

The Source Code

V121: Dilution Improves in 2020

This is our annual look at shareholder dilution. The fully diluted share count for most of our companies goes up each year, and there are a number of factors that cause that increase. Many investors tell us that they believe it is primarily due to stock-based compensation, but, on average, that is only half the story. In 2020, dilution across our coverage was 3.7%, down a little from 2019. We think understanding the sources and magnitude of dilution is important when investors look at valuing companies today and considering target prices a year out.

- Dilution - fully diluted share count increased 3.7% in 2020 for our coverage.** The increase in fully diluted share count in 2020 was down to 3.7% from 4.7% in 2019 but still remains above 2.0% average increase shown since 2010. The main factor in this decline is the dip in issuance of primary stock by existing public companies. Higher stock prices and continued depressed share repurchases prevented dilution from falling further.
- Covid-19 drags on share issuance.** In 2020, primary share issuance from existing public companies drove less dilution than in 2019. Share counts grew 1% from issuance as compared to 3.1% in 2019. COVID brought issuance to a halt initially, but then as the year progressed activity picked up.
- Stock Based Compensation (SBC) steady at 2% per year.** Looking at the data for 51 companies, stock-based compensation dilution has steadily increased from 0.5% in 2010 to 2.0% in 2020. Over the last 10 years, dilution from SBC has averaged 1.2% per year. When a company first goes public through an IPO that first year sees the heaviest SBC, but by year five, SBC dilution has settled into the 3-4% range.
- Buyback activity remained depressed.** We measure the pace of buybacks by looking at the number of shares repurchased in a year as a percentage of the beginning of the year fully diluted share count. In calendar year 2020 that number was 0.85%, in line with the 0.83% for 2019, the lowest level we have seen over the last 11 years. Some might argue that this makes sense given the performance in the software industry and the level of stock prices.
- Dilution standouts.** In 2020, Q TWO showed the most dilution in our coverage with fully diluted shares increasing 21.4% on the back of an equity offering to raise cash and the dilutive impact of convertible debt arising from higher stock prices. On the other hand, FTNT had the least dilution (5.9%), as they bought back \$1.1B in stock. The most consistent performers over the past decade are ADBE and DOX as both have reduced fully diluted share count through continuous share repurchase.

Software - Large Cap / Mid & Small Cap

Sterling Auty, CFA ^{AC}

(1-212) 622-6389

sterling.auty@jpmorgan.com

Bloomberg JPMA AUTY <GO>

J.P. Morgan Securities LLC

Jackson E Ader, CFA

(1-212) 622-4863

jackson.e.ader@jpmorgan.com

J.P. Morgan Securities LLC

Drew E Glaeser

(1-212) 622-8020

drew.e.glaeser@jpmchase.com

J.P. Morgan Securities LLC

Rachit Agrawal

(91-22) 6157 3092

rachit.x.agrawal@jpmchase.com

J.P. Morgan India Private Limited

Maya R Kilcullen

(1-212) 622-1696

maya.r.kilcullen@jpmorgan.com

J.P. Morgan Securities LLC



See page 13 for analyst certification and important disclosures, including non-US analyst disclosures.

J.P. Morgan does and seeks to do business with companies covered in its research reports. As a result, investors should be aware that the firm may have a conflict of interest that could affect the objectivity of this report. Investors should consider this report as only a single factor in making their investment decision.

Dilution Analysis

In any given year the fully diluted share count of a company within our coverage will go up by between 0-5% and many investors automatically believe the reason comes from stock-based compensation (SBC) but there is a lot more happening that creates that variability from year-to-year. This report attempts to disaggregate and understand the reasons for the changes in fully diluted share count that we have seen over the last 11 years.

Basic vs fully diluted share count – what they mean

The basic share count is the total number of shares of common stock outstanding at any given point in time. To make our analysis easy we used the 10-K (or 20-F) as the key point of analysis since every company publishes the basic share count on the front cover. Fully diluted share count includes all of the additional potential shares – options (using treasury method), RSUs (restricted stock units including all derivations of performance based or market triggered stock units), and impact of convertible securities (if in the money).

Basic vs fully diluted share count - which is being used

When a company is losing money at the net income line, accounting standards require that a company use only the basic share count for EPS calculations. For valuation purposes, however, we always want to use the fully diluted share count to understand how a company would be valued in an acquisition scenario. There are some nuances that will cause basic and fully diluted share counts to change at different rates, as we will show, including items like option exercises, RSU vesting and others.

How does share count change from year to year?

Below is the list of things that can impact the basic and fully diluted share count. Note that all the impacts on basic shares also impact the dilutive count since the fully diluted share count begins with the basic count.

Basic share count goes up or down from:

- Share issuance (e.g. secondary offers, acquisitions)
- Share buyback
- RSU vesting – net of shares withheld for tax
- Option exercise
- Conversion of convertible security (e.g. convertible debt)

Fully diluted share count goes up or down from:

- Changes in basic share count
- Stock based compensation
 - Option issuance (if options are in the money)
 - RSU grants
- Options cancelled

- RSUs forfeited
- The shares withheld for vested RSUs for tax purposes
- Option exercise as compared to treasury method
- Stock price changes – impacts options given treasury method and convertible securities (embedded options)

RSUs and options will impact the basic and diluted count at different milestones

What can be confusing at first is the timing of milestones for shares issued for SBC purposes and it will depend on vesting schedules and other factors. When a company issues an RSU with, say a 3 year vesting schedule, on day 1 that RSU is outstanding (and included in the fully diluted count) but will not be included in the basic share count because it has not vested. The year that the RSU vests (year 3 in this example) it moves into the basic share count but this will not have any impact on the fully diluted share count since it was already accounted for in the fully diluted count at the time of issuance. Another situation to account for is when stock options are included in the fully diluted share count using a treasury method but once those options are exercised they go into the basic share count. Here we have to account for the change in stock price to quantify the impact on dilution.

Over the last 11 years fully diluted dilution has averaged 2%

Table 1 shows the summary of the average change in fully diluted share, for all the companies in our coverage (51 stocks) year-by-year from 2010 through calendar 2020. In addition, it breaks down the percentage change due to each of the key levers that cause increase or decrease to that fully diluted share count.

Table 1: Summary of Why FDS Changes Year-to-Year

	CY10	CY11	CY12	CY13	CY14	CY15	CY16	CY17	CY18	CY19	CY20
% Change in FDS	0.4%	0.6%	1.6%	0.6%	1.9%	1.0%	0.9%	1.6%	4.5%	4.7%	3.7%
% Change in Basic Share Count	0.3%	0.5%	0.7%	0.6%	2.0%	1.6%	1.0%	1.6%	4.6%	5.5%	3.4%
Corporate action (issuance/buyback)	-0.8%	-0.8%	-0.7%	-0.4%	-1.0%	0.3%	-0.5%	-1.7%	-0.9%	2.4%	3.1%
Option Exercise / RSU Vesting	1.0%	1.1%	1.0%	1.5%	1.7%	1.9%	2.0%	2.2%	2.7%	3.0%	2.7%
ESPP	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.2%	0.2%	0.3%	0.3%	0.3%
Impacts from fully diluted items											
+ SBC	0.5%	0.4%	0.6%	0.7%	1.1%	1.3%	1.7%	1.6%	1.7%	1.9%	2.0%
- Forfeitures	0.0%	0.0%	0.1%	0.1%	0.3%	0.2%	0.3%	0.4%	0.4%	0.4%	0.5%
- Impact of option exercise	0.2%	0.3%	0.2%	0.6%	0.8%	0.9%	0.8%	0.8%	0.8%	1.4%	1.0%
- Impact from RSU vesting	0.2%	0.3%	0.3%	0.3%	0.5%	0.7%	0.8%	1.0%	1.2%	1.3%	1.3%
+ Impact from Share Price	0.3%	0.6%	0.7%	0.4%	0.1%	-0.5%	0.3%	0.8%	0.6%	0.9%	1.4%
+ Others	-0.2%	-0.1%	0.2%	0.0%	0.3%	0.6%	-0.1%	-0.2%	0.3%	0.1%	0.0%
+ Basic share change (% of FDS)	0.3%	0.4%	0.7%	0.5%	1.9%	1.4%	0.9%	1.5%	4.2%	5.0%	3.1%
Net Impact	0.4%	0.7%	1.6%	0.6%	1.9%	1.1%	0.9%	1.6%	4.6%	4.7%	3.7%

Note: SBC, impact from share price and basic share change have a positive impact; Forfeitures, Options exercised and RSU vesting have a negative impact on fully diluted share count.

