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February 28, 2018

To Our Clients and Friends:

The Monthly Letter covers three topics this month. First, we look at the Federal Reserve and its moves to restore the economy to a state where it can apply traditional monetary policy. Second, the traditional products for the Semiconductor Industry, such as PCs, Laptops, and Smartphones, have matured with some entering declines. With the Cloud expected to have captured 90%+ of all computing loads by 2021, the industry needs new growth drivers. These appear to be emerging in fields as diverse as Artificial Intelligence, Electric Vehicles, and the Internet of Things, which should underpin the industry's growth for the next decade. Third, the economy is finally in a Late Cycle position. And while inflation should pick up, so should economic growth and productivity as companies move to invest in their businesses for the first time in a decade and the US begins to update and modernize its infrastructure for the first time since 2007. And Fourth, as always, we close with brief comments of interest to our readers.

The Federal Reserve: Back on the Highway

"*Velocity is a function of real income and the interest rate. Consider first the effects of a change in the interest rate on velocity. An increase in the interest rate reduces the demand for real balances and therefore increases velocity: when the cost of holding money increases, money holders make their money do more work, and thus turn it over more often.*

The way in which chages in real income affect velocity depends on the income elasticity of the demand for money…[W]e have seen that the income elasticity of the demand for money is less than 1. That means that velocity increases with increases in real income…

The empirical work reviewed in Section 7-4 makes it clear that the demand for money and, therefore, also velocity do react systematically to changes in interest rates and the level of real income. The empirical evidence therefore decisively refutes the view that velocity is unaffected by changes in interest rates and that fiscal policy is, accordingly, incapable of affecting the level of nominal income… [E]xpansionary fiscal policy can be thought of as working by increasing interest rates, thereby increasing velocity, and thus making it possible for a given stock of money to support a higher level of GNP."

Macro-Economics
Chapter 7: The Demand For Money
By Rudiger Dornbusch and Stanley Fischer, 1981
(Stanley Fishcher, Vice Chair Federal Reserve, 2014 – 2017)

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Over the past 10 years, the Federal Reserve relived its 1930s experience in a nostalgic return to yesteryear. The financial system went broke. The demand for money rose. And interest rates and velocity collapsed. The only missing ingredient from this nostalgic cocktail was deflation. That bugaboo from the 1930s that bankrupted a large portion of the economy and sent unemployment soaring to over 25%. To prevent a repeat of deflation, the Fed massively expanded the monetary supply to offset the decline in credit growth and the velocity of money. Using this “Quantitative Easing” (QE), the Federal Reserve prevented true deflation from spreading across the economy and undermining the ability of businesses to fund their operations and to repay their debts. In addition, by artificially creating negative interest rates, the US central bank intervened to stimulate the economy in the absence of federal action to support final demand and jumpstart economic growth. And finally, by providing life support to the patient, the Federal Reserve put a backstop under the consumer and the housing market turning the tide and setting in motion a massive recovery in housing prices. All of this from printing little pieces of paper.

However, as with anything, any good idea taken to an extreme becomes a bad idea. After successive bouts of QE, the Fed faced that old saw, the law of diminishing returns. In addition, with a change in Congress and the Presidency, the federal government once more moved to support the economy by growing Federal spending and enacting a tax cut. In this environment of supportive economic policies and the ensuing faster economic growth, having negative real interest rates that stimulate the economy further makes no sense in a late cycle economic environment. With this as background, the Federal Reserve is moving to normalize interest rates slowly but surely.

The reason to normalize interest rates now comes down to velocity and inflation. Velocity is the speed at which all the little pieces of paper representing currency circulate in the economy. And inflation is the lagged result of rising tightness for goods, services, and labor in the economy. With inflation on the rise from fundamental economic forces and growth accelerating due to the pro-cyclical policies enacted at the federal level, velocity should increase, reinforcing the upward move in inflation. There is a simple equation for velocity:

$$MV = PQ$$

In other words, Money times Velocity, which is how quickly money turns over in the economy, equals the Quantity of goods times the Price. The Federal Reserve used QE to put lots of Money into the US economy to offset the decline in Velocity that occurred post the recession due to the bankruptcy of the US financial system and the need to recapitalize the banking system. The following chart from the Federal Reserve Economic Database shows how Velocity slowed post-Recession:

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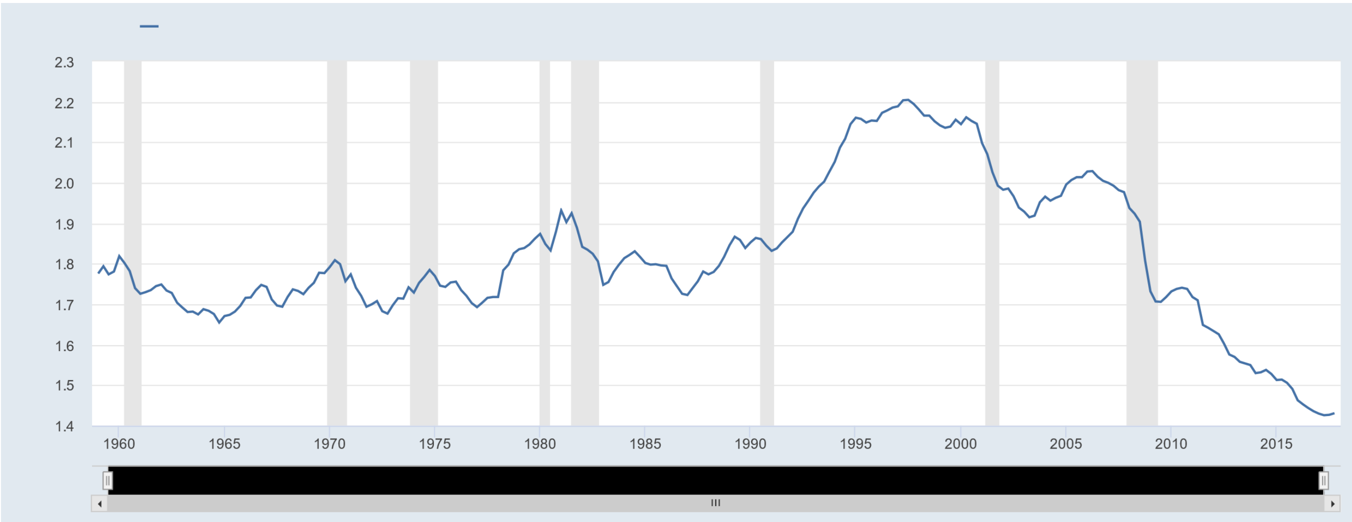

Velocity of M2. Chart Courtesy of Federal Reserve of St. Louis.

As the chart also demonstrates, Velocity bottomed recently. This bottoming means that the faster pace of economic growth, with a lag, began to impact Velocity, causing all the pieces of paper the Fed created to circulate more quickly in the economy. And in order to prevent Inflation from accelerating dramatically, Price in the equation above, the Fed entered into anti-QE late last year to remove Money from the economy and offset the Velocity increase.

With interest rates normalizing and Velocity on the rise, the Federal Reserve can now envision returning to the monetary policy that it utilized from 1945 through 2007 and the traditional monetary tools with which it is comfortable. However, in the transition, Chairman Powell must move gingerly so as not to cause a new recession prior to reaching the holy land of traditional policy. Essentially, the Fed will need to err on the side of caution, allowing the economy to overheat and recreating the mid to late 1960s lest it end up back at the zero bound and need to go back to some form of QE. With the path clear for the Federal Reserve and traditional monetary policy ahead, the Fed will soon be Back On The Highway it has travelled many times before. (Data from the Federal Reserve coupled with Green Drake Advisors analysis.)

