

Year-End 2012 Situation & Outlook

American Chemistry Council

December 2012

After three years of recovery from the Great Recession, the global economy stumbled in 2012 with the Euro Area in recession again, a slowdown in China became particularly pronounced, and confidence-erosion and other negative factors spread. Global manufacturing entered a soft period this summer with particular weakness in Europe and East Asia. The manufacturing sector represents the primary customer base for chemistry.

Dynamic growth has been fleeting this year, especially in China and in other emerging markets. In Europe, a crisis turned into an outright recession, which at the close of 2012 still shows no signs of abating. In the United States a typical business cycle recovery has yet to emerge in many sectors. Although US GDP surpassed its pre-recession peak, growth has been painfully slow in 2011 and 2012.

In the US recovery thus far, business investment and exports were drivers boosting manufacturing output. But rising uncertainty over the election, and now, over the Fiscal Cliff and likely 1st quarter negotiations over raising the debt ceiling and future tax reform are factors hindering business confidence. The uncertainty is resulting in a paring of business investment and hiring decisions, which are already being felt and eroding economic growth. Whether the nation falls off the Fiscal Cliff is a matter of conjecture but the adverse effects of the possibility have already served to stifle the economy. Recent regional surveys and other indicators suggest that the strong manufacturing recovery in the United States has lost momentum, hopefully temporarily. Moreover, the recession in Europe and weakness in Asia are hindering export sales which were a pillar of growth during the 2009-2011 period.

Of the 8.7 million US jobs lost during the Great Recession, only one-half have been regained. Unemployment persists and consumer incomes have stagnated. In addition, the Federal debt, continued structural unemployment, and the drag from the recession in Europe still encumber growth prospects in the years ahead. The good news is that consumer deleveraging has resulted in more normal household debt burdens and the apparently sustainable recovery in housing is resulting in rising home prices. These factors should help strengthen the anemic recovery. Indeed, the consumer is now taking over from the business sector in providing foundational support for the US economy. The results so far in the 2012 Christmas shopping season are encouraging.

This year, the ACC Economics Department developed the Chemicals Activity Barometer (CAB), a composite index of economic indicators that track the activity of the chemical industry. Due to its early position in the supply chain, chemical industry activity leads that in the overall economy. The CAB can be used to anticipate potential turning points in the overall economy. That is, business cycle peaks and troughs. Currently, the CAB is signaling slow, tentative economic growth into 2013.

The consensus forecast (our base case scenario) for US GDP is for continued but anemic growth, well below trend in 2013, about 2.0%. This assumes some resolution of the Fiscal Cliff, but some economic damage has already occurred. If the Fiscal Cliff is avoided, a rebound of activity will emerge in 2013. The likelihood is that the United States will avoid another recession but that economic growth will not reach long-term trend levels until 2014. Nonetheless, the recovery is fragile and multiple risks remain, the largest of which is the Fiscal Cliff. While not the most likely scenario, the probability of another recession remains elevated. Other domestic risks include uncertainty about US debt levels, policy and long-term economic prospects. The recession in Europe also continues to present one of the greatest risks to the world economy, as does concern over a hard landing in China. Concerns about the stability of the banking system in China have been raised in light of massive credit inflation and exposure to real estate and local government loans. Any of these could combine to foster another recession. The wrong trade, tax or other policy initiatives could also derail activity. Indeed, the present uncertainty about falling off the Fiscal Cliff may lead to another recession. In this case, the economy could shrink nearly 0.5% during 2013 as opposed to an anemic 2.0% growth under the base case. This could be a mild recession.

Global economic prospects will be characterized by a two-speed world in which the developed nations (constrained by debt, adverse demographic factors, and tighter fiscal policies) grow slowly while the emerging markets offer more dynamic prospects as a result of industrialization and rising consumer-driven economies. Asia will continue to outpace the rest of the world and growth in other emerging markets will be strong as well.

Several major end-use markets for chemistry have recovered in the United States, especially those tied to export markets and business investment. But many markets, however, still remain below their 2007 peaks. The manufacturing sector,

which is the largest consumer of chemistry, strongly rebounded during late-2009 and into 2011 but growth has abated this year. Manufacturing output still remains below its pre-recession peak in the United States and activity slowed in the 3rd quarter. A two-speed manufacturing sector, with about one-half of the industries soft and others doing well, has emerged. The boom in oil and gas is creating both demand side (e.g., pipe mills, oilfield machinery) and supply-side (e.g., chemicals, fertilizers, direct iron reduction) opportunities. There is strength in light vehicles and aircraft, a recovery in construction materials, and industries involved with business investment (iron and steel, foundries, etc.) are strong. Elsewhere, structural issues held back growth in a number of industries (appliances, textiles, paper, printing, etc.) and other industries (computers and semiconductors and electronic components, etc.) faced sector downturns. Forward momentum depends upon demand for consumer goods, which ultimately drives factory output. But lower foreign demand (chemicals are early on in the supply chain and exports to Europe have evaporated) presents challenges for the manufacturing sector. Balance sheets are strong, and lower input costs have benefited manufacturers. Nonetheless, an uncertain business and regulatory environment is constraining business optimism (and hiring).

Light vehicles represent an important market for chemistry (nearly \$3,650 in chemistry per vehicle), and production continues to improve. US light vehicle sales are expected to rise in 2013 and in 2014 as pent-up demand, improving employment (and income) prospects, and better availability of credit foster growth. Housing is the other large consumer of chemistry (over \$15,000 in chemistry per start) and evidence of a recovery is very encouraging, and perhaps the major economic news of 2012. After years of declining activity, weak prices and rising foreclosures, the necessary reductions of inventory have occurred. Shortages have emerged in some local markets and prices have stabilized and begun to rise nationwide. Moreover, credit conditions appear to be repairing and a sustainable recovery in housing is underway. Moreover, demographic factors are reemerging as a driving force and housing starts gained in 2012. Although the recovery in this sector will be slow, housing activity should begin to stir in 2013 and 2014. Activity will remain well below the previous peak of 2.07 million units in 2005 but by mid-decade will approach the long-term underlying demand of 1.5 million units per year as suggested by demographics and replacement needs.

Global Business of Chemistry

At the headline global level, a trough was reached in 1st quarter 2009 and a sharp V-shaped recovery ensued. This was particularly the case in China and other East Asian countries. Virtually every nation and region experienced recovery. There was continued demand recovery in North America, Europe, and Japan coupled with strong sustained momentum in the emerging markets. At the global level, production volumes exceeded their previous peak in 4th quarter 2009, and the re-

covery evolved into an expansion for a number of nations and regions. The recession in Europe this year, however, combined with inventory imbalances and has a decline in global manufacturing.