Source: Company Reports, Bloomberg Finance L.P. and J.P. Morgan Research.

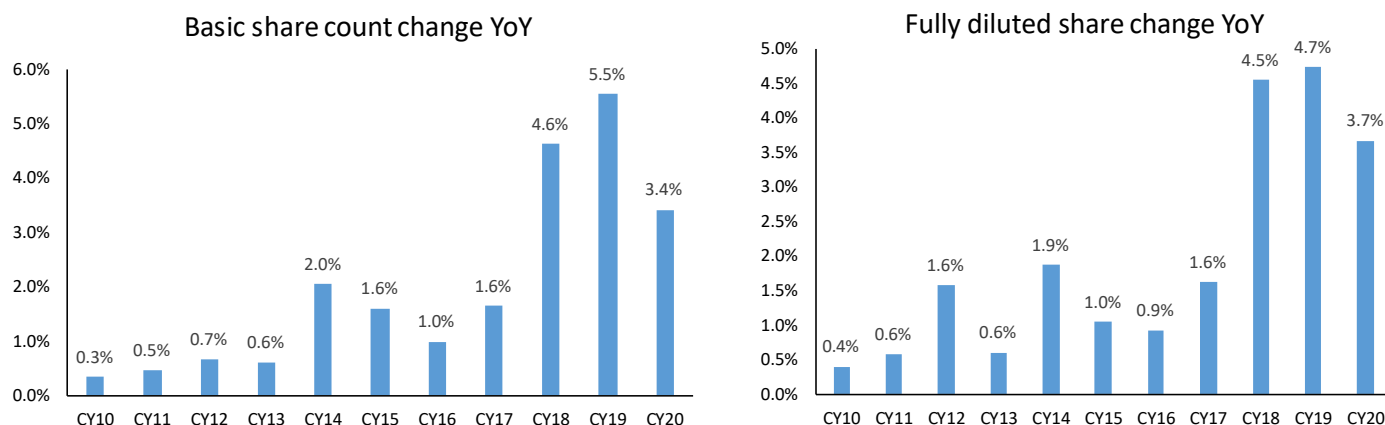
Stock-based compensation is the biggest cause for yearly dilution at 1.2%

Looking across the last 11 years, more than half of the total increase in fully diluted shares was caused by stock-based compensation of the 2.0% average dilution. All of the other drivers pale in comparison.

Basic and fully diluted share count dilution are similar

In Figure 1 below we show the average annual increase in both the basic and fully diluted share count across our coverage universe. On average both increase ~2% per year.

Figure 1: Basic and Fully Diluted Changes YoY



Source: Company Reports, Bloomberg Finance L.P. and J.P. Morgan Research.

Stock Based Compensation Post IPO

The first couple of years after a company goes public (IPO) is when we would expect to see the greatest level of dilution associated with stock-based compensation. The reason is that companies are typically in a hyper growth mode and are hiring at a rapid rate along with providing executives with attractive incentive compensation to keep them focused on the goal at hand or rewarding them for getting the company public. Table 2 below shows the companies in our coverage that have gone public since 2009 and what the SBC looked like each year post IPO.

Table 2: SBC Post IPO Year by Year

IPO Date		T+0	T+1	T+2	T+3	T+4	T+5	T+6	T+7	T+8	T+9	T+10	T+11
6/26/2015	ALRM	20.7%	1.6%	1.9%	1.3%	2.1%	1.5%						
11/1/2017	ALTR		0.4%	1.0%	6.7%								
6/15/2018	AVLR		3.9%	2.1%									
6/12/2019	CRWD	2.5%	2.3%										
9/24/2014	CYBR		3.6%	3.2%	3.5%	3.8%	2.7%	2.9%					
9/19/2019	DDOG	3.9%	1.6%										
4/27/2018	DOCU		3.8%	2.2%									
9/16/2016	EVBG		6.9%	4.5%	2.7%	1.9%							
9/20/2013	FEYE		5.4%	11.0%	7.9%	7.9%	6.5%	7.6%	7.6%				
4/4/2014	FIVN		2.9%	4.3%	3.4%	3.6%	3.0%	2.6%					
9/16/2020	FROG	4.8%											
11/18/2009	FTNT		1.8%	4.4%	2.8%	2.7%	2.7%	4.3%	4.1%	2.7%	2.9%	2.0%	1.5%
4/1/2015	GDDY		3.3%	3.0%	2.6%	2.6%	2.5%						
1/25/2012	GWRE		4.5%	3.3%	2.6%	2.2%	2.1%	2.6%	1.5%	1.9%			
7/22/2020	JAMF	1.3%											
4/7/2000	LPSN											7.7%	7.0%
11/19/2015	MIME		4.5%	1.8%	5.2%	5.0%							
3/20/2013	MODN		7.7%	6.0%	7.7%	6.5%	4.6%	5.2%	4.2%				
9/13/2019	NET	3.1%	2.3%										
12/12/2014	NEWR	11.6%	3.9%	3.6%	3.6%	3.6%	5.4%						
6/29/2012	NOW		5.5%	5.2%	4.9%	4.7%	4.1%	3.0%	3.1%	1.9%			
4/7/2017	OKTA		3.9%	2.6%	2.1%								
7/20/2012	PANW	12.9%	3.6%	7.2%	5.2%	5.1%	4.6%	5.8%	7.2%	4.0%			
4/11/2019	PD	7.9%	5.5%										
6/28/2007	PRO				6.5%	2.8%	3.7%	4.8%	5.2%	4.5%	7.8%	4.3%	3.4%
9/28/2012	QLYS		6.4%	8.5%	4.7%	8.1%	4.8%	2.4%	2.8%	2.9%			
3/20/2014	QTWO		3.7%	4.2%	3.9%	2.8%	2.7%	1.9%					
9/27/2013	RNG		5.2%	4.7%	4.6%	4.1%	2.2%	2.6%	1.8%				
4/22/2016	SCWX		1.4%	2.8%	2.6%	4.1%							
3/31/2010	SSNC		2.4%	3.8%	2.5%	2.6%	8.2%	1.2%	5.6%	6.7%	3.6%	3.3%	
10/19/2018	SWI		0.9%	3.1%									
4/11/2019	TUFN	11.9%	6.5%										
10/16/2013	VEEV		1.2%	2.0%	3.1%	3.0%	0.9%	2.3%	1.3%				
2/28/2014	VRNS		3.5%	4.5%	4.8%	4.5%	4.4%	4.6%					
11/6/2013	WIX		3.8%	6.1%	5.5%	6.0%	5.0%	4.6%	3.4%				
4/18/2019	ZM	1.5%	1.2%										
3/16/2018	ZS	5.0%	3.5%	5.1%									
Average		7.3%	3.6%	4.1%	4.2%	4.1%	3.8%	3.7%	4.0%	3.5%	4.7%	4.3%	4.0%

Note: Weighted average fair value of RSUs granted has been taken as a proxy for share price before the company went public

Source: Company filings, Bloomberg Finance L.P. and J.P. Morgan Research.

GWRE, NOW, and RNG are what we expect to see post IPO

Looking at the table a few companies really jump out as poster children of what we would expect dilution would look like in the years following an IPO. GWRE, NOW, and RNG all start with SBC in the mid-to-high single digit range in the first year post-IPO and gradually dwindled down to low single-digit dilution percentages by year 5. GDDY is another example of consistently decreasing SBC but remains in lower single digit range throughout.

