

The “New” New Normal

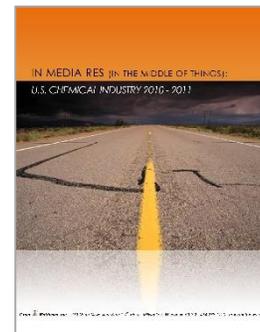
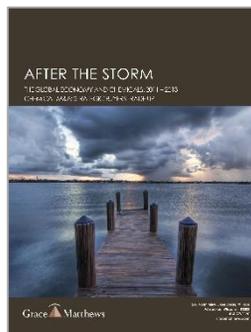
Chemicals 2015



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gracematthews.com/chemicals

John Beagle *CEO, Chemical Practice Lead*
jbeagle@gracematthews.com

Doug Mitman *Head of Investment Banking, Managing Director*
dmitman@gracematthews.com

Ben Scharff *Managing Director*
bscharff@gracematthews.com

Kevin Yttre *Managing Director*
kyttre@gracematthews.com

Tom Osborne *Senior Executive*
tosborne@gracematthews.com

Andy Hinz *Director*
ahinz@gracematthews.com

Trent Myers *Vice President*
tmyers@gracematthews.com

Miguel Mireles *Business Development & Finance*
mmireles@gracematthews.com

Andrew Cardona *Associate*
acardona@gracematthews.com

Jon Glapa *Associate*
jglapa@gracematthews.com

Patrick Maag *Analyst*
pmaag@gracematthews.com

George Liu *Analyst*
gliu@gracematthews.com

Michelle Tveten *Marketing Coordinator*
mtveten@gracematthews.com

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CONTACT INFORMATION

Grace Matthews, Inc.
219 North Milwaukee Street, 7th Floor
Milwaukee, WI 53202

P: 414.278.1120

F: 414.278.1119

gracematthews.com
info@gracematthews.com

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KEY TAKEAWAYS

The “New” New Normal

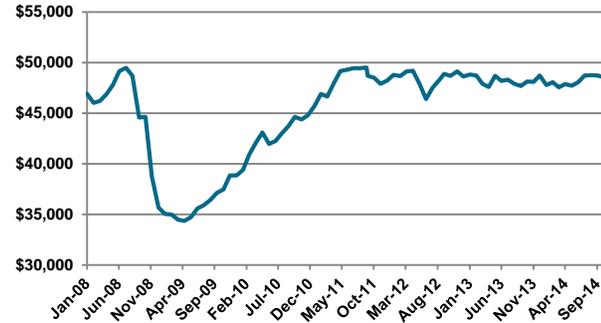
- ▶ **21st Century global demographic trends are fundamentally different** than those of the 20th century, and present unique challenges for the chemical industry and the global economy.
- ▶ The U.S. has its share of demographic challenges, but **U.S. industry and markets are well positioned to thrive in the coming decades** due to the U.S.’ free market economy, culture of entrepreneurship and innovation, and growing population. By contrast, countries in Europe and Asia are at risk for a sustained decline in GDP because of their declining and aging populations.
- ▶ **The recovery from the Great Recession in the U.S. has been much slower than expected.** Employment has declined to less than 6%, but participation in the civilian labor force has also declined. “Real” unemployment that factors in labor force dropouts is close to 9%.
- ▶ The European Union’s lack of coordinated and aggressive policy responses to its sovereign debt crisis and double dip recessions means **Europe is several years behind the U.S. in its recovery.** The prospect of deflation and a potential “triple dip” recession has led the European Central Bank to institute a U.S. style quantitative easing program.
- ▶ **In Asia, China’s growth rate has fallen**, in part by design, as it shifts from an export-driven to a more consumer oriented economy. Japan unexpectedly fell into recession in 2014, and its GDP growth for the next two years is expected to be less than 2% per year.
- ▶ Some government statistics appear to show that the U.S. chemical industry is recovering more slowly than other sectors of the economy, even though the market performance of chemical stocks has outpaced the S&P 500. The disconnect may be explained by the fact that key markets for chemicals – automobiles and construction in particular – are well below their pre-recession levels, and **chemical stocks may be anticipating considerable upside** in the coming years.
- ▶ **The worldwide geopolitics of oil have been permanently changed by the revival of the U.S. oil and gas industry.** The U.S. is becoming energy independent and has surpassed Russia and Saudi Arabia as the world’s largest producer of crude oil and natural gas.
- ▶ **Disruptions in the oil and gas industries, particularly relating to a steep decline in crude oil prices in 2014, will cause growth in U.S. oil production to slow**, but many U.S. oil producers will continue to operate as long as prices are above their breakeven level.
- ▶ **Oilfield chemicals will be affected by low oil prices, but not to the extent many expect** because producing wells will still require large amounts of production chemicals. Exports to oil producing nations also will mitigate the impact on U.S. oilfield chemical producers.
- ▶ **An extended period of low oil prices will cause the benefits currently enjoyed by ethane crackers producing ethylene to spread to other petrochemical value chains**, chiefly propane and butane. European and Asian petrochemical producers will become more competitive with U.S. imports.
- ▶ **Specialty chemical manufacturers will be best positioned to benefit from low oil prices** as the costs of petrochemical raw materials fall and margins expand.
- ▶ **Valuations for specialty chemical firms are high**, and M&A activity may accelerate in 2015 due to a supply of quality companies coming on the market, and increasing competition between strategic and private equity buyers.

U.S. CHEMICAL INDUSTRY

A Graphical Overview

Chemical Products Value of Shipments

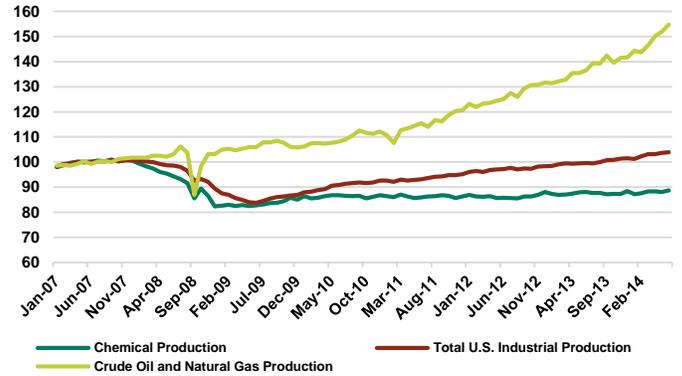
(2008 - 2014)
Seasonally Adjusted
\$ millions



Source: U.S. Census Bureau

U.S. Chemical, Crude Oil and Natural Gas, and Industrial Production Indexes

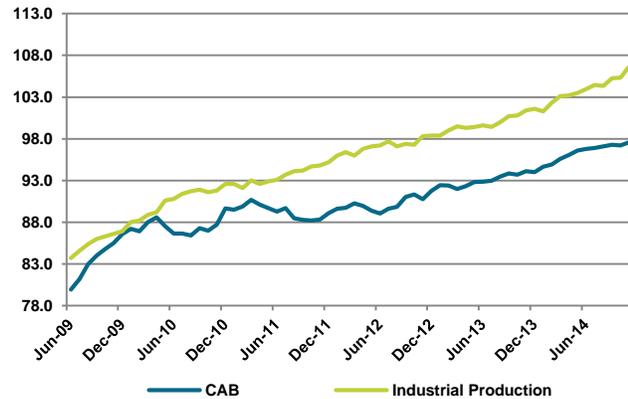
(2007-2014)



Source: Federal Reserve Board

The American Chemistry Council's Chemical Activity Barometer

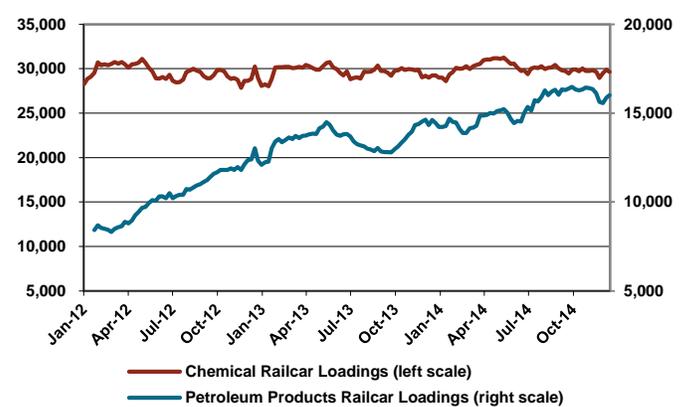
(June 2009 – November 2014)



Source: American Chemistry Council

U.S. Railcar Loadings: Chemicals and Petroleum Products

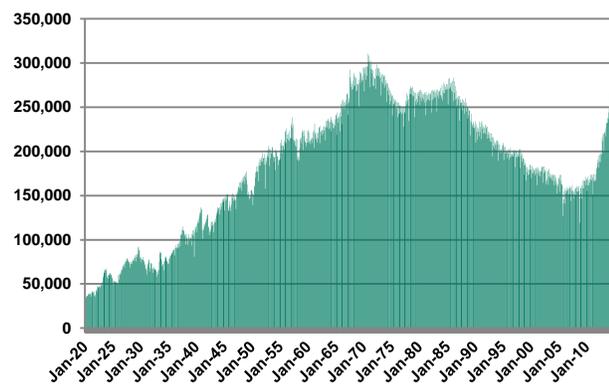
(2012 – 2014)



Source: American Association of Railroads

U.S. Crude Oil Production

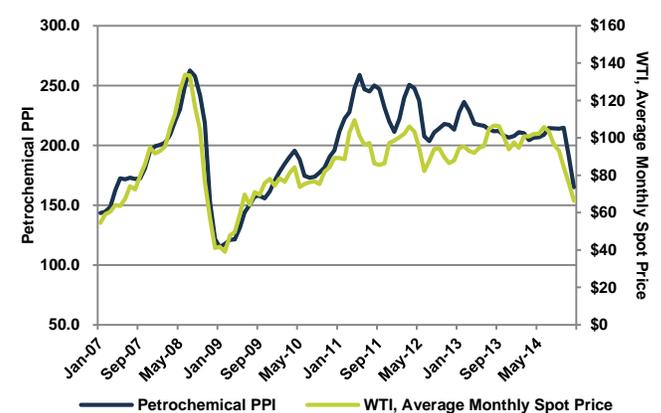
(1920-2014)
Thousands of Barrels



Source: Energy Information Council

Crude Oil Prices and the Petrochemical Producer Price Index

(2007-2014)



Source: Energy Information Administration and Bureau of Labor Statistics

THE “NEW” NEW NORMAL: CHEMICALS 2015

What is the “New” New Normal?

The “New Normal” was a catch phrase that went viral in the wake of the Great Recession and which captured a widely-held view that the global economy was entering into an extended period of slow economic growth and fundamental structural change. Underpinning the New Normal was the view that overleveraged U.S. consumers could no longer be depended upon to be the drivers of worldwide growth, and that global economic leadership would inevitably pass to emerging market countries like China, whose “free” enterprise model includes a heavy dose of government subsidies allocated in a way designed to achieve geopolitical as well as economic objectives. Additionally, as the weakened U.S. financial system emerged from recession, it was believed that the hand of big government, overreacting to past excesses and abuses of the system by a few, would tighten its fist around the financial markets, enacting “reforms” that actually would make the system less competitive and efficient. Finally, the popping of the housing bubble dealt a severe blow to the net worth of the American middle-class, disproving perhaps once and for all the old adage that real estate values never decline. Bill Gross, formerly head of PIMCO, the world’s largest bond fund management firm, who along with PIMCO’s then Co-CEO Mohammed El-Erian coined the phrase “the New Normal,” mused that the malaise could last ten or even twenty years.¹

Taken together, there is no question that these factors were driving the early phases of the recovery, but in retrospect, they hardly seem to represent a fundamental realignment of the world economy, and even seem short-sighted in their almost exclusive focus on short-term political and economic issues. More significantly, they may have obscured the role of longer-term, and ultimately more consequential, forces that are shaping the still emerging “New Normal” economy. These long-term phenomena rarely make headlines, and when they do, they usually are buried somewhere after page three of the Sunday edition of the newspaper. Our point is that the leaders in the chemical industry, because of its unique position at the front of the supply chain for the material economy, need to be aware of both the short- and long-wave phenomena to ensure their companies’ future success. They need to focus not just on maximizing next year’s return on investment, but on preparing their companies to compete in an economy that is going to be very different from the one they compete in today.

In this paper, we will discuss some of the short-term forces that chemical industry managers need to confront right now – the slowness of the recovery, the prospects for the end markets for chemicals, and how an extended period of low oil prices may reshape the global dynamics of the chemical industry. But we believe that these developments have to be understood in the context of what is really going to drive change in the long-run. To that end, we will spend some time reviewing demographic and economic trends in different regions of the world that are altering global patterns of consumption and production. These trends are fundamentally different from those of the 20th century, and will present unique challenges not just for chemical industry, but for the entire global economy. Taking this long view, what may be called the “New” New Normal isn’t just about the direction of interest rates, stock market returns, or employment trends; it’s about what the industry and the world are going to look like 25 or 50 years down the road.

The good news is that most of the trends we examined will have net positive benefits for U.S. industry and markets. Chemicals will be at the forefront of these developments; U.S. chemical manufacturers (and multi-nationals investing in the U.S.) are uniquely positioned to not just survive, but to thrive in the “New” New Normal economy. To

¹ William Gross, ‘On the “Course” to a New Normal’, PIMCO Investment Outlook, September 2009; www.pimco.com/EN/Insights/Pages/Gross_Sept_On_the_Course_to_a_New_Normal.aspx

understand why this is so, we first need to take a closer look at some of the social and demographic trends now underway in the U.S., Europe and Asia.

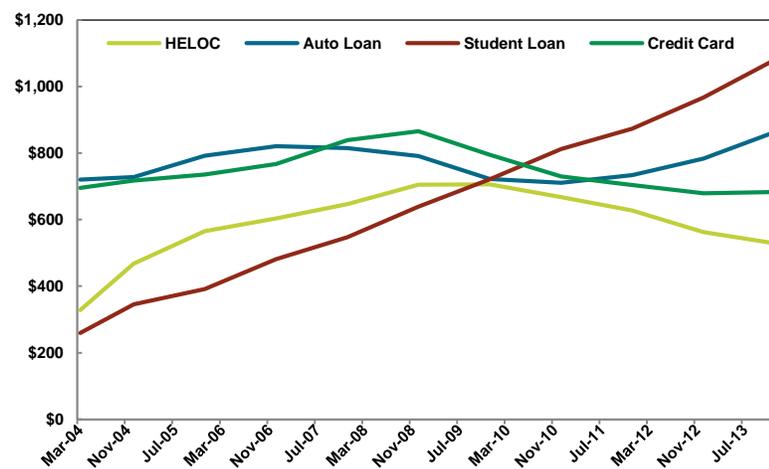
The United States: Millennials, Baby-Boomers and their Problems

In the United States, much has been written about Millennials, the generation of young adults usually considered to have been born between about 1985 and 2000. Perhaps because they saw their parents suffer through two serious recessions in less than a decade, the Millennials have emerged as perhaps the most economically conservative group since the “Greatest Generation,” which came of age during the Great Depression. Given a choice, Millennials would rather rent than buy, an attitude that extends not only to housing, but also to automobiles and other discretionary consumer goods. This attitude has led to an emerging “sharing” economy which may be “greener” and more in tune with Millennial values, but it is decidedly out of step with the old models of consumption driven growth.²

The Millennials have come of age in a period when many cherished traditions and attitudes have been discredited or severely undermined. A college education – long considered the most direct route to a comfortable middle-class lifestyle – no longer seems like such a sure bet. It’s not unusual to find new college graduates working as baristas at Starbucks or toiling away in other low wage service jobs at the local mall. According to one report, one of every two new college graduates in 2012 was unemployed or working at a job that required a high school education or less.³ With such bleak employment prospects, some have postponed the reckoning by continuing their education in graduate school.

Compounding the problem is the escalating cost of a college education, which many Baby Boom parents and their Millennial children simply can no longer afford. It’s rare for a Millennial college student to not have at least some student loan debt, and many have had to take on huge debt burdens. Student loans now total over \$1.1 trillion, and in less than a decade have gone from being the lowest to highest type of consumer debt after mortgages.⁴ (Figure 1)

Figure 1: Non-Mortgage Consumer Debt (2004 – 2014)
(\$ millions)



Source: New York Fed Consumer Credit Panel / Equifax

Both overeducated and simultaneously un- or underemployed, many Millennials have been forced into a protracted adolescence,⁵ compelled to move back in with their parents after college, and with scant means to work off their student debt within the foreseeable future. Marriages have been postponed, and hence the rate of household formation and all its attendant economic benefits – including everything from the sales of baby clothes to appliances – have been negatively impacted. Between 2006 and 2011, only about 550,000 new households were created each year,

² “The rise of the sharing economy,” *The Economist*, March 9th 2013. See also, “The Cheapest Generation,” *The Atlantic*, September 2012.

³ Lilly Altavena, “One in Two New College Graduates Is Jobless or Underemployed,” *The New York Times*, April 27, 2012.

⁴ Federal Reserve Bank of New York. www.newyorkfed.org/studentloandebt/

⁵ For a concise and informative overview of the dynamics of what we are calling a “protracted adolescence” see Adam Davidson, “It’s Official: The Boomerang Kids Won’t Leave,” *The New York Times*, June 20, 2014. <https://nyti.ms/1qtbj2vfor>

compared with 1.35 million in the previous five years.⁶ Although the recession undoubtedly slowed the rate of household formation, the magnitude of the drop -- at 60% -- suggests that other, more sociological factors have played a role.

Needless to say, the economic implications of this development are huge. It's likely that the evolving social values of the Millennials and the low rate of household formation have had a more recent effect on the speed of the economic recovery, and specifically has dampened the recovery of specific segments of the chemical industry that serve the construction and auto industries, a point we shall return to later.

Another demographic change with significant economic implications is the ongoing aging of the Baby Boom generation. Between now and 2050, the percentage of the population over 65 is expected to increase from 13% to 20% of the total population. As many as 10,000 Baby Boomers retire every day, and as they do, they are stressing the social security and medical delivery systems in ways they were never designed to handle.⁷ As time passes, there will be fewer workers per retiree, and as noted above, many of these workers may not, and perhaps never will, make enough to pay the taxes that will be required to support the aging population.

“Between 2006 and 2011, only about 550,000 new households were created each year, compared with 1.35 million in the previous five years.”

