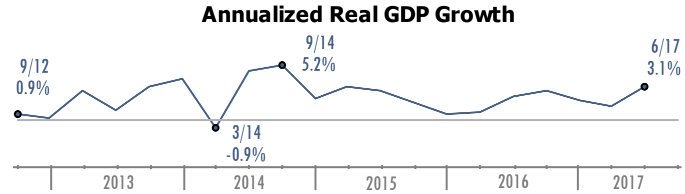
Bellwether
CONSULTING

*Your Quarterly Update on the Financial Markets*
*September 30, 2017*

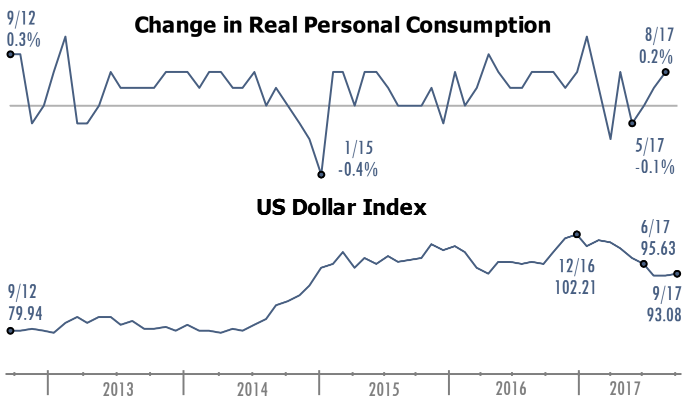
# MARKET Recap

## The US Economy: "Death and Taxes"

Economic growth ticked upward in the second quarter, continuing a 3-year trend of slow oscillation between an annualized pace of 0.5% to 3.2%. Positive contributors included personal consumption expenditures, net exports, private inventory investment, and defense spending. Residential fixed investment declined for Q2 following a sharp Q1 increase.



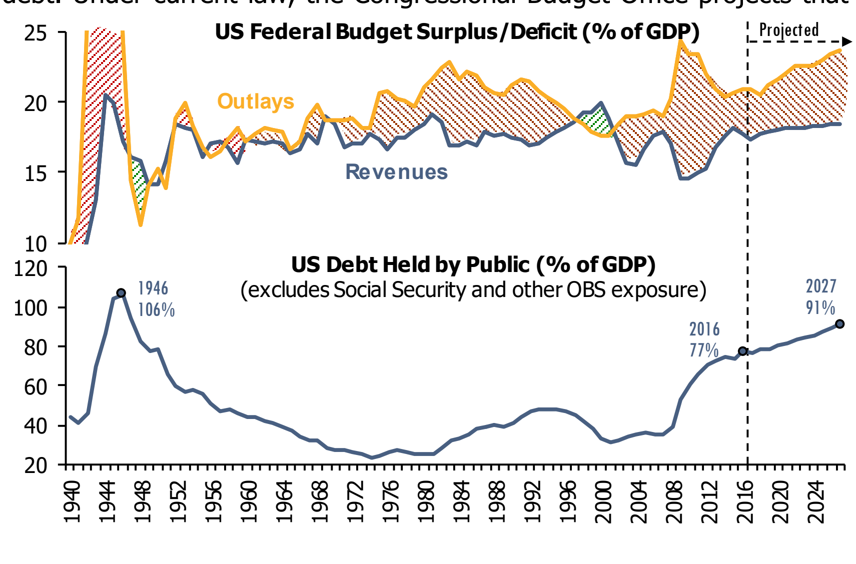

Two of these tailwinds likely continued through the third quarter. First, real personal consumption expenditures, which have been fickle this year, rose in July and August. Estimates for August include the impact of Hurricane Harvey, but it is unclear at this point how much impact the unusually severe storm will have on spending through September.




Second, net exports (exports minus imports) increased as imports declined more quickly than exports. Trade is, over time, impacted by changes in relative currency values. The US dollar has gradually weakened against a broad basket of other currencies through 2017 following a big post-election bump in 2016. For Q3, the dollar fell by 2.7%, as measured by the US Dollar Index (DXY), after declining 4.7% in Q2. This makes imports more expensive for US consumers relative to domestic goods and services, and makes US exports cheaper for foreign buyers. Note, however, virtually all of the decline occurred in July, and the dollar strengthened slightly in September.

The Fed likely had something to do with that, as they announced a reduction process for the Federal Reserve's balance sheet. Refer back to last quarter's newsletter for details, but the upshot is that the central bank will gradually phase out purchases of Treasuries, mortgage-backed securities, and other instruments to replace current holdings as they mature. This places very gradual upward pressure on longer-term interest rates. Higher yields increase foreign demand for dollar-denominated fixed income securities and strengthen the dollar, all else equal. "Gradual" is the key word here.