ALRM is the least dilutive and FEYE is the most dilutive consistently

Two other companies stood out to us in terms of SBC dilution post IPO but for different reasons: ALRM and FEYE. ALRM has consistently been one of the lowest issuers of SBC, and most conscientious for shareholders, as compared to the rest of our software coverage. On the other hand, FireEye has consistently issued more than mid-single digit percentage in terms of options/RSU dilution. Part of this may stem from the acquisition of Mandiant, or perhaps it is reflective of higher employee

turnover as FEYE has one of the highest forfeiture rates at ~2.2% as compared to the average of 0.2% of FDS for our overall coverage.

SBC Dilution has Increased in the Last Couple of Years

The SBC dilution to fully diluted share count over the entire analysis timeframe has average 1.2% but, interestingly, that number has increased and appears to have settled into a baseline of 1.8% the last four years. In Table 3 we highlighted companies that are consistently above and below the average dilution seen in our coverage from SBC.

Table 3: SBC Dilution by Company per Year

	CY10	CY11	CY12	CY13	CY14	CY15	CY16	CY17	CY18	CY19	CY20
ADBE	1.3%	1.0%	2.4%	1.6%	1.0%	0.9%	1.0%	1.3%	1.0%	0.9%	0.8%
ADSK	1.1%	0.4%	1.7%	1.8%	1.9%	1.7%	1.8%	1.1%	1.3%	1.4%	1.1%
AKAM	1.7%	1.8%	2.0%	1.7%	1.5%	1.7%	2.3%	2.0%	2.0%	1.9%	1.6%
ALRM							0.6%	1.3%	0.9%	1.5%	1.1%
ALTR									0.3%	0.9%	2.0%
ANSS	0.2%	0.1%	0.1%	0.1%	0.4%	0.5%	0.5%	1.0%	0.9%	1.1%	0.6%
AVLR										2.7%	1.8%
AZPN	3.1%	1.2%	1.2%	0.7%	0.5%	0.4%	0.5%	0.8%	0.6%	0.9%	0.3%
BCOR	2.4%	2.0%	2.1%	2.6%	-0.4%	-0.3%	8.9%	1.8%	1.3%	2.0%	2.3%
CDNS		1.8%	2.3%	1.9%	1.7%	1.6%	2.3%	2.1%	1.3%	1.4%	0.8%
CSGP	0.7%	1.0%	3.4%	1.0%	0.8%	0.7%	0.6%	0.7%	0.4%	0.5%	0.3%
CRWD									3.4%	2.1%	2.1%
CYBR						0.7%	1.4%	1.9%	3.1%	2.4%	2.7%
DDOG									1.6%	2.8%	1.5%
DOCU										3.3%	2.0%
DOX	0.1%	0.2%	0.4%	0.4%	0.5%	0.5%	0.4%	0.5%	0.2%	0.5%	0.3%
EVBG								3.7%	3.0%	2.3%	1.6%
FEYE					3.5%	9.7%	6.8%	7.0%	5.9%	6.8%	6.8%
FIVN						2.6%	2.9%	2.3%	2.7%	2.4%	2.0%
FROG									2.5%	-0.5%	3.3%
FTNT	0.6%	0.1%	0.0%	2.4%	2.4%	3.4%	3.1%	2.3%	2.4%	1.6%	1.1%
GDDY							2.1%	1.9%	1.8%	1.6%	2.3%
GWRE				3.3%	2.5%	2.3%	2.1%	2.0%	2.5%	1.5%	1.9%
INTU	1.8%	1.0%	1.3%	1.3%	1.5%	1.2%	1.4%	1.5%	1.1%	0.9%	1.0%
JAMF									0.1%	0.7%	1.2%
LPSN	2.6%	0.2%	-1.4%	1.4%	1.5%	1.4%	1.0%	1.0%	4.9%	3.3%	4.0%
MIME							0.4%	0.5%	1.8%	0.6%	0.0%
MODN					6.9%	5.4%	7.0%	5.8%	4.2%	4.8%	3.9%
NET									-1.5%	3.0%	2.0%
NEWRR					6.3%	1.8%	2.7%	2.7%	2.5%	2.7%	0.0%
NOW				3.4%	4.0%	4.0%	3.8%	3.6%	2.7%	2.6%	1.8%
OKTA									3.0%	2.0%	1.7%
PANW			9.4%	2.9%	6.3%	4.6%	4.2%	4.2%	4.1%	4.2%	3.7%
PD									-5.1%	3.6%	4.6%
PRO	6.1%	2.6%	3.4%	4.3%	4.5%	3.9%	6.8%	3.7%	3.1%	2.6%	2.6%
PTC		2.2%	2.3%	2.1%	1.6%	1.6%	2.1%	1.6%	1.8%	1.5%	2.3%
QLYS				1.8%	2.3%	-0.6%	2.7%	3.7%	1.2%	1.4%	1.5%
QTWO						2.0%	2.1%	2.1%	2.6%	2.5%	1.8%
RNG					2.7%	2.6%	3.7%	3.7%	2.0%	2.3%	1.7%
SCWX								1.4%	2.7%	2.4%	3.9%
SNPS	1.6%	1.0%	1.7%	1.2%	1.3%	1.2%	1.3%	1.3%	1.1%	1.3%	1.4%
SSNC		0.4%	-0.1%	0.1%	0.0%	4.4%	-0.1%	0.4%	-0.4%	0.0%	0.1%
SWI										0.9%	2.9%
TENB											
TUFN									2.9%	-0.6%	3.8%
VEEV					0.7%	1.3%	2.0%	0.9%	0.7%	0.7%	0.1%
VRNS						0.1%	3.4%	4.6%	4.2%	4.1%	4.2%
VRSN	1.2%	1.1%	0.7%	0.6%	0.5%	0.6%	0.4%	0.5%	0.3%	0.0%	0.0%
WIX					0.1%	2.2%	3.4%	2.8%	2.5%	2.3%	2.3%
ZM									0.8%	1.1%	1.1%
ZS									3.8%	3.1%	4.7%
Average	1.7%	1.1%	1.8%	1.7%	2.1%	2.1%	2.5%	2.2%	1.8%	2.0%	2.1%

Source: Company reports, Bloomberg Finance L.P. and J.P. Morgan Research.

Note: Weighted average fair value of RSUs granted has been taken as a proxy for share price before the company went public.

Forfeitures: Employees Give Up 14% of RSUs

Employees that voluntarily leave an organization will forfeit their unvested RSUs. This is why when we are calculating target prices that are one year into the future we include an estimate of additional dilution for SBC but also back out an estimated forfeiture rate. Over the last several years we have been using 10% as the forfeiture rate to try to be reasonable. Our analysis shows a higher rate with employees, on average, giving up 13.7% of last year's ending RSU outstanding balance each year. The Table 4 shows the forfeiture rates for each of the companies in our coverage list going back to 2010.

