leading Indicators

- Possible to produce industry, regional, international and other leading indicators
- By combining leading indicators into a composite index we can develop a consistent pattern over time
- A non-model approach, steps in construction are:

  1. Calculate month-to-month changes in the component indices;
  2. Adjust month-to-month changes by multiplying them by the component's weighting;
  3. Sum the adjusted month-to-month changes (across the components for each month);
  4. Compute preliminary levels of the composite index; and
  5. Rebase the composite index to reflect the average lead (in months) of a reference time series

Business Cycle Forecasting

- Identifying the business cycle requires separating the cyclical element from the seasonal and random

- Eliminate seasonal elements by converting data to annual rate of change data (i.e., year-earlier comparisons, preferably on a three-month-moving average basis)

- Plot the data on a graph, which reveals regular upswings and downswings

- Compare this curve to the curves of leading indicators, noting the lags and leads

- Use the actual history of the leading indicator to forecast <u>directional change</u> (i.e. turning points) in your business data

Give Every Business Cycle (Recession and Expansion) its DUE

- <u>D</u>istance - It's depth, intensity, and pronounced effect
- <u>U</u>biquity - It's diffusion, dispersion, universality, frequency, incidence, and pervasiveness among markets and industries
- <u>E</u>ndurance - It's duration, extent, length, and persistence in time

Conference Board Index of Leading Economic Indicators (LEI)

Index where 2016=100
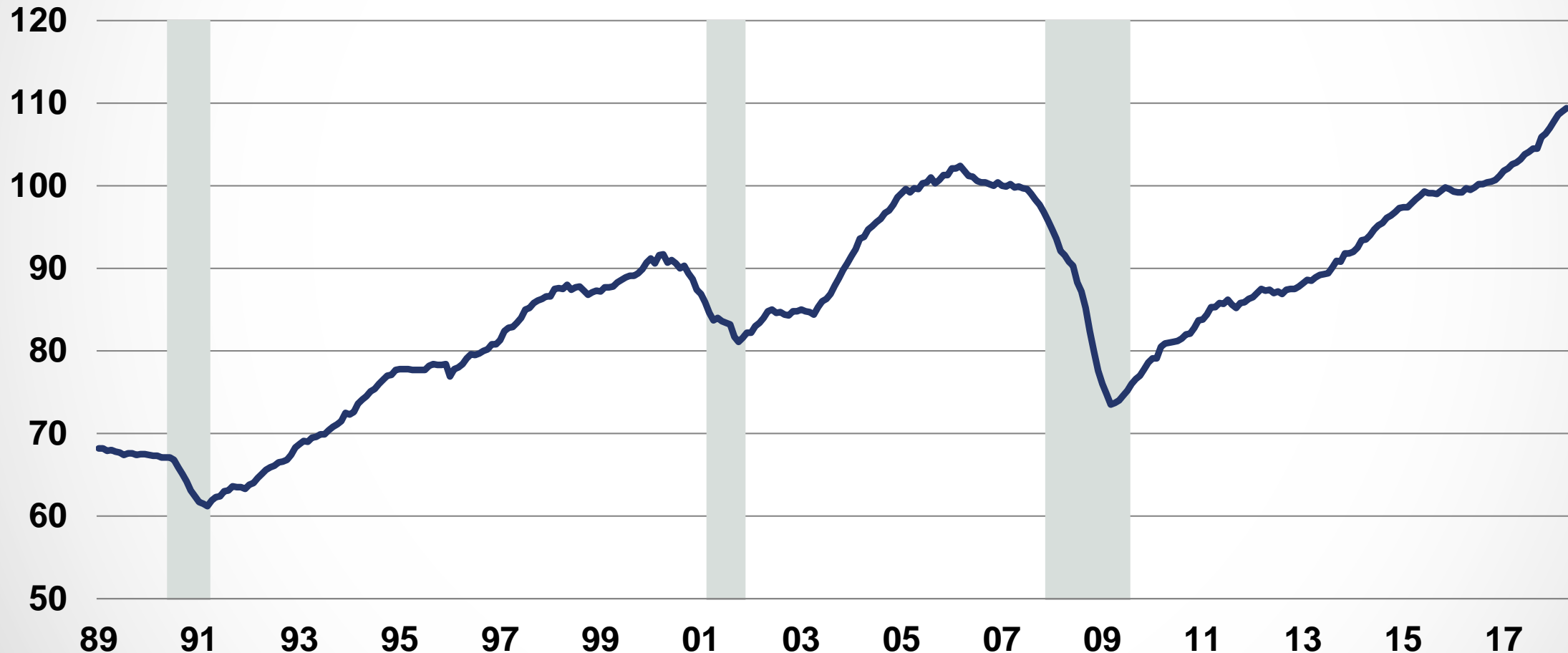
Source: Conference Board