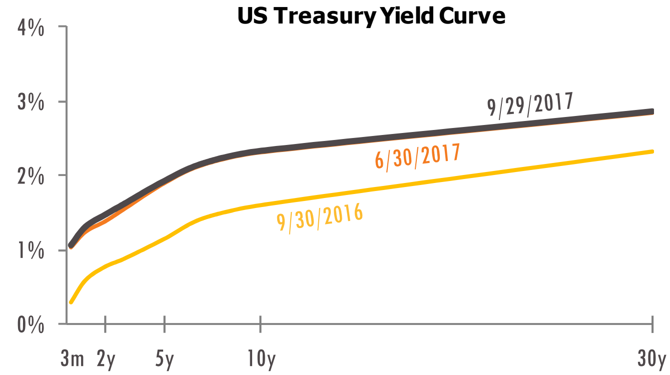
With a fairly clear course for monetary policy, attention is now focused on the fiscal side. On September 27th, Republicans unveiled a strategy for tax reform, proposing net decreases in the income and inheritance taxes. The political discourse immediately turned to an accounting of specific winners and losers under the proposal, but as of yet few have commented on the long-term impact on fiscal deficits and debt. Under current law, the Congressional Budget Office projects that debt held by the public will exceed 90% of GDP by 2027. This assumes average GDP growth of 3.9% per year over the next 10 years with no recessions, a generous scenario in our view. Sketchy estimates by the Committee for a Responsible Federal Budget place additional deficits under the proposed plan at $2.2 trillion, driving debt up to 99% of GDP by 2027, approaching levels last reached at the end of World War II.




Of course, the central premise of Republican tax reform since Reagan has been to make up deficits through growth. What we struggle to understand in the current environment is how fiscal stimulus will drive high levels of growth in a mature economy when monetary stimulus has not.

# The US Bond Market

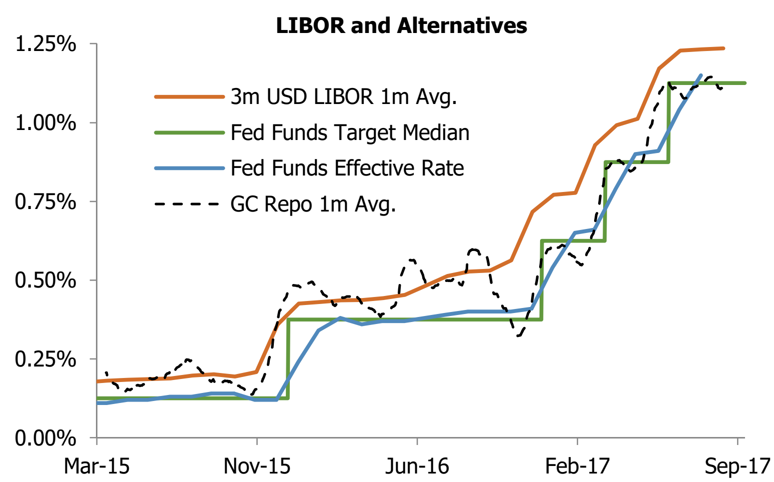
Overnight rates stayed fixed within a target range of 1.00% - 1.25% under the watchful eye of the Federal Reserve. Sampled quarter-over-quarter, the entire yield curve appears to have followed suit, with little measurable movement. However, a rally in the 5 through 10-year sectors steadily led the way down in yield by 26 basis points through September 7th. Lower inflation expectations and geopolitical concerns around North Korea's missile tests helped funnel more investment toward the safety of US Treasuries. Rates softened up in the last three weeks at a peppier pace. The benchmark 5-year rate rose 3 bps in Q3, ending the quarter at 1.92%. The 10-year key rate increased by 2 bps to 2.33%. The reversal was initially spurred by consumer price data pointing to rising inflation and continued on fuel from central banks indicating tighter monetary policy ahead. The probability priced into fed funds futures for another rate hike by year-end rose to approximately 75% during the month of September.




| US Bond Indices - Total Returns | | |
|---|---|---|
| **Blmbg Barclays** | **3Q17** | **YTD** |
| Aggregate | 0.85% | 3.14% |
| Interm. Gov't | 0.34% | 1.55% |
| Long Gov't | 0.59% | 6.06% |
| TIPS | 0.86% | 1.72% |
| Municipal | 1.06% | 4.66% |
| Interm. Credit | 0.99% | 3.55% |
| Long Credit | 2.17% | 8.75% |
| High Yield | 1.98% | 7.00% |
| MBS | 0.96% | 2.32% |

Real yields followed nominal yields on US Treasury bonds on the way down but lagged on the reverse trip. As rates found their bottom, 5-year TIPS closed as low as 0.01% in real yield. In total, 5-year TIPS declined 2 bps and 10-year TIPS fell 9 bps, for real yields at quarter-end of 0.24% and 0.49%, respectively.

Credit spreads widened in the second week of August on disappointing quarterly financial reports and building rhetoric between President Trump and North Korea. Coinciding with declines in the stock market, high yield spreads rose 36 bps in the span of 3 days, to hit a peak of 4%. Gradually, spreads drifted back down to just over 3.5% - a support level only briefly undercut in 2014 and otherwise not seen since the start of the last recession. High yield spreads narrowed 21 bps overall and finished the third quarter at 3.56% (BAML US HY OAS). Similar to last quarter, investment grade spreads contracted by 8 bps, closing the quarter at a yield of 1.07% (BAML US Corp. Master OAS). Corporate bond issuance ran steadily through the quarter. However, high yield issuance dipped in July to $11 billion, half the run rate of 2016, which was itself a modest year for high yield issuance. Despite this misstep, both investment grade and high yield paper remain on track to exceed 2016 levels. The strong pace of investment grade debt comes partly thanks to the replacement of called bonds. Callable bonds were exercised at the highest rate in four years as the July-August decline in rates led to refinancing opportunities for corporate, municipal, and federally sponsored debt with a call feature.