Additionally, because Baby Boomers have never been such great savers in the first place and because the Great Recession took such a broad toll on Americans' net worth, many Baby Boomers that would like to retire will not have the personal resources to do so. As a result, there is a growing trend for older, well-educated workers to stay in the workforce longer. This scenario presents its own problems for Millennials, as older workers displace younger workers just entering the labor force and contribute to the growing income inequality between an older, well-compensated class and a younger generation of workers.⁸

All these factors may appear to paint an excessively bleak picture, and in truth they do present considerable short-term challenges. But all is not lost. Consider that even as the population as a whole grows progressively older, it will continue to grow, with children and working adults outpacing the elderly population in absolute numbers. (Figure 2) Even accounting for the U.S.' low fertility rate, which at 2.01 is just below the 2.1 live births per female needed just to replace the existing population, the U.S. population is expected to expand to 438 million by 2050, up from about 295 million in 2005. Driving this growth will be immigration, such that by 2025, the foreign-born share of population will surpass the peak proportion from the last great wave of immigration in the early 20th century.⁹ Putting aside the short-term debate over the method and timing of immigration reform, it is likely that immigration to the U.S. will

⁶ Andrew D. Paciorek, "The Long and Short of Household Formation," Finance and Economics Discussion Series, Federal Reserve Board, Washington, D.C., 2013.

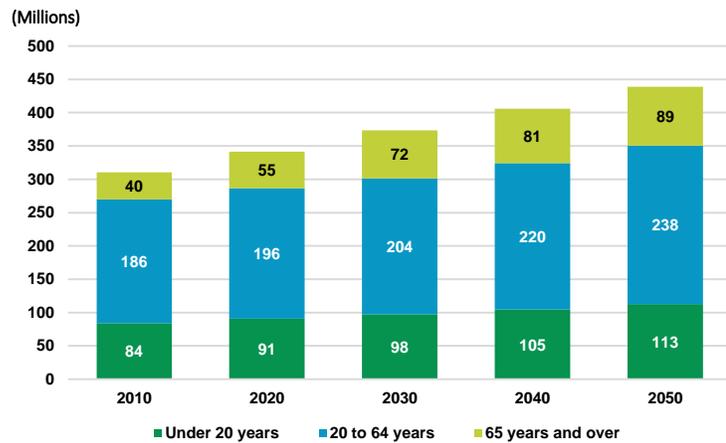
⁷ "Baby Boomers Retire," www.pewresearch.org/daily-number/baby-boomers-retire/. See also Joel Kotkin, "The Changing Demographics of America," Smithsonian Magazine, August 2010.

⁸ The Brookings Institution has calculated that 65% of all American men with professional degrees between the ages of 62 and 74 are still in the workforce. By contrast, only 32% of men with a high school education are still working after age 62. See "Age Invaders," The Economist, April 26, 2014. Some may notice that we have neglected the impact that immigration may have on the age composition of the population and the ratio of workers to retirees. However, most demographers now believe that immigration, while contributing to an overall increase in the total population, will have only a limited impact on the aging of society. See Steven A. Camarota, "Projecting Immigration's Impact on the Size and Age Structure of the 21st Century American Population," Center for Immigration Studies, December, 2012.

⁹ For immigration statistics, see "U.S. Population Projections 2005 – 2050," Pew Research Center, February 2008. The fertility rate, or more technically, the "Total Fertility Rate" is the average number of children that would be born to a woman over her lifetime if she were to survive from birth to the end of her reproductive life. For most developed countries, the fertility rate required just to replace the current population -- the "replacement fertility rate" -- is about 2.1, being higher than 2.0 to account for children that will not survive to reach reproductive maturity. In developing countries, the replacement fertility rate is higher at about 2.33.

continue, and this is a net positive for our country. After all, most immigration is legal and the United States remains the land of opportunity and the destination of choice for some of the smartest people in the world who may have limited opportunities in their home countries. We suggest two modest proposals for inclusion in any immigration reform legislation: 1) given that the U.S. is home to some of the world’s best universities, why not give every foreign student who graduates a green card along with their diploma?, and 2) ease restrictions on visas for knowledge workers. Especially for small- and mid-sized businesses, the red tape involved in hiring non-citizen engineers is formidable, to say the least.

Figure 2: U.S. Population Projections (2010 – 2050)



Source: U.S. Census Bureau

If you take a long-term perspective, U.S. demographic trends are really not that bad. Ask yourself: is it better to have an *educated* unemployed class or an *uneducated* unemployed class? Education is an absolute economic good, and if some believe that the current mismatch between education and available jobs is a structural issue, then the structure will change as capitalism realigns the economy to the changing needs and tastes of the population. The United States has a culture of innovation and entrepreneurship that is unique in the world. Millennials may be economically conservative in some ways, but paradoxically they also seem more likely to start their own businesses (start-up costs are cheap when you work out of your parents’ basement). To some extent it may be a matter of faith, but with a free market economy, a restless culture that embraces innovation, and a growing population to drive growth, the United States is going to be just fine.

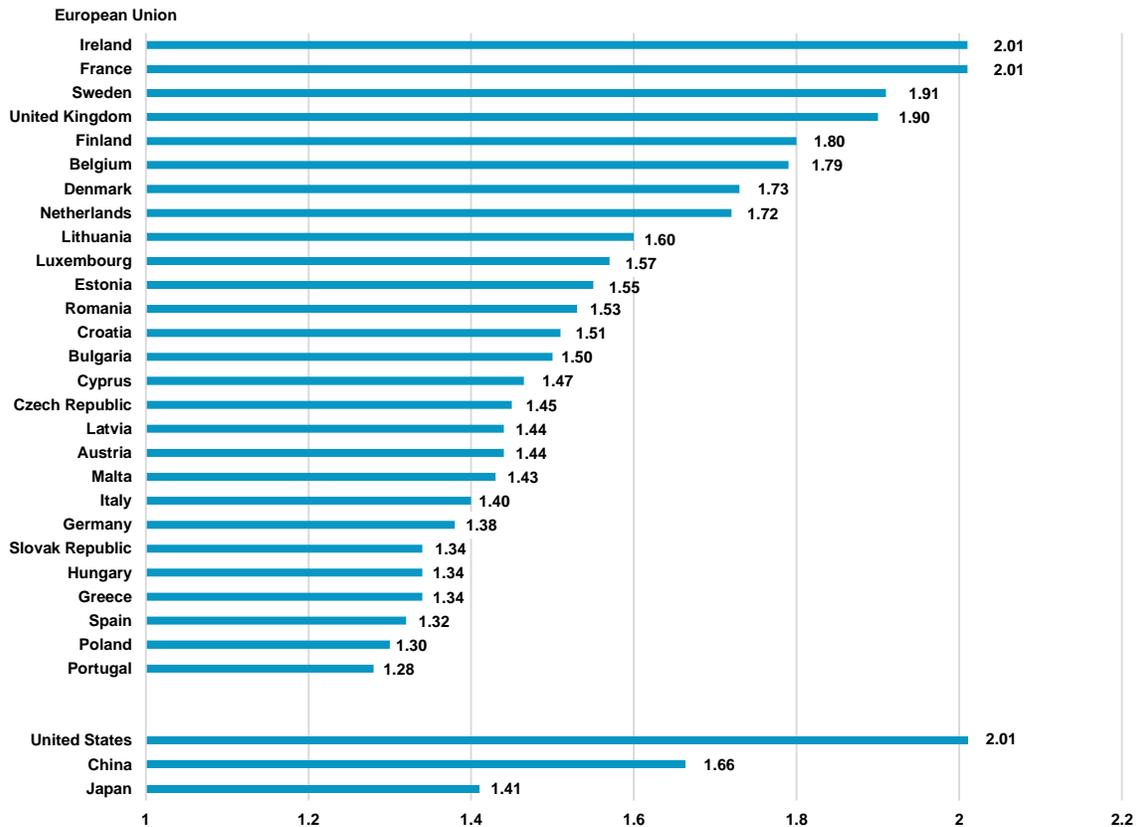
Europe: Where is the Growth Going to Come From?

Demographic trends in other countries are in stark contrast to the United States. In Europe, since 1995 all of the 28 countries that currently make up the European Union (“EU”) have had fertility rates well below the 2.1 replacement rate. Germany, the EU’s economic powerhouse and Europe’s most populous country, has one of the lowest fertility rates in the world at 1.38. France and Ireland have the highest fertility rates in Europe at 2.01, equal to the U.S. but still just below the replacement rate.¹⁰ (Figure 3)

Unlike the U.S., immigration into Europe is not expected to be high enough to offset low fertility rates. Immigration into some of the more developed countries in Western Europe, in large measure consisting of low-skilled workers from Eastern Europe, the Middle East, and Africa, may alleviate the problem in particular countries, but other nations

¹⁰ For historical and current statistical data on the fertility rates of Europe, see [http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/File:Total_fertility_rate,_1960%E2%80%932012_\(live_births_per_woman\)_YB14.png](http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/File:Total_fertility_rate,_1960%E2%80%932012_(live_births_per_woman)_YB14.png)

Figure 3: Fertility Rates of the European Union Countries, United States, China, and Japan



Source: The World Bank

are expected to undergo significant declines in population. The EU population in total is projected to increase from 501 million in 2010 to a peak of 526 million around 2040, after which it will gradually decline to 517 million by 2060.¹¹ In other words, Europe’s population will be range bound within 5% of its current population *for the next 45 years*.

What the combination of low fertility and immigration rates means is that the age profile of Europe’s population, and its labor force in particular, is changing and that there are not enough workers coming in to the labor force to replace those that will retire. In 2006, the International Monetary Fund projected that the ratio of retirees to workers in Europe will double by the middle of the century, from about 1:4 now to 1:2 by 2050.¹²

In theory, a sustained period of low fertility and low immigration should reduce the supply of younger workers and drive unemployment lower, but paradoxically, youth unemployment is a major economic issue in Europe. Unemployment in the European Union is not only higher than in the U.S., it has actually *increased* since 2007, with younger workers faring the worst. Currently, unemployment in the under 25 age group is nearly double the average. (Figure 4) In 2013, the EU unemployment rate overall was about 11.9%, but youth unemployment (under 25) was 22.5%. In some countries, Spain and Greece for example, youth unemployment is over 50%.¹³

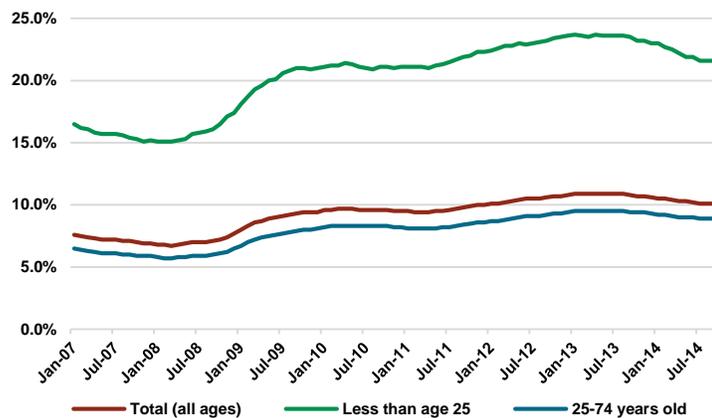
¹¹ “EU27 Population is Expected to Peak around 2040,” Eurostat, http://epp.eurostat.ec.europa.eu/cache/ITY_PUBLIC/3-08062011-BP/EN/3-08062011-BP-EN.PDF

¹² Giuseppe Carone and Declan Costello, “Can Europe Afford to Grow Old?” International Monetary Fund Finance and Development Magazine. <http://www.imf.org/external/pubs/ft/fandd/2006/09/carone.htm>

¹³ For statistical data on European unemployment by age group, see http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Unemployment_statistics

Additionally, although it's beyond the scope of a paper focused on economic issues, it should be noted that unlike the U.S., social/cultural tensions between native Europeans and large communities of immigrant, ethnic minorities are high and are likely to remain so, continuing to fuel an anti-immigration backlash in many countries. High unemployment among ethnic minority youths exacerbates this problem, and the events in France and Belgium in the opening days of 2015 have only underscored the seriousness of this issue.

Figure 4: European Unemployment Rate by Age Group (2007 – 2014)



Source: Eurostat

Asia: You Thought Europe had Issues?

Asia has population and employment issues that parallel Europe's, but they are worse. China and Japan, the second and third largest economies in the world respectively, have very low fertility rates: 1.66 for China and 1.41 for Japan.¹⁴ (Figure 3) China's population is still growing, but at less than one percent a year, and it is predicted to start declining by 2030. Part of the problem is the government's 35-year old one-child policy, which was introduced in 1979 as a response to what the government perceived as developing overpopulation and environmental issues. Though the country recently loosened the policy, few Chinese seem to be interested in having larger families and the fertility rate has remained low. Some demographers have suggested that China is following a typical pattern for countries with a developing middle class, where an emphasis on higher education and the rising costs of living and raising a child have diminished the desire for a second child.¹⁵

As a result, the composition of China's population is aging: currently only about 10% of the population is over 65, but the percentage will rise to as much as 27% of the total population by 2030.¹⁶ Analysts at the International Monetary Fund predict that China's working age population will start shrinking as soon as 2020, causing widespread labor shortages and eliminating China's global competitive advantage in low cost labor.¹⁷ With fewer younger and comparatively more productive workers, China's economic growth inevitably will slow, no matter what government policies are in place to drive growth.

¹⁴ CIA. The World Factbook. <https://www.cia.gov/library/publications/the-world-factbook/rankorder/2127rank.html>. Fertility rates around the Pacific Rim are worse than in China and Japan. South Korea, Hong Kong, Taiwan, Macau, and Singapore have the lowest in the world, ranging from 0.80 to 1.25.

¹⁵ The policy required married couples to register with government family planning authorities and pay fines based on income if couples had more than one child. Some exceptions were allowed and in 2007 only about 36% of the population was subject to the policy. In November 2013, the policy was changed such that families could have a second child if one of the parents was an only child. See Guan Xiaofeng, "Most people free to have more child," China Daily, July 11, 2007. http://www.chinadaily.com.cn/china/2007-07/11/content_5432238.htm See also, Laurie Burkitt, "China's Changed One-Child Policy Doesn't Give Baby Boost," Wall Street Journal, November 7, 2014. <http://www.wsj.com/articles/chinas-changed-one-child-policy-doesnt-give-baby-boost-1415359577>

¹⁶ Feng Wang, "Racing Towards the Precipice," China Economic Quarterly, June 2012. <http://www.brookings.edu/research/articles/2012/06/china-demographics-wang>

¹⁷ Mitali Das and Papa N'Diaye, "The End of Cheap Labor," International Monetary Fund – Finance and Development, June 13, 2013. <http://www.imf.org/external/pubs/ft/fandd/2013/06/das.htm>

The aging population will also cause social and political challenges: China's social safety net is weaker than most other countries with aging populations and, in a country where the support of the elderly traditionally has been considered a family responsibility, the support of aging parents in the majority of cases will devolve to a single child.

Japan's demographic future by any measure is the bleakest. The population of Japan has been declining since 2004, and a government sponsored study published in 2012 warned that the population could shrink from 128 million to about 87 million by 2050, when almost 39% of the population will be 65 or older. In the study's worst-case scenario, this would mean that Japan could slip from being the world's third-largest economy to the ninth.¹⁸

Additionally, the ratio of Japan's public debt to GDP is the highest in the world at 226%, and almost half of the government's budget goes to public pensions and interest payments. Most of the government's debt is held by Japanese citizens, although it would make more sense for the Japanese to invest abroad in countries with growing populations and GDP, rather than at home where the population of taxpayers is shrinking. Sometime around mid-century, there just may not be enough taxpayers around to pay off that debt.¹⁹

“If you are looking for the first potential domino to fall in the next global financial crisis, look no further than Japan”

Immigration could mitigate against this outcome, but immigration is a non-starter for most Japanese: 65% of the population was opposed to immigration in a recent survey, and government policies actively discourage long-term residency for foreign workers. Indonesian and Filipino nurses for example, many of whom come to Japan specifically to care for the elderly, must pass a certification exam if they want to stay in the country for an extended period. Of course, the exam is given only in Japanese. Ninety percent of Japanese nurses pass the test, but less than 1% of foreign nurses pass due to the language barrier.²⁰

The notion of a “Lost Decade” in Japan between 1990 and 2000 has now been extended by some pundits to “Two Lost Decades Plus.” If Japan keeps on its present course, it actually may be much longer than that. If you are looking for the first potential domino to fall in the next global financial crisis, look no further than Japan. One writer has even suggested that the “risk free” trade for the remainder of this decade would be to short the yen.²¹

The general point to be made from these observations is that the economic consequences of declining and aging populations are not just theory: in the absence of serious changes in policy that reward child bearing, immigration, and education of the workforce, they are close to a mathematical certainty. Simply put, fewer and younger workers, many of whom will be less skilled than the retirees they replace, means that a sustained decline in GDP may be inevitable, and beyond a certain point, impossible to reverse.

In the long-term, an aging population will set up a generational conflict such that a government will have to confront some harsh choices: either, A) cut pension and welfare systems, or B) raise taxes on a working class that already may be stretched thin, or C) do both, either a little or a lot as needed. Any of these choices could be a recipe for political and social instability.

¹⁸ Global Japan – 2050 Simulations and Strategies, 2012, Keidanren, the 21st Century Public Policy Institute. For a summary, see Tango Yasutake, Global Japan – 2050 Simulations and Strategies, Nippon.com <http://www.nippon.com/en/features/h00011/>

¹⁹ Peter Boone and Simon Johnson, “The Next Panic,” The Atlantic, October 2012.

²⁰ Chico Harlan, “Strict Immigration Rules May Threaten Japan’s Future,” The Washington Post, July 28, 2010.

²¹ Charles Sizemore, “Japan: Apocalypse Now Or Apocalypse Later,” Forbes, September 24, 2014 <http://www.forbes.com/sites/moneybuilder/2014/09/24/japan-apocalypse-now-or-apocalypse-later/>

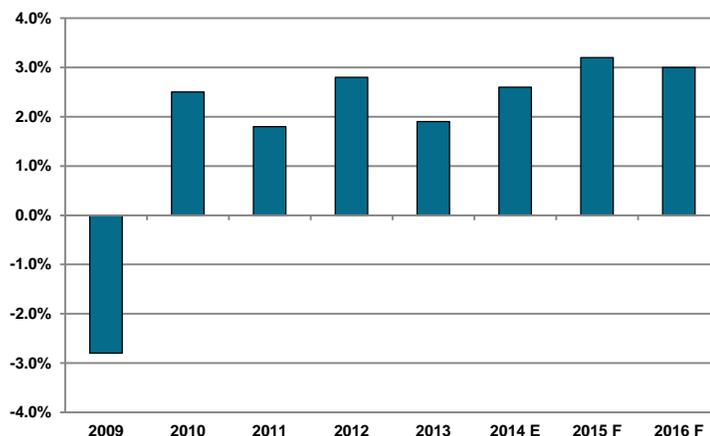
The New Normal in the U.S., Europe, and Asia: 2010 – 2014

Given the backdrop of changing demographics of populations in the U.S. and abroad, it's not surprising that the recovery from the 2008-2009 financial crisis has been one of the slowest and weakest since the 1930s.