During 2012, the trends in the global business of chemistry have paralleled the trends in broader manufacturing. Overall growth in the \$5.0 trillion global business of chemistry stalled, with a recession in Europe and pronounced slowdown in China. Global business of chemistry output will increase 1.2% in 2012, a slowdown from the 4.5% volume gain in 2011. With a recession in Europe weighing on activity, only a 3.6% gain in global output is expected in 2013. As economic recovery resumes in 2014, a 4.6% gain is expected.

Production Volumes by Country/Region: Over the next several years, the most rapid growth will occur in the emerging nations of Asia-Pacific, Africa and the Middle East, Emerging Europe, and Latin America. The most notable growth will occur in China and India. The chemical industries of the emerging nations will increase 4.9% in 2012, 6.8% in 2013, and 7.6% in 2014.

In contrast, most chemical industries of the developed nations are experiencing recession or other adverse conditions, and volumes among these will decline 1.0% in 2012 and gain only 1.8% in 2013 before improving to a 3.1% gain in 2014. Among the developed nations, the United States will be aided by low natural gas prices. Ireland, Sweden and Switzerland will achieve stronger growth than most other developed nations in Europe.

Production Volumes by Segment: The outlook for the global business of chemistry varies by major segment. During 2010 and into early 2011, it was the cyclical basic chemical segments that experienced the strongest growth. The weakness in global manufacturing, however, has resulted in basic chemistry activity slowing to only 0.6% growth in 2012. Specialties also enjoyed strong growth but lagged basics in 2010, which is typical in that phase of a cyclical upswing. By 2011, specialties had begun to take over from basics in terms of growth. This continued into 2012. Consumer products and agricultural chemicals are experiencing gains of 3.0% and 2.1%, respectively, while pharmaceuticals rose by a more modest 1.3% in 2012.

This growth pattern will likely continue into 2013 as a result of the recession in Europe. Gains in basic chemicals will lag in 2013 with specialties experiencing slightly above-average growth as major end-use customer industries recover. Consumer products and pharmaceuticals will continue to achieve solid increases in production volumes. In 2014, gains will strengthen in basic chemicals and in most other segments as a recovery more fully emerges. During the next few years, specialties will grow faster than basic chemicals.

As global production eased in wake of the financial crisis, global capacity utilization in chemistry slipped from an average of over 93% in 2007 to 80% in 2009. The closure of plants during the 2009 global production downturn partially offset a number of previously committed projects that came on-line. Although additional capacity has come on-line as anticipated, production improved so much in the 2010 and 2011 recovery that the operating rate exceeded 87% in 2011. Additional capacity has come on-line and coupled with the recession in Europe and weakness elsewhere, capacity utilization slipped to 85% for 2012. Global capacity utilization will hover around 85% in 2013 and 2014.

US Business of Chemistry

For the business of chemistry in the United States, the softening of the manufacturing recovery has dampened domestic chemical demand and the recession in Europe and weakness elsewhere have hindered export sales. Inventories provide the “razor’s edge” between a slowdown and a recession and in general, inventories along the supply chain have become only slightly imbalanced. Barring a major recession, however, a large correction is not expected. Production of chemicals, excluding pharmaceuticals, has eased as demand from key end-use markets also slowed, but capacity utilization continues to tighten. Chemical exports have been aided by a favorable oil-to-gas price ratio.

Trade: As Europe fell into recession and manufacturing slowed in China, gains in export volumes moderated in 2012. The weakness in exports to Europe and China was prominent, but was offset by gains in other regions. At the same time, imports slowed as industrial demand weakened. Imports from many destinations declined in 2012. By the end of 2012, chemistry exports will be up 1.8% to \$190.7 billion and imports will have slipped 0.8% to \$189.5 billion. Thus, the trade balance which had reverted to a deficit position in 2011 will return to a modest surplus of \$1.2 billion in 2012.

During 2013, ACC expects trade in chemicals will continue to expand at moderate rates as global manufacturing activity remains fragile. Exports will grow 4.7% to \$199.7 billion in 2013 before growing 6.6% to \$212.8 billion in 2014. Imports are expected to grow by 4.1% to \$197.3 billion in 2013 before growing by 6.2% to \$209.6 billion in 2014. As a result, the trade surplus in chemicals will expand to \$2.4 billion in 2013 and to \$3.3 billion in 2014 on higher export growth. Trade deficits will continue in pharmaceuticals and agricultural chemicals but will be offset by large (and growing) surpluses in basic and specialty chemicals.

Renewed competitiveness from shale gas (and the resulting disconnect between US natural gas prices and global oil prices) will boost US exports in the years ahead. New investments to take advantage of this competitive position will begin to supply export markets in the coming years. The large surpluses in

basic chemicals will continue to expand as will surpluses in specialties and consumer chemistry.

Production Volumes by Segment: The slowdown in global manufacturing is clearly affecting US chemistry and volume gains have moderated. Although some slight inventory imbalances have emerged, a large build-up of downstream customer inventories and a subsequent drawdown (or destocking) has yet to fully emerge. With an improvement in customer industries and in emerging markets, the effects of an enhanced competitive position with regard to feedstock costs on US chemical industry production should be supportive for future growth.

Basic chemicals -- inorganic chemicals, petrochemicals, plastic resins, synthetic rubber, and man-made fibers -- were the hardest hit from the recession in Europe and manufacturing slowdown, despite improving demand from important customer markets such as light vehicles and housing. Downstream customers remain cautious about building inventories and improvements in final demand could necessitate replenishing. Leading indicators of manufacturing activity are not yet pointing to strong growth.

The consensus is that US chemical output will improve during 2013. As a result, for chemistry excluding pharmaceuticals, following the 10.3% gain in volumes during in 2010 and 1.5% gain in 2011, expectations are for only a 1.5% gain in 2012 before improving to a 1.9% gain in 2013 and a 2.3% gain in 2014. Growth is expected in plastic resins as export markets revive. Production of specialty chemicals will be driven by demand from end-use markets; most notably light vehicles and housing. Strong 2012 gains are expected in consumer products as well but these gains will moderate in 2013 and 2014. After a weak 2012, demand for agricultural chemicals will revive. In the long-term, US chemistry growth is expected to expand at a pace exceeding that of the overall US economy. Pharmaceuticals will eventually emerge as a growth segment in 2013.

