WILLIAM BLAIR

The Dollar Problem and the Fed

IMPORTANT NOTICE

The following material is provided by a third-party strategist unaffiliated with AssetMark. The strategist is solely responsible for its content. Please read the risks and disclosures section for additional important information. AssetMark has not verified the accuracy of the information contained in this material.

For financial advisor use with advisory clients.

C20-15759 | 04/2020 | EXP 03/31/2021

William Blair

Equity Research
Economics

3 April 2020

Richard de Chazal, CFA
rdechazal@williamblair.com
+44 20 7868 4489

Economics Weekly
The Dollar Problem and the Fed

Please refer to important disclosures on pages 14 and 15. Analyst certification is on page 14.

The dollar is our currency, but it's your problem.

— John Connally, U.S. Secretary to the Treasury, 1971

The Federal Reserve on Tuesday announced the establishment of a temporary repurchase agreement facility for foreign and international monetary authorities (FIMA Repo Facility) to help support the smooth functioning of financial markets, including the U.S. Treasury market, and thus maintain the supply of credit to U.S. households and businesses.

— Federal Reserve, March 31, 2020

One of the key features of this crisis is the speed at which the financial markets have reacted, the speed at which a recession has been declared, and the speed at which policymakers have responded to the crisis. In the past, we would normally have watched the macroeconomic data filter through, or possibly even disputed whether or not there had even been a recession well after the fact—e.g., following two quarters of negative GDP growth (a rule of thumb, not the official definition of recession) already behind us. Today, few would hesitate to doubt we are now in the midst of a sharp economic downturn, with the duration and depth really the only key questions.

In this *Economics Weekly*, we discuss how the Fed, after helping to put out the fires springing up on its own turf, is being forced to broaden its reach to calm the next phase of the crisis—foreign economies and their dollar funding shortfall—and how it is reacting to the shifting demand between reserves or Treasurys by domestic banks.

Owing to the nature of this crisis—in that it originated outside the financial system, is impacting our physical health, and is global—it has been impossible for the Federal Reserve (or global central banks) to remedy the situation on its own, and as a result, substantial fiscal assistance has been formally brought into play. Yet even this will not be enough to cure all victims of the virus or make solvent all those companies that may eventually fall victim financially to the crisis.

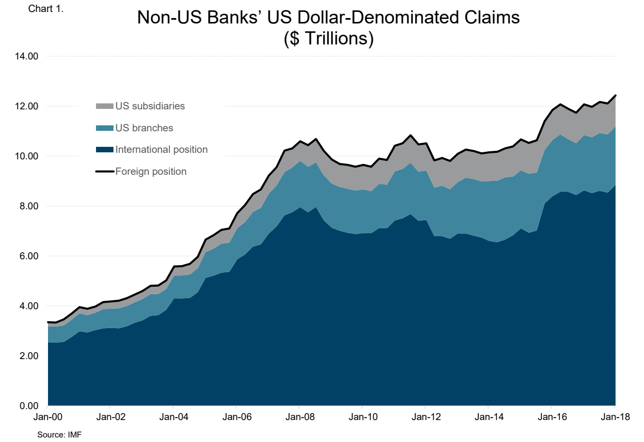
What the Fed can do, however, is act as a sponge—help to absorb some of the shock, while also squeezing out liquidity to those who need it where financial markets have seized up.

The Dollar Problem (Again)

While the Fed is happy to do this for its own domestic financial system, it is naturally a little reluctant to ride to the rescue of foreign economies where it has no regulatory oversight or jurisdiction. Yet in light of the dollar's role as the global reserve currency, the Fed has no choice but to help patch up one of the biggest fault lines in the global financial system—the global dollar shortage—for fear that if it does not it might quickly start to impact its own financial system.

Last October we wrote about this dollar shortage problem (*Economics Weekly: The Dollar Problem May Be at the Heart of Today's Issues*); despite an increasingly more globalized world—where one may have mistakenly thought that the adoption of euros, yen, and yuans as transaction currencies was more widespread—the dollar has, in fact, become even more entrenched in the global financial system. For example, the BIS has calculated that since 2000, nonbanking dollar claims have grown from \$3.3 trillion to \$12.0 trillion (chart 1).

Chart 1.



Source: IMF

In our October report, while referencing a speech by the Governor of the Bank of England Mark Carney, we wrote:

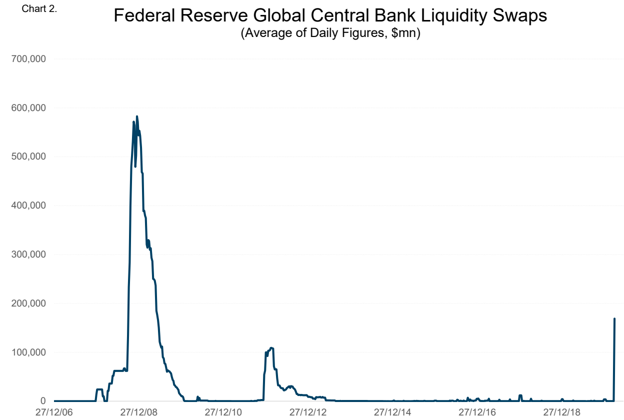
Carney points out that the dollar may no longer be fit for purpose as the world's reserve currency, and its continued use is placing increasing strains on the global financial system. He noted that while the U.S. accounts for a diminishing share of global GDP (now only about 15% on a purchasing power parity basis), 33% of countries still explicitly peg their currencies to the dollar, 50% of global trade is invoiced in dollars, and 67% of EME [emerging market economy] external debt is in dollars, as are 67% of foreign-exchange reserves and 67% of global security issuance. In addition, the countries that make up to 70% of global GDP currently use the dollar as their anchor currency.

Furthermore, in a more globalized and interconnected world with increasingly powerful network effects, the dollar's use has been rising and in the process amplifying global sensitivity to U.S. financial conditions and the direction of Fed policy.

It is unsurprising, therefore, that this current crisis has yet again been exposing these fragilities to the point where the Fed not only had to introduce swap-line agreements with the usual batch of friendly central banks—the Bank of Canada, the Bank of England, the Bank of Japan, the European Central Bank, and the Swiss National Bank—but it also had to broaden this scope to include the Reserve Bank of Australia, the Banco Central do Brasil, the Danmarks Nationalbank (Denmark), the Bank of Korea, the Banco de

Mexico, the Norges Bank (Norway), the Reserve Bank of New Zealand, the Monetary Authority of Singapore, and the Sveriges Riksbank (Sweden). It then had to increase the frequency of their operations from weekly to daily. And this past Tuesday, as described in the above quote, the Fed has had to further supplement these swap lines with dollar repo operations (chart 2).

Chart 2.



Source: Federal Reserve, William Blair Equity Research

Emerging Market Economies Feeling the Pain

The reality is that many foreigners—this time around mainly the nonfinancial corporate sectors, where national governments largely learned their lessons from the Asian crisis—have committed the original sin of taking out dollar-denominated debt. The BIS estimates that "the total stock of U.S. dollar-denominated debt of non-banks outside the United States stood at $11.4 trillion, according to the latest BIS estimate (BIS, 2018), of which non-banks from emerging market economies (EMEs) accounted for $3.7 trillion. This total of $3.7 trillion is more than double the level in 2010."

Many of these emerging economies are now facing the quadruple whammy of:

1. Collapse in revenues – Many EMEs are seeing a collapse in the key revenue drivers of their economies, including commodities such as oil, copper, aluminum, etc., and/or a collapse in tourism, as travel has dried up. Unfortunately, when the revenues disappear, the debt does not.

2. Higher interest costs – A rise in interest costs has occurred as hot money has been flooding out of these emerging markets. For example, IMF Managing Director Kristalina Georgrieva remarked last week that, "Investors have already removed US$83 billion from emerging markets since the beginning of the crisis, the largest capital outflow ever recorded. We are particularly concerned about low-income countries in debt distress."

