

# A. Gary Shilling's **INSIGHT**

Economic Research and Investment Strategy

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**Why** Commodity prices are falling with the broad-based CRB index down 15% from its January 26 top. We believe they will continue to be weak for 10 distinct reasons.

1. Global economic growth is slowing and a worldwide recession may be in prospect.
2. The strengthening dollar curbs commodity demand abroad, especially in emerging markets.
3. Commodity producers are prone to excess capacity.
4. Slowing growth in China reduces commodity demand.
5. Spending on goods grows slower than on services as economies expand.
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**Both Sides** Hurricanes, severe winter storms, wildfires in the West and European droughts, along with the issuance of several new reports, have raised fresh concerns about climate change and the threat it poses to the planet.

One side claims humans are playing a major role in rising global temperatures and urges immediate action to stave off what they feel will be a catastrophe affecting all aspects of life. The other side thinks it's simply part of a natural climatic cycle that's not as dire as is being proclaimed and, in any event, favors free-market solutions to any problems that might arise.

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## Falling Commodities: 10 Reasons Why

Many commodity prices have fallen this year, and the CRB index is down 9.4% from its January 26 peak (*Chart 1*). According to Thomson Reuters, the index's sponsor, the 19 commodities in their broad index are weighted by requisite liquidity as demonstrated by suitable levels of open interest, trading volumes, bid/ask spreads; global economic significance such as consumption production levels and trends; commodity sector correlations, relationships and properties; and contribution to strategic properties commonly associated with commodities such as an asset class, for example, inflation protection, diversification to traditional financial assets, etc.

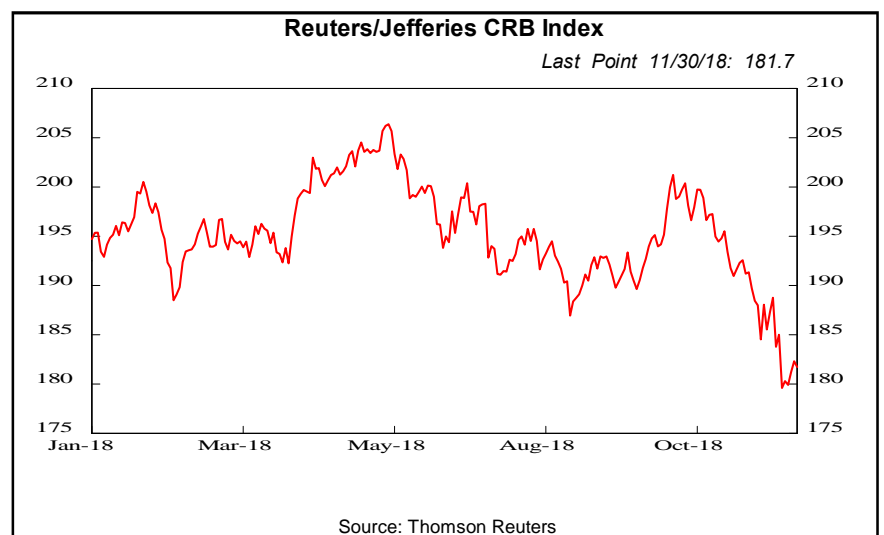
### Special Factors

Not surprisingly, crude oil has the biggest weight at 23% (*Chart 2, page 2*), and petroleum's price, like many other specific commodities, is heavily influenced by specific factors. Natural gas has spiked recently due to forecasts of colder weather and relatively low inventories going into winter (*Chart 3, page 2*). Soybeans, like any commodity, are fungible, so if China is buying beans from

CHART 1

### Reuters/Jefferies CRB Index

Last Point 11/30/18: 181.7



Source: Thomson Reuters

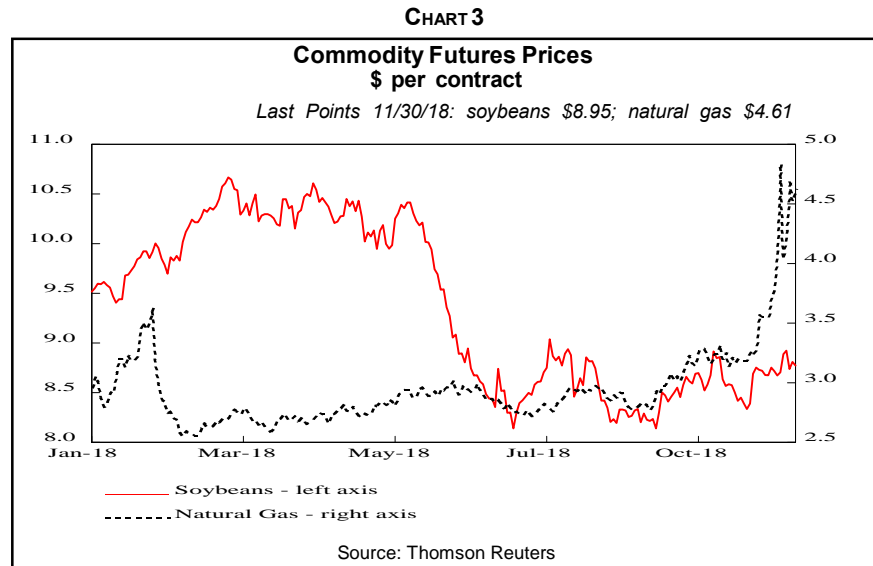
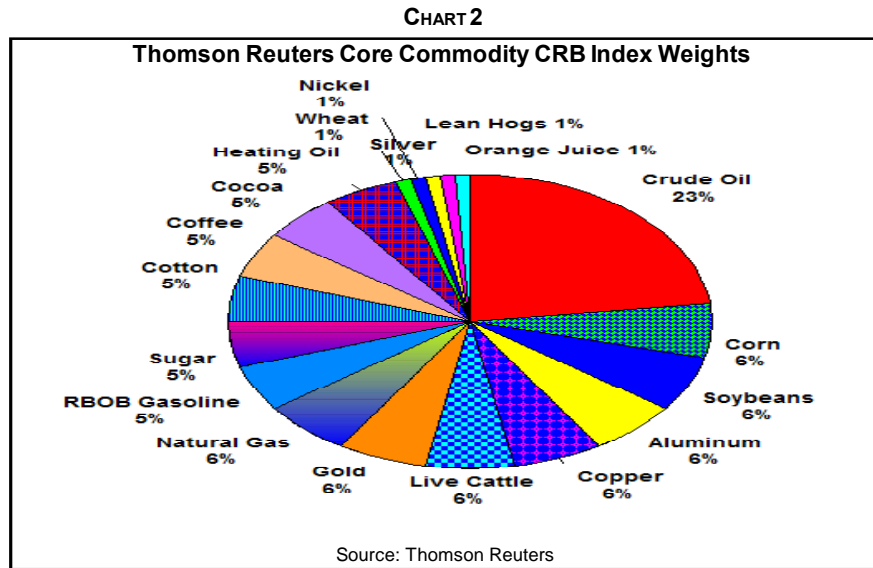
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Brazil vs. the U.S., American soybeans should replace those in markets that earlier bought Brazilian beans. That replacement would only work, however, if supply and demand for soybeans were in balance, but the USDA estimates that U.S. inventories at the end of the current crop year are 955 million bushels, up from 425 million bushels a year earlier (*Chart 4, opposite page*) while world soybean stocks are 112.1 million metric tons compared to 99.7 million metric tons.

Soybean prices have slumped as the trade war-spawned tariff leap on Chinese imports from the U.S. have slashed exports of beans to America's biggest foreign customer (*Chart 3*). Crude oil prices climbed earlier this year, but then nosedived in the face of U.S. sanctions against Iran, a major exporter, and surging U.S. output (*Chart 5, opposite page*).

**The Forest vs. The Trees**

Nevertheless, concentrating on the forest instead of the individual trees, we see 10 reasons why commodity prices are weak, many of which are likely to persist for years. Perhaps the best gauge of the forest is copper. It's sometimes called the commodity with a Ph.D. in economics because it's used in almost every manufactured good produced from plumbing fixtures to electric motors to



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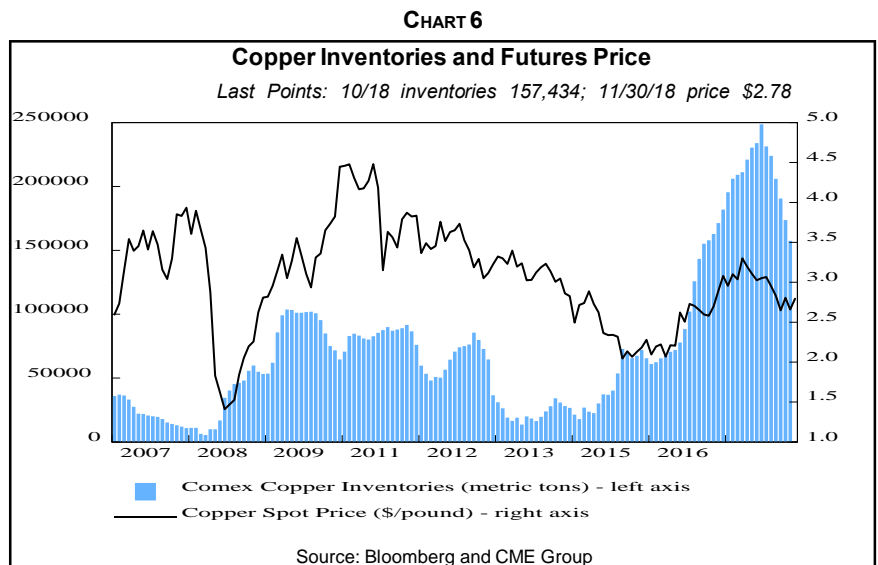
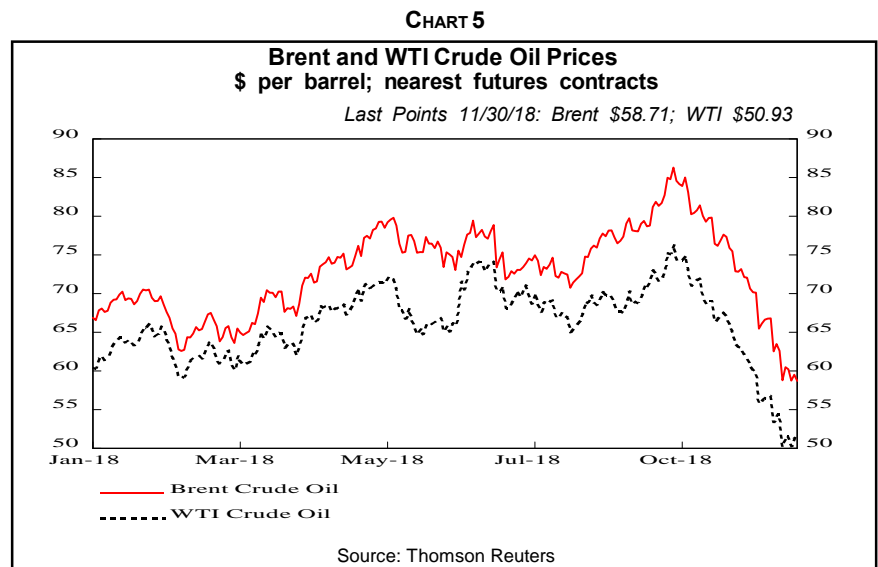
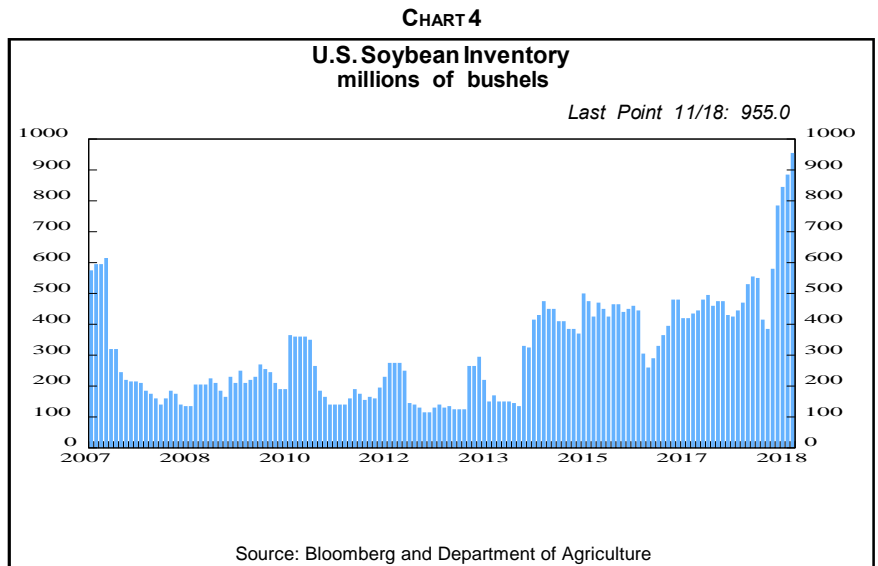
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autos to computers to machinery to door locks to clocks. Like any commodity, copper can be subject to temporary supply constraints, but it remains an excellent measure of global industrial production. And copper prices are falling this year (*Chart 6*).

Furthermore, copper is free to reflect fundamental economic forces since it is free of cartels or other restraints on the supply or demand side. Oil prices, of course, are somewhat subject to the supply restraints imposed by OPEC, which now includes Russia, in essence (*Chart 5*). Sugar prices in the U.S. are higher than abroad because of the American quota on sugar imports (*Chart 7, page 4*). The \$0.12 per pound premium for American sugar is designed to support sugar cane growers in Louisiana, Florida, Hawaii and Texas and sugar beet farmers in North Dakota, Minnesota, Idaho and Michigan. The quotas also confine the U.S. market to American “friends” such as the Philippines but not to “non-friends” like Cuba.

1. Slowing global economic growth and a recession may be in prospect. As aggregate demand weakens the usage of most commodities worldwide and producers seldom moderate supply fast enough to match the weakness in demand, commodity prices fall. *Chart 8 (page 4)* shows this consistent pattern of commodity prices in relation to post-World War II recessions. And note that when the economy is weakening, aggregate measures of activity tend to be reduced in subsequent revisions. The initially-reported growth for September in U.S. payroll employment, retail sales and industrial production were all cut upon revision as additional data reflects further weakness.

The German and Japanese economies both shrank in the third quarter and Chinese growth fell to its lowest rate in a decade. World trade volume, which normally grows at a faster rate than economies overall, saw a sharp decline



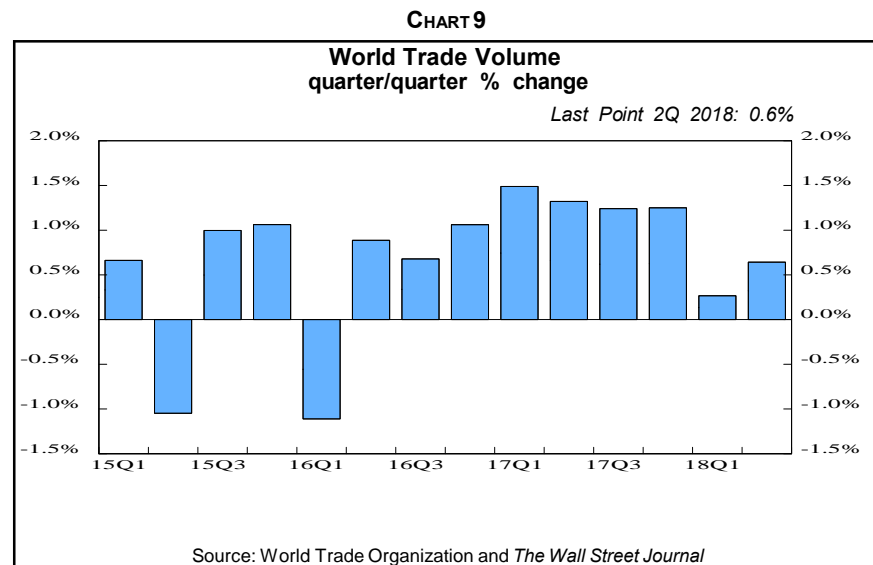
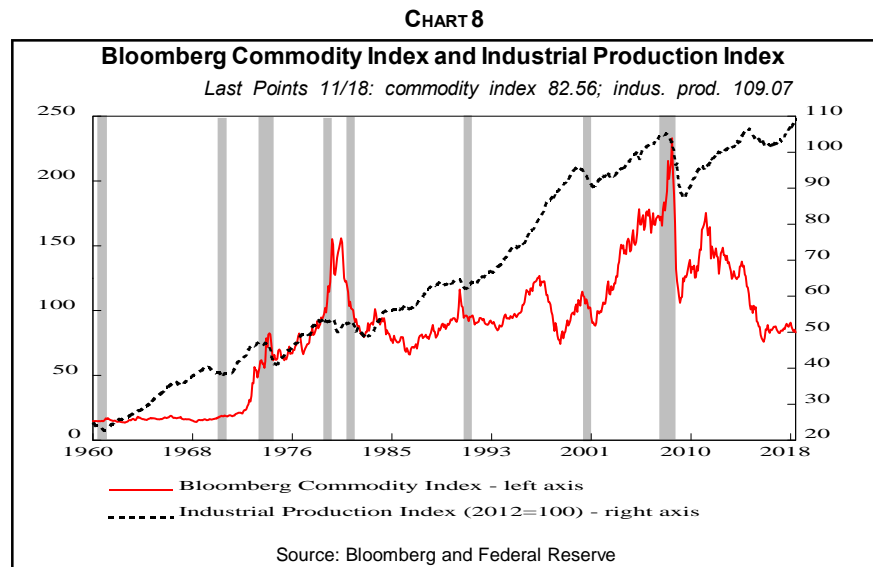
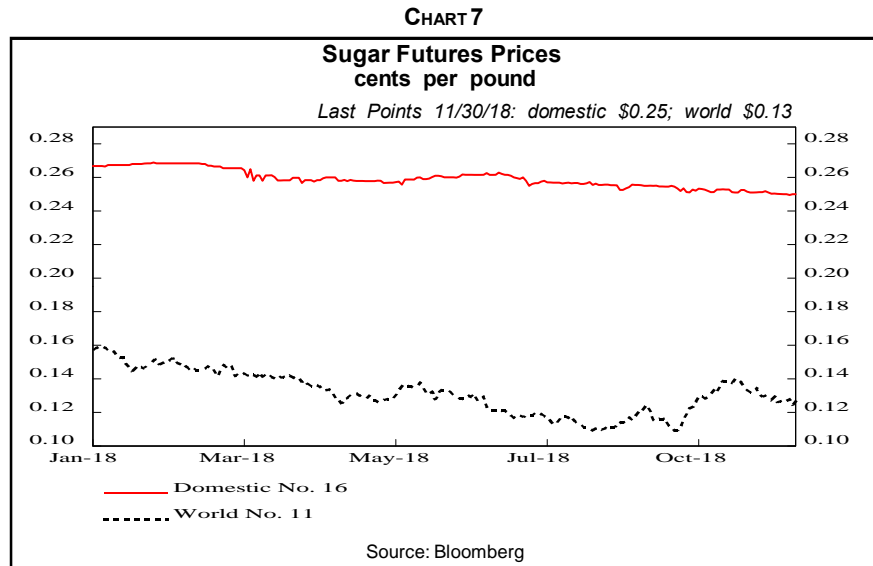
in its rate of advance in the first half of this year (*Chart 9*).

Our October 2018 *Insight* article, “Looming Recession?,” explored the many reasons that a U.S. and, indeed, a global recession may commence in the next year or so. Stocks are falling worldwide (*Chart 10, opposite page*) as they always do ahead of recessions (*Chart 11, opposite page*). This in part is due to ongoing central bank interest rate hikes.

The Fed is raising its federal funds policy rate, and as we’ve observed many times in past reports, when it did so 13 times since World War II to cool what it saw as an overheating economy, it only succeeded in effecting a soft landing once, in the mid-1990s. The other 12 rate-raising campaigns resulted in recessions. And in all those cases, the Fed used interest rates as its policy instrument. Now, it is also reducing its \$4.1 trillion portfolio of assets with no previous experience in using this measure.

In addition, the Treasury yield curve, as measured by the spread between 2-year and 10-year Treasury notes, will probably invert with another Fed rate hike or two, with shorter rates above longer-term yields (*Chart 12, opposite page*). In the past, inversion has always been associated with a recession, no exceptions. The widening of the yield curve between junk bonds and investment-grade corporate issues (*Chart 13, page 6*) is also normal ahead of a recession as investors worry about the ability of marginal companies to meet their obligations.

Home sales are heavily leveraged financially by borrowing and, therefore, very sensitive to rising mortgage rates. So this is the first economic sector to fall when the Fed raises rates ahead of a recession (*Chart 14, page 6*). The ongoing rise in 30-year fixed-rate mortgages has, with the usual delay, begun to push down the sales of existing as well as new



houses, which nosedived 8.9% in October from September and 12% from a year earlier (*Chart 15, page 6*).

**Flagging Profits**

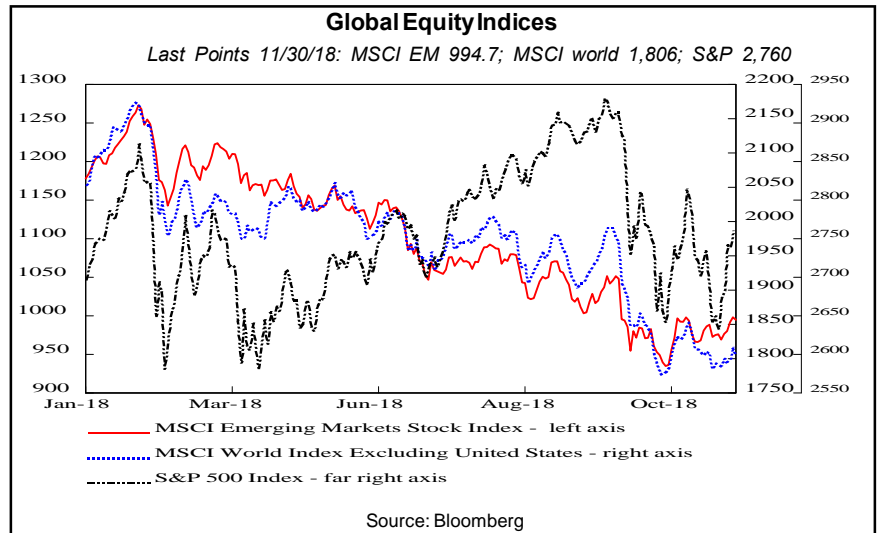
Corporate profits' share of national income normally falls ahead of a recession as strains on labor markets increase the share going to labor compensation (*Chart 16, page 7*). U.S. multinational corporations are being hurt by slowing economic growth abroad and the strong dollar. Profits earned abroad rose 7% in the third quarter, down from a 13.7% growth in the second and 15.6% in the first quarter. Notice the negative correlation between changes in the dollar and the S&P 500 (*Chart 17, page 7*).

Currently, with job openings exceeding the number of unemployed (*Chart 18, page 7*), employees are confident enough to quit their existing jobs (*Chart 19, page 8*) and strike (*Chart 20, page 8*). The earlier rise in stock prices also buoyed consumer confidence (*Chart 21, page 8*), which is high at business cycle peaks. Another sign of an impending top is high consumer expectations of higher stock prices in one year. Also, households are confident enough to increase their spending faster than their incomes rise, resulting in a declining saving rate (*Chart 22, page 9*).

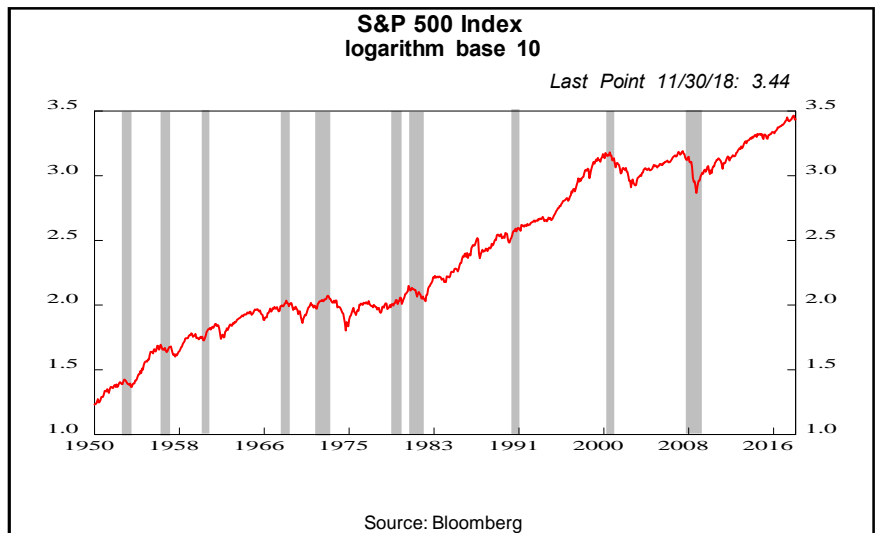
Investors may be taking note of the unsustainability of consumer spending, especially going into the crucial Christmas selling season. Despite rising sales reported by major U.S. retail chains for the third quarter, investors have been dumping their shares. In some cases, their profits are up from a year earlier only because of the cut in the maximum corporate tax rate from 35% to 21%.

Also, U.S. retailers speeded up imports from China to get ahead of the new U.S. import tariffs. The result is high inventories that may prove troublesome and may require price slashes to clear out. One estimate is that the already-

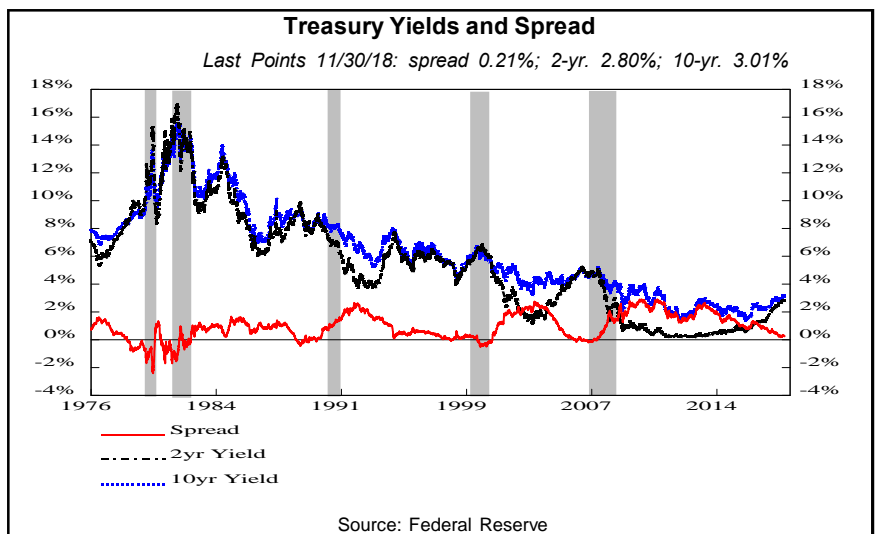
**CHART 10**



**CHART 11**



**CHART 12**





imposed 10% tariff on imports from China will cut retailers' earnings in half in 2019, and those tariffs are scheduled to rise to 25% in January. Meanwhile, U.S. retailers are squeezing suppliers and slashing costs since they fear consumers, accustomed to low inflation, won't accept cost pass-throughs.

Globally, the Organization for Economic Cooperation and Development's total index of leading indicators is falling (Chart 23, page 9). This index contains economic harbingers from 33 major economies and six non-member economies, and falls in anticipation of recessions.

Commodity prices are also vulnerable to recessions (Chart 8). Sometimes they fall before the peak of business, as was the case in the 1981-1982 and 1990-1991 recessions, and sometimes coincident with the business downturn, as in the 2001 business slump. Commodities have also peaked after the recession started, as in the 1973-1975 recession, the 1980 business decline and the 2007-2009 Great Recession. So the timing of commodity index price declines and aggregate business drops are uncertain, but falling commodity prices are a clear warning signal.

2. The dollar's strength curbs emerging-market demand for commodities. As we explored in "Debt and the Dollar Are Sinking Emerging Markets" (October 2018 *Insight*), emerging markets feasted on cheap and readily-available debt after the Great Recession. As a percentage of GDP, their government, individual and business debt leaped from 110% in 2007 to 212% in the fourth quarter of 2017 (Chart 24, page 9).