Conference Board Composite Economic Index Components

U.S. Composite Economic Indexes: Components and Standardization Factors

Leading Economic Index		Factor
1	Average weekly hours, manufacturing	0.2778
2	Average weekly initial claims for unemployment insurance	0.0328
3	Manufacturers' new orders, consumer goods and materials	0.0830
4	ISM® new orders index	0.1589
5	Manufacturers' new orders, nondefense capital goods excl. aircraft	0.0410
6	Building permits, new private housing units	0.0295
7	Stock prices, 500 common stocks	0.0393
8	*Leading Credit Index™*	0.0812
9	Interest rate spread, 10-year Treasury bonds less federal funds	0.1125
10	Avg. consumer expectations for business conditions	0.1440

Coincident Economic Index		
1	Employees on nonagricultural payrolls	0.5302
2	Personal income less transfer payments	0.2042
3	Industrial production	0.1462
4	Manufacturing and trade sales	0.1194

Lagging Economic Index		
1	Inventories to sales ratio, manufacturing and trade	0.1260
2	Average duration of unemployment	0.0371
3	Consumer installment credit outstanding to personal income ratio	0.1821
4	Commercial and industrial loans	0.0960
5	Average prime rate	0.3009
6	Labor cost per unit of output, manufacturing	0.0498
7	Consumer price index for services	0.2081

Monthly Conference Board LEI and CEI Summary

Table 1. Summary of U.S. Composite Economic Indexes

	2017			2018			
	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Leading index	105.9	106.3	107.0	107.8 r	108.6 r	109.0	109.4 p
Percent change	1.3	0.4	0.7	0.7 r	0.7	0.4 r	0.4 p
Diffusion index	100	60	70	80	80	60	80
Coincident index	102.4	102.7	102.9	102.8	103.0 r	103.2 r	103.5 p
Percent change	0.4	0.3	0.2	-0.1	0.2 r	0.2	0.3 p
Diffusion index	100	100	100	25	100	100	100
Lagging index	103.0	103.1 r	103.8	104.2 r	104.5 r	104.4 r	104.7 p
Percent change	0.2	0.1 r	0.7 r	0.4 r	0.3	-0.1 r	0.3 p
Diffusion index	50	57.1	78.6	64.3	71.4	64.3	64.3
Coincident-lagging ratio	99.4	99.6 r	99.1	98.7 r	98.6 r	98.9	98.9 p

	Apr to	May to	Jun to	Jul to	Aug to	Sep to	Oct to
	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Leading index							
Percent change	3.0	3	3.1	3.6	3.9	4.3	3.3
Diffusion index	100	95	90	90	100	100	90
Coincident index							
Percent change	1.1	1.2	1.3	1.0	1.2	1.2	1.1
Diffusion index	100	100	100	100	100	100	100
Lagging index							
Percent change	0.8	0.7	1.2	1.4	1.5	1.6	1.7
Diffusion index	71.4	42.9	71.4	71.4	78.6	85.7	85.7

Trends in Components of the Conference Board LEI
"The Swiss Army Knife of Economic Reports"

Table 2. Data and Net Contributions for Components of The Conference Board Leading Economic Index® (LEI) for U.S.