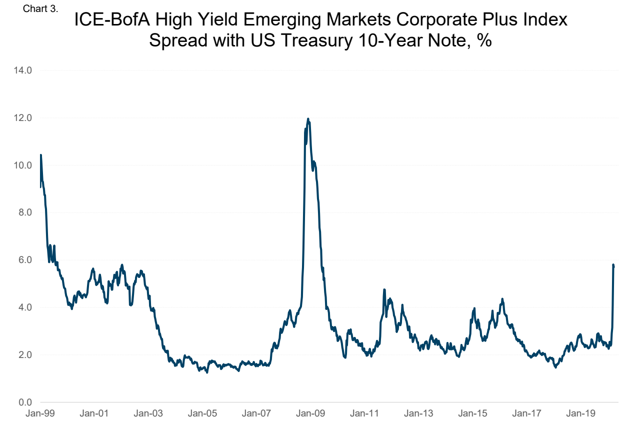
3. Stronger dollar – As the dollar has strengthened as a result of the flight to safety, it has increased the costs to foreigners who need to make regular interest payments, let alone maturing principal repayments.

4. Virus – While fiscal policymakers are finding themselves stretched in having to help shore up their own corporate and banking sectors, they might also be faced with tackling the same viral pandemic that is straining our developed market budgets—and the physical health of our populations—as it spreads.

Furthermore, it is possible that the demand for dollars might actually get worse as the crisis persists. Some companies that may initially be benefiting, of a sort, from not having to make fuel payments, e.g., airlines, still have to pay staff, maintenance, storage, rent, and so on, and might have found they have some balance sheet space for those dollar payments. Over time, however, without revenues that space evaporates, yet those interest payments continue. Investors, of course, have already started to price in these effects and the rise in credit spreads is compounding the problem (chart 3).

The IMF has estimated that the EMEs—at the very least—need $2.5 trillion in external support. The trouble, however, is that while many DMs are still putting out their own fires at home, they will not be as ready, willing, and able to step up their support abroad. It suggests further pain ahead.

Chart 3.



Source: Bloomberg, William Blair Equity Research

Fixing the Plumbing—New FIMA Repo Facility

In addition to the expanded swap lines described above, the Federal Reserve this week introduced an entirely new facility, the Foreign and International Monetary Authorities (FIMA) Repo Facility. FIMA allows foreign central banks to swap their Treasury holdings for dollars. The facility will open for business on April 6 and remain open for 6 months.

According to the Fed:

> *The FIMA Repo Facility will allow FIMA account holders, which consist of central banks and other international monetary authorities with accounts at the Federal Reserve Bank of New York, to enter into repurchase agreements*

with the Federal Reserve. In these transactions, FIMA account holders temporarily exchange their U.S. Treasury securities held with the Federal Reserve for U.S. dollars, which can then be made available to institutions in their jurisdictions. This facility should help support the smooth functioning of the U.S. Treasury market by providing an alternative temporary source of U.S. dollars other than sales of securities in the open market. It should also serve, along with the U.S. dollar liquidity swap lines the Federal Reserve has established with other central banks, to help ease strains in global U.S. dollar funding markets.

International Repos

One of the big concerns for the Fed has been that foreign central banks, which may or may not have access to its international swap facilities, may be forced to start selling down their Treasury reserve holdings, putting upward pressure on U.S. interest rates. For example, the People's Bank of China—which does not have access to Fed swap lines but will still need dollars to purchase commodities such as oil, gas, copper, etc. (all priced in dollars) in order to grow its economy as it exits the COVID-19 slump—may have no option but to sell Treasurys to raise this cash. This might put additional pressure on Treasury yields, given that numerous funds have already been forced to liquidate their Treasury holdings to meet investors' redemptions.

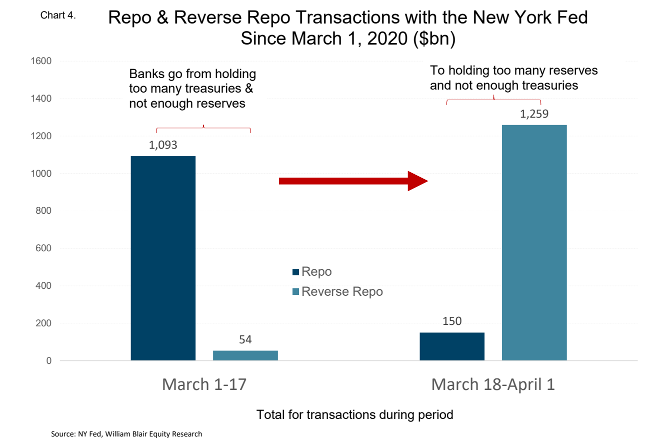
Foreign and international repos, therefore, help solve this problem by allowing these banks (or companies, using their own monetary authorities as a conduit) to temporarily offload their Treasurys for cash, without selling them. They will be able to do this on a daily basis for (at least) the next six months, rolling over repo contracts where necessary. This should help to smooth over another potential area of financial instability.

The Fed is also not exposed to any credit or exchange rate risk, given it is swapping dollars for Treasurys. And, as a result, it might also be less picky about who it does business with. For example, it is quite possible that the PBoC may be allowed to participate, where it is not afforded such an opportunity through the Fed's swap lines.

Domestic Repo and Supplemental Leverage Ratio Requirements Eased

Domestically, we've also seen some radical behavior among the major banks over the last month. At the start of March, when investors dumping assets for cash and banks were scrambling to increase their dollar reserves, we saw a huge $1.1 trillion increase in use of the Fed's repo facility (banks swapping Treasurys for reserves). Such high demand was one of the key reasons behind the Fed unveiling QE-infinity, to help soak up and stabilize the Treasury market.

In the second half of the month, however, we've seen just the opposite. Banks have found themselves flooded with customer cash deposits and reserves, following QE, that they are now keen to swap those reserves back into Treasurys, hence the $1.3 trillion surge in reverse repos (chart 3). Increased Treasury holdings, however, come at a cost in that they adversely impact banks' supplemental leverage ratio (SLR).



SLR was a post-financial crisis banking measure, which had forced large financial institutions to hold a 3% tier-1 capital to total assets ratio, to provide them with a greater cushion in the case of another financial crisis. The rule has worked well up to now, given that banks have indeed gone into this crisis with much more solid balance sheets.

However, according to the Fed, over the last few weeks, "[l]iquidity conditions in Treasury markets have deteriorated rapidly, and financial institutions are receiving significant inflows of customer deposits along with increased reserve levels," which is reducing banks' ability to lend. As a result, the Fed is no longer counting Treasurys and reserves from the calculation of the rule, which subsequently frees up more space for those banks to lend to corporations and households.

Conclusion

While fluctuations in the dollar in the past were largely the result of interest rate differentials, in more recent years they have been the result of risk-on/risk-off movements in international financial markets. The recent crisis has been no different in that there has been a huge surge in the demand for safe dollar assets internationally. Yet even during the best of times there is a shortage of dollars—companies and nations have built up very large and still growing amounts of dollar-denominated debt that needs to be serviced; they need to purchase raw materials in dollars as well as shore up their own FX reserves, etc. So when a crisis hits, this shortage becomes even more acute and is currently being reflected in the EME credit spreads and currency weakness. The Fed recognizes that a major EME crisis would also threaten the global economy, and, as a result, would no longer agree with Secretary Connally that the dollar is "our currency, but your problem"—it's now both "our currency, and our problem."

As a result, it has been helping to meet this challenge with the establishment of broadened swap lines extended to international central banks. It has also been forced to open up repo facilities to a wider group of monetary authorities to ease any pressures they may have to sell their Treasurys to raise dollars for their financial and nonfinancial corporate sectors.