For more than 30 years, daily LIBOR (London Interbank Offered Rate) interest rates have been published for use by global financial markets. A set of 35 LIBOR rates (5 currencies and 7 dates) is used to price the interest rates on more than $350 trillion dollars of debt and derivatives. Despite its critical role in global financial markets, LIBOR's regulating agency recommended in July that market participants transition to a new benchmark by 2021. This decision came after years of deliberation and goes back to a 2012 scandal where Barclays was fined £290 million for attempts from 2005-2009 to manipulate LIBOR and EURIBOR to the advantage of Barclays derivatives traders. LIBOR, like the US Prime rate, is set by surveying rates voluntarily reported by a network of banks. Barclays was not the only offender. Instead of trying to repair a broken system with inherent conflicts of interest, alternatives are being considered. In the US, a committee delegated with the task by the Federal Reserve has proposed transitioning to the Broad Treasury Financing Rate (BTFR). This newly created index incorporates financing rates paid on short-term repurchase agreements for US Treasury and Agency debt. These liquid high-quality issues are commonly posted as general collateral overnight at a rate that approximately tracks the overnight fed funds target rate, albeit with added volatility and tracking error. While the BTFR may be more volatile than LIBOR or fed funds rates, it has the benefit of being subject to diverse market forces.

# The US Stock Market

For the eighth consecutive quarter, US stocks climbed higher. On the positive side, economic growth, falling unemployment, rising consumer sentiment, strong corporate earnings, and proposed tax reform all contributed to returns. These worked to offset negative effects from escalating geopolitical tension with North Korea, failure by the administration to enact health care reform, subdued inflation, and multiple hurricanes. Corporate revenue and earnings continued to exceed analyst expectations well above long-term averages. Earnings grew 12.3% (YoY) with positive contributions from all sectors, most notably energy, technology, and financials.

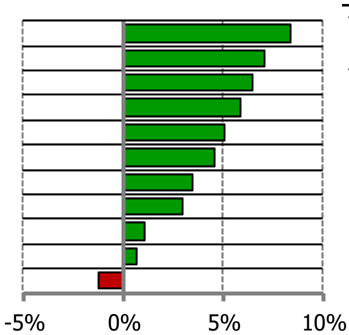
**US Stock Indices - Total Returns**

| Large-cap Stocks | 3Q17 | YTD | Mid-cap Stocks | 3Q17 | YTD |
|---|---|---|---|---|---|
| S&P 500 | 4.48% | 14.24% | S&P Midcap 400 | 3.22% | 9.40% |
| Russell 1000 | 4.48% | 14.17% | Russell Midcap | 3.47% | 11.74% |
| Growth | 5.90% | 20.72% | Growth | 5.28% | 17.29% |
| Value | 3.11% | 7.92% | Value | 2.14% | 7.43% |
| **Broad Markets** | | | **Small-cap Stocks** | | |
| S&P 1500 | 4.44% | 13.70% | S&P Smallcap 600 | 5.96% | 8.92% |
| Russell 3000 | 4.57% | 13.91% | Russell 2000 | 5.67% | 10.94% |
| Growth | 5.93% | 20.43% | Growth | 6.22% | 16.81% |
| Value | 3.27% | 7.72% | Value | 5.11% | 5.68% |

During Q3, large-cap stocks outpaced their mid-sized counterparts, although small-cap equities outperformed both groups. The majority of small-cap outperformance came with the September release of more information on a future proposal for tax reform, and the market cap segment rose 6.24% (as measured by the Russell 2000 Index). Because smaller companies typically pay higher tax rates than larger corporations, it is expected that they would benefit most from corporate tax reform.

From a style perspective, value continued to lag as investors remain focused on earnings growth over valuations. A significant driver of this effect has been demand for technology stocks. Momentum and quality were the top factor performers over the three months, while the low volatility and value factors underperformed. Year-to-date, momentum has been, by far, the best performer.

**S&P 1500 Economic Group Components - Total Returns**




| Sector | 3Q17 | YTD |
|---|---|---|
| Technology | 8.39% | 26.40% |
| Energy | 7.04% | -7.76% |
| Telecom | 6.53% | -4.94% |
| Materials | 5.89% | 14.93% |
| Financials | 5.12% | 11.66% |
| Industrials | 4.62% | 13.88% |
| Health Care | 3.47% | 20.51% |
| Utilities | 2.94% | 11.59% |
| Consumer Discr. | 1.03% | 11.57% |
| Real Estate | 0.68% | 6.12% |
| Consumer Staples | -1.21% | 6.27% |

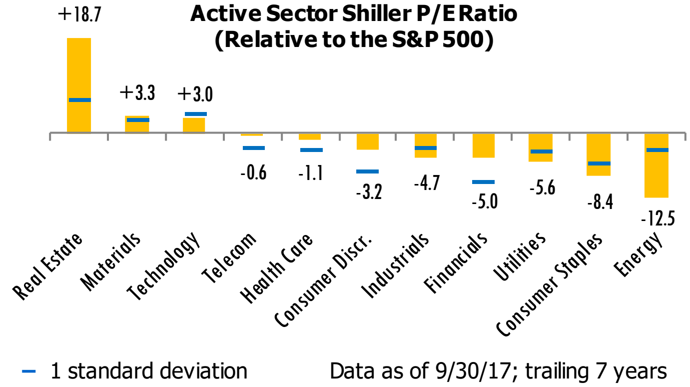
*Source: Standard & Poor's*

At the sector level, performance was distributed quite normally for the quarter, although this has not been the case year-to-date. Technology, energy and telecom were the best performers. Within technology, the internet, semiconductor, and hardware sub-sectors primarily drove returns. The growing use of machine learning across industries has led to strong demand for hardware produced by semiconductor companies, resulting in large gains. Energy and telecom stocks experienced a nice rebound this quarter after being the worst-performing sectors in the prior two quarters. Energy's performance can be attributed to the rising price of crude oil, up 12.3% for the period. This had the biggest impact on the integrated and exploration & production stocks. In telecom, market giants Verizon and AT&T experienced greater-than-expected revenue and earnings as a result of reduced "churn" or subscriber loss. Despite strong Q3 returns, both sectors remain in negative territory for the year.