Although projected year-on-year growth rates for most segments appear good during the next few years, they must be considered in the context of the exceptionally sharp declines seen in 2008 and continuing into 2009. Moreover, it may take years for activity to recover from these steep declines and broach past peaks. Another factor is that these projections reflect the consensus, and mainstream forecasters’ models are largely demand-driven. With the revolution in shale gas, the competitive position of the United States has improved and significant investment is planned. ACC counts over 50 projects (totaling over \$40 billion in capital investment) that have been announced to date to capitalize on the new shale gas advantage. This is a supply-side response and if incorporated into projections suggest a much higher growth profile. This subject is addressed in the discussion on shale gas in this report. The consensus growth outlook is likely too low.

The American chemical industry is sensitive to a number of risks. High and volatile energy costs are paramount in this regard as are potential adverse regulatory and other policy initiatives. Falling off the Fiscal Cliff, a recession in the United States and concomitant falling industrial activity would dampen domestic demand further and lastly, an even weaker world economy would adversely affect exports.

Production Volumes by Region: As manufacturing eased during 2012, performance across the regions of the US was mixed with declines in the Mid-Atlantic and West Coast regions offsetting gains elsewhere. The largest gains were in the Ohio Valley and Gulf Coast regions boosted by export demand for plastics. Other regions posted smaller gains. Moderate growth in all regions is expected in 2013 domestic manufacturing and export markets improve. Output will continue to improve across all regions of the US during 2014 as the global recovery strengthens.

Shipments: During 2012, shipments of the business of chemistry slipped by 1.5% to \$765.1 billion, following an 11.3% surge in 2011. The first half of the year was especially weak as export demand fell and customers worked down inventories. During the second half of 2012, manufacturing activity in the US improved, supporting chemistry shipments. Despite a weakening of key export markets in Europe and China, US chemical shipments have become increasingly competitive due to low cost ethane supplies from shale gas development. As the recovery continues into 2013, shipments are expected to expand to \$794.2 billion. Further expansion of industry activity both in the United States and abroad combined with improved competitiveness will push shipments to \$833.1 billion in 2014.

Capacity Utilization: With a stalling of volumes, overall operating rates slipped during 2012. Looking forward, modest gains in chemical industry production volumes and stable capacity suggests improving operating rates in 2013, and with strengthening production volumes, capacity utilization could improve even further in 2014 and beyond. The possibility of over 50 new chemical production projects should result in fairly strong gains in capacity during the 2014-17 period.

R&D Spending: As a science and technology, knowledge-based endeavor, the business of chemistry invested \$56.1 billion in research and development (R&D) in 2011. With improved margins and prospects, spending likely rose 3.5% to \$58.1 billion in 2012. Companies continue to focus on improving efficiencies as well as on new leading-edge product innovations and are strengthening R&D activities. Looking forward, R&D spending is expected to increase 4.0% to \$60.4 billion in 2013. Continued but modest gains are expected thereafter and by 2014, R&D spending will reach \$63.1 billion. Pharmaceutical R&D spending gains will be greater than in non-pharmaceutical segments although the latter will enjoy new buoyancy.

Capital Spending: The worst business conditions since the 1930s combined with a credit crisis and lower profits created a difficult environment for capital spending in wake of the Great Recession. With narrowing margins, austere market conditions, lower operating rates, and a high level of uncertainty, a number of capital investment projects were extended or delayed. Furthermore, capital spending budgets were slashed to conserve cash flow and, as a result, US capital investment in chemistry fell 9.2% to \$26.6 billion in 2009. This followed a 9.3% drop in 2008 and came off a peak level in 2007. Despite lingering uncertainty and lower-than-average operating rates, the recovery in 2010 combined with the need to enhance competitiveness pushed capital spending up by 8.4% in 2010 and with debottlenecks and expansions arising from the shale gas revolution and enhanced competitiveness, capital spending surged 19.8% in 2011. These gains continued into 2012 and capital spending grew 15.5% to about \$38.1 billion.

Capital spending cycles generally lag cycles of industry activity as profits and operating rates lead determinants of spending. In general, improving production and utilization rates, cost containment from earlier cost reduction efforts, low feedstock and other raw material costs (compared to Europe and North-east Asia) and higher selling prices resulted in a strong recovery of profits during 2010 and into 2012. Given the new dynamics from shale gas, there is a possibility that the current up-cycle in profits will last longer than recent cyclical up-swings. In addition, utilization rates have improved although they are still below the levels of several years ago and are below the long-term average. On top of profits and capacity utilization, other factors influence the level of capital spending, including the business cycle, long-term business expectations, taxation policies, the cost of capital, the burden of debt, the supply of credit, and mandated expenditures.

With improving operating rates and profit margins, and a low cost of capital, increases in new plant and equipment (P&E) investment in the United States are forthcoming. The need to replace existing capital is apparent and will be a driver but most important will be the large investment arising from renewed US competitiveness, the result of shale gas. The industry investment cycle had clearly reengaged, and US chemical industry capital spending has quickly surpassed the most recent peak. Maintenance capital will support investment in the United States, with capital spending also allocated towards replacement of worn out plant/equipment. Furthermore, the majority of the expansion of production capacity is for the existing product range and this motivation is clearly gaining as a result of shale gas development.

As a recovery further unfolds and strengthens into an expansion by mid-decade, this growth trajectory will change with increased spending for capacity additions expected during the next five years. Various estimates by industry consultants on the gains to basic olefins capacity range from 35% to 40%. With improving competitiveness resulting from developments

in shale gas, a re-evaluation of the United States as a favorable location for investment is occurring. Indeed, over 50 new chemical production projects (valued at over \$40 billion altogether) have been announced and the dynamics for sustained capital investment are in place. Strong gains in capital spending by American chemistry are thus expected during the next several years, the result of new investment in petrochemicals and derivatives arising from shale gas developments. Double-digit gains in capital spending are expected through 2015 with only a minor slowdown in growth after that. The need to add capacity and improve operating efficiencies will play a role as well. This emerging shale gas story is noteworthy. By 2017, US capital spending by the chemical industry will reach \$64.5 billion; more than double that of 2007 or the start of this decade.