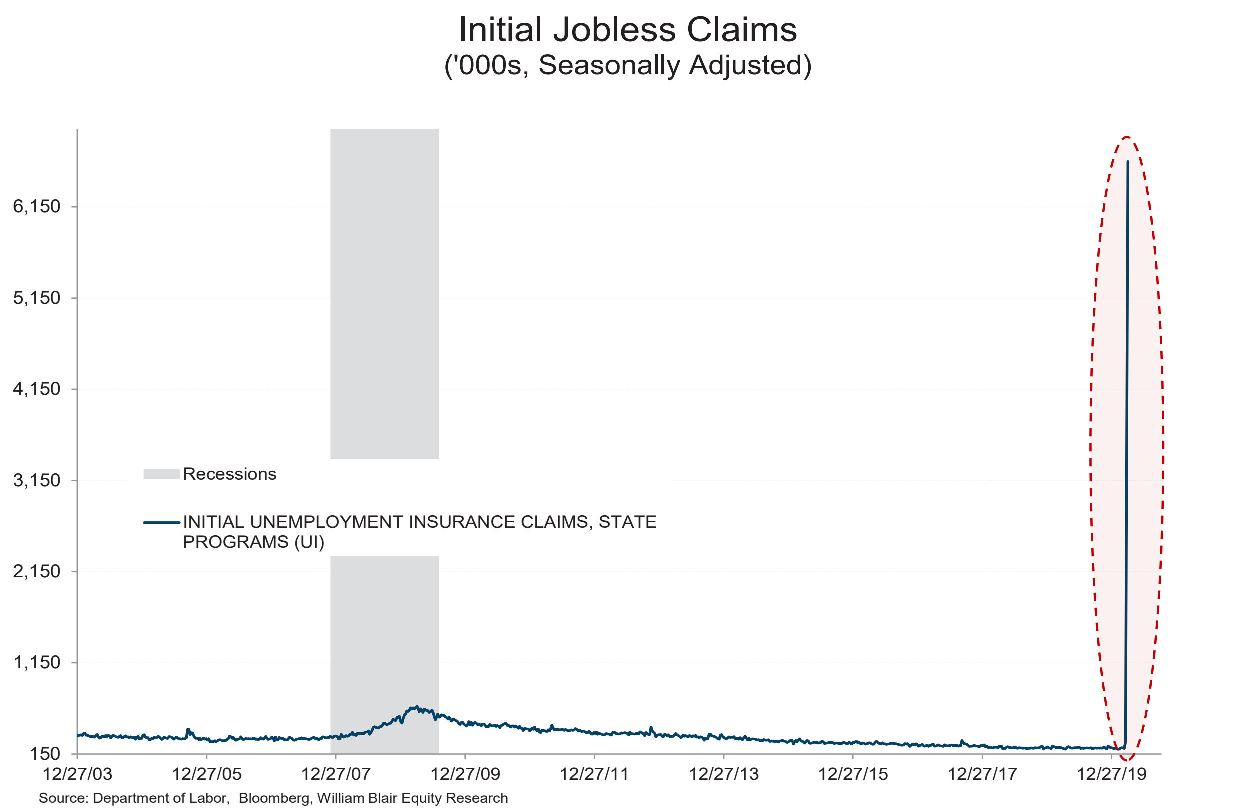
Domestically, banks have also seen big swings in the demand and supply of cash and reserves. Earlier on in the crisis banks were cash short and Treasury long, as companies and investors were desperate for cash. Over the last two weeks, however, they have swung in just the opposite direction, with the results reflected in the big shift from heavy use of the Fed's repo facility to heavy use of its reverse repo facility. In part because of this, the Fed has also tried to smooth out what has been a constraint for banks on increased bank lending, by easing their supplemental leverage ratio to no longer include Treasurys and reserves in the calculation.

Highlights in the Week Ahead

Date	Time (EDT)	Indicator	Last	Consensus	WB Estimate	Actual
8 Apr	2:00 p.m.	FOMC Minutes (Mar)				
9 Apr	8:30 a.m.	Producer Prices Index (Mar)	-0.6%	-0.3%	-0.4%	
		PPI Less-food & energy	-0.3%	0.0%	-0.1%	
9 April	8:30 a.m.	Initial Jobless Claims (Apr 4)	6648	NA	NA	
9 April	10:00 a.m.	University of Michigan Survey (Apr)	89.1	82.0	NA	

Sources: Bloomberg, William Blair

Indicator of the Week: Initial Jobless Claims



Economic Scorecard

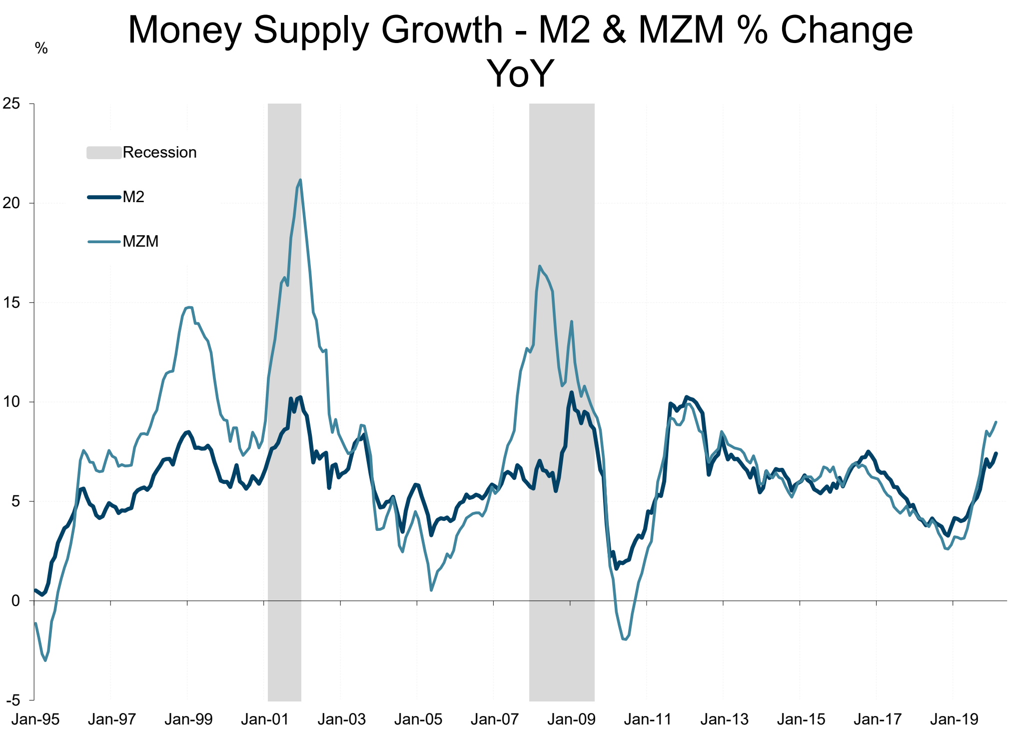
Rolling monthly heat map, % Change on Year Ago (unless otherwise noted)