Components	2017			2018			
	Oct	Nov	Dec	Jan	Feb	Mar	Apr
U.S. Leading Economic Index Component Data							
Average workweek, production workers, mfg. (hours)	42.0	41.9	41.8	41.9	42.3	42.2	42.4
Average weekly initial claims, state unemployment insurance (thousands)*	234.7	240.7	240.1	234.1	224.9	228.5	221.6
Manufacturers' new orders, consumer goods and materials (mil. 1982 dol.)	137,344	138,680	141,197 r	138,188	138,931 r	139,554 r	139,726 **
ISM® New Orders Index (percent)	63.5	63.9	67.4	65.4	64.2	61.9	61.2
Manufacturers' new orders, nondefense capital goods excl. aircraft (mil. 1982 dol.)	39287	39216	39003	38857	39241 r	38981 r	39143 **
Building permits (thous.)	1,343 r	1,323 r	1,320 r	1,366 r	1,323 r	1,377 r	1,352
Stock prices, 500 common stocks © (index: 1941-43=10)	2,557.00	2,593.61	2,664.34	2,789.80	2,705.16	2,702.77	2,653.63
Leading Credit Index™ (std. dev.[1])*	-0.72 r	-1.44 r	-1.44 r	-1.69 r	-0.83 r	-0.46 r	-0.27
Interest rate spread, 10-year Treasury bonds less federal funds	1.21	1.19	1.10	1.17	1.44	1.33	1.18
Avg. Consumer Expectations for Business Conditions (std. dev.[1])	0.94 r	1.01 r	0.66 r	0.62 r	0.83 r	0.63 r	0.60
LEADING INDEX (2016=100)	105.9	106.3	107.0	107.8 r	108.6 r	109.0	109.4 p
Percent change from preceding month	1.3	0.4	0.7	0.7 r	0.7	0.4 r	0.4 p
Average workweek, production workers, mfg		-.07	-.07	.07	.26	-.07	.13
Average weekly initial claims, state unemployment insurance		-.08	.01	.08	.13	-.05	.10
Manufacturers' new orders, consumer goods and materials		.08	.15 r	-.18 r	.04 r	.04 r	.01 **
ISM® New Orders Index		.17	.25	.20	.18	.13	.12
Manufacturers' new orders, nondefense capital goods excl. aircraft		-.01	-.02	-.02	.04 r	-.03 r	.02 **
Building permits		-.04 r	-.01	.10 r	-.09 r	.12 r	-.05
Stock prices, 500 common stocks ©		.06	.11	.18	-.12	.00	-.07
Leading Credit Index™		.12	.12	.14	.07 r	.04	.02
Interest rate spread, 10-year Treasury bonds less federal funds		.13	.12	.13	.16	.15	.13
Avg. Consumer Expectations for Business Conditions		.14	.10	.09	.12	.09 r	.09

Notes on the Chemicals Activity Barometer(CAB)

What is it?
The Chemicals Activity Barometer (CAB) is a composite index of economic indicators that are based on data (and signals) from the chemical industry.

Why is it important?
Due its early position in the supply chain, chemical industry activity leads that in the overall US economy and business cycle.

What is it used for?
The CAB can be used to anticipate potential turning points in the overall US business cycle. The media and analysts will find this helpful.

How is the Chemicals Activity Barometer (CAB) Constructed?

- Based on 100 years of business cycle research
- The CAB is derived from:
    - Production data on a group of chemical products and related materials
    - Average weekly hours worked in chemicals
    - Chemical prices and input costs
    - Chemical company equity prices
    - Several broader economic leading economic measures (building permits, new orders, and inventories)
    - High frequency data such as chemical railcar loadings, equity prices and other prices are used to extend the CAB for the current month
- A composite index is built from these, and was found to lead turning points in the US business cycle based as measured by US industrial production, non-farm employment, real (i.e., inflation-adjusted) personal income (less transfer payments), and real business (manufacturers, wholesalers and retail) sales
- The CAB leads overall US business cycle peaks by eight months, and troughs by four months
- A paper explaining the methodology is available at www.businesschemistry.org (see volume 12, Issue 1).

Chemicals Activity Barometer vs. NBER Business Cycle Peaks and Troughs

NBER Business Cycle		Chemicals Activity Barometer		Timing Relationship (Months)	
Peak	Trough	Peak	Trough	Peak	Trough
August 1918	March 1919	January 1918	February 1919	7	1
January 1920	July 1921	October 1919	May 1921	3	2
May 1923	July 1924	December 1922	November 1923	5	8
October 1926	November 1927	June 1926	December 1926	4	11
August 1929	March 1933	December 1928	July 1932	8	8
May 1937	June 1938	December 1936	April 1938	5	2
February 1945	October 1945	August 1943	September 1945	18	1
November 1948	October 1949	September 1948	July 1949	2	3
July 1953	May 1954	May 1953	January 1954	2	4
August 1957	April 1958	December 1956	March 1958	9	1
April 1960	February 1961	May 1959	October 1960	12	4
December 1969	November 1970	May 1969	April 1970	7	7
November 1973	March 1975	February 1973	February 1975	9	1
January 1980	July 1980	March 1979	June 1980	14	1
July1981	November 1982	December 1980	August 1982	8	5
July 1990	March 1991	October 1989	January 2001	9	2
March 2001	November 2001	April 2000	October 2001	11	1
December 2007	June 2009	May 2007	March 2009	5	3
Source: National Bureau of Economic Research (NBER) and ACC			Average	8	4