Employment/Wages: Following a decade of job losses in the chemical industry, the industry gained jobs for the second year in a row. Total employment in the business of chemistry will average 798,500 in 2012, up 1.3% from 2011. This reflects in large part increasing production of comparatively more labor-intensive plastic resins, synthetic rubber, and manmade fibers. In 2013, productivity gains (which typically average around 2.5% per year) are expected to outpace output growth. Thus, employment will slip by 0.2% in 2013 before expanding by 0.8% in 2014. Reflecting weak wage growth throughout the economy, average hourly wages will have risen 1.8% to \$21.85 per hour in 2012. In 2013 and 2014, wages will advance further.

Shale Gas Developments: Production of natural gas from shale is possibly the most important domestic energy development of the past 50 years. Following a decade of high and volatile natural gas prices that destroyed industrial demand and led to the closure of many gas-intensive manufacturers, shale gas offers a new era of American competitiveness that will lead to greater investment, industry growth, and employment.

American manufacturers use natural gas to fuel and power a wide variety of processes to produce a diverse portfolio of manufactured goods. Growth in domestic shale gas production is helping to reduce US natural gas prices and create a more stable supply of natural gas for fuel and power. It is also leading to more affordable supplies of natural gas liquids (NGLs), including ethane, which is a key petrochemical feedstock. A reduction in the cost of a factor input such as natural gas leads to enhanced competitiveness and a positive supply response. This, in turn, leads to new private sector investment in the United States, which fosters job creation.

Following a March 2011 ACC analysis that examined the gains from a hypothetical 25% increase in ethane utilization of the chemical industry, ACC conducted a second analysis of potential economic and employment benefits of natural gas development from shale. The new analysis examines the impact of lower natural gas costs and ethane availability for eight

gas-intensive manufacturing industries, including the chemical industry. In this new report, *Shale Gas, Competitiveness and New Investment: Benefits for the Economy, Jobs, and US Manufacturing*, ACC reported the effects of renewed competitiveness and the supply response among eight key manufacturing industries: paper, chemicals, plastic and rubber products, glass, iron and steel, aluminum, foundries, and fabricated metal products. ACC found a tremendous opportunity for shale gas to strengthen US manufacturing and boost economic output by \$121 billion for these eight industries. Increased output would generate 200,000 direct jobs in manufacturing and through supply-chain and payroll-induced impacts, generate an additional 979,000 jobs. To build the capacity necessary to increase production, an investment of \$72 billion would be necessary, generating more than one million jobs in construction, capital goods manufacturing, supply chain, etc. during the investment phase.

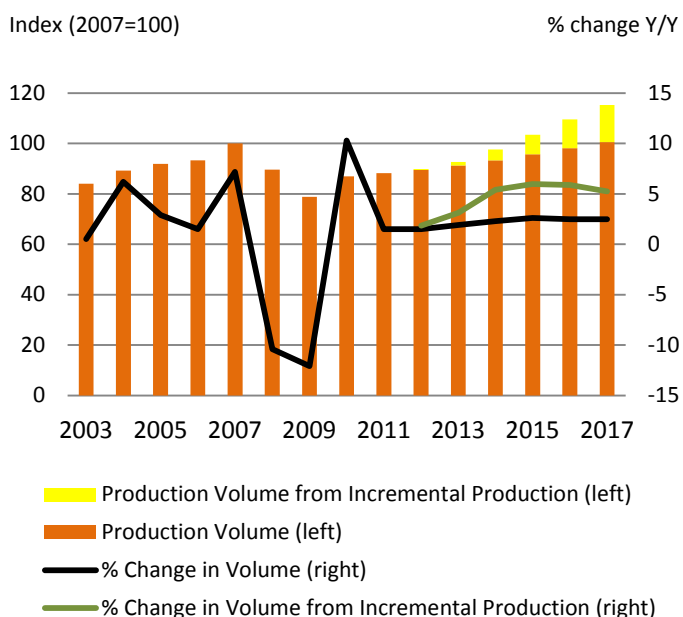
The scenario outlined in ACC's report is corroborated by trends in the chemical and other industries. A number of companies have announced new investments in US capacity to benefit from available resources and grow their businesses. In the chemical industry alone, more than 50 projects have been announced in the past two years to capitalize on the new competitive advantage of abundant supplies of natural gas and NGLs. Such projects include new ethylene crackers, derivative products (i.e., polyethylene, ethylene oxide, etc.), methanol, ammonia, on-purpose ethylene co-products, etc.

The outlook for the chemical industry presented here reflects the consensus of several economic models that are demand-driven. That is, they do not account fully for changes on the supply side. However, based on announced projects, it's our contention that the growth profile from the supply-side response scenario should be much greater than that of the consensus forecast of the mainstream forecasting models. To illustrate the potential of these new announced investments, ACC developed a scenario in which most investment announcements proceed. The estimated incremental production from these announced projects is shown in addition to the baseline consensus forecast of production volume. Including production from new investments, growth will likely average 4.6% per year through 2017, more than double the 2.2% average annual growth presented by the consensus forecast.

Year-over-Year Percent Change in Production Volumes for Chemicals (excluding Pharmaceuticals)

	Consensus Outlook	Consensus Outlook + Incremental Production from New Investments
2012	1.5	1.5
2013	1.9	2.9
2014	2.3	5.4
2015	2.6	6.0
2016	2.5	5.9
2017	2.5	5.3

Outlook for Production of Chemicals (excluding Pharmaceuticals)



In addition to those in the chemical industry, other manufacturing investments are being made in areas of the country that have been hardest-hit by industrial sector declines. These investments improve the outlook in these economically depressed areas of the country. Further development of the nation's shale gas and ethane can drive an even greater expansion in domestic manufacturing capacity, provided that policymakers develop balanced regulatory policies and permitting practices.

As US manufacturing is set to gain substantially, due in large part to shale gas development, government and industry need to work together to ensure that the American workforce is prepared for the jobs building and working in the emerging manufacturing renaissance. Between a graying manufacturing workforce and decades of young people turning away from careers in manufacturing and the trades, there is concern about the quality and quantity of workers available for the diverse portfolio of skilled manufacturing and construction occupations that will be required in the coming years.

ACC supports a comprehensive energy policy that maximizes all domestic energy sources including renewables, alternatives, coal, nuclear, and oil and natural gas; prioritizes greater energy efficiency in homes, buildings and industrial facilities; and employs economically sound approaches to encourage the adoption of diverse energy sources, including energy recovery from plastics and other materials and renewable sources. The United States must ensure that our regulatory policies allow us to capitalize on shale gas as a vital energy source and manufacturing feedstock, while protecting our water supplies and environment.