	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20
Growth																		
US Leading Indicators	5.2	4.9	4.0	3.4	2.9	2.7	2.4	2.4	1.7	1.5	1.0	0.3	0.2	0.2	0.1	0.8	0.7	0.7
US Coincident Indicators	2.3	2.2	2.2	2.4	2.2	2.2	1.8	1.8	1.7	1.5	1.5	1.6	1.4	1.5	1.2	1.1	1.4	1.4
US Lagging Indicators	2.8	3.0	2.9	2.9	3.1	3.2	2.9	2.4	2.8	3.5	2.9	2.8	2.6	2.5	2.2	1.7	1.8	1.8
Consumer																		
Total Retail Sales	4.8	4.1	1.6	2.4	2.2	3.8	3.8	3	3.3	3.5	4.4	4	3.1	3.3	5.4	5	4.3	4.3
Personal Income	5.1	4.7	5	4.5	4.7	4.7	4.8	4.7	4.6	4.1	4.1	4.3	4.1	4.4	3.7	4	4	
Real Disposable Personal Income	3.8	3.7	4.2	3.2	3.4	3.3	3.1	3	2.9	2.5	2.6	3	2.6	2.9	1.8	2.2	2.2	
Real Personal Consumption	3.2	3	1.7	2.4	2.3	2.8	2.7	2.6	2.6	2.6	2.5	2.7	2.3	2.3	3.3	2.8	3	
Personal Saving Rate (%)	7.3	7.2	8.8	8.3	8.8	8.4	8	7.8	7.8	7.4	7.7	7.8	7.6	7.7	7.5	7.9	8.2	
Consumer Confidence (Conference Board)**	137.9	136.4	126.6	121.7	131.4	124.2	129.2	131.3	124.3	135.8	134.2	126.3	126.1	126.8	128.2	130.4	132.6	120
Employment																		
Employment Growth	1.6	1.5	1.6	1.7	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.4	1.3	1.4	1.4	1.4	1.6	1.6
ASA Temporary Staffing Index	3.7	1.1	-12.7	-0.6	-1.3	-1.9	-3.0	-2.4	-1.7	-4.6	-4.7	-5.1	-6.5	1.4	-6.9	-6.2	-6.8	-12.2
ISM Employment Index Manufacturing*	56.6	57.8	56.2	55.2	53.2	57.1	52.4	53.1	54.3	51.3	47.6	46.5	47.9	46.8	45.2	46.6	46.9	43.8
ISM Employment Index Services*	58.4	57.8	56.2	56.4	55.6	55.9	54.5	57.1	55.2	55.7	53.7	51.7	53.9	54.9	54.8	53.1	55.6	55.6
Unemployment Rate, %	3.8	3.7	3.9	4	3.8	3.8	3.6	3.6	3.7	3.7	3.7	3.5	3.6	3.5	3.5	3.6	3.5	3.5
Average Hourly Earnings	3.3	3.4	3.4	3.3	3.5	3.4	3.3	3.3	3.4	3.5	3.5	3.1	3.2	3.3	3	3.1	3	3
Initial Jobless Claims (avg. wkly. chg. '000s)	216	226	217	220	225	217	216	217	221	214	217	213	215	216	226	210	214	2612
Jop Openings	13.4	21.0	17.1	13.2	7.2	7.3	4.3	3.9	-1.3	-1.2	-1.1	-3.2	1.0	-9.5	-10.3	-7.4	-1.2	-5.4
Layoff Announcements	153.6	51.5	35.3	18.7	117.2	0.4	10.9	85.9	12.8	43.2	39	-24.8	-33.5	-16	-25.2	27.8	-26.3	266.9
Housing Market																		
Housing Starts	-4.3	-7.8	-5.6	-3.2	-10.9	-9.6	0.2	-5.1	4.5	1.7	7.5	2.4	10.7	14.9	40.2	25.8	39.2	39.2
New Home Sales	-11.7	-14	-14	2.5	3.9	6	4.3	-8	18	8.4	17.2	19.4	26.9	13.8	28.4	24.2	14.3	
Existing Home Sales	-5.0	-8.2	-10.1	-8.6	-2.5	-5.6	-3.7	-1.1	-2.0	0.8	2.5	3.2	4.2	3.1	10.4	8.8	7.2	
Median House Price (Existing Homes)	2.8	-10.2	-4	-7.3	-2	-7.4	7.8	-1.3	0.4	-5.9	1.7	-3.8	-1.8	6.3	-0.6	6.5	7.8	
Existing Homes Inventory (Mths' supply)	4.1	4.1	4.3	4.3	3.9	3.9	4	4	4	3.9	3.8	3.9	3.9	3.9	3.6	3.5	3.2	
New Homes Inventory (Mths' supply)	7.2	6.5	7.4	6.5	6.1	5.8	6.1	6.7	5.4	6	5.5	5.3	5.4	5.5	5.4	4.8	5	
NAHB Homebuilder Sentiment*	68	60	56	58	62	62	63	66	64	65	67	68	71	71	76	75	74	72
Inflation																		
Consumer Price Index	2.5	2.2	1.9	1.6	1.5	1.9	2	1.8	1.6	1.8	1.7	1.7	1.8	2.1	2.3	2.5	2.3	2.3
CPI Less-food & energy	2.1	2.2	2.2	2.2	2.1	2	2.1	2	2.1	2.2	2.4	2.4	2.3	2.3	2.3	2.3	2.4	2.4
Producer Price Index	3.1	2.6	2.6	1.9	1.9	2	2.4	2.1	1.6	1.6	1.9	1.5	1	1.1	1.3	2.1	1.3	1.3
PPI Less-food & energy	2.7	2.7	2.9	2.6	2.5	2.3	2.5	2.4	2.2	2.2	2.3	2	1.6	1.3	1.1	1.7	1.4	1.4
PCE Price Index	2	1.9	1.8	1.4	1.3	1.4	1.5	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.6	1.8	1.8	
PCE Prices Less-food & energy	1.9	2.0	2.0	1.8	1.6	1.5	1.6	1.5	1.6	1.6	1.8	1.7	1.6	1.5	1.6	1.7	1.8	
Business Activity - US																		
Industrial Production	4.1	4.1	3.8	3.6	2.7	2.3	0.7	1.7	1.0	0.4	0.3	-0.2	-0.8	-0.4	-0.9	-1.0	0.0	0.0
New Cap Gds Orders less-aircraft & parts	5.7	6.4	2.2	3.5	2.3	2.2	2.4	0.7	-0.5	0.7	-1.9	0.2	-0.5	-1.5	1.8	1.5	1.5	
Business Inventories	5.2	4.7	2.2	5.3	4.9	5	5.3	5.3	5.2	4.8	4.2	3.7	3	2.8	2.2	1.1	0	
ISM Manufacturing PMI*	58.5	58.8	55	55.5	54.1	54.6	53.4	52.3	51.6	51.3	48.8	48.2	48.5	48.1	47.8	50.9	50.1	49.1
Markit US Manufacturing PMI*	55.7	55.3	53.8	54.9	53	52.4	52.6	50.5	50.6	50.4	50.3	51.1	51.3	52.6	52.4	51.9	50.7	48.5
ISM Non-Manufacturing Index*	60.3	60.2	58	56	58.5	56.3	55.7	56.3	55.4	54.8	56	53.5	54.4	53.9	54.9	55.5	57.3	57.3
Markit US Services PMI*	54.8	54.7	54.4	54.2	56	55.3	53	50.9	51.5	53	50.7	50.9	50.6	51.6	52.8	53.4	49.4	39.1
Business Activity - International																		
Germany Manufacturing PMI Markit/BME*	52.2	51.8	51.5	49.7	47.6	44.1	44.4	44.3	45	43.2	43.5	41.7	42.1	44.1	43.7	45.3	48	45.4
Japan Manufacturing PMI Jibun Bank*	52.9	52.2	52.6	50.3	48.9	49.2	50.2	49.8	49.3	49.4	49.3	48.9	48.4	48.9	48.4	48.8	47.8	44.8
Caixin China Manufacturing PMI*	50.1	50.2	49.7	48.3	49.9	50.8	50.2	50.2	49.4	49.9	50.4	51.4	51.7	51.8	51.5	51.1	40.3	50.1
China Manufacturing PMI*	50.2	50	49.4	49.5	49.2	50.5	50.1	49.4	49.4	49.7	49.5	49.8	49.3	50.2	50.2	50	35.7	52
UK Manufacturing PMI Markit/CIPS*	51.1	53.3	54.3	52.8	52.1	55.1	53.1	49.4	48	48	47.4	48.3	49.6	48.9	47.5	50	51.7	47.8
France Manufacturing PMI Markit*	51.2	50.8	49.7	51.2	51.5	49.7	50	50.6	51.9	49.7	51.1	50.1	50.7	51.7	50.4	51.1	49.8	43.2
Currencies***																		
Euro (EUR/USD)	-2.9	-4.9	-4.5	-7.8	-6.7	-9.0	-7.1	-4.5	-2.7	-5.3	-5.3	-6.1	-1.4	-2.6	-2.2	-3.1	-3.0	-1.7
Renmimbi (USD/CNY)	5.1	5.3	5.7	6.5	5.7	7.0	6.4	7.7	3.7	0.9	4.8	4.1	0.9	1.0	1.2	3.2	4.5	5.5
Yen (USD/Yen)	-0.6	0.9	-2.7	-0.3	4.4	4.3	1.9	-0.5	-2.6	-2.8	-4.3	-4.9	-4.3	-3.6	-1.0	-0.5	-3.1	-3.0
Sterling (GBP/USD)	-3.9	-5.7	-5.6	-7.6	-3.6	-7.0	-5.3	-5.0	-3.9	-7.4	-6.2	-5.7	1.4	1.4	3.9	0.7	-3.3	-4.7
Canadian $ (USD/CAD)	2.1	3.1	8.5	6.6	2.7	3.5	4.2	4.3	-0.3	1.4	2.1	2.6	0.1	-0.1	-4.7	0.9	1.8	5.3
Mexican Peso (USD/MXN)	6.2	9.3	0.0	2.7	2.4	6.9	1.2	-1.5	-3.4	2.7	5.1	5.4	-5.4	-4.1	-3.7	-1.4	1.9	21.8
US Equities																		
S&P 500	5.3	4.3	-6.2	-4.2	2.6	7.3	11.2	1.7	8.2	5.8	0.9	2.2	12.0	13.8	28.9	19.3	6.1	-8.8
S&P 400 Midcap	-0.5	-1.1	-12.5	-6.1	2.5	0.9	5.2	-7.0	-0.3	-0.9	-8.0	-4.2	7.1	7.0	24.1	9.4	-5.0	-23.9
S&P 600 Smallcap	4.2	2.1	-9.8	-2.6	5.7	0.1	2.9	-11.8	-6.3	-8.1	-16.4	-10.8	1.6	3.2	20.9	4.9	-9.1	-27.1
Russell 2000	0.6	-0.7	-12.2	-4.8	4.2	0.7	3.2	-10.3	-4.7	-5.8	-14.1	-10.2	3.4	6.0	23.7	7.6	-6.3	-25.1