Table 4: RSU Forfeiture Rates Year by Year

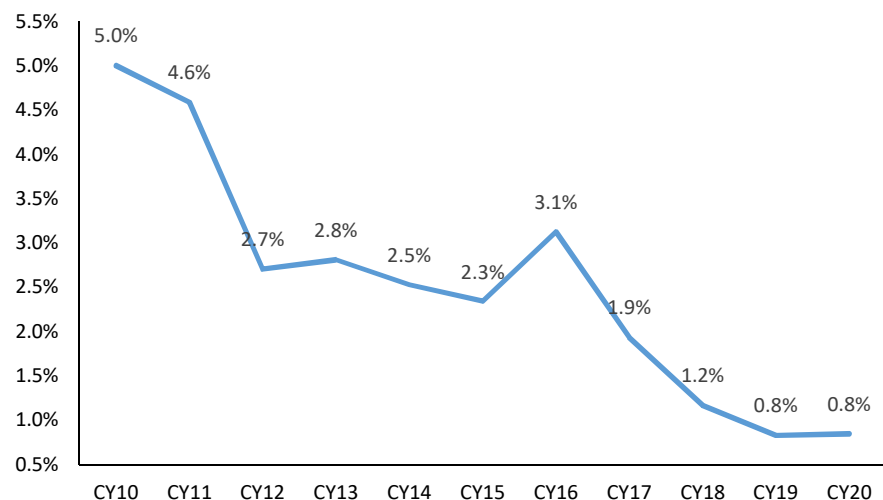
	CY10	CY11	CY12	CY13	CY14	CY15	CY16	CY17	CY18	CY19	CY20
ADBE	11.7%	11.4%	12.8%	7.9%	7.4%	7.9%	7.2%	8.1%	7.7%	8.0%	6.3%
ADSK	6.5%	59.8%	52.1%	8.4%	6.8%	6.1%	9.4%	9.1%	12.0%	9.9%	7.3%
AKAM	19.7%	20.3%	14.5%	10.7%	17.6%	5.7%	10.1%	9.6%	12.7%	11.3%	6.8%
ALRM								-60.8%	5.7%	8.0%	4.2%
ALTR										28.7%	5.8%
ANSS						24.9%	12.6%	11.6%	5.3%	7.7%	3.8%
AVLR										159.7%	10.6%
AZPN	921.3%	63.7%	68.7%	67.0%	80.5%	72.6%	86.9%	83.1%	55.7%	76.1%	89.1%
BCOR	23.7%	27.4%	18.2%	11.0%	39.9%	26.6%	44.5%	11.5%	11.3%	22.4%	44.0%
CDNS		6.6%	5.5%	5.8%	7.7%	6.7%	6.6%	7.5%	6.3%	5.5%	5.6%
CSGP	10.1%	7.1%	9.8%	8.3%	6.3%	6.8%	10.8%	7.9%	11.0%	4.8%	10.3%
CRWD										7.7%	6.0%
CYBR						41.6%	8.0%	17.1%	10.7%	5.5%	9.9%
DDOG											26.2%
DOCU										13.6%	7.0%
DOX	6.9%	18.8%	9.9%	11.5%	5.3%	6.9%	6.2%	6.0%	9.7%	14.4%	7.9%
EVBG									3.1%	13.6%	6.9%
FEYE					22.5%	28.5%	33.2%	31.6%	15.6%	14.8%	32.5%
FIVN						13.7%	11.6%	9.5%	11.9%	8.3%	6.2%
FROG											
FTNT				61.1%	11.2%	16.4%	18.4%	13.7%	10.6%	9.0%	6.6%
GDDY								18.0%	10.7%	18.4%	17.1%
GWRE				9.2%	7.5%	10.2%	11.5%	9.6%	9.7%	13.2%	13.0%
INTU	12.5%	7.4%	6.3%	8.3%	17.3%	12.4%	17.5%	14.0%	13.8%	13.9%	11.2%
JAMF									0.0%	0.0%	67.4%
LPSN							15.9%	23.9%	44.7%	15.7%	23.7%
MIME							0.0%	23.1%	93.4%	23.1%	
MODN				0.0%	44.6%	22.3%	23.0%	38.6%	28.2%	16.8%	7.2%
NET								0.0%	1.3%		9.0%
NEWR						22.5%	24.1%	23.4%	15.1%	23.9%	
NOW				18.3%	13.6%	11.8%	14.9%	13.4%	8.9%	12.9%	8.7%
OKTA									15.5%	13.4%	9.1%
PANW					21.4%	8.2%	8.4%	7.9%	10.7%	11.4%	13.7%
PD									10.4%	41.5%	51.9%
PRO	5.0%	2.8%	2.3%	4.5%	5.2%	9.4%	9.7%	7.2%	6.7%	3.5%	13.9%
PTC	21.2%	5.2%	7.3%	8.1%	7.3%	9.8%	14.9%	17.2%	16.2%	12.0%	34.1%
QLYS							213.7%	23.0%	14.6%	13.8%	18.4%
QTwo							12.0%	9.9%	6.9%	9.5%	11.0%
RNG					197.1%	14.1%	19.1%	16.8%	11.6%	13.3%	9.8%
SCWX								24.6%	19.6%	32.5%	14.5%
SNPS	3.9%	6.4%	5.6%	3.6%	2.9%	5.2%	2.8%	5.9%	6.7%	6.6%	7.5%
SSNC							10.4%	0.0%	0.0%	7.1%	0.0%
SWI										11.4%	40.9%
TENB									0.0%	0.0%	0.0%
TUFN											
VEEV					41.3%	30.6%	18.1%	12.4%	11.2%	8.2%	6.6%
VRNS						117.4%	13.0%	19.2%	8.0%	15.0%	8.1%
VRSN	41.6%	37.7%	13.9%	10.8%	12.0%	9.7%	7.2%	5.7%	5.9%	0.0%	
WIX					60.4%	67.8%	12.6%	9.2%	8.3%	9.4%	6.7%
ZM											9.2%
ZS										68.9%	16.3%
Average	90.4%	21.1%	17.5%	15.0%	28.9%	22.8%	22.3%	13.6%	13.8%	18.4%	15.9%
Average (ex-AZPN and MIME)	14.8%	17.6%	13.2%	11.7%	26.5%	20.9%	20.9%	11.2%	10.7%	16.9%	14.3%
Aggregate	19.0%	13.8%	12.4%	10.0%	12.3%	12.2%	16.3%	15.2%	11.6%	12.7%	14.9%

Source: Company Reports, Bloomberg Finance L.P. and J.P. Morgan Research.

Buybacks Steadily Declining

Over the last 11 years we have seen a steady decline in the magnitude of share repurchases as a percent of the previous year ending fully diluted share count. It peaked in 2010 where we saw companies across our coverage repurchase 5% of outstanding fully diluted shares. In 2020 that number had dwindled to 0.8%. Granted, share prices have increased dramatically over that timeframe in software making it a lot more expensive to buy back a similar level of shares. But in our opinion true value creation for shareholders is only generated once you buy back at least 5% of outstanding shares.

Figure 2: Buybacks have Been Declining as Percent of Fully Diluted Share count



Source: Company Reports Bloomberg Finance L.P. and J.P. Morgan Research.

Over the last 11 years AZPN, DOX, and QLYS have been the most consistent

Table 5 below shows the percentage of beginning year fully diluted share count that each company bought back. Over our timeframe the most consistent buyback programs in terms of buying the highest percentage of fully diluted shares came from Qualys, Amdocs and Aspen Technology. Verisign has also been consistent on its repurchase program.

Table 5: Buybacks as Percent of Fully Diluted Share Count

	CY09	CY10	CY11	CY12	CY13	CY14	CY15	CY16	CY17	CY18	CY19	CY20
ADBE		5.8%	4.2%	2.3%	4.2%	2.1%	1.6%	2.0%	1.6%	1.7%	2.0%	1.6%
ADSK		3.9%	4.1%	5.4%	4.5%	2.9%	3.6%	4.2%	3.0%	1.0%	1.2%	1.2%
AKAM		1.4%	6.2%	2.3%	2.1%	2.5%	2.4%	3.8%	3.8%	5.8%	2.4%	1.2%
ANSS			0.3%	1.6%	1.6%	3.1%	4.1%	4.1%	3.1%	1.9%	0.4%	0.8%
AZPN			0.7%	2.5%	3.1%	3.3%	8.3%	5.6%	9.0%	3.8%	4.2%	1.8%
BCOR		0.9%	2.0%	0.0%	1.0%	5.1%	1.3%	0.0%	0.0%	0.0%	2.6%	0.0%
CDNS			0.5%	0.4%	0.4%	2.0%	4.7%	12.9%	1.3%	2.5%	2.1%	1.8%
DOX		6.6%	11.3%	9.2%	6.3%	5.2%	5.4%	4.7%	3.7%	4.3%	4.7%	4.2%
FEYE												0.6%
FTNT					2.1%	1.0%	1.0%	2.1%	6.1%	2.1%	1.1%	6.5%
GDDY									4.1%		3.8%	5.5%
GWRE											0.1%	
INTU		8.6%	8.5%	5.3%	1.6%	7.2%	4.6%	8.6%	2.6%	0.7%	0.9%	0.4%
LPSN		1.0%			4.2%	1.1%	0.2%					
NET										0.0%	0.0%	0.0%
NOW									0.3%			
PANW				0.1%	0.1%				3.3%	1.7%	1.8%	5.8%
PTC		3.0%	2.1%	1.3%	2.4%	4.1%	2.3%		0.8%	7.9%	3.6%	
QLYS										2.6%	2.4%	3.1%
Q TWO							0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RNG										0.3%		
SCWX										1.0%	0.5%	0.0%
SNPS		5.5%	9.8%	1.7%	2.5%	1.9%	3.5%	5.3%	3.4%	3.0%	1.8%	1.0%
SSNC								1.3%				
VRSN		8.7%	9.5%	4.0%	10.8%	8.8%	5.6%	4.8%	4.1%	2.9%		
ZS										0.8%	0.0%	
Aggregate		5.0%	4.6%	2.7%	2.8%	2.5%	2.3%	3.1%	1.9%	1.2%	0.8%	0.8%
Highest		VRSN	DOX	DOX	VRSN	VRSN	AZPN	CDNS	AZPN	PTC	DOX	FTNT

Source: Company Reports, Bloomberg Finance L.P. and J.P. Morgan Research.