Summary

The global recovery stalled in 2012 with Europe slipping back into recession and manufacturing in China slowing sharply. In the US, uncertainty about the election, Fiscal Cliff, and the overall pace of recovery curbed growth. More than three years since the official end of the recession, the majority of manufacturing industries remain below their pre-recession peak. But while growth has slowed in the developed countries, emerging market economies continued to expand. In the coming year, growth is expected to accelerate across most regions of the world. As a favorable oil-to-gas price ratio continues in North America, this bodes well for American chemistry as the US emerges as a global low cost supplier of many petrochemical and plastic products. As balance sheets continue to improve and the nation's shale resources are developed further, chemical producers and other manufacturers are bringing investment back to the United States. This manufacturing renaissance offers huge potential, not only to the millions of American workers it will employ, but to the US economy as a whole.

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This report was created by ACC's Economics & Statistics Department which provides a full range of statistical and economic advice and services for ACC and its members and other partners. The group works to improve overall ACC advocacy impact by providing statistics on American Chemistry as well as preparing information about the economic value and contributions of American Chemistry to our economy and society. They function as an in-house consultant, providing survey, economic analysis and other statistical expertise, as well as monitoring business conditions and changing industry dynamics. The group also offers extensive industry knowledge, a network of leading academic organizations and think tanks, and a dedication to making analysis relevant and comprehensible to a wide audience.

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TABLE 1
MACROECONOMIC OUTLOOK

<i>% Change Y/Y unless noted otherwise</i>	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average 2018-22
Global Macroeconomic Indicators										
GDP (Market Exchange Rate basis)	-2.2	4.1	2.8	2.1	2.3	3.0	3.6	3.5	3.4	3.3
GDP (PPP basis)	-0.6	5.1	3.8	3.0	3.3	3.9	4.3	4.3	4.5	4.3
World Trade	-10.4	12.6	5.8	2.6	4.3	5.7	6.0	5.9	6.2	6.2
Industrial Production	-6.6	10.0	5.4	2.8	3.7	4.3	4.3	4.0	4.0	3.8
Consumer Prices	2.4	3.7	4.9	3.7	3.6	3.6	3.6	3.4	3.3	2.9
US Macroeconomic Indicators										
GDP	-3.1	2.4	1.8	2.1	2.0	3.0	3.2	3.0	2.9	2.5
Consumer Spending	-1.9	1.8	2.5	1.9	2.0	2.8	2.8	2.6	2.5	2.3
Business Investment	-18.1	0.7	8.6	7.3	3.7	6.4	6.8	5.1	4.9	3.7
Industrial Production	-7.0	5.4	4.1	3.8	2.3	3.1	3.5	3.0	2.8	2.5
Light Vehicle Sales (mm)	10.4	11.6	12.7	14.4	14.7	15.1	15.7	15.9	15.8	15.6
Housing Starts (mm)	0.55	0.59	0.61	0.79	0.96	1.36	1.51	1.61	1.61	1.65
Consumer Prices	-0.3	1.7	3.1	2.1	1.9	2.1	2.2	2.2	2.2	2.1
10-Year Treasury Notes (%)	3.26	3.21	2.79	1.84	2.11	2.67	3.46	4.21	4.71	4.97
Unemployment Rate (%)	9.3	9.6	9.0	8.1	7.8	7.6	7.0	6.4	5.9	5.4
Exchange Rate (\$US/euro)	1.39	1.33	1.39	1.28	1.24	1.24	1.26	1.28	1.31	1.36
US End-Use Market Output										
Construction	-15.3	3.9	5.5	5.6	7.1	12.3	10.3	5.8	3.8	3.3
Food, Beverages & Tobacco	-0.7	-0.1	1.7	2.3	1.4	1.6	1.7	1.7	1.4	1.5
Textile Mill Products	-15.9	4.0	0.1	-0.4	-1.0	-1.1	-0.9	-2.2	-3.0	-3.3
Apparel	-19.7	-0.2	-2.4	-2.9	-4.2	-4.8	-4.2	-3.8	-3.9	-4.7
Structural Panels	-17.2	2.2	0.4	3.8	6.5	12.3	9.6	3.9	1.3	2.7
Paper	-6.3	2.1	-1.4	-2.2	0.0	0.8	1.1	1.0	1.0	0.8
Printing	-10.5	0.1	-4.3	-1.9	-0.9	-0.5	0.1	0.2	0.8	0.6
Petroleum Refining	0.3	-2.3	3.7	1.3	0.9	1.1	1.3	1.5	1.5	0.7
Rubber & Plastic Products	-10.2	8.9	8.4	3.0	2.0	2.7	2.8	2.5	2.4	2.3
Iron & Steel	-22.2	30.0	9.1	7.8	2.4	4.5	4.8	4.0	2.7	1.9
Fabricated Metal Products	-15.7	6.9	10.0	8.0	2.6	4.8	4.8	3.2	2.7	2.8
Computers	-7.5	10.9	7.9	0.5	4.9	7.3	8.5	7.9	7.4	7.4
Semiconductors & Electronic Components	-7.3	32.7	12.0	-0.6	5.0	7.3	8.2	7.5	6.7	6.4
Appliances	-12.2	-0.2	-1.7	-0.2	2.9	4.7	4.3	2.7	1.4	1.8
Motor Vehicles & Parts	-14.3	32.5	11.8	16.7	5.6	5.8	4.7	3.5	3.6	2.6
Aerospace	-1.6	-2.3	8.9	8.6	12.5	11.3	9.5	5.6	4.3	2.4
Furniture	-19.3	-1.8	5.0	4.4	3.8	4.8	3.3	1.6	0.8	1.8

Sources: Bureau of the Census, Bureau of Economic Analysis, Bureau of Labor Statistics, Federal Reserve Board, and American Chemistry Council analysis.