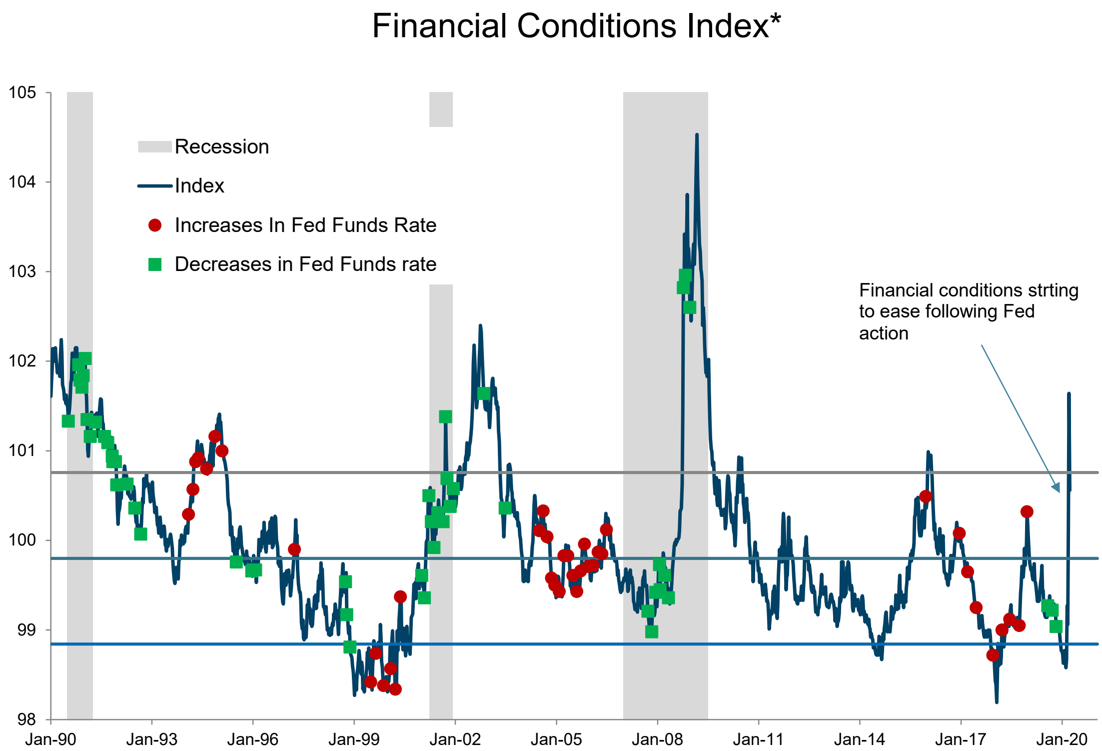
* Diffusion Index, **1985=100, ***Currencies - green/red = strengthening/weakening foreign currency vs dollar

Source: ISM, Federal Reserve, Census Bureau, Bureau of Labor Statistics, Conference Board, Bloomberg, William Blair