Foreign investors, zealous for returns in a low interest rate world, were eager to lend to emerging markets. President Recep Erdogan of Turkey saw this as an easy way to finance new infrastructure, including shopping centers, and ran Turkey's foreign currency-denominated

CHART 13

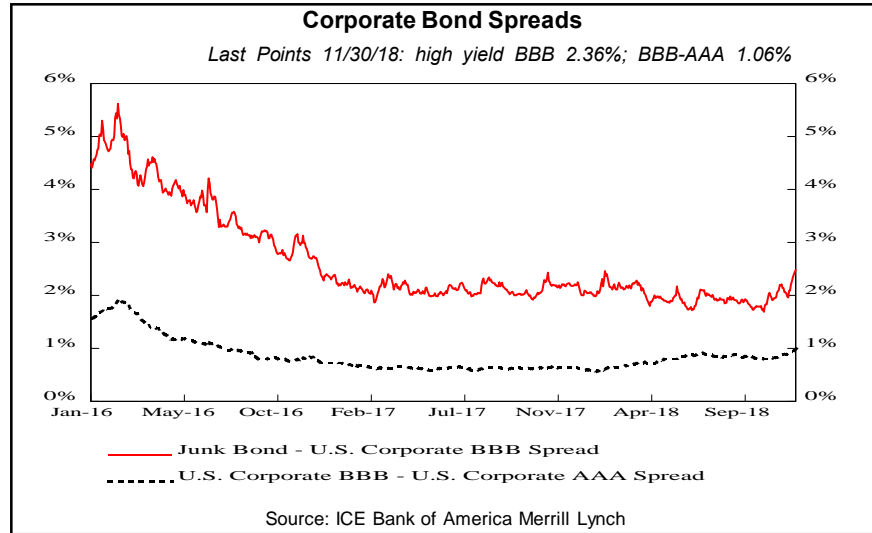


CHART 14

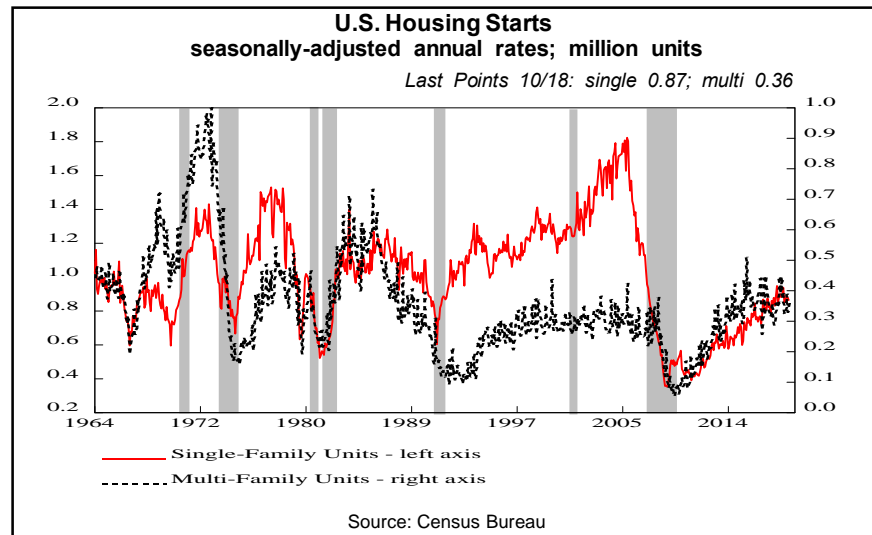
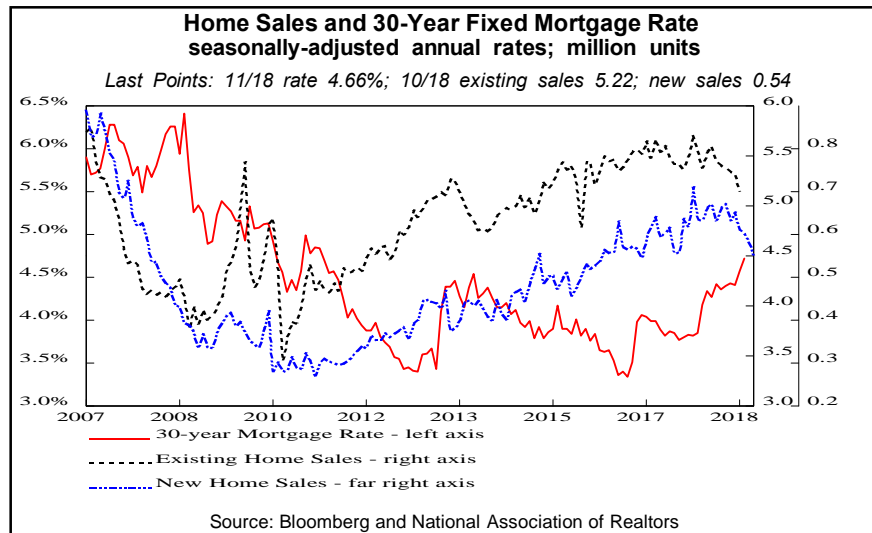


CHART 15



debt to 70% of GDP in 2017 (Chart 25, page 10). But Turkey was not alone. Hungary's foreign currency-denominated debt reached 64% of GDP and 54% for Argentina. The U.S. dollar portion of Turkey's debt jumped from 13% in 2008 to 23% in 2017 (Chart 26, page 10).

The earlier decline in the greenback made those foreign debts increasingly cheaper to service in local emerging-market currencies but now the U.S. dollar index vs. seven other major currencies is rising with emerging-market currencies now falling against the buck (Chart 27, page 10). Now, paying interest and principal on those dollar-denominated debts is taking more and more emerging-market currency.

This problem is enhanced by emerging markets with current-account deficits (Chart 28, page 11). They must already import foreign capital to fill those gaps, which rise as worried foreign investors flee and are attracted by Fed-led rising interest rates in the U.S. Many, such as Turkey, are digging deeply into their foreign-currency reserves to fund the outflows (Chart 29, page 11).

**Commodity Imports**

In addition, the commodity imports of emerging markets are rising in cost since almost all major commodities are traded in dollars. Of 45 important commodities, 42 are priced in greenbacks (Chart 30, page 11). With the 27% plummet in the Turkish lira so far this year, Brent crude oil, the global benchmark, in lira is up 58% vs. 6% in dollars (Chart 31, page 12). Falling emerging-market currencies against the dollar make commodities increasingly expensive for emerging markets and reduce demand.

And emerging-market problems will only intensify if the buck's long slide since 1985 is decisively reversed, as we believe (Chart 32, page 12). The greenback fell 52% from its March 1985 top to its July

CHART 16

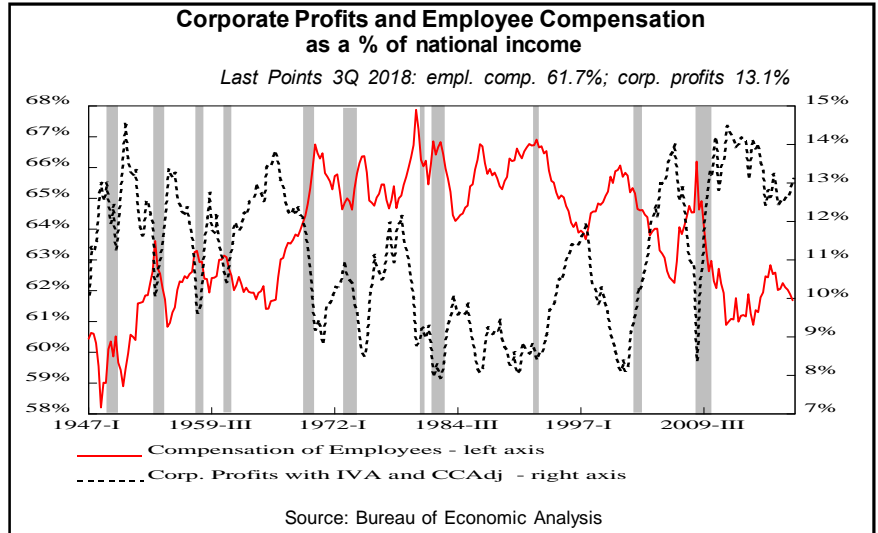


CHART 17

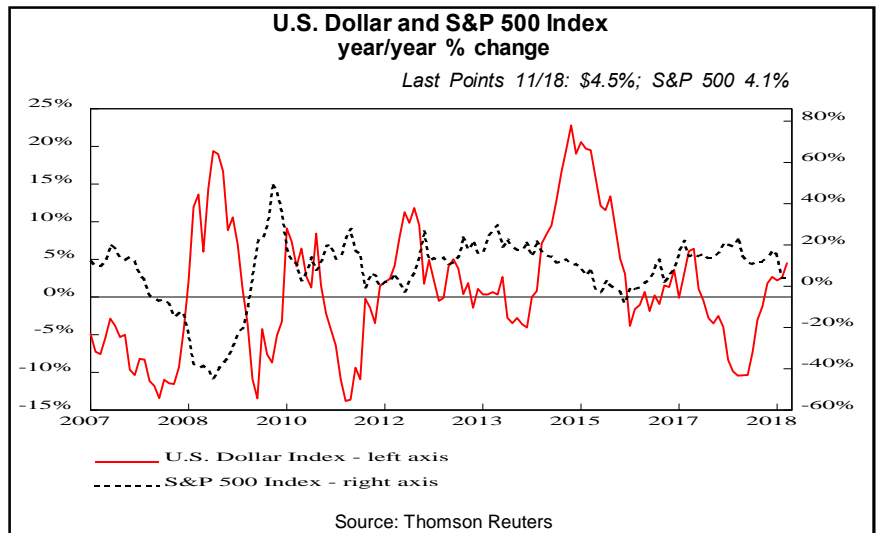
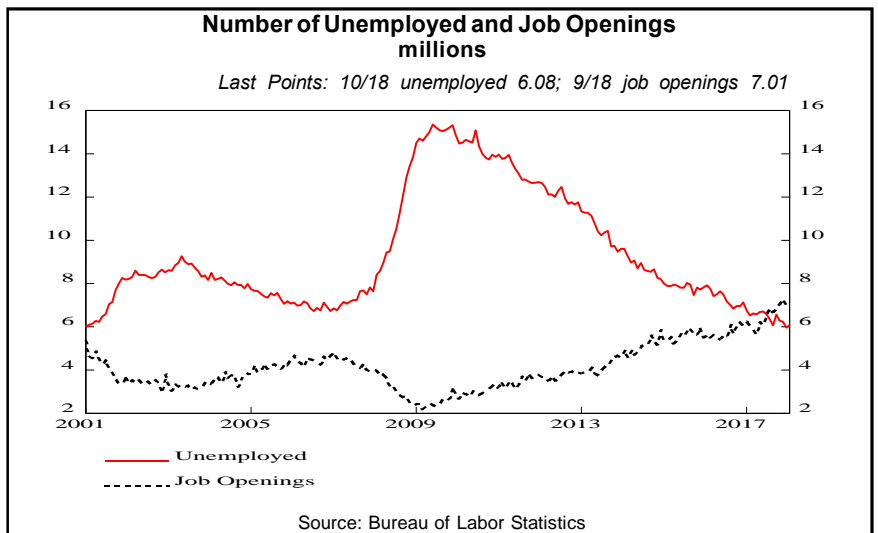


CHART 18



2011 low and has since risen 32.9%. But it's still 33.8% below that earlier peak and likely to continue to move toward it.

The dollar is a global safe haven in a sea of populist political upheaval, trade wars and worldwide uncertainty. Interestingly, the buck benefits even if American initiates the trouble. Witness its rally as Trump intensifies the trade war with China.

**Dollar Shortage**

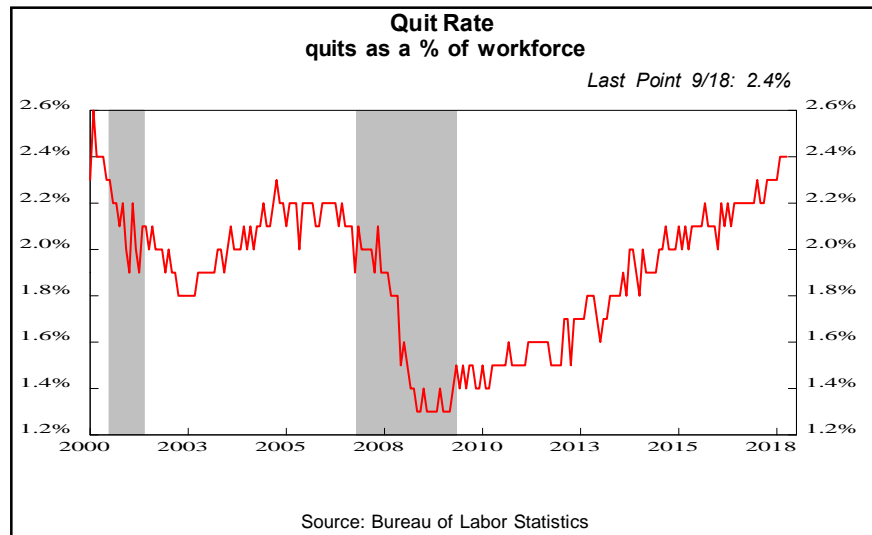
Furthermore, there is a dollar shortage abroad that enhances its value. And the shortage will grow as the Fed steps up its sale of assets and thereby sucks greenbacks out of the financial system.

In addition, Trump will probably win the trade war with China. As we've discussed in past *Insights*, there are ample supplies of goods in the world so the buyer—the U.S.—has the upper hand over the seller—China. Besides, where, except to America, could China sell all those consumer goods? Also, Chinese growth is slowing (*Chart 33, page 12*) as her export growth slows (*Chart 34, page 13*) and the infrastructure spending she relies on to replace exports spurs ghost cities, excess capacity and leaping debt (*Chart 35, page 13*).

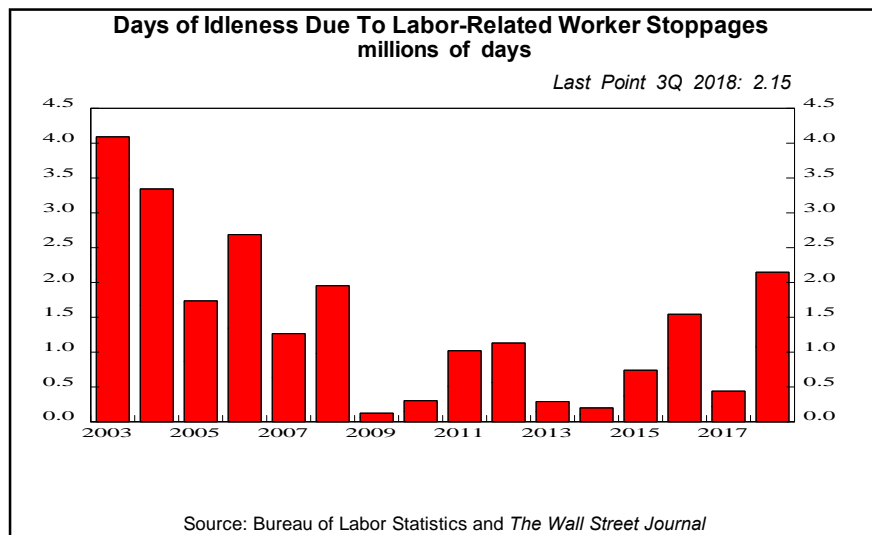
China will probably steal less U.S. technology, demand less technology transfers as the price of American firms doing business there and import more U.S. goods and services. That will reduce the American trade and current-account deficits (*Chart 36, page 13*). Since the annual current-account deficit equals the number of dollars the U.S. pumps into the rest of the world, \$496 billion in the first quarter at annual rates, the result will be a shrinkage in the supply of dollars abroad and higher values in foreign currency terms.

In the long run, the dollar should continue to benefit from being the world's first and foremost international currency. As

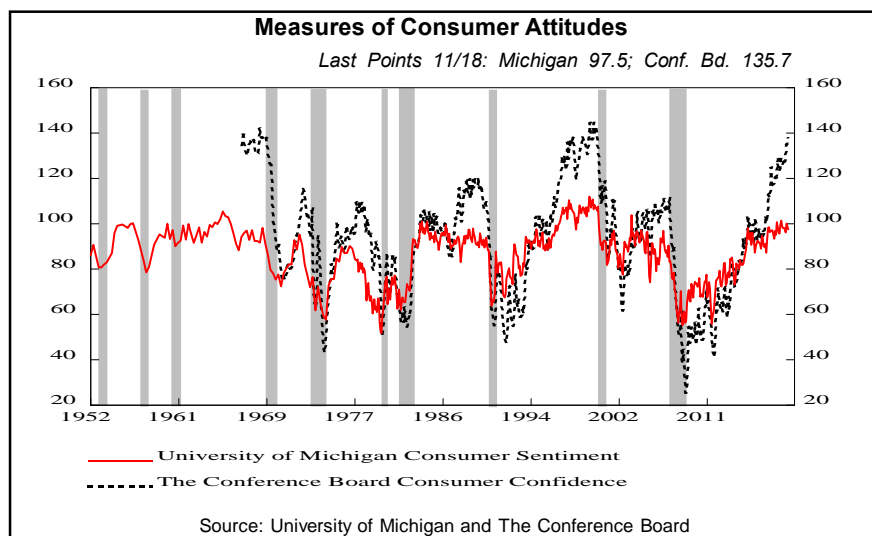
**CHART 19**



**CHART 20**



**CHART 21**





we first discussed in the 2013 book, *Currencies After The Crash*, our research going back to ancient times revealed six characteristics of a leading currency, all of which the dollar fulfills and will no doubt continue to do so. Our October 2018 *Insight* updated this analysis, which appears increasingly valid.

1. The U.S. has the highest GDP per capita with \$59,532 in 2017 compared to \$36,869 in the eurozone and only \$8,827 in China (*Chart 37, page 14*). Also, the American economy has grown faster than other major economies in Europe and Japan since the Great Recession.

2. The American economy is the largest by far with \$19,291 billion GDP in 2017 compared to \$12,589 billion in the eurozone and \$12,238 billion in China (*Chart 37*).

3. The depth and breadth of U.S. financial markets is unexcelled, making them and the dollar attractive to foreigners. America’s stock market capitalization last year was \$32.12 trillion, far outdistancing the eurozone’s \$11.03 trillion and China’s \$8.72 trillion (*Chart 38, page 14*). And American sovereign debt, heavily used by foreigners as a share of assets, was \$15.3 trillion in 2017, double heavily-indebted Japan’s \$7.6 trillion (*Chart 39, page 14*).

4. America has largely free and open economy and markets, making it an attractive place to invest, especially compared to China with tight controls and unpredictable policies. The World Bank ranks the U.S. sixth out of 189 countries for business-friendly regulations. The U.K. is seventh, Germany 20th, Japan 34th and China a distant 78th (*Chart 40, page 14*).

5. There’s no substitute of any size for the greenback on the global stage. The euro is curtailed by continuing economic and financial turmoil in the eurozone

CHART 22

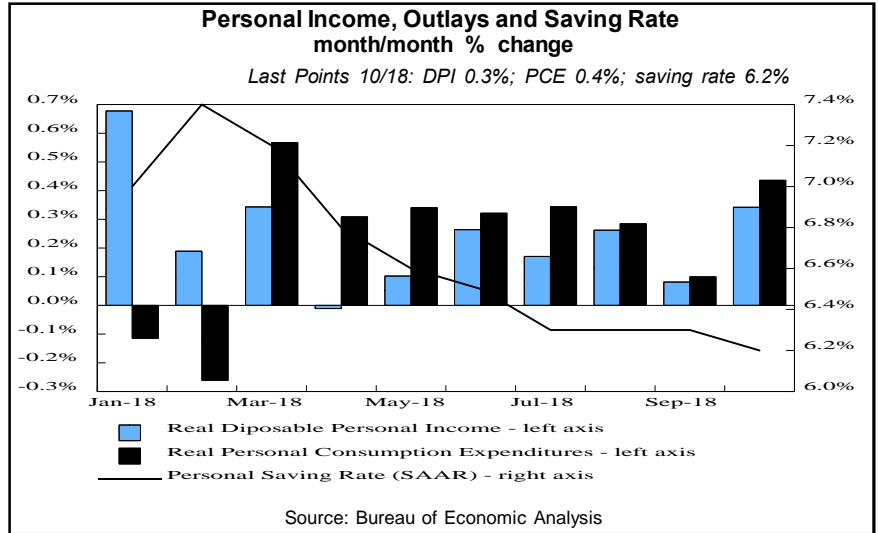


CHART 23

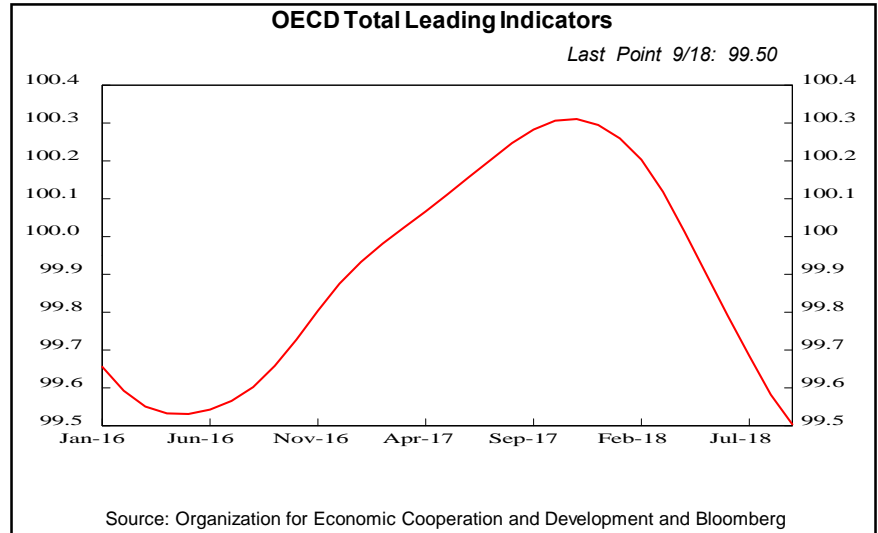
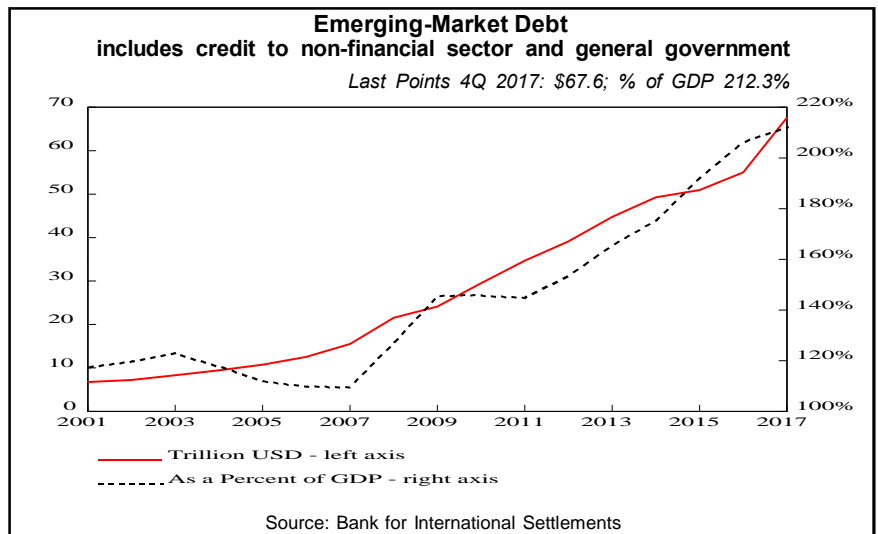


CHART 24



and insular Japan doesn't want the yen to be a global currency. China lusts for worldwide status for her yuan, but her tight control of that currency repels foreigners.

6. The U.S. dollar enjoys unprecedented credibility with virtually no perceived risk of confiscation or devaluation. Also, Trump's vigorous assertion of economic, financial and military strength, especially in his showdown with China, raises the greenback's credibility and appeal.

A strengthening greenback not only makes economic conditions difficult for emerging markets, it also makes commodities more expensive for developed country buyers. As a result, commodity prices are forced down to the point that importers can afford to buy them and equilibrium is re-established.

3. Chronic excess capacity among commodity producers. As we discussed in "Sic Transit Gloria Mundi" (March 2018 *Insight*), in many segments of commodity production, fixed costs are high but variable costs are low. The cost of developing a major new copper mine can be \$5 billion to \$10 billion, considering all the roads, mining equipment, personnel facilities, overburden removal, etc. But once those expenses are completed, the variable costs of mining another ton of copper ore are small. Canadian oilsands companies can't cover all costs at current low prices, but they had huge sunk costs in mining and processing bitumin, and marginal costs are low. So they keep producing to generate cash flow.

As a result, after demand and prices are high enough to cover fixed costs, a major percentage of additional revenue drops right to the bottom line. These industry economics also encourage investment and expansion when profits are lush, especially since producers don't tend to be aware of the existence of commodity

CHART 25

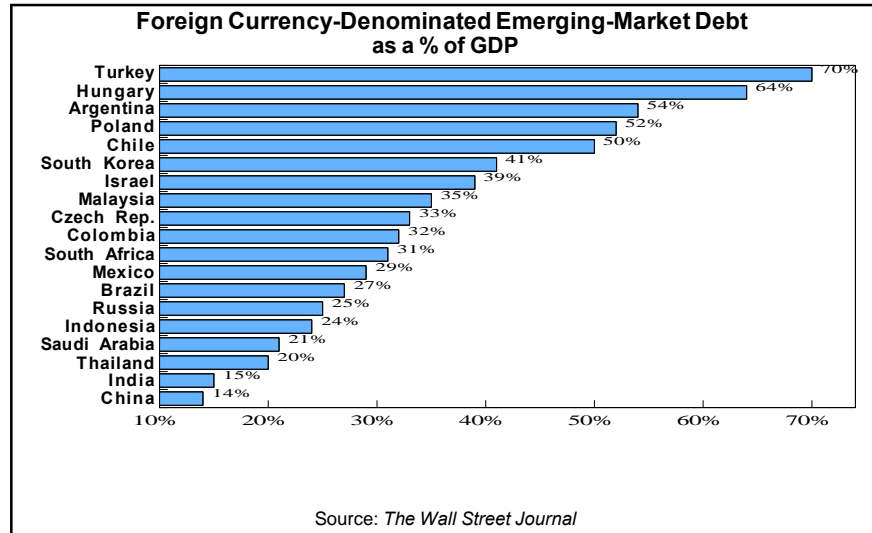


CHART 26

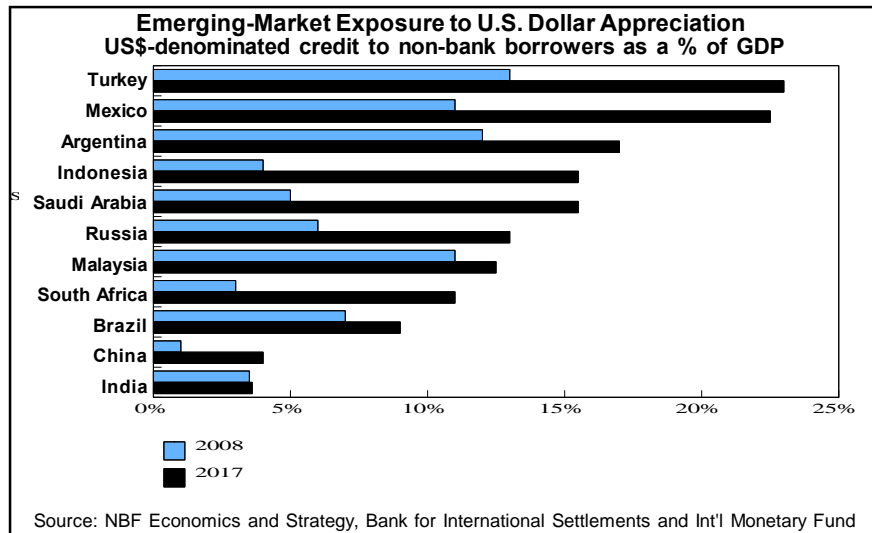
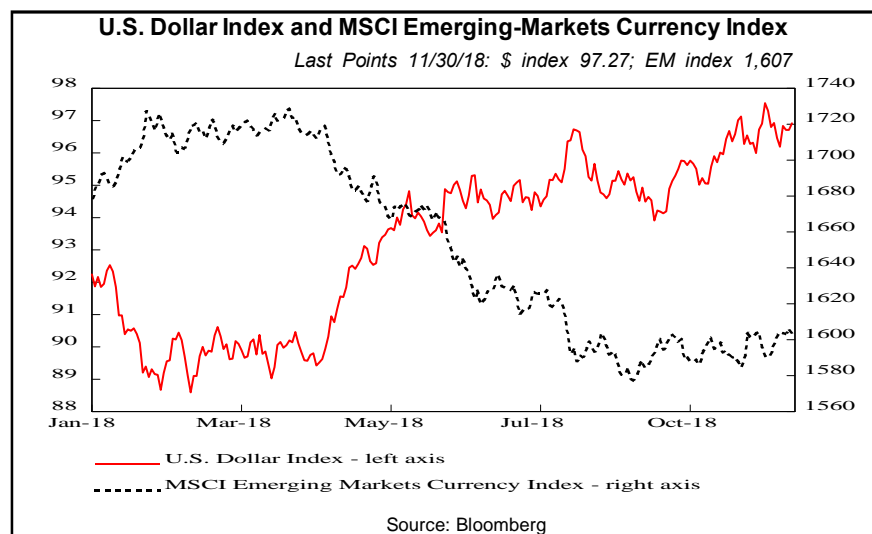


CHART 27



cycles and the reality that high demand and prices don't last indefinitely. In fact, heavy investment and the resulting excess capacity, followed by declining prices, are key aspects of those cycles.

Commodity producers worldwide were energized when China joined the World Trade Organization at the end of 2001. At that point, many reasoned that with expanded access to global markets for her manufactured goods, Chinese demand for commodities would be almost insatiable. She was buying more than 40% of the global output of tin, zinc, copper and other nonferrous metals as well as immense quantities of iron ore and coal (*Chart 41, page 15*). Almost on cue, commodity prices leaped, beginning in January 2002 (*Chart 42, page 15*). Those developments spurred huge investments in commodity production around the world.

What many commodity producers failed to realize, however, was that China was not adding much to net global demand for commodities but rather absorbing more of the world's total as manufacturing shifted there from North America and Europe. Notice the resulting devastating effects on U.S. manufacturing employment (*Chart 43, page 15*) and share of GDP (*Chart 44, page 16*). Globalization was in full force.

Commodity prices jumped to their peak in early July 2008, but then collapsed with the global Great Recession (*Chart 42*). The post-recession rebound lasted until April 2011 when the commodity price slide resumed. And that decline commenced before the drop in crude oil prices commenced in June 2014. The quick trip from feast to famine left many commodity producers, small and large, in sore shape with threatened bankruptcies. Capital spending budgets were axed and dividends slashed or eliminated.