Buying Back Stock To Offset Option Dilution—Companies Delivering On The Promise, But At What Cost?

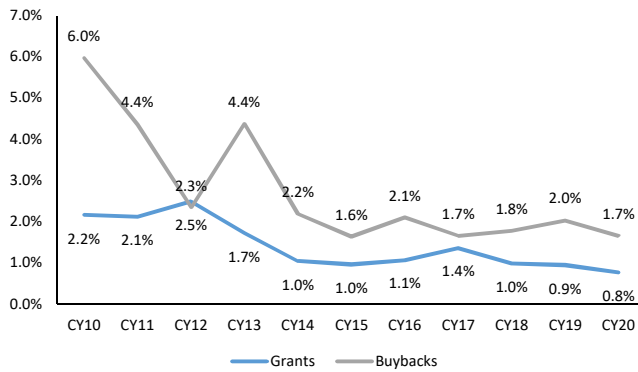
One of the common buyback strategies that we hear in software is to buy back enough stock to offset the dilution created by stock-based compensation. The good news is that the companies that follow this strategy actually do deliver on that goal consistently but in situations where stock prices are going up we believe this is a more expensive method of compensation than if companies had simply paid their employees in cash.

Roughly 15% of coverage uses buybacks to offset SBC

Looking across our coverage universe there are seven companies that have stated goals to at least offset SBC dilution through the use of share repurchase. Those companies are:

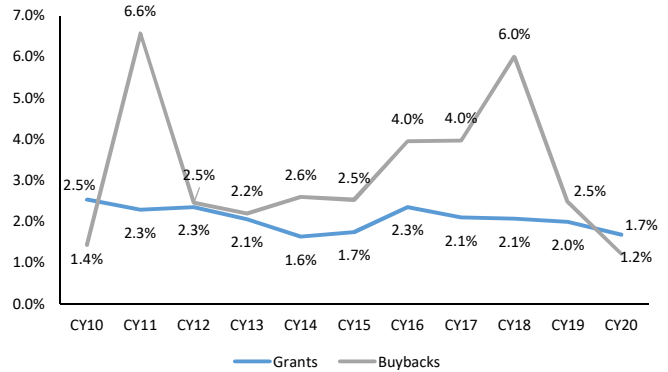
- Adobe
- Akamai
- Autodesk
- Intuit
- Qualys
- Synopsis
- Verisign

Figure 3: ADBE Grants Vs Buybacks



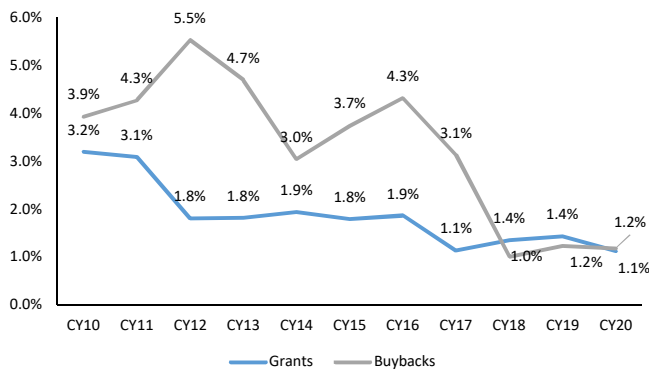
Source: Company reports, Bloomberg Finance L.P. and J.P. Morgan Research.

Figure 4: AKAM Grants Vs Buybacks



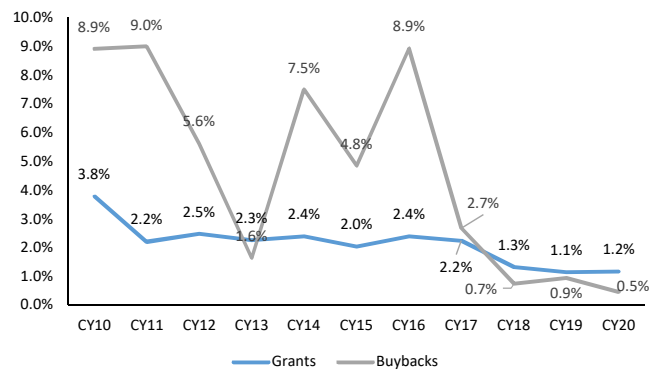
Source: Company reports, Bloomberg Finance L.P. and J.P. Morgan Research.

Figure 5: ADSK Grants Vs Buybacks



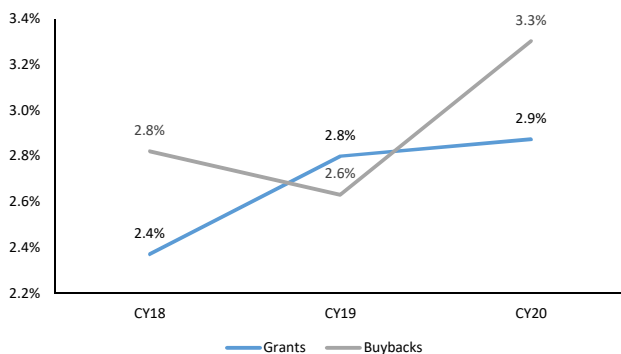
Source: Company reports, Bloomberg Finance L.P. and J.P. Morgan Research.

Figure 6: INTU Grants Vs Buybacks



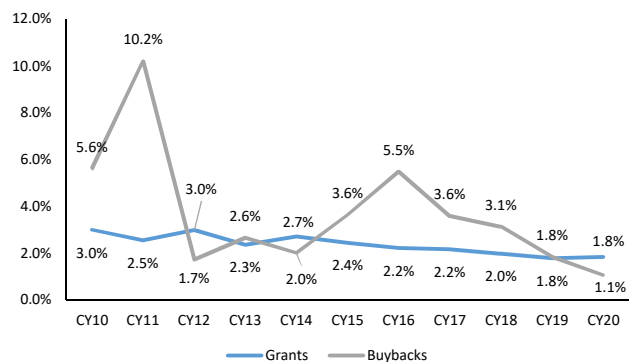
Source: Company reports, Bloomberg Finance L.P. and J.P. Morgan Research.