Our Leading Barometer (CAB) of the US Business Cycle Suggests Accelerating Activity Through Year-End

Index where 2012 =100 (3MMA)

Recession — Chemical Activity Barometer
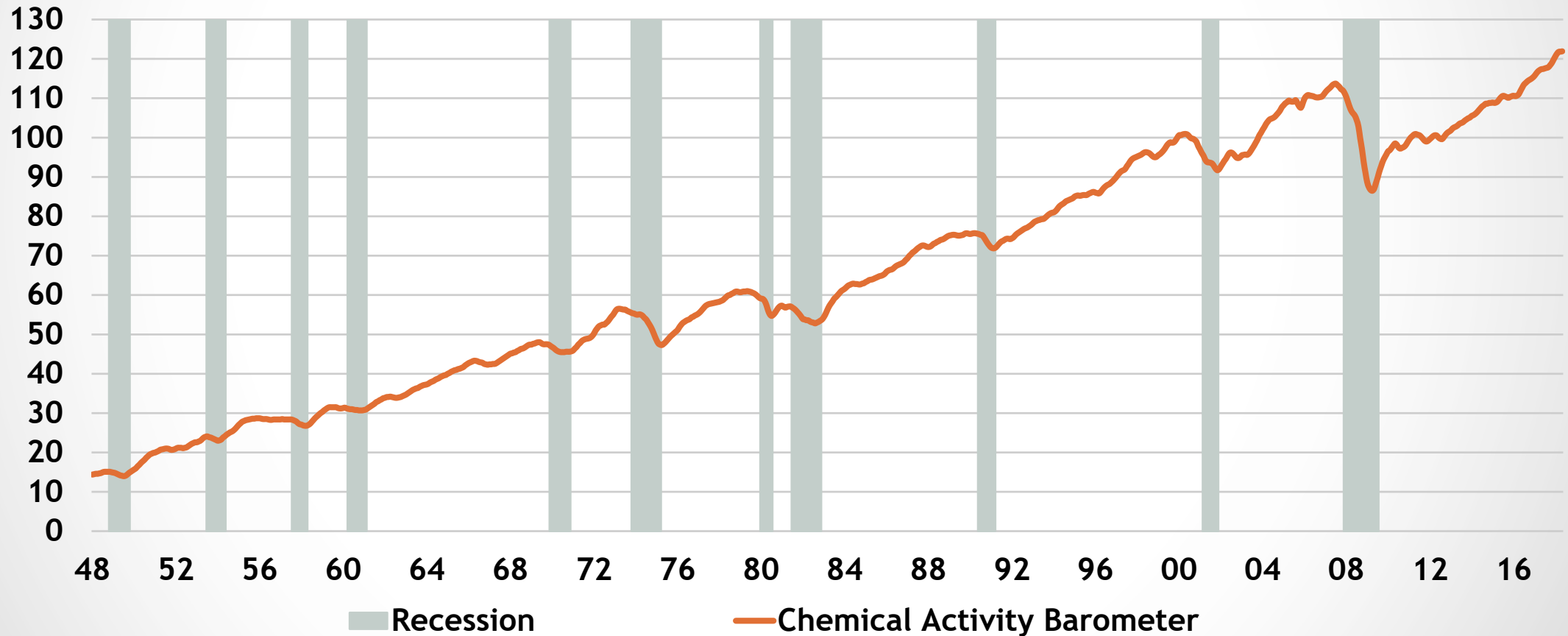
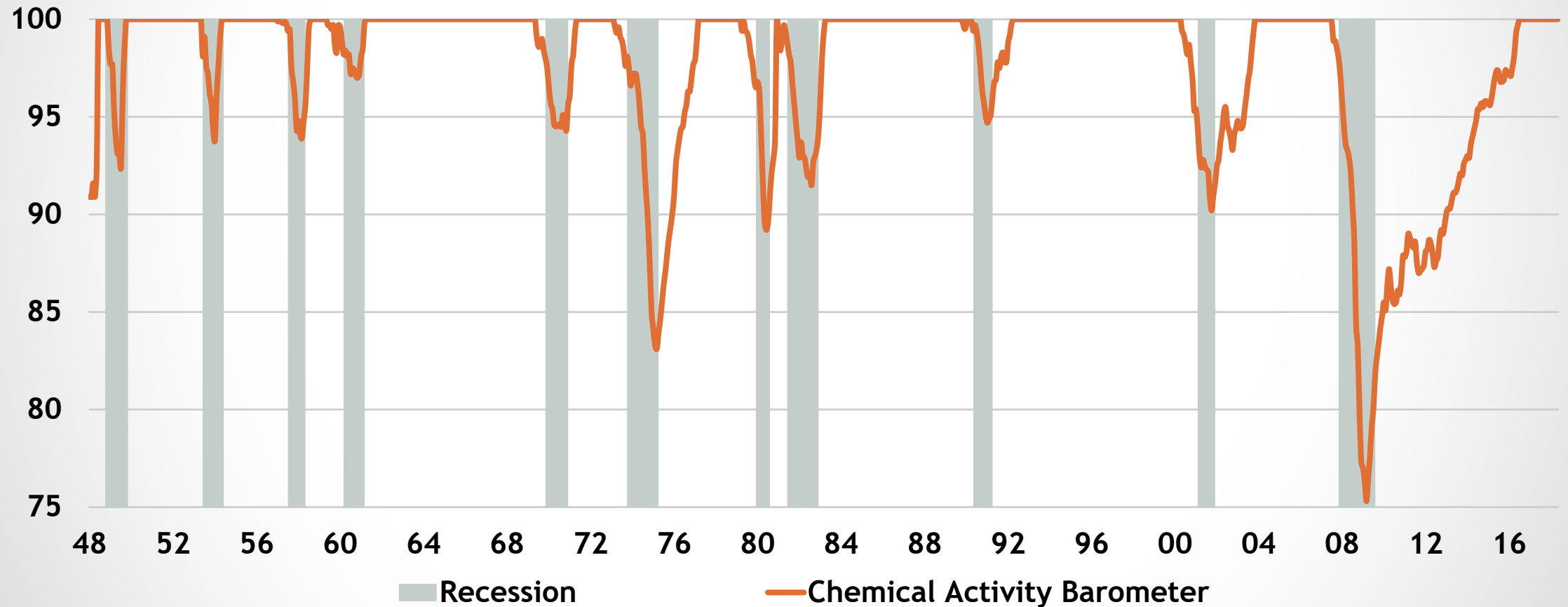# Annualized Six-Month CAB Growth Rate:1948-2018