CHART 28

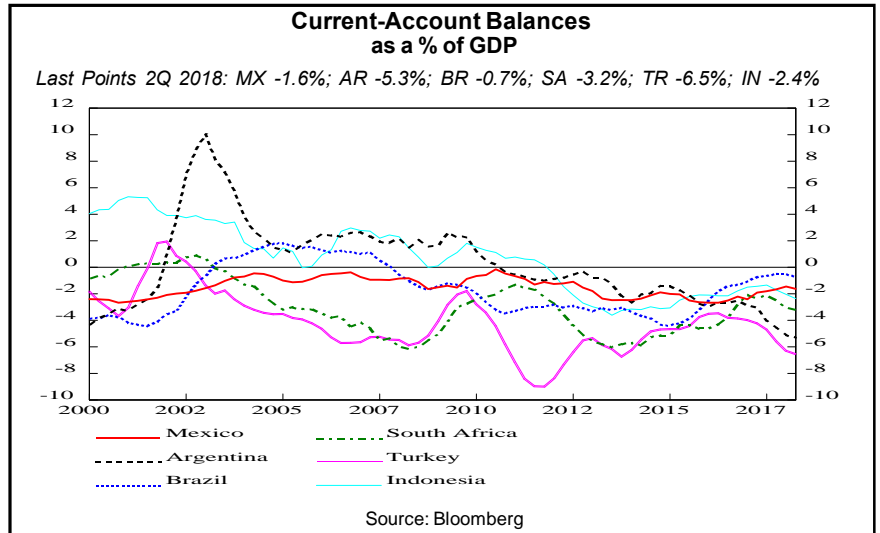


CHART 29

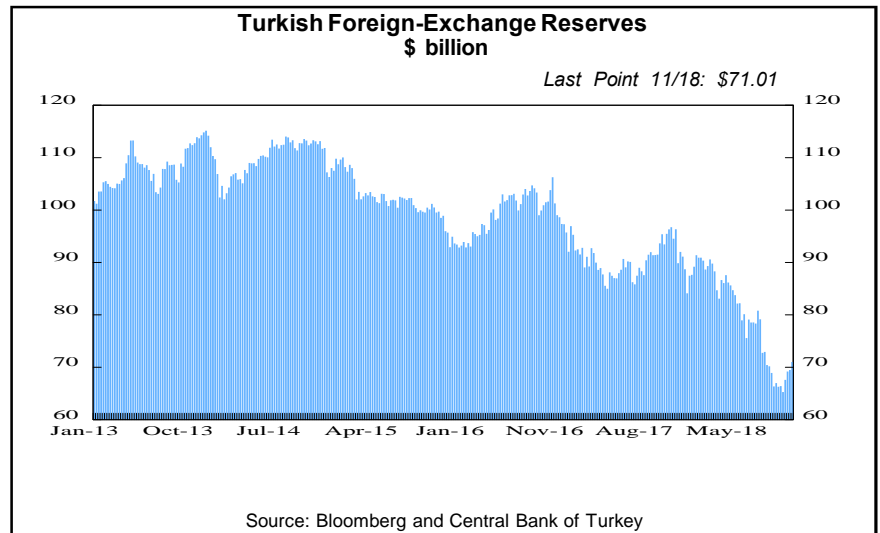


CHART 30

**Commodities Traded by Currency**

**U.S. Dollar:** Corn, Oats, Rough Rice, Soybeans, Rapeseed, Soybean Meal, Soybean Oil, Wheat, Milk, Cocoa, Coffee C, Cotton No. 2, Sugar No. 11, Froz. Concentrated Orange Juice, Adzuki Bean, Lean Hogs, Live Cattle, Feeder Cattle, WTI Crude Oil, Brent Crude, Ethanol, Natural Gas, Heating Oil, Gulf Coast Gasoline, Gasoline, Propane, Purified Terephthalic Acid (PTA), Copper, Lead, Zinc, Tin, Aluminum, Aluminum Alloy, Nickel, Cobalt, Molybdenum, Recycled Steel, Gold, Platinum, Palladium, Silver and Rubber

**Malaysian Ringgit:** Palm Oil

**Australian Dollar:** Wool

**Russian Ruble:** Amber

Source: NYMEX, ICE, CME Group, London Metals Exchange and Wikipedia

Commodity prices have recovered, but only 2.4% of the fall from the July 2008 peak, and the CRB index still remains below its October 2000 level (Chart 42). Corrected for producer price inflation, that index has fallen 39.2% over the 18 intervening years. So you might think that major commodity producers would hang on only to their profits and using them to rebuild balance sheets while restraining capital spending.

Not so! They returned to their old ways, apparently believing that the rebound in commodity demand and prices would last indefinitely. Booming cash flow gave them plenty of room to make more acquisitions and return more cash to investors, as shareholders demanded.

4. Slowing growth in China is reducing demand for commodities. As explained earlier, much of China's earlier growth (Chart 33) was not added net new global demand but replacing manufacturing that was previously done in North America and Europe. Her switch to infrastructure spending when export growth slowed (Chart 34) resulted in troubling excess capacity, ghost cities and the leap in total debt (Chart 35).

Beijing seems well aware that with relatively slow economic growth in the U.S. and elsewhere in the West, as well as Trump's determination to reduce China's huge and growing trade surplus with the U.S. (Chart 45, page 16), her growth-through-export game is over.

So Chinese leaders are emphasizing domestic-led growth, based on consumer spending. This is a difficult and time-consuming effort. Chinese households saved a huge 30% of their after-tax income compared to 6.7% in the U.S. in 2017 (Chart 46, page 16). That Confucian society emphasizes taking care of one's family, financially and otherwise. Also, Chinese must save to pay for their children's education since there is little government support, and high saving is

CHART 31

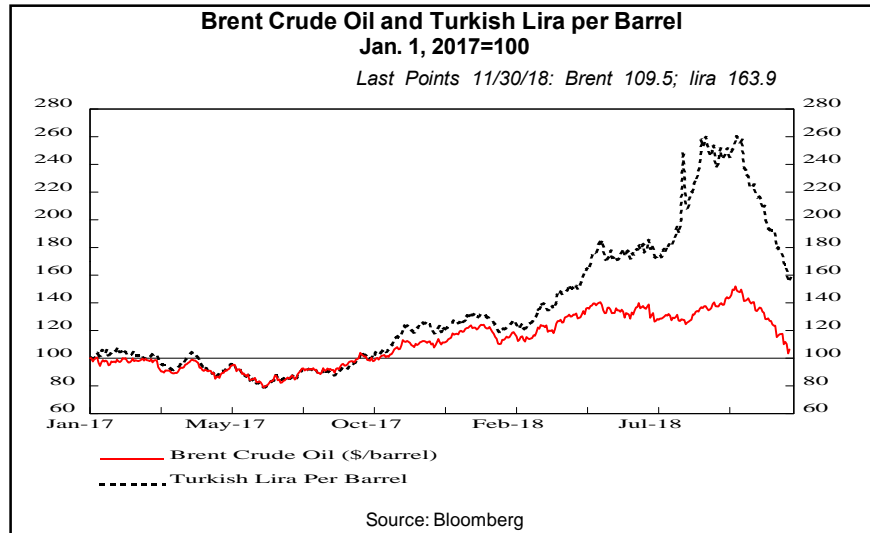


CHART 32

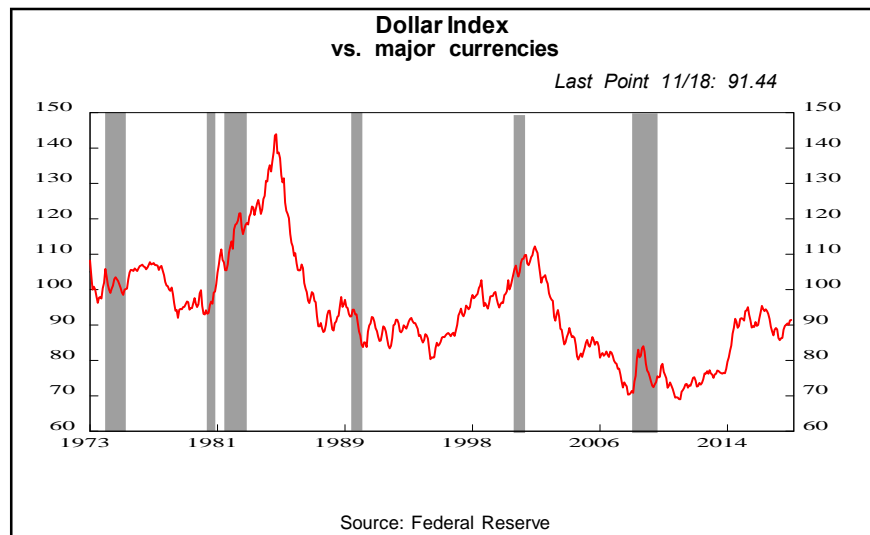
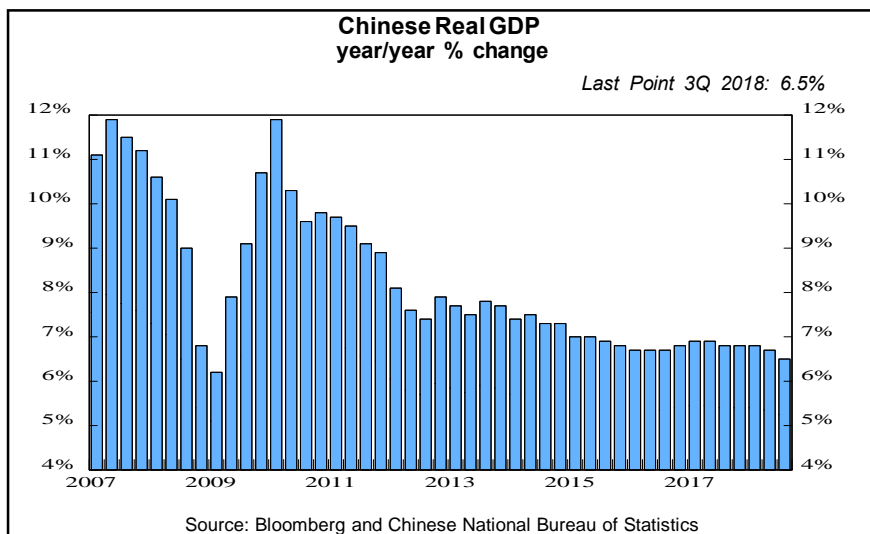


CHART 33



needed to cover health and retirement needs since the equivalent of Social Security old-age pensions as well as Medicare and Medicaid are only beginning to be developed. In October, Chinese consumer spending hits its slowest growth rate in five months.

Furthermore, 6.8% of Chinese consumer spending is on services that use much fewer commodities to produce than goods. In contrast, goods constitute almost all of Chinese exports and infrastructure spending. Growth in Chinese investment in fixed assets has dropped from over 30% annual rates in 2009 when Beijing pursued massive spending in reaction to the Great Recession to just 5.7% in October (*Chart 47, page 17*).

China's growth will also be limited in future years as she approaches middle-income status—the “middle income trap.” From the supply side, she grew by putting unemployed and underemployed people to work, moving many from the hinterland to coastal cities. Furthermore, China promoted productivity by emulating Western technology as well as stealing it and forcing technology transfers as the gateway for Western firms doing business in China, as noted earlier.

But China is catching up and will, in future years, rise to the point of South Korea, which also used Western technology to grow in earlier years but now has reached the level that rapid growth is no longer possible. Notice (*Chart 48, page 17*) that between 1970 and 2001, real GDP there rose an average 8.7% per year but has subsequently cooled to a 3.8% rate.

Chinese growth will also be constrained in future years by her declining working-age population, a result of her earlier one child-per-couple policy that is leading the 15-to-64 year-old age group to fall from 1 billion in 2015 to 717 million in 2060 (*Chart 49, page 17*).

CHART 34

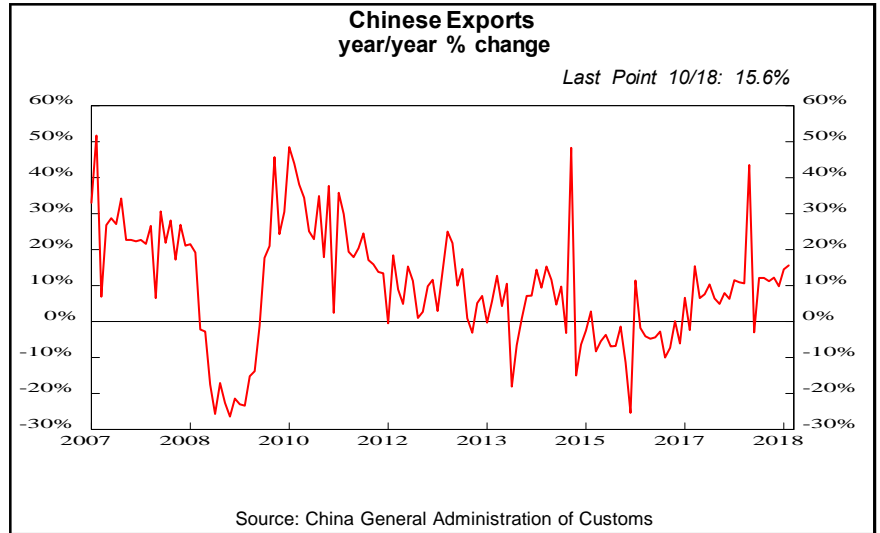


CHART 35

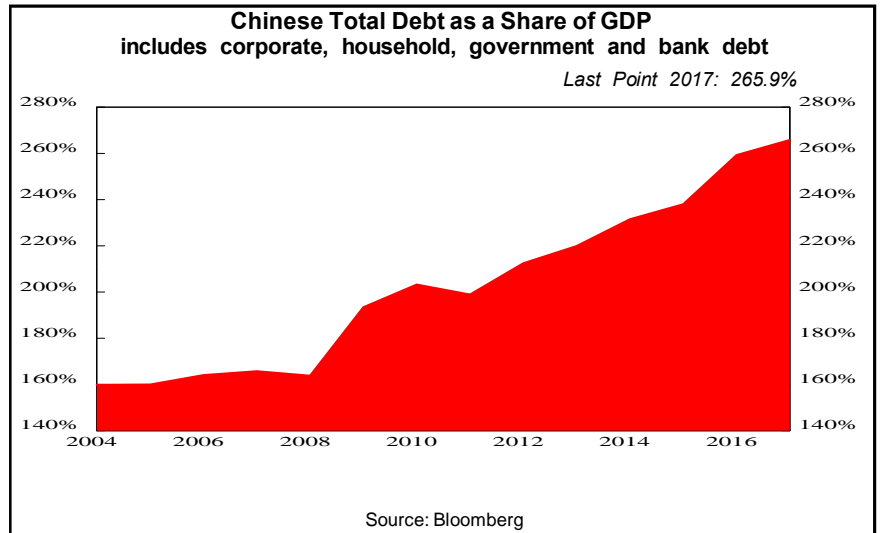
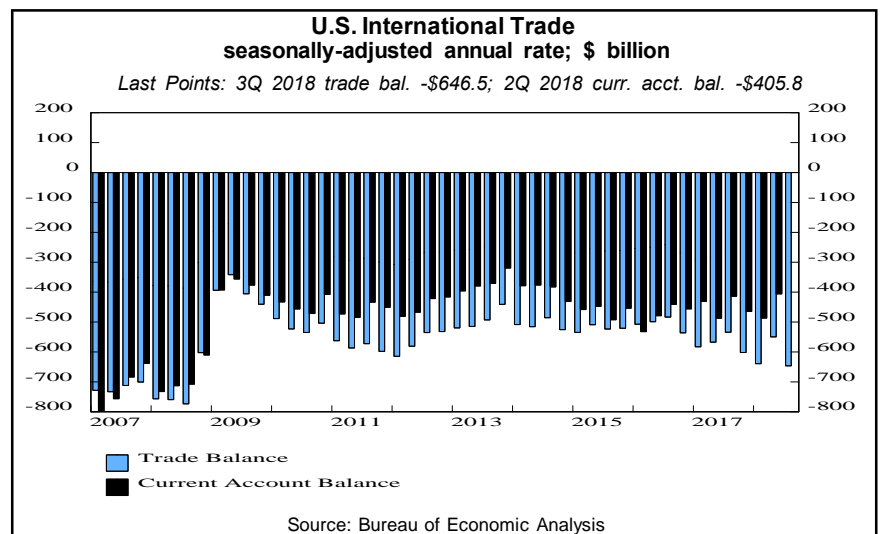


CHART 36





5. Spending on goods grows slower than services as economies expand, to the detriment of commodity consumption. Sure, medical services involve lab and office equipment and education involves computers, but per dollar of output, services are much less commodity-intensive than autos and appliances.

You can put only so many cars in your driveway and only drive one at a time, but spending on services such as recreation and travel, medical care and education is almost limitless. So in developed economies such as the U.S., a growing share of spending is on services and a declining portion on goods (*Chart 50, page 18*). It's also true for developing lands such as China (*Chart 51, page 18*).

**CHART 37**

<b>2017 GDP, Population and GDP per Capita</b>				
	<b>\$ Billion</b>	<b>% of U.S.</b>	<b>Population (million)</b>	<b>GDP per Capita (\$)</b>
U.S.	\$19,391	100.0%	325.7	\$59,532
Euro area	\$12,589	64.9%	341.5	\$36,869
China	\$12,238	63.1%	1,386.4	\$8,827
Japan	\$4,872	25.1%	126.8	\$38,428
U.K.	\$2,622	13.5%	66.0	\$39,720
India	\$2,597	13.4%	1,339.2	\$1,940

Source: World Bank

6. Globalization disrupts economic growth to the detriment of commodities. We continue to believe that the most significant worldwide economic event of the last three decades has been globalization—the shift of manufacturing and other production from relatively-high cost North America and Europe to China and other Asian lands. Then those goods, produced with Western technology and cheap Asian labor, have been exported to the West.

This shift devastated manufacturing employment and output in the U.S. (Charts 43 and 44) and elsewhere. Consequently, real wages in G-7 mature economies have been basically flat for over a decade (*Charts 52 and 53, pages 18 and 19*). This has made voters “mad as hell” in the words of Howard Beale in the old movie “Network.”

The result is the populism that has thrown out centrist politicians and installed governments on the far right and the extreme left.

Examples are Brexit in the U.K. two years ago where voters rebelled against EU bureaucrats as well as open immigration of low-income Eastern Europeans, the election of leftist Justin Trudeau as Canadian Prime Minister replacing Conservative Stephen Harper, the more recent election of Italian Prime Minister Giuseppe Conti, who is systematically thumbing his nose at EU budget deficit limitations and, of

**CHART 38**

<b>Stock Market Capitalization by Area: 2017 (US\$ trillion)</b>	
U.S. (Nasdaq and NYSE)	32.12
Eurozone*	11.03
China (Shanghai and Shenzhen)	8.72
Japan	6.22
London Stock Exchange Group	4.46

\* Includes Athens, Cyprus, Irish, Luxembourg, Nasdaq Nordic and Swiss Stock Exchanges, Euronext, BME Spanish and Deutsche Borse AG  
Source: World Federation of Exchanges

**CHART 39**

<b>Government Net Debt: 2017</b>	
	<b>\$ billion</b>
U.S.	15,322.0
Japan	7,574.4
China	6,135.0
Italy	2,229.1
France	2,161.0
U.K.	2,072.1
Germany	1,568.5
Spain	1,068.3
Brazil	926.5
Mexico	482.8
Canada	426.8
Australia	230.0
Ireland	182.4
Switzerland	154.2
Sweden	46.4

Source: International Monetary Fund

**CHART 40**

<b>Ease of Doing Business Rankings in 10 largest economies</b>	
Of 189 countries	
1=Most business-friendly regulations	
U.S.	6
U.K.	7
Canada	18
Germany	20
France	31
Japan	34
Italy	46
China	78
India	100
Brazil	123

Source: World Bank

course, Trump’s election as U.S. president in 2016.

Trump appealed to economically-strained voters in the middle of the country who believed liberals on the East and West coasts were ignoring them. He blamed their plight on immigration and imports, sidestepping the underlying cause: globalization. But then the loss of a high-paid job to immigrants and imports is a simple, easy-to-sell concept compared to explaining the movement of output to much lower-cost venues and the resulting cheap imported consumer goods.

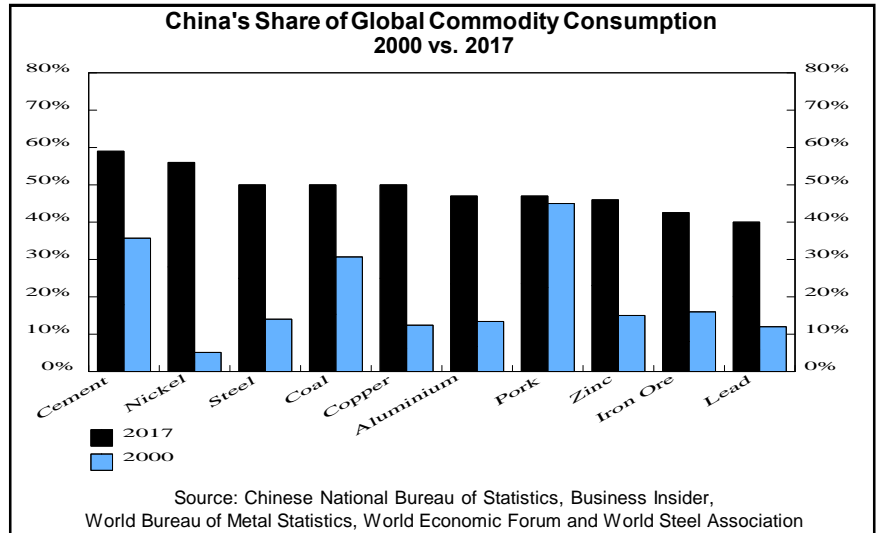
**Disruptive Globalization**

Globalization has disrupted Western economies and left many who have failed to adjust with permanently lower incomes or out of the labor force. It has also enhanced the income polarization that has persisted for decades. Notice (*Chart 54, page 19*) that the share of American income going to the top 20% continues to rise while the other four quintiles’ shares fall.

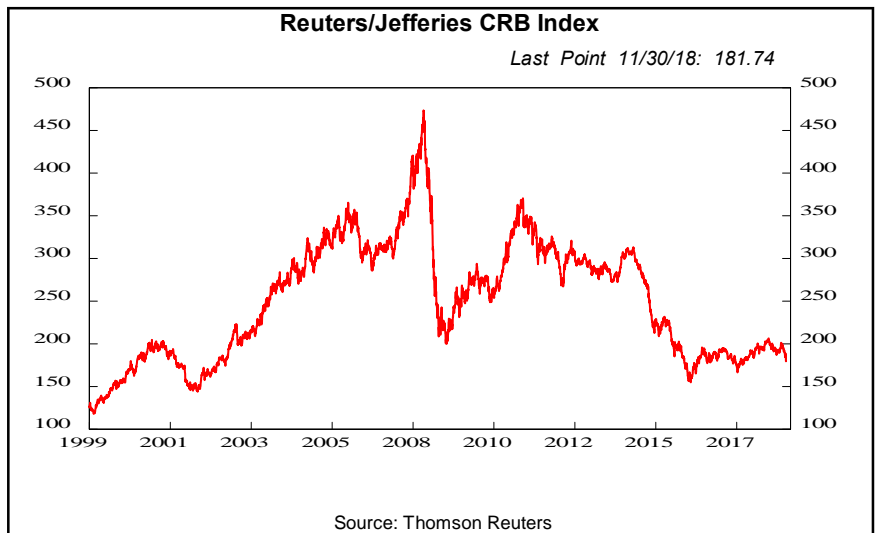
This adds to the “mad as hell” feelings. People don’t seem to mind if others’ incomes are growing faster than theirs as long as their spending power is rising. But not if theirs is falling or flat at best, as has been the case for years for most Americans.

The effects of globalization on American job losses have probably largely played out. About all of the production that can be moved to Asia economically has been. Any manufacturing that has returned—”reshored”—is robotic and capital-, not labor-intensive. No one in the U.S. is going to open a shoe factory employing thousands of workers. Chart 43 reveals a slight rebound in manufacturing payrolls in this economic expansion. Still, the disruptive effects of globalization will take years to be completed, to the detriment of economic growth and commodity usage.

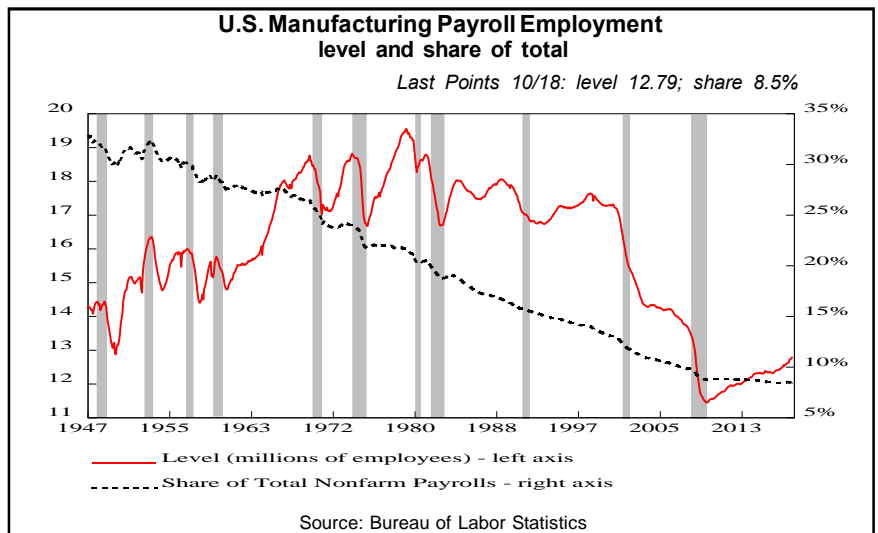
**CHART 41**



**CHART 42**



**CHART 43**



Globalization, of course, is highly deflationary as cheap Asian labor is used to produce low-cost goods, and labor incomes in Western economies are depressed. It also has spawned a deflationary atmosphere in which buyers expect prices to remain stable or fall. And Amazon and other online sellers and smart phones have reinforced their convictions by making the lowest price for a given product readily available and overnight delivery of online orders almost irresistible. The University of Michigan survey reveals that consumers expect inflation over the next five years to average 0.5 percentage point less than they projected before the 2007-2009 Great Recession.

As a result, retailers are reluctant to offset higher labor and supply costs with higher selling prices even though the result is lower profit margins, as noted earlier. Retail chains such as TJX, Ross Stores and Target recently reported that rising freight and wage costs are eating into their gross margins.

7. The ongoing trade wars also curtail economic growth and commodity demand. As noted earlier, we continue to believe that Trump will win his trade war with China, resulting in more U.S. exports and less tech transfers and theft by that country. Nevertheless, that long-term gain is being preceded by short-term pain.

The uncertainty alone over tariff threats and counter-threats causes businesses to postpone capital outlays. Furthermore, supply chains are being disrupted by the new U.S. tariffs and Chinese retaliation. In Asia, computer chips are manufactured in South Korea, sent to Japan for sub-assembly that are then shipped to China for final assembly into TVs or other consumer products. Consequently, many countries have large shares of their exports linked to global supply chains (*Chart 55, page 19*).

CHART 44

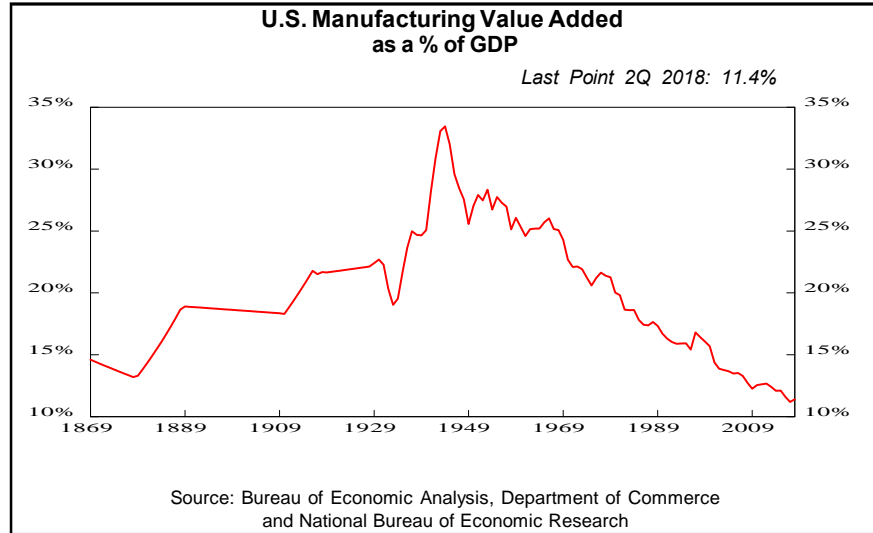
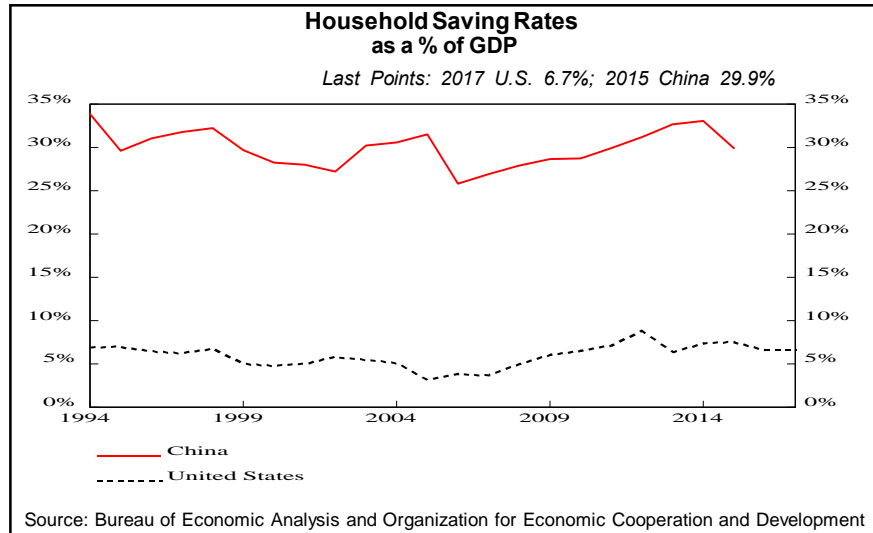


CHART 45



CHART 46



At the same time, many American companies may appear domestic in orientation and not involved in exports to China, but depend on intermediate goods from that country. In Trump's initial \$50 billion first round of tariffs on imports from China, 53% were on intermediate goods and 50% on the impending \$200 billion second round of imports (*Chart 56, page 20*).

8. Excess inventories depress commodity prices. When demand weakens, commodity producers, like most businesses, aren't sure it's a temporary or longer-term, serious development. So, with the high costs of shutting down and later restarting operations, producers tend to keep operations running full tilt. The result is excess inventories, a major part of past recessions as output cutbacks are then needed to run off undesired stocks. Already, inventories are heavy in such commodities as copper (*Chart 6*).

Adding to this normal cyclical phenomenon are the ongoing trade disputes that have left many other producers such as soybean farmers stuck with price-depressing inventories (*Chart 4*). Meanwhile, excess steel production in China, plus U.S. tariffs, has depressed China steel prices by 20% since mid-year and China produced over half the world's crude steel. So as inventories mount, iron ore prices have nosedived (*Chart 57, page 20*).

Crude oil inventories are depressing prices in Texas' Permian Basin due to lack of pipelines to get the oil out to markets. As a result, there is a large discount of \$15 per barrel for benchmark West Texas Intermediate (*Chart 58, page 21*). Increases in fracked oil in North Dakota are strained pipeline capacity and will force producers to rely more on rail transportation.