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Semiconductors: Its An AI, EV, AV, IOT, VR, Robot, Drone World

> "*We're just at the beginning of a transformation. Artificial intelligence is going to be similar to what the Internet was back in the '90s. You remember back in the '90s everybody said, 'If you're not going to be an internet company, you're not going to be around.' The same thing is going to be true. Almost every company you can think of, every application, it's going to be affected by artificial intelligence. You're going to be using artificial intelligence or you're going to be outpaced by people who are.*"

Brian Krzanich
CEO, Intel Corporation
2017 Analyst Meeting

For the semiconductor industry, the past 30 years have been very good to it. First came the explosion of PCs in the 1980s and early 1990s along with the laptop. Then came the cellular phone revolution followed by the internet revolution in the late 1990s. Then, as these products matured and long term growth looked bleak, slowing from 15%/year in the 1980s and 1990s to just 4% in the 2000s, along came the Cloud, which drove growth in the industry from 4% to 8% then to 10% or more. And now, it appears, just as the Cloud starts to mature over the next few years and growth once more appears in jeopardy, several new growth segments will rescue the industry from growing no faster than the auto or chemical industries. These new growth segments comprise an alphabet soup of areas such as AI, EV, VR, … While each area does not comprise a huge portion of the industry, given its vast scale and integration into every aspect of the economy, when combined, these new areas will provide significant growth over the next decade, enabling the industry to continue its growth.

To understand the need for massive new areas, one must understand the scale and scope of the industry. The industry will ship almost 400 billion Units in 2018 while revenue will approach $500 billion this year. The average ground up fab to produce semiconductors can cost $22 billion when fully outfitted. Thus, a small market cannot move the needle. Any new area must comprise a large novel application, such as Artificial Intelligence (AI), that can permeate throughout a large portion of the global economy, or a major industry transformation, such as Electric Vehicles (EV), that can replace the output of an entire existing global sector. If not of such scale, new applications will fail to accelerate growth.

Fortunately, for the semiconductor industry, a fortuitous convergence of these applications, which have been in development for over a decade, will produce a simultaneous rollout across several large scale sectors, underpinning real growth for the industry over the next decade. As a result, industry revenue growth accelerated over the past year as the following chart from the Semiconductor Industry Association demonstrates:

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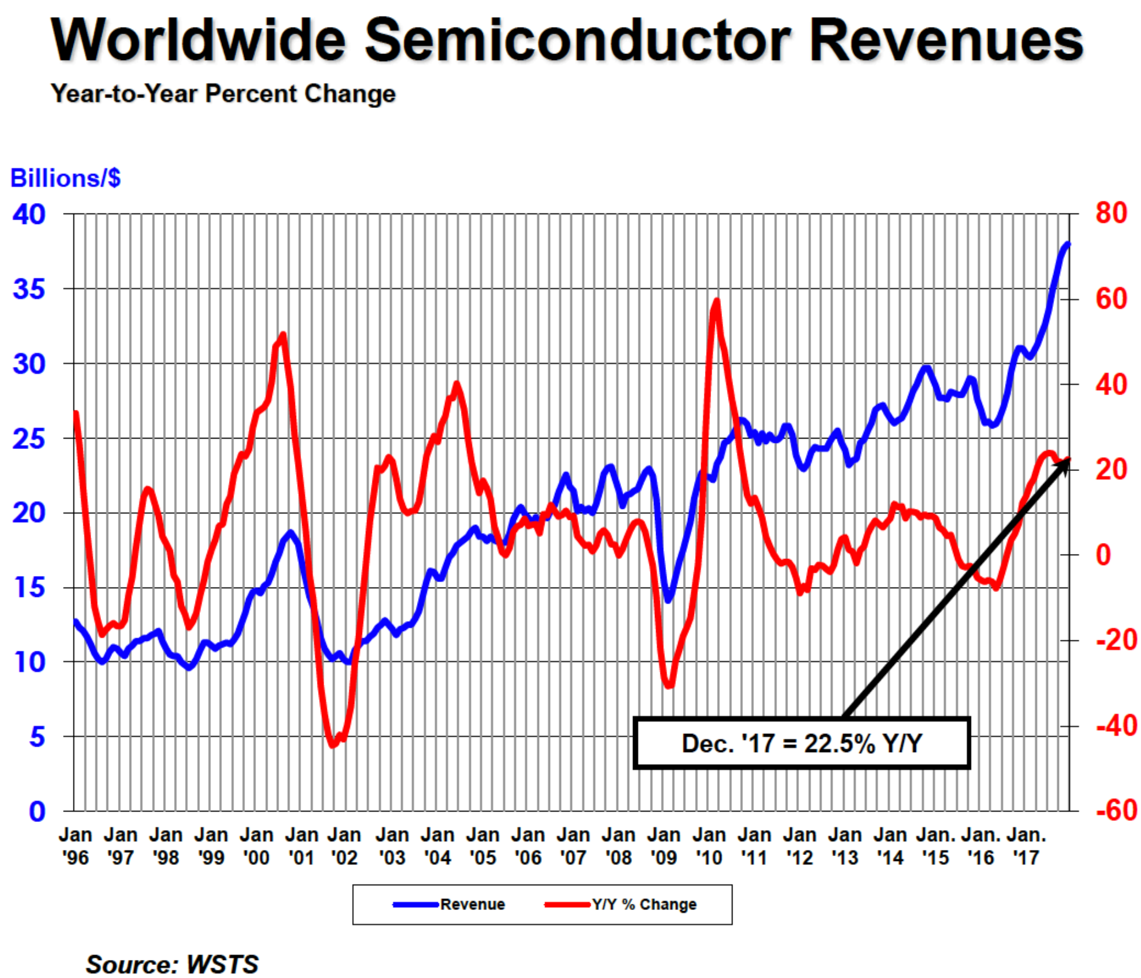

And while there was some inventory pipeline fill in 2017, the vast majority of the revenue represented real growth driven by continued Cloud rollouts and the early adoption of AI in select applications. AI revenue growth will compound at almost a 60% rate over the next five years, reaching $33 billion in 2022 from just $3 billion in 2017. And this revenue excludes the growth in fast memory chips that are needed to support the core AI chips by providing supporting fast data storage. These memory chips could easily equal or exceed the incremental revenue from AI chips.