In the United States, real U.S. GDP growth averaged just 2.3% year-over-year for 2010 through 2014. (Figure 5) More than five years after the recession officially ended, there are signs that the economy may finally be on the verge of shifting into a higher gear. In part because of an exceptionally cold winter, the GDP declined 2.1% in the first quarter of 2014, its first such decline since the recession ended in 2009. But it rebounded in the second and third quarters, with third quarter growth of 5%, its strongest pace in more than a decade. Fourth quarter growth was not nearly as strong at 2.2%, essentially representing a reversion to the mean for the past few years. Modest growth in the range between 3.0% and 3.2% is projected for 2015 and 2016,²² although the collapse of oil prices at the end of 2014 will benefit consumers and businesses in the aggregate and may cause revisions to the upside.

U.S. unemployment has come down since it peaked at 10.0% in October 2009, and as of January 2015, the unemployment rate was at 5.6%. On its face, the employment picture has improved, but it is a bit deceiving. Although the trend may appear encouraging, a level that could be considered “full employment” may still be some time off.²³ The apparent improvement in labor picture is tempered by the fact that the civilian labor force participation rate, a measure of the number of adults (those over age 16) that either are employed or seeking work as a percentage of total population, has been decreasing since 2008. A key point in understanding the unemployment rate is to know that to be counted as “unemployed,” one has to be actively looking for work. Another way of looking at this is to flip the unemployment statistic on its head and look at the total number of employed individuals as a percentage of the total adult population that is eligible to work.²⁴ So for all “eligible to work” individuals in January 2008, about 63% had jobs, just as the Great Recession was getting underway. By September 2009, this number had dropped to 59%, and there has been little improvement since then, so in this sense the labor market really hasn't recovered at all. (Figure 6)

Figure 5: Real U.S. GDP Growth (2009 – 2016F)
(Percent change year over year)



Source: Bureau of Economic Analysis (BEA) and the World Bank

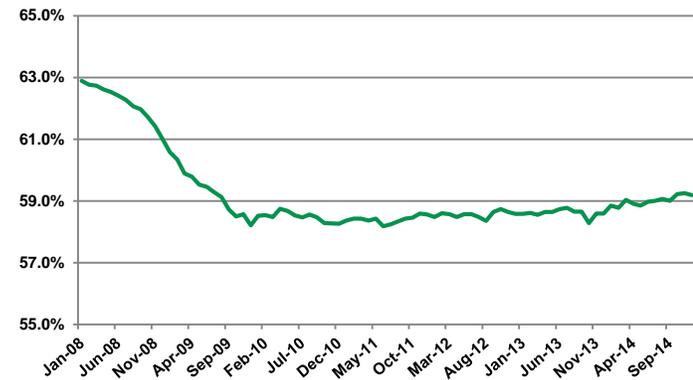
²² “Global Economic Prospects,” The World Bank, January 2015.

²³ “Full employment” is generally considered the rate at which inflation is kept in check and is the corollary of “frictional” or “natural” unemployment that results only from new entrants to workforce or voluntary, temporary unemployment as workers change jobs or relocate. Many economists believe that the natural unemployment rate falls between a range of possible values; the Organization for Economic Co-operation and Development (OECD) estimated a rate of 4.0% to 6.4% for the United States in 1999. More recently, the economist William T. Dickens estimated a 5.5% natural unemployment rate for the United States during the 2000s.

²⁴ “Eligible to work” has a particular meaning in the Bureau of Labor Statistics employment statistics, meaning essentially all adults who are over 16, not in the military, and are not institutionalized. Of course, there are many reasons why “eligible to work” individuals may choose to not work: for example, stay-at-home spouses or full-time college students. There is probably a “natural” rate of non-working, eligible to work individuals, just as there is probably a “natural” rate of unemployment.

In early 2015, unemployment fell to 5.6%, but the civilian labor participation rate dropped to 62.5%, its lowest level since 1978.²⁵ A broader definition of the unemployment rate – an “actual unemployment rate” if you will – would include the official reported rate and add in the effect of the long-term unemployed who have dropped out of the labor force. Using this measure, “actual unemployment” peaked at 14.6% in December 2009, and was about 9.3% as of December 2014.²⁶ (Figure 7) Persistent high levels of unemployment, once you factor labor force dropouts, may be more of a structural issue than the simple result of a downturn in the business cycle. In other words, there is a mismatch between the skills of the existing labor force and the skills required in a changing economy.²⁷ “Full employment” is not likely to be attained until this structural issue is resolved.

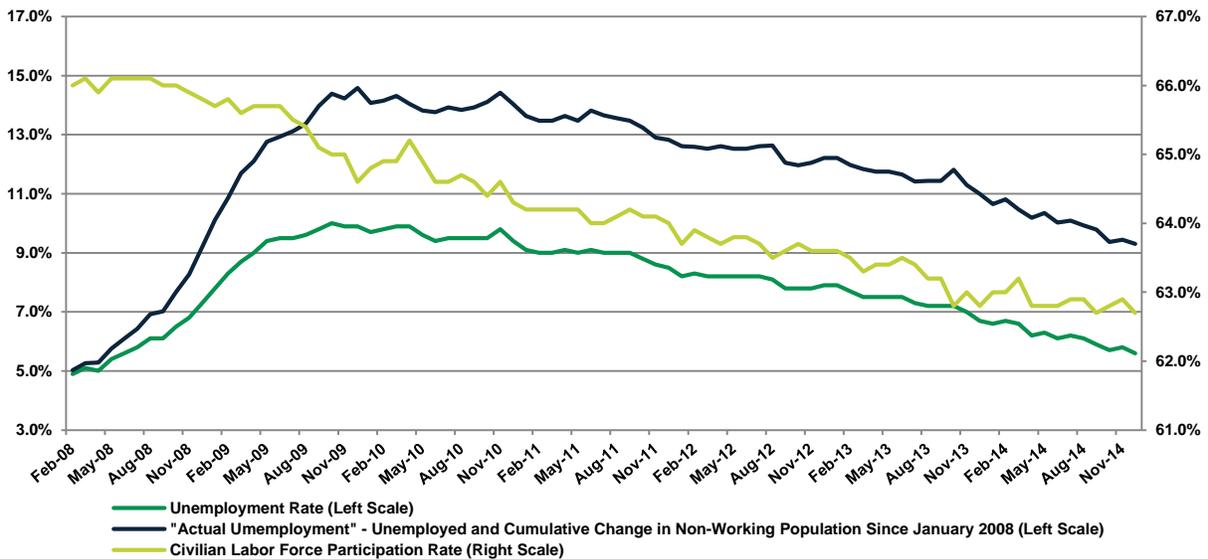
Figure 6: Employed Individuals as a Percent of Those Eligible to Work (2008 – 2014)



Source: Bureau of Labor Statistics

As many readers already know, employment and a skills gap are especially acute issues in the chemicals industry. Until the recent turnaround due to the availability of cheap energy and petrochemical feedstocks (see pages 28-31),

Figure 7: Unemployment Rate and Civilian Labor Force Participation Rate (2008 – 2014)



Source: Bureau of Labor Statistics

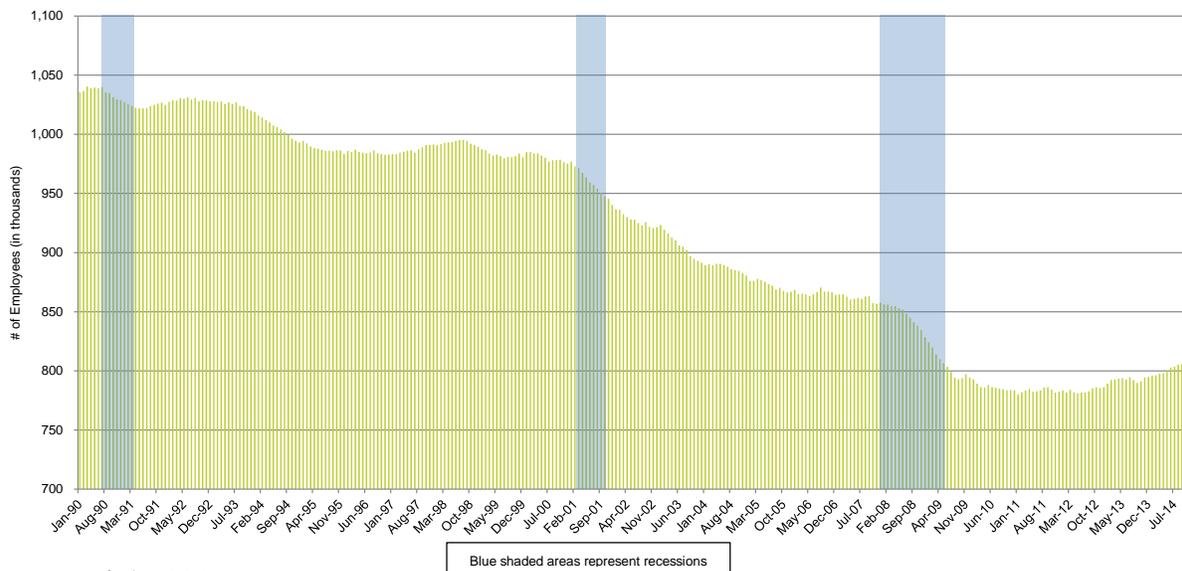
²⁵ Source: Federal Reserve Bank of St. Louis, Economic Research, <http://research.stlouisfed.org/fred2/data/LNU01300000.txt>

²⁶ In defining an “actual unemployment rate” above, we used the reported unemployment rate and added to it the cumulative change since January 2008 in the non-working, but eligible to work (see note 24 above), population as a percentage of the total adult civilian population. In January 2008, the sum of the unemployment rate and the non-working population was 37.1% of the total adult civilian population. We’re using this level somewhat arbitrarily as representative of the “natural” non-working, eligible to work rate.

²⁷ The disconnect between the skills available and the skills required in the labor market primarily is an affliction of the developed economies. On one hand, there are skilled college graduates who are having trouble finding work in their chosen field, and on the other, skilled blue-collar workers who have fallen behind and don’t have the skills needed in a manufacturing environment that increasingly has embraced advanced technologies. See Matthew Bishop, “The Great Mismatch”, *The Economist*, September 10, 2011.

the chemical industry has been losing jobs for decades. (Figure 8) Job losses have been especially acute during recessions, when inefficient plants were closed and workers were laid off. Many of those job losses were permanent as chemical employment continued to decline in the subsequent recoveries. In the U.S., the remaining workers were those in the most efficient and productive facilities. They tended to be highly-trained and experienced, and therefore difficult to replace as they retired. Qualified chemical engineers in particular seem to be in short supply. As one of Grace Matthews’ clients recently commented “If a chemical engineer were to walk in the door looking for work, we would probably hire him or her on the spot.”

Figure 8: U.S. Chemical Industry Employees (1990 – 2014)
(Thousands)



Source: Bureau of Labor Statistics

In Europe, the recovery from its recession and sovereign debt crisis has probably been delayed by the ill-considered reliance on “austerity” as a policy response by the European Union. After recognizing the failure of the austerity measures that were adopted²⁸ – either voluntarily or imposed by the EU – by some of the more financially stressed EU countries, the EU has moved toward, but hasn’t exactly embraced, a more accommodative monetary policy. Since the end of 2009, the European Central Bank (“ECB”) has been purchasing sovereign debt and covered loans from countries with troubled economies (e.g., Portugal, Italy, Ireland, Greece, and Spain, the so-called “PIIGS”) in order to provide liquidity and keep interest rates low.

But even though Mario Draghi, the head of the ECB, promised in 2012 to “do whatever it takes” to revive the economy, it’s clear that ECB hasn’t been aggressive enough. The EU economy appeared to emerge from a double dip recession in 2013, but GDP growth in 2013 was only 0.2%. Economists don’t see that much improvement for 2014, which at the time of this writing is expected to be reported at about 1.3%. At the end of 2014, there was concern that the economy might again be on the brink of slipping into recession. With inflation in the EU hovering near 0%, outright

²⁸ In the October 2012, the International Monetary Fund’s chief economist, Olivier Blanchard, wrote that “recent efforts among wealthy countries to shrink their deficits through tax hikes and spending cuts have been causing far more economic damage than experts had assumed...” *World Economic Outlook, October 2012*.
<http://www.washingtonpost.com/blogs/wonkblog/wp/2012/10/12/imf-austerity-is-much-worse-for-the-economy-than-we-thought/>

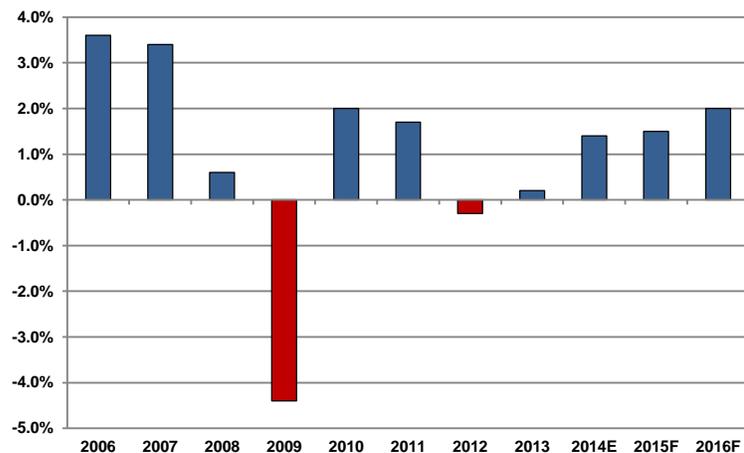
deflation is a real possibility, which would virtually guarantee a “triple dip” recession. In January 2015, the ECB finally determined to undertake a U.S. style quantitative easing program that calls for the ECB to purchase approximately €60 million of government bonds a month for an indefinite period.²⁹

In 2015, the EU’s GDP growth is projected to marginally improve to 1.5%, and then increase to 2.0% in 2016 (Figure 9), but those may be aggressive estimates that will have to be revised. Unemployment across the EU is expected to remain above 9.5% through 2016.³⁰ Growth over the

next few years is expected to be uneven across all the countries of the EU, with countries that share the Euro as a common currency (i.e., the “Euro zone”) generally having somewhat more constrained prospects than non-Euro countries. The difference results from the fact that all of the most overleveraged countries at the heart of the European financial crisis were in the Euro Zone, such that the policy responses of the European Commission and Central Bank inevitably were going to act as a drag on the growth of the stronger economies.

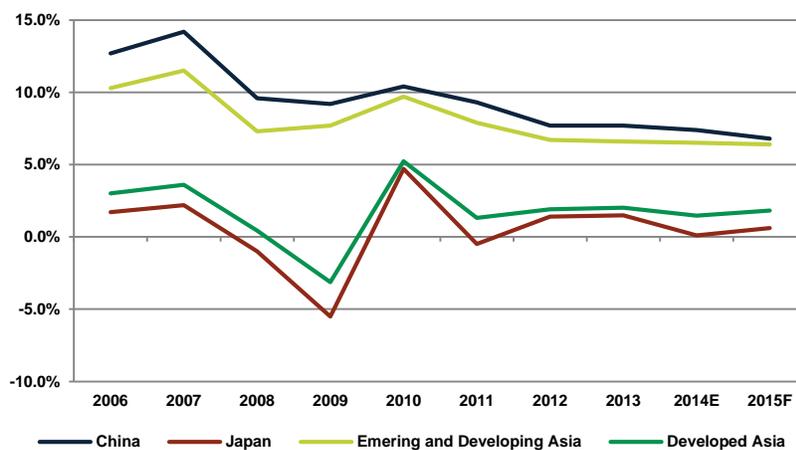
Elsewhere, the New Normal is manifest in a continuing slowdown in the growth rate of the economies of China and the Pacific Rim. China’s slowdown in part is by design, as the Chinese government shifts emphasis from export driven

Figure 9: European Union: Real GDP Growth (2006 – 2016F)
Annual Percentage Change



Source: IMF, World Economic Outlook

Figure 10: Emerging and Developed Asia: Real GDP Growth (2006 – 2015F)
Annual Percentage Change



Source: IMF, World Economic Outlook

growth to domestic consumption. In the double digits as late as 2007, China’s GDP growth rate declined steadily and is expected to be about 6.8% in 2015.³¹ Other emerging and developing Asian economies, some of which never participated in the Great Recession, have followed a similar pattern: most continued to grow through the Great Recession, though at a decelerating rate, and now seem to have entered into a period of expected steady state growth of approximately 6.4% to 6.7% per year. By contrast, the developed Asian economies, led by Japan and more

²⁹ See Jana Randow, “Europe’s QE Quandry,” Bloomberg, January 22, 2015.

<http://www.bloombergview.com/quicktake/europes-qe-quandary>

David Jolly, “Eurozone Inflation Rate Dips, Stirring Deflation Fears,” New York Times, November 28, 2014

http://www.nytimes.com/2014/11/29/business/european-central-bank-economy-unemployment.html?_r=0

³⁰ European Economic Outlook, European Commission, November 2014.

³¹ “China PBOC Economist Says GDP Growth to Slow to 7.1 Percent in 2015,” Bloomberg News, December 14, 2014.