Similarly, Western Canada Select sells at \$21.93 per barrel, a \$29 per barrel discount to U.S. crude at \$50.93 per

CHART 47

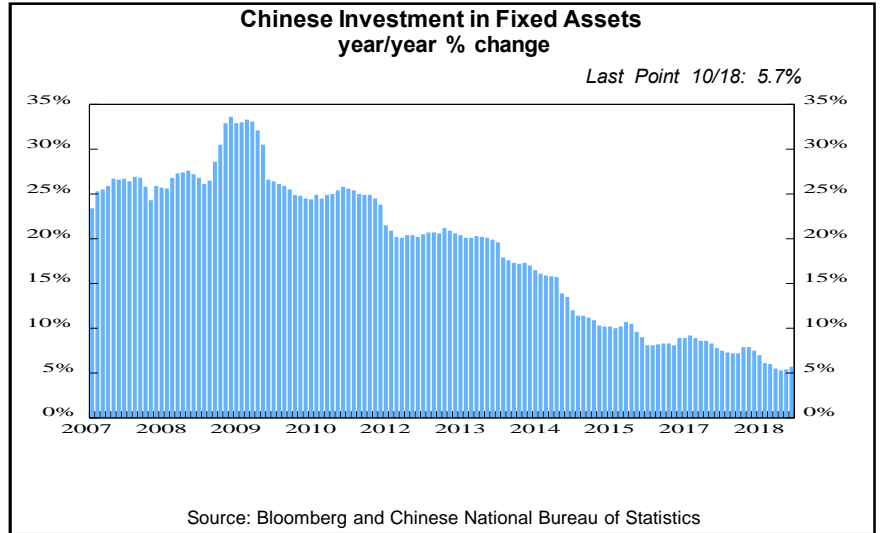


CHART 48

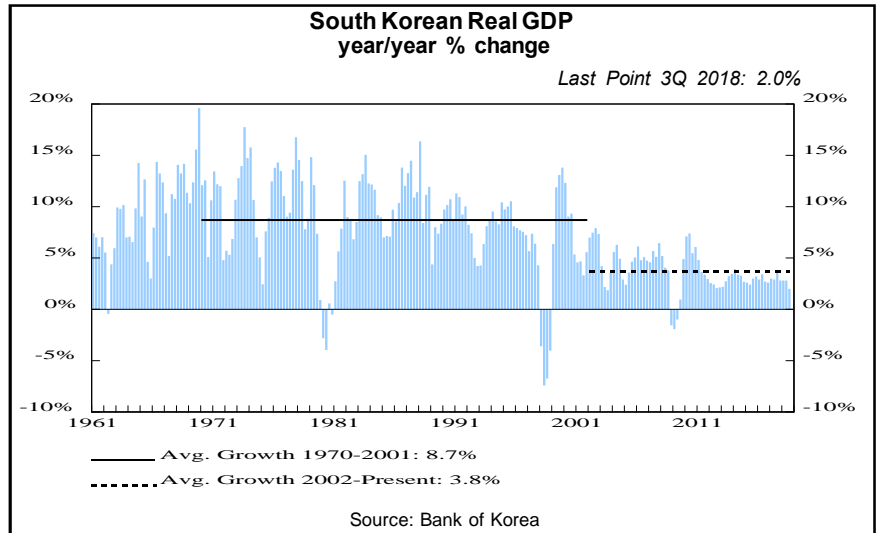
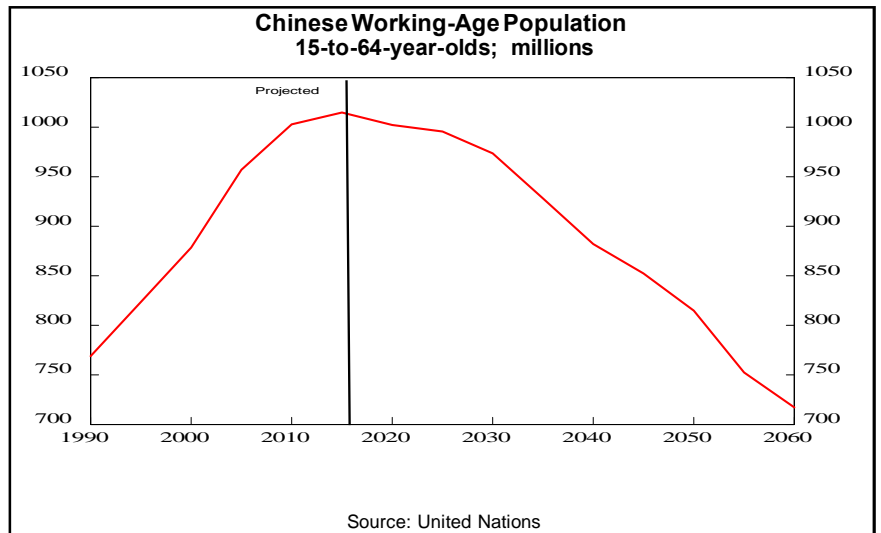


CHART 49



barrel because the lack of pipeline capacity requires it to be moved by much more expensive railroad tank cars or trucks. At the same time, total Canadian oil output rose to a record 5.3 million barrels a day in August, and the global market needs more of the heavy crude that Canada produces as output in Venezuela and Iran declines. In the past decade, Canadian crude on average has traded \$17 per barrel below U.S. prices because it is costlier to move and refine into premium fuels.

The recent surge in U.S. oil production, which is expected to rise another 1.38 million barrels a day next year to 12 million barrels a day, has pushed up inventories for eight straight weeks, and they now stand at 442 million barrels, the most in nearly a year (*Chart 59, page 21*). Global supply continues to run above demand (*Chart 60, page 21*), and OPEC recently lowered its forecast for demand growth in 2019 to 1.29 million barrels a day from 1.45 million barrels a day in July. Also, the recent federal budget deal reached by Congress will result in the sale of 100 million barrels of oil held in the Strategic Petroleum Reserve, out of 665 million barrels, between 2022 and 2027. So price-depressing inventories are likely to remain heavy in future years.

**DUCs**

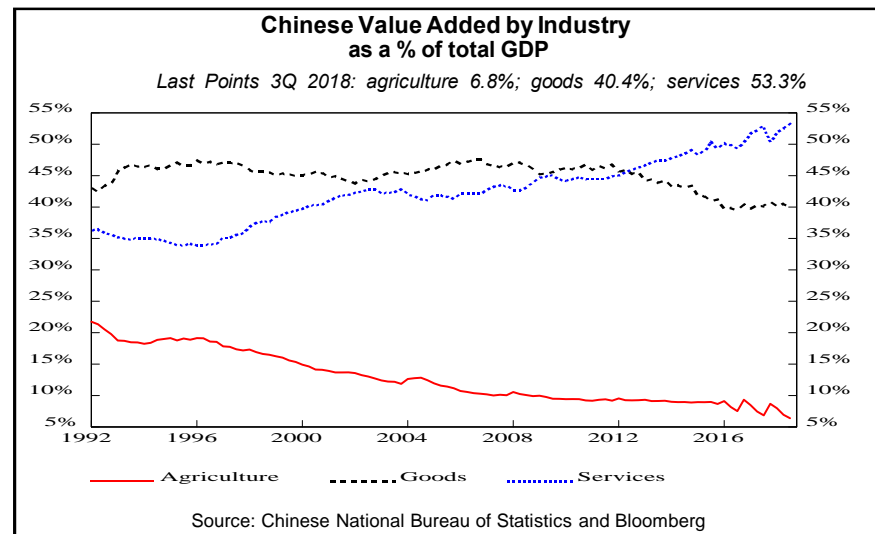
Furthermore, considerable oil is stored underground in 8,545 drilled but uncompleted wells (DUCs) that can be tapped quickly when transportation becomes available and price discounts fade (*Chart 58*). Additional Canadian pipelines are tied up in environmental disputes but considerable new pipeline capacity in Texas will be completed next year. Three major pipelines will add a combined 1.8 million barrels a day to capacity.

That would allow much more Permian Basin crude to be moved to the Gulf Coast for export. With the tremendous

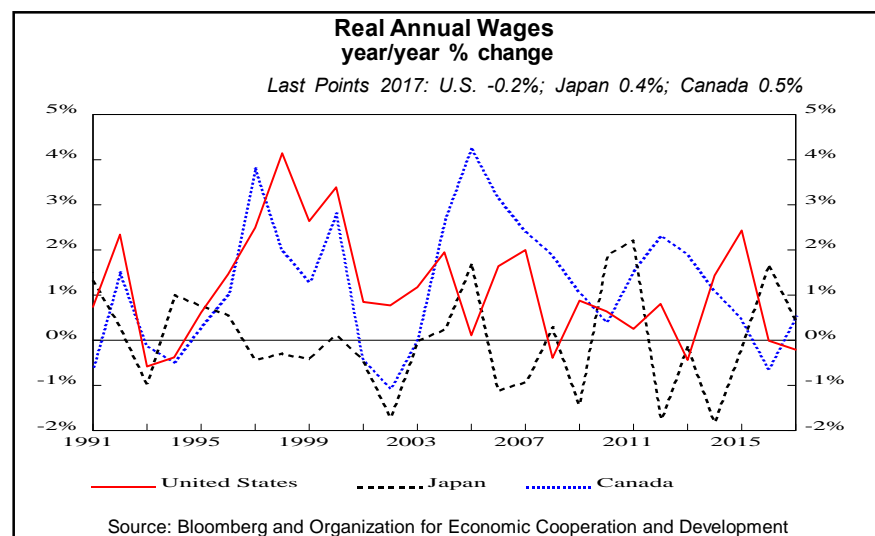
**CHART 50**



**CHART 51**



**CHART 52**





leap in American fracked oil, the U.S. is rapidly moving from an oil importer to an oil exporter (*Chart 61, page 22*). And given the wide spread between WTI and Brent oil prices (*Chart 5*), U.S. exports will leap as pipelines from the Permian Basin to the Gulf Coast are completed. The U.S. Energy Information Administration predicts that if LNG and other energy sources are included, declining American imports will switch to net exports by 2023, and exports already reached 3 million barrels a day in June. If essentially safe supplies from Canada and Mexico are included, U.S. crude imports are already close to zero (*Chart 62, page 22*).

OPEC pumped 32.76 million barrels a day in September, 1.13 million barrels a day more than the market will need in the first half of 2019. Oil inventories in the 33 major OECD countries are the highest in five years.

9. Peak oil supply, not peak demand, will depress prices. Until recently, there was widespread conviction that the world would soon run out of crude oil. M. King Hubbert (1903-1989), a geophysicist who joined Shell Oil in 1947, believed that oil field production followed the classical bell curve, or normal distribution, and that oil gets

CHART 53

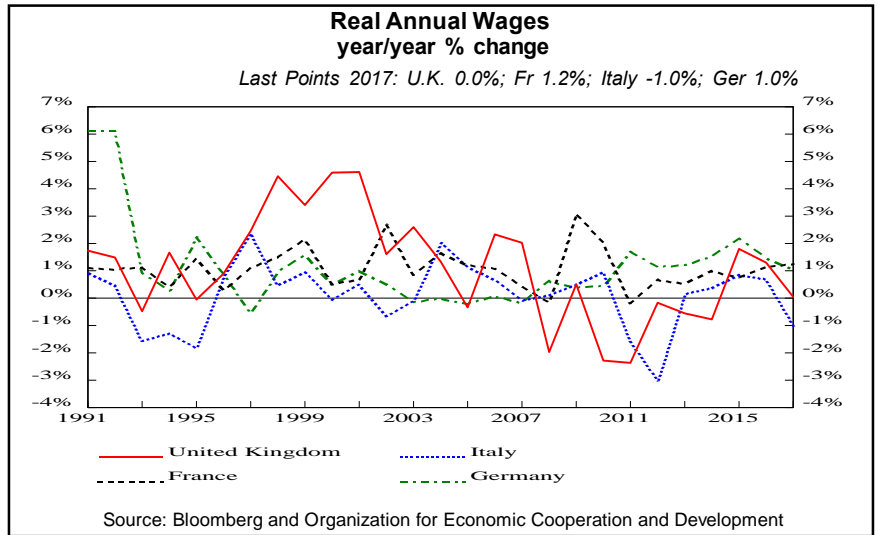


CHART 54

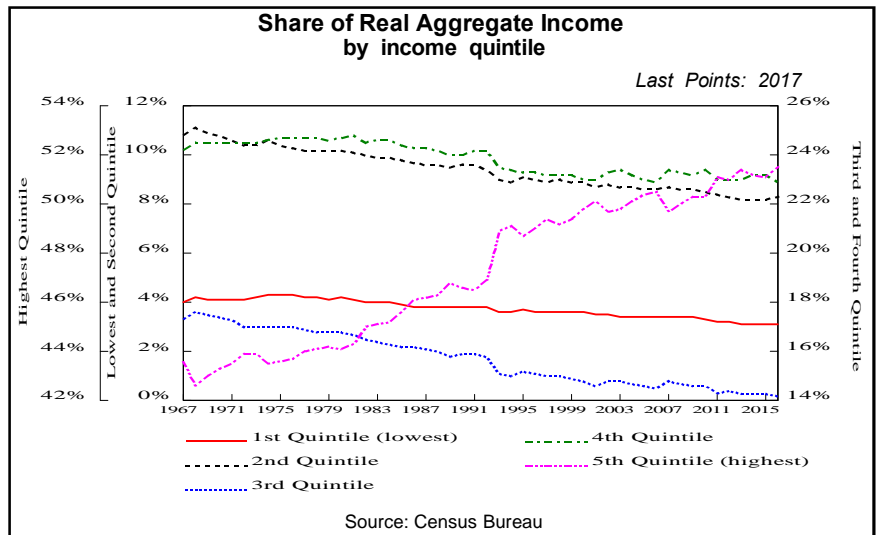


CHART 55

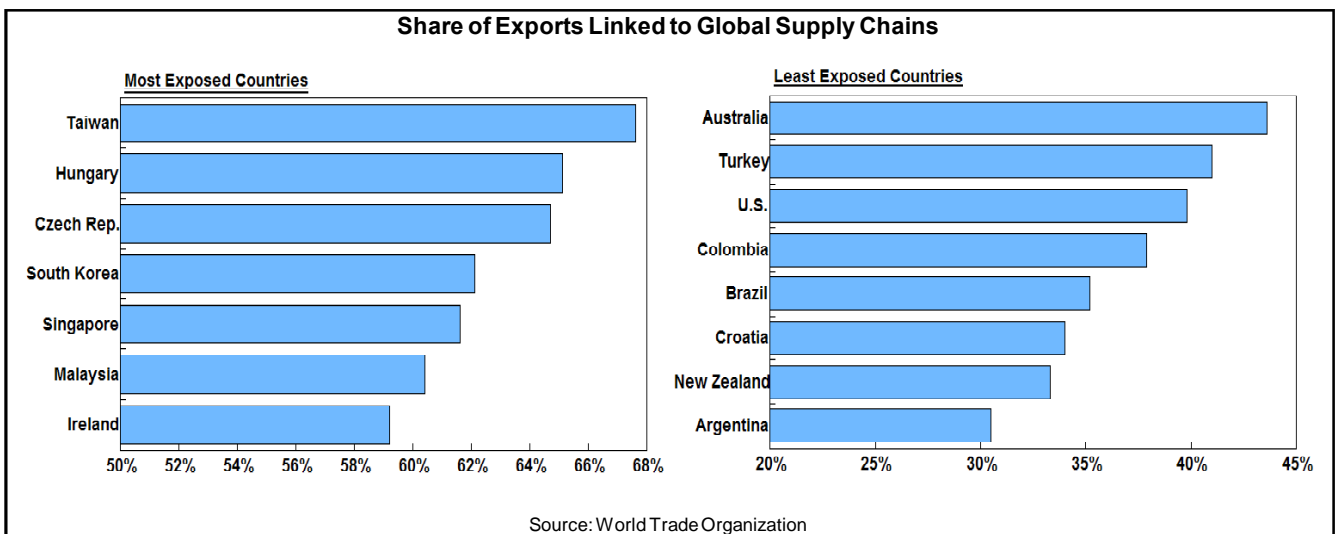
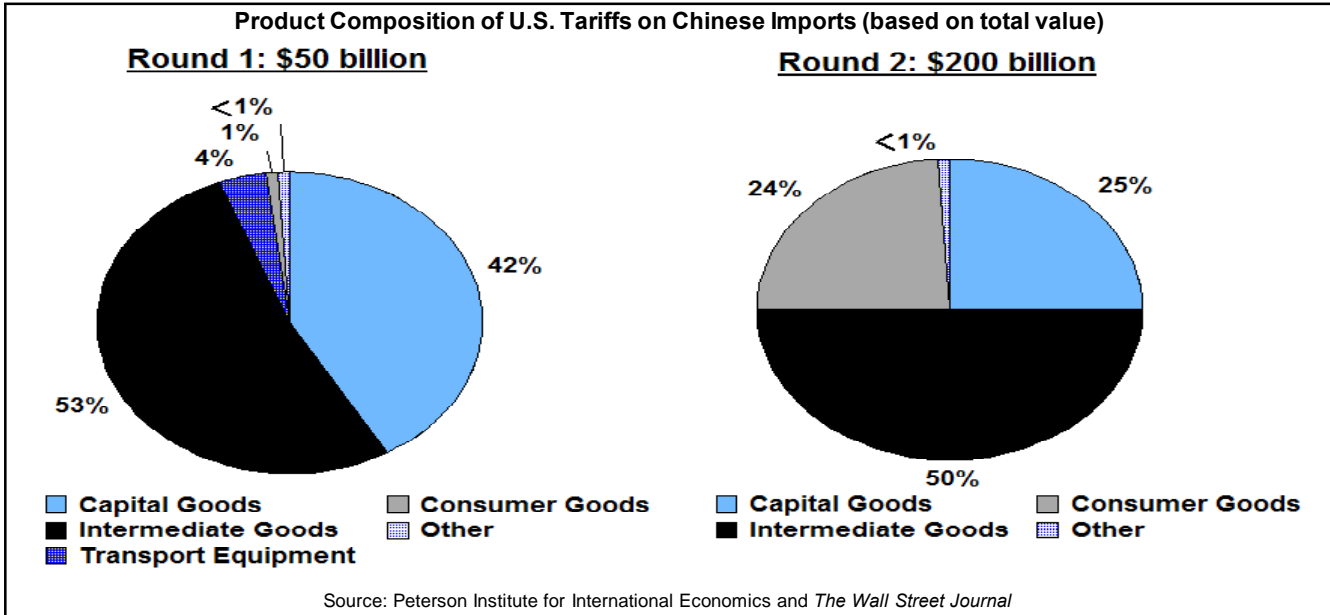


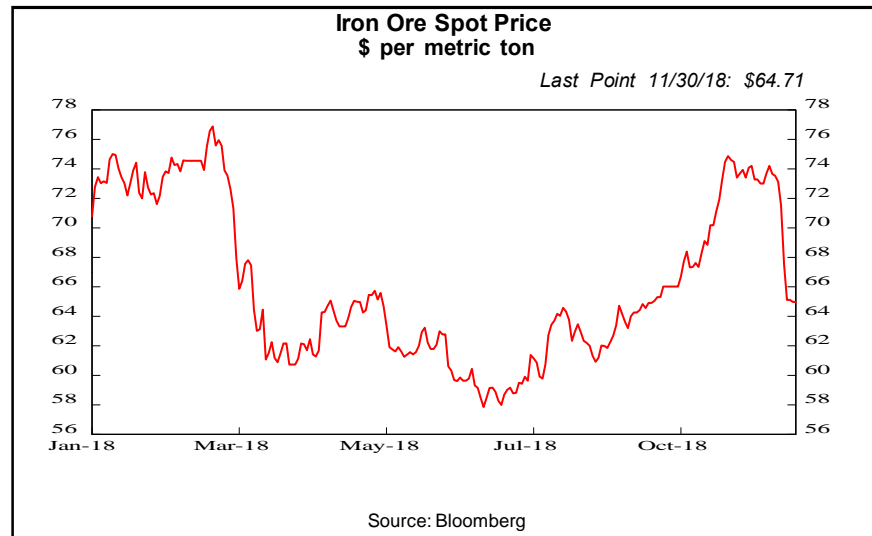
CHART 56



increasingly expensive to extract and is of lower quality after a field's production peaks. Based on his theory, he predicted that production in the lower 48 states would peak in the early 1970s. So as demand for petroleum grew, shortages and sky-high prices might impede economic growth.

Few believed him at the time of his predictions. U.S. oil output was expanding rapidly after World War II and, indeed, American production not only supplied domestic needs but also much of the rest of the world through exports. Still, his forecast proved accurate (*Chart 63, page 23*).

CHART 57



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media appearances and his thoughts on the economy**

**Be sure to follow him on Twitter**

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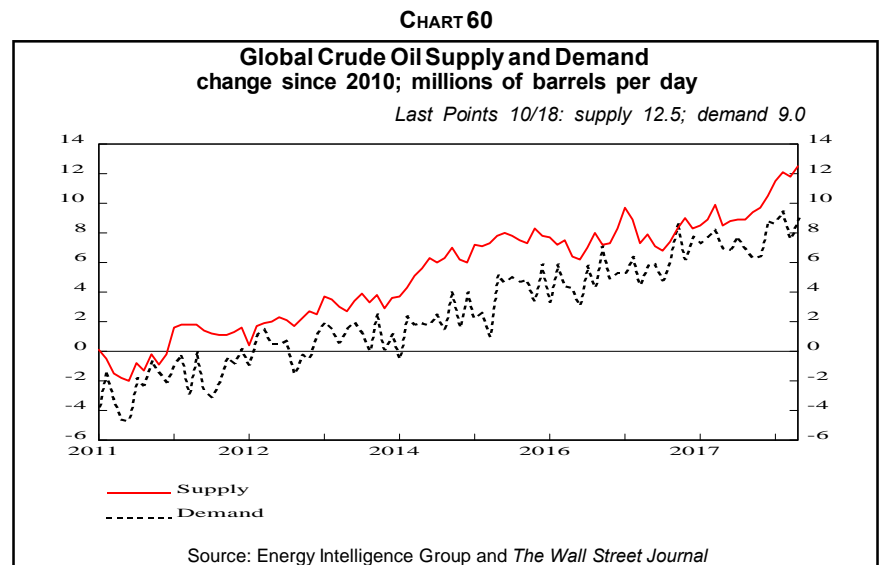
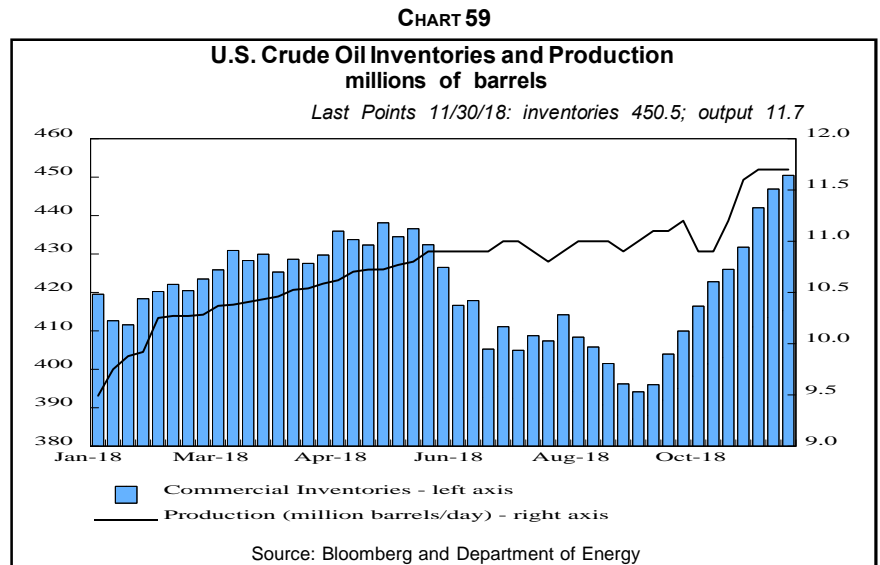
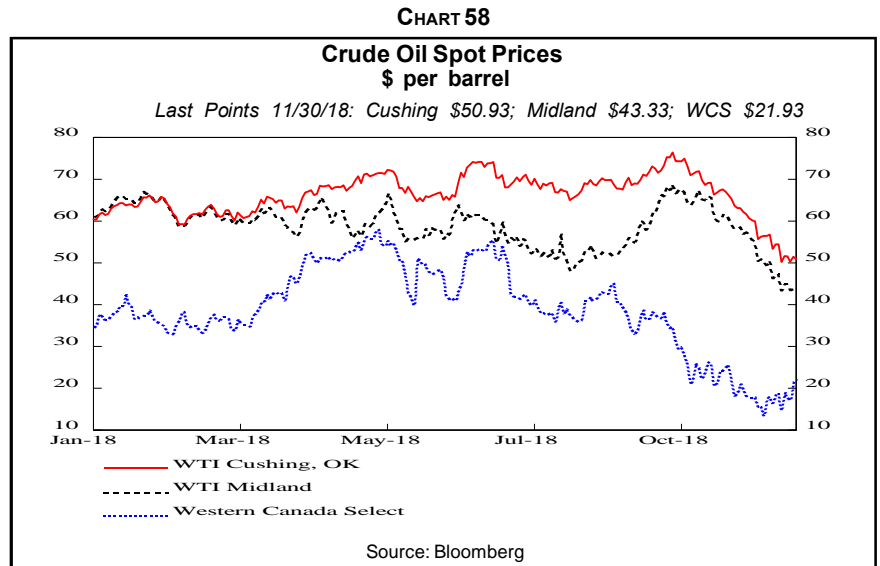
His followers subsequently extended his concepts globally and believed that worldwide production would top out in 2010 or in 2012 at the latest. They were convinced that no big economically-feasible oil fields remained to be found, so new oil supplies would continue to fall short of demand increases. They discounted the fact that reserves are often underestimated since oil fields produce more than original conservative estimates.

More recently, however, oil producers themselves are forecasting that demand, not supply, will peak in the next several decades. Royal Dutch Shell and Norway’s Statoil see the peak as early as the mid-2020s, but say that 2030 is more likely. Shell’s CEO last year said oil prices would remain “lower forever” and never regain the earlier high of \$147 a barrel in the summer of 2008 (*Chart 64, page 23*). The International Energy Agency says oil demand will peak, but probably by 2040. The Carbon Tracker Initiative, a London-based think tank, thinks fossil fuel demand will top out around 2023. BP looks for peak oil demand between 2035 and 2040 and has lowered its breakeven point for oil prices from \$60 a barrel to \$35 to \$40 a barrel this year. Norwegian risk-management firm DNVGL believes oil demand will max out in five years.

China has been the biggest source of crude oil growth in the past decade, but China Petroleum & Chemical Corp., a major fuel marketer, says gasoline demand in China could peak in 2025. IHS Markit believes the demand peak will come in 2040 or a few years earlier with faster adoption of new technologies.

**Demand Peak**

As we discussed in detail in “Crude Oil: Peak Supply to Peak Demand” (October 2018 *Insight*), production of natural gas, a major competitor with oil, is exploding due to fracking in the U.S. (*Chart 65, page 23*). Furthermore, natural gas, after



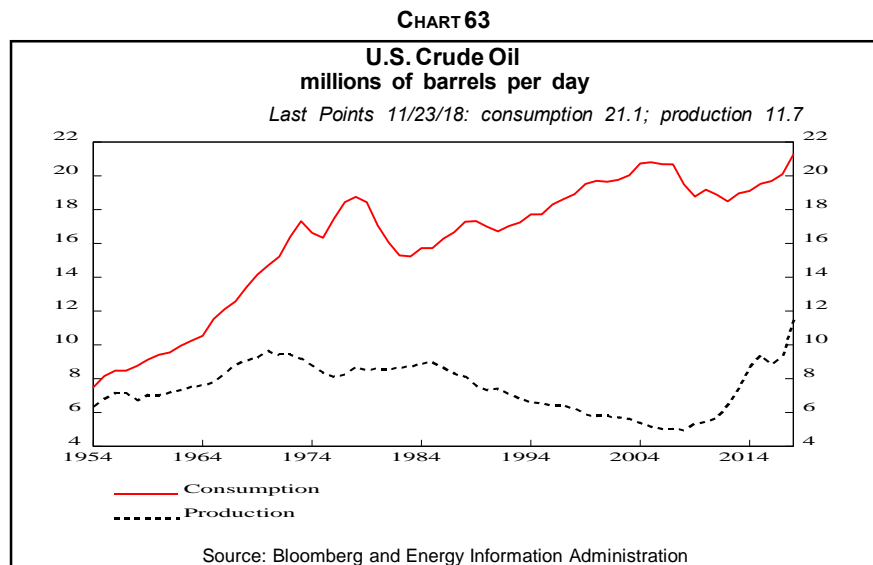
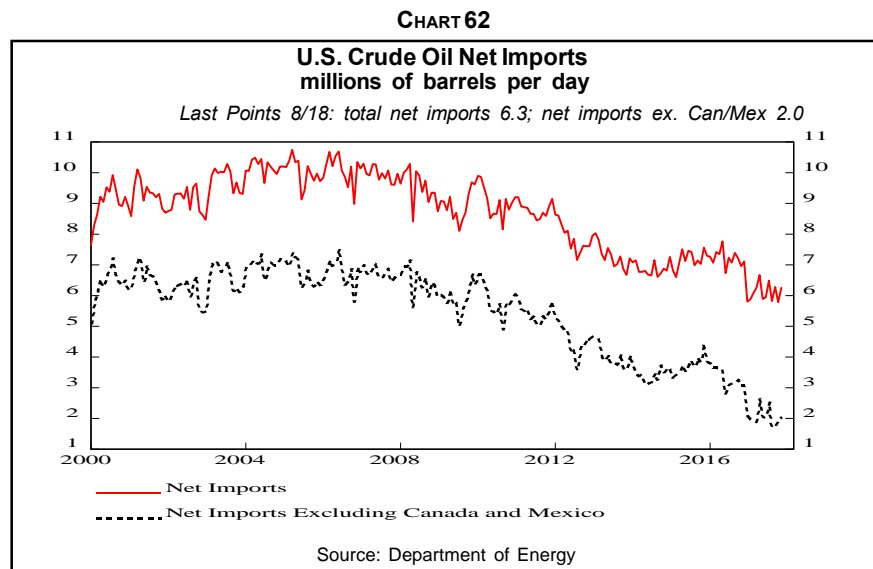
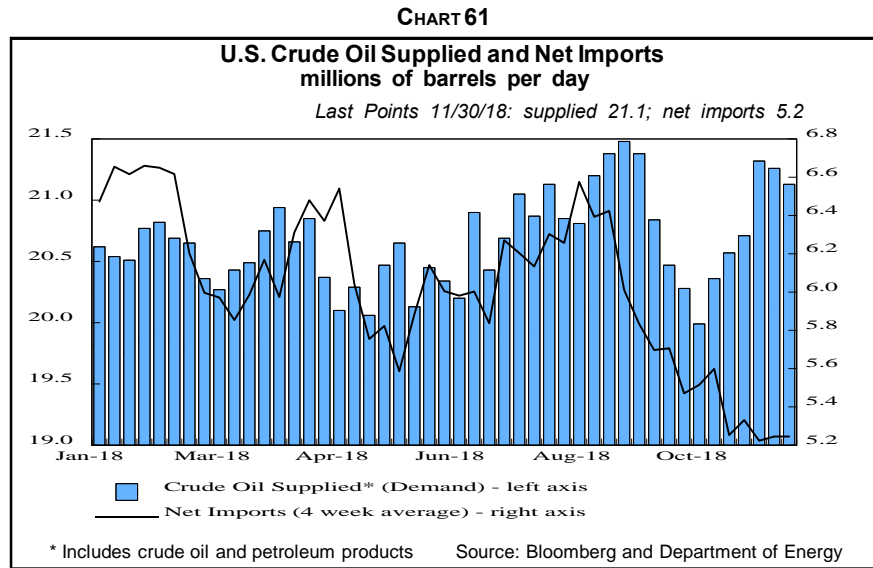
being cooled and converted to liquefied natural gas, is now exported in specially-built ships (*Chart 66, opposite page*) and thereby competes with oil globally—and with the added attraction of lower carbon emissions. Gas is expected to be 24% of the world’s energy mix by 2040, up from 22% in 2016 with LNG’s share jumping from 33% last year to 40%. Canada is developing major facilities to ship LNG to Asia from British Columbia, a much shorter distance than from the U.S. Gulf Coast.