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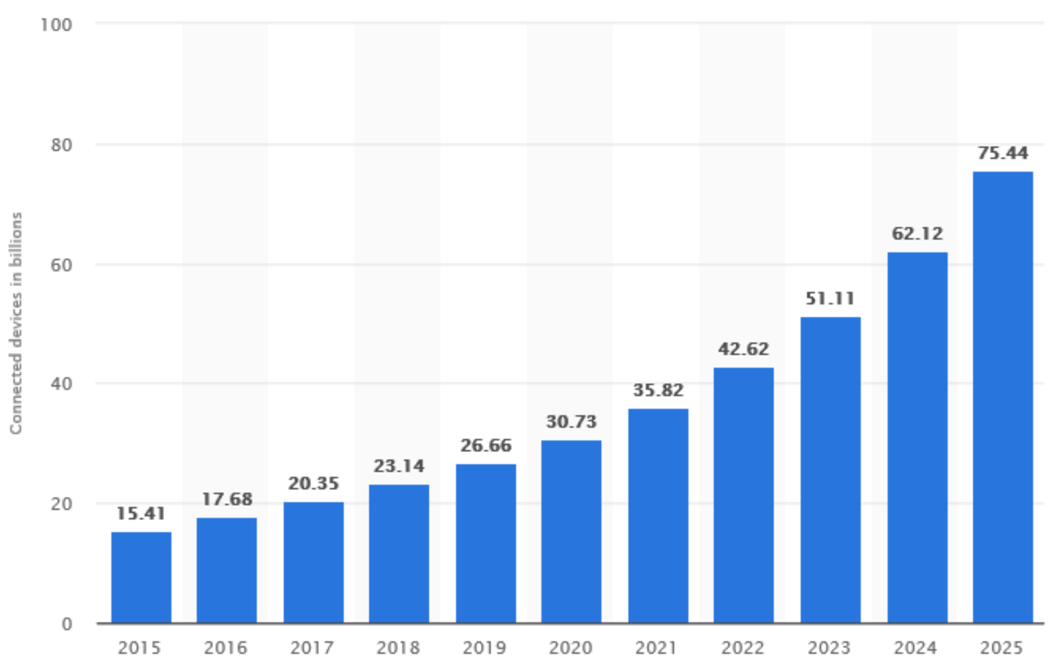
Other new markets, such as Drones, will support rapid industry growth. Sales of Drones totaled less than $10 billion in 2017. But numerous industry projections show the Drone industry growing to over $70 billion by 2021. And while semiconductor industry content in the planes' flying systems and controllers is limited, there is a significant amount of AI that will support the Drones in image recognition, response time, navigation systems, and autonomous capabilities. This will add to the demand for AI chips, as core industry demand projections noted above only includes Cloud applications. Virtual Reality (VR) and Augmented Reality (AR) represent another opportunity for rapid growth. From just 8 million units in 2017, the industry expects to ship 67 million in 2021, according to IDC. This 53% annual growth will support the growth of graphics chips, which dominate both VR/AR and AI. From the surreal world of VR to the very real world of the global auto market, the combination of EVs and Hybrids will add another nice niche to the industry. For a 48V Micro Hybrid, the additional power electronics are estimated at $450 per vehicle. For a full 200 mile range EV, the additional power electronics are estimated at $1,500 per vehicle. With 120 million cars estimated to be sold globally in 2025 and assuming just a 20% penetration of Hybrids and EVs, as electric batteries move down the cost curve and become competitive with the traditional engine, this market represents another $30 - $50 billion in annual semiconductor industry revenue by 2025. The Internet of Things (IOT) represents another nice growth market. The following chart demonstrates the projected explosive growth in connected devices:



Data courtesy of Statista.com

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While not growing as quickly as VR/AR or AI, the Internet Of Things will grow from 20 billion connected devices in 2017 to over 30 billion in 2020. Should the semiconductor content just reach $10 per device, this market could represent almost an additional $10 billion in growth per year.

Altogether, these markets, plus others such as 5G, Autonomous Vehicles (AV), and devices with the potential for fixed broadband wireless, could easily add significant revenue to the industry, enabling it to sustain the types of growth exhibited over the past five years. And while not the 15% annual growth of the 1990s, it represents a sea change from the 4% growth of the 2000s. For the Semiconductor Industry, it is truly an AI, EV, AV, IOT, VR, Robot, Drone World. (Data from public companies, Statista.com, Semiconductor Industry Association, IDC, JP Morgan and Credit Suisse coupled with Green Drake Advisors analysis.)

Finally, A Late Cycle Economy: Productivity, Investment, and The Coming US Growth Acceleration

> "*[T]he isolation of cyclical fluctuations is a highly uncertain operation. Edwin Frickey once diligently assembled 23 trend lines fitted by various investigators to pig iron production in the United States, and found that some of the trend lines yield cycles averaging 3 or 4 years in duration while other yield cycles more than ten times as long. This range of results illustrates vividly the uncertainty that attaches to separations of trends and cycles, though it perhaps exaggerates the difficulties. If an investigator fits a trend line in a mechanical manner, without specifying in advance his conception of the secular trend or of cyclical fluctuations, he may get cycles of almost any duration. But an informed investigator who is seriously studying cycles of a given order of duration will use whatever guidance he can get from history and statistics…*
> *It is fairly common for statisticians to assume that the elimination of the secular trend from a time series indicates what the course of the series would have been in the absence of secular movements, and that the graduation of a time series, whether in original or tend-adjusted form, indicates what the course of a series would have been in the absence of random movements. There is no warrant for such simple interpretations …*
> *There is always danger that the statistical operations performed on the original data may lead an investigator to bury real problems and worry about false ones. When new commodities, new techniques of production, new methods of organizing business, new methods of financing are first introduced on a substantial scale, they affect the general business situation more profoundly than at a later time when they have fully penetrated the economic system and become a part of routine experience.*"

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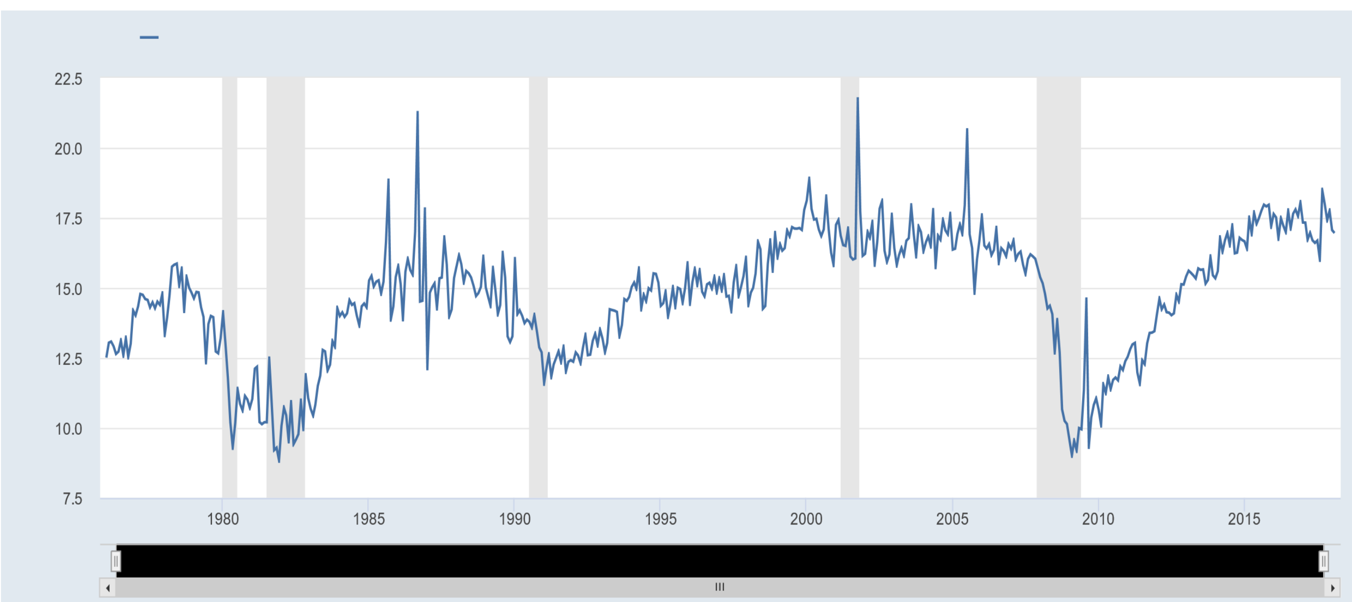
Measuring Business Cycles
Chapter 3: Plan of Treating Secular, Seasonal, and Random Movements
By Wesley C. Mitchell and Arthur F. Burns, 1946

US economic growth over the past six years depended on a recovery in housing and autos, a significant up cycle in commercial real estate, and a large expansion of the healthcare system. However, with the change in government in Washington, D.C., the movement to faster growth, and the rise in interest rates, their role in leading the race appears over. As they hand off the baton, new areas of the economy are rising to the forefront to drive overall economic growth. These areas include Investment, Infrastructure, and Government Stimulus. These areas will carry economic growth moving forward as the country moves into a true expansion phase of the cycle.