TABLE 2
US CHEMISTRY OUTLOOK

	% Change Y/Y unless noted otherwise									
	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average 2018-22
Total Chemistry	-11.3	3.4	0.5	-0.5	1.9	2.8	3.3	3.3	3.3	3.2
By Segment:										
Pharmaceuticals	-6.0	-7.3	-1.5	-3.3	1.8	3.5	4.2	4.4	4.3	4.3
Chemicals, excl. Pharmaceuticals	-12.1	10.3	1.5	1.5	1.9	2.3	2.6	2.5	2.5	2.4
Consumer Products	-9.1	1.0	12.5	5.0	2.4	1.8	2.1	2.0	1.9	2.0
Agricultural Chemicals	5.1	4.3	-1.8	-0.9	0.7	2.0	1.7	1.6	1.3	1.1
Specialties	-14.2	10.7	4.2	6.2	2.9	2.6	2.9	2.8	2.8	2.7
Coatings	-18.6	9.3	-2.9	7.5	2.5	2.5	2.7	2.5	2.3	2.4
Other Specialties	-12.7	11.2	6.4	5.6	3.1	2.6	3.0	2.9	3.0	2.8
Basic Chemicals	-16.1	17.5	-2.6	0.7	1.6	2.3	2.6	2.5	2.5	2.4
Inorganic Chemicals	-20.6	14.4	3.0	6.1	1.9	2.0	2.1	1.8	1.4	1.2
Bulk Petrochemicals & Organics	-15.3	19.9	-4.2	-1.7	1.5	2.6	2.9	3.0	3.0	2.9
Plastic Resins	-11.0	15.3	-4.4	0.0	1.7	2.3	2.9	2.6	3.0	2.7
Synthetic Rubber	-19.2	15.1	2.4	1.6	1.6	1.9	2.2	1.8	2.0	2.2
Man-Made Fibers	-23.9	27.6	-5.7	0.6	0.0	-0.4	0.0	0.2	-0.3	-0.7
By Region:										
Gulf Coast	-14.4	14.7	-1.6	1.1	1.7	2.3	2.6	2.5	2.4	2.3
Midwest	-9.7	2.3	-0.1	0.1	1.9	2.8	3.2	3.2	3.2	3.1
Ohio Valley	-12.3	10.0	1.2	2.5	1.9	2.2	2.5	2.4	2.3	2.3
Mid-Atlantic	-8.5	-1.0	0.3	-0.6	1.9	2.9	3.4	3.5	3.4	3.4
Southeast	-8.6	2.9	0.4	0.2	1.8	2.6	3.0	3.0	2.9	2.9
Northeast	-8.5	-0.9	1.6	0.1	2.1	2.9	3.4	3.4	3.4	3.4
West Coast	-7.7	-2.4	0.1	-0.8	1.9	3.0	3.5	3.6	3.5	3.5
Trade Indicators										
Exports (billions)	\$145.5	\$171.2	\$187.3	\$190.7	\$199.7	\$212.8	\$227.8	\$242.9	\$259.7	n/a
Imports (billions)	\$145.7	\$166.6	\$191.1	\$189.5	\$197.3	\$209.6	\$223.6	\$237.6	\$253.3	n/a
Trade Balance (billions)	-\$0.1	\$4.6	-\$3.7	\$1.2	\$2.4	\$3.3	\$4.2	\$5.2	\$6.4	n/a
Pharmaceuticals	-\$36.4	-\$40.1	-\$47.2	-\$42.2	-\$43.0	-\$45.2	-\$47.5	-\$49.8	-\$52.3	n/a
Chemicals, excl. Pharmaceuticals	\$36.3	\$44.6	\$43.5	\$43.4	\$45.4	\$48.4	\$51.7	\$55.1	\$58.7	n/a
Consumer Products	\$2.9	\$2.8	\$2.4	\$2.5	\$2.4	\$2.4	\$2.9	\$3.1	\$3.1	n/a
Agricultural Chemicals	-\$0.4	-\$3.2	-\$5.0	-\$4.2	-\$4.1	-\$3.7	-\$3.3	-\$3.0	-\$2.7	n/a
Specialties	\$8.5	\$11.8	\$11.4	\$10.5	\$10.0	\$10.5	\$11.0	\$11.6	\$12.2	n/a
Basic Chemicals	\$25.2	\$33.2	\$34.7	\$34.6	\$37.1	\$39.2	\$41.1	\$43.4	\$46.2	n/a
Other Chemistry Indicators										
Capacity	-5.9	-6.5	-2.4	0.3	0.8	1.5	2.5	3.0	3.5	2.5
Capacity Utilization (%)	68.0%	75.2%	77.5%	76.9%	77.7%	78.6%	79.2%	79.4%	79.4%	80.3%
Shipments (billions)	\$628.9	\$697.8	\$776.8	\$765.1	\$794.2	\$833.1	\$878.9	\$927.2	\$978.2	n/a
% Change	-14.9	14.5	11.3	-1.5	3.8	4.9	5.5	5.5	5.5	n/a
R&D Spending (billions)	\$49.41	\$55.41	\$56.07	\$58.05	\$60.35	\$63.05	\$65.75	\$68.40	\$71.15	n/a
% Change	2.4	12.1	1.2	3.5	4.0	4.5	4.3	4.0	4.0	n/a
Capital Spending (billions)	\$26.56	\$27.52	\$32.96	\$38.08	\$43.40	\$48.75	\$54.00	\$59.30	\$64.50	n/a
% Change	-9.2	8.4	19.8	15.5	14.0	12.3	10.8	9.8	8.8	n/a
Employment (thousands)	804.1	786.5	788.3	798.5	797.0	803.0	805.0	806.0	807.0	n/a
% Change	-5.1	-2.2	0.2	1.3	-0.2	0.8	0.2	0.1	0.1	n/a
Hourly Wages (\$/hour)	\$20.30	\$21.08	\$21.47	\$21.85	\$22.40	\$23.00	\$23.50	\$24.25	\$24.75	n/a
% Change	4.1	3.8	1.9	1.8	2.5	2.7	2.2	3.2	2.1	n/a

Sources: Bureau of the Census, Federal Reserve Board, Moore Economics, and American Chemistry Council analysis.