<http://www.bloomberg.com/news/2014-12-14/china-pboc-economist-says-2015-gdp-growth-to-slow-to-7-1-percent.html>

aligned economically and politically with the West, currently are growing much slower than the rest of Asia at 1.5% to 2.0% per year.³² (Figure 10) We expect that Japan’s and developed Asia’s growth rates for 2015 and beyond will be adjusted downward, since Japan unexpectedly returned to recession in 2014, with its GDP contracting 1.9% in Q2 and 0.4% in Q3.³³

The New Normal in the U.S. Chemical Industry: 2010-2014

The slow growth that is the hallmark of the New Normal economy is nowhere more evident than in the U.S. Chemical Industry. Despite a sharp, two-year recovery that began in the spring of 2009, chemical product shipments peaked in August 2011 and have been range bound ever since, averaging about \$48 billion per month. (Figure 11) Chemical production also appears to have plateaued after an initial recovery, even as total industrial production has continued to advance. Lest you think that chemicals are lagging other industries, it should be noted that the industrial production index includes crude oil and natural gas production, one of the few bright spots in the recovery. (Figure 12)

Figure 11: Chemical Products Value of Shipments (2008 – 2014)

Seasonally Adjusted – Excludes Pharmaceuticals
(\$ millions)



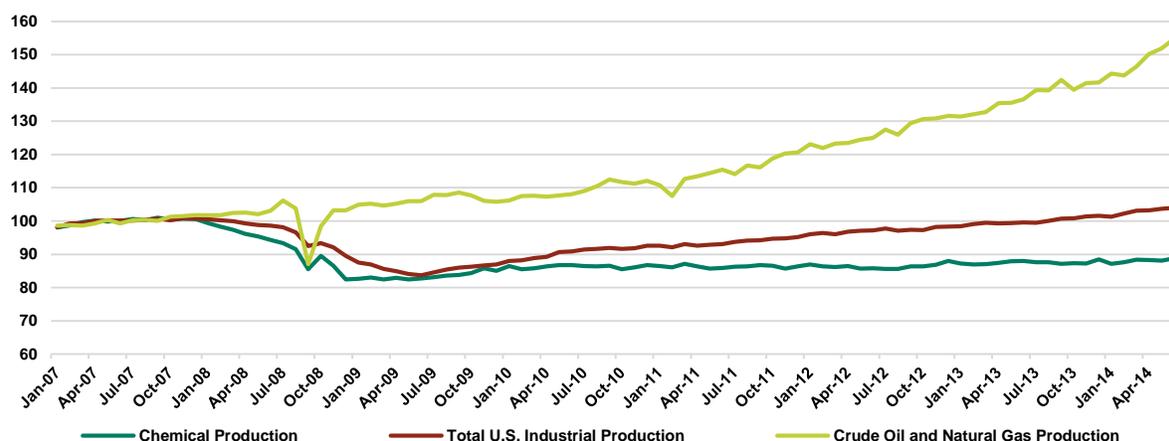
Source: U.S. Census Bureau

The American Chemistry Council’s Chemical Activity Barometer (CAB), a reliable leading economic indicator that deserves more attention than it receives from mainstream economists, appears to show that chemicals have performed somewhat better than the government statistics suggest. Since the beginning of the recovery in June 2009 through December 2014, the CAB grew at a 3.7% annualized rate, although growth has slowed over the last three years (January 2012 – December 2014) to a 2.9% annual rate. (Figure 13) Nevertheless, that number is better than the 2.3% rate of U.S. GDP growth over the same period, but still lower than industrial production’s growth rate of 4.5%.

³² The IMF counts Japan, Taiwan, South Korea, Australia, Singapore, and Hong Kong as developed Asian economies. The IMF includes 28 countries in its list of emerging and developing Asian economies, the most significant of which are China and India in terms of their contribution to weighted GDP averages. See World Economic Outlook, October 2014, Pages 161-166.

³³ Source: Federal Reserve Bank of St. Louis, Economic Research, <http://research.stlouisfed.org/fred2/series/NAEXKP01JPQ6575>

Figure 12: U.S. Chemical, Crude Oil and Natural Gas, and Industrial Production Indexes (2007-2014)

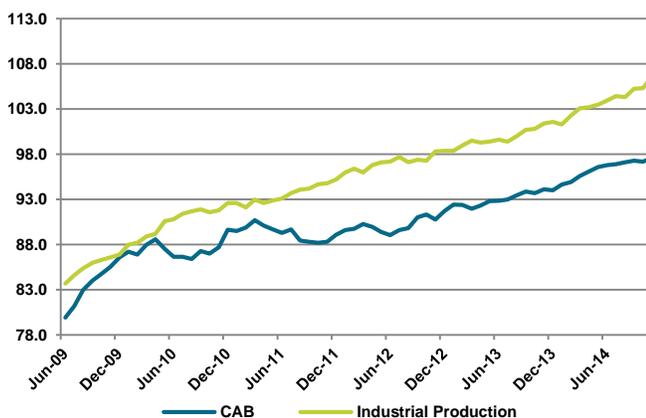


Source: Federal Reserve Board

Another important indicator, chemical rail car loadings, which is widely regarded as one of the few real-time indicators (reported weekly) of future activity, has been flat for more than three years now, generally averaging a little less than 30,000 loadings per week since early 2011. Just to get back to the pre-recession levels of 2007, rail car loadings would need to increase to a sustained level of about 32,000 loadings a week, and though they have come close, they have surpassed this level only four times since 2011. (Figure 14)

However, it should be pointed out that rail car loadings may not be as reliable an indicator of chemical industry activity as it has been in the past. During the recession, thousands of leased and aging railcars were scrapped when their leases expired and were not renewed. As the recovery developed, shortages occurred, such that lease rates for tank cars – commonly used to transport liquid chemicals – have more than tripled since 2011, from about \$500 per month to about \$1,500 - \$2,000 per month currently. Chemical manufacturers have been pressured to compete for tank cars with oil producers, as rail shipments of crude oil have surged with the revival of North American oil production and the failure of the federal government to address the regulatory issues relating to the pipeline infrastructure. With oil production increasing in North Dakota’s Bakken Shale oil field and the Canadian tar sands, railcar shipments of petroleum products have increased from an average of 8,400 railcars per week at the beginning of 2012 to over 16,000 currently. (Figure 15) Presumably, these shipments have directly cut into the number of tank cars available for chemicals, forcing many chemical producers to turn to over-the-road transportation. As one purchasing manager for a major chemical firm put it, “Tank cars are almost impossible to get.”³⁴ Given this background, the lack of growth in railcar loadings may indicate a scarcity of railcar supply rather than a lack production shipments.

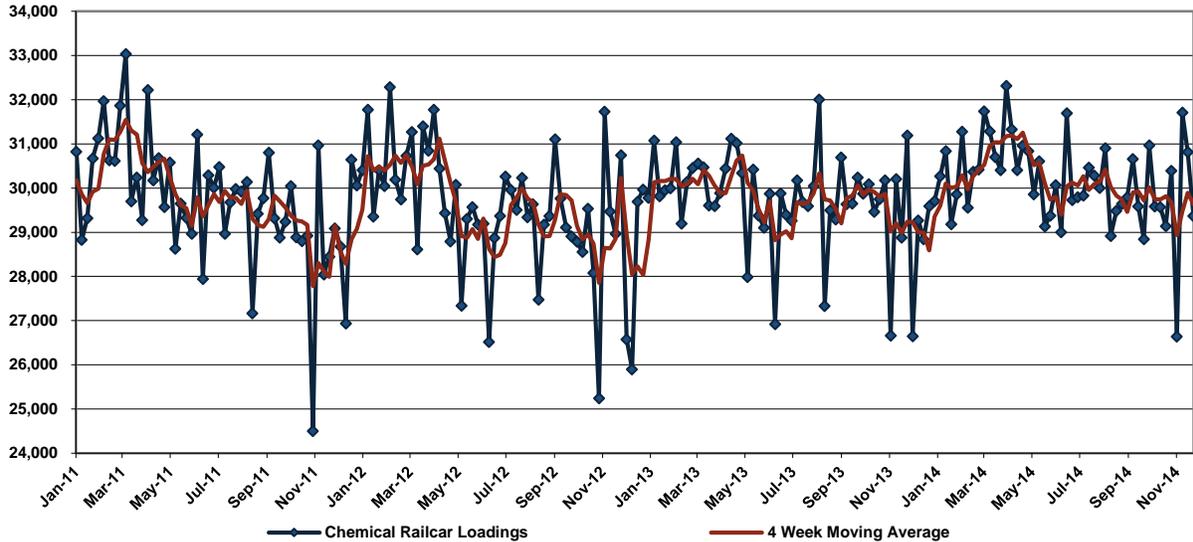
Figure 13: Chemical Activity Barometer (June 2009 – November 2014)



Source: American Chemistry Council

³⁴ Bob Tita, “Railcar Shortage in U.S. Pushes Up Lease Rates,” The Wall Street Journal, May 29, 2014.

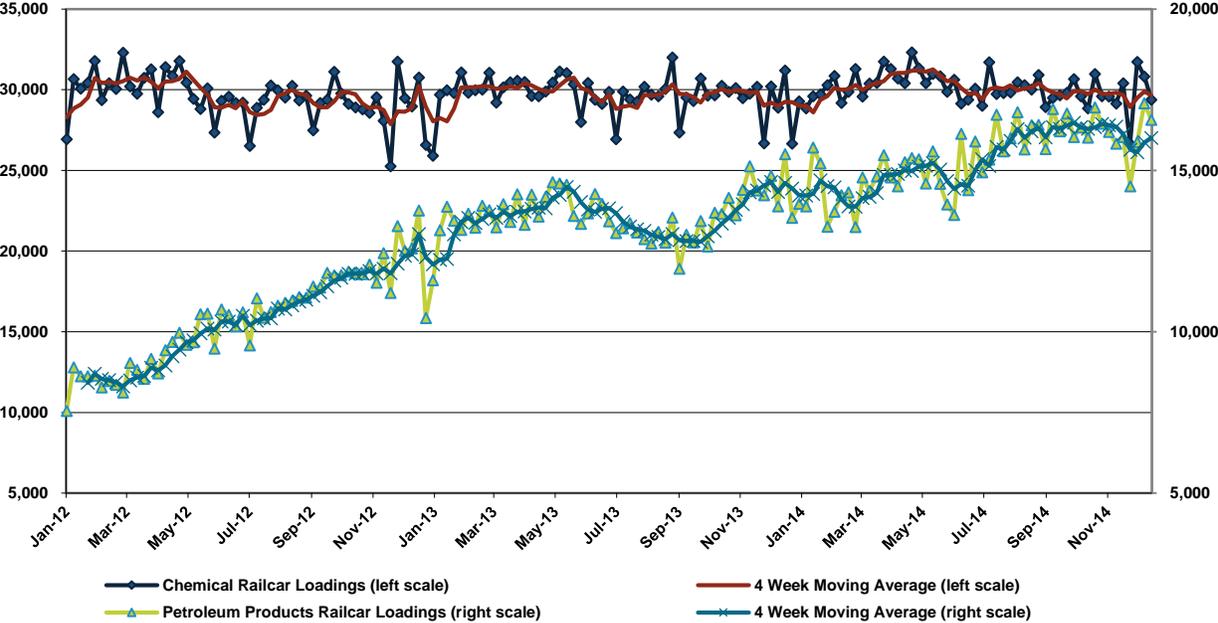
Figure 14: U.S. Railcar Loadings: Chemicals (2011-2014)



Source: American Association of Railroads

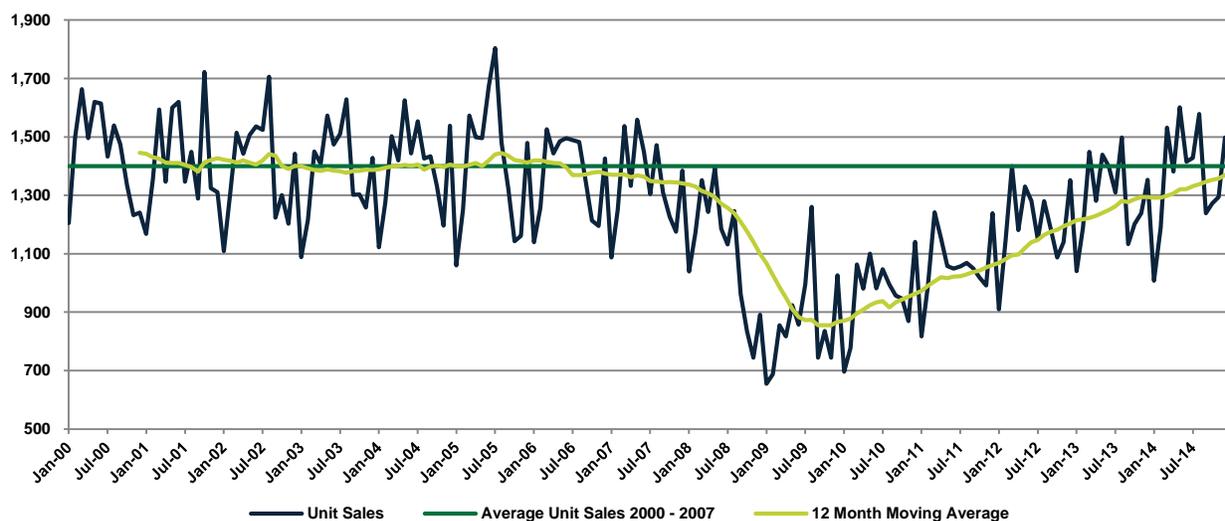
The chemical industry’s relatively uninspiring performance over the past few years typifies the “go slow” recovery of the New Normal economy. Headwinds to growth in the chemical industry have included political uncertainty, higher taxes and regulatory burdens, overseas weakness, volatility in feedstock prices, rising production costs, and a stronger U.S. dollar that has dampened exports. Other proximate causes for the chemical industry’s slow growth are the lagging performance of some of the larger and more cyclical end markets for chemicals, construction and automobiles in particular. For several years, we have predicted that these markets were beginning to turn around, but their recovery has been much slower than expected.

Figure 15: U.S. Railcar Loadings: Chemicals and Petroleum Products (2012-2014)



Source: American Association of Railroads

Figure 16: Monthly Total Light Vehicle Sales (2000-2014)
In thousands of vehicles



Source: Bureau of Economic Analysis

Automobile and light truck production, along with other transportation equipment, is an estimated \$13.6 billion annual market for chemicals.³⁵ From August 2008 until March 2013, unit sales did not exceed 1,400 units per month, the average for the pre-recession period 2000 - 2007. Vehicle sales bottomed in the fall of 2009, and the trend since then has been steadily up, with sales growing just under 10% annually. (Figure 16) That sounds like strong growth, until you realize that average unit sales dropped by nearly 41% in the two years before hitting a bottom, and growth off such a low base is bound to look strong on a percentage basis. Indeed, the U.S. auto industry nearly went bankrupt during the recession and had to be bailed out by the government.

Looking forward, it appears that we may have broken through the long-term averages. The average age of autos on the road has been creeping upward, which augurs well for future sales. In 2013 it hit a record of 11.4 years, and it is expected to rise to 11.7 by 2019. All these vehicles eventually will be scrapped and have to be replaced, and industry analysts are optimistic about future growth. Light vehicle sales increased 5.1% from 15.5 million units in 2013 to 16.4 million units in 2014, and by 2017, new vehicle sales are projected to rise to 17.4 million.³⁶

On the negative side, it's not clear that Millennials are getting in line to buy new cars: a recent study found that 40% of Americans younger than 35 believe that giving up their mobile phone would be a greater hardship than giving up an automobile. After all, Millennials can use mobile apps on their smart phones to summon a host of new transportation options such as Uber, Lyft, or Zipcar. Local transit systems are also developing mobile apps that feature schedules, fares, and information about delays, which is driving record demand for public transportation.³⁷

The construction industry is also a heavy consumer of chemicals, estimated to be about \$9.1 billion annually.³⁸ Products sold into the construction markets, ranging from commodities to specialties, include paints and coatings;

³⁵ 2014 Guide to the Business of Chemistry, American Chemistry Council, Page 5.

³⁶ Automotive News, "IHS hikes U.S. auto sales forecast to 16.4 million," September 17, 2014.

³⁷ The study was commissioned by Zipcar. See Micheline Maynard, "Millennials in 2014: Take My Car, Not My Phone," Forbes, January 24, 2014. Other interesting findings from the study: in contrast to the Millennials, Americans over 35 said giving up their car would be the greater hardship. Also, 35% of the Millennials surveyed said they were actively looking for alternatives to automobiles, and 17% did not even have a driver's license.

³⁸ 2014 Guide to the Business of Chemistry, American Chemistry Council, Page 5.

adhesives, caulks, and sealants; concrete and cement additives, flooring materials, insulation, and other materials. Construction also drives secondary markets that impact chemical consumption, including durable goods such as carpets, furniture and fixtures; and consumables such as cleaning products and maintenance/repair materials.

Construction spending took a huge downturn in the recession and has yet to recover. Though the recession officially ended in 2009, spending on residential construction kept declining through 2011, falling 62% from a high of \$647 billion in 2006 to \$246 billion in 2011. (Figure 17a) The severity and duration of the decline in residential construction is not entirely unexpected, given that the inflated value of housing and the questionable way the housing boom was financed were among the primary causes of the Great Recession. Private investment in construction picked up between 2008 and 2010 due to government stimulus spending, but it was not enough to offset the decline in private investment. (Figure 17b) Since bottoming in 2011, construction spending in total has turned around and is growing, but it is still well below the peak years of 2005 – 2007.