Economic transitions, such as the one the United States is undergoing, occur at points in time when natural economic cycles in select sectors and industries peak out while other sectors and industries see their growth continue and/or accelerate and new areas see their growth bottom and turn up. In this case, the US leaves behind the traditional sectors of Autos and Housing as well as a traditional mid/late cycle sector, Commercial Real Estate, which turned into an early/mid-cycle sector this time. These peaking sectors, the traditional interest rate sensitive, "early cycle" sectors, exhibit a leveling out in their cycles that indicate they will no longer drive economic growth. From 1985 – 1990 and from 1998 – 2006, Auto sales flattened out growing little. As the following chart demonstrates, auto sales stand today at the same level as 2015:



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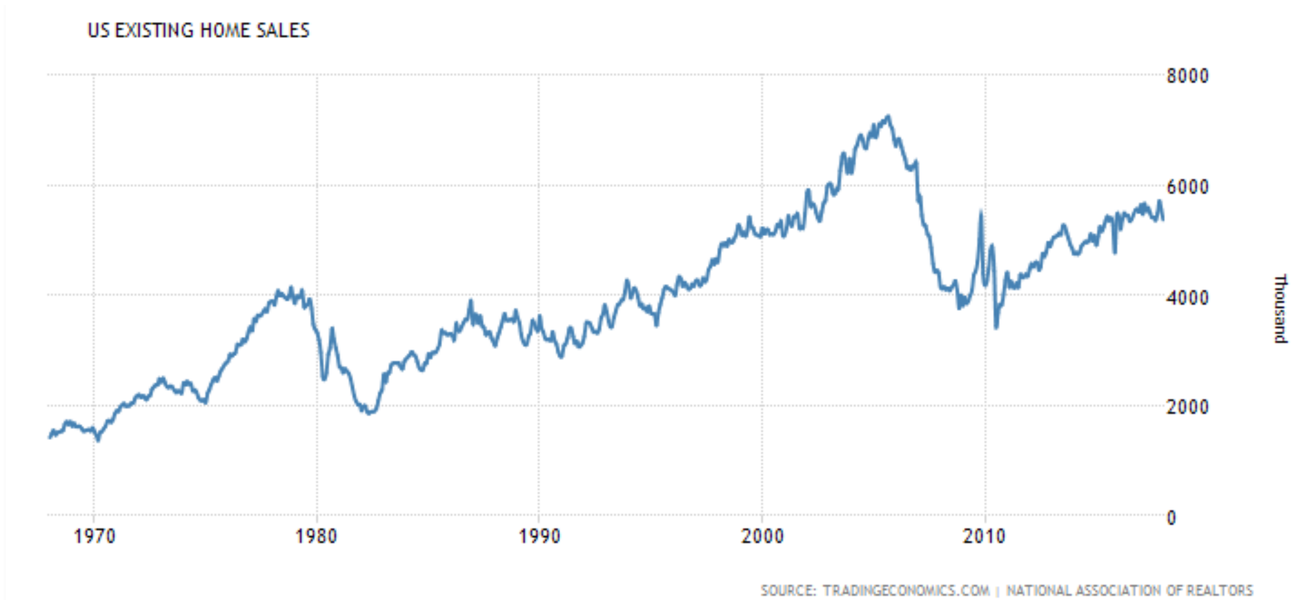
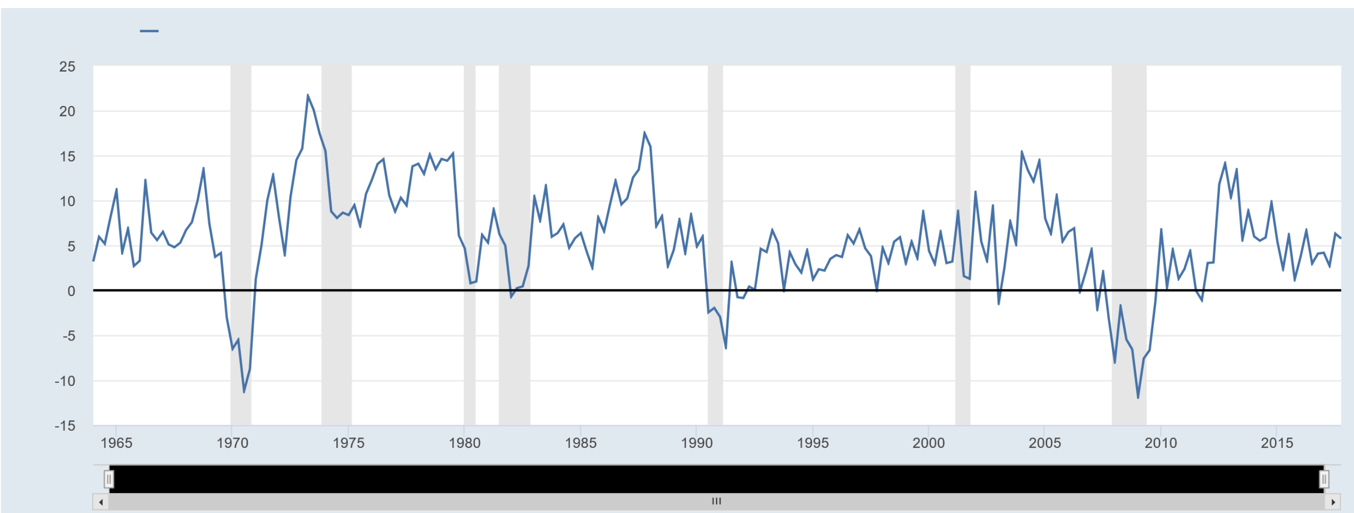
A similar story is unfolding for Housing. Existing Home Sales normalized over the past five years. With the rise in interest rates transactions are leveling out:



This leveling of housing turnover would replicate the path housing took from 1986 – 1995 when housing turnover went sideways. Unlike this earlier period, national new home sales prices today continue upward, according to the government:



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However, according to the public homebuilders, prices have decelerated and in some cases are flattening out. This would make sense as prices now exceed their peaks during the housing bubble a decade ago:

S&P/Case-Shiller U.S. National Home Price Index, 1987 – 2017

And for the low to middle end of housing, the marginal buyer of a home, rising interest rates present a real bite. The following chart shows the recent jump in rates, yet how they stand a long distance from where they stood back in 2000:

30 Year Fixed Rate Mortgage Average, US, St. Louis Federal Reserve Economic Database

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In fact, the rise in interest rates coupled with the massive rise in prices over the last few years drove Housing Affordability down to its lowest level since 2008.