TABLE 3
GLOBAL CHEMISTRY PRODUCTION OUTLOOK: BY COUNTRY AND REGION

<i>% Change Y/Y unless noted otherwise</i>	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average 2018-22
United States	-11.3	3.4	0.7	-0.5	1.8	2.8	3.2	3.3	3.3	3.2
Canada	-10.0	4.5	0.8	2.3	2.8	3.3	2.9	2.6	2.5	2.8
Mexico	-1.4	0.0	-0.3	0.8	3.7	5.5	4.8	4.5	4.1	3.9
North America	-10.6	3.3	0.6	-0.3	2.0	2.9	3.3	3.3	3.3	3.2
Brazil	-6.5	8.7	-1.9	1.8	4.8	5.3	4.6	4.3	4.3	3.9
Other	-4.2	5.3	3.0	1.0	3.1	3.9	4.0	4.0	3.9	3.8
Latin America	-5.3	7.0	0.6	1.4	3.9	4.6	4.3	4.1	4.1	3.9
France	-6.2	7.0	1.0	-0.4	0.6	2.2	2.8	2.9	2.6	2.5
Germany	-12.2	10.8	3.7	-3.6	1.0	2.4	2.3	2.2	2.1	1.9
Italy	-9.4	5.0	-3.0	-3.8	0.1	1.3	1.9	1.9	1.7	1.4
United Kingdom	-6.9	-4.3	-4.1	-5.3	0.6	2.4	2.6	2.4	2.4	2.3
Belgium	-13.7	15.8	7.8	-8.3	1.6	2.9	2.4	2.5	2.4	2.2
Ireland	10.5	16.6	6.0	1.7	2.2	3.8	4.0	4.2	4.2	4.4
Netherlands	-7.1	12.3	0.3	3.5	0.6	2.1	2.3	2.3	2.3	1.9
Spain	-2.6	7.4	0.9	-0.9	0.0	1.9	2.5	2.4	2.2	1.8
Sweden	-7.3	4.6	10.8	0.6	4.1	3.4	3.3	2.9	2.7	3.0
Switzerland	1.5	10.3	-0.8	3.2	2.4	2.9	3.1	2.9	2.9	2.7
Other	-6.7	8.6	3.8	-0.5	1.0	2.4	2.6	2.6	2.5	2.4
Western Europe	-7.2	7.8	1.5	-2.1	0.9	2.3	2.6	2.5	2.4	2.2
Russia	-13.5	16.8	5.6	-7.3	5.8	5.3	4.9	4.8	4.7	4.6
Other	-19.0	10.8	2.8	2.0	3.1	4.7	5.0	4.6	4.3	4.4
Emerging Europe	-16.3	13.8	4.2	-2.5	4.4	5.0	4.9	4.7	4.5	4.5
Africa & Middle East	-2.0	10.8	1.8	4.1	4.7	5.6	5.4	5.4	5.2	5.1
Japan	-7.5	6.6	4.0	-0.4	3.1	4.3	3.9	2.4	2.0	1.8
Asia-Pacific (ex Japan)	1.2	14.2	7.6	6.6	8.0	8.7	8.1	7.7	7.5	7.3
China	4.8	17.7	10.7	9.9	9.8	10.5	9.7	9.2	9.1	8.9
India	2.2	1.2	2.5	2.7	8.7	9.6	9.7	9.2	8.9	8.8
Australia	-4.0	4.2	0.1	1.4	2.1	2.7	2.4	2.3	2.2	2.0
Korea	0.4	10.4	3.6	4.0	4.7	5.6	5.0	4.5	4.2	4.1
Singapore	-14.2	13.3	7.4	4.1	6.0	5.2	5.0	4.8	4.6	4.6
Taiwan	-12.7	21.9	-0.9	-2.7	4.9	5.5	5.5	5.3	5.0	4.8
Other	-2.7	9.1	6.1	6.0	6.1	7.0	6.7	6.2	5.8	5.7
Asia-Pacific	2.1	15.5	9.5	5.0	6.8	7.7	7.1	6.4	6.2	6.0
Total Global Output	-4.8	10.0	4.5	1.2	3.6	4.6	4.6	4.3	4.2	4.0
Developed	-8.9	6.1	1.5	-1.0	1.8	3.1	3.2	3.0	2.9	2.7
Developing	-1.8	13.0	5.6	4.9	6.8	7.6	7.1	6.7	6.6	6.4

Source: American Chemistry Council

TABLE 4
GLOBAL CHEMISTRY PRODUCTION OUTLOOK: BY SEGMENT

<i>% Change Y/Y unless noted otherwise</i>	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average 2018-22
Pharmaceuticals	2.0	3.0	4.6	1.3	4.2	5.0	5.1	4.9	4.7	4.5
Chemicals, excl. Pharmaceuticals	-6.8	12.4	4.5	1.1	3.4	4.5	4.4	4.1	4.0	3.9
Consumer Products	-1.1	10.1	4.4	3.0	3.6	4.4	4.3	4.2	3.9	3.8
Agricultural Chemicals	-4.2	5.2	7.2	2.1	3.1	3.8	3.9	3.6	3.4	3.3
Specialties	-8.5	15.0	4.0	1.3	3.9	4.9	4.8	4.5	4.3	4.0
Coatings	-10.0	12.5	5.7	1.5	3.1	4.2	4.2	4.0	3.7	3.4
Other Specialties	-9.3	15.2	3.1	1.3	4.2	5.2	5.0	4.7	4.5	4.3
Basic Chemicals	-7.3	15.8	3.3	0.6	3.3	4.5	4.4	4.1	4.0	3.9
Inorganic Chemicals	-10.9	20.0	9.7	0.9	3.1	4.1	4.1	3.8	3.7	3.6
Bulk Petrochemicals & Organics	-1.1	13.5	7.2	0.5	3.6	4.9	4.6	4.3	4.2	4.2
Plastic Resins	-5.4	9.5	4.5	0.7	3.4	4.9	4.9	4.7	4.6	4.5
Synthetic Rubber	-9.8	8.4	3.3	2.2	3.9	4.6	4.6	4.3	4.1	4.0
Man-Made Fibers	-3.6	9.9	5.0	3.3	3.7	4.6	4.4	4.2	3.9	3.7
Total Global Output	-4.8	10.0	4.5	1.2	3.6	4.6	4.6	4.3	4.2	4.0
Other Chemistry Indicators										
Capacity	6.1	1.4	3.8	3.8	4.0	4.3	4.8	5.0	5.0	4.3
Capacity Utilization (%)	80.1%	86.9%	87.5%	85.3%	85.0%	85.2%	85.1%	84.5%	83.8%	84.3%