Renewable energy is growing rapidly (*Chart 67, page 24*), driven by public policies in reaction to public concerns over carbon emissions. Wind and solar energy still need considerable government subsidies, but costs are dropping rapidly due to technological innovations and economies of scale.

**Coal Falls**

From around 1970, energy from coal, petroleum and natural gas fell from 93% of the U.S. total to 78% (*Chart 68, page 24*), but until 2005, that decline was due to the rise in nuclear energy. Since then, the drop in nuclear output’s share due to safety concerns and costs has been replaced by renewables as a share of total energy production. Burning oil currently generates only 4.3% of global electricity, half the share two decades ago, and it is expected to drop to 2.5% by 2025.

More than half of power-generating capacity added worldwide in recent years has been in renewable sources such as wind and solar, according to the IEA. In 2016, the latest data, \$297 billion was spent on renewables compared to \$148 billion on new nuclear, coal, gas and fuel-oil power plants. Note that although renewables are growing rapidly, they still only accounted for 12.1% of electricity generation last year (*Chart 67*), but the IEA believes renewables will make up 56% of net generating added capacity through 2025, up from 54% in 2016.



Solar energy capacity globally grew 50% in 2016 but half of that expansion was in China and driven by government edicts in response to serious air pollution. China represents half of global solar energy demand and 60% of solar cell manufacturing capacity.

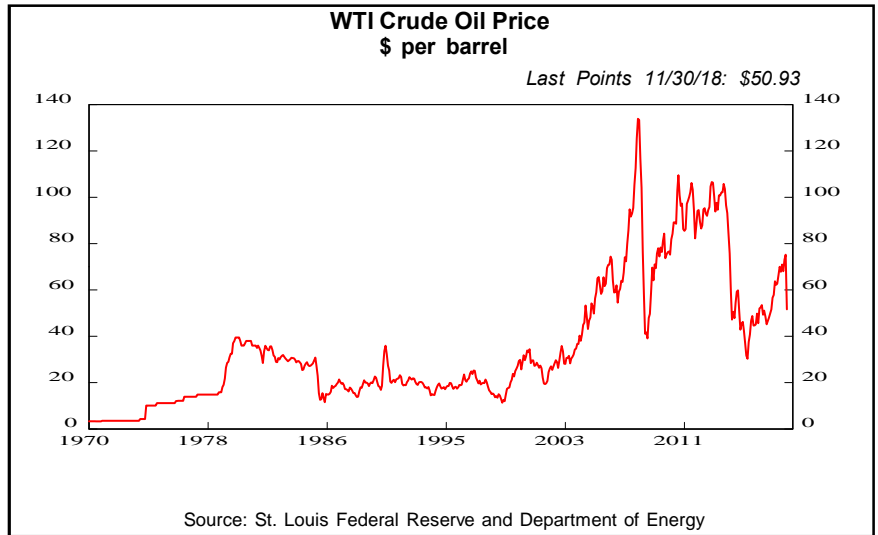
**Conservation**

Since the 1973 Arab oil embargo, energy conservation has been in vogue. And it has been effective. Energy research and information company IHS reported in 2015 that the U.S. was 2½ times more energy efficient than in the 1970s. And further improvements have occurred in the last three years. Energy consumption per U.S. dollar of economic activity has declined since 1970 in major countries, by 43% in Canada, 61% in the U.S., 48% in Japan and 70% in the U.K. (Chart 68).

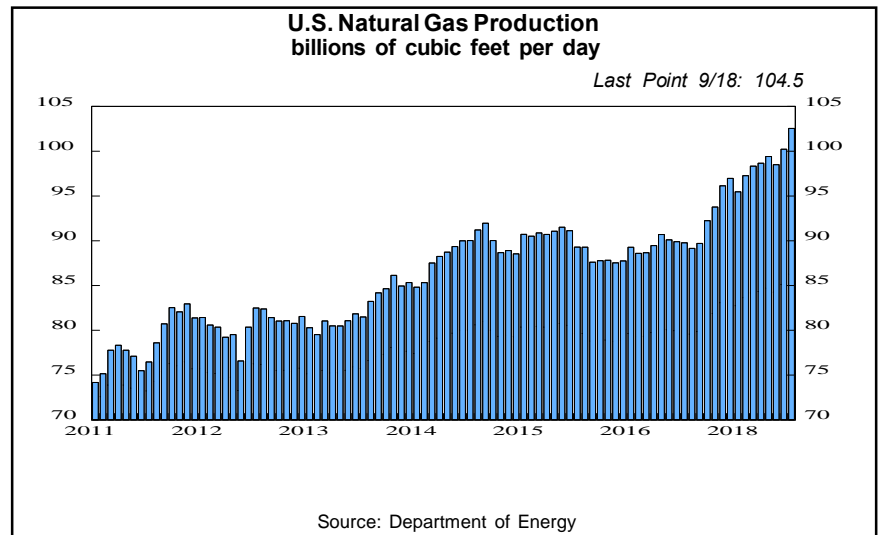
Corporate average fuel efficiency (CAFE) standards were created by Congress in reaction to the energy shortages and leaps in oil prices following the Arab oil embargo. In 1978, new cars were required to average 18 miles per gallon, although actual efficiency in realistic driving conditions has never been as high as CAFE standards (Chart 69, page 24). That standard rose over time, but with ample energy supplies, real gasoline prices are down 35% since 2011. So the rationale for fuel efficiency then shifted from less consumption to lower greenhouse gases. Tailpipe emission standards had the same goal.

Due to limits on the potential efficiency of internal-combustion engines, the 54.5 miles per gallon goal further encouraged the development of electric vehicles. They are growing from a small base, but rapidly, and were still only 1.2% of vehicle sales in 2017 (Chart 70, page 25). If they become extremely popular, it could cause a big drop in crude oil consumption. Transportation fuel accounts for about half of crude oil use and autos account for around half of

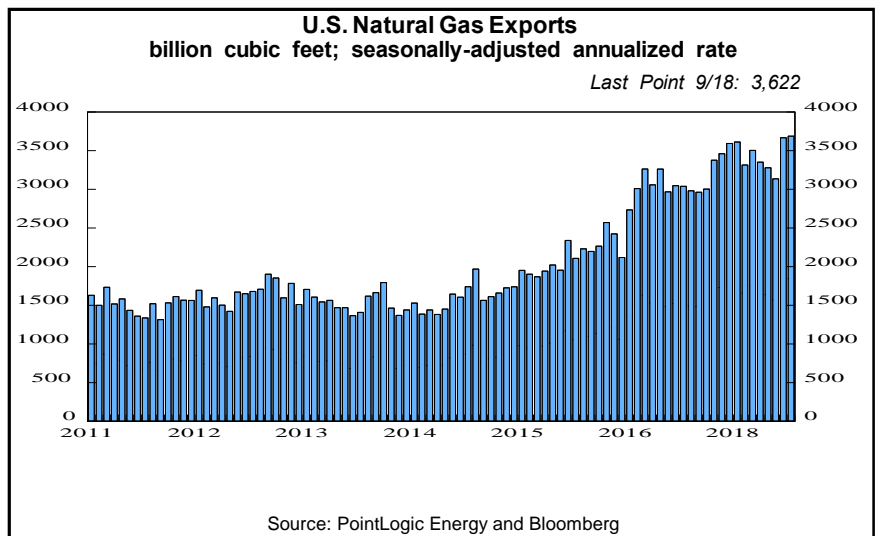
**CHART 64**



**CHART 65**



**CHART 66**





that, or 25% of total oil demand. Electric vehicle battery technology is increasing rapidly and as costs drop, electric vehicle demand should expand beyond luxury-car buyers.

**Growing Oil Supply**

Just as looming peak demand depresses crude oil prices, so does ongoing excess supply. As noted earlier, OPEC in September pumped oil at a level that is 1.13 million barrels per day more than the global market will need in the first half of 2019. In October, OPEC output rose another 127,000 barrels a day and Russian production climbed by 50,000 barrels a day.

Recently, oil prices have nosedived in part because the Trump Administration has backed off its complete embargo on Iranian crude exports by allowing eight countries to continue to receive oil from that country. So Brent, the international benchmark, has plunged from \$85 per barrel earlier to \$58.71 per barrel (Chart 5), below the \$88 per barrel price Saudi Arabia needs to balance its government budget (Chart 71, opposite page).

Still, American shale oil frackers are incentivized to invest in the Permian Basin even at prices \$10 a barrel lower than their current levels. North Dakota's Bakken shale region pumped a record 1.3 million barrels a day in October, more than Oman or Libya, and ever-increasing efficiency now permits producers to operate at \$40 per barrel compared with the WTI benchmark price of \$25 per barrel. Costs to drill and complete wells are down 17% since 2011. As a result of horizontal drilling and other improvements, Bakken oil output has jumped from about 300,000 barrels a day in 2011 to 1.3 million barrels a day even though the number of active drilling rigs has dropped from over 200 to about 50.

So the Saudis plan to cut output by 1 million barrels a day to force up prices

CHART 67

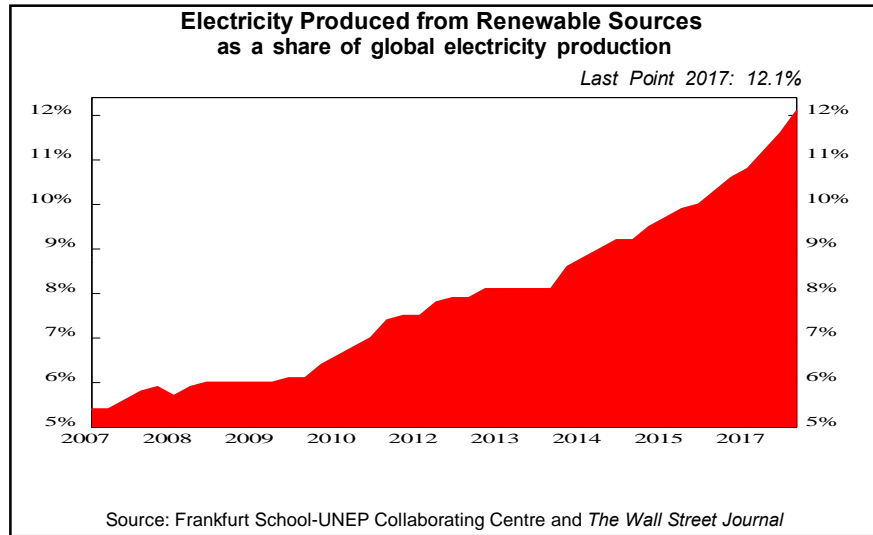


CHART 68

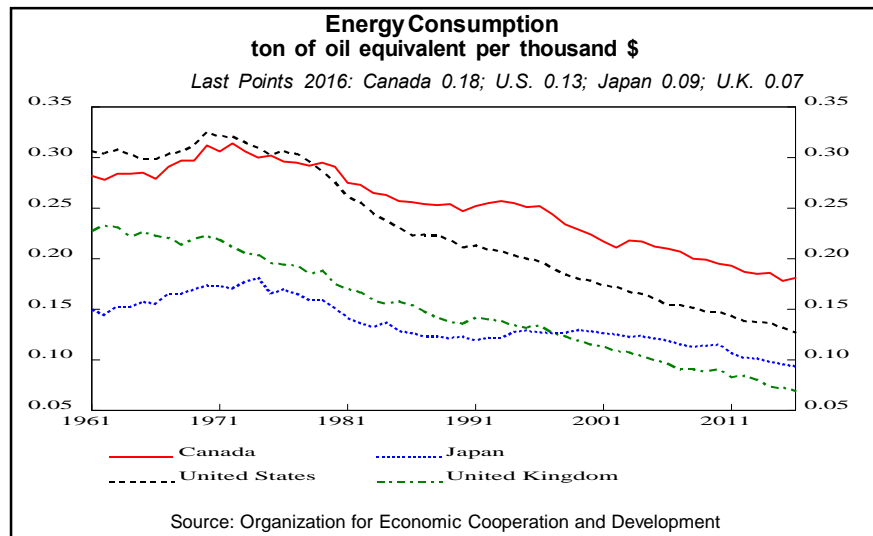
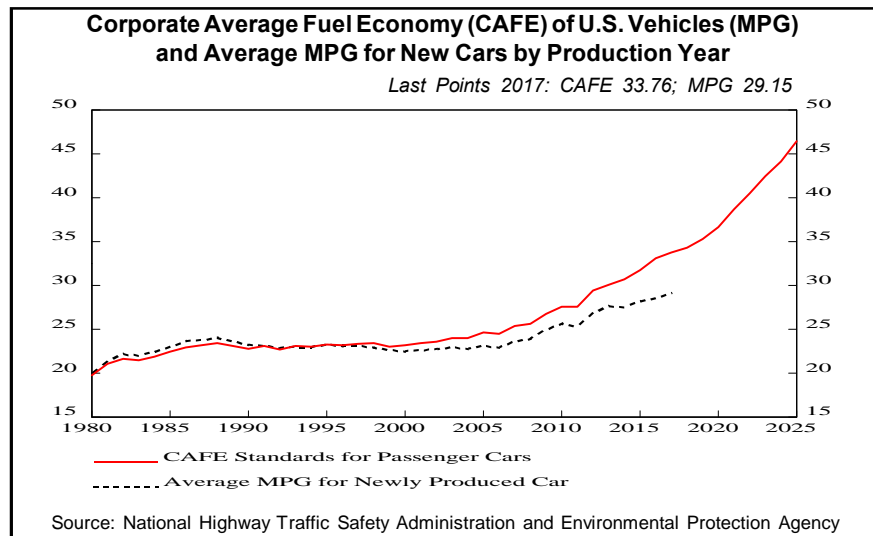


CHART 69



regardless of what other producers do. And Russia, the world's biggest crude oil producer (*Chart 72*), is resisting. Their government budget will balance with \$53 per barrel this year (*Chart 71*), below the current \$58.71 per barrel price of Brent, and, with budget discipline, it is headed toward break-even at \$44 per barrel in two years. That's down from a \$115 per barrel break-even for the Russian budget in 2013. Consequently, the Russians are being encouraged to produce more, not less, oil because they no longer need high prices.

About 40% of Russia's government budget is funded from oil and gas, and Russian President Putin said recently that a \$60 per barrel Brent price was "absolutely fine." Russia has a large domestic oil-field services industry with expenses in rubles, a currency that's fallen 14% against the dollar so far this year.

Russia's current coziness with the Saudis may be that of a hot friendship cooling. Russia is competing vigorously in global energy markets, especially in natural gas. In part to compete with U.S. LNG in Western Europe, state-owned energy giant Gazprom's average selling price for gas has dropped 50% since 2013 compared to the 20% in the American benchmark.

Leaping supply outside OPEC plus the realization that oil demand will peak in coming years is forcing the Saudis to consider the likelihood that demand will drop so much that OPEC loses sway over petroleum and disbands. The research project by the King Abdullah Petroleum Studies and Research Center plans to assess the short/medium-term consequences of a dissolution of OPEC.

And this view comes in the face of major Western energy companies restraining investment in oil exploration and development to the point that annual

CHART 70

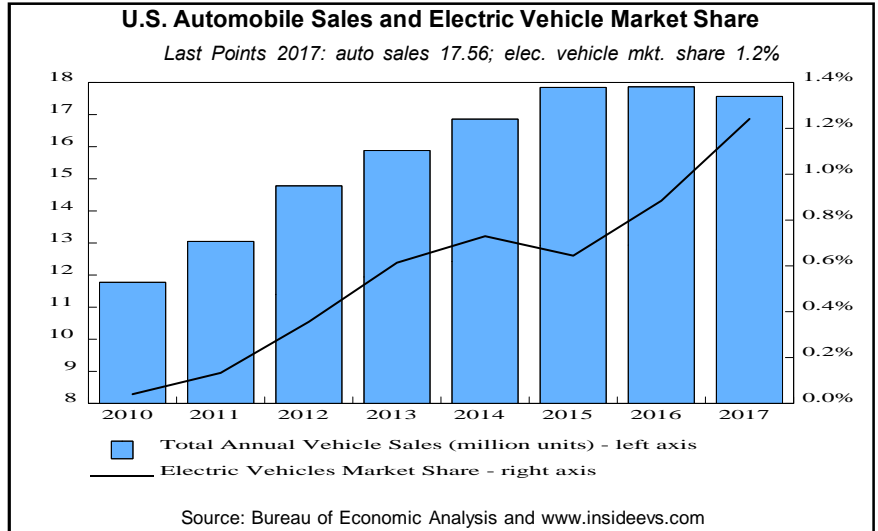


CHART 71

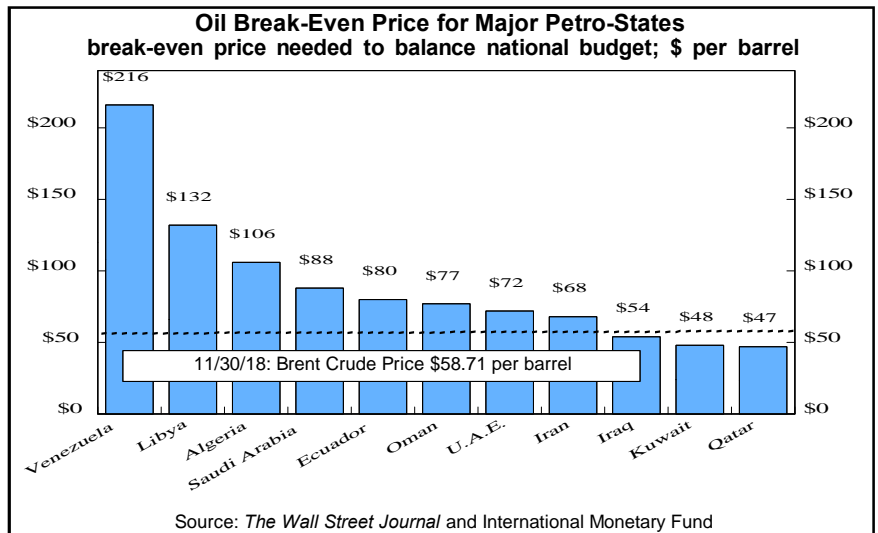
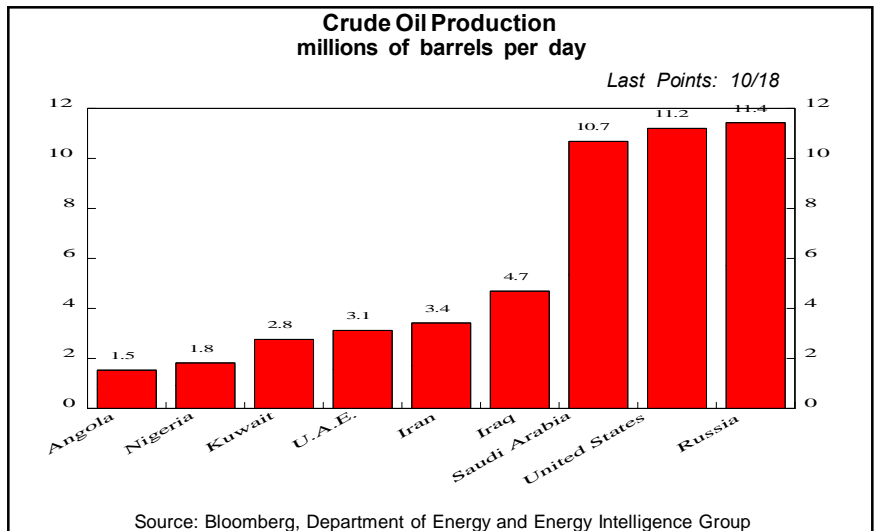


CHART 72



additions to proven reserves are falling short of their withdrawals. Since the oil price collapse in 2015-2016 (Chart 64), their emphasis has shifted from finding new reserves to developing known reserves and low-cost production that generates the cash flow that investors now prefer.

Nevertheless, BP, still recovering from retrenchment and asset sales following its fatal blowout in the Gulf of Mexico in 2010, has begun production in its huge North Sea project that's expected to produce 120,000 barrels of oil a day for 40 years. BP has slashed North Sea production costs from a peak of more than \$30 per barrel in 2014 to less than \$15 per barrel and expects a further reduction to \$12 per barrel by the end of the decade. Shell plans to spend \$600 million to \$1 billion per year in coming years on renewed North Sea activities that are once again attractive after its costs have declined 60%. At its peak, around 2000, the North Sea produced as much oil as Saudi Arabia, but output has fallen by a third since then.

### End Of OPEC

If OPEC disappears, at least as an effective cartel, it will be no surprise, at least to us. As we noted years ago, American frackers, not OPEC, are now the swing producers and U.S. output, now running 11.7 million barrels a day (Chart 73), will probably surpass that of even Russia next year (Chart 72).

Cartels exist only to keep prices above equilibrium by curtailing output. So the cartelleader's job—in the case of OPEC, it's Saudi Arabia—is to cut its output to accommodate those in the cartel who want more than their shares as well as outside producers. Consequently, in the last two decades, OPEC production has been essentially flat while the growth in global demand has been satisfied by non-OPEC producers including Russia, Canadian oil sands and American frackers.

CHART 73

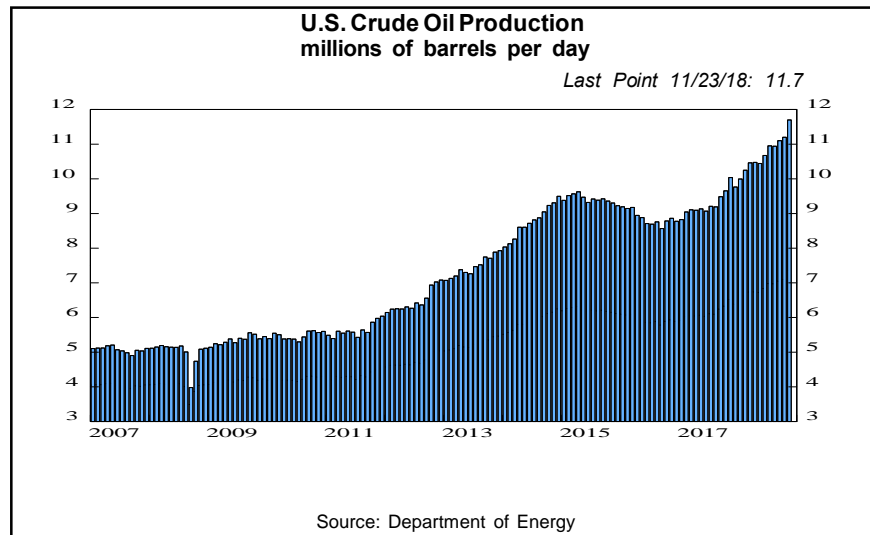


CHART 74

### A Successful Cartel

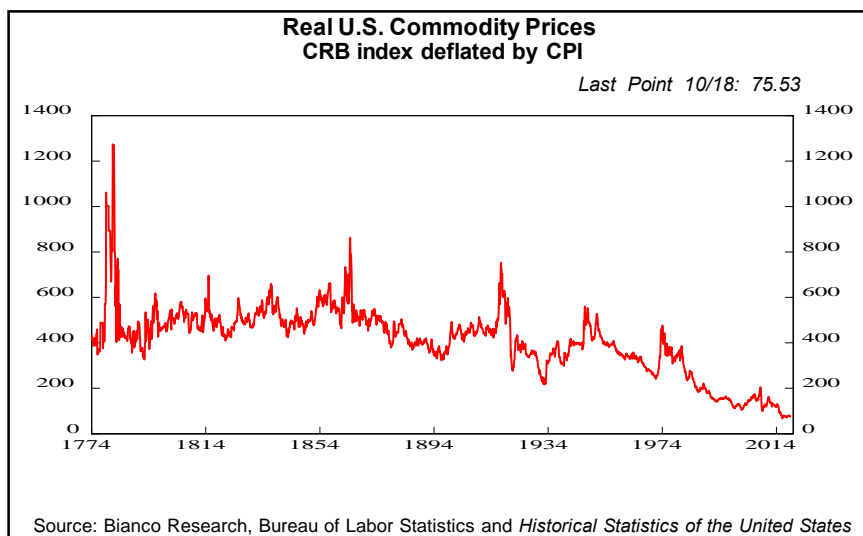
1. Involves a commodity that can otherwise be left in the ground, avoiding production and inventory costs until it's needed.
2. Its product is so much in demand that buyers are relatively insensitive to price.
3. The commodity has few if any close substitutes.
4. It includes most of the low-cost suppliers and has few meaningful non-cartel competitors.
5. It involves relatively few cartel members, thereby promoting discipline.
6. It's sponsored by governments and even religious authorities that benefit from the cartel and protect it.
7. It operates in a period of strong economic growth and robust demand for the product.
8. It faces few technological improvements in the industry.

CHART 75

### Unfavorable Climate for OPEC

1. Alternatives to oil, especially natural gas but also government-subsidized renewables, are growing.
2. Non-OPEC supplies are leaping, notably from Russia and especially American frackers.
3. Infighting among OPEC members has destroyed discipline.
4. Global economic growth is shifting from goods production to services and thereby curbing oil demand.
5. Conservation is limiting oil demand.
6. Rapid technological advances in fracking, horizontal drilling, deep-water and Arctic drilling, etc. are mushrooming non-OPEC supplies at low and declining costs.

CHART 76



OPEC, in business 58 years, has lasted longer than most cartels. In the 20th century, cartels held together from 3.7 to 7.5 years. Earlier, OPEC enjoyed the attributes of a successful cartel (*Chart 74, opposite page*) but that is no longer the case (*Chart 75, opposite page*). OPEC may continue to exist, but it is becoming less and less relevant as its share of global oil output shrinks, and even more so, its portion of worldwide energy supply, considering the rise of natural gas and renewables. And this is all in the face of slowing demand growth and a likely peak in crude oil consumption within the next several decades.

10. Real commodity prices fall steadily in the long run. We've argued for years that commodity supplies continue to be more than ample, especially in the face of human ingenuity's ability to use them more efficiently and find substitutes whenever shortages appear.

Sure, there is only so much oil, copper, iron, etc. in the earth's crust and we can remember when serious economists forecast limitations on telecommunications growth since there would not be enough copper for wires. Then came fiber optics, made from silicone, the second most abundant element in the earth's surface.

Anyone worrying about shortages should study *Chart 76*, which traces the CRB broad commodity index in real (inflation-adjusted) terms since 1774. Notice that since the mid-1800s, it's been steadily declining with only temporary spikes caused by the Civil War, World Wars I and II and the 1973 oil embargo. The decline in the late 1800s is noteworthy in the face of huge commodity-consuming development then: In the U.S., the Industrial Revolution and railroad-building were in full flower while forced industrialization dominated Japan.

### The Bottom Line

The Fed probably hasn't constricted credit enough to, as usual, precipitate a recession. And there's no current financial bubble such as the dot com exuberance of the late 1990s or the subprime mortgage bonanza of the mid-2000s to generate a crisis and recession. Historically, these are the two causes of recessions.

Still, complacency bred by the long, Fed-led rise in the economy and financial assets may be a confidence bubble that we don't fully comprehend until it breaks with financial setbacks and recessionary results.

# INVESTMENT THEMES

**Our Investment Themes section reflects ideas that may serve as the basis for investment decisions within client portfolios. We actively manage client portfolios during the month, and any ideas underlying portfolio changes will not be shown in *Insight* until the following month's report.**

As we stated last month, we're not forecasting a recession yet. But in view of the credit tightening by the Federal Reserve, falling stock prices, a likely yield curve inversion, junk bond spreads opening, falling housing activity, the probable decline in corporate profits growth, exuberant consumers, falling global leading indicators, dropping commodity prices, mounting energy market troubles, the escalating U.S.-China trade war and other leading indicators, a business downturn in the U.S. and elsewhere in the next year or so is increasingly likely.

The Fed probably hasn't constricted credit enough to, as usual, precipitate a recession. And there's no current financial bubble such as the dot com exuberance of the late 1990s or the subprime mortgage bonanza of the mid-2000s to generate a crisis and recession. Historically, these are the two causes of recessions.

Still, complacency bred by the long, Fed-led rise in the economy and financial assets may be a confidence bubble that we don't fully comprehend until it breaks with financial setbacks and recessionary results.

In this environment, our investments are definitely cautious and defensive.

## Our Suggestions

1. Long the dollar, which is a global safe-haven and benefits from ongoing Fed hikes of short-term interest rates as well as trade war uncertainties.

### **Does your current portfolio need more insight? Interested in more than just *Insight*?**

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To be truly successful, Gary Shilling believes an investment strategy must be non-consensus and challenge the common view that is generally fully-known and priced into the financial markets.

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# INVESTMENT THEMES

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2. Sell emerging-market stocks and bonds. We favor this theme in view of the dollar's strength, which depressed developing country currencies and their ability to service their \$8 trillion in dollar-denominated debts and pay for dollar-based commodity imports. Also, ongoing Fed interest rate hikes make the U.S. more attractive to U.S. and foreign investors than developing economies.

3. Sell U.S. overall market indices as the sell-off persists and gains momentum.

4. Short commodities such as copper as the dollar rises and demand weakens as the Chinese and other economies sag. Also, short crude oil as supply exceeds demand.

5. As an anchor to windward, we continue to suggest small long equity positions in defensive sectors such as health care, consumer staples and utilities.

6. Long Treasury bonds with a small position. They, like the dollar, are a safe-haven in a sea of global trouble. Still, spillover from Fed-led rises in short-term rates is a partial offset. In any event, investors are weighing pro Treasury bond forces such as deflationary pressures and Treasuries' safe-haven status more heavily than Fed tightening, as witnessed by the less-than-normal spillover from central bank rate increases to Treasury bond yields.