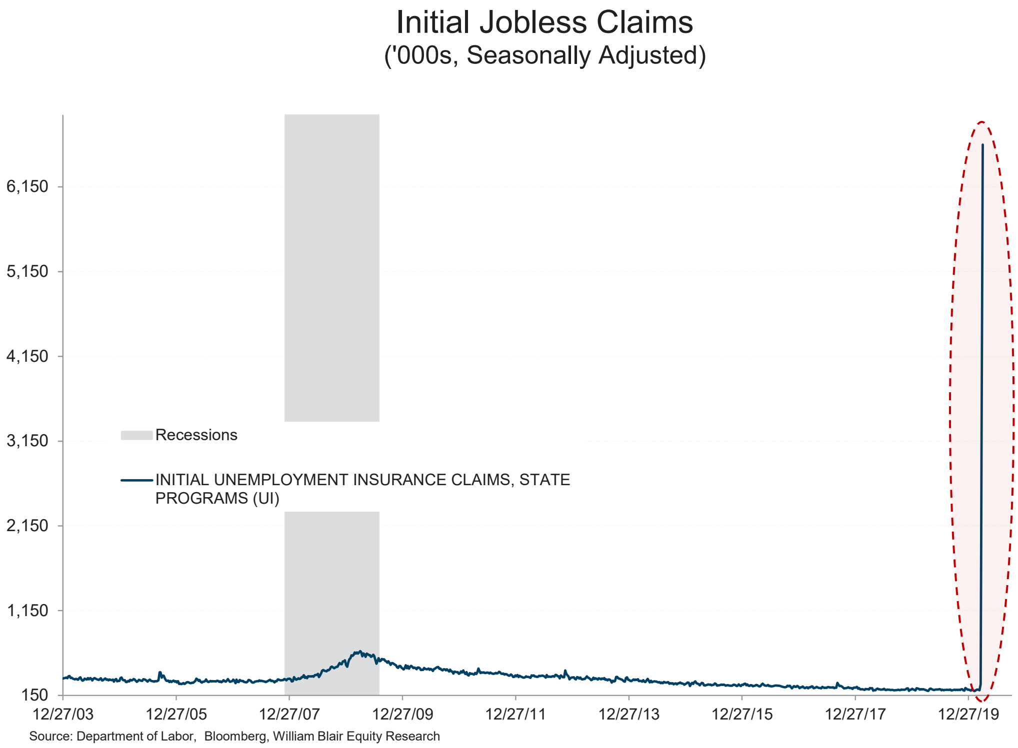
Other Economic Indicators



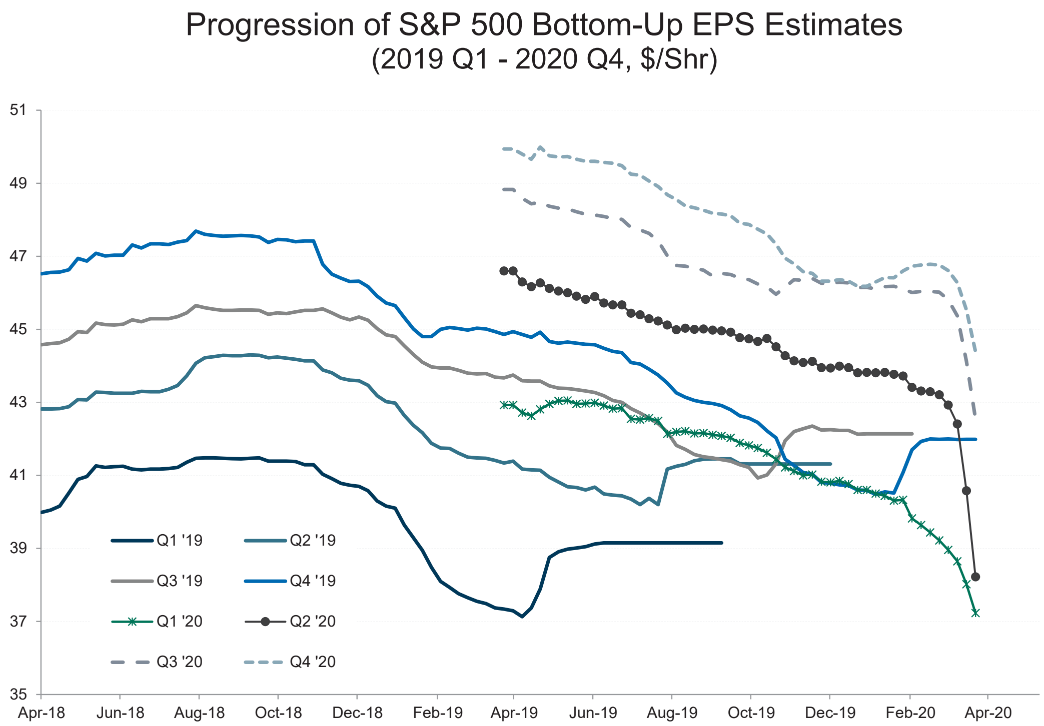
Source: Federal Reserve, William Blair



*The Goldman Sachs FCI is a weighted sum of a short-term bond yield, a long-term corporate yield, the exchange rate, and a stock market variable. Since 2005, the long-term corporate yield has been measured as a sum of the 10-year swap rate and the 10-year credit default swap spread.
Source: Bloomberg, William Blair