Source: American Chemistry Council

TABLE 5
GLOBAL ECONOMIC ENVIRONMENT

<i>% Change Y/Y unless noted otherwise</i>	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average 2018-22
Real GDP										
United States	-3.1	2.4	1.8	2.1	2.0	3.0	3.2	3.0	2.9	2.5
Canada	-2.8	3.2	2.4	2.0	2.1	2.5	2.5	2.4	2.3	2.3
Mexico	-6.0	5.6	3.9	3.8	3.7	4.2	3.9	3.8	3.7	3.7
Brazil	-0.3	7.5	2.7	1.7	3.8	4.5	4.3	4.4	4.2	4.0
United Kingdom	-4.0	1.8	0.8	-0.3	1.0	1.8	2.4	2.3	2.3	2.2
Eurozone	-4.4	2.0	1.4	-0.5	0.1	1.0	1.6	1.7	1.7	1.8
France	-3.1	1.7	1.7	0.0	0.3	1.0	1.6	1.9	1.9	1.9
Germany	-5.1	4.0	3.1	0.8	0.9	1.4	1.6	1.6	1.6	1.5
Italy	-5.5	1.8	0.4	-2.3	-0.9	0.5	1.3	1.3	1.2	1.2
Spain	-3.7	-0.3	0.4	-1.5	-1.5	0.4	1.5	1.9	1.9	1.9
Russia	-7.8	4.3	4.3	3.6	3.6	4.1	4.1	3.9	3.8	3.5
Japan	-5.5	4.5	-0.8	2.1	1.2	1.7	2.0	1.2	1.0	1.1
China	9.2	10.4	9.2	7.7	8.1	8.3	8.2	7.9	7.7	7.2
India	5.9	10.1	6.8	5.8	6.5	7.4	7.9	8.1	7.9	7.7
World GDP (Market Exchange)	-2.2	4.1	2.8	2.1	2.3	3.0	3.6	3.5	3.4	3.3
World GDP (PPP)	-0.6	5.1	3.8	3.0	3.3	3.9	4.3	4.3	4.5	4.3
World Trade	-10.4	12.6	5.8	2.6	4.3	5.7	6.0	5.9	6.2	6.2
Industrial Production										
United States	-7.0	5.4	4.1	3.8	2.3	3.1	3.5	3.0	2.8	2.5
Canada	-9.5	4.9	3.5	1.8	3.0	3.7	3.6	3.1	2.8	2.3
Mexico	-7.6	6.1	3.8	4.0	4.6	5.6	4.9	4.1	3.9	3.6
Brazil	-7.2	10.5	0.3	-1.6	3.6	4.2	4.1	4.1	4.1	4.0
United Kingdom	-8.6	1.8	-1.1	-1.6	1.1	1.4	2.1	1.8	1.6	1.5
Eurozone	-14.9	7.3	3.5	-2.4	0.2	1.7	2.3	2.0	1.8	1.6
France	-12.8	4.8	2.5	-1.7	-0.1	1.5	2.2	1.9	1.9	1.6
Germany	-16.3	10.9	7.6	-0.1	2.2	2.8	2.3	2.1	2.0	1.9
Italy	-18.8	6.8	0.1	-6.3	-1.6	4.5	1.9	1.7	1.9	1.9
Spain	-15.8	0.9	-1.4	-5.3	-2.6	0.6	2.2	2.6	2.5	2.0
Russia	-9.3	8.2	4.8	4.2	3.9	4.2	3.9	3.8	3.8	3.7
Japan	-21.8	16.6	-2.3	0.4	2.5	4.2	4.2	3.5	2.5	1.3
China	8.7	12.7	9.6	9.9	10.5	11.6	10.6	10.4	9.8	9.2
India	6.3	12.3	4.7	2.2	5.5	7.3	7.7	7.6	7.2	6.9
World Industrial Production	-6.6	10.0	5.4	2.8	3.7	4.3	4.3	4.0	4.0	3.8
Inflation (Consumer)										
United States	-0.3	1.6	3.1	2.1	1.9	2.1	2.2	2.2	2.2	2.1
Canada	0.3	1.8	2.9	1.8	2.0	2.1	2.1	2.1	2.0	2.0
Mexico	5.3	4.2	3.4	4.1	3.8	3.7	3.5	3.4	3.5	3.7
Brazil	4.9	5.0	6.6	5.1	5.2	4.9	4.5	4.6	4.7	4.7
United Kingdom	2.1	3.3	4.5	2.7	2.2	2.1	2.1	2.3	2.5	2.5
Eurozone	0.3	1.6	2.7	2.4	1.8	1.6	1.8	1.8	1.9	1.8
France	0.1	1.5	2.1	2.1	1.7	1.7	1.8	1.8	2.0	2.0
Germany	0.2	1.2	2.5	2.0	1.8	1.9	1.9	1.9	1.9	1.9
Italy	0.8	1.6	2.9	3.0	2.1	1.7	1.8	1.7	1.9	1.9
Spain	-0.2	2.0	3.1	2.4	1.9	1.6	1.7	1.7	1.7	1.8
Russia	11.7	6.9	8.4	5.9	6.5	6.2	5.9	5.5	5.5	5.0
Japan	-1.3	-0.7	-0.3	0.0	-0.2	0.7	0.8	1.1	1.1	1.4
China	-0.7	3.3	5.4	3.1	3.4	3.7	3.8	3.7	3.5	3.5
India	10.9	12.0	8.9	9.1	8.0	6.7	6.0	5.6	5.4	5.1
World Inflation	2.4	3.7	4.9	3.7	3.6	3.6	3.6	3.4	3.3	2.9

Source: American Chemistry Council

Methodology

This report presents an assessment of current conditions and expectations for the global business of chemistry, with particular emphasis on the US. The analysis uses economic data and publicly available information through late-November 2012.

In looking ahead, several models of global output, trade, etc. for the business of chemistry are employed. Also taken into account are the forecasts made by economists at the various national chemical associations in Europe (the expertise of whom ACC gratefully acknowledges) and from economic forecasting consultants and other institutions. Also gratefully acknowledged is the macroeconomic and chemical industry expertise of IHS Global Insight and Oxford Economics, leading providers of economic advice and consultancy services. The macroeconomic forecasts of the Economist Intelligence Unit (EIU) were also important to

our thinking as was the US Industrial Outlook of the Manufacturers Alliance/MAPI. These were supplemented by forecasts provided by the Asian Development Bank, IMF, OECD, the WTO, and various banks.

Historical data (back to 1994) and annual projections (to 2017 and beyond) for the tables in the report are available in a spreadsheet. More details are provided in the spreadsheet.

Note: Every effort has been made in the preparation of this publication to provide the best available information. However, neither the American Chemistry Council, nor any of its employees, agents or other assigns makes any warranty, expressed or implied, or assumes any liability or responsibility for any use, or the results of such use, of any information or data disclosed in this material.