7. Short Bitcoin, which more and more looks like a giant Ponzi scheme and is only useful for illegal purposes.

8. In the current uncertain investment atmosphere, we suggest a heavy cash position.

**Gary Shilling's next webinar is scheduled for  
Thursday, December 20 at 4:15 pm Eastern Time**

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## Summing Up

Another wild ride—both up and down—last month ended with major indices up slightly as investors spent November concerned about the ongoing trade tensions with China and its slowing economy, plunging oil prices, rising interest rates, exploding federal deficits, the housing slump and creeping concerns about a U.S. recession.

Yields on 10-year Treasury notes last month briefly hit their highest levels since early 2011 as the yield curve continued to head towards inversion. Meanwhile, the dollar moved sideways against the euro and the yen.

Look for the Fed to raise its federal funds rate for the fourth time this year when its policymakers meet on December 18-19. What's in store for 2019, though, is anyone's guess, with minutes from the Fed's early November meeting revealing some concerns among policymakers about further rate increases if the economy runs into headwinds.

Later in the month, Fed Chairman Powell said he was "very happy about the state of the economy," crediting the Fed for playing a role in the long expansion. Powell also jolted the markets sharply upward late in the month when he said that interest rates are "just below" a level considered neutral.

The second estimate of third quarter GDP showed a 3.5% gain—the same as the initial estimate—thanks mainly to quicker inventory-accumulation and more business spending on equipment. Consumer spending and exports were revised downward from the first report.

Weaker demand, especially from China, and rising U.S. production led crude oil prices to plummet last month by a third from their October 3 peak and to their lowest level in more than a year. At one point in November, oil prices declined for 12 straight trading days—the longest stretch since futures trading began in 1983.

Higher gasoline prices led to inflation figures that were the highest in some time, with consumer prices in October up 0.3%, the biggest increase in nine months. The 12-month rate was up 2.5%. Core CPI rose 0.2% and the 12-month rate was up 2.1%. Producer prices, meanwhile, rose 0.6% in October, the biggest

increase since late 2012. The 12-month rate was up 2.9%. Core PPI rose 0.5% in October and the year-over-year core rate was up 2.6%.

Retail sales rose 0.8% in October on strength in auto sales and building material sales related to the recovery from Hurricane Florence. September's 0.1% gain was revised down to a 0.1% decline. With online shopping more and more prevalent, the mad rush of Black Friday at bricks-and-mortar stores isn't as big a barometer of holiday shopping as it used to be. Instead, Internet sales rose more than 26% from Wednesday through Black Friday, Nov. 23. vs. a year earlier, according to Adobe Systems, which also reported that online sales on Cyber Monday, Nov. 26, rose 19.3% to make it the largest online shopping day that it's tracked.

Nonfarm payrolls rose by a strong 250,000 in October while the August number was revised up by 16,000 and September's numbers were revised down by 16,000. The national unemployment rate remained at 3.7% while the labor participation rate rose to 62.9% from 62.7%. Average hourly wages, though, increased 3.1% year-over-year, the biggest gain since 2009.

Housing starts rose 1.5% in October from September but were 2.9% lower than a year earlier. Single-family groundbreakings fell 1.8% while multi-family starts jumped 10.3%. Building permit issuance fell 0.6%. Mortgage rates are near a seven-year high, and home sales are feeling the effects. After six straight declines, existing home sales rose 1.4% in October from September but were down 5.1% from a year earlier. The median price of \$255,400 was up 3.8% from a year earlier. New home sales, though, fell 8.9% in October. The median price of \$309,700 was 3.1% lower than a year earlier.

The S&P/Case-Shiller 20-city house price index rose 5.1% in September as monthly price increases continue to shrink. Meanwhile, the National Association of Home Builders'

confidence index plunged eight points in November to 60. Builders cited rising rates and home prices as factors in the decline.

The University of Michigan's consumer sentiment index fell from 98.6 in October to 97.5 in November. The Conference Board's consumer confidence index fell to 135.7 in November from 137.9 in October.

*Fred T. Rossi*  
Editor

THE NUMBERS		
	Nov. 2018 % Change*	Year-to-Date % Change
Dow Jones Industrials	+1.7%	+3.3%
S&P 500	+1.8%	+3.3%
Nasdaq Composite	+0.3%	+6.2%
Nikkei Average	+1.9%	-1.8%
STOXX Europe 600	-1.1%	-8.0%
Shanghai Composite	-0.5%	-21.3%
FTSE 100	-2.2%	-9.2%
	<b>11/30/18</b>	<b>10/31/18</b>
10-yr. Treasury note	2.99%	3.15%
\$=¥	113.48	112.88
€=\$	1.13	1.13
West Texas Inter.	\$50.72	\$65.07

\*through Nov. 30

## Climate Change: A Look From Both Sides

The spate of powerful hurricanes this year in the Atlantic Ocean and Gulf of Mexico as well as the devastating typhoons in the Pacific Ocean along with other extreme weather events such as severe winter storms, wildfires in the West and European droughts, along with the issuance of two new reports, have raised fresh concerns about climate change and how much of a threat it poses to the planet.

One side claims humans are playing a major role in rising global temperatures and urges immediate action to stave off what they feel will be a catastrophe affecting all aspects of life while the other side thinks it's simply part of a natural climatic cycle that's not as dire as is being proclaimed and that would cost far too much in jobs and economic upheaval to address in the way that's being pushed by activists.

In the U.S., at least, opinions about climate change, like pretty much everything else, are divided mainly by political leanings, with activists believing not only that it exists but that addressing it via government action is of paramount importance and warning of dire consequences if things accelerate. The other side tends to be more cautious or skeptical about the causes of climate change and prefers market-based, not government-imposed, solutions to address any issues related to it. They also point out that many of the doomsayers' dire warnings and forecasts have not panned out.

We'll do our best to explore the issue from both sides, starting with the more skeptical viewpoint and then followed with the other side's viewpoint.

### New Warnings

Conversations about the climate change issue were elevated anew in October when a United Nations scientific panel on climate change issued a report that painted a far more troubling picture of the immediate consequences of climate

change than previously thought, with dire warnings of a world of worsening food shortages and wildfires, and a mass die-off of coral reefs as soon as 2040. The study by the UN's Intergovernmental Panel on Climate Change found that if greenhouse gas emissions continue at the current rate, the atmosphere will warm up by as much as 2.7°F above pre-industrial levels by 2040, inundating coastlines and intensifying droughts and poverty.

The IPCC was the subject of some controversy 10 years ago when hacked emails led to questions about its methodology in earlier studies. A series of independent investigations concluded that researchers at the Climatic Research Unit of the University of East Anglia in England hadn't skewed science to inflate evidence of man-made global warming, but did criticize them for not sharing data and for presenting information in a "misleading" way in one instance and urged climate scientists to be more transparent in responding to critics and explaining their methods.

And a new National Academy of Sciences report issued in late October is calling for a "substantial research initiative" focused on developing technologies that directly remove carbon dioxide from the atmosphere. The report envisions 10 billion tons of CO<sub>2</sub> emissions-removal needed annually by the middle of this century, an amount that doubles by 2100.

The report represents a significant shift in thinking because, for decades, experts said nations could prevent large temperature increases mainly by reducing reliance on fossil fuels and moving to cleaner sources like solar, wind and nuclear power. But nations have delayed so long in cutting their CO<sub>2</sub> emissions that even a major shift toward clean energy would most likely not be enough, according to this report.

Late last month, the Trump Administration also quietly issued a report by 13 federal agencies that warned of stark

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consequences resulting from climate change and predicting that the damage could knock as much as 10% off the size of the U.S. economy by the end of this century. The leader of the Administration quickly threw cold water on his own government's report, saying a few days after its release, "I don't believe it."

A former Obama Administration undersecretary of energy, Steven Koonin, played down the warnings of economic doom in the report, writing in *The Wall Street Journal* that his analysis of the National Climate Assessment showed a worse-case scenario where annual GDP growth will be reduced by 0.05 percentage point, given likely overall GDP growth between now and the end of the century.

**Consensus?**

The world is getting warmer. Whether the cause is human activity or natural variability, thermometer readings all around the world have risen steadily since records started to be kept 140 years ago (*Chart 1*). Furthermore, carbon dioxide levels since the start of the Industrial Revolution have increased nearly 38% as of 2009 and methane levels have increased 148% (*Chart 2*).

Surveys of the peer-reviewed scientific literature and the opinions of experts consistently show a 97%–98% consensus on humans causing climate change. That's also the position of the Academies of Science from 80 countries plus many scientific organizations that study climate science. More specifically, around 95% of active climate researchers actively publishing climate papers endorse the consensus position.

But climate skeptics question these consensus figures, taking issue, for one, with the methodologies that leads to the 97%–98% figure or questioning the sources for such claims.

**Polls**

Opinion surveys have consistently shown a general belief that the climate is changing and that humans play a big role in those changes. A Gallup poll last year revealed Americans are increasingly concerned about climate change, with clear majorities

CHART 1

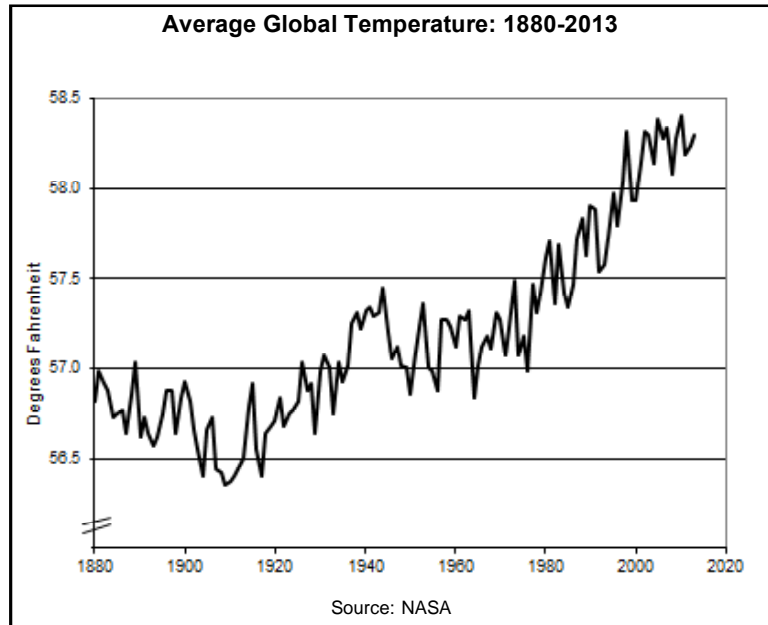


CHART 2

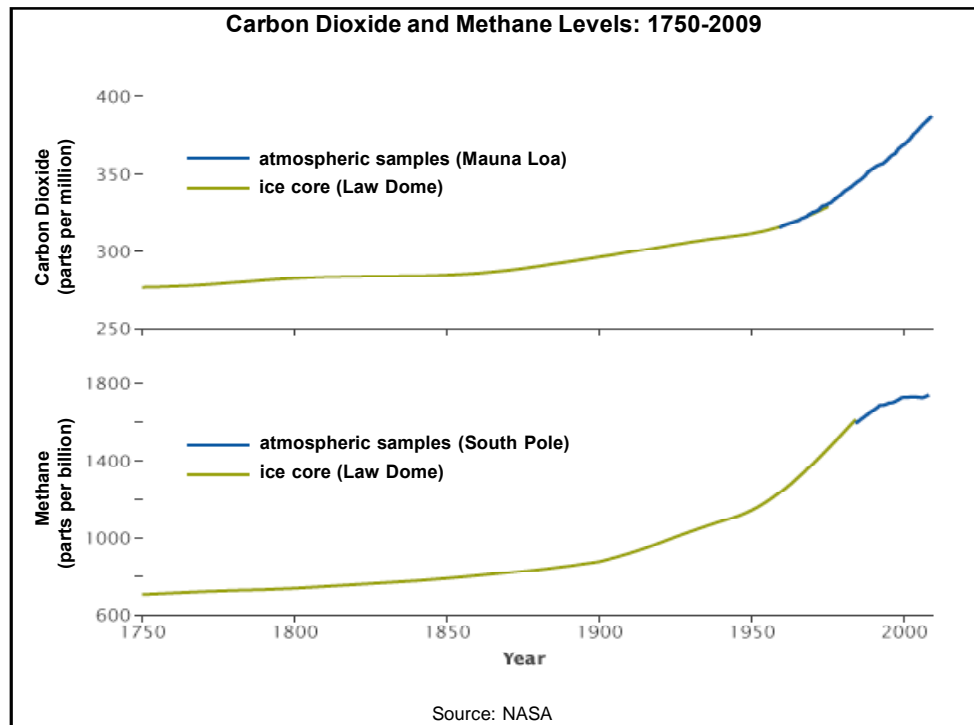
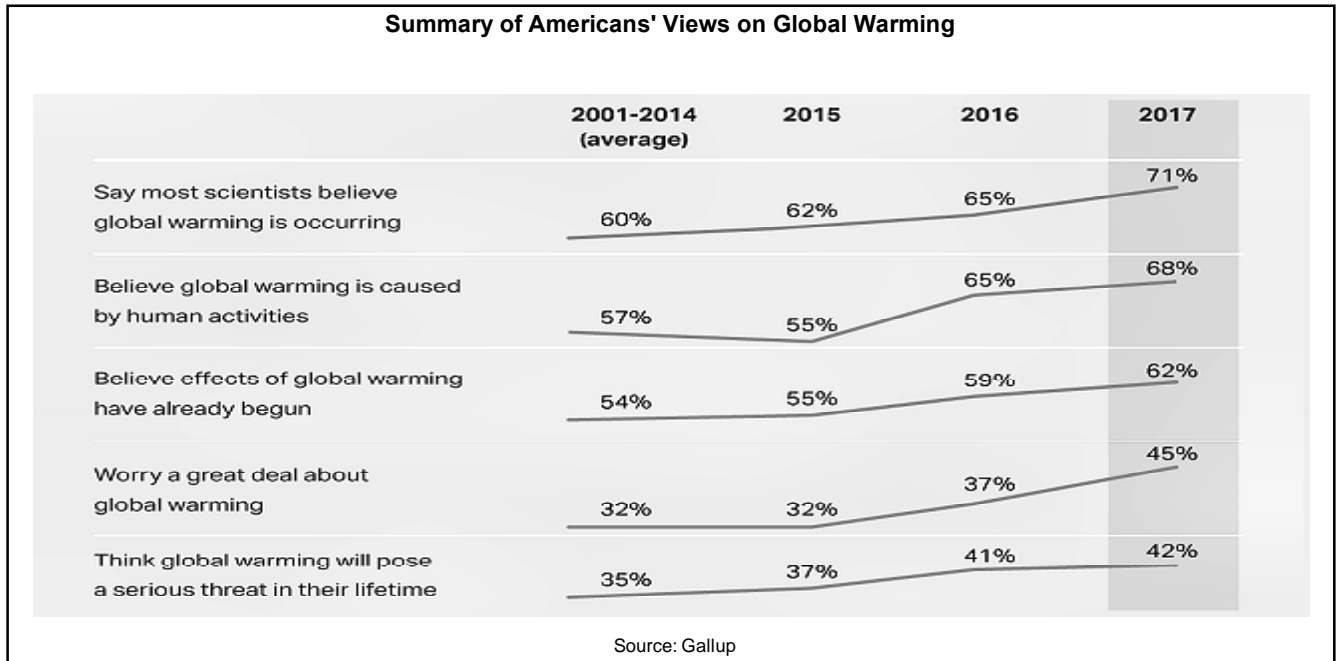


CHART 3



believing that global warming is caused by human activities and that its effects are already underway. More Americans also worry about global warming and think it will pose a serious threat in their lifetimes (*Chart 3*).

Another poll, from the University of Michigan’s Center for Local, State, and Urban Policy, showed 60% saying that global warming is taking place and that human activity is either primarily or partially why temperatures are rising. That’s higher than the previous high of 58% recorded in 2008, 2009 and 2017. Slightly more than a third of respondents said humans were primarily responsible for global warming while 26% said human activity was partially responsible. On the other hand, 12% said climate change was caused by natural patterns with another 12% saying they weren’t sure if it is occurring at all. And 15% of survey respondents said the climate is not changing.

**What To Do?**

While there is general agreement among scientists that the climate is changing—and that the effects will lead to some degree of rising sea levels, more extreme temperatures, worsening air quality, population displacement—what to do about it is something that’s vexed policymakers for decades. NASA says that “answering these questions is perhaps the most significant scientific challenge of our time.”

On one hand, there are those who tout things that most of the public have heard about for years, including establishing a carbon tax; subsidizing clean energy and ending subsidies

for so-called “dirty energy”; moving away from coal as an energy source; increasing energy efficiency via higher fuel standards, upgraded lighting and better insulation; investing in clean-energy innovation; moving away from fossil fuel-powered vehicles to ones that run on electric power; and emphasizing reforestation to reduce carbon dioxide levels in the air.

**Climate Change From The Right: It's Real, But...**

Two conservative analysts, Jim Manzi from the free-market-oriented think tank The Manhattan Institute and Peter Wehner, a veteran of the Reagan and Bush White Houses and senior fellow at the Ethics and Public Policy Center, a conservative think tank, wrote a piece for *National Affairs* three years ago offering market-based ideas for addressing climate change, but they also castigated conservatives who they say have “plugged their ears not only to ludicrous exaggerations [of the climate change alarmists], but also to the available facts.”

They criticized conservative political leaders for adopting the “I’m not a scientist” talking point on climate change, which the two writers said was “an attempt to invoke ignorance in order to avoid embarrassment,” adding that “scientific ignorance is not an excuse for refusing to stake out a position.”

While a good deal of right-leaning observers and policymakers accept the scientific consensus that humans

are the primary driver of climate change, there are some outliers. Oklahoma Sen. James Inhofe, ironically the chairman of the Senate Environment Committee, has called climate change “the greatest hoax” ever perpetuated on Americans and has criticized the Environmental Protection Agency as an “activist organization” burdening everyone from farmers to fossil-fuel companies with excessive regulations. Inhofe garnered attention in February 2015 when he took to the Senate floor holding a snowball as proof, he said, that the globe could not be warming in any threatening way, given the cold weather outside—in the middle of winter.

Manzi and Wehner say that the position of “either avowed ignorance or conspiracy theorizing is ultimately unsustainable” and criticize those who “still cling to it” in the belief that “accepting the premise that some climate change is occurring as a result of human action means accepting the conclusions of the most rabid left-wing climate activists.” Conservatives, they believe, fear that accepting the reality of climate change will set them down a “twisted road with a known destination: supporting new carbon taxes, a cap-and-trade system, or other statist means of energy rationing, and in the process ceding yet another key economic sector to government control. Conservatives seem to be on the horns of a dilemma: They will have to either continue to ignore real scientific findings or accept higher taxes, energy rationing, and increased regulation.”

In general, though, right-leaning and free-market-oriented groups have been examining the issue of climate change and seeking ways to address it while also casting a skeptical eye on some of the more liberal approaches to the problem.

The CATO Institute, an influential libertarian think-tank, states that global warming “is indeed real, and human activity has been a contributor since 1975.” But the group calls the issue “very complicated and difficult” and warns against “very unwise policy in response to political pressure.” While there are numerous legislative proposals for substantially reducing carbon dioxide emissions, “there is no operational or tested suite of technologies that can accomplish the goals of such legislation.” CATO says that, “fortunately, and contrary to much of the rhetoric surrounding climate change, there is ample time to develop such technologies, which will require substantial capital investment by individuals.”

Lee Lane, in a 2014 piece for *The New Atlantis*, a journal published by the right-leaning Center for the Study of Technology and Society, took conservatives to task for

“dogmatically asserting that no serious threat is on the horizon.” He stated that “bald claims that man-made climate change is a hoax—which would imply that tens of thousands of scientists are engaged in a coordinated conspiracy—are slowly losing credence, even for conservatives.”

### Predictions Come True?

Back in 1988, James Hansen, a NASA scientist, testified before a congressional committee amidst a record-setting heatwave during what would become a record-setting summer, and expressed a “high degree of confidence” in a “cause and effect relationship between the greenhouse effect and observed warming.” Patrick Michaels and Ryan Maue from the CATO Institute’s Center for the Study of Science, said Hansen’s testimony “lit the bonfire of the greenhouse vanities” that set off a global debate about global warming.

Hansen put forth three possible scenarios for the future of CO<sub>2</sub> emissions. The first, which he called “business as usual,” maintained the accelerating emissions growth typical of the 1970s and 1980s and predicted that the earth would warm by one degree Celsius by 2018. The second scenario set emissions lower, rising at the same rate in 2018 as in 1988, an outcome Hansen said was the “most plausible” and would lead to warming of about 0.7 degrees by 2018. A third scenario, deemed by Hansen to be highly unlikely, forecast temperatures to rise a few tenths of a degree before flat-lining after 2000.

Messrs. Michaels and Maue analyzed Hansen’s forecasts on the 30th anniversary of his landmark testimony and concluded that global surface temperatures had “not increased significantly” since 2000. “Surface temperatures are behaving as if we had capped 18 years ago the carbon dioxide emissions responsible for the enhanced greenhouse effect. But we didn’t.” The duo said Hansen wasn’t the only one to get things wrong, noting that the IPCC’s models have predicted about twice as much warming has been observed since temperature monitoring began in the late 1970s.

The authors also noted other claims made by Hansen they say didn’t pan out. Hansen in 1988 said that the late 1980s and 1990s would see “greater than average warming in the southeast U.S. and the Midwest,” but “no such spike has been measured in these regions.” Hansen also predicted in 2007 that most of Greenland’s ice would soon melt, raising sea levels 23 feet over a 100-year period, but this has not occurred.

The CATO researchers also knocked down Hansen’s 2016 prediction that hurricanes would get stronger, citing satellite data from 1970 onward that “shows no evidence of this in relation to global surface temperature.” Similarly, they found no evidence that storms have caused increasing amounts of damage in the U.S., citing data from the National Oceanic and Atmospheric Administration that show no such increase in damage, measured as a percentage of GDP. How about stronger tornadoes? The opposite may be true, Michaels and Maue stated, pointing to NOAA data they say offers some evidence of a decline. “The list of what didn’t happen is long and tedious.”

Saying Hansen’s and the UN’s models were faulty, Michaels and Maue said several newer climate models project about half the warming predicted by UN models and are in line with observed temperatures. The flawed predictions, they say, raises the question of “Why should people worldwide pay drastic costs to cut emissions when the global temperature is acting as if those cuts have already been made?”

Three years ago, Michaels and Paul Knappenberger made the case for not a warming world but what they called a “lukewarming” world, saying that “the rate of warming” over the past several decades “has been slower than what was anticipated” by various climate models. They concluded

that “future global warming will occur at a pace substantially lower” than what the U.S. government and international agencies are anticipating as they formulate actions to combat greenhouse gas emissions.

A report in June in the journal *Nature Climate Change* claimed that carbon dioxide itself will have a “significant direct impact on Northern Hemisphere summer temperatures, heat stress and tropical precipitation extremes.” CATO’s Michaels and Maue analyzed this and concluded that “it is really not what it shows,” again pointing to faults in the climate models.

**Anything Positive?**

While most would agree that a warming planet will, overall, have detrimental effects on everything from rising seas, coastal flooding and population movement to agriculture, air pollution and wildlife and sea life, there are some positive aspects resulting from a warmer planet.

Warmer temperatures will lead to improved agriculture—and economic growth—in some high latitude regions such as the northern U.S. and Canada. A recent study in *Science* magazine analyzed the economic impacts of climate change on the U.S., county by county, and while the overall impact

CHART 4

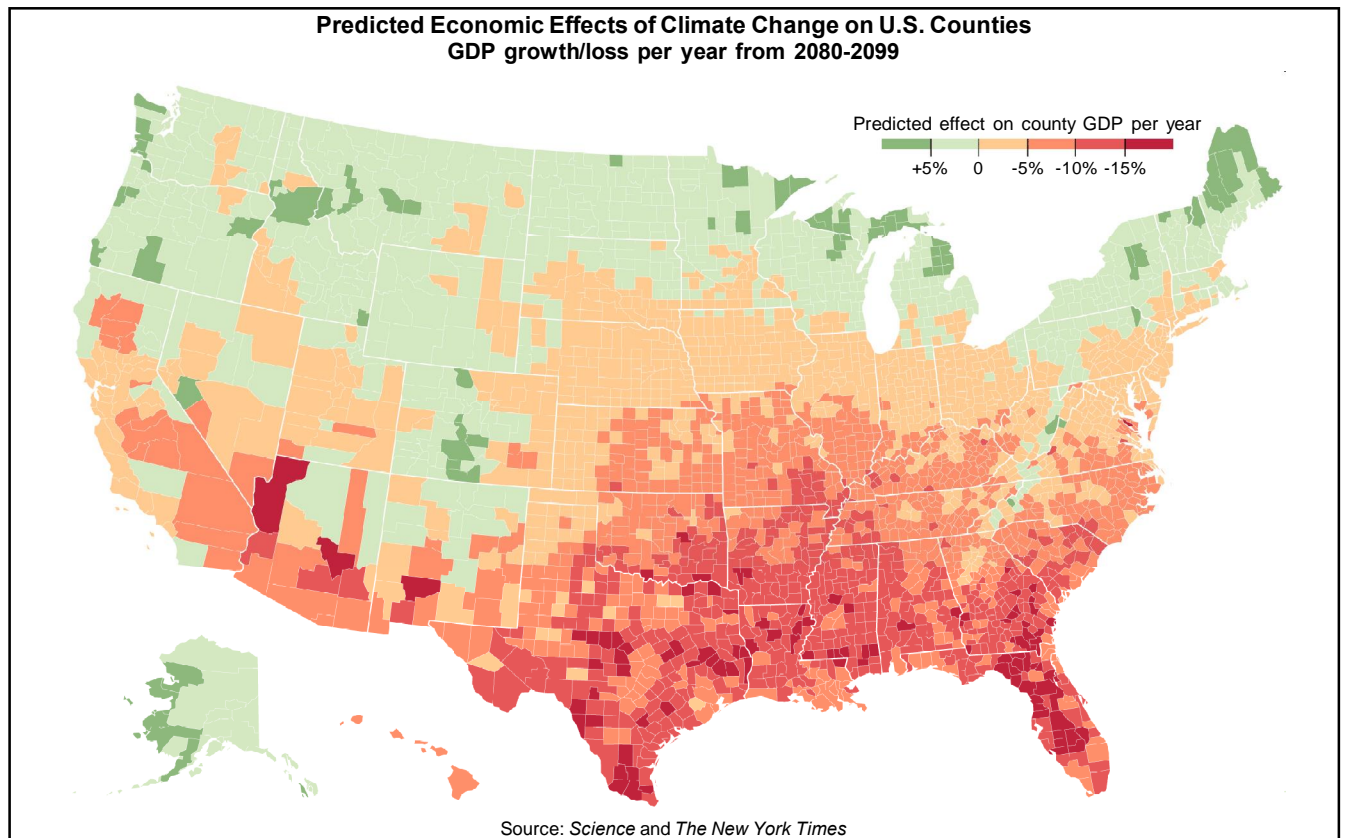
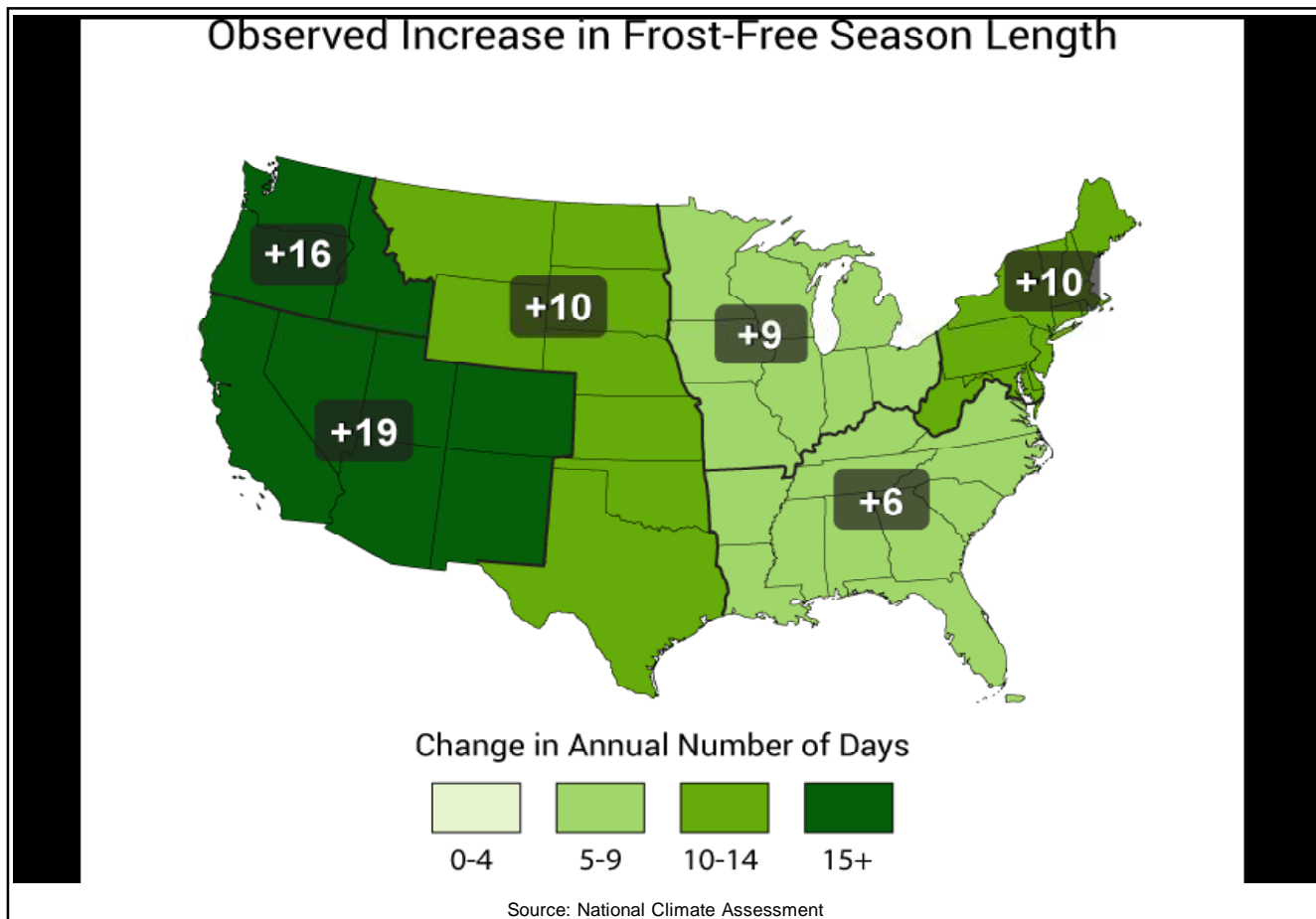




CHART 5



was negative, researchers found that states in the Northeast and West would fare relatively well, with county GDP holding steady or even gaining in some locales such as the northern parts of Maine, Vermont, New Hampshire, Michigan, Wisconsin and Minnesota as well as isolated sections of Idaho, Montana, Oregon, Washington State and Colorado—and, of course, Alaska (*Chart 4, page 31*).