Figure 7: QLYS Grants Vs Buybacks



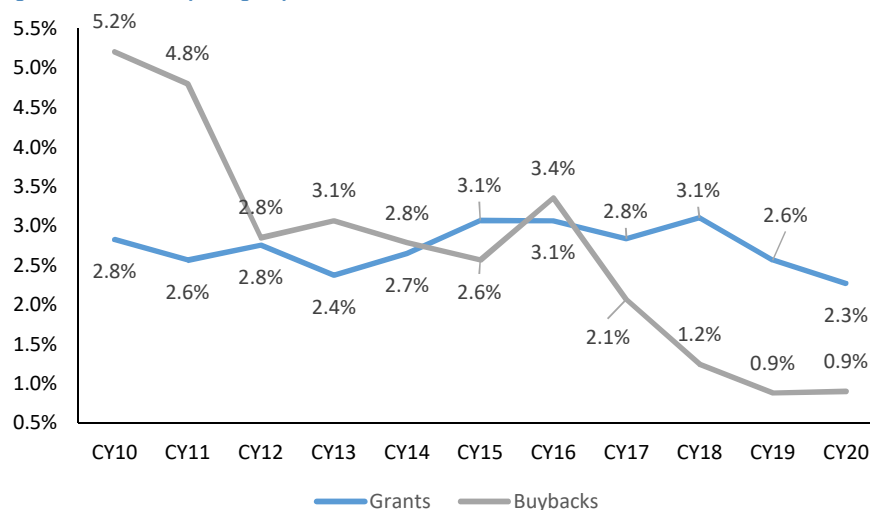
Source: Company reports, Bloomberg Finance L.P. and J.P. Morgan Research.

Figure 8: SNPS Grants Vs Buybacks



Source: Company reports, Bloomberg Finance L.P. and J.P. Morgan Research.

Figure 9: SBC is Outpacing Repurchases – trend continues in 2020



Source: Company reports, Bloomberg Finance L.P. and J.P. Morgan Research.

Analyst Certification: The Research Analyst(s) denoted by an “AC” on the cover of this report certifies (or, where multiple Research Analysts are primarily responsible for this report, the Research Analyst denoted by an “AC” on the cover or within the document individually certifies, with respect to each security or issuer that the Research Analyst covers in this research) that: (1) all of the views expressed in this report accurately reflect the Research Analyst’s personal views about any and all of the subject securities or issuers; and (2) no part of any of the Research Analyst’s compensation was, is, or will be directly or indirectly related to the specific recommendations or views expressed by the Research Analyst(s) in this report. For all Korea-based Research Analysts listed on the front cover, if applicable, they also certify, as per KOFIA requirements, that the Research Analyst’s analysis was made in good faith and that the views reflect the Research Analyst’s own opinion, without undue influence or intervention.

All authors named within this report are Research Analysts unless otherwise specified. In Europe, Sector Specialists (Sales and Trading) may be shown on this report as contacts but are not authors of the report or part of the Research Department.

Important Disclosures

Company-Specific Disclosures: Important disclosures, including price charts and credit opinion history tables, are available for compendium reports and all J.P. Morgan–covered companies by visiting <https://www.jpmm.com/research/disclosures>, calling 1-800-477-0406, or e-mailing research.disclosure.inquiries@jpmorgan.com with your request. J.P. Morgan’s Strategy, Technical, and Quantitative Research teams may screen companies not covered by J.P. Morgan. For important disclosures for these companies, please call 1-800-477-0406 or e-mail research.disclosure.inquiries@jpmorgan.com.

Explanation of Equity Research Ratings, Designations and Analyst(s) Coverage Universe:

J.P. Morgan uses the following rating system: Overweight [Over the next six to twelve months, we expect this stock will outperform the average total return of the stocks in the analyst’s (or the analyst’s team’s) coverage universe.] Neutral [Over the next six to twelve months, we expect this stock will perform in line with the average total return of the stocks in the analyst’s (or the analyst’s team’s) coverage universe.] Underweight [Over the next six to twelve months, we expect this stock will underperform the average total return of the stocks in the analyst’s (or the analyst’s team’s) coverage universe.] Not Rated (NR): J.P. Morgan has removed the rating and, if applicable, the price target, for this stock because of either a lack of a sufficient fundamental basis or for legal, regulatory or policy reasons. The previous rating and, if applicable, the price target, no longer should be relied upon. An NR designation is not a recommendation or a rating. In our Asia (ex-Australia and ex-India) and U.K. small- and mid-cap equity research, each stock’s expected total return is compared to the expected total return of a benchmark country market index, not to those analysts’ coverage universe. If it does not appear in the Important Disclosures section of this report, the certifying analyst’s coverage universe can be found on J.P. Morgan’s research website, www.jpmm.com.

Coverage Universe: Auty, Sterling P: Adobe Inc (ADBE), Akamai Technologies, Inc. (AKAM), Alarm.com (ALRM), Autodesk (ADSK), Avalara (AVLR), Check Point Software (CHKP), Cloudflare (NET), CoStar Group (CSGP), CrowdStrike (CRWD), CyberArk (CYBR), Datadog (DDOG), DocuSign (DOCU), Duck Creek (DCT), Dynatrace (DT), Everbridge (EVBG), FireEye (FEYE), Five9 (FIVN), Fortinet, Inc (FTNT), GoDaddy Inc (GDDY), Guidewire Software (GWRE), Intuit (INTU), JFrog (FROG), Jamf (JAMF), LivePerson (LPSN), Mimecast (MIME), New Relic (NEWR), Okta (OKTA), Olo Inc. (OLO), On24 (ONTF), PTC Inc (PTC), PagerDuty (PD), Palo Alto Networks (PANW), Q2 Holdings Inc. (Q2WO), Qualys (QLYS), RealPage (RP), RingCentral (RNG), Sapiens (SPNS), SecureWorks (SCWX), ServiceNow (NOW), SolarWinds (SWI), Tenable (TENB), Tufin Software (TUFN), Varonis Systems (VRNS), Veeva Systems (VEEV), VeriSign (VRSN), Vonage (VG), Wix.com (WIX), Zoom Video (ZM), Zscaler (ZS)

J.P. Morgan Equity Research Ratings Distribution, as of April 03, 2021

	Overweight (buy)	Neutral (hold)	Underweight (sell)
J.P. Morgan Global Equity Research Coverage*	49%	38%	12%
IB clients**	54%	48%	38%
JPMS Equity Research Coverage*	46%	39%	14%
IB clients**	78%	70%	55%

*Please note that the percentages might not add to 100% because of rounding.

**Percentage of subject companies within each of the "buy," "hold" and "sell" categories for which J.P. Morgan has provided investment banking services within the previous 12 months.

For purposes only of FINRA ratings distribution rules, our Overweight rating falls into a buy rating category; our Neutral rating falls into a hold rating category; and our Underweight rating falls into a sell rating category. Please note that stocks with an NR designation are not included in the table above. This information is current as of the end of the most recent calendar quarter.

Equity Valuation and Risks: For valuation methodology and risks associated with covered companies or price targets for covered companies, please see the most recent company-specific research report at <http://www.jpmm.com>, contact the primary analyst or your J.P. Morgan representative, or email research.disclosure.inquiries@jpmorgan.com. For material information about the proprietary

models used, please see the Summary of Financials in company-specific research reports and the Company Tearsheets, which are available to download on the company pages of our client website, <http://www.jpmorganmarkets.com>. This report also sets out within it the material underlying assumptions used.

Analysts' Compensation: The research analysts responsible for the preparation of this report receive compensation based upon various factors, including the quality and accuracy of research, client feedback, competitive factors, and overall firm revenues.

Registration of non-US Analysts: Unless otherwise noted, the non-US analysts listed on the front of this report are employees of non-US affiliates of J.P. Morgan Securities LLC, may not be registered as research analysts under FINRA rules, may not be associated persons of J.P. Morgan Securities LLC, and may not be subject to FINRA Rule 2241 or 2242 restrictions on communications with covered companies, public appearances, and trading securities held by a research analyst account.

Other Disclosures

J.P. Morgan is a marketing name for investment banking businesses of JPMorgan Chase & Co. and its subsidiaries and affiliates worldwide.

All research material made available to clients are simultaneously available on our client website, J.P. Morgan Markets, unless specifically permitted by relevant laws. Not all research content is redistributed, e-mailed or made available to third-party aggregators. For all research material available on a particular stock, please contact your sales representative.

Any long form nomenclature for references to China; Hong Kong; Taiwan; and Macau within this research material are Mainland China; Hong Kong SAR (China); Taiwan (China); and Macau SAR (China).