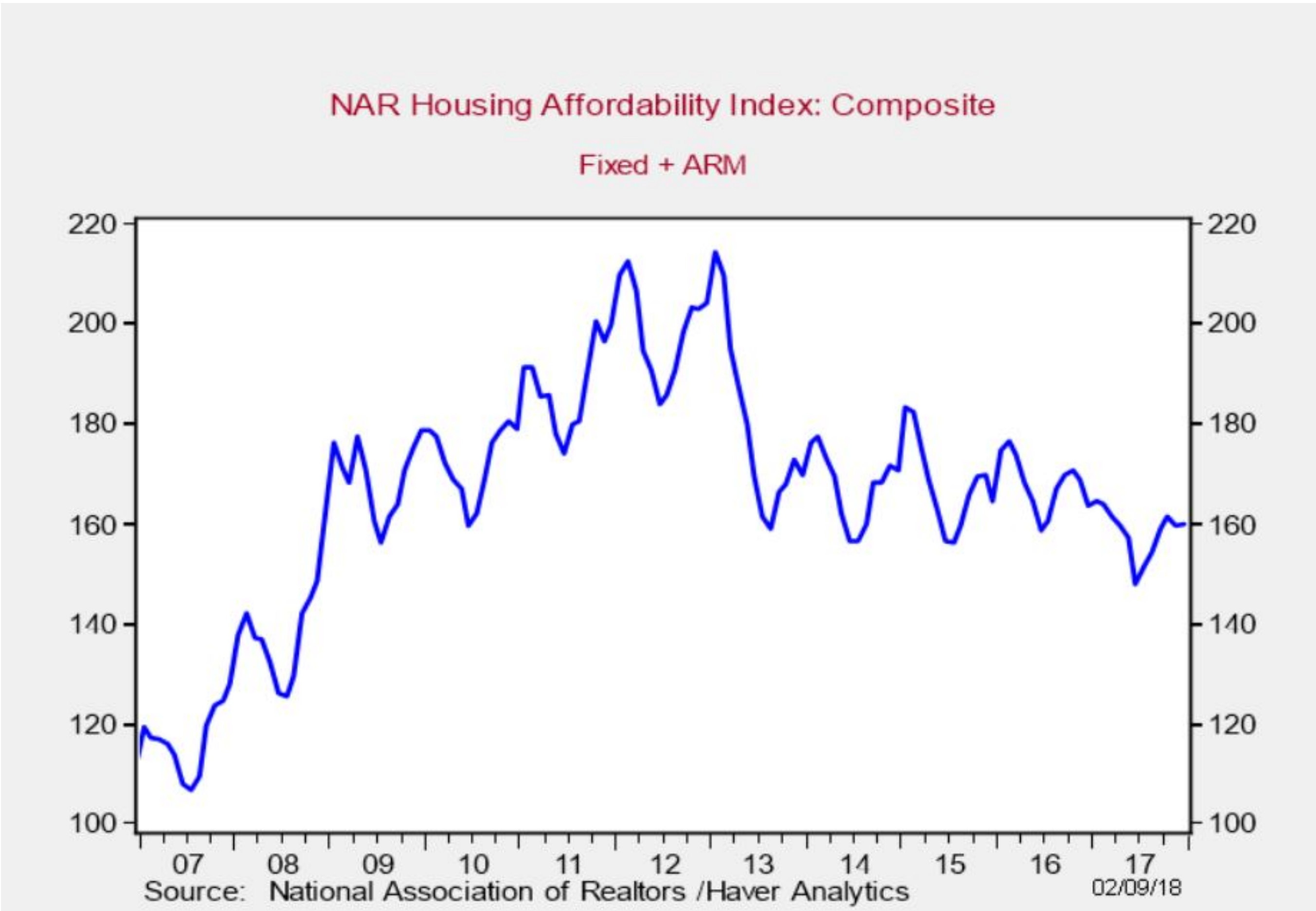

Chart courtesy of Haver Analytics

And while the above chart shows a significant bounce in affordability since June, mortgage rates today stand 0.5% higher than June and home prices continue to outpace income growth, which likely means homes are less affordable today than six months ago. The latest Pending Home Sales show future sales down 3.8% year-over-year. That data more likely reflects reality than the Housing Affordability Index above. Should Mortgage Rates just return to their 2008 level of 6.0% from their current level of 4.4% over the next few years, the monthly payment would rise an additional 20%, putting further pressure on

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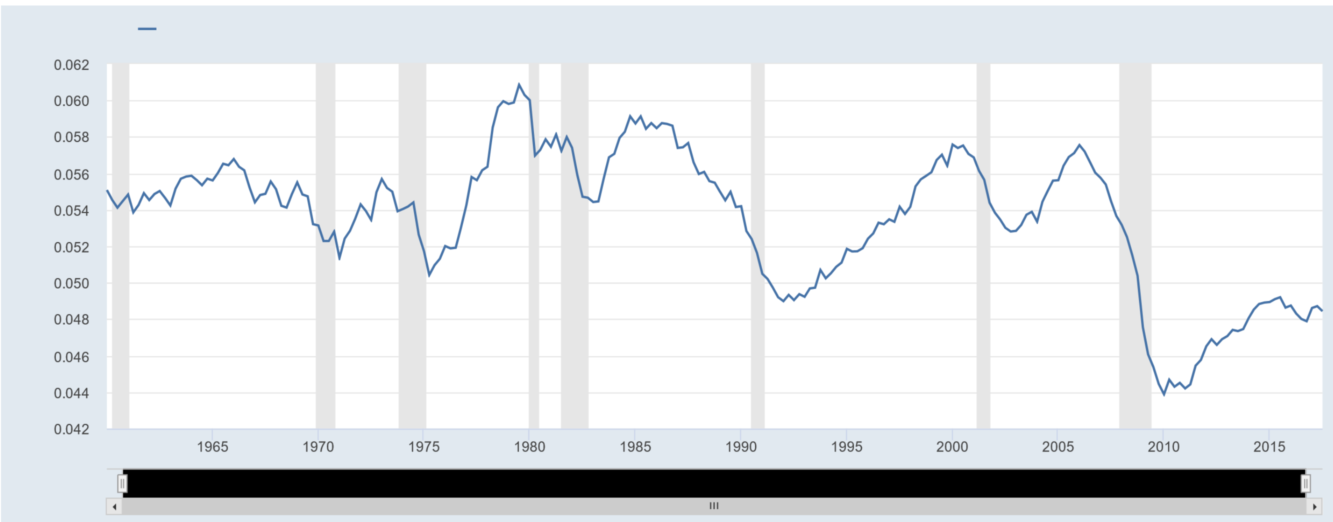
Housing. Given this reality, Autos and Housing face a period of sideways motion over the next few years.

In their place will stand raw mined stones that will turn into the gemstones of tomorrow as time moves onward and the gem cutters and polishers exhibit their work. These stones begin with Investment. Due to the entry of China into the World Trade Organization (WTO) and the granting of permanent Most Favored Nation (MFN) Status by the Clinton Administration, the US exported a significant portion of its manufacturing to China collapsing domestic Capital Formation (GFCF):



Gross Fixed Capital Formation to GDP, US, 1960 – 2017, St. Louis Federal Reserve

And while Capital Formation rose from 2004 – 2007, it came from the Housing Bubble and not proper industrial investment. As a result, this non-productive investment, which did temporarily maintain economic growth, became obsolete in the ensuing recession, bankrupting the banking system. If we remove the impact of the bubble from the chart, instead of a rise in GFCF, there would exist a straight line down to the bottom in 2010 from 2000. As housing recovered from 2011 to today, Capital Formation recovered, but only to levels reminiscent of the post-recession lows in 1993 and 1976.