Six-Month Annual Growth Rate*
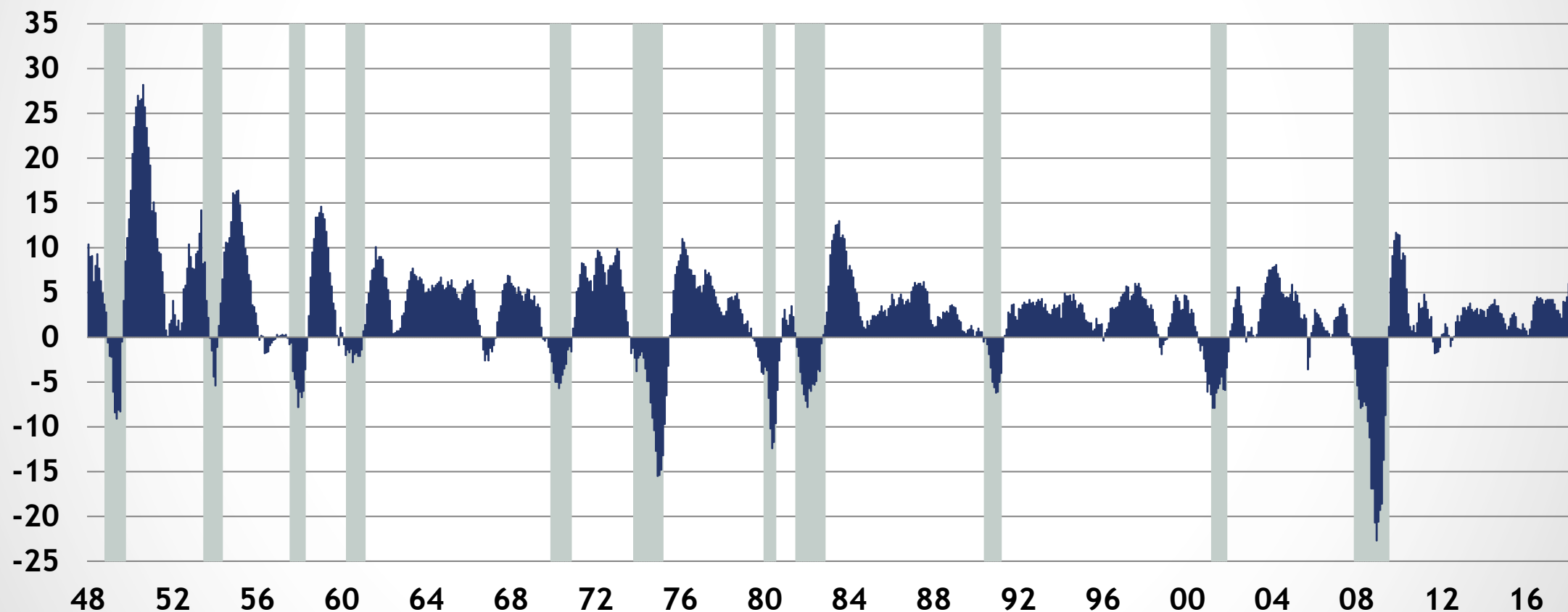
Source: American Chemistry Council