Growing seasons will likely lengthen the further north and further south from the equator one travels. In the U.S., for instance, the growing season hinges in great part on the time of the last frost of the early spring and the first frost of the subsequent autumn. In New Jersey—a major grower of tomatoes, corn, apples and cranberries—the average last frost of the spring is the first week of April and the first frost of the coming winter usually falls in early November.

**Frost-Free Season Lengthens**

A recent National Climate Assessment report says the length of the frost-free season—and the corresponding growing season—has been increasing nationally since the 1980s and is projected to continue to lengthen. During the

1991-2011 years, the average frost-free season was about 10 days longer than during the 1901-1960 years (*Chart 5*).

The report notes that a longer growing season provides a longer period for plant growth and productivity and can slow the increase in atmospheric CO<sub>2</sub> concentrations through increased CO<sub>2</sub> uptake by living things and their environment. A longer growing season can increase the growth of beneficial plants such as crops and forests as well as undesirable ones such as ragweed.

In some cases where moisture is limited, the greater evaporation and loss of moisture through plant transpiration, i.e., the release of water from plant leaves, associated with a longer growing season can mean less productivity because of increased drying and earlier and longer fire seasons, the NCA report points out.

Of course, the flip side of better economic conditions in northern climates also means worsening economic conditions in the south, as we'll explore later in the second part of this report.

Greenland will also benefit from a longer growing season and improved fishing near its waters, which will be advantageous to its economy. Certain areas may experience cost savings and improved mobility from reduced snowfall and less-frequent winter storms since warmer winters may lead to reductions in snow and ice removal as well as salting requirements.

As the Arctic ice cap melts (*Chart 6*), the Arctic Ocean could become essentially ice free in summer before mid-century, and that will result in newly-accessible shipping routes between the Atlantic and Pacific Oceans, thus cutting shipping time and expenses for vessels that will no longer need to traverse the Panama and Suez Canals.

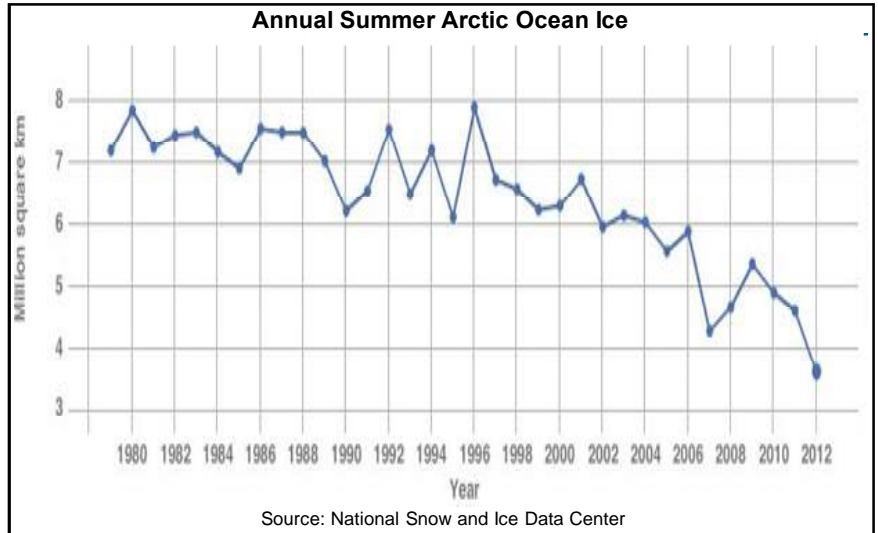
The Arctic is potentially a faster, more direct route between Asia and ports in Europe and eastern North America, with one estimate showing a reduction in travel distance of nearly one third (*Chart 7*). Between now and 2030, routes connecting North America and Europe with Japan will take an average of just over 22 days. But by midcentury, more of those routes will have shorter journey times.

Tourism in certain regions in Europe could see an uptick in summer tourism as the climate there becomes more favorable, and heating demands in presently-cold areas would decrease as winter months get milder. And winter deaths will decrease as temperatures in general rise, resulting in warmer winter climates in general.

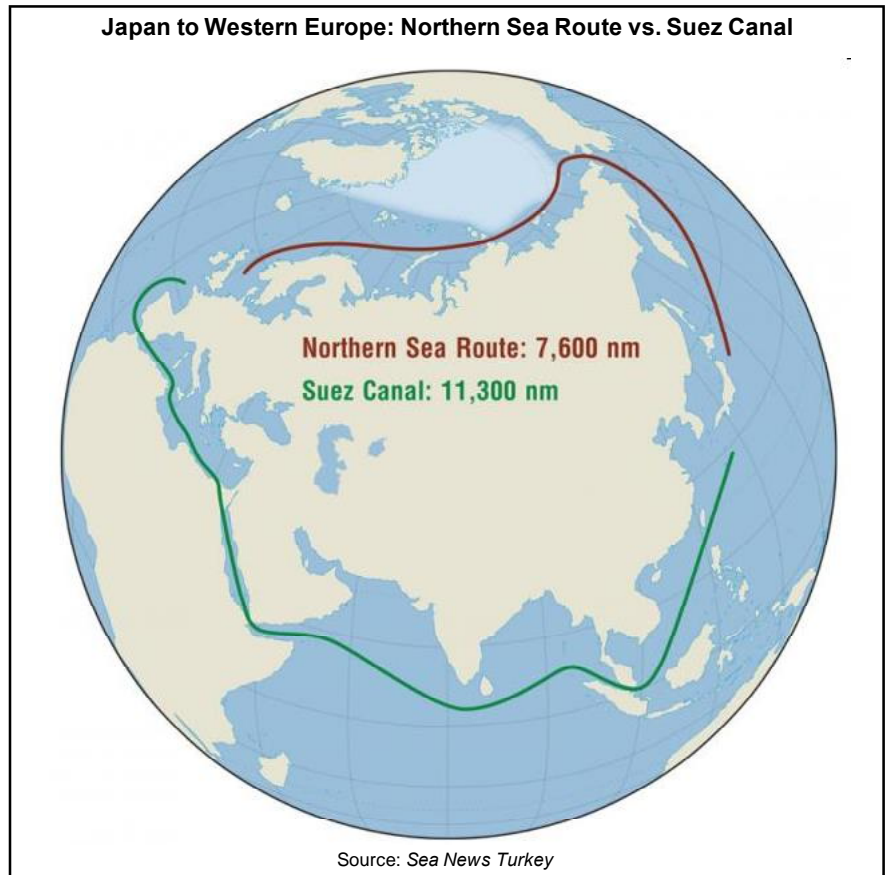
**Market-Based Solutions**

While not denying climate change outright, the general consensus of those who don't subscribe to the climate activists' agenda is to instead let the free market and new innovations lead the way in tackling any issues related to a warming planet. Analysts on this side of the argument tend to be more skeptical of the severity of the problem as well as skeptical of many of the cures—and their costs and their impacts—that are being promoted by environmental activists.

**CHART 6**



**CHART 7**



### Surprising Free-Market Advocate

Fred Krupp, the president of the Environmental Defense Fund, probably the leading environmental advocacy group and a leading voice in the climate change and global warming arena, might be one of the last people you'd expect to state that while climate change "is an urgent problem," the right approach to combatting it is not a "command-and-control solution, with governments telling companies how to retool." Instead, he argues that "the world should harness the marketplace—the most powerful force available."

In a piece for *The Wall Street Journal* in October, Krupp called for slowing deforestation and restoring damaged forests. "Forests could deliver a quarter or more of the carbon emissions reductions needed by 2030," he wrote. Krupp favors cutting short-term climate pollutants such as methane, which is responsible for a quarter of all current warming. EDF's goal is a 45% reduction in methane pollution from oil and gas by 2025, something Krupp says will deliver the same climate benefit over the next 20 years as closing a third of the world's coal-fired power plants. In order to "stop letting companies pollute for free," he calls for a carbon tax that will be "a much cheaper way of hitting climate goals than command-and-control regulations."

Krupp also points out that scientists, investors and philanthropists also are looking at ways to remove carbon dioxide directly from the atmosphere. "It's a challenge," he said, "but a system that pays a bounty for carbon soaked out of the sky would spur a race to develop and commercialize this promising concept."

### New Vision For Climate Policy

Lee Lane, in his 2014 article for *The New Atlantis*, called for a new vision for U.S. climate policy comprised of three elements. "The quest for new knowledge about the science of climate change and the technologies required to combat it is vital," he wrote. U.S. climate policy must also be "open to using the full range of available options to lessen the threat of climate change, not just greenhouse gas control." And Lane called for the U.S. to adopt "a less hubristic view of its role as a supplier of global public goods."

Both the left and the right have, for decades, "assumed that the United States can and should serve as the prime supplier of global public goods," which can include such things as fresh air, knowledge, lighthouses, national defense, flood control systems, and street lighting. "The two sides have merely disagreed about which kinds of goods were important," Lane stated, with the right has "focused on oil security and displayed a strong bent toward the use of

armed force" and the left focused on "climate change, biodiversity and human rights," with a stress on "costly domestic regulations and vague hopes about global legalism."

Lane says the world has changed, with the U.S. share of global GDP falling as developing economies mature and grow. In this environment, what is needed, he says, is a climate policy "that strives to deepen our scientific understanding of the challenges we face, to make incremental improvements where they are cost-effective, and to eschew wishful thinking about the political and scientific realities of the world in which we live."

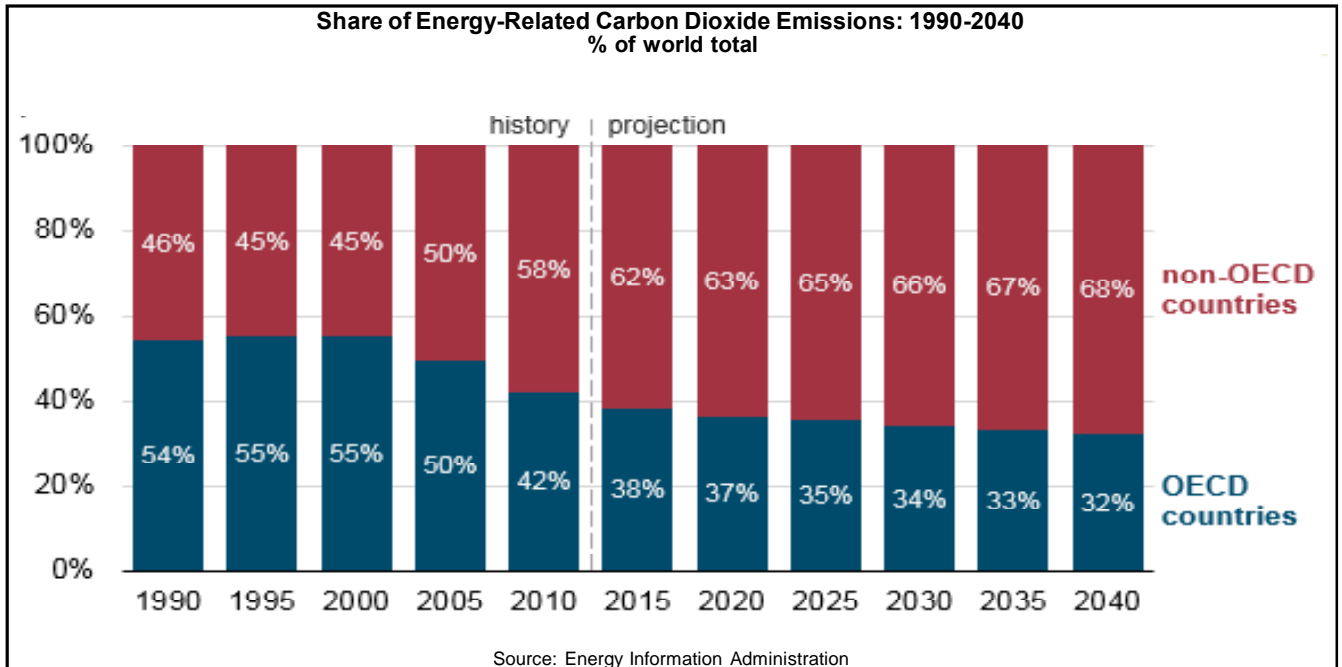
### Innovation

Marian Tupy, in an article published this past summer by the Foundation for Economic Education, a libertarian economic think-tank, notes that renewable energy is nowhere close to producing enough power to replace fossil fuels, and asks whether overall energy consumption should be limited—something he said would harm productivity and restrain growth in peoples' standards of living. He thinks not. "Market forces are actually pretty good at reducing the amount of energy used in production."

The nearly 100-fold increase in the world's economy over the past two centuries, he writes, "was powered by fossil fuels." Replacing them would be costly, Tupy says. "Just think of the hectares of land and miles of coastline that would have to be covered by wind turbines if wind energy were to produce as much energy as fossil fuels can." He also cites the unreliability of supply in downplaying the advantage of green energy. "Wind turbines need wind to turn the blades, water turbines need rain to fill the dams with flowing water and solar panels need sunshine. When nature does not cooperate, green energy becomes unpredictable and inconsistent."

Tupy says major economies and businesses have already seen the value of energy efficiency and, thus, increased environmental consciousness. Emissions of CO<sub>2</sub> per dollar of GDP have been cut by nearly a third in the U.S. since 1960, by more than half in the EU since 1991 and by 75% in China after it abandoned its communist system of production in the late 1970s. And the share of CO<sub>2</sub> emissions by advanced economies has been declining and is expected to continue doing so (*Chart 8, opposite page*). While businesses are primarily concerned with their bottom line, Tupy points out that energy consumption usually accounts for a large share of corporate expenses, giving businesses a strong incentive to cut their energy consumption.

CHART 8



Messrs. Manzi and Wehner, in their 2015 *National Affairs* article, spelled out market-based ideas for addressing climate change that focus on innovation and technology and not new carbon taxes or cap-and-trade legislation. They cited work by William Nordhaus, who in October was awarded the Nobel Prize in Economics, who found that “an optimally designed and implemented global carbon tax would provide an expected net benefit of about 0.2% of the present value of global GDP over the next several centuries. Even in Nordhaus’s theoretical world,” though, “the tax would be set at a level that would still allow about 75% of the unconstrained damages from emissions to take place, since it would be economically more damaging to set the tax high enough to prevent them.”

And the authors add that getting every nation to agree to and then enforce a global tax would require the agreement of governments ranging from the U.S. Congress and the Indian parliament to the Chinese Politburo and Vladimir Putin.

Manzi and Wehner cite the technology-driven energy revolution that America has experienced in the past decade or so, “with little inducement or guidance from Washington,” that they say has led to “the fastest rate of reduction in CO<sub>2</sub> emissions of any major country.” A series of innovations has led to the extraction of unconventional fossil fuels, the most important of which has been fracking, but also includes tight-oil extraction and horizontal drilling. And they remind that as late as the mid-2000s, “virtually no one

saw the rapid development of an alternative energy source on the horizon.”

The U.S., they wrote, was able to launch its energy revolution thanks to three core elements they say undergirded similar revolutions in information technology, biotechnology and certain other sectors: “a foundation of free markets and strong property rights; the new-economy innovation paradigm of entrepreneurial start-ups with independent financing and competitive-cooperative relationships with industry leaders; and support by government technology investments.”

Instead of a carbon tax, for instance, Manzi and Wehner favor allowing “would-be innovators to learn through trial and error,” government investment “in visionary technologies that are too long-term, too speculative or have benefits too diffuse to be funded by private companies” and promoting “greater high-skill immigration” that will “bring innovators here” and a better education system to “make innovators out of today’s young people.”

Not surprisingly, ExxonMobil, the world’s biggest energy company, prefers market-based technology and innovation as the basis for a sound climate policy. “Technological advancements that change the way we produce and use energy will be instrumental to providing the global economy with the energy it needs while reducing greenhouse gas emissions,” the company states. “And history has shown

## CHART 9

## Carbon Tax Pros and Cons

Pros	Cons
Makes polluters pay the external cost of carbon emissions	Higher tax may discourage investment and economic growth
In theory, enables greater social efficiency as we pay full social cost	May encourage tax evasion; firms polluting in secret to avoid tax
Raises revenue that can be spent on mitigating effects of pollution	It can be difficult to measure external costs, and how much tax should actually be
Encourages firms and consumers to look for alternatives, e.g., solar power	Administration costs in measuring pollution and collecting tax
Reduces environmental costs associated with excess carbon pollution	Firms may shift production to countries without a carbon tax

Source: economicshelp.org

that open, competitive markets create strong incentives for industry to invest in and develop breakthrough technologies.”

### Carbon Tax

Carbon is present in every hydrocarbon fuel—coal, petroleum and natural gas—and is converted to CO<sub>2</sub> and other products when combusted. In contrast, non-combustion sources like wind, sun, geothermal, hydropower and nuclear do not convert hydrocarbons to CO<sub>2</sub>, a heat-trapping greenhouse gas.

A carbon tax, a levy on the carbon content of fuels, has its backers and detractors (*Chart 9*), but has been seen as the most politically palatable way to control greenhouse gas emissions.

A number of countries, including the U.K., Ireland, France, Scandinavia, Spain, Portugal, Poland, Chile, South Africa and Argentina, have instituted some form of a carbon tax, and many others are seriously considering it. The number of carbon pricing initiatives implemented or scheduled for implementation has almost doubled over the past 5 years, reaching 51 countries in 2018.

Canada will soon institute a nationwide carbon tax, but some of its provinces have already done so on their own. British Columbia’s carbon tax, which was imposed 10 years ago, remains the standard-bearer for carbon taxing in the Western Hemisphere, says the Carbon Tax Center. That province taxes fossil fuels burned for transportation, home heating and electricity while reducing personal income taxes and corporate taxes by a roughly equal amount. The carbon

tax is collected at the point of retail consumption, such as at a gasoline station.

A carbon tax has been debated in the U.S. for some years and been generally favored to varying extents by both political parties, but with the word “tax” a radioactive word that politicians seeking election don’t want to be associated with, it’s never fully come to fruition on a nationwide basis. Some conservative think tanks like the Hudson Institute, the American Enterprise Institute and the Energy and Enterprise Initiative have argued in favor of carbon taxes over cap-and-trade schemes for controlling greenhouse gas emissions. But the right’s general antipathy to anything that has the word “tax” attached to it holds sway.

### No To A Carbon Tax

The CATO Institute’s Robert Murphy, Patrick Murphy and Paul Knappenberger argued against a carbon tax in a paper issued two years ago. They admit that within conservative and libertarian circles, “some proponents claim that a revenue-neutral carbon tax ‘swap’ could deliver a double dividend, reducing climate change while shifting some of the nation’s tax burden onto carbon emissions, which supposedly would spur the economy.”

The trio sees several problems with those claims. “Future economic damages from carbon dioxide emissions can only be estimated in conjunction with forecasts of climate change,” they wrote, but claim that “recent history shows those forecasts are in flux, with an increasing number of forecasts of less warming appearing in the scientific literature in the last four years.”

As a result, “the claim of a double dividend is on even shakier ground” if the case for emission cutbacks is weaker than the public has been led to believe. Claiming a consensus in the literature they examined, the authors state that “carbon taxes cause more economic damage than generic taxes do on labor or capital, so that in general even a revenue-neutral carbon tax swap would probably reduce economic growth.”

They also claim that carbon taxes have not lived up to the promises of their supporters. In Australia, a carbon tax was enacted in 2012 and then removed two years later after the public recoiled against electricity price hikes and a faltering economy. The CATO researchers call the experience in British Columbia “underwhelming,” saying the tax “has not yielded significant reductions in gasoline purchases, and it has arguably reduced the [British Columbian] economy’s performance relative to the rest of Canada.”

As a result, the CATO trio states: “Both in theory and in practice, economic analysis shows that the case for a U.S. carbon tax is weaker than its most vocal supporters have led the public to believe. At the same time, there is mounting evidence in the physical science of climate change to suggest that human emissions of carbon dioxide do not cause as much warming as is assumed in the current suite of official models. Policymakers and the general public must not confuse the confidence of carbon tax proponents with the actual strength of their case.”

Nicolas Loris, a Fellow in Energy and Environmental Policy with the Heritage Foundation, a conservative public policy think tank, criticized the idea of a carbon tax in a paper issued last month in the wake of the IPCC’s climate change report. “Levying a price on carbon dioxide will directly raise the cost of electricity, gasoline, diesel fuel and home-heating oil,” he wrote. “But the economic pain does not stop there. When considering the impact of a carbon tax on individuals, it is important to note that carbon is intertwined in all parts of life.” Loris pointed out that energy is “a necessary component for just about all of the goods and services consumed,” meaning that would “pay more for food, health care, education, clothes—you name it.”

### “Economically Cataclysmic”

He said the IPCC’s policy proposals for a carbon tax on every ton of carbon emitted of between \$135 and \$5,500 by 2030 would be “economically cataclysmic” and would bankrupt families and businesses and “undoubtedly catapult the world into economic despair.”

Heritage Foundation analysts estimated a \$37 per ton carbon tax, less than a third of the IPCC’s lowest recommendation, would reduce U.S. aggregate GDP by more than \$2.5 trillion over the next 17 years. That translates to more than \$21,000 in lost income per family while also destroying more than a million jobs, half of them in energy-intensive manufacturing sectors. “The higher the tax goes, the greater the economic damage,” the analysis concluded.

A poll by the Energy Policy Institute at the University of Chicago and the AP-NORC Center for Public Research Affairs found that only a little more than half of Americans would pay as much as a dollar a month to reduce carbon emissions. Only 27% were willing to pay \$20 per month to combat climate change. Even among households earning more than \$100,000, just 46% were willing to pay as much as \$20 a month.

The American Energy Alliance, a group that opposes increased vehicle mileage standards and higher gasoline taxes, also opposes a carbon tax for a variety of reasons. The purpose of a carbon tax, the group says, is “to make the existing energy infrastructure more expensive, forcing Americans to change how they live and work.” The AEA says more expensive energy “means more expensive goods and services,” which it says will disproportionately hurt low-income people and senior citizens while also damaging American economic competitiveness.

The group also claims a carbon tax won’t impact climate change, asserting that in British Columbia, “a carbon tax was expected to reduce gasoline consumption, but drivers simply went elsewhere to get cheaper gas, like Alberta or Washington State. And, citing calculations done by the CATO Institute in 2013, AEA says that even if the U.S. eliminated all carbon dioxide emissions, it would have a “negligible impact on the world’s climate.”

### Dismantle Capitalism To Solve Climate Change?

The Heritage Foundation takes an even dimmer view of climate change and some of the proposed solutions to address it. Nicolas Loris wrote last month in the wake of the IPCC’s climate-change warning, that “the world’s top scientist just gave rigorous backing to systemically dismantle capitalism as a key requirement to maintaining civilization and a habitable planet.”

He pointed to a 1989 news article warning that governments had a 10-year window of opportunity to solve the greenhouse gas effect or face severe coastal flooding, crop failures and an exodus of “eco-refugees” that would threaten political



chaos. Similar dire predictions were made three years ago during the push to sign the Paris climate accord, Loris said. A UN climate official at the time said, “This is the first time in the history of mankind that we are setting ourselves the task of intentionally, within a defined period of time, to change the economic development model that has been reigning for at least 150 years, since the Industrial Revolution.”

Loris retorted that the current economic development model that reigns supreme “does so for compelling reasons.” He wrote that “free, competitive energy markets drive innovation and provide the affordable, reliable energy that families and businesses need, and yield a cleaner environment.” And he is critical of international efforts to combat climate change, describing them as “centrally-planned boondoggles” that have resulted in “wasted taxpayer money, higher energy prices and handouts for preferred energy sources and technologies—all for no noticeable impact on climate.”

### Is The Sky Falling?

David Kreutzer with the Heritage Foundation wrote in September, as Hurricane Florence was hitting the Carolinas, that “in today’s hyper-politicized world of climate science, hardly a thunderstorm passes without somebody invoking the ‘scientists say’ trope to blame it on carbon emissions.” He said we are not seeing more floods, droughts, tornadoes or hurricanes “in spite of the steady rise in the small amount of carbon dioxide, and in spite of the mild warming of the planet.”

He cited an IPCC study issued before its dire October report that stated that “no robust trends in annual numbers of tropical storms, hurricanes and major hurricane counts have been identified over the past 100 years in the North Atlantic basin.” Kreutzer says there was “never a time when the climate was stable” and when weather events happened with “smooth regularity. There have always been cycles—years and decades that included large numbers of hurricanes, and others with few.”

“The fact that tragic weather events have not stopped is not evidence that carbon emissions are leading us to a climate catastrophe,” Kreutzer concluded. “Perhaps we will see a decades-long increase in one category or another, it has happened before—but that will not prove the predictions of catastrophic climate change one way or the other.”

### Cap and Trade

Cap and Trade is another system for controlling carbon emissions and other forms of atmospheric pollution by

which an upper limit is set on the amount a given business or other organization may produce, but which also allows further capacity to be bought from other organizations that have not used their full allowance.

The idea was pushed by the Obama Administration but never enacted by Congress. Even so, a number of countries including Australia, New Zealand, South Korea as well as the EU have instituted some form of cap and trade. Eleven U.S. states have adopted carbon pricing policies either as part of a regional initiative or on their own. Nine states in the northeast jointly cap power sector emissions through the Regional Greenhouse Gas Initiative and California has an economy-wide cap-and-trade system.

Opposition to the concept is similar to opposition to a carbon tax, namely that cap and trade will lead to higher energy costs, with a U.S. Senate analysis of proposed cap and trade legislation in 2007 estimating the costs to the average American household being between \$800 and \$1,300 by 2015 and then increasing to \$1,500 to \$2,500 by 2050. Opponents also claim cap and trade won’t help the environment and would have only a negligible effect on lowering the earth’s temperature.

The Heartland Institute reports that where cap and trade has been tried, specifically the EU, it hasn’t worked, with 12 of the 15 EU nations taking part in the 1997 Kyoto Protocol—which set greenhouse gas reduction targets and served as a precursor to cap and trade—failing to meet their reduction targets. Emissions for all EU countries went up an average 2.1% between 2000 and 2004, Heartland says, while emissions in the U.S., with no such regulatory regime, went up only 1.3% during the same time period.

### Climate Change From The Left: It's Getting To Be Too Late...

Climate change activists on the opposite side of the political spectrum tend to more alarmist and somewhat increasingly pessimistic that significant actions will be taken in time to stem what they feel is a looming environmental and humanitarian catastrophe. They foresee dire consequences *if* global warming accelerates and doesn't prove to be just part of a long natural cycle.

Former vice president Al Gore, a leading liberal voice on the subject, has compared global warming to “an asteroid colliding with the Earth and wreaking havoc.” He has written: “Our food systems, our cities, our people and our very way of life developed within a stable range of climatic conditions on Earth. Without immediate and decisive action, these favorable conditions on Earth could become

a memory if we continue to make the climate crisis worse day after day after day.”

Climate activists agree that, yes, the climate is always changing, but also point out that it's undeniable that the world is getting warmer and that the effects of rising temperatures are widespread and significant.

### Rising Air Temperatures and Sea Levels

NASA says that 17 of the 18 warmest years in the 136 years of recordkeeping all have occurred since 2001, with the exception of 1998. Temperatures have been rising since the Industrial Revolution (Chart 1). According to an ongoing temperature analysis conducted by scientists at NASA's Goddard Institute for Space Studies, the average global temperature on Earth has increased by about 1.4° F since 1880, and two-thirds of that warming has occurred since 1975.

But does a one-degree change really matter? Consider that a one-degree *global* change is significant because it takes a vast amount of heat to warm all the oceans, the atmosphere and the land by that much. A one- to two-degree drop was all it took to plunge the Earth into the Little Ice Age between 1300 and 1870. A five-degree drop was enough to bury a large part of North America under a towering mass of ice 20,000 years ago.

Global sea levels have been rising over the past century, according to the National Oceanic and Atmospheric Administration, and the rate has increased in recent decades. Sea levels continue to rise at a rate of about one-eighth of an inch per year, posing the most immediate threat to coastal cities and towns. The two major causes of rising sea levels are thermal expansion caused by warming of the

ocean, since water expands as it warms, and increased melting of land-based ice, such as glaciers and ice sheets.

### Melting Ice

The polar ice caps continue to shrink, with the Arctic warming at a rate twice as fast as the rest of the planet. The Arctic Ocean is expected to become essentially ice free in summer before mid-century. Large chunks of the ice shelf covering Antarctica periodically fall off, with one, in 2017, as large as Luxembourg and another, the size of Delaware. Greenland, which is almost entirely covered in ice, has been melting for the past 30 years and adding about 0.027 inches a year to global sea levels.

We saw a vivid example of a warming earth on two visits to Iceland, where we explored one of the island's massive glaciers, Mýrdalsjökull, located in the southern highlands. To get to one of its tongues, we drove a few hours outside of Reykjavik, turned off the main highway and proceeded a few miles off the beaten path to a parking area that, on our first visit in 2013, was a little over a quarter-mile from the edge of the glacial ice. We hiked toward the ice, passing a massive and deep lake formed by what had already melted in recent times.

Our guide, an Iceland resident for 20 years, informed us that 10 years earlier, the edge of the glacier was much closer to the parking area itself. A warming climate has contributed to a receding of Iceland's glaciers in general, he said, and when we returned to Mýrdalsjökull in 2016, we could see very clearly how much more melting had occurred in the intervening three years, with the edge of the glacier tongue even farther from the parking area and the adjacent lake even larger.

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**Hurricanes**

Hurricane Florence in September was just the latest of a series of recent Atlantic hurricanes that devastated the U.S. and Caribbean. Maria wreaked havoc on Puerto Rico last year and, coupled with Irma, seriously damaged St. John, U.S.V.I. Harvey flooded Houston and its environs, making that 2017 hurricane the costliest on record as it inflicted \$125 billion in damages, tying it for first place with Hurricane Katrina, which devastated New Orleans in 2005 (Chart 10).

The Accumulated Cyclone Energy Index is used to account for the strength, frequency and duration of storms, and it shows that over the past 24 years, there have been 16 above-normal hurricane seasons, according to the Earth System Research Laboratory. The 28 named storms in 2005 were the most on record for a single year. National Hurricane Center data shows there were about 90 named storms in every decade from the 1900s through the 1980s. Since then, the number has increased to 110 in the 1990s, 151 in the 2000s and 131 so far in this decade (Chart 11).