Options and Futures related research: If the information contained herein regards options- or futures-related research, such information is available only to persons who have received the proper options or futures risk disclosure documents. Please contact your J.P. Morgan Representative or visit <https://www.theocc.com/components/docs/riskstoc.pdf> for a copy of the Option Clearing Corporation's Characteristics and Risks of Standardized Options or http://www.finra.org/sites/default/files/Security_Futures_Risk_Disclosure_Statement_2018.pdf for a copy of the Security Futures Risk Disclosure Statement.

Changes to Interbank Offered Rates (IBORs) and other benchmark rates: Certain interest rate benchmarks are, or may in the future become, subject to ongoing international, national and other regulatory guidance, reform and proposals for reform. For more information, please consult: https://www.jpmorgan.com/global/disclosures/interbank_offered_rates

Private Bank Clients: Where you are receiving research as a client of the private banking businesses offered by JPMorgan Chase & Co. and its subsidiaries ("J.P. Morgan Private Bank"), research is provided to you by J.P. Morgan Private Bank and not by any other division of J.P. Morgan, including, but not limited to, the J.P. Morgan Corporate and Investment Bank and its Global Research division.

Legal entity responsible for the production and distribution of research: The legal entity identified below the name of the Reg AC Research Analyst who authored this material is the legal entity responsible for the production of this research. Where multiple Reg AC Research Analysts authored this material with different legal entities identified below their names, these legal entities are jointly responsible for the production of this research. Research Analysts from various J.P. Morgan affiliates may have contributed to the production of this material but may not be licensed to carry out regulated activities in your jurisdiction (and do not hold themselves out as being able to do so). Unless otherwise stated below, this material has been distributed by the legal entity responsible for production. If you have any queries, please contact the relevant Research Analyst in your jurisdiction or the entity in your jurisdiction that has distributed this research material.

Legal Entities Disclosures and Country-/Region-Specific Disclosures:

Argentina: JPMorgan Chase Bank N.A Sucursal Buenos Aires is regulated by Banco Central de la República Argentina ("BCRA"- Central Bank of Argentina) and Comisión Nacional de Valores ("CNV"- Argentinian Securities Commission" - ALYC y AN Integral N°51). **Australia:** J.P. Morgan Securities Australia Limited ("JPMSAL") (ABN 61 003 245 234/AFS Licence No: 238066) is regulated by the Australian Securities and Investments Commission and is a Market, Clearing and Settlement Participant of ASX Limited and CHIX. This material is issued and distributed in Australia by or on behalf of JPMSAL only to "wholesale clients" (as defined in section 761G of the Corporations Act 2001). A list of all financial products covered can be found by visiting <https://www.jpmm.com/research/disclosures>. J.P. Morgan seeks to cover companies of relevance to the domestic and international investor base across all Global Industry Classification Standard (GICS) sectors, as well as across a range of market capitalisation sizes. If applicable, in the course of conducting public side due diligence on the subject company(ies), the Research Analyst team may at times perform such diligence through corporate engagements such as site visits, discussions with company representatives, management presentations, etc. Research issued by JPMSAL has been prepared in accordance with J.P. Morgan Australia's Research Independence Policy which can be found at the following link: [J.P. Morgan Australia - Research Independence Policy](#). **Brazil:** Banco J.P. Morgan S.A. is regulated by the Comissão de Valores Mobiliários (CVM) and by the Central Bank of Brazil. Ombudsman J.P. Morgan: 0800-7700847

/ ouvidoria.jp.morgan@jpmorgan.com. **Canada:** J.P. Morgan Securities Canada Inc. is a registered investment dealer, regulated by the Investment Industry Regulatory Organization of Canada and the Ontario Securities Commission and is the participating member on Canadian exchanges. This material is distributed in Canada by or on behalf of J.P. Morgan Securities Canada Inc. **Chile:** Inversiones J.P. Morgan Limitada is an unregulated entity incorporated in Chile. **China:** J.P. Morgan Securities (China) Company Limited has been approved by CSRC to conduct the securities investment consultancy business. **Dubai:** JPMorgan Chase Bank, N.A., Dubai Branch is regulated by the Dubai Financial Services Authority (DFSA) and its registered address is Dubai International Financial Centre - The Gate, West Wing, Level 3 and 9 PO Box 506551, Dubai, UAE. This material has been distributed to persons regarded as professional clients or market counterparties as defined under the DFSA rules. **European Economic Area (EEA):** Unless specified to the contrary, research is distributed in the EEA by J.P. Morgan AG ("JPM AG"), which is a member of the Frankfurt Stock Exchange, is authorised by the European Central Bank ("ECB") and is regulated by the Federal Financial Supervisory Authority (BaFin). JPM AG is a company incorporated in the Federal Republic of Germany with a registered office at Taunustor 1, 60310 Frankfurt am Main, the Federal Republic of Germany. The material has been distributed in the EEA to persons regarded as professional investors (or equivalent) pursuant to Art. 4 para. 1 no. 10 and Annex II of MiFID II and its respective implementation in their home jurisdictions ("EEA professional investors"). This material must not be acted on or relied on by persons who are not EEA professional investors. Any investment or investment activity to which this material relates is only available to EEA relevant persons and will be engaged in only with EEA relevant persons. **Hong Kong:** J.P. Morgan Securities (Asia Pacific) Limited (CE number AAJ321) is regulated by the Hong Kong Monetary Authority and the Securities and Futures Commission in Hong Kong, and J.P. Morgan Broking (Hong Kong) Limited (CE number AAB027) is regulated by the Securities and Futures Commission in Hong Kong. JP Morgan Chase Bank, N.A., Hong Kong (CE Number AAL996) is regulated by the Hong Kong Monetary Authority and the Securities and Futures Commission, is organized under the laws of the United States with limited liability. **India:** J.P. Morgan India Private Limited (Corporate Identity Number - U67120MH1992FTC068724), having its registered office at J.P. Morgan Tower, Off. C.S.T. Road, Kalina, Santacruz - East, Mumbai - 400098, is registered with the Securities and Exchange Board of India (SEBI) as a 'Research Analyst' having registration number INH000001873. J.P. Morgan India Private Limited is also registered with SEBI as a member of the National Stock Exchange of India Limited and the Bombay Stock Exchange Limited (SEBI Registration Number - INZ000239730) and as a Merchant Banker (SEBI Registration Number - MB/INM000002970). Telephone: 91-22-6157 3000, Facsimile: 91-22-6157 3990 and Website: www.jpmpi.com. JPMorgan Chase Bank, N.A. - Mumbai Branch is licensed by the Reserve Bank of India (RBI) (Licence No. 53/ Licence No. BY.4/94; SEBI - IN/CUS/014/ CDSL : IN-DP-CDSL-444-2008/ IN-DP-NSDL-285-2008/ INBI00000984/ INE231311239) as a Scheduled Commercial Bank in India, which is its primary license allowing it to carry on Banking business in India and other activities, which a Bank branch in India are permitted to undertake. For non-local research material, this material is not distributed in India by J.P. Morgan India Private Limited. **Indonesia:** PT J.P. Morgan Sekuritas Indonesia is a member of the Indonesia Stock Exchange and is regulated by the OJK a.k.a. BAPEPAM LK. **Korea:** J.P. Morgan Securities (Far East) Limited, Seoul Branch, is a member of the Korea Exchange (KRX). JPMorgan Chase Bank, N.A., Seoul Branch, is licensed as a branch office of foreign bank (JPMorgan Chase Bank, N.A.) in Korea. Both entities are regulated by the Financial Services Commission (FSC) and the Financial Supervisory Service (FSS). For non-macro research material, the material is distributed in Korea by or through J.P. Morgan Securities (Far East) Limited, Seoul Branch. **Japan:** JPMorgan Securities Japan Co., Ltd. and JPMorgan Chase Bank, N.A., Tokyo Branch are regulated by the Financial Services Agency in Japan. **Malaysia:** This material is issued and distributed in Malaysia by JPMorgan Securities (Malaysia) Sdn Bhd (18146-X), which is a Participating Organization of Bursa Malaysia Berhad and holds a Capital Markets Services License issued by the Securities Commission in Malaysia. **Mexico:** J.P. Morgan Casa de Bolsa, S.A. de C.V. and J.P. Morgan Grupo Financiero are members of the Mexican Stock Exchange and are authorized to act as a broker dealer by the National Banking and Securities Exchange Commission. **New Zealand:** This material is issued and distributed by JPMSAL in New Zealand only to "wholesale clients" (as defined in the Financial Advisers Act 2008). JPMSAL is registered as a Financial Service Provider under the Financial Service providers (Registration and Dispute Resolution) Act of 2008. **Pakistan:** J. P. Morgan Pakistan Broking (Pvt.) Ltd is a member of the Karachi Stock Exchange and regulated by the Securities and Exchange Commission of Pakistan. **Philippines:** J.P. Morgan Securities Philippines Inc. is a Trading Participant of the Philippine Stock Exchange and a member of the Securities Clearing Corporation of the Philippines and the Securities Investor Protection Fund. It is regulated by the Securities and Exchange Commission. **Russia:** CB J.P. Morgan Bank International LLC is regulated by the Central Bank of Russia. **Singapore:** This material is issued and distributed in Singapore by or through J.P. Morgan Securities Singapore Private Limited (JPMSS) [MCI (P) 018/04/2020 and Co. Reg. No.: 199405335R], which is a member of the Singapore Exchange Securities Trading Limited, and/or JPMorgan Chase Bank, N.A., Singapore branch (JPMCB Singapore) [MCI (P) 052/09/2020], both of which are regulated by the Monetary Authority of Singapore. This material is issued and distributed in Singapore only to accredited investors, expert investors and institutional investors, as defined in Section 4A of the Securities and Futures Act, Cap. 289 (SFA). This material is not intended to be issued or distributed to any retail investors or any other investors that do not fall into the classes of "accredited investors," "expert investors" or "institutional investors," as defined under Section 4A of the SFA. Recipients of this material in Singapore are to contact JPMSS or JPMCB Singapore in respect of any matters arising from, or in connection with, the material. As at the date of this material, JPMSS is a designated market maker for certain structured warrants listed on the Singapore Exchange where the underlying securities may be the securities discussed in this material. Arising from its role as a designated market maker for such structured warrants, JPMSS may conduct hedging activities in respect of such underlying securities and hold or have an interest in such underlying securities as a result. The updated list of structured warrants for which JPMSS acts as designated market maker may be found on the website of the Singapore Exchange Limited: <http://www.sgx.com>. **South Africa:** J.P. Morgan Equities South Africa Proprietary Limited and JPMorgan Chase Bank, N.A., Johannesburg Branch are members of the Johannesburg Securities Exchange and are regulated by the Financial Services Board. **Taiwan:** J.P. Morgan Securities (Taiwan) Limited is a participant of the Taiwan Stock Exchange (company-type) and