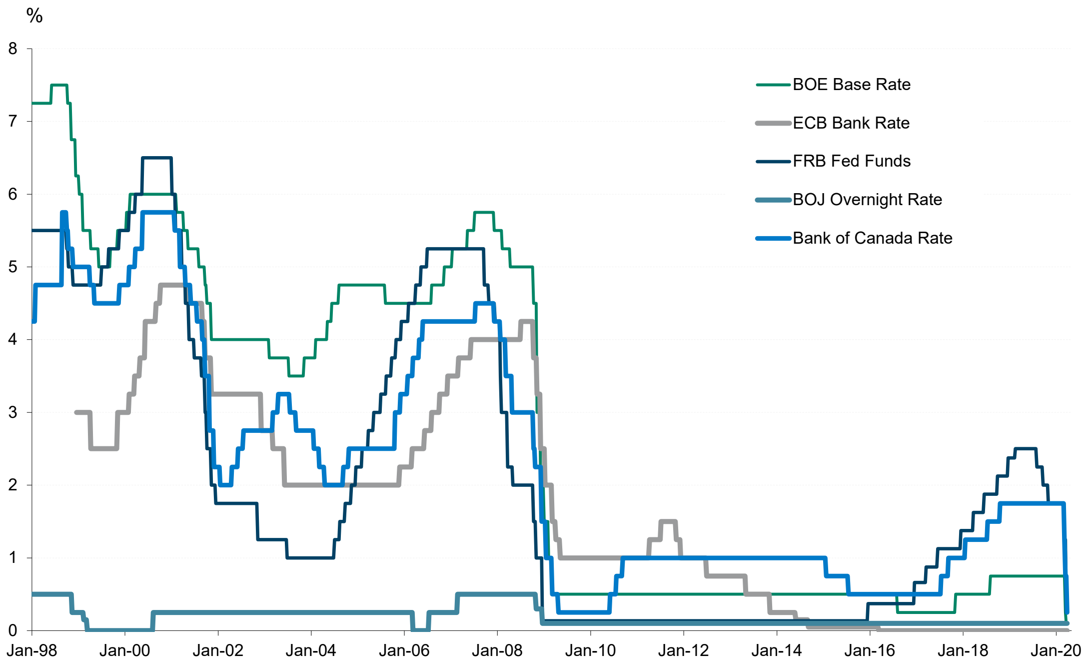


Source: Department of Labor, Bloomberg, William Blair Equity Research



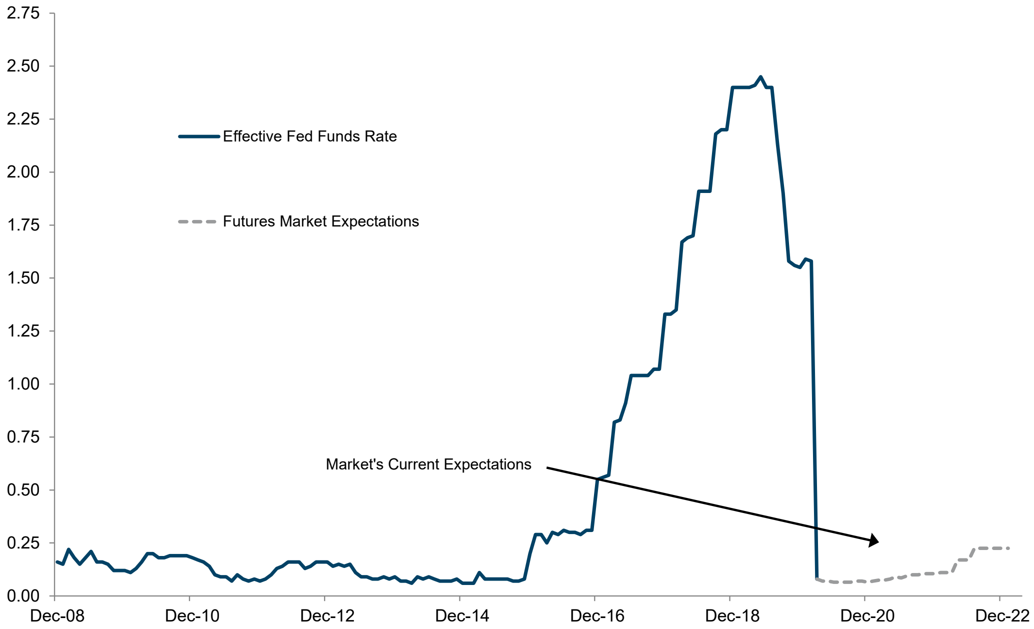
Source: Refinitiv, William Blair

Central Bank Target Short Term Interest Rates



Source: Bloomberg, William Blair

Fed Funds Rate, The FOMC's Expectations & Futures Market Expectations, %



Source: Bloomberg, Federal Reserve, William Blair

S&P 500 Sector Performance

Global Industry Classification System	Current Weight* 02-Apr-20	Week Ago 26-Mar-20	Month Ago 02-Mar-20	Qtr-to-Date 31-Mar-20	Year-to-Date 31-Dec-19
S&P 500 Index	**100.00**	**-3.92**	**-18.23**	**-2.23**	**-21.79**
S&P400 MidCap Index		**-6.54**	**-26.67**	**-4.71**	**-33.33**
S&P600 SmallCap Index		**-7.90**	**-28.92**	**-5.78**	**-36.81**
Dow Jones Industrials		**-5.05**	**-19.81**	**-2.30**	**-24.97**
Nasdaq Composite		**-3.98**	**-16.36**	**-2.76**	**-16.55**
Communication Services	**11.05**	**-3.33**	**-17.09**	**-2.18**	**-19.03**
Advertising	0.08	-9.63	-28.82	-7.20	-36.39
Alternate Carriers	0.04	-5.29	-30.11	-6.97	-33.39
Broadcasting	0.14	-9.49	-35.80	-5.11	-52.47
Cable & Satellite	1.21	-5.96	-18.08	-0.18	-20.77
Integrated Telecommunication Services	1.99	-1.43	-13.78	0.79	-18.69
Interactive Home Entertainment	0.41	4.32	-0.39	1.95	-0.89
Interactive Media & Services	5.11	-3.70	-19.75	-4.30	-19.05
Movies & Entertainment	1.58	-3.85	-12.69	-0.97	-17.16
Publishing & Printing	0.02	-10.56	-34.36	-8.75	-42.42
Wireless Telecommunication Svcs	0.47	-0.26	-9.52	0.61	7.64
Consumer Discretionary	**10.12**	**-6.53**	**-19.36**	**-3.63**	**-22.51**
Apparel Retail	0.39	-9.17	-31.21	-8.83	-31.24
Apparel & Accessories & Luxury Goods	0.16	-21.22	-43.51	-10.66	-56.74
Auto Parts & Equipment	0.07	-15.70	-41.28	-7.75	-51.09
Automobile Manufacturers	0.20	-18.37	-41.01	-11.32	-51.54
Automobile Retail	0.25	-10.04	-27.43	-3.39	-35.36
Casinos & Gaming	0.19	-18.40	-42.76	-6.17	-54.30
Computer & Electronics Retail	0.06	-16.10	-33.73	-7.44	-39.91
Consumer Electronics	0.06	-1.04	-21.41	-2.00	-24.70
Department Stores	0.02	-29.65	-66.32	-15.14	-73.77
Distributors	0.07	-13.09	-33.97	-9.18	-44.67
Footwear	0.46	-4.93	-13.53	-3.14	-20.90
General Merchandise Stores	0.48	2.14	-9.28	2.14	-17.16
Home Furnishings	0.04	-20.70	-43.58	-12.45	-52.41
Home Improvement Retail	1.18	-6.84	-22.22	-3.09	-20.82
Homebuilding	0.16	-19.73	-43.75	-8.56	-40.51
Hotels, Resorts & Cruise Lines	0.22	-29.57	-55.20	-19.02	-66.70
Household Appliances	0.02	-1.88	-39.02	-4.86	-44.67
Housewares & Specialties	0.02	-14.46	-26.63	-9.11	-37.20
Internet Retail	4.75	-2.70	-4.99	-2.03	-1.93
Leisure Products	0.04	3.14	-11.17	-1.56	-33.31
Motorcycle Manufacturers	0.01	-22.41	-48.16	-14.94	-56.70
Restaurants	1.10	-6.22	-22.51	-2.59	-24.53
Specialized Consumer Services	0.01	-20.91	-41.58	-10.79	-46.51
Specialty Stores	0.16	-4.11	-17.38	-2.47	-16.93
Consumer Staples	**8.83**	**2.16**	**-9.85**	**1.01**	**-12.52**
Agricultural Products	0.09	-0.38	-11.61	-2.42	-25.93
Brewers	0.04	3.57	-22.30	2.54	-25.79
Distillers & Vintners	0.18	-5.06	-22.87	-6.42	-27.59
Drug Retail	0.16	-11.71	-16.19	-11.87	-31.61
Food Distributors	0.10	-22.79	-40.74	-9.51	-51.73
Food Retail	0.11	8.97	6.47	4.91	9.00
Household Products	1.94	6.14	-4.85	3.47	-6.01
Hypermarkets & Supercentres	2.13	4.27	-1.28	3.46	-0.45
Packaged Foods & Meats	1.30	3.19	-6.81	0.60	-12.30
Personal Products	0.17	-14.69	-24.58	-6.65	-29.96
Soft Drinks	1.79	0.73	-15.96	1.01	-15.19
Tobacco	0.84	2.32	-13.03	-1.31	-18.75
Energy	**2.72**	**-0.59**	**-34.30**	**4.02**	**-49.09**
Integrated Oil & Gas	1.49	1.92	-25.85	5.93	-41.73
Oil & Gas Drilling	0.01	-13.72	-56.54	4.48	-64.01
Oil & Gas Equipment & Services	0.18	-8.02	-49.71	3.82	-64.80
Oil & Gas Exploration & Production	0.52	1.17	-39.52	7.58	-54.18
Oil & Gas Refining & Marketing & Transportation	0.26	-6.94	-41.20	-6.89	-57.50
Oil & Gas Storage & Transportation	0.26	-5.36	-42.70	-1.34	-48.08

Financials	**10.22**	**-7.80**	**-27.86**	**-3.65**	**-34.81**
Asset Management & Custody Banks	0.81	-3.31	-20.42	-2.07	-27.86
Consumer Finance	0.46	-20.88	-43.03	-11.36	-49.73
Diversified Banks	3.17	-11.10	-32.05	-3.94	-42.95
Financial Exchanges & Data	1.21	-2.17	-16.01	-0.93	-11.68
Insurance Brokers	0.52	-4.08	-24.86	-4.76	-23.59
Investment Banking & Brokerage	0.75	-5.25	-25.55	-0.80	-32.06
Life & Health Insurance	0.41	-13.86	-37.81	-9.25	-46.52
Multi-line Insurance	0.17	-14.84	-43.05	-8.88	-50.95
Multi-Sector Holdings	1.14	-2.27	-17.41	-1.69	-20.65
Property & Casualty Insurance	0.80	-2.33	-22.41	-2.55	-22.99
Reinsurance	0.04	-3.91	-27.30	-2.46	-32.20
Regional Banks	0.76	-13.56	-37.98	-5.97	-47.40
Health Care	**15.16**	**0.54**	**-9.48**	**-1.18**	**-14.10**
Biotechnology	2.46	4.36	-3.79	1.06	-2.30
Health Care Distributors	0.27	-1.64	-13.29	-4.28	-9.19
Health Care Equipment	3.47	-1.37	-12.75	-2.38	-18.12
Health Care Facilities	0.16	-9.39	-36.69	-7.59	-42.08
Health Care Services	0.76	-4.65	-17.03	-5.85	-22.52
Health Care Supplies	0.16	-8.71	-24.61	-4.22	-31.36
Health Care Technology	0.09	1.51	-14.60	-1.63	-15.57
Life Sciences Tools & Services	1.07	-0.47	-8.90	0.13	-16.44
Managed Health Care	1.62	-5.86	-12.72	-4.34	-19.54
Pharmaceuticals	5.11	4.15	-5.51	0.57	-10.74
Industrials	**8.13**	**-7.18**	**-23.95**	**-3.19**	**-29.73**
Aerospace & Defense	2.02	-14.32	-32.56	-5.19	-37.42
Agricultural & Farm Machinery	0.20	0.21	-14.97	0.88	-19.55
Air Freight & Logistics	0.53	-5.03	-5.18	-0.73	-19.79
Airlines	0.20	-28.03	-47.49	-17.32	-59.12
Building Products	0.30	-6.42	-26.27	-3.86	-31.21
Construction & Engineering	0.07	0.58	-17.52	0.85	-14.36
Construction Machinery & Heavy Trucks	0.52	1.83	-13.00	-0.76	-24.35
Diversified Support Svcs	0.15	-12.79	-34.37	-5.31	-34.35
Electrical Components & Equipment	0.43	-4.11	-24.07	-2.10	-29.42
Environmental & Facilities Services	0.34	-4.61	-20.51	-1.02	-17.03
Human Resource & Employment Services	0.02	-12.96	-25.93	0.21	-40.09
Industrial Conglomerates	1.22	-4.68	-21.89	-3.51	-26.51
Industrial Machinery	0.69	-4.32	-25.68	-2.90	-30.46
Railroads	0.87	-1.98	-16.22	-0.53	-22.40
Research & Consulting Svcs	0.41	-2.17	-19.23	-0.71	-17.14
Trading Companies & Distributors	0.17	-4.31	-17.97	-3.38	-27.29
Trucking	0.11	-8.45	-6.49	-3.87	-11.00
Information Technology	**25.01**	**-4.93**	**-15.83**	**-2.55**	**-14.45**
Application Software	2.01	-8.71	-18.50	-5.06	-13.00
Communications Equipment	1.00	-3.38	-6.47	0.65	-17.01
Data Processing & Outsourced Services	4.18	-7.79	-20.88	-2.88	-19.41
Electronic Components	0.16	-13.61	-26.21	-7.05	-36.18
Electronic Equipment & Instruments	0.13	-4.84	-18.31	-1.33	-26.33
Electronic Manufacturing Services	0.12	-13.27	-29.51	-6.39	-37.14
Internet Software & Services	0.17	1.21	-3.42	1.32	-0.10
IT Consulting & Services	1.12	-6.64	-19.96	-2.98	-24.32
Semiconductor Equipment	0.42	-13.11	-25.24	-7.00	-26.85
Semiconductors	3.93	-3.39	-12.53	-0.77	-14.57
Systems Software	6.48	-1.06	-10.15	-1.51	-2.04
Technology Distributors	0.06	-12.95	-26.68	-5.67	-38.41
Technology Hardware, Storage & Peripherals	5.23	-5.55	-18.66	-3.88	-17.89
Materials	**2.37**	**-5.20**	**-20.36**	**-3.16**	**-28.92**
Commodity Chemicals	0.17	-9.15	-34.65	-5.37	-49.76
Construction Materials	0.12	-0.93	-19.03	-2.51	-30.28
Copper	0.04	-8.58	-39.14	-5.33	-51.29
Diversified Chemicals	0.03	-5.36	-27.89	-2.58	-42.75
Fertilizers & Agricultural Chemicals	0.16	-8.01	-26.77	-6.84	-33.44
Gold	0.18	-0.10	2.99	6.52	11.01
Industrial Gases	0.60	-5.03	-16.70	-4.32	-21.15
Metal & Glass Containers	0.10	3.20	-14.12	-0.16	-0.17
Paper Packaging	0.24	-3.05	-18.40	-2.56	-30.30
Specialty Chemicals	0.69	-8.21	-22.96	-3.94	-33.07
Steel	0.05	7.17	-15.82	-0.21	-36.14