An acceleration of the recovery in housing is unlikely until the economy works off the lingering effects of the construction recession, in particular as it relates to the value of the existing housing stock and the rate of new home construction. It's not just that construction is a major part of GDP: residential home values and consumer spending (believed to account for about 2/3rds of GDP) are inextricably linked. Rising home values contribute to a "wealth effect" that causes consumers to spend more in response to a perceived increase in their wealth. But it also works in

Figure 17a: U.S. Construction Spending: Residential and Non-Residential (2004-2014)

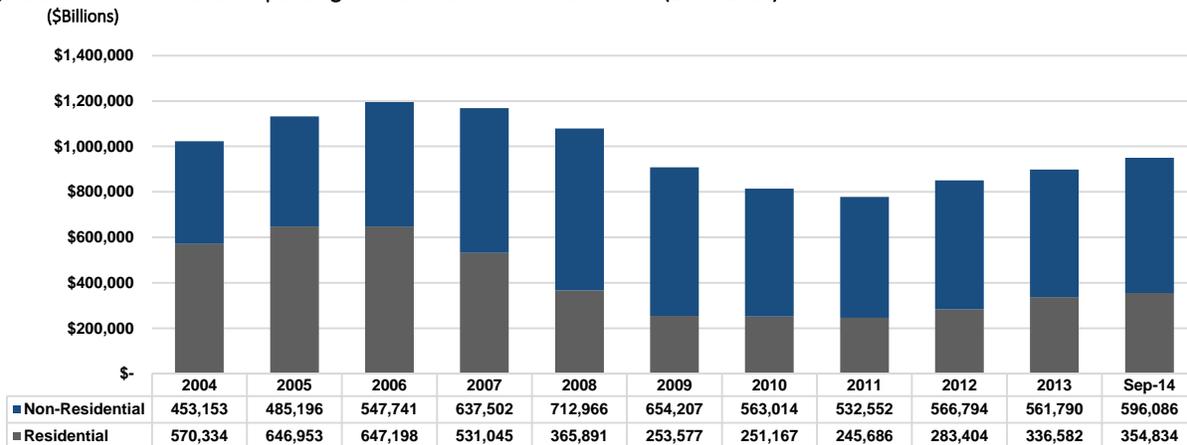
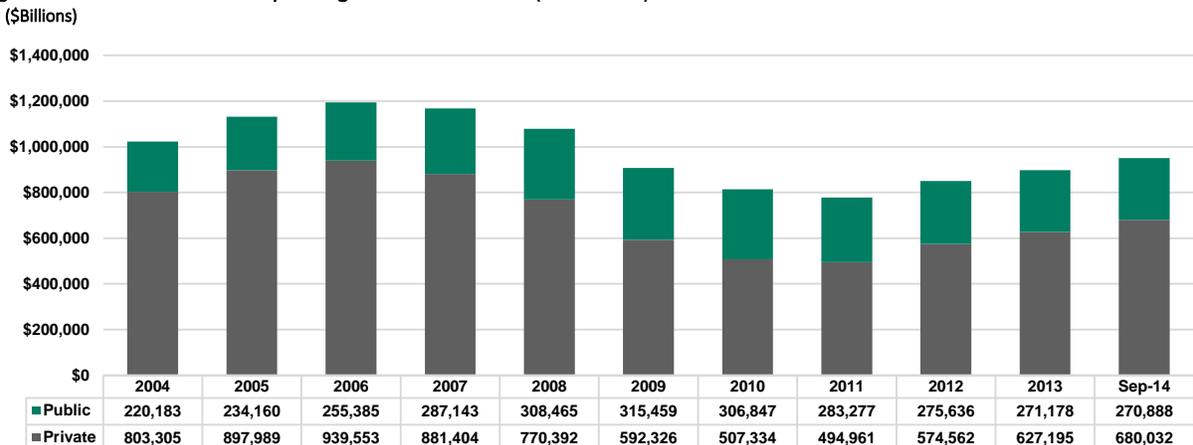


Figure 17b: U.S. Construction Spending: Public and Private (2004-2014)



Source: U.S. Census Bureau

reverse: falling values may cause consumers to reign in their spending.³⁹ For home owners who purchased at the height of the housing bubble, this negative wealth effect isn't a "perceived" loss of wealth – it's actual. If their home is worth less than the value of their mortgage, they may be paying a disproportionate share of their income for housing, and being "underwater" may constrain their income in less obvious ways; if they can't sell their home for enough to pay off their mortgage, they can't move to another region to take a better paying job. The lingering recession in housing acts as a brake on the rest of the economy, and takes a particular toll on chemicals – not just construction chemicals, but for chemicals sold into related markets – carpeting, furniture and furnishings, and household appliances.

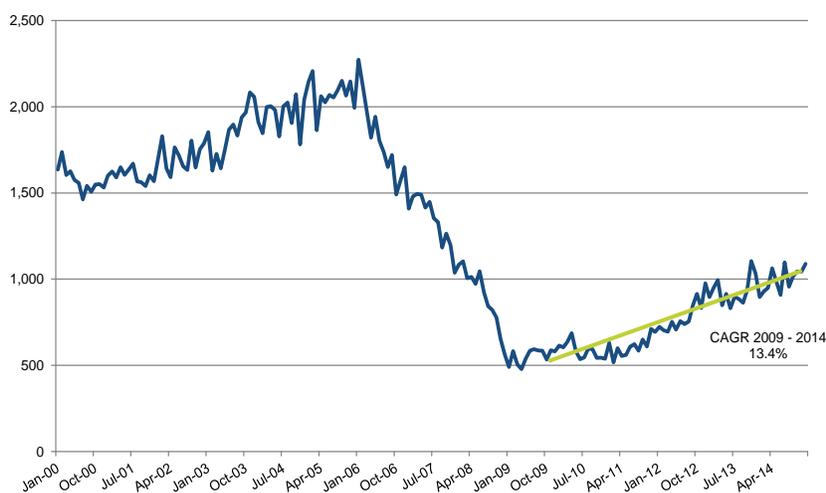
Figure 18: Existing Home Sales (2000 – 2014)
Seasonally Adjusted with 12 Month Moving Average



Source: St. Louis Federal Reserve

The residential housing markets are recovering, but the strength of the recovery presents a mixed picture. Seasonally adjusted sales of existing homes trended upward at a slow and tentative pace until the summer of 2013, when it turned down in the fall and winter, before resuming an upward trajectory in the spring of 2014. Over the past five years (December 2009 – December 2014), sales of existing homes have grown only at a 2.6% annual pace (Figure 18).

Figure 19: Housing Starts (2000 – 2014)
Seasonally Adjusted Annual Rate
(in thousands)



Source: U.S. Census Bureau

New housing starts, currently averaging a little over a million units per year, have exhibited a more robust pattern, with a five year growth rate of 13.4%. (Figure 19) But even with that growth rate, new housing starts are less than half of what they were at the peak of the housing boom. The American Chemistry Council has estimated that the value of chemicals in each new housing start is about \$15,000, and that long-term underlying demand is about 1.5 million units annually.⁴⁰ With an approximate

³⁹ For one of the best known studies on housing values and the wealth effect, see Robert Shiller, Karl Case, and John Quigley, "Comparing Wealth Effects: the Stock Market versus the Housing Market," National Bureau of Economic Research (NBER), 2001; and by the same authors "Wealth Effects Revisited: 1975-2012", NBER, 2013. Case and Shiller are the creators of the well-known Case-Shiller home price indices, and Shiller is a 2013 Nobel Laureate in Economics.
See: <http://www.nber.org/papers/w8606.pdf> and <http://www.nber.org/papers/w18667>.

⁴⁰ American Chemistry Council, "Year-End Chemical Industry Situation and Outlook, December 2013, Page 3.

500,000 unit difference between that level peak and current levels, that represents a \$7.5 billion value gap for the U.S. chemical industry.

The “New” New Normal for U.S. Chemicals

If the data and economic indicators appear to show that the chemical industry’s recovery is lagging the rest of the economy, the stock market evidently hasn’t been paying attention. From its bottom in March 2009 through the end of 2014, the S&P 500 advanced 204%, while the S&P Chemical Index, consisting of 16 of the largest publicly traded chemical companies, returned 224%, with most of the chemical index’s outperformance occurring within the past three years.⁴¹ (Figure 20)

Figure 20: S&P 500 and S&P Chemical Index (March 2009 – December 2014)



Source: Capital IQ

Outperformance of the broader market indexes by economically sensitive, cyclical stocks like chemicals should be expected during the early stages of a recovery, and you would expect that performance to fade towards the middle and later stages of the expansion. In 2014 that is exactly what appears to have happened. Although chemicals outperformed the S&P throughout much of the year, the Chemical Index lagged in Q4 even as the S&P went on to hit

Figure 21: S&P 500 and S&P Chemical Index (2014)



Source: Capital IQ

⁴¹ The S&P 500 Chemical Index is a sub-segment of the S&P 500, comprised of sixteen of the largest publicly traded commodity, diversified, and specialty chemical companies. Included in the Index are Air Products & Chemicals, Airgas, CF Industries Holdings, Dow Chemical, DuPont, Eastman Chemical, Ecolab, FMC Corp., International Flavors & Fragrances, LyondellBasell Industries, Monsanto, The Mosaic Company, PPG Industries, Praxair, Sigma-Aldrich, and Sherwin-Williams. The S&P Chemical Index actually has outperformed the S&P 500 over a longer time frame. Going back a decade, a period that includes the worst bear market since the 1930s Depression, the Chemical Index has increased by 132% since November 2004, while the S&P 500 is up only 78%.

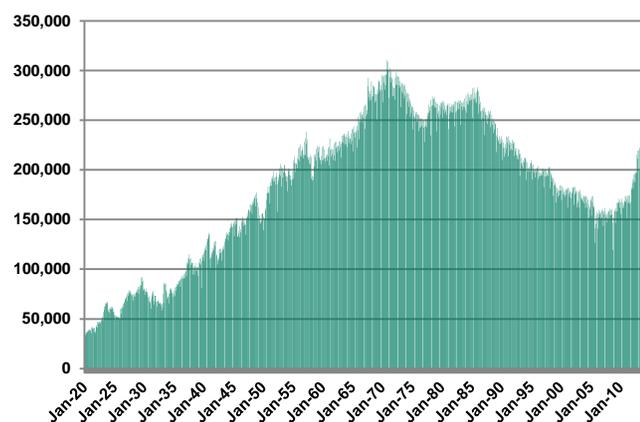
an all-time high just before the end of the year. (Figure 21) A legitimate question, especially considering the collapse in crude oil prices in the final months of the year and the effect it might have on the chemical industry, is whether the recent underperformance of chemicals might signal a rotation out of cyclicals into sectors with more staying power in the latter part of the business cycle. If true, that might mean that the recovery, already over five years old, is approaching the top of the curve.

We don't believe there's a strong case to be made for this line of thinking. As we have noted, key markets for chemicals – construction and autos in particular – are still in recovery mode. With lower energy costs acting as a fiscal stimulus to the economy, it's reasonable to expect that GDP growth will accelerate in 2015. Most obviously, lower gasoline prices directly diverts more cash into consumers' wallets, which might just provide the kick the economy needs to shift into a higher gear. Consumer spending, the largest determinant of aggregate demand, may finally shake off the lingering effects of the recession. Other immediate beneficiaries of lower fuel costs include airlines, trucking firms, and other transportation companies.

Positioned at the front end of the supply chain for the entire economy, chemicals will benefit from both the uptick in demand and, as we will show, a decline in oil prices and energy costs. The Chemical Index could regain its leadership and outperform the broader indexes in 2015, and perhaps for years to come. Simply put, we believe the Chemical Index's outperformance of the broader stock indexes over time is a better predictor of the long-term economic trend.

The reason for our optimism is fairly straightforward: surging North American shale gas and oil production, which appears on track to surpass peak oil production attained in the early 1970s (Figure 22), have changed the fundamental economics of the chemical industry. The steep decline in 2014 in crude oil prices have not changed this premise. For U.S. based chemical producers, as we will explain, the impact of a sustained period of low oil prices on the whole should be positive, although certain sectors will be affected disproportionately, depending in large measure on where they are positioned on the supply chain.

Figure 22: U.S. Crude Oil Production (1920-2014)
Thousands of barrels



Source: Energy Information Agency

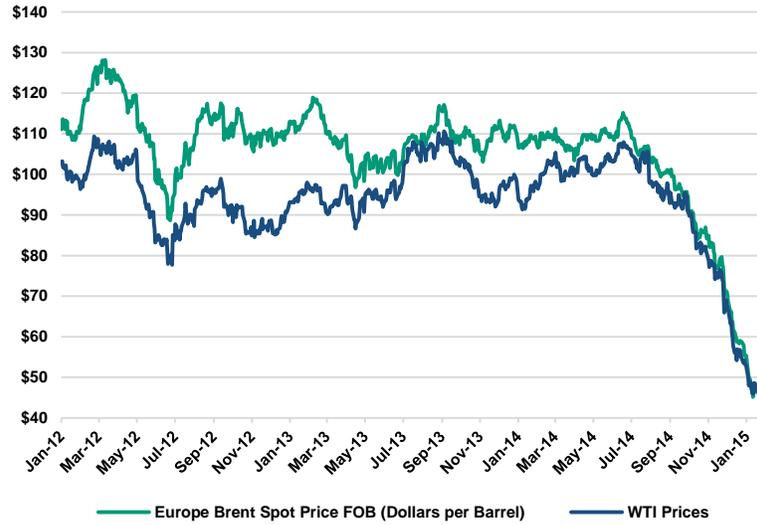
This is not to discount the disruptions now occurring in the global energy markets. As we know, in the second half of 2014, the price of crude oil dropped from above \$105 per barrel WTI in June to less than \$75 per barrel WTI by late November, a 28% decline, and then plunged another 32% from Thanksgiving to the end of year, when it closed out at just above \$53 per barrel.⁴² In January 2015, the price dropped below \$50 per barrel (Figure 23). The steep decline at the end of the year and into 2015 followed a meeting of the OPEC nations on Thanksgiving Day when Saudi Arabia rejected a proposal from other member nations to cut production in order to prop up sagging oil prices. The potential consequences of OPEC's decision to keep production at current levels may have dramatic consequences for Saudi Arabia and its fellow OPEC members, as well as for non-OPEC nations that are petro- or pseudo-petro states.

⁴² WTI stands for "West Texas Intermediate," the benchmark for U.S. crude oil production. The global benchmark is "Brent" crude oil from the North Sea. Because the U.S. bans crude oil exports (with some exceptions), expanding inventories in the U.S. have often driven WTI prices below the Brent prices, and there is usually a spread of several dollars between the two benchmarks. To make it clear which price we're referring to, we have appended "WTI" or "Brent" to per barrel prices cited in the text.

The Geopolitics of Low Oil Prices

From a classical economic perspective, crude oil's decline is simply a matter of the changing balance in supply and demand: surplus production (North American shale oil) plus weakening demand abroad (slumping economies in Asia and Europe) equals lower prices. On the supply side, U.S. producers have built up large inventories, and in the near-term will continue to produce oil and gas from profitable shale plays. On the demand side, structural changes in the U.S., Europe, and Japan have tempered the demand for oil and gas. Emission regulations and the use of alternative energy sources,

Figure 23: Crude Oil Prices (2012-2014)



Source: Energy Information Agency

although still small relative to total energy production, coupled with economic softness have stemmed the demand for oil. The slowdown in China's economy has also resulted in decreased demand.

However, the real story is the changing power structure in the global energy markets. In 2010, the U.S. surpassed Russia as the world's largest natural gas producer, and this past summer, it overtook Saudi Arabia and Russia as the world's largest oil producer.⁴³ The U.S. is also the world's biggest consumer and importer of oil, with a significant portion of imports historically coming from Saudi Arabia and other OPEC nations. North American production has cut deeply into imports from OPEC, reducing them by over half since 2008.⁴⁴ Simultaneously, U.S. production has pressured OPEC and other oil producing nations into competing more aggressively against one another in the remaining export markets, chiefly China, Japan, and other Asian countries. Additionally, Saudi Arabia and other petro states may have viewed with mounting alarm the U.S.'s easing of export restrictions on exports of processed ultra-light oil also known as condensate, perhaps viewing it as a prelude to the ending of the U.S. four decade-long ban on crude oil exports.

Analysts estimate that Saudi Arabia needs a price of just under \$106 per barrel Brent in order to finance government expenditures, about \$228 billion in 2014, without running a deficit. The petroleum sector provides 80% of the Saudi government's budget revenues, and accounts for 45% of GDP and 90% of export earnings. From January 2011 until June 2014, when it peaked at \$115 a barrel, the price of Brent oil averaged just over \$110 a barrel, enabling the Saudis to balance their budget, including the funding of generous social programs and additions to its foreign currency

⁴³ Institute for Energy Research, July 10, 2014, <http://instituteforenergyresearch.org/analysis/u-s-overtakes-saudi-arabia-russia-worlds-biggest-oil-producer/>

⁴⁴ U.S. Energy Information Agency, <http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MTTIMXX1&f=M>

reserves.⁴⁵ When oil was at its peak value, export earnings from oil were valued at about \$360 billion; at \$50 per barrel Brent, those exports would be worth less than \$157 billion.⁴⁶

On the face of it, the Saudis' 2014 Thanksgiving Day decision to accept lower oil prices doesn't make economic sense: it certainly means that they will run a budget deficit and may have to scale back on social spending. However, it makes total sense from a strategic perspective, if their goal is to maintain market share and their hegemony over other oil producers that might challenge Saudi Arabia's leadership in the global markets. As Daniel Yergin noted in his excellent history of the global oil industry, *The Prize*, Saudi Arabia historically has used its dominant position in oil as a weapon of sorts to exert its influence on intended targets.

The Saudis' strategy became clear a week after the OPEC Thanksgiving meeting when they actually *cut* the price of their oil exported to the U.S.: an action aimed at U.S. producers who have disrupted the market and undermined OPEC's supremacy and, more specifically, Saudi Arabia's position as the "swing" producer with the power to set global oil prices.⁴⁷ U.S. producers, with wells that utilize relatively higher cost fracking and horizontal drilling technologies, generally have higher breakeven costs than foreign producers. By driving prices below these breakeven levels, the Saudis intend to test just how long U.S. producers can endure before significantly cutting back production, or even better, going out of business. In other words, they have started an old fashioned price war.

The Saudis have good reason to believe they can outlast the U.S. Those foreign reserves that the Saudis have built up over the past few years? At the end of 2013 they were nearly \$740 billion: Saudi Arabia could easily finance three years of public spending by drawing down those reserves or borrowing against them based on future oil revenues.⁴⁸

But the strategy is not without its risks. Saudi Arabia and other Gulf regimes have used oil revenues to fund public spending on schools, hospitals, roads, housing and roads and other public works in order to fend off the kind of unrest that toppled the governments of Egypt and Tunisia, not to mention the conflicts now engulfing Syria and parts of Iraq. The Arab Spring which lasted from 2010 to 2013 did not touch Saudi Arabia, but there have been growing tensions and dissent within the country that the government has attempted to placate by increasing entitlements. If the Saudi government cuts back on social spending due to low oil prices, the Kingdom may see its own version of an Arab Spring, perhaps one that resembles more what happened in Libya and Egypt than in Tunisia.

"The Saudis intend to test just how long U.S. producers can endure before significantly cutting back production, or even better, going out of business. In other words, they have started an old fashioned price war"

Low oil prices have already caused several gulf nations to scale back their spending plans, which could further destabilize the region. It may already be too late for some OPEC countries – Iraq, Algeria, and Nigeria come to mind – that don't have the resources of Saudi Arabia and where Islamic Jihadi groups have established a presence. Also, the Sunni versus Shia dynamic within OPEC likely deserves its own separate discussion; however, it is important to

⁴⁵ "Here Are the Big Winners and Losers of Low Oil Prices, The Economist, October 26, 2014.

<http://www.businessinsider.com/here-are-the-big-winners-and-losers-of-low-oil-prices-2014-10>

⁴⁶ At the end of November 2014, the Saudi oil minister stated that he believed oil prices would stabilize at around \$60 per barrel. At the time, prices were about \$70 per barrel Brent. A little over a month later, prices dropped below \$50 per barrel. See "Saudis: Oil to Firm at \$60," The Wall Street Journal, December 4, 2014, Page C1.