On the downside, the consumer and real estate sectors lagged in the quarter. Within consumer staples, the tobacco and packaged food industries detracted most. Late in July, the Food and Drug Administration announced a multi-year plan for tobacco and nicotine regulation with a particular focus on protecting children and young adults. For packaged food companies, softening demand, commodity price volatility and the Amazon-Whole Foods merger resulted in broad losses. Performance among real estate sub-sectors was mixed over the three months, but the sector was ultimately hurt by rising interest rates in September.

Active sector valuations, relative to historical ranges against the S&P 500 index, are mixed at the moment. Specifically, real estate's valuation to the broad market is above its historical three-standard deviation level, signaling the sector is significantly overvalued. Conversely, energy's valuation to the broad market is below its historical four-standard deviation level, indicating massive undervaluation and a potential opportunity for active managers going forward.

**Active Sector Shiller P/E Ratio (Relative to the S&P 500)**




Data as of 9/30/17; trailing 7 years

# Overseas Markets

Strong performance continued unabated in global markets, even in the face of geopolitical uncertainty from elections in Germany and continued saber-rattling between the US and North Korea. Most foreign markets experienced positive performance for the period. The only difference was the magnitude, as emerging markets and developed European markets posted the best returns.

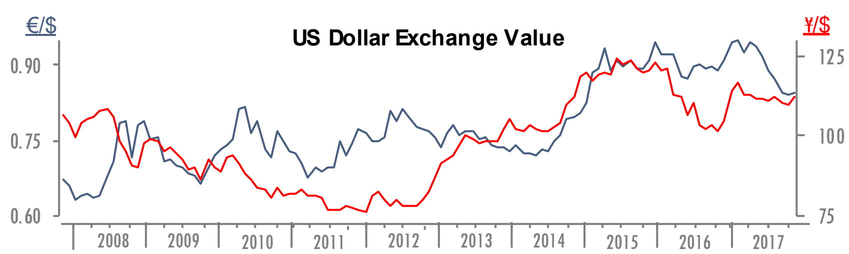
| Foreign Stock & Bond Indices - Total Returns | | | | | |
|---|---|---|---|---|---|
| **MSCI Broad Indices** | **3Q 17** | **YTD** | **Barcap Global Indices*** | **3Q 17** | **YTD** |
| World Index | 4.84% | 16.01% | Global Aggregate | 1.76% | 6.25% |
| EAFE (Developed) | 5.40% | 19.96% | Pan-Euro | 4.01% | 11.60% |
| Emerging Markets | 7.89% | 27.78% | Asian-Pacific | 0.20% | 4.32% |
| | | | Eurodollar | 1.02% | 3.45% |
| **MSCI Regions** | | | Euro-Yen | 0.22% | 4.50% |
| Europe | 6.45% | 22.79% | Other Currencies | 0.96% | 16.46% |
| Japan | 3.97% | 14.28% | ** Unhedged* | | |
| Pacific ex-Japan | 3.66% | 17.64% | | | |
| Latin America | 15.07% | 26.71% | | | |

## Europe

Euro-area markets continued to show strength amid growing optimism within the global economy. In Germany, the unemployment rate fell to a record low of 5.6% near the end of the quarter, while Eurozone inflation remained stable at 1.5%. Strong corporate earnings performance in Q2 served as a springboard into Q3. The major European markets, including Germany's DAX, France's CAC, UK's FTSE and Spain's IBEX, all showed solid gains. Banks were among the strongest advancers near the end of the period, with the Stoxx Europe 600 Banks index up 4.8% for September. ECB President Draghi indicated in early September that the central bank will share its plans to start the reduction of its QE program in October. In the meantime, the bank will continue its asset purchase program of €60billion per month through the end of 2017. While the positive growth signs are encouraging, there are still a number of things that could upset the applecart, not the least of which are Brexit negotiations and southern European peripheral countries.

Brexit negotiations began during the second quarter and are proving to be as difficult as anticipated. The parties are currently in the fourth round of negotiations, covering the Irish border, citizens' rights, and an exit bill. Talks are in peril of breaking off before any substantive discussions of future trade arrangements or a transition period have taken place, as the EU positions itself to send a message to member states that leaving the union is not beneficial.

In the periphery, Greece has slowly been implementing the demands of its European creditors. After the country received additional bailout monies from the EU, credit rating agencies revised their outlook on Greece, recognizing improving fiscal prospects and tentative signs of economic stabilization as the basis for upgrades. However, Greece is not out of the woods yet. Debt issues remain, and any economic weakness could negatively impact the economy and markets. Greece's public debt will reach 178.8% of GDP this year and 174.6% in 2018, according to the European Commission. Italy's growth remains below the eurozone average, and its high levels of debt are a concern. High levels of bad loans are likely to constrain banks from lending. According to the IMF, the recovery in Italy is expected to continue. And while the IMF revised forecasts for Italian growth upward for the year, it warned that significant downside risks remain.