* Smoothed annualized growth rates based on ratio of index to its average over preceding 12 months
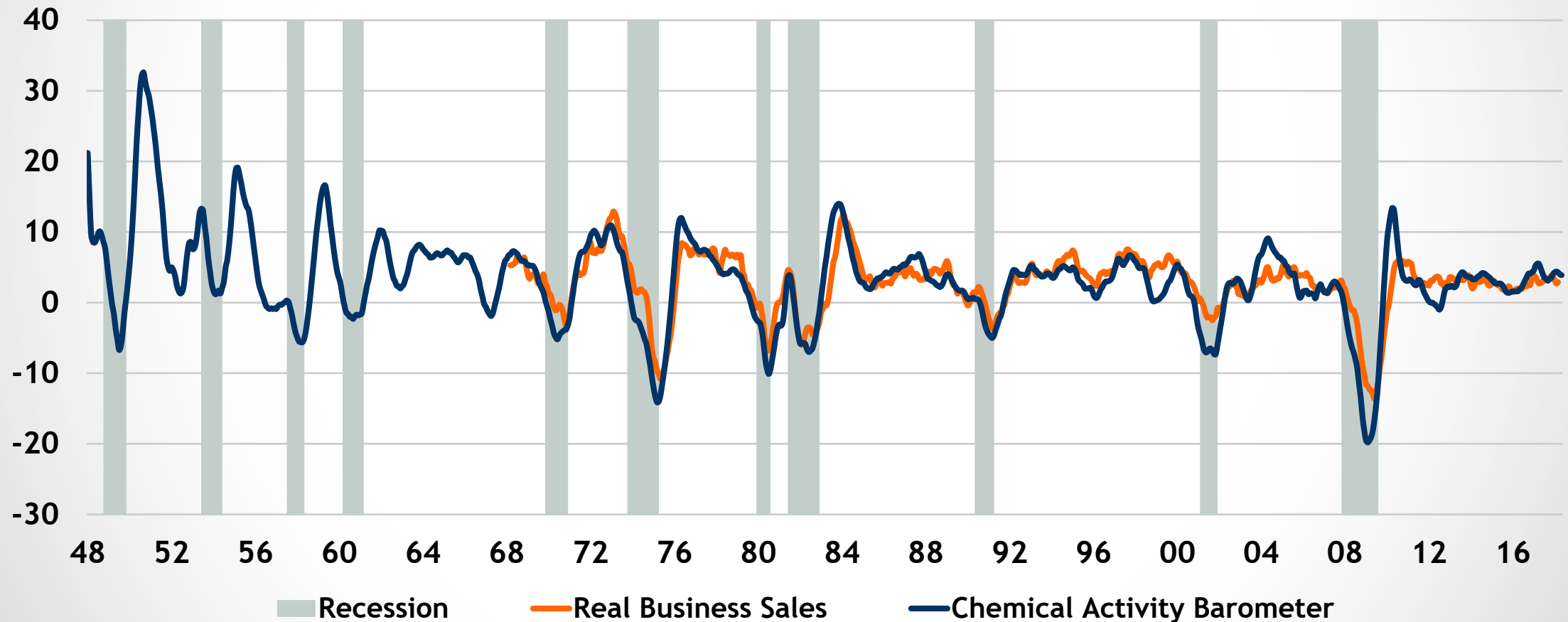
Year-over-Year Change in CAB vs. Real Business Sales: 1948-2018