regulated by the Taiwan Securities and Futures Bureau. Material relating to equity securities is issued and distributed in Taiwan by J.P. Morgan Securities (Taiwan) Limited, subject to the license scope and the applicable laws and the regulations in Taiwan. According to Paragraph 2, Article 7-1 of Operational Regulations Governing Securities Firms Recommending Trades in Securities to Customers (as amended or supplemented) and/or other applicable laws or regulations, please note that the recipient of this material is not permitted to engage in any activities in connection with the material that may give rise to conflicts of interests, unless otherwise disclosed in the "Important Disclosures" in this material. **Thailand:** This material is issued and distributed in Thailand by JPMorgan Securities (Thailand) Ltd., which is a member of the Stock Exchange of Thailand and is regulated by the Ministry of Finance and the Securities and Exchange Commission, and its registered address is 3rd Floor, 20 North Sathorn Road, Silom, Bangrak, Bangkok 10500. **UK:** Unless specified to the contrary, research is distributed in the UK by J.P. Morgan Securities plc ("JPMS plc") which is a member of the London Stock Exchange and is authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority. JPMS plc is registered in England & Wales No. 2711006, Registered Office 25 Bank Street, London, E14 5JP. This material is directed in the UK only to: (a) persons having professional experience in matters relating to investments falling within article 19(5) of the Financial Services and Markets Act 2000 (Financial Promotion) (Order) 2005 ("the FPO"); (b) persons outlined in article 49 of the FPO (high net worth companies, unincorporated associations or partnerships, the trustees of high value trusts, etc.); or (c) any persons to whom this communication may otherwise lawfully be made; all such persons being referred to as "UK relevant persons". This material must not be acted on or relied on by persons who are not UK relevant persons. Any investment or investment activity to which this material relates is only available to UK relevant persons and will be engaged in only with UK relevant persons. Research issued by JPMS plc has been prepared in accordance with JPMS plc's policy for prevention and avoidance of conflicts of interest related to the production of Research which can be found at the following link: [J.P. Morgan EMEA - Research Independence Policy](#). **U.S.:** J.P. Morgan Securities LLC ("JPMS") is a member of the NYSE, FINRA, SIPC, and the NFA. JPMorgan Chase Bank, N.A. is a member of the FDIC. Material published by non-U.S. affiliates is distributed in the U.S. by JPMS who accepts responsibility for its content.

General: Additional information is available upon request. The information in this material has been obtained from sources believed to be reliable. While all reasonable care has been taken to ensure that the facts stated in this material are accurate and that the forecasts, opinions and expectations contained herein are fair and reasonable, JPMorgan Chase & Co. or its affiliates and/or subsidiaries (collectively J.P. Morgan) make no representations or warranties whatsoever to the completeness or accuracy of the material provided, except with respect to any disclosures relative to J.P. Morgan and the Research Analyst's involvement with the issuer that is the subject of the material. Accordingly, no reliance should be placed on the accuracy, fairness or completeness of the information contained in this material. Any data discrepancies in this material could be the result of different calculations and/or adjustments. J.P. Morgan accepts no liability whatsoever for any loss arising from any use of this material or its contents, and neither J.P. Morgan nor any of its respective directors, officers or employees, shall be in any way responsible for the contents hereof, apart from the liabilities and responsibilities that may be imposed on them by the relevant regulatory authority in the jurisdiction in question, or the regulatory regime thereunder. Opinions, forecasts or projections contained in this material represent J.P. Morgan's current opinions or judgment as of the date of the material only and are therefore subject to change without notice. Periodic updates may be provided on companies/industries based on company-specific developments or announcements, market conditions or any other publicly available information. There can be no assurance that future results or events will be consistent with any such opinions, forecasts or projections, which represent only one possible outcome. Furthermore, such opinions, forecasts or projections are subject to certain risks, uncertainties and assumptions that have not been verified, and future actual results or events could differ materially. The value of, or income from, any investments referred to in this material may fluctuate and/or be affected by changes in exchange rates. All pricing is indicative as of the close of market for the securities discussed, unless otherwise stated. Past performance is not indicative of future results. Accordingly, investors may receive back less than originally invested. This material is not intended as an offer or solicitation for the purchase or sale of any financial instrument. The opinions and recommendations herein do not take into account individual client circumstances, objectives, or needs and are not intended as recommendations of particular securities, financial instruments or strategies to particular clients. The recipients of this material must make their own independent decisions regarding any securities or financial instruments mentioned herein and should seek advice from such independent financial, legal, tax or other adviser as they deem necessary. J.P. Morgan may trade as a principal on the basis of the Research Analysts' views and research, and it may also engage in transactions for its own account or for its clients' accounts in a manner inconsistent with the views taken in this material, and J.P. Morgan is under no obligation to ensure that such other communication is brought to the attention of any recipient of this material. Others within J.P. Morgan, including Strategists, Sales staff and other Research Analysts, may take views that are inconsistent with those taken in this material. Employees of J.P. Morgan not involved in the preparation of this material may have investments in the securities (or derivatives of such securities) mentioned in this material and may trade them in ways different from those discussed in this material. This material is not an advertisement for or marketing of any issuer, its products or services, or its securities in any jurisdiction.

"Other Disclosures" last revised April 17, 2021.

Copyright 2021 JPMorgan Chase & Co. All rights reserved. This material or any portion hereof may not be reprinted, sold or redistributed without the written consent of J.P. Morgan.