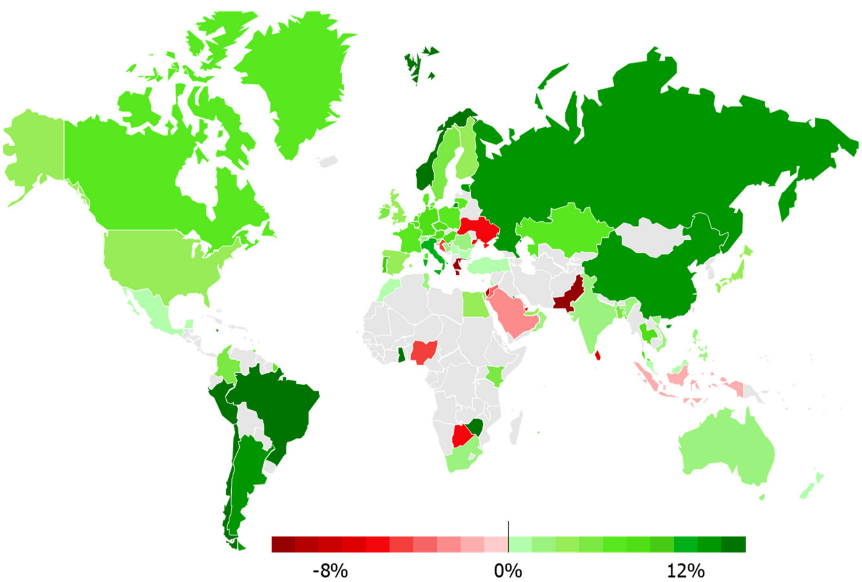

Norway's Government Pension Fund Global, the largest sovereign wealth fund in the world, passed a key milestone in September: the one-trillion-dollar mark. In 1990, Norway began investing oil money in a national fund. Debate on whether or not to allow the fund to invest in infrastructure and private equity is ongoing. As of June 30, the fund reports an allocation of 65.1% equity, 32.4% fixed income, and 2.5% unlisted real estate. The Norwegian Finance Ministry is considering a proposal from Norges Bank Investment Management, which manages the national fund, to cut its exposure to fixed income from 23 currencies to simply dollar, euro, and pound.

## Asia

The Bank of Japan kept its monetary policy steady in Q3. Japan's Ministry of Finance reported government debt to GDP stood at a ratio near 250% in 2016. This makes the Japanese government one of the most indebted in the world, in part due to its aging population. In August, consumer prices rose for an eighth straight month and at a faster pace, a small sign of progress toward the BOJ's 2% inflation target. The core consumer price index rose 0.7% from a year earlier, compared with a 0.5% increase in July. While the signs are encouraging, the CPI numbers remain short of the bank's goal, suggesting a continuation of easy monetary policy. Household spending also rose for the second time in three months, gaining 0.6% in August year-over-year, though the outcome was weaker than a 0.9% increase expected by economists. Household spending had risen for the first time in 16 months in June, but it fell again in July. The unemployment rate held steady for the third straight month at 2.8%. Another indicator of labor market tightness showed that there were 152 jobs available for every 100 job seekers, the strongest rate in more than 43 years.

Near the end of the quarter, Japanese Prime Minister Shinzo Abe unveiled a ¥2 trillion ($17.8 billion) stimulus plan causing investors to pare their holdings of Japanese government paper on concerns that the new package would hurt the government's finances. The yield on the Japanese 10-year government bond rose more than 4 basis points to 0.073% over the last week of the quarter, its highest level since early August. Abe said the government would divert the revenues from a planned consumption-tax hike on the fiscal package, instead of clearing its debt as initially planned. Childcare and education will be the biggest beneficiaries of the spending. Analysts, however, feel the move could weigh on Japan's finances, potentially resulting in a credit downgrade.

Global Quarterly Returns 3Q17




China's corporate credit growth led to a Q3 downgrade by S&P going to A+ from AA-. The big three rating agencies are more or less in agreement on their outlooks in China. October will see the 19th National Congress of the Communist Party of China. Xi Jinping hopes to further consolidate his power as 11 of the 25 Politburo members are anticipated to retire, including 5 out of 7 within the powerful Politburo Central Committee. He is expected to be granted another 5-year term. With such an important event looming, Xi Jinping does not have an appetite for dramatic reforms. After the party congress, Xi will be in a position to make tough reforms that are needed to curb corporate credit growth and continue his corruption purges. Chinese regulators have implemented some measures to shore up the yuan, including the banning of initial coin offerings and regulating bitcoin exchanges into extinction. In large part, the yuan strengthened over the quarter as efforts earlier in 2017 to cancel foreign spending sprees by large conglomerates have succeeded. The Wall Street Journal reported an order by Chinese authorities to stop funding for Dalian Wanda Group's overseas purchases of AMC Entertainment Holdings and Legendary Entertainment. The move forces the group's overseas assets to raise foreign capital rather than move yuan out of the country. It also highlights the growing connection between Hollywood and China.

Every year China has an unofficial "blackout" of Hollywood films in theatres. This year, it started on August 1st to coincide with the founding of the People's Liberation Army. The government wants the summer film season to belong to Chinese-made films. This comes at a time when US movie attendance is struggling, and the 2017 summer box office posted the worst ticket sales since 2006. The US movie industry increasingly depends on Chinese audiences to boost ticket sales. Surprisingly, the Chinese love American-made films, accounting for approximately $1.8 billion in ticket sales in 2016. When the blackout is enforced, sales are spread more or less evenly across the domestic offerings. But without a blackout, foreign films can account for 90% of the revenue.