With Housing set to move sideways for the next few years, the next upward leg will need to originate in true Investment. This will come from both the Manufacturing side of the equation as well as the Infrastructure side of the equation. As the below chart demonstrates, Real Private Fixed Investment in Manufacturing stands no higher than almost 20 years ago:

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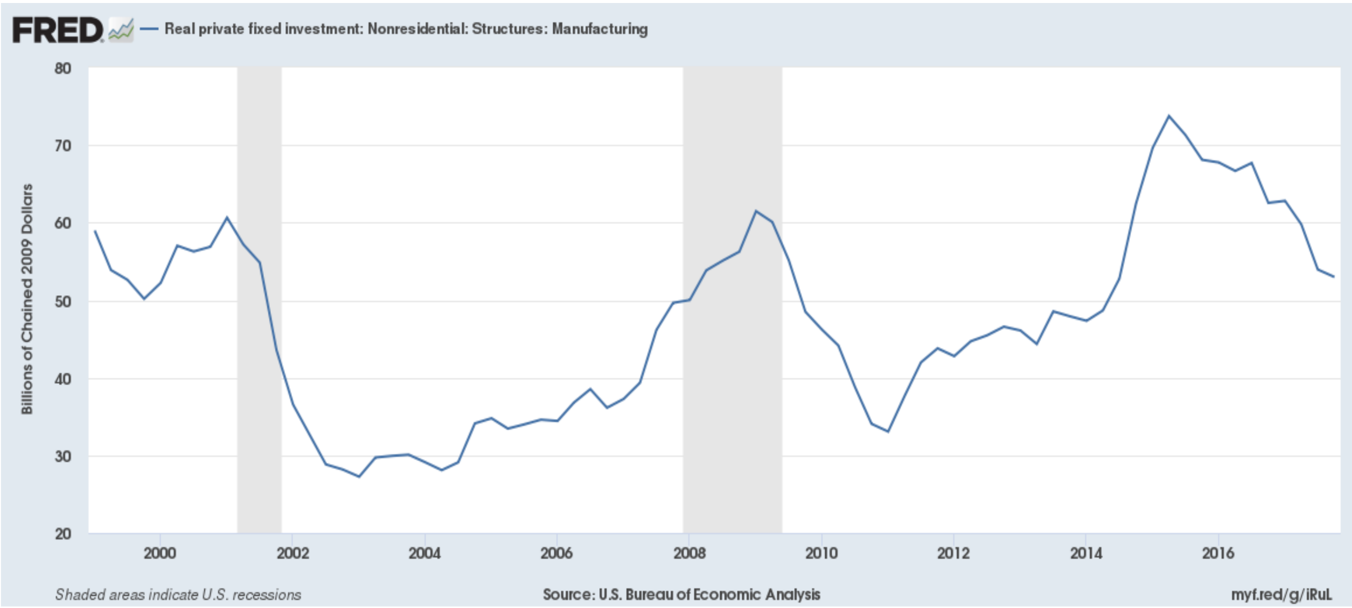
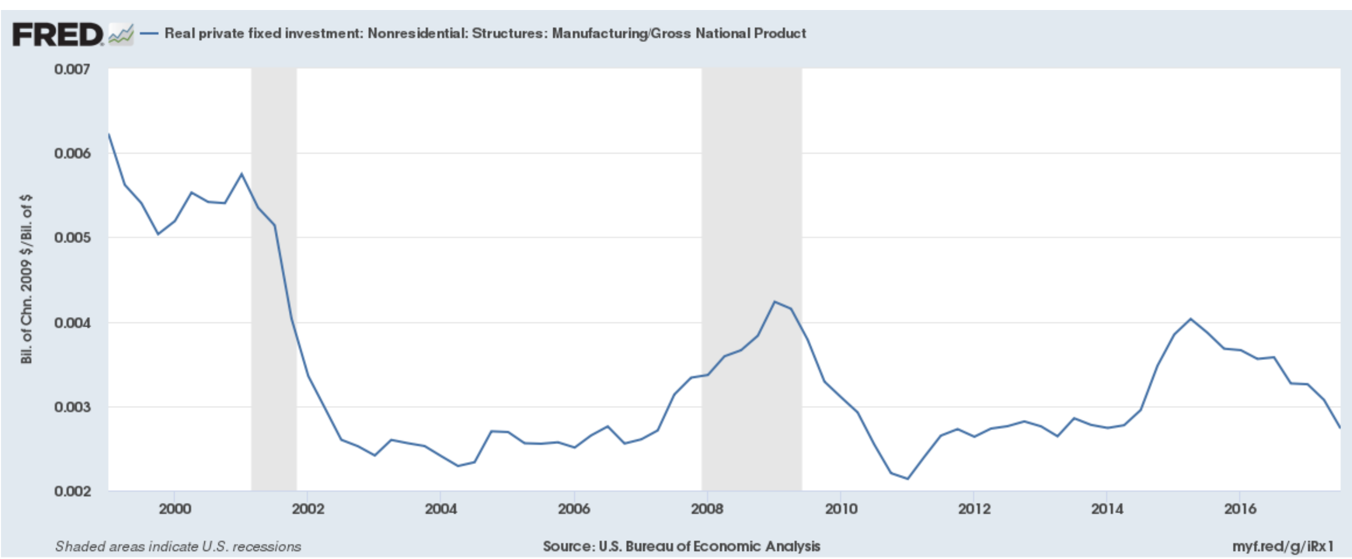


Real Private Fixed Investment: Manufacturing, 1999 – 2017, St. Louis Federal Reserve

But, with Real GDP up 109% from Q1 1999 to Q4 2017, Real Manufacturing Investment stands 52% below its 1999 levels as the following graph shows.



Real Manufacturing Investment to GDP, 1999 – 2017, St. Louis Federal Reserve

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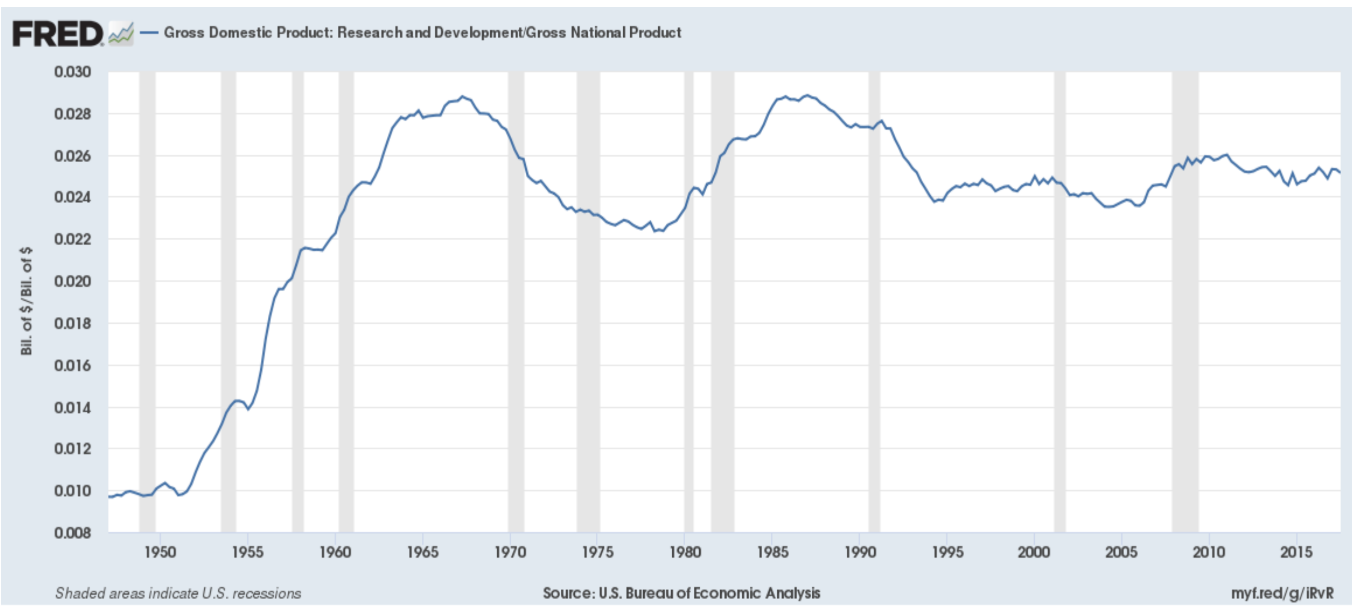
This drop makes intuitive sense given the following factors:

1. The rise of China as a manufacturing powerhouse as US companies exported their manufacturing to government subsidized, Chinese companies to maximize margins over the short term. (If a government pays for 50% or more of the capital to construct a manufacturing plant, then the products can be sold at prices well below the true cost of manufacturing as the companies do not bear the full cost of building the plant.)
2. US Corporations focused on maximizing Free Cash Flow at all costs, regardless of the long term impact on their growth or competitiveness. (This can be seen in the ratio of Capital Investment to Revenue which averaged 5.2% from 2000 – 2017 compared to 7.2% from 1990 – 2000.)