**Ocean Temperatures**

Hurricanes draw their energy from deep below the ocean’s surface at depths of 2,000 meters. The temperature at these depths is measured by Ocean Heat Content, which has risen sharply since 1970 (Chart 12), according to the National Climatic Data Center, which says the increase has been driven largely by four of the world’s major oceans. Last year was the hottest on record. The Southern Ocean around Antarctica has seen the biggest rise of OHC since 1970. Hurricanes in the Atlantic Ocean have increased in strength and rapid intensification in recent decades while the Pacific Ocean, the world’s largest, is significantly warmer than in 2017.

Warmer waters have also made the speed at which hurricanes intensify in strength faster in recent years. “Rapid Intensification” is a term used by meteorologists to describe a storm that increases its maximum sustained winds by at least 35 mph within a 24-hour period. Between 1982 and 1994, according to the National Hurricane Center, there were 10 cases of rapid intensification on average per year; between 2005 and 2017, that figure doubled to 20 cases per year.

Scientists at the National Center for Atmospheric Research developed an analysis that was published in the *Journal of Climate* of how 22 recent hurricanes would be different if they formed under the conditions that are being predicted

**CHART 10**

**Costliest U.S. Hurricanes**

	<b>Damage*</b>
Katrina (2005)	\$125.0 billion
Harvey (2017)	\$125.0 billion
Maria (2017)	\$90.0 billion
Sandy (2012)	\$65.0 billion
Irma (2017)	\$50.0 billion
Ike (2008)	\$30.0 billion
Andrew (1992)	\$27.0 billion
Ivan (2004)	\$20.5 billion
Wilma (2005)	\$19.0 billion
Rita (2005)	\$18.5 billion

\* Unadjusted \$  
Source: National Oceanic and Atmospheric Administration

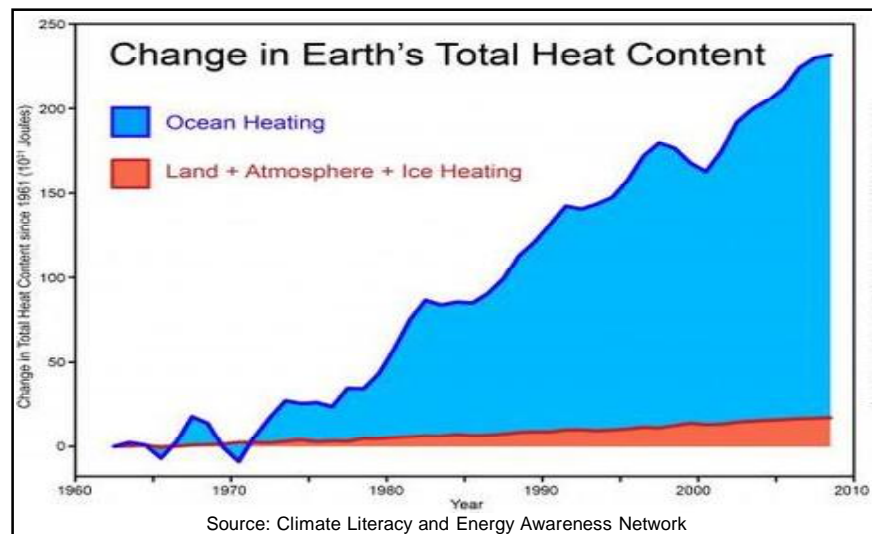
**CHART 11**

**Number of Named Atlantic Hurricanes and Tropical Storms**

1900-1909:	84
1910-1919:	61
1920-1929:	71
1930-1939:	115
1940-1949:	98
1950-1959:	104
1960-1969:	95
1970-1979:	95
1980-1989:	93
1990-1999:	110
2000-2009:	151
2010-present:	131*

\* Through mid-September 2018 Source: National Hurricane Center

**CHART 12**



for the late 21st century. While each storm's transformation would be unique, on balance, the study found that hurricanes would become a little stronger, a little slower-moving, and a lot wetter.

Hurricane Ike, for example, which killed more than 100 people and devastated parts of the U.S. Gulf Coast in 2008, could have 13% stronger winds, move 17% slower, and be 34% wetter if it formed in a warmer climate. Other storms might become slightly weaker or move slightly faster, but none would become drier, the study further found, with the rainfall rate of simulated future storms increasing by an average of 24%.

### **Economic Effects**

The effects of a warming planet are being clearly felt and seen now—not just during hurricane season or during severe and powerful winter storms. Agriculture, transportation, the economies of coastal cities, global income inequality, population shifts and military policy are all subject to the rise in temperatures and sea levels and will be even more so in future years.

#### **1. Effects on Agriculture**

Climate change impacts agriculture in numerous ways as average temperatures, rainfall and climate extremes on both the hot and cold ends all increase. These factors are leading to changes in atmospheric carbon dioxide and ozone levels, pests and diseases and sea levels and threatening already-vulnerable regions with more drought conditions.

As noted earlier, there are a few agricultural benefits from warming temperatures. But while several northern and western U.S. states may benefit from milder winters and longer frost-free seasons (Chart 5), a study in the journal *Science* that analyzed the economic impacts of climate change on the U.S., county by county, concluded that states in the south and midwest could be hard hit (Chart 4).

The researchers estimated that the U.S. could face damages worth 0.7% of GDP per year by the 2080s for every one degree Fahrenheit rise in global temperature. And the worst-hit counties, mainly in agricultural states that already have warm climates like Texas, the Gulf Coast states and Florida, could see losses worth 10% to 20% of GDP, or more, if emissions continue to rise unchecked.

But a 2001 Intergovernmental Panel on Climate Change report concluded that the world's poorest countries would be hardest hit by higher temperatures, with reductions in crop yields in most tropical and sub-tropical regions due to

decreased water availability and new or changed incidents of insect pests.

In Africa and Latin America, many rain-fed crops are near their maximum temperature tolerance, meaning that yields are likely to drop sharply for even small climate changes. The IPCC report projects declines in agricultural productivity of up to 30% during this century and says further that marine life and the fishing industry will also be severely affected in some places.

Climate change caused by increasing greenhouse gases is likely to affect crops differently from region to region, with average crop yield under one scenario expected to drop down to 50% in Pakistan while corn production in Europe is expected to grow up to 25%.

The IPCC report says a changing and warming climate could lead to an increase in pest insect populations, harming yields of staple crops like wheat, soybeans and corn. Insects that previously had only two breeding cycles per year could gain an additional cycle, and set off a population boom, if warm growing seasons get longer.

Future climate change will likely negatively affect crop production in low-latitude countries while the outlook is mixed for those in northern latitudes, the IPCC says. Climate change will also probably increase the risk of food insecurity for some vulnerable groups, such as the poor. A study by the UN World Food Program lists food availability, access, utilization and stability as being at risk from climate change.

A 2008 study published in *Science* suggested that a warming climate could result in southern Africa losing “more than 30% of its main crop, maize, by 2030. In South Asia, losses of many regional staples, such as rice, millet and maize could top 10%.”

A University of Illinois study measures the effect of warmer temperatures on soybean plant growth and Japanese beetle populations. Warmer temperatures and elevated CO<sub>2</sub> levels were simulated for one field of soybeans while the other was left as a control. The study revealed that the soybeans with elevated CO<sub>2</sub> levels grew much faster and had higher yields, but also attracted Japanese beetles at a significantly higher rate than the control field. The beetles in the field with increased CO<sub>2</sub> also laid more eggs on the soybean plants and had longer lifespans, indicating the possibility of a rapidly-expanding population.

## Africa

Africa's geography makes it particularly vulnerable to climate change, the IPCC says, and 70% of the population rely on rain-fed agriculture for their livelihoods. A report on climate change in Tanzania says that areas that usually get two rainfalls in the year will probably get more, and those that get only one rainy season will get far less. As of 2005, the net result was expected to be that 33% less maize—Tanzania's main crop—would be grown.

## Asia

In East and Southeast Asia, the IPCC projects crop yields could increase up to 20% by the middle of this century. On the other hand, in Central and South Asia, the projections suggested that yields might decrease by up to 30% over the same time period. Taken together, the risk of hunger was projected to remain very high in several developing countries.

Rice-growing economies are at risk due to climate change. An analysis of rice yields by the International Rice Research Institute forecasted 20% reduction in rice yields over the region for every one-degree Celsius increase in temperature. Rice becomes sterile if exposed to temperatures above 35 degrees for more than one hour during flowering and consequently produces no grain.

Climate change could lead to decreased livestock production in Bangladesh due to diseases, scarcity of forage, heat stress and breeding strategies.

## Australia

The IPCC report said that without further adaptation to a changing and warming climate, the impact on Australia and New Zealand could be "substantial." By 2030, production from agriculture and forestry was projected to decline over much of southern and eastern Australia and over parts of eastern New Zealand. In New Zealand, initial benefits were projected close to major rivers and in western and southern areas of that country.

## Europe

The IPCC projects that in Southern Europe, climate change would reduce crop productivity; in Central and Eastern Europe, forest productivity was expected to decline; and in Northern Europe, the initial effect of climate change was projected to increase crop yields.

## Latin/South America

Livestock and grains—maize, wheat, soybeans and rice—are the major agricultural products in Latin and South America, and IPCC forecasts that increased temperatures and altered hydrological cycles will result in shorter growing

seasons, overall reduced biomass production and lower grain yields. Brazil, Mexico and Argentina contribute 70% to 90% of total agricultural production in region and in these and other dry regions, maize production is expected to decrease. Wheat is anticipated to decrease in Brazil, Argentina and Uruguay. Livestock, which is the main agricultural product for parts of Argentina, Uruguay, southern Brazil, Venezuela and Colombia, is also likely to be reduced.

## North America

The IPCC report projects that over the first few decades of this century, moderate climate change would increase aggregate yields of rain-fed agriculture by 5% to 20%, but would vary among regions. Major challenges were projected for crops that are near the warm end of their suitable range or which depend on highly-utilized water resources.

Droughts are becoming more frequent and intense in arid and semi-arid western North America as temperatures rise, hastening the timing and magnitude of spring snow melt floods and reducing river flow volume in summer. An academic study out of the Colorado State University said the direct effects of climate change include increased heat and water stress, altered crop phenology and disrupted symbiotic interactions, adding that these effects may be exacerbated by climate changes in river flow, and the combined effects are likely to reduce the abundance of native trees in favor of non-native herbaceous and drought-tolerant competitors and reduce the habitat quality for many native animals. Climate change effects on human water demand and irrigation may intensify these effects.

## U.S.

The U.S. Global Change Research Program in 2009, assessing studies on the impacts of climate change on agriculture in the United States, found that many crops will benefit from increased atmospheric CO<sub>2</sub> concentrations and low levels of warming, but that higher levels of warming will negatively affect growth and yields. Extreme weather events will likely reduce crop yields while weeds, diseases and insect pests will benefit from warming temperatures and will require additional pest and weed control.

## Glacier Melting

The world's glaciers are melting, as we saw first-hand during our Iceland trips. The IPCC says that in the areas heavily dependent on water runoff from glaciers that melt during the warmer months, a continuation of the current retreat will eventually deplete the glacial ice and substantially reduce or eliminate runoff. A reduction in runoff will affect the ability to irrigate crops and will reduce summer

stream flows necessary to keep dams and reservoirs replenished.

## 2. Effects on Transportation

A 2016 analysis by the U.S. Environmental Protection Administration concluded that climate change is likely to damage transportation infrastructure through higher temperatures, more severe storms and flooding, and higher storm surges, affecting the reliability and capacity of transportation systems. Coastal roads, railways, ports, tunnels and airports are vulnerable to a rise in sea level, which could lead to delays as well as temporary and permanent closures. And the EPA study said climate change impacts will likely increase the cost of America's transportation systems.

### Marine Transportation

The EPA study said that climate changes will likely affect marine transportation infrastructure and logistics "in many ways, both positive and negative." Increasing temperatures could reduce the amount of sea ice in many important shipping lanes, such as the Arctic and other northern areas, thus extending the shipping season and shortening shipping distances, as noted earlier.

It's estimated that a sizable amount of crude oil and natural gas deposits lie under the Arctic, and the melting of the ice cap may result in claims by several nations—the U.S., Russia and Canada, to name a few—that they have the right to explore for those energy sources.

The EPA report says that shipping lanes experiencing a rise in sea level will be able to accommodate larger ships, reducing shipping costs. But higher sea levels will also mean lower clearance under waterway bridges, and ships could face weight restrictions as channels become too shallow.

Changes in precipitation can affect shipping in a variety of ways, the study found. Flooding could close shipping channels, and increased runoff from extreme precipitation events could cause silt and debris to build up, leading to shallower and less accessible channels. Channels that are not regularly maintained or have a lower capacity to store sedimentation are more vulnerable to abrupt disruptions in service. More severe storms could also increase disruptions in marine travel and shipping. In areas experiencing increasing drought, water levels could periodically decrease, limiting inland shipping on rivers.

### Air Transportation

Periods of extreme heat can affect aircraft performance and may cause airplanes to face cargo restrictions, flight

delays and cancellations, the EPA said, adding, though, that warmer weather in winter will reduce the need for airplane de-icing.

In the winter and spring, increased rains and flooding may also disrupt air travel. Severe storms can force entire airports to close, as occurred along the Gulf Coast during Hurricane Katrina in 2005 and throughout the Northeast during Superstorm Sandy in 2012. Climate change may increase the frequency of such closures and the number of airports that could be affected.

Furthermore, flooding may damage facilities, including airstrips. Thirteen of the 47 largest U.S. airports have at least one runway within 12 feet of sea level, making them particularly vulnerable to coastal storm surge and inundation. For example, in the New York-New Jersey region, many critical transportation infrastructure facilities, including Newark and LaGuardia airports, lie within the range of current and projected 50-year coastal storm surges. A typhoon in September caused severe runway flooding that closed Kansai International Airport in Osaka, Japan.

Many airstrips in Alaska are built on permafrost, but warmer temperatures will thaw the permafrost and cause the ground to settle, potentially damaging the foundation and structure of key infrastructure. Runways and airports may require rebuilding, relocation, or increased maintenance, the EPA study stated.

### Land Transportation

Higher temperatures can cause pavement to soften and expand, the EPA analysis said, which can lead to roadway damage such as potholes and put stress on bridge joints while heat waves can limit construction activities, particularly in areas with high humidity. As a result, it could become more costly to build and maintain roads and highways.

On the other hand, certain areas may experience cost savings and improved mobility from reduced snowfall and less-frequent winter storms since warmer winters may lead to reductions in snow and ice removal, as well as salting requirements.

Heavier rainfalls, though, may result in flooding, which could disrupt traffic, delay construction activities and weaken or wash out the soil and culverts that support roads, tunnels, and bridges. Road infrastructure in coastal areas is particularly sensitive to more frequent and permanent flooding from a rise in sea levels and storm surges. The EPA estimates that some 60,000 miles of coastal roads in the U.S. are already exposed to flooding from coastal



storms and high waves. Furthermore, major highways in coastal areas serve as critical evacuation routes that must be protected from flooding and damage so they may be used for emergencies.

In some places, warmer temperatures are projected to cause more winter precipitation to fall as rain instead of snow. Winter flooding could occur more frequently if the frozen ground cannot absorb precipitation. Landslides could also occur more frequently as saturated soils are exposed to more rainwater. Drought in areas such as the Southwest could increase the likelihood of wildfires that reduce visibility and threaten roads and infrastructure, the EPA report said.

### 3. Effects on Coastal Areas

Coastal areas, particularly along the Atlantic Ocean and Gulf of Mexico, are sensitive to higher sea levels, changes in the frequency and intensity of storms, increases in precipitation and warmer ocean temperatures. Rising atmospheric concentrations of CO<sub>2</sub> are causing the oceans to absorb more of the gas and become more acidic, which has significant impacts on coastal and marine ecosystems.

Accelerating sea level rise in the lower 48 states, primarily driven by climate change, is projected to worsen tidal flooding, putting as many as 311,000 coastal homes with a collective market value of about \$117.5 billion at risk of chronic flooding within the next 30 years, according to a recent report by the Union of Concerned Scientists. Some 14,000 coastal commercial properties assessed at a value of about \$18.5 billion also are at risk during that time frame. By the end of the century, homes and businesses currently worth more than \$1 trillion could be at risk: as many as 2.4 million homes valued at approximately \$912 billion and 107,000 commercial properties assessed at \$152 billion.

“For some communities, the potential hit to the local tax base could be staggering,” said Kristy Dahl, senior climate scientist at UCS and a co-author of the report. “Some smaller, more rural communities may see 30, 50, or even 70% of their property tax revenue at risk due to the number of chronically-inundated homes. Tax base erosion could create particular challenges for communities already struggling with high poverty rates.”

#### Sea Levels

Since 1901, global sea level has risen approximately eight inches. Some of the fastest rates of relative sea level rise in the U.S. are occurring in areas where the land is sinking, including parts of the Gulf Coast. Coastal Louisiana has seen its relative sea level rise by eight inches or more in the

last 50 years, which is about twice the global rate. Subsiding land in the Chesapeake Bay area worsens the effects of relative sea level rise, increasing the risk of flooding in cities, inhabited islands and tidal wetlands. A recent study painted a grim picture of how a powerful hurricane could slam into the Virginia Beach area and cause a storm surge in the Chesapeake that could push a wall of water 150 miles up the Potomac River to Washington, D.C. and seriously flood the low-lying capital city.

A 2017 analysis by Climate Central listed the top 25 U.S. cities most vulnerable at present to coastal flooding. New York City was tops, with the next 13 on the list being cities in Florida, including Miami, St. Petersburg, Fort Lauderdale and Hollywood. In fact, of the 25 cities on the list, 22 were in Florida, where the average elevation is about six feet above sea level and the Sunshine State’s highest point is a mere 345 feet. That same study lists most of the same 25 cities, along with Virginia Beach and Norfolk, as being most vulnerable to coastal flooding in 2050. Low-lying Florida and Louisiana, along with Illinois, are the three U.S. states with buildings that are taller than their highest natural elevation.

The EPA report also noted that increasing populations and development along the coasts increase the vulnerability of coastal ecosystems to rising sea levels. “Development can block the inland migration of wetlands in response of sea level rise, and change the amount of sediment delivered to coastal areas and accelerate erosion,” the report stated. Coastal Louisiana lost approximately 2,000 square miles of wetlands in recent decades due to human alterations of the Mississippi River’s sediment system and oil and water extraction that has caused land to sink. As a result of these changes, wetlands do not receive enough sediment to keep up with rising seas and may no longer function as natural buffers to flooding. The EPA also warns that rising sea level also increases the salinity of ground water and pushes salt water further upstream, affecting freshwater supplies.

#### Warming Waters

Coastal waters have warmed during the last century, a trend that’s very likely to continue—potentially by as much as 4° to 8°F. This warming may lead to big changes in coastal ecosystems, the EPA warns, and affect species that inhabit these areas.

Warming U.S. coastal waters also cause suitable habitats of temperature-sensitive species to shift northward. Pollock, halibut, rock sole, and snow crab in Alaska and mangrove trees in Florida are a few of the species whose habitats have already begun to shift, the EPA report points out. And

suitable habitats of other species could also shift, because they cannot compete for limited resources with the southern species that are moving northward.

#### 4. Effects on Population

Where people live influences their vulnerability to climate change, the EPA stated in a report, noting that over the past four decades, U.S. population has grown rapidly in coastal areas and in the southern and western regions. “These areas are most sensitive to coastal storms, drought, air pollution, and heat waves,” the report stated. Populations in the Mountain West will likely face water shortages and increased wildfires in the future while Arctic residents will likely experience problems caused by thawing permafrost and reduced sea ice—although winter temperatures will be less intense. Along the coasts and across the western United States, both increasing population and changes in climate place growing demands on transportation, water, and energy infrastructure.

#### Aging Population

Climate change will impact people in varying ways. Those living in poverty may have a difficult time coping with changes, the EPA report stated, since they have limited financial resources to cope with heat, relocate or evacuate, or respond to increases in food costs. Older adults may be among the least able to cope with impacts of climate change. This population is particularly prone to heat stress, says the Centers for Disease Control. Older residents make up a larger share of the population in warmer areas of the United States that will likely experience higher temperatures, tropical storms or extended droughts in the future, *i.e.*, Florida, the Carolinas, the Gulf Coast and the Southwest, and in some cases their only option may be to move back north—or not move south when retiring. Young children are another sensitive age group since their immune system and other bodily systems are still developing and they rely on others to care for them in disaster situations.

#### Urban Dwellers

It's estimated that about two-thirds of the U.S. population live in urban areas that are sensitive to climate change. For one, heat waves can be amplified in cities because cities absorb more heat during the day than suburban and rural areas. As a result, increases in heat waves, drought or violent storms in cities would affect a larger number of people than in suburban or rural areas. City dwellers may also be particularly susceptible to vulnerabilities in aging infrastructure, including drainage and sewer systems, flood and storm protection assets, transportation systems and power supply during periods of peak demand, which typically occur during summer heat waves.

#### Population on the Move

A 2012 report by Population Action International noted that while people have always moved from place to place in search of greater opportunity, “climate change is expected to trigger larger and more complex waves of human migration.” Estimates of future “climate migrants” range from 200 million to 1 billion by 2050.

Climate change is considered a “threat multiplier” by experts in the security community, and climate-induced mass migration can contribute to heightened tension in the world. Impaired access to food and water and severe weather are challenges that have historically led to tension and conflict. As more and more people are displaced or compelled to migrate in the face of these challenges, political, ethnic and religious tensions may result, the report warns.

Population displacement due to climate change will take different forms and require different responses. Millions may be forcibly displaced in response to climate events such as floods, extreme weather and rises in sea levels, which over time could render entire populations stateless, the PAI report states. Others will migrate due to more gradual changes such as shifting temperature and rainfall patterns that affect water supply and agricultural production.

A new World Bank report projects that tens to hundreds of millions of people fleeing the gradual effects of climate change will shift centers of population within many countries in Latin America, South Asia and sub-Saharan Africa. If greenhouse gas emissions remain high, as many as 143 million “internal migrants” might move within their own countries, the report says, comprising as much as 3.5% of the total population of those regions by 2050, and that movement of people could accelerate after 2050. Many will relocate within their countries from lowlands to higher ground, forced to move by rising sea levels and storm surges along with lowered crop productivity due to increasing heat and declining water availability.

Researchers from Penn State University, the University of North Carolina-Chapel Hill and the International Food Policy Research Institute, in a study published in *Global Environmental Change*, examined the effects of climate change on human migration in South America, and found that abnormally high and low temperatures increased the need to migrate to more favorable climates.

In the U.S., states like Arizona, Texas, the Gulf Coast states and Florida that are already in hot locales could see a migration to the north as temperatures rise. Matthew



economic strata to subsidize wealthier households buying a Tesla.

Poorer people and families in Europe typically don't own houses and therefore cannot actively invest in publicly-subsidized solar panels, energy-efficiency measures or car charging stations. And even if they own houses, they do not have access to capital to finance these additional investments. As a result, poorer Europeans will pay an increasing share of their low income on pollution penalties while richer households can afford to invest in switching away from fossil fuels to avoid paying higher carbon taxes. Thus, the cost of increasingly aggressive climate policies instituted by governments on the Continent would fall disproportionately on poorer households.

## 6. Effects on Military Policy

The U.S. military, not exactly a bastion on dreamy-eyed liberal ideology, nonetheless has been aware of the risks of climate change for the past several decades. In a report four years ago, the Department of Defense said climate change poses "immediate risks" to national security and will have broad and costly impacts on the way the U.S. military carries out its missions. Indeed, military planners have been actively working for a number of years already to avoid and adapt to the worst effects of climate change, including flooding, extreme heat, extreme weather and more.

Rising seas could have profound effects on military operations. A 2016 report conducted by a military expert panel and published by the Center for Climate and Security Policy Institute found that rising sea levels could flood parts of military bases along the East and Gulf coasts for up to three months a year as soon as 2050, something that could affect military infrastructure, training and operations. Sea level increases and storm surges could interfere with amphibious landings and navigational safety, and cause power outages that affect transportation, command and control and intelligence centers.

Globally, rising sea levels will cause more flooding and could also displace populations in many regions, prompt mass migrations and destabilize vulnerable countries, as noted earlier, and result in the U.S. military increasingly being called upon to provide humanitarian aid or disaster relief.

Rising temperatures and more extreme weather will threaten military training, disrupt supply chains, result in higher heating and cooling costs, and could affect intelligence, surveillance and reconnaissance capabilities, the study said. Warmer temperatures will increase the incidence of pests and diseases, stress land and water resources, and exacerbate

health and safety risks for military personnel around the world. Extreme weather will also mean more maintenance and repair for runways and roads, infrastructure and equipment.

## Arctic Region

With the Arctic warming up much faster than the rest of the planet, the melting of sea ice is opening the Arctic Ocean up to new opportunities for oil and gas exploration, fishing and tourism—and conflicts between nations operating in the region. This will make it necessary for the U.S. military to be active in the area to ensure the free passage of ships, the safety of people working there and the protection of the environment.

Furthermore, a warming planet and an Arctic region newly accessible to ships will result in new military strategies for transporting troops, fighting wars and mapping out supply chains.

## 7. What Are States Doing?

Trump has announced plans to pull the U.S. out of the 2015 Paris accord, that aims to keep global temperatures from rising more than 2° Celsius, and has shrugged off the issue as nothing more than a Chinese hoax. Meanwhile, his EPA seems fairly uninterested in the matter as it deregulates polluting industries.

The states have thus taken the reins in addressing and trying to combat climate change. Eleven states, plus Washington, D.C. and Puerto Rico, are pursuing policies that will uphold the country's commitments to the accord. They've joined the United States Climate Alliance, a bipartisan group that seeks to reduce greenhouse-gas emissions nationwide (*Chart 13, opposite page*). Another unnamed group, which includes dozens of cities, university presidents and business leaders, also pledged to work towards the emissions reduction goals that the U.S. set as part of the accord.

California last month enacted a law to mandate carbon-free electricity by 2045. Twenty states, some one hundred cities and a thousand companies have already set targets for reducing the greenhouse effect, according to America's Pledge, an initiative launched by former New York mayor Michael Bloomberg and California Governor Jerry Brown.

Last year, the We Are Still In group was launched in response to Trump's withdrawal from the Paris Agreement. This coalition, which numbers more than 3,500 institutions across government, the private sector, faith communities and higher education institutions in all 50 states, aims to reduce emissions in their states, businesses, and institutions by pushing for compliance with the Paris Agreement.

## Commentary

### Rudolph vs. Mr. Rogers

December is the Holiday Season. It used to be called the Christmas Season but retailers substituted “Holiday” to not offend non-Christians. Furthermore, the 12 days of Christmas don’t start until December 25 and run until January 6. In the Western Christian calendar, December is the season of Advent. It’s my favorite season, and it has to be for a career-long forecaster since in Advent, we look forward—forward—to the birth of Jesus and to his Second Coming.

For most Americans, there’s little left of the Christian significance of Christmas as it’s become the season of mass retailing. “Black Friday” is so named because it’s the day retailers cover their cumulative costs for the year and their profits move into the black. Cyber Monday might as well be a holiday for many since they spend most of their time ordering online.

Even in Christian tradition, Christmas never ranked with Good Friday, Easter or Pentecost when the Holy Spirit arrived to replace the physical Jesus in Christians’ lives. The rise of Christmas as a secular holiday, focused on family and friends, led the Puritans in England and New England to ban its observance.

The Gospel of Mark, the earliest written, as well as John’s don’t even mention Christmas. As far as gift-giving, Jesus was God’s gift to mankind but human gifts originated with the Wise Men, and their gifts of gold, frankincense and myrrh are celebrated not on Christmas, but on Epiphany, January 6. And gift-giving only started in the 15th century.

Still, despite the commercialism, who can complain about the warm seasonal

spirit and 20 more Hallmark Christmas movies? Nevertheless, some aspects of today’s Christmas celebration are downright anti-Christian. Read carefully the words of the popular Christmas song, “Rudolph the Red Nosed Reindeer.”

*Rudolph, the red-nosed reindeer  
had a very shiny nose  
and if you ever saw it  
you would even say it glows.*

*All of the other reindeer  
used to laugh and call him names  
They never let poor Rudolph  
play in any reindeer games.*

*Then one foggy Christmas eve  
Santa came to say:  
“Rudolph with your nose so bright,  
won’t you guide my sleigh tonight?”*

*Then all the reindeer loved him  
as they shouted out with glee,  
Rudolph the red-nosed reindeer,  
you’ll go down in history!*

The other reindeer mocked Rudolph because he was different and they didn’t accept him as he was. Only after he saved Santa one foggy Christmas Eve was he not only accepted, but celebrated. In contrast, a basic belief of Christianity is that each of us matters, that God accepts us as we are, warts and all.

Fortunately, Mr. Rogers emphasized this conviction, as we’re all reminded with the new movie, “Won’t You Be My Neighbor?” Fred Rogers graduated from Pittsburgh Theological Seminary and was a trained composer and pianist, but wasn’t an ordained minister.

“Mister Rogers Neighborhood,” first broadcast on public television in 1968, always began with him singing, “It’s a beautiful day in the neighborhood” and “Won’t you please? Won’t you please? Please won’t you be my neighbor?”

His low-key friendliness was infectious but he wasn’t shy about being a role model or a benevolent authority figure. He encouraged children to talk honestly about their emotions and to trust the people with whom they shared them.

He emphasized the specialness of everyone—that fundamental Christian belief—and had an unwavering commitment to the value of kindness in a world that seems intent on devising new ways to be mean. He told his viewers, “You make each day a special day. You know how, by just your being you. There’s only one person in this whole world like you. And people can like you exactly as you are.”

Mr. Rogers took his young viewers by trolley to the Neighborhood of Make-Believe, inhabited by his puppet alter egos, but then always returned them to reality at the end of his show. When they were young, our four kids were mesmerized by Mr. Rogers, and my wife and I believe it gave them confidence as they began to realize that the world is a very competitive place where kindness and respect for others is often in short supply.

Commercial TV pursued Mr. Rogers and his increasingly popular public TV show but he refused to risk interference with his fundamental message to children. He died of stomach cancer in 2003 at age 74, but fortunately after being awarded the Presidential Medal of Freedom, the nation’s highest civilian honor.

As we move from Advent to Christmas, I hope you’ll minimize the commercialism and certainly the reindeers’ hero worship of Rudolph. Instead, concentrate on the love of God as shown by the birth of Jesus and witnessed by Mr. Rogers.