Real Estate	**2.84**	**-5.51**	**-23.38**	**-4.85**	**-23.73**
Health Care REITs	0.16	-20.34	-48.10	-14.75	-52.05
Hotel & Resort REITs	0.03	-23.36	-36.21	-13.49	-48.52
Industrial REITs	0.31	-2.67	-13.97	-6.25	-14.95
Office REITs	0.17	-10.74	-32.74	-7.87	-37.18
Real Estate Service	0.06	-9.79	-36.98	-2.76	-40.17
Residential REITs	0.35	-9.34	-33.06	-10.40	-33.62
Retail REITs	0.20	-24.50	-53.22	-14.18	-57.29
Specialized REITs	1.57	1.28	-8.06	-0.15	-2.73
Utilities	**3.41**	**-3.12**	**-17.88**	**-3.17**	**-16.91**
Electric Utilities	2.30	-3.33	-18.62	-3.67	-15.92
Gas Utilities	0.05	1.15	-9.75	-1.88	-12.95
Independent Power Producers & Energy Traders	0.04	-3.40	-28.43	-4.12	-34.65
Water Utilities	0.10	-1.41	-10.09	-1.61	-4.24
Multi-Utilities	1.07	-3.03	-16.95	-2.31	-18.75

*Current Weight is market cap based, based on calculations by William Blair Intl. Ltd.

IMPORTANT DISCLOSURES

This report is available in electronic form to registered users via R*Docs™ at https://williamblairlibrary.bluematrix.com or www.williamblair.com.

Please contact us at +1 800 621 0687 or consult williamblair.com/Research-and-Insights/Equity-Research/Coverage.aspx for all disclosures.

Richard de Chazal attests that 1) all of the views expressed in this research report accurately reflect his/her personal views about any and all of the securities and companies covered by this report, and 2) no part of his/her compensation was, is, or will be related, directly or indirectly, to the specific recommendations or views expressed by him/her in this report. We seek to update our research as appropriate. Other than certain periodical industry reports, the majority of reports are published at irregular intervals as deemed appropriate by the research analyst.

DOW JONES: 20943.50
S&P 500: 2470.50
NASDAQ: 7360.58

Additional information is available upon request.

Current Rating Distribution (as of April 2, 2020):

Coverage Universe	Percent	Inv. Banking Relationships *	Percent
Outperform (Buy)	71	Outperform (Buy)	22
Market Perform (Hold)	28	Market Perform (Hold)	9
Underperform (Sell)	1	Underperform (Sell)	0

*Percentage of companies in each rating category that are investment banking clients, defined as companies for which William Blair has received compensation for investment banking services within the past 12 months.

The compensation of the research analyst is based on a variety of factors, including performance of his or her stock recommendations; contributions to all of the firm's departments, including asset management, corporate finance, institutional sales, and retail brokerage; firm profitability; and competitive factors.

OTHER IMPORTANT DISCLOSURES

Stock ratings and valuation methodologies: William Blair & Company, L.L.C. uses a three-point system to rate stocks. Individual ratings reflect the expected performance of the stock relative to the broader market (generally the S&P 500, unless otherwise indicated) over the next 12 months. The assessment of expected performance is a function of near-, intermediate-, and long-term company fundamentals, industry outlook, confidence in earnings estimates, valuation (and our valuation methodology), and other factors. Outperform (O) - stock expected to outperform the broader market over the next 12 months; Market Perform (M) - stock expected to perform approximately in line with the broader market over the next 12 months; Underperform (U) - stock expected to underperform the broader market over the next 12 months; not rated (NR) - the stock is not currently rated. The valuation methodologies include (but are not limited to) price-to-earnings multiple (P/E), relative P/E (compared with the relevant market), P/E-to-growth-rate (PEG) ratio, market capitalization/revenue multiple, enterprise value/EBITDA ratio, discounted cash flow, and others. Stock ratings and valuation methodologies should not be used or relied upon as investment advice. Past performance is not necessarily a guide to future performance.

The ratings and valuation methodologies reflect the opinion of the individual analyst and are subject to change at any time.

Our salespeople, traders, and other professionals may provide oral or written market commentary, short-term trade ideas, or trading strategies-to our clients, prospective clients, and our trading desks-that are contrary to opinions expressed in this research report. Certain outstanding research reports may contain discussions or investment opinions relating to securities, financial instruments and/or issuers that are no longer current. Always refer to the most recent report on a company or issuer. Our asset management and trading desks may make investment decisions that are inconsistent with recommendations or views expressed in this report. We will from time to time have long or short positions in, act as principal in, and buy or sell the securities referred to in this report. Our research is disseminated primarily electronically, and in some instances in printed form. Research is simultaneously available to all clients. This research report is for our clients only. No part of this material may be copied or duplicated in any form by any means or redistributed without the prior written consent of William Blair & Company, L.L.C.

This is not in any sense an offer or solicitation for the purchase or sale of a security or financial instrument. The factual statements herein have been take from sources we believe to be reliable, but such statements are made without any representation as to accuracy or completeness or otherwise, except with respect to any disclosures relative to William Blair or its research analysts. Opinions expressed are our own unless otherwise stated and are subject to change without notice. Prices shown are approximate.

This material is distributed in the United Kingdom and the European Economic Area (EEA) by William Blair International, Ltd., authorised and regulated by the Financial Conduct Authority (FCA). William Blair International, Limited is a limited liability company registered in England and Wales with company number 03619027. This material is only directed and issued to persons regarded as Professional investors or equivalent in their home jurisdiction, or persons falling within articles 19 (5), 38, 47, and 49 of the Financial Services and Markets Act of 2000 (Financial Promotion) Order 2005 (all such persons being referred to as "relevant persons"). This document must not be acted on or relied on by persons who are not "relevant persons."