Fortunately for the US, spending on Research & Development (R&D) remains high:



Research & Development Spending to GDP, St. Louis Federal Reserve

Thus, the US can fix its Manufacturing Investment through the reversal of exporting its manufacturing capacity, what is known as Reshoring, given that it still possesses strong Intellectual Property (IP) due to maintaining high levels of R&D. And not only can the US do this, it can benefit from implementing the latest manufacturing technology such as 3D/Additive Manufacturing, Robotics, and Artificial Intelligence. In the process, as a side benefit to the country, these plants should become the most efficient in the globe, obsoleting much of the capacity erected in China and elsewhere over the past 20 years. Thus, not only would they restore US Capital Formation to levels not seen since the 1990s, but they

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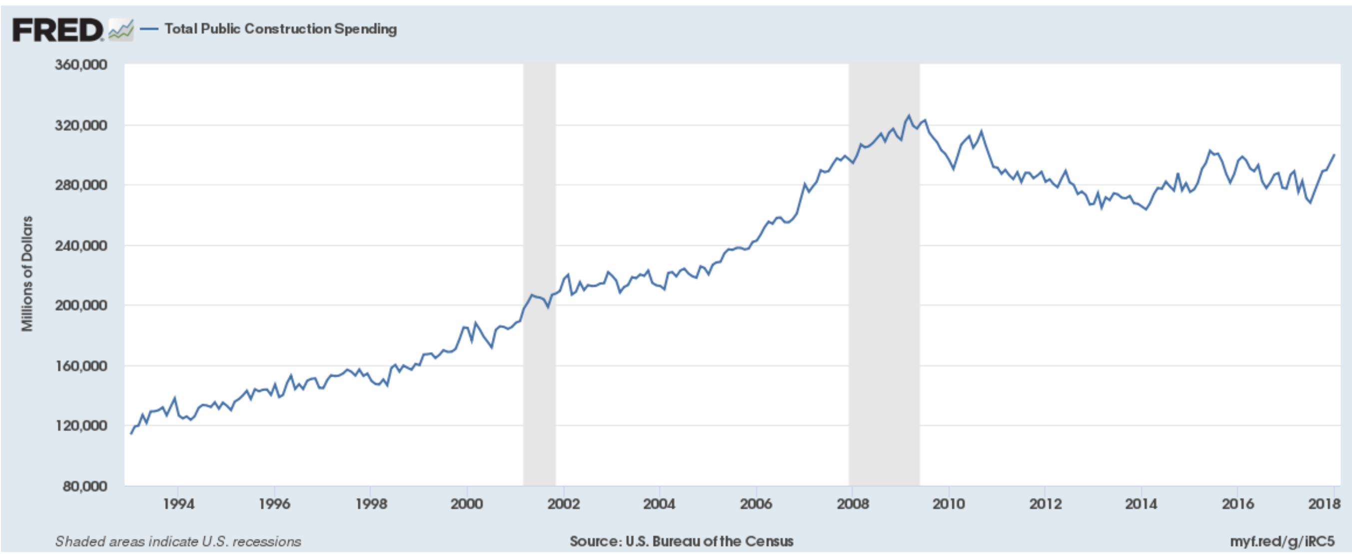
would improve Productivity and accelerate GDP growth. In effect, they would restore the United States to its position as a premier global manufacturer, underpin the country's global strategic position, restore economic growth, and undercut a global rival's strategic position, all at the same time.

While such a change in Manufacturing would address a portion of the collapse in Capital Formation, a full redress requires the country to increase its Infrastructure spending. As the below chart makes clear, Public Construction Spending stands almost 10% below its level in 2009:



Total Public Construction Spending, 1993 – 2018, St. Louis Federal Reserve

While on the surface it appears that the US treaded water for the past decade, that is an illusion. When viewed in Real Terms relative to GDP, Total Public Construction Spending collapsed over the past decade. It now stands 35% below its level in 2009 but, more importantly, over 20% below its Normalized Level from 1993 – 2007:

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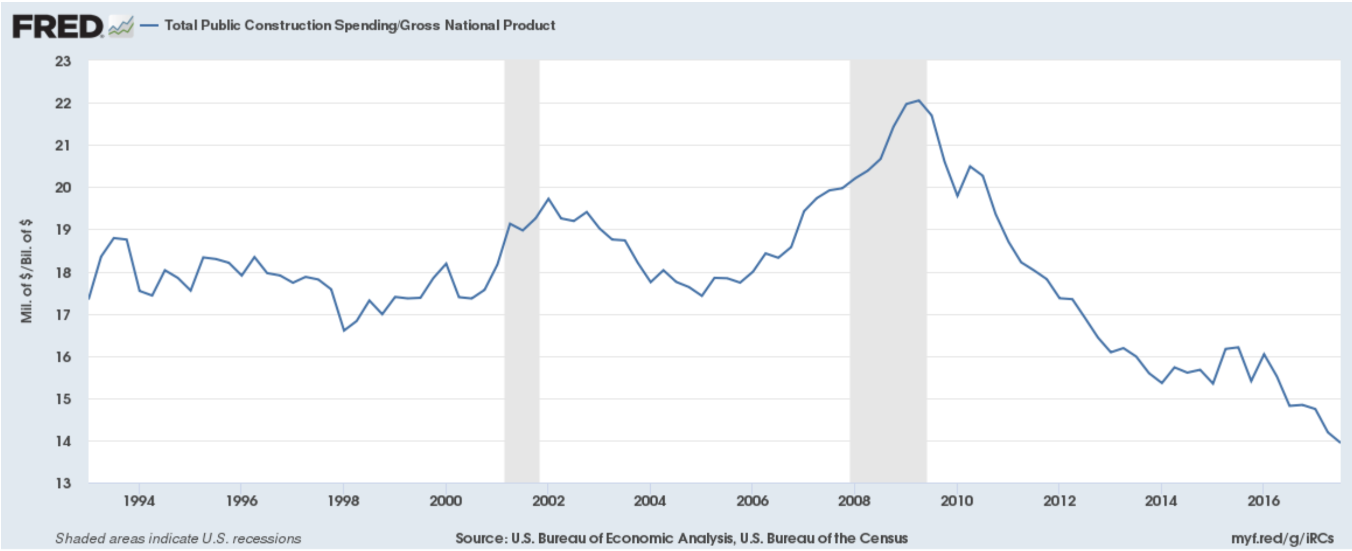

Total Public Construction Spending to GDP, 1993 – 2018, St. Louis Federal Reserve

This collapse did not go unnoticed by the public. Voters approved a record amount of public bonds to fund infrastructure at the state and local level in 2016. And in 2 states with troubled finances, Illinois and New Jersey, voters approved measures creating "Lock Boxes" that prohibit state lawmakers from diverting transportation fees to non-transportation uses. (Voters seemed to have an issue with legislators diverting money to pay for pet projects or budget holes they created in those two states for some reason.)

The one remaining area for increased Public Infrastructure Spending remains the Federal Government. And while President Trump proposed a massive $1.5 trillion Public-Private Partnership to move Infrastructure forward, Congress acted as Congress does under the rubric, "The President Proposes and Congress Disposes." In other words, the Trump proposal became a non-starter for Congress which possesses its own plans. These plans include a modest amount of incremental spending of around $20 billion in some of the current legislation. But as the chart above makes clear, the US needs to spend an incremental 4% of GDP or almost $800 billion to just reach its 1993 – 2007 average. While it remains unclear the source of this funding, pressure will rise on Congress to act as the 2020 elections approach. As a member of Congress's #1 priority is re-election and the public patience for Congress stands thin, the probability of action rises as the 2020 elections approach.