⁴⁷ Nicole Friedman and Summer Said, "Oil Futures Slide on Saudi Price Cut to U.S." The Wall Street Journal, December 4, 2014. In its historical role as the swing producer for global oil supplies, Saudi Arabia has maintained spare production capacity, allowing it to increase or decrease global supplies at will in order to balance supply and demand and influence prices.

⁴⁸ CIA World Fact Book, <https://www.cia.gov/library/publications/the-world-factbook/rankorder/2188rank.html>

note that the Sunni-majority states such as Saudi Arabia, United Arab Emirates, Qatar, and Kuwait are in a better position to cope with lower oil prices than Shia rival Iran.

For the other “have-not” OPEC nations and petro-states that need oil revenues just to balance their budgets, such as Russia and Venezuela, low oil prices are a disaster. With few alternative sources of income, many of these countries may have to continue producing no matter how low the price of oil goes. For this reason, they are likely to keep up the pressure for production cuts and higher prices.⁴⁹ Figure 24 outlines the financial position of some of the key petro-economies, both OPEC and non-member countries, and shows the effect low oil prices are likely to have on their GDP.

Figure 24: The Effect of Low Oil Prices on the GDP of Select Oil Producing Countries

Country	Est Fiscal "Breakeven" Price Per Barrel**	Population (millions)	2013 GDP (\$ billions)	2013 Production (mmb/day)***	Value of 2013 Production			Potential loss in GDP (\$ billions)	Potential % Change in GDP
					@ \$110 per barrel (\$ billions)	@ \$50 per barrel (\$ billions)			
Libya*	\$184.10	6.2	\$65.5	0.98	\$39.3	\$17.9	-\$21.5	-32.8%	
Iran*	\$130.70	75.0	\$367.1	3.19	\$128.1	\$58.2	-\$69.9	-19.0%	
Algeria*	\$130.50	38.7	\$212.5	1.76	\$70.7	\$32.1	-\$38.5	-18.1%	
Nigeria*	\$122.70	167.0	\$521.8	2.37	\$95.2	\$43.3	-\$51.9	-9.9%	
Venezuela*	\$117.50	28.8	\$227.2	2.49	\$100.0	\$45.4	-\$54.5	-24.0%	
Saudi Arabia*	\$106.00	29.2	\$748.5	11.6	\$465.7	\$211.7	-\$254.0	-33.9%	
Iraq*	\$100.60	34.7	\$229.3	3.06	\$122.9	\$55.8	-\$67.0	-29.2%	
Russia	\$98.00	146.0	\$2,096.8	10.53	\$422.8	\$192.2	-\$230.6	-11.0%	
UAE*	\$77.30	9.0	\$402.3	3.23	\$129.7	\$58.9	-\$70.7	-17.6%	
Qatar*	\$60.00	2.1	\$202.5	2.07	\$83.1	\$37.8	-\$45.3	-22.4%	
Kuwait*	\$54.00	3.3	\$175.8	2.81	\$112.8	\$51.3	-\$61.5	-35.0%	
Norway	\$40.00	5.1	\$512.6	1.83	\$73.5	\$33.4	-\$40.1	-7.8%	

* Denotes OPEC member
 ** "Breakeven" in this context means price that would balance the national budget
 *** mmb/day = millions of barrels per day

Source: The Wall Street Journal

There's also not an insignificant probability that oil prices could suddenly reverse direction, and head upwards just as quickly as they have fallen. Geopolitics have been pushing oil prices around ever since OPEC first drove up prices in 1973 in retaliation for the U.S. support of Israel in the Yom Kippur War. The risk of a geopolitical shock now perhaps could not be greater, given the military conflicts in the Middle East, Iranian nuclear ambitions, and heightened tensions with Russia. Saudi Arabia is surely aware of how destabilizing low oil prices are to the economies of not just its OPEC allies, but also to its enemies, particularly Iran and Russia whose leaders already see a conspiracy between the U.S. and Saudi Arabia.⁵⁰ That's probably just paranoia, but it's quite possible that there is something going on behind the scenes diplomatically to bring some stability to oil prices and ratchet down the risks. It's not clear whether oil prices at currently depressed levels adequately price in potential geopolitical risks, but assuming they do not, an external shock could cause oil prices to rapidly escalate.

⁴⁹ "Here Are the Big Winners and Losers of Low Oil Prices, The Economist, October 26, 2014. Ambrose Evans-Pritchard, "Saudis Risk Playing with Fire in Shale-Price Showdown as Crude Crashes," The Telegraph (UK), November 30, 2014, <http://www.telegraph.co.uk/finance/oilprices/11263851/Saudis-risk-playing-with-fire-in-shale-price-showdown-as-crude-crashes.html> Tomas Hirst, "For Some Nations, Saudi Arabia's Oil Price War is and Existential Threat," Business Insider, November 27, 2014. <http://www.businessinsider.com/saudi-arabia-pec-and-the-price-of-oil-2014-11>

⁵⁰ See Anthony Zucher, "Is the Oil Crash a Secret U.S. War on Russia?" BBC News, October 19, 2004. <http://www.bbc.com/news/blogs-echochambers-29651742>

The Staying Power of the U.S. Oil Industry

Saudi Arabia may have also underestimated the resilience of the U.S. oil industry. It's true that at pricing of around \$70 a barrel WTI or lower, a lot of U.S. oil production is below "breakeven" pricing. But the term "breakeven" has different meanings in reference to oil production. Most published breakeven estimates for U.S. "tight" oil (obtained through fracking and horizontal drilling) range between \$60 and \$80 a barrel WTI, with the higher costs generally associated with the North Dakota Bakken shale play, and lower costs with the Marcellus (Mid-Atlantic States) and Eagle Ford (Texas) plays. The problem with these estimates is that the main factors in calculating breakeven levels – well costs and productivity – vary widely between different fields and even between different wells within the same play. In an excellent report published by Citi Research, the authors noted that a well with an \$8 million cost and producing 400 barrels a day would break even at \$70 per barrel WTI, but that another well with the same cost and producing 500 barrels a day would break even at \$55 per barrel WTI.⁵¹

Another issue is that published breakeven costs often refer to "full-cycle" costs, which includes land acquisition, drilling expenses and hardware. Once these sunk, upfront costs are taken out, a producing well, or a new well drilled just to maintain production from the same formation, becomes a lot less expensive. The Citi Research report notes that "half-cycle" breakeven prices in the U.S. – after removing the sunk cost of initial investment – can be \$40 - \$50 per barrel, and as low as \$30 per barrel for some wells.

Other factors will mitigate the effect of low prices on U.S. producers. Keep in mind that hydraulic fracking and horizontal drilling are relatively new techniques for extracting oil and gas from formations that were previously thought to be inaccessible. Yet since the shale oil and gas boom got underway in 2008, productivity gains from improved technologies and efficiencies continue to surprise on the upside, and have driven down production costs.

We cannot predict the future direction of oil prices, and it may be that as we write this (in January 2015) oil may be making a bottom in the range of \$40 - \$50 a barrel WTI. In the near-term, U.S. producers who hedged their exposure to the 2014 oil price decline through futures contracts likely will keep on pumping, at least for a time. Many of those contracts will begin to expire in 2015, and marginal wells will begin to be shut down, especially those with half-cycle breakeven prices at the higher end of the range. Capital spending budgets are already being trimmed, and some explorations & production firms and oil service providers have begun laying off employees. Further, many drillers that financed their expansion in the boom times with high-yield debt will find it increasingly difficult to service their debt loads, and

We can't predict oil prices, so we'll defer to the experts. Here's where they're saying oil prices are headed:

- As low as \$30 a barrel – *Goldman Sachs Group President Gary Cohn*
- Potential to climb to \$200 per barrel – *OPEC General Secretary Abdell El-Badri*
- Below \$60 per barrel for at least three years – *BP CEO Bob Dudley*
- As cheap as \$20 per barrel before rebounding in the fourth quarter to about \$75 – *Citigroup Analyst Edward Morse*
- Definitely between \$20 and \$200 a barrel sometime in the future – *Grace Matthews brain trust*

Forecasts (except Grace Matthews) gathered by Bloomberg News between January 25 and February 6, 2015.

Source: Tom Randall, "These Experts Know Exactly Where Oil Prices are Headed," Bloomberg News, February 6, 2015.

⁵¹ Citi Research, "Energy 2020, Out of America" <https://ir.citi.com/rBWYa6YM4Scr4LsmpuQB8DZubx61JU8NqGw5jsCxMMfxMRxBp4u4gwbWrQgfNlfhZMSpx1Jv3qA%3D>
See also Citi Research, "The Abyss Stares Back" <https://ir.citi.com/ydkzNOCTV8MJIO6ROIB1swXynUNPUsyoxJ3%2fRa1pTg0%2bz3QZ2rd51ChsGdiUlt9K>

some will probably go into bankruptcy.⁵² Surviving operators will likely benefit, as they may be able to pick up surplus equipment and drilling leases at bargain prices.

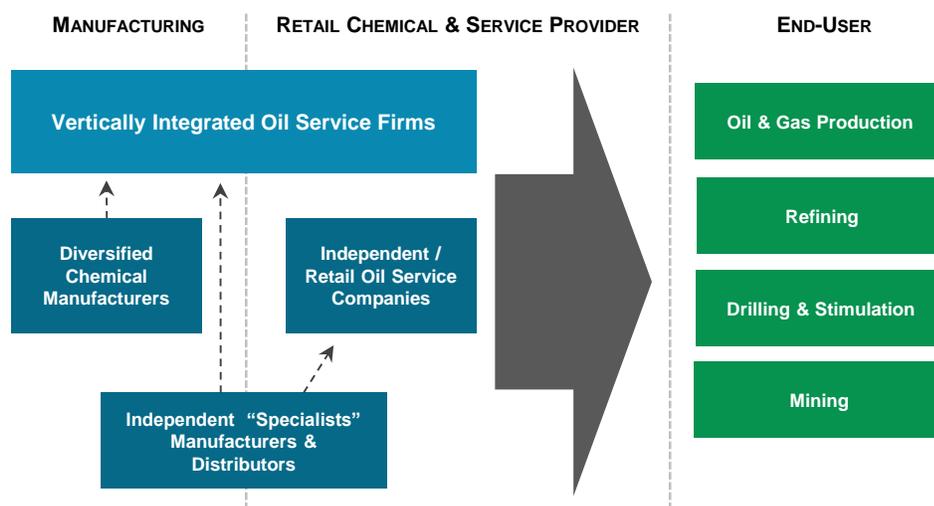
In the Citi Research report, published in October 2014, analysts estimated that production growth could flatten out at prices below \$50 per barrel WTI. As of the end of January 2015, we're below that price, but we need to keep in mind that production is already higher than it was in 1992, and all that oil in the ground isn't going anywhere. If flat production is the worst case scenario, U.S. oil production still would seem to have a promising future in the long-term.

The Impact on Oilfield Chemicals

The oilfield chemicals sector will be affected by an extended period of low oil prices, but not as much as many would expect. Oilfield chemicals, generally considered to be a \$25-\$30 billion industry worldwide, is controlled by the large integrated oil services firms – Halliburton/Baker Hughes, Schlumberger, and now Lubrizol after its December 2014 acquisition of Weatherford's engineered chemistry and drilling fluids business. With the exception of the independent Lubrizol, these firms are integrated providers, bundling equipment, chemicals, and services that are sold to oil producers. However, the end markets are quite fragmented, and there are numerous small players that successfully serve various niche markets.

Because the quality of crude oil – its level of water content and concentration of impurities – varies considerably between different geographies, and even from well to well within the same formation, the most cost-effective oilfield chemicals are those that are custom formulated for a particular geography or well. Because of the demand for these custom formulations, there are a staggering number of specialty chemicals and blends that are used in oilfield applications. Through their chemical operating subsidiaries, the major oil service firms manufacture some of these chemicals, but they also buy and resell large volumes from specialty chemical manufacturers, both major suppliers that serve global markets as well as smaller, niche players in the industry. (Figure 25)

Figure 25: Oilfield Chemical Value Chain



Source: Grace Matthews

⁵² See Sean Hanlon, Oil's Price's Decline Weighs on High-Yield Debt, Forbes, December 16, 2014. <http://www.forbes.com/sites/advisor/2014/12/16/oils-price-decline-weighs-on-high-yield-debt/2/>. Also Daniel Gilbert and Alison Sider, "MLPs: The Oil Market's Lost Children," The Wall Street Journal, January 1, 2015. <http://www.wsj.com/articles/energy-partnerships-lose-allure-as-oil-prices-fall-1420154800>

At the risk of overgeneralization, oilfield chemicals can be divided into four broad segments:

- Drilling fluids and muds, consisting of lubricants for drill bits and additives that help remove materials from the hole and protect the formation,
- Cement additives, used to secure the connection between the steel wellhead and drill hole equipment and the rock formation,
- Stimulation chemicals, which as the name implies are used to increase the flow of oil and gas from the wellhead, and
- Production chemicals, used to maintain equipment, prevent corrosion, and keep the oil flowing.

There is considerable overlap between the chemicals in these categories, so it is difficult to quantify the breakout of market sizes. That said, you might expect that the first two categories, drilling fluids and muds and cement additives, will be the most affected by low oil prices since they are associated with developing infrastructure, and will be directly impacted as capital investment in new wells is cut back. Even so, the effect of these cutbacks on chemical suppliers will be mitigated by the wells that are drilled just to maintain production from an existing formation. The incremental cost of these additional wells is much lower than the first well in a formation, and they will have lower (half-cycle) breakeven costs.

The third and fourth segments, stimulation and production chemicals, are used on an ongoing basis to bring the oil out of the ground, and will be the least impacted by low oil prices. As noted earlier, production at existing wells should be maintained as long as breakeven “half cycle” costs are below the market price of oil. Additionally, the older the well, the more chemicals it usually requires. The growth curve for these applications may bend a bit lower, but specialty chemicals producers servicing producing wells are going to be insulated to some extent from the financial pressures facing the oilfield operators.

It’s also important to keep in mind that these considerations apply only to the U.S. markets; many oilfield chemical suppliers export their products, either directly or through sales to the multi-national oil service firms that resell the products overseas. For reasons we outlined above, many overseas oil producers, especially state-owned companies in petro-states, may have no choice but to keep on pumping, no matter what the price of oil.

More significantly, for chemical firms supplying the fracking and horizontal drilling markets, it’s not just about oil: drilling for natural gas and natural gas liquids require the same chemicals as oil drilling, and natural gas production is likely to continue unabated. Natural gas prices in the U.S. are now among the lowest in the world, and the US has gone from being a gas importing nation to the leading global producer. The U.S. is now positioned to become an exporter of liquefied natural gas.⁵³ It has already begun exporting chemicals – mainly ethylene and its downstream derivatives – as well as other natural gas liquids that are extracted from the gas stream. Indeed, as we describe below, natural gas has revolutionized the U.S. petrochemical industry.

For any of the reasons cited above, pullbacks in U.S. oil production are likely to have a limited effect on oilfield chemical suppliers.

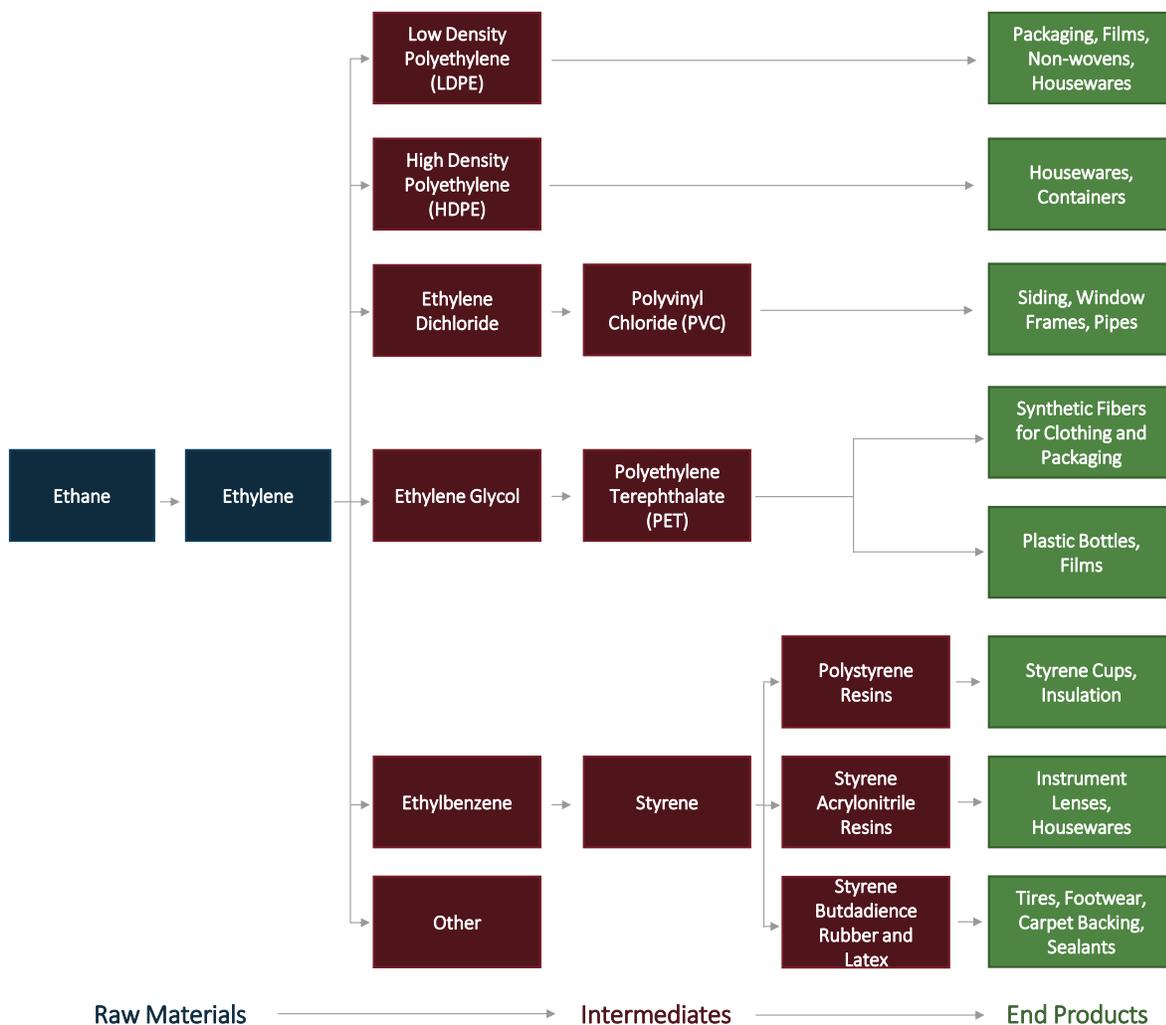
⁵³ See “Shale gas: Still a boon to US manufacturing?” PwC, December 2014, Page 3. http://www.pwc.com/en_US/us/industrial-products/publications/assets/shale-gas-boosts-us-manufacturing.pdf

The Petrochemical Renaissance

Any discussion of the impact of low oil prices on petrochemical manufacturing has to consider the roles that natural gas and associated natural gas liquids (“NGLs”) play in the U.S. energy and chemical industries. The importance of natural gas and NGLs to the U.S. economy and the chemical industries cannot be underestimated, although they have been largely neglected by the media during the panic over rapidly falling oil prices.