## Latin America

In Brazil, the Central Bank's Monetary Policy Committee cut the benchmark SELIC interest rate by 100 basis points in September to 8.25%. The committee's decision met analysts' expectations and marked the eighth consecutive cut as the Central Bank continues to support economic growth in the battered economy. Favorable inflation data and a stabilizing economy provided the Bank space to loosen monetary policy and were cited as the primary factors for the decision. Price pressures appear to be receding and inflation fell to an 18-year low in August. Inflation is forecasted at around 3.3% for 2017 (in a scenario where the SELIC rate ends the year at 7.25%), and at 4.4% in 2018.

Venezuela's suspension from the Mercosur trade bloc and the imposition of harsher sanctions by the United States are clear indications of the growing diplomatic isolation the country is facing, which will likely accelerate its economic meltdown. Inflation is predicted to end 2017 at 933.5%. Substantial increases in the money supply, a sharp depreciation of the currency in the parallel market, and the dysfunctional price control system in the country have caused acute shortages of consumer goods in the economy and are among the myriad reasons behind Venezuela's spiraling inflation.

# Focus On: Blockchain – The Next Wave of Creative Destruction

The Austrian-American economist Joseph Schumpeter called creative destruction the "essential fact about capitalism." First introduced in his 1942 work *Capitalism, Socialism, and Democracy*, it's a term that has pervaded economic journals since that time and has become shorthand for the way free markets move forward. In 2014 we saw the debate on foreign direct investment that was unfolding in India as an interesting example of Schumpeter's theory in practice (see our June 30, 2014 issue). Now it strikes us that the rapidly evolving landscape in fintech is another.

The catchy abbreviation for financial technology, fintech, is decades old in use, but it has only recently made its way into the vernacular due to an impressively disruptive host of enterprises. These include peer-to-peer (P2P) lending, cryptocurrencies, crowdfunding, and robo-advice. One of the most potentially disruptive fintech segments is blockchain technology, which parallels the development of TCP/IP and other protocols upon which the internet is built. Blockchain's melding of networked computers with a cryptographically-secured chain of information blocks is novel and powerful. The technology is immature compared to the internet today, but it threatens to be just as disruptive.

## Distributed Ledger or "Blockchain" Technology

One of the most disruptive fintech categories is being promoted not by a company, but by a virtual currency. Bitcoin started off as a quiet experiment in 2008. As of September 30, 2017, the value of all bitcoins totaled more than $60 billion. Although many other competing cryptocurrencies have sprung up, some with compelling features that make them arguably superior to bitcoin, none have garnered the same levels of interest or value. The protocol that bitcoin is built on is a distributed ledger or, more colloquially, blockchain technology.

Blockchain technology works by using a distributed network of connected devices to generate and store a series of data blocks, called a ledger. Each block in the ledger is labeled with unique identifying information, including a timestamp, and contains a set of data. For cryptocurrencies, this data preserves the queued transaction information between senders and receivers of the virtual currency. In the case of bitcoin, each block also contains a prize (currently 12.5 bitcoins) awarded to the device that finds the next valid solution to a cryptographic puzzle seeded with information from the last confirmed block and the current proposed block. By requiring a commitment of time, computer processing power, and energy to solve the mathematical problem by trial and error, the ledger is secured by proof of work – or as bitcoin's creator analogized "...essentially one-CPU-one-vote" [Nakamoto]. Bitcoin's cryptocurrency prize incentivizes people to join the network, where their devices preserve ledger data and verify newly created blocks, effectively processing transactions. Other blockchain schemes might attract network participants by rewarding their contribution toward storing the ledger or verifying new blocks directly - and rather than proof of work, might rely on proof of stake (e.g., public equity where one share of stock equals one vote) or proof of authority (e.g., stocks with both voting and non-voting share classes).


Some bitcoin alternatives, like Ethereum, offer substantial improvements over bitcoin, such as built-in smart-contracts that make it possible to effectively create your own currency or shares of ownership. A smart contract can be hard-coded to execute automatically when set criteria are met. Future iterations and implementations of blockchain technology will continue to extend far beyond cryptocurrency. Startups are exploring many applications for distributed ledgers, primarily in finance.

For example, Concensys promises to replace the double-entry accounting standard with triple-entry accounting. The blockchain ledger would provide an incorruptible and transparent third-party record. Beyond accounting, distributed ledgers have many potential applications. Emerging (and developed) markets would benefit immensely from trustworthy, tamper-proof public or private government ledgers. A sovereign currency ledger could reduce corruption, illicit goods, and even tax evasion. Regulatory and administrative ledgers could better enable citizens to securely hold property and protect their identity. A title search could be performed in seconds using a distributed ledger and virtually eliminate the risk of unknown claims. Implementation costs, however, may be a hurdle. For instance, converting an antiquated paper system for titles to a blockchain would require running a search on every existing entry, prohibitively expensive for many long-standing land-title recording systems.

## Peer-to-Peer Solutions

Although distributed ledger technology (DLT) is a large space in its own right, it is a subset of an even bigger and more established technological movement: peer-to-peer solutions. Peer-to-peer (P2P) decentralized technology platforms have been successfully disrupting more traditional business empires long before bitcoin arrived. In 1999, Napster brought the joys of digital music piracy to over 80 million registered users, much to the ire of record labels. Ultimately, a centralized server used to connect users created a legal liability for Napster, leading to its shutdown in 2001. Since then, the BitTorrent's P2P protocol has taken up the mantle of P2P file sharing without the use of a central server. Outside the financial sector, Uber, Lyft and AirBnB exemplify the massive momentum in P2P solutions and have gained tremendous popularity for their immensely disruptive peer-to-peer platforms in ride-hailing and lodging.