While the handoff in the economy from early/ mid-cycle industries to late cycle will be bumpy and likely entail a slowdown in H2 2018 and early 2019, this hand-off, already in process, remains critical for the economy. It stands as the lynchpin of President Trump's economic program which recognizes the lack of

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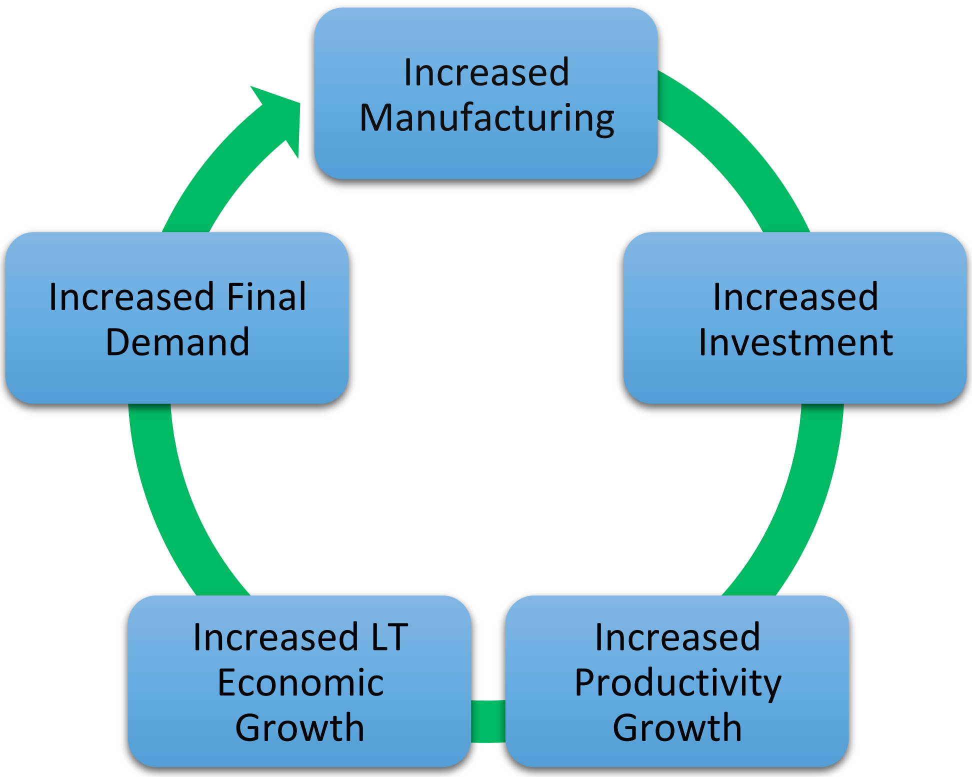
Investment in the US. It focuses on driving faster economic growth by increasing Investment which undergirds productivity growth, the bedrock of long term economic growth:



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And, as the handoff gains steam in 2019, Real Investment should begin to rise at a rapid pace. Once this train begins to move, it will gather steam as the salutary effects on the economy become apparent and the above virtuous circle moves into ascent. In addition, with pressure on Congress growing to spend money on basic infrastructure sorely in need of a facelift as opposed to new social programs, the following positive dynamic should come into view as well:

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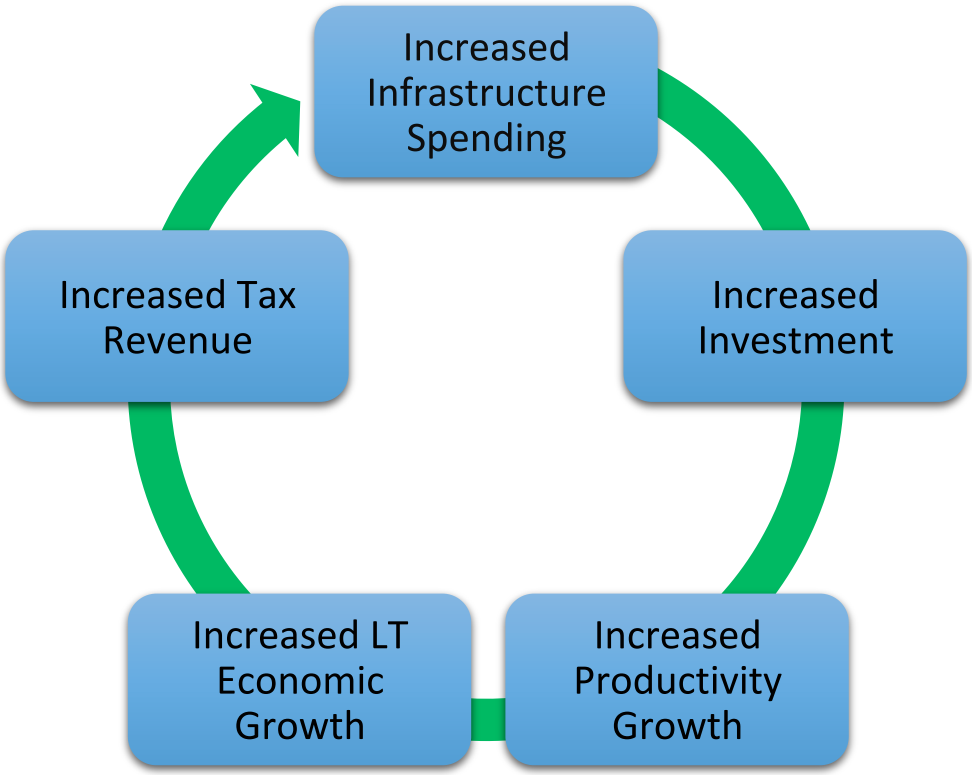

And with both these dynamics in play, Productivity Growth should make a long term bottom and head upward once again as Finally, A Late Cycle Economy stands in place. And with Productivity and Investment both charging ahead, The Coming US Growth Acceleration will transform the economy once again, as it has repeatedly over the past 250 years. (Data from St. Louis Federal Reserve, Haver Analytics, Bureau of Economic Analysis, Census Bureau, MKM Partners, tradingeconomics.com, and public company reports coupled with Green Drake Advisors analysis.)

<u>Pea Soup, That Old Clunker, and The Micro, Mini-Me Outer Space</u>

Finally, we close with brief comments on Pea Soup, That Old Clunker, and Micro Space. First, India has imposed tariffs of 40% on Chick Peas, 30% on Lentils, and 50% on Peas, principally to deter Canadian imports of these basic foodstuffs into the largest market for them. For the Canadian farmer, we see them left making Pea Soup. Second, Porsche has announced that it will employ 3D/Additive Manufacturing to print older parts that would otherwise not be available to keep the classic cars of yesteryear running. For

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the classic car collector, they finally have a way to keep That Old Clunker running. And third, new companies are launching constellations of micro-satellites into orbit. These satellites, no bigger than a person's arm, cost a fraction of a conventional satellite, which can run $3 billion or more to develop and launch. Planet Labs just launched a 200 satellite constellation. Major companies, such as Iridium and Gilat, plan to launch their own micro-satellite constellations. With all these shrunken satellites headed to launch, it will soon be the Micro, Mini-Me Outer Space.

In Closing

Should you have any questions on how the above issues or the items discussed in our accompanying cover letter impact your family's financial position or your business's future as well as the potential actions you could take in response, please do not hesitate to contact us. We welcome the opportunity to discuss this with you.

Yours Truly,

Paul L. Sloate
Chief Executive Officer
& Senior Advisor

Steve Rodia
President
& Senior Advisor