Petrochemical feedstocks can be derived either from NGLs or naphtha, a derivative of crude oil. A barrel of NGL typically consists of up to 40% ethane and lesser proportions of other liquid petroleum gases (LPGs), mainly propane and butane.⁵⁴ Ethane is the main economic driver for NGL extraction from the natural gas stream, because cracking ethane, in comparison to cracking alternative feedstocks, yields higher concentrations of ethylene, the world’s most widely used chemical and the key upstream material used in important polymers and plastic resins, including polyethylene (PE), polyvinyl chloride (PVC), and polyethylene terephthalate (PET). (Figure 26)

Figure 26: Simplified Ethylene Supply Chain



Source: American Chemistry Council

⁵⁴ Bassam Fattouh and Craig Brown, “US NGLs Production and Steam Cracker Substitution: What will the Spillover Effects be in Global Petrochemical Markets,” The Oxford Institute for Energy Studies, September 2014, Page 4.

Historically, to manufacture ethylene as well as other petrochemical “building block” chemicals like propylene and butadiene, petrochemical manufacturers had the choice of steam cracking ethane and LPGs from natural gas or naphtha from crude oil. The input feedstock they used depended in large measure on the relative pricing of oil versus natural gas. There were periods when naphtha was the preferred feedstock, as between 2002 and 2006, when natural gas NGLs were priced at a competitive disadvantage to naphtha.⁵⁵

The rapid and somewhat unexpected advent of shale oil and gas production beginning around 2008 completely changed the equation in favor of NGLs. In the initial “gold rush” phase of the shale gas production, lasting roughly from 2008 through 2011, production ramped up so quickly that supply outpaced demand, and natural gas prices dropped so far and fast that many operators cut back production until a more profitable balance between supply and demand was restored (Figure 27). Low prices during this period also refocused drillers’ attention on developing “wet” plays -- that is, formations rich in NGLs -- because of the value-added economics of extracting the NGLs from the gas stream. Ethane and LPGs from natural gas allowed producers to extract natural gas at a cost of less than \$3.50 per thousand cubic feet.⁵⁶

A Renaissance in petrochemical manufacturing, still ongoing, ensued and both U.S. and foreign chemical manufacturers began to make capital investments in U.S. ethane crackers to take advantage of cheap and abundant feedstocks.⁵⁷ Inexpensive natural gas also drove down petrochemical manufacturers’ energy costs, which can account for more than half of total production costs.

The combination of low energy and feedstock costs has allowed the U.S. to become the worldwide low cost producer of ethylene. Because ethane is difficult to transport and its U.S. cost position is so advantageous, it makes sense for manufacturers to invest domestically in ethane crackers to produce ethylene. However, they have done so at the expense of investment in crackers focused on LPGs – i.e., propane and butane. As of January 2015, over 10 million

Figure 27: U.S. Natural Gas Prices (2000-2014)



Source: Energy Information Agency

⁵⁵ Ibid, Page 6.

⁵⁶ “Shale Gas, Competitiveness, and New US Chemical Industry Investment: An Analysis based on Announced Projects, American Chemistry Council, May 2013, Page 12

⁵⁷ Ibid, p. 17. Shale gas pushed ethane prices from a peak of \$0.98 per gallon in 2008 to as low as \$0.23 per gallon in 2013. Also, in 2013, 90% of ethylene production came from shale ethane, it was 63% in 2005. Fattouh and Brown, “US NGLs Production and Steam Cracker Substitution,” Page 3.

metric tons of new ethane cracker capacity is scheduled to come online within a few years, as opposed to under 4 million metric tons for crackers focused on producing polypropylene from propane. (Figure 28) With growing surpluses of LPGs, natural gas producers turned to exports, and LPG exports have surged in recent years, so much so that in 2012 the U.S. became a net exporter of LPGs.⁵⁸ (Figure 29)

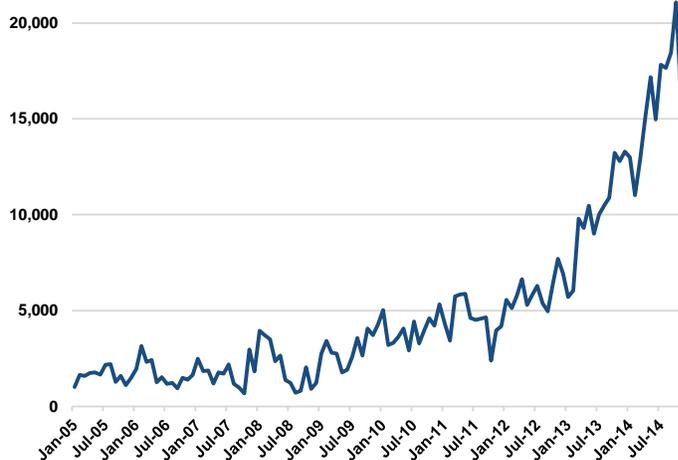
Petrochemical manufacturers in Europe and Asia, where natural gas may cost two to three times as much as in the U.S., historically have relied on cracking naphtha from crude oil, which yields relatively modest amounts of ethylene and various proportions of other petrochemicals including propylene, butadiene, and the aromatics benzene and toluene. Even with the steep decline in oil prices, foreign-based petrochemical manufacturers using naphtha as a feedstock are unlikely to unseat U.S. produced ethylene in the world markets: the ethane richness of “wet” U.S. shale gas and its abundance virtually assures the long-term competitive advantage of U.S. ethylene.⁵⁹

Figure 28: Select Prospective Green-field Petrochemical Projects

Project	Annual Capacity (thousand metric tons)	Estimated Investment (\$ millions)	Location	Start-up date
Ethane Crackers				
Axiall/Lotte	1,000	\$2,000	Louisiana	2018
Chevron Phillips Chemical	1,500	\$6,000	Texas	late-2017
Dow	1,500	\$4,000	Texas	2017
ExxonMobil	1,500	\$6,000	Texas	2017
Formosa	1,591	\$2,000	Texas	2017
Occidental/Mexichem	544	\$1,000	Texas	2017
Sasol	1,500	\$8,100	Louisiana	2017
Shin-Etsu	500	N/A	Louisiana	N/A
	<u>9,635</u>	<u>\$29,100</u>		
PDH (Propane) Units				
Ascend Performance	1,000	\$1,200	Texas	late 2015
Dow	750	\$4,000	Texas	mid-2015
Enterprise Products	750	N/A	Texas	mid-2016
Formosa Plastics	600	\$1,700	Texas	2017
REXtac	300	\$680	Texas	mid-2016
Williams	500	\$760	Canada	mid-2016
	<u>3,900</u>	<u>\$8,340</u>		

Source: ICIS, Morgan Stanley research, press releases

Figure 29: U.S. Exports of Liquefied Petroleum Gases (2005-2014) (Thousands of Barrels)



Source: Energy Information Agency

Acknowledging U.S. ethylene’s pre-eminence in the global chemical industry, it’s clear that ethane’s strength as a petrochemical feedstock is also its weakness. Ethane is used to manufacture ethylene, but little else – there really are no significant by-products that have economic value. For other important building block petrochemicals, it’s necessary to use other feedstocks with more diversified yields: either the LPGs propane and butane from natural gas, or naphtha from crude oil. (Figure 30) For this reason, an extended period of low crude oil prices will change the dynamics of the world petrochemical markets, such that the cost benefits enjoyed by U.S. ethylene producers will spread to other major chemical value chains based on propylene, benzene, toluene

⁵⁸ Fattouh and Brown, “US NGLs Production and Steam Cracker Substitution,” Page 9.

⁵⁹ In an October 2013 presentation by Martha Moore of The American Chemistry Council, it was noted that U.S. chemical petrochemical producers enjoy a relative competitive advantage over overseas producers as long as the ratio of Brent oil prices to the price of U.S. (Henry Hub) natural gas is higher than about seven. Given U.S. pricing of natural gas at around \$4.00 MMBtus, the price of Brent oil would have to drop below \$25 - \$28 a barrel for foreign oil to become competitive for making ethylene.

and xylene. Most of these chemicals can be made by cracking either LPGs or naphtha, but benzene and toluene can be manufactured only from naphtha or gas oil, both of which are derivatives of crude oil.⁶⁰

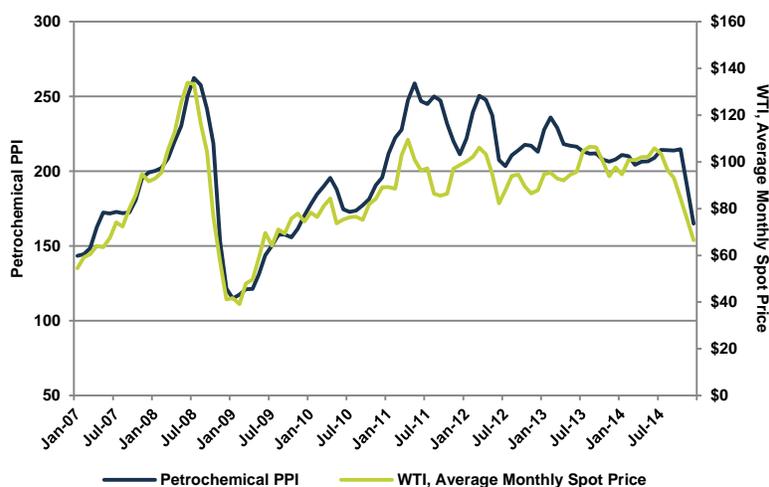
As long as crude oil prices remain low, Asian and European petrochemical manufacturers will benefit from this situation; since they have access to both LPG imports from the U.S. and naphtha from the Middle-East and Russia, they will have more flexibility in choosing feedstocks based on end market demands and the relative pricing of feedstocks. Plunging oil prices will only enhance Naphtha's competitiveness against LPG imports from the U.S. The strong dollar, especially in light of the 16% drop in the value of the Euro against the dollar from March 2014 to January 2015, will also make naphtha more competitive against imported feedstocks.

The broadening of the petrochemical renaissance to feedstocks other than ethane will not be limited to overseas producers. For as long as the North American oil glut persists, U.S. manufacturers operating naphtha crackers or investing in LPG facilities will benefit from the low cost of domestic oil, low energy costs, and increasing supplies of low-cost LPGs that no longer necessarily will be exported due to the increased competition from naphtha feedstocks overseas.

Specialty Chemicals: The Long-Term Winners

Because feedstocks and energy are the largest components of petrochemical production costs, the producer price index for petrochemicals closely tracks changes in oil prices. When oil prices collapsed at the end of 2014, so did the petrochemical producer price index (Figure 31). But did petrochemical producer's margins expand? You might think

Figure 31: Crude Oil and Petrochemical Producer Price Index (2007-2014)



Source: Energy Information Administration and Bureau of Labor Statistics

so, because between Thanksgiving 2014 and the beginning of the New Year oil and natural gas prices dropped so quickly that petrochemical producers probably couldn't pass their cost savings through to their downstream customers fast enough. However, petrochemicals are a commodity market, and their pricing is transparent and sensitive to changes in the underlying input costs. In December, the cost of petrochemicals started to come down, and the IPEX petrochemical index published by the market

⁶⁰ Gas oil is primarily used as a fuel, and because of its low petrochemical yields in relation to naphtha, its use as a feedstock is relatively insignificant.

information company ICIS shows that petrochemical prices may have declined by as much as 10% in December alone.⁶¹

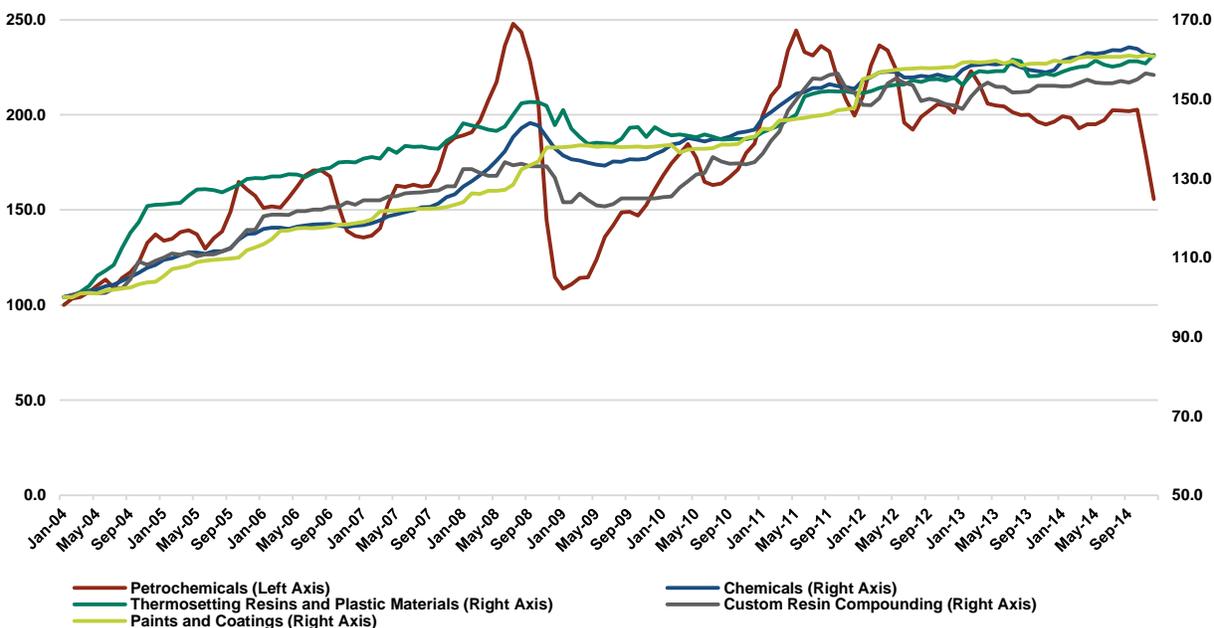
The Producer Price indexes (PPIs) compiled by the U.S. Bureau of Labor Statistics seem to indicate that petrochemical producers may have experienced some cost relief and margin expansion toward the end of the year, that is, their costs declined while their specialty chemical customers' costs remained flat (Figure 32). However, those indexes are subject to frequent revisions, and even if the petrochemical producers did get a year-end bump in profitability, we expect it to be short-lived and that the majority of the cost savings inevitably will be absorbed by downstream specialty chemical producers.

“Just about all specialty manufacturers downstream from the basic petrochemical building block chemicals will benefit from low oil prices.”

Specialty chemical manufacturers then will be the main benefactors of an extended period of low oil prices – doubly so in fact, if low energy (gasoline) prices spark an uptick in general consumption and their end markets begin to grow at a faster pace. Unlike petrochemical manufactures selling commodities, specialty chemicals manufacturers are under less pressure to cut their prices when their input prices fall, because competition is only partly based on prices. Product differentiation and customer service play equal, if not more important roles. As result, during periods when their raw material costs are falling, their margins expand.⁶²

Just about all specialty chemical manufacturers that are downstream from the basic petrochemical building block chemicals, including propylene and the aromatics benzene, toluene, and xylene will benefit from low oil prices. Each

Figure 32: Chemical Producer Price Indexes (2004-2014)



Source: Bureau of Labor Statistics

⁶¹ “Petrochemical prices lower globally on plunging crude latest IPEX shows,” ICIS News, January 8, 2015. The IPEX index is often revised as contracts are settled and new information becomes available; hence the 10% value should be considered preliminary.

⁶² This dynamic works in reverse: during periods of rising raw material costs, specialty manufacturers typically have to absorb rising costs and accept price increases from downstream suppliers, at least until such a time that a market leader -- typically, the company with the largest market share -- raises their prices, at which point the smaller players can follow.

of these chemistries is the foundation for a diverse array of downstream applications, from intermediate chemicals to the resins, alcohols and plastics that make up thousands of consumer and industrial goods.

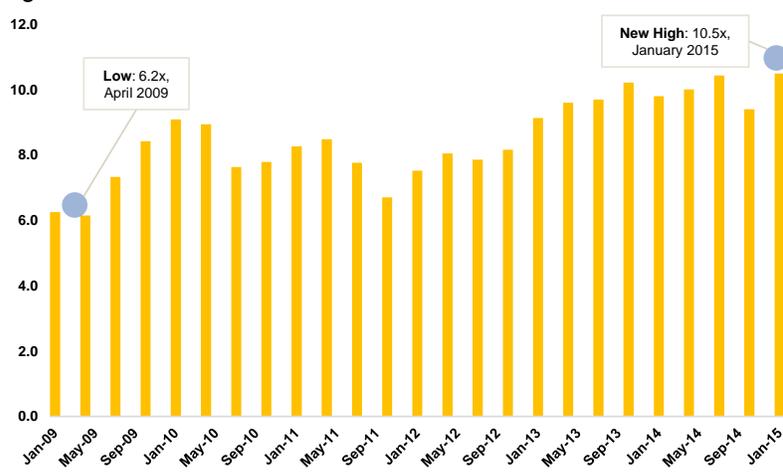
Additionally, as we noted previously, over 10 million metric tons of new ethane capacity and 4 million metric tons of new propane capacity are scheduled to come online by the end of 2018 (Figure 28). Assuming all these projects are completed, that could result in new supplies of up to 8 million tons of ethylene and 1.8 million tons of propylene, representing approximately 40% and 14% respectively of 2013 total production of each chemical. Depending on the economy's ability to absorb these new supplies, it's possible that there could be considerable downward pressure on ethylene and propylene prices, all to the benefit of downstream specialty chemical manufacturers.

Mergers and Acquisitions in Specialties: Higher Values in 2015?

With the background of the changes in energy prices, a continuing U.S. advantage in ethylene, and declining costs for other petrochemical raw materials, specialty chemical manufacturers' margins are poised to increase. We expect that this will create a robust M&A market for specialties, as both strategic and chemical focused private equity buyers continue a recent trend of realigning their portfolios to overweight higher margin specialty assets.