% Change Year-over-Year (3MMA)

Recession | Real Business Sales | Chemical Activity Barometer

Sources: Bureau of Economic Analysis and ACC analysis

Some Resources on Creating Your Own

- *General Readings*
  - *Ahead of the Curve* by Joseph Ellis
  - *The Well-Time Strategy* by Peter Navarro
  - *Beating the Business Cycle* by Lakshman Aschuthan and Anirvan Banerji
- *Technical Readings*
  - *Measuring Business Cycles* by Arthur Burns and Wesley Mitchell
  - *Forecasting Financial and Economic Cycles* by Michael Niermira and Philip Klein
  - Working Papers and Business Cycle Indicator Manual at Conference Board (www.conference-board.org)
  - Technical notes for USGS Metals and Non-Metallic Minerals Indicators (www.usgs.gov)
  - My paper explaining the CAB methodology is available at www.businesschemistry.org (see volume 12, Issue 1).

For Further Information

American Chemistry Council

Please feel free to address questions to:

Dr. Thomas Kevin Swift, CBE

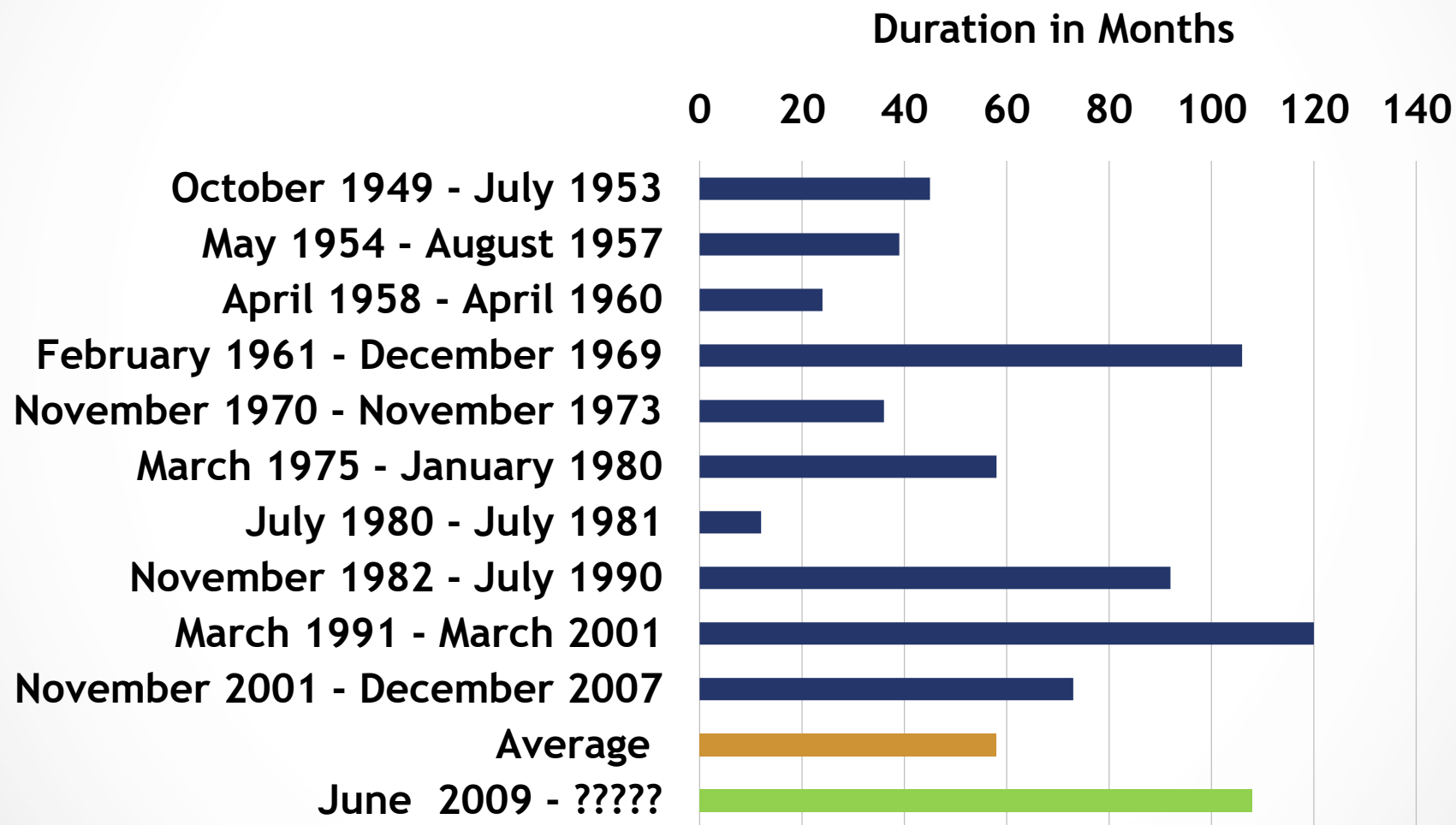Chief Economist & Managing Director

American Chemistry Council

Email: kevin_swift@americanchemistry.com
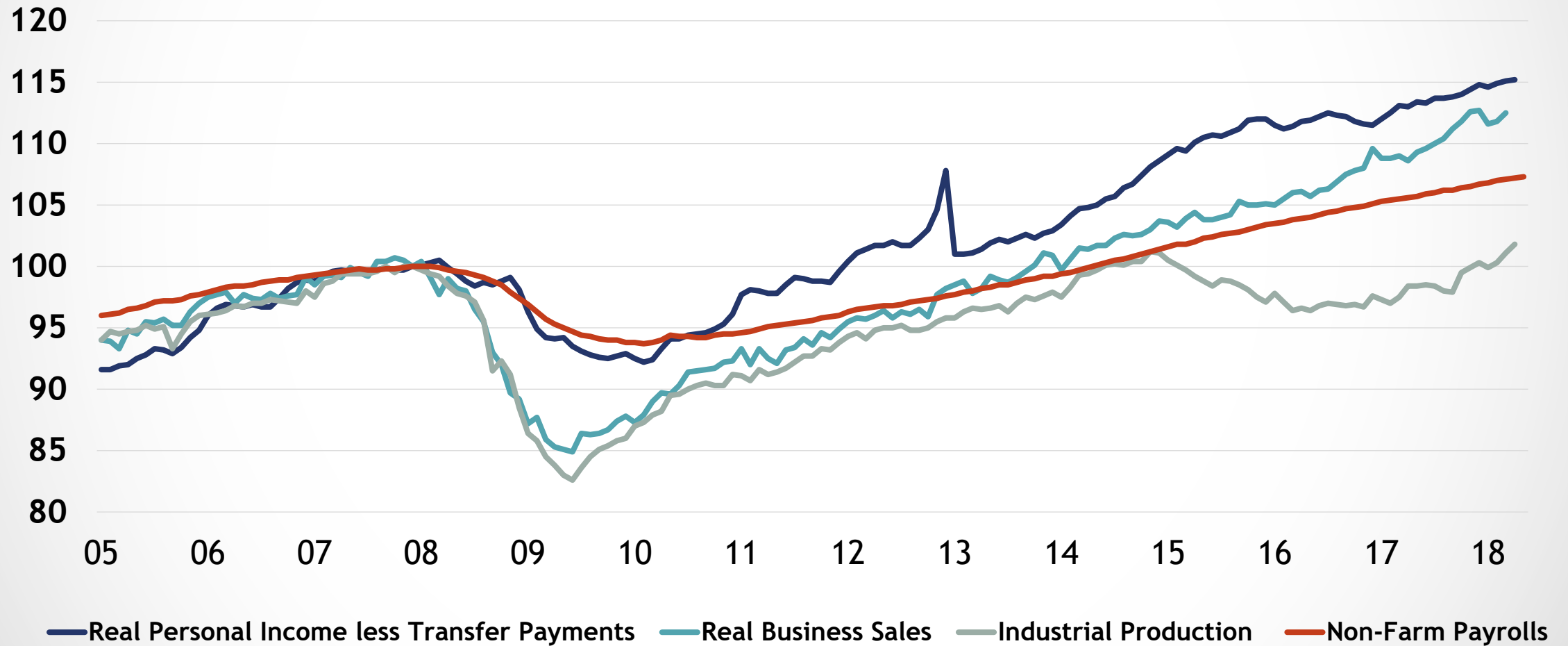
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Missteps in C-Suite Decision-Making

Research by Barclay's analyst Scott Davis (now with Melius Research) determined that weak performance among industrials can be traced to several missteps:

1. bad acquisitions often related to timing;
2. mismanaging the business cycle and costs; and
3. becoming too complex or unfocused.

All of these are areas in which the business economist can contribute to the bottom line.