In the connected space of peer-to-peer funding, Kickstarter allows entrepreneurs, inventors, and artists to pitch a product or service online and accept pre-orders to back the project if a predetermined funding goal is met. This crowd-funding approach cuts out the need for institutional investors and distributors or other middlemen. Similarly, crowd-offerings have started gaining traction as an alternative to the standard initial public offering (IPO). Using a blockchain platform, companies can raise capital with an initial coin offering (ICO), although it is often unclear what economic interest, if any, "investors" in some ICOs are buying – regulators and middle-men do serve some purpose after all.

## Financial Transactions Applications

Blockchain technology promises to threaten many established financial industries with a decentralized system that is safe and secure. It eliminates some very substantial barriers to entry in the financial transactions space. And while many practical limitations today prevent Bitcoin from replacing PayPal, let alone Visa and MasterCard, these limitations may be solved over time. For example, Bitcoin transactions must enter a queue and wait to be validated by subsequent blocks added further down the chain. Because each block in the ledger can only hold 1 megabyte of data, the queue can build up to dozens of blocks' worth of transactions. This can translate to hours, or even days, of waiting before you can safely assume your transaction cleared. While you can opt to pay a nominal (for now) transaction fee to skip ahead of transactions in the queue with less or no fees, transactions are still subject to a lower limit as it takes roughly 10 minutes for a new block to form. In contrast, Visa and MasterCard process thousands of transactions per second. (Imagine waiting in the grocery store checkout for 30 minutes while your transaction processed.) In response, Bitcoin was branched (split 1:1) on August 1, 2017 into Bitcoin Core (a.k.a. Bitcoin) and Bitcoin Cash. The latter is a new cryptocurrency that raises the data size of a block to 8 megabytes, among other changes, vastly speeding up transaction times.


Given the potential for market disruption, it is no surprise that large financial institutions and tech companies have been some of the biggest proponents of distributed ledger technology. In September 2015, nine financial companies, including State Street, Goldman Sachs, and JP Morgan, banded together to form the R3 consortium led by distributed database startup R3CEV. Thirty-three more financial companies joined by the end of the year. In 2016, R3 began wide-scale testing of blockchain solutions, including Ethereum. (Goldman subsequently left the consortium in 2016 on disagreements over capital investment and equity allocation.) Following a one-year trial of a distributed ledger interbank payment platform, the experiment demonstrated how the platform could improve efficiency through netting payments and reducing back-office costs. However, some unsolved hurdles currently preclude adoption of the system. The trial found that attempts to increase privacy or scalability on the platform made the system more fragile. The consortium concluded that distributed ledger technology cannot presently match the safety, security, efficiency, and resiliency of current centralized interbank payment systems, which also must conform to international regulatory standards. JP Morgan exited R3 in April, but it remains committed to the technology as a member of the Enterprise Ethereum Alliance and the Hyperledger Project.

Although scalability poses a major obstacle for many distributed ledger solutions, including bitcoin, some real-world applications are meeting success. A private equity platform built on the Linux Foundation's open source Hyperledger Fabric framework was implemented in February 2017 by Northern Trust for the administration of a private equity fund managed by Unigestion. Northern Trust was able to accomplish smooth processing of transactions that are efficient and secure by using Hyperledger's private, permissioned, blockchain approach. Transparency and real-time access for the fund manager, investors, and regulator provide a compelling edge over traditional centralized administration. Privacy concerns can be allayed by different levels of permissioning for each type of user to control what can be viewed or added. Scalability is not an issue in this case because the volume of transactions or other events on the ledger is fairly low.

## The Eve of Disruption

Delaware is the home to over half of all publicly traded companies in the US. As such, its corporate law is widely regarded as the most important in the country. On July 21, 2017, Delaware's Governor signed legislation approving blockchain use for digital shares and corporate records. Corporations, specifically the Depository Trust and Clearing Corporation (DTCC), have taken notice, as they should.

DTCC owns National Securities Clearing Corporation, NSCC, and Depository Trust Company, DTC, which together provide clearing and settlement services for almost all the securities transactions in the US. DTC is now the authority on stock transfers. So when problems arise and litigation follows, the only way to settle the dispute is to consult the central ledger at DTC. There is, however, one significant challenge with the central ledger at DTC: it can have gaps. There are times when DTC needs to suspend updating the ledger - right before a merger, for instance. This means that the central ledger that keeps track of all transactions on the stock exchange occasionally stops recording. Blockchain would solve this problem since the ledger can reside in multiple places simultaneously.