On the demand side, the ongoing availability of low-cost financing is expected to support higher transaction values. Corporate balance sheets are strong: publicly traded companies have both plenty of cash and the ability to borrow funds at a relatively low cost. In 2014, publicly traded specialty chemical firms traded at relatively high multiples, and currently are valued at a record high of 10.5 times EBITDA. (Figure 33) High multiples can encourage strategics to use stock as a source of funds for acquisitions, and also have the potential to provide a "pop" in valuation when the target company's earnings are accretive to the new parent's profitability.

Figure 33: Grace Matthews Chemical Index



Source: Grace Matthews

Also supporting demand for specialties is a large supply of private equity "dry powder," money raised but not yet invested, that is estimated to be at a record \$1.19 trillion.⁶³ According to Peter Young of Young & Partners, private equity committed \$9.3 billion to chemical transactions in the first three quarters of 2014, representing 29% of the total value of chemical transactions and 25% of the total number of transactions, both well ahead of 2013 levels.⁶⁴ A relatively large number of transactions were announced in the final quarter of 2014, and we expect that once the numbers are counted, 2014 will be a record year for chemical deals. (Figure 34)

On the supply side, we expect that many privately-held, high quality companies will come on the market in 2015. Many prospective sellers are aware that the Federal Reserve may begin raising short-term interest rates as early as

⁶³ Steve Johnson, "Private Equity's Goose is Overcooked," Financial Times, August 24, 2014.

<http://www.ft.com/intl/cms/s/0/cc45f188-22d4-11e4-8dae-00144feabdc0.html#axzz3OMHVYS6m>

⁶⁴ ICIS News, "OUTLOOK '15: Global Chemical M&A Set for Robust Year, December 30, 2014.

<http://www.icis.com/resources/news/2014/12/30/9849303/outlook-15-global-chemical-m-a-set-for-robust-year/>

Figure 34: 2014 Q4 Transactions

Announced	Buyer	Seller/Target
December	H.B. Fuller	Continental Products Limited (Kenya)
December	SKC Co. – JV polyurethane business	Mitsui Chemicals – JV polyurethane business
December	H.I.G. Capital	Ferro's polymer additives business
December	PPG Industries	REVOCOAT
December	Hastings Equity Partners	Select Chemicals, Ltd.
December	Asahi Holdings	Johnson Matthey's gold and silver refining business
December	Lubrizol	Weatherford's oilfield chemicals and drilling fluids business
December	PolyOne	Accella Performance Materials specialty chemical assets
December	HEXPOL AB	Portage Precision Polymers
November	Quaker Chemical	AAK's Binol biolubricants business
November	Vertellus	Pentagon Chemicals
October	PPG Industries	Comex (Mexico)
October	Bayer CropScience	DuPont Crop Protection Land Management assets
October	Asian Paints	Kadisco Paint (Eithopia, 51% Stake)
October	Synthomer	AkzoNobel (Eka Synthomer Oy, 50% Stake JV)
October	Archroma	BASF global textile chemicals
October	Platform Specialty Products	Arysta LifeScience Limited
October	Celanese	Cool Polymer
October	Tikkurila Oyj	ISO Paint Nordic
October	Archer Daniels Midland	Specialty Commodities Inc.
October	Lion Copolymer Holdings	Ashland's styrene butadiene rubber elastomers business
October	HEXPOL AB	Grupo Vigar rubber compounding business
October	Innospec	Independence Oilfield Chemicals

Source: Grace Matthews, Inc.

mid-year, undermining support for the relatively high valuations sellers have received in recent years. A rising interest rate environment could lead to a steady erosion of values, and sellers may want to bring their companies to market in advance of rising interest rates. Additionally, some independent manufacturers who may have contemplated an exit in the years leading up to the Great Recession, but who hesitated or held out for a higher valuation, understand that we are now into the sixth year of a recovery and that current valuations may be near a cyclical peak. Having missed a window of opportunity in the last cycle, many of these independents may believe that the next year or two may be the opportune time to exit their business. For reasons we hope we have made clear, we do not believe a contraction is imminent, but we certainly understand the thinking behind wanting to reduce risk and realizing value now.

The supply/demand dynamics suggest that 2015 will be healthy year for chemical M&A. Over the past five years, there have been a number of high-profile transactions involving large, diversified firms acquiring businesses to emphasize higher margin specialties. Going forward, we expect that this trend will continue with the emphasis shifting to smaller “bolt-on” deals. Strategic buyers have recognized that specialties are one area where localized market knowledge or a niche application focus can provide competitive advantages, and for these reasons, it’s not uncommon to find small- to medium-sized companies that are the market leaders in select, highly focused markets. Private equity firms have drawn similar conclusions; a common PE strategy for investing in chemicals is to acquire a “platform” company with a strong position in a particular market, and then to grow that business with additional acquisitions that either go “deeper” into the market or “outward” geographically.

The challenge for both strategic and private equity investors is to retain what made the acquired business attractive in the first place, but to make it “scalable” either through market/product synergies or by wringing out excess costs

by eliminating duplicative functions. More specifically, “scalability” in the context of acquisitions means strengthening the core business of the combined companies through improving raw material purchasing, reducing production and administrative costs, leveraging formulation and market expertise, expanding geographic distribution, or extending the reach of brand names and market reputation.

Realizing synergies and having the capability to scale an acquisition are very important in the current environment, because the competition between private equity and strategic buyers for high-margin specialty companies that have distinctive brands or a niche market focus is very strong. To win in an auction for such companies in today’s competitive environment, a buyer usually has to pay what may seem to be a premium value. For example, Grace Matthews recently brought to market two companies - each highly profitable and having strong positions in growing markets – that attracted over 40 initial bids in an auction process. Most bids were clustered in range of what could be considered to be fair market values, but there were several “outlier” bids at high multiples. Superficially, it may seem that the outlier buyers were willing to overpay, but from their perspective, they may have understood that once projected synergies were factored into their valuation, they were actually buying at a discount value. As a Grace Matthews Director recently put it when discussing the importance of synergies and scalability in auction processes, “If a buyer always bids what they think is the ‘market’ multiple, they will win the auctions they should lose, and lose the ones they should win.”

To summarize, a number of economic trends are converging that will favor the performance and valuation of U.S. specialty chemical businesses over the next few years: the economy is improving, material costs are coming down, and important end markets for chemicals have the near-term potential to grow faster than overall GDP. Additionally, demographic trends and the general economic climate in the U.S. are relatively favorable when compared with the rest of the world. Managers that understand and respond to both the short-term challenges and opportunities, but who simultaneously are positioning their firms for the long game, are poised to have a very good run.



M&A and Low Cost Oil – Patience and a Long-Term View Will Pay Dividends

Strategic players who take a long-term view recognize that the effects of low oil prices go far beyond their immediate impact on the profitability of new oil exploration and drilling. For these firms, now may be the opportune time invest in firms that “touch” the oilfield space, but whom may be somewhat insulated from the temporary pressures of low commodity prices.

A good example of a strategic play on this theme is Hempel’s recent announcement of its pending acquisition of Jones-Blair Company, a manufacturer of industrial coatings based in Dallas, Texas. Hempel, itself a major international manufacturer of protective industrial coatings, recognized in Jones-Blair a nearly perfect strategic fit with its complementary products and technologies that serve the North American oil and gas markets. Jones-Blair sells proprietary protective coatings into the oil and gas markets to a blue-chip customer base. Hempel recognized that the highly sought after Jones-Blair presented a unique opportunity to fill a geographic and technology need, which should result in a positive outcome for all involved. In our experience, a long term view generally pays off in strategic acquisitions.



2014 CHEMICAL INDUSTRY SELECTED TRANSACTIONS

Date	Acquirer	Target	Business Description
December	H.B. Fuller	Continental Products Limited (Kenya)	Industrial adhesives
December	SKC Co. (JV)	Mitsui Chemicals (JV)	Polyurethane business JV
December	H.I.G. Capital	Ferro's polymer additives business	Polymer additives
December	PPG Industries	REVOCOAT	Automotive sealants, adhesives, and dampers
December	Hastings Equity Partners	Select Chemicals, Ltd.	Oilfield chemicals
December	Asahi Holdings	Johnson Matthey's gold and silver refining business	Precious metal refining
December	Lubrizol	Weatherford's oilfield chemicals and drilling fluids business	Oilfield chemicals
December	PolyOne	Accella Performance Materials specialty chemical assets	Colors, additives, inks, and specialty coatings
December	HEXPOL AB	Portage Precision Polymers	Rubber compounds
November	Quaker Chemical	AAK's Binol biolubricants business	Vegetable-based lubricants
November	Vertellus	Pentagon Chemicals	Specialty chemicals - life sciences
October	PPG Industries	Comex (Mexico)	Architectural and industrial coatings
October	Bayer CropScience	DuPont Crop Protection Land Management assets	Herbicides
October	Asian Paints	Kadisco Paint (Eithopia, 51% Stake)	Industrial and decorative coatings
October	Synthomer	AkzoNobel (Eka Synthomer Oy, 50% Stake JV)	Styrene-butadiene latex products
October	Archroma	BASF global textile chemicals	Specialty chemicals
October	Platform Specialty Products	Arysta LifeScience Limited	Agrochemicals and biological products
October	Celanese	Cool Polymer	Conductive polymers
October	Tikkurila Oyj	ISO Paint Nordic	Coatings
October	Archer Daniels Midland	Specialty Commodities Inc.	Food ingredients
October	Lion Copolymer Holdings	Ashland's styrene butadiene rubber elastomers business	Elastomers
October	HEXPOL AB	Grupo Vigar rubber compounding business	Rubber compounds
October	Innospec	Independence Oilfield Chemicals	Oilfield chemicals
September	Arkema	Bostik	Adhesives
September	Trecora Resources	SSI Chusei	Polyethylene waxes
September	Eastman Chemical	Taminco	Specialty chemicals
September	FMC Corp.	Cheminova	Crop protection chemicals
September	Solvay Specialty Polymers	Chevron Phillips Chemical polyphenylene sulfide business	Polyphenylene sulfide resins
August	Yara International	Galvani (60% Stake)	Fertilizers
August	Eastman Chemical	Knowlton Technologies	Wet-laid nonwovens for filtration, friction and custom composites
July	Albemarle	Rockwood Holdings	Specialty chemicals
June	Soudal Holding	Accumetric	Specialty chemicals
June	A. Schulman	Ferro's specialty plastics business	Specialty materials
June	Dunes Point Capital	Alco Industries	Specialty chemicals
May	Flint Hills Resources	PetroLogistics	Specialty chemicals
May	Westlake Chemical	Vinnolit Holdings	Commodity chemicals
May	Suncor Energy Products	Chemtrade's Montreal East business	Commodity chemicals

Date	Acquirer	Target	Business Description
May	Koch Agronomic Services	Agrium Advanced Technologies' turf and ornamental horticulture assets	Agricultural nutrients
April	Graycliff Partners	Harper Love Adhesive Corporation	Adhesives
April	Permira Advisors	CABB Group	Specialty chemicals
April	Sumitomo Bakelite	Vaupell Holdings	Specialty materials
April	Platform Specialty Products	Chemtura AgroSolutions	Agrochemicals
April	Symrise	Diana Group	Food and pet food ingredients
April	Koppers	Osmose's wood preservatives and railroad services business	Specialty chemicals
April	Koch Industries / Goldman Sachs	Flint Group	Printing inks and graphics arts
April	Chemetall	SaberPack glass protection business	Specialty glass coatings
April	SIMONA	Boltaron Performance Products	Specialty thermoplastic sheet products
March	Balchem	SensoryEffects	Food and beverage ingredients
March	Calumet Specialty Products	Anchor Drilling Fluids	Oilfield chemicals
March	PPG Industries	Canal Supplies Inc.	Protective and marine coatings
March	SICPA	Cabot Security Materials	Specialty security inks and materials
March	Serafin Group	LANXESS' Perlon-Monofi subsidiary	Specialty chemicals
March	Deb Group	Evonik's Stoko skin care business	Personal care products
March	Eastman Chemical	Commonwealth Laminating & Coating	Specialty films
March	Arsenal Capital Partners	Kel-Tech	Oilfield chemicals
March	Penford Corporation	Gum Technology	Food and beverage ingredients
March	Edgewater Capital Partners	BASF's PolyAd Services business	Plastic additives services
February	Gladstone Investment Corporation	Edge Adhesives	Industrial adhesives
February	Evonik	Silbond	Specialty chemicals
February	Minerals Technologies	Amcol International	Inorganic materials
February	Artek Surfin Chemicals	Galata Chemicals	PVC additives
February	CHS Inc.	Terral RiverService's fertilizer business	Fertilizers
February	ALTANA	Royal DSM's wax emulsions business	Polypropylene wax emulsions
February	KODA Distribution Group	The DeWolf Companies	Personal care products
February	PPG Industries	Hi-Temp Coatings Technology	Heat-resistant coatings
January	Rust-Oleum Corporation	Citadel Restoration and Repair	Concrete, wood, and floor coatings
January	International Flavors & Fragrances	Aromor Flavors & Fragrances	Specialty ingredients for personal care and food products
January	H.I.G. Capital	American Pacific Corporation	Specialty chemicals
January	Sun Chemical Group	Tintas/Sinclair Group	Printing inks and graphics arts
January	A. Schulman	Prime Colorants	Colors and additives for plastics
January	ICIG	Clariant's Detergents and Intermediates business	Specialty chemicals
January	Crypton	NANO-TEX	Nanotechnology performance finishes
January	Rhino Lining	Expo Industries	Interior/exterior stucco products, sealers, bonders, and patch products
January	Laticrete	L&M Construction Chemicals	Concrete coatings, sealers, grouts, mortars, and color hardeners

GRACE MATTHEWS CHEMICAL AND MATERIALS OVERVIEW

Strong Commitment to Chemical M&A

Grace Matthews chemical investment banking group is recognized globally as a leader in middle market transaction advisory services for manufacturers and distributors of specialty, commodity, and formulated chemicals. Grace Matthews' clients include family-held businesses, private equity funds, and large, multinational corporations.

Grace Matthews' practice is global in scope, and focuses on several areas: sell-side transactions for private companies, private equity holdings, and divestitures for multi-national corporations; buy-side work, typically for large, public companies or major multi-nationals and sponsor-backed chemical platforms; leveraged transactions involving raising debt and/or equity capital, strategic advisory analysis, and transaction fairness opinions. Industries of expertise include:

- Paints, Industrial Coatings, Inks
- Adhesives, Sealants, Tapes
- Plastics, Polymers, Resins
- Colorants, Additives
- Construction Materials
- Contract Packaging
- Bio Materials
- Agricultural Chemicals
- Inorganics, Ceramics, Catalysts
- Personal Care, Soaps, Cleaners
- Fine & Organic Chemicals
- Water Treatment Chemicals
- Oil & Gas Process Chemicals
- Industrial Minerals

Grace Matthews is a privately held investment bank with successful chemical industry transactions dating back to the early 1990s. Grace Matthews principals have completed over 100 transactions involving global corporations such as AkzoNobel, 3M, Lubrizol, BASF, DuPont, Sherwin-Williams, PPG Industries, Ashland, Ceradyne, DSM, ICI, Borregaard, Air Products, Landec Corporation, The Home Depot, Hexion Specialty Chemicals, ITW, PolyOne, Weatherford, and Evonik, to name a few.

Contact Our Team

John Beagle

CEO, Chemical Practice Lead
jbeagle@gracematthews.com

Doug Mitman

Head of Investment Banking, Managing Director
dmitman@gracematthews.com

Ben Scharff

Managing Director
bscharff@gracematthews.com

Kevin Yttre

Managing Director
kyttre@gracematthews.com

Andy Hinz

Director
ahinz@gracematthews.com

Tom Osborne

Senior Executive
tosborne@gracematthews.com

Trent Myers

Vice President
tymers@gracematthews.com

Miguel Mireles

Business Development & Finance
mmireles@gracematthews.com

Andrew Cardona

Associate
acardona@gracematthews.com

Jon Glapa

Associate
jglapa@gracematthews.com

Patrick Maag

Analyst
pmaag@gracematthews.com

George Liu

Analyst
gliu@gracematthews.com

Grace Matthews, Inc.

219 North Milwaukee Street
7th Floor
Milwaukee, WI 53202

414.278.1120

www.gracematthews.com

info@gracematthews.com

SELECT GRACE MATTHEWS CHEMICAL TRANSACTIONS



has announced its sale to



Grace Matthews, Inc. advised
Jones-Blair Company



has been acquired by



Grace Matthews, Inc. advised
Silbond Corporation



*has acquired select assets of the
Capcure business from*



Grace Matthews, Inc. advised
Gabriel Performance Products



has sold certain assets to



Grace Matthews, Inc. advised
Spraylat Corporation



has been acquired by



Grace Matthews, Inc. advised
Syrgis Performance Products



has sold its portfolio company



to



Grace Matthews, Inc. advised
The ColorMatrix Corporation



has been acquired by



Grace Matthews, Inc. advised
Syrgis Performance Products



has sold its portfolio company



to Management and



Grace Matthews, Inc. advised
Edge Adhesives and Superior Capital



*has sold its Resilient Floor
Coatings Business to*



Grace Matthews, Inc. advised
LORD Corporation



has acquired



from



Grace Matthews, Inc. advised
Landec Corporation



merged with



Grace Matthews, Inc. advised
Columbia Paint & Coatings



has acquired



Grace Matthews, Inc. advised
NorthStar Chemicals, Inc.



has acquired the stock of



Grace Matthews, Inc. advised
Specialty Coatings Company



has acquired



Grace Matthews, Inc. advised
AkzoNobel nv



has acquired



Grace Matthews, Inc. advised
Minco



has acquired



Grace Matthews, Inc. advised
AkzoNobel nv



has acquired



Grace Matthews, Inc. advised
Northwest Coatings, LLC



*has licensed exclusive fields of
Intelimer technology from*



Grace Matthews, Inc. advised
Landec Corporation



has acquired the assets of



Grace Matthews, Inc. advised
Pacific Epoxy Polymers, Inc.



*has sold its
specialty chemical subsidiary*



to



Grace Matthews, Inc. advised
Landec Corporation



Grace Matthews, Inc. (www.gracematthews.com) is a middle market investment banking group providing merger, acquisition, and corporate finance advisory services for industrial companies both in the U.S. and internationally. Grace Matthews is global in scope and well known for its strong track record of success dating back to the early 1990s. The firm's three main practice areas are sell-side transactions (private companies, divestitures for large multi-national corporations and private equity-owned businesses), buy-side projects (typically for major multi-nationals), and financing, where debt and/or equity capital is raised to support private equity sponsored management buy-outs or recapitalizations.

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