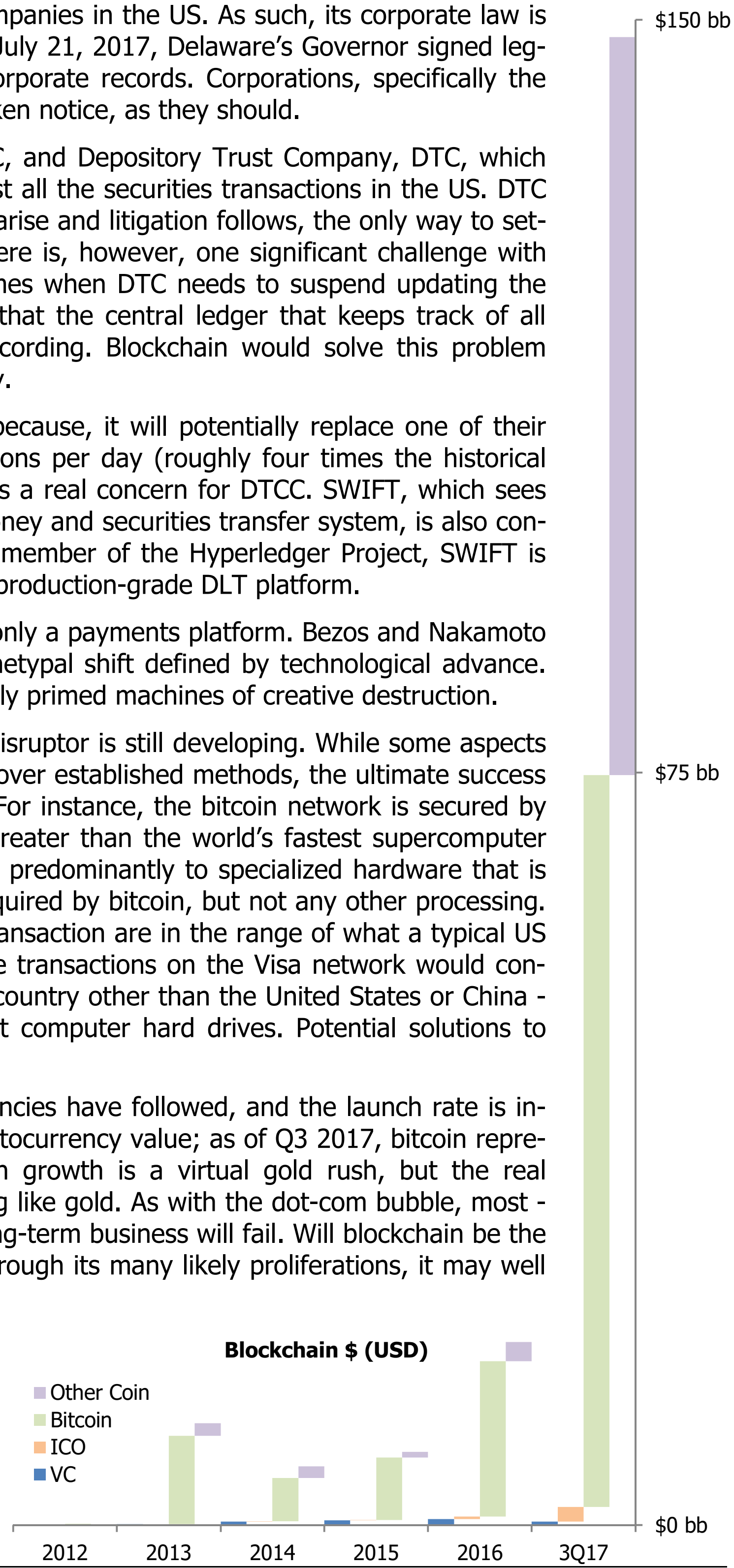
DTCC has embraced blockchain despite that, or perhaps because, it will potentially replace one of their core services. With 1.4 million settlement-related transactions per day (roughly four times the historical peak of bitcoin transaction volume), the scalability hurdle is a real concern for DTCC. SWIFT, which sees 24 million messages a day flow through its international money and securities transfer system, is also considering the potential for a distributed ledger. As a board member of the Hyperledger Project, SWIFT is working to overcome the challenges of creating a scalable, production-grade DLT platform.

Just as Amazon.com is not only a bookstore, bitcoin is not only a payments platform. Bezos and Nakamoto saw, what was to them, an obvious application of an archetypal shift defined by technological advance. Leveraging books and bitcoins, respectively, they successfully primed machines of creative destruction.

However, the case for blockchain technology as a market disruptor is still developing. While some aspects of distributed ledger technology provide a clear advantage over established methods, the ultimate success of the technology hinges on conquering its shortcomings. For instance, the bitcoin network is secured by the processing power of its network, a combined power greater than the world's fastest supercomputer multiplied two million times over. This network has shifted predominantly to specialized hardware that is very efficient at the specific cryptographic computations required by bitcoin, but not any other processing. In addition, estimates of the energy required for a single transaction are in the range of what a typical US household uses in 1-3 days. At this rate, processing all the transactions on the Visa network would consume more electricity each day than is used by any single country other than the United States or China - and the ledger would quickly exceed the capacity of most computer hard drives. Potential solutions to these problems have been proposed but remain unproven.

Since the inception of bitcoin, over a thousand cryptocurrencies have followed, and the launch rate is increasing. Bitcoin entered 2017 representing 90% of all cryptocurrency value; as of Q3 2017, bitcoin represents a minority 49% share [CoinDesk]. Explosive altcoin growth is a virtual gold rush, but the real treasure likely has yet to be imagined and may look nothing like gold. As with the dot-com bubble, most - but not all - attempts to turn blockchain into a profitable long-term business will fail. Will blockchain be the next gold, the next internet, or just a pyramid scheme? Through its many likely proliferations, it may well turn out to be all of the above.

Those of us who invested through the rise of the internet and the dot-com bubble remember that it can take time for new technology to become rooted in the business-sphere. While it is too early to determine which applications will ultimately dominate, it is clear that fintech has already dramatically altered the financial landscape and that these changes are likely just the tip of the iceberg.

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