



June 19, 2023

A Deep Dive into CY Q1/23 Software Metrics

Separating the noise from the fundamentals

Our view: Coming out of CY Q1/23 earnings for on- and off-quarter software, we felt demand trends were stable to down in some cases, and as such, we took a deep dive into underlying software metrics. Through this analysis we found that fundamental data points did in fact show increased weakness vs CY Q1/22 and Q4/22 with an average decline in customer expansion, new logos, large customer growth metrics and sales efficiency (q/q). Specifically, key takeaways include: 1) we saw a heavier reliance on expansions vs. new logos, though both continue to be negatively impacted by macros; 2) slower q/q large customer adds compared to both CY Q4/22 and Q1/22; 3) sales efficiency ticked down slightly from last quarter; and 4) management teams continue to reduce SBC while most investors we speak with want to see the dependency on SBC reduced even further.

Expansions and new logo growth weakened: Underlying fundamentals deteriorated slightly in CY Q1/23 with average expansions and new logo growth at 16%/14%, respectively, vs. 18%/17% in CY Q4/22 and 21%/28% in CY Q1/22. Additionally, within SaaS, we saw on average ~55% of top-line growth was driven by expansions in CY Q1/23, which was up vs. ~46% in CY Q1/22. While growth has slowed for both new logos and expansions, it is evident that growth from new logos has declined at a faster rate as software vendors lean into their existing customer base for growth. With macros that remain uneven, we think software companies with less reliance on new logos remain more resilient. That said, if macros improve faster than expected, companies with more reliance on new logos could see a rapid rebound.

Large customer trends deteriorated: Large deal trends across software companies continued to slow down sequentially in CY Q1/23, which is expected to some level after a seasonally strong CY Q4/22. That said, large deal metrics were also lower than in CY Q1/22. On average, large customer growth q/q was +3% in CY Q1/23, down 400 bps from +7% in CY Q4/22 and down 300 bps from +6% in CY Q1/22. This makes sense with the qualitative commentary around longer deal cycles and additional deal scrutiny as customers remain thoughtful around IT budgets. Regarding large customer trends, **SNOW, IOT, GTLB, CFLT,** and **CYBR** performed the best compared to last quarter while **FTNT, DOCU, ZI, INFA,** and **ASAN** saw the most deterioration.

Sales efficiency stable to slightly down q/q: We looked at revenue and gross profit divided by non-GAAP S&M along with revenue growth compared to non-GAAP S&M to show which companies are more or less effectively allocating sales dollars to generate growth. On average, sales efficiency based on revenue was 3.6x in CY Q1/23 compared to 3.7x in CY Q4/22 and 3.5x in CY Q1/22. What we found when looking at sales efficiency in CY Q1/23 for revenue growth, **PCTY, BILL, CWAN, OLO,** and **GEN** performed the best while **PEGA, ZD, AI, INFA,** and **ZM** saw the most deterioration. We think trends impacting sales efficiency include macro pressures, increased costs associated with more travel, selling in a tougher macro, and efforts to restructure GTM strategies.

SBC trends: While we have seen investor interest wane slightly vs. prior quarters, SBC remains topical with trends in CY Q1/23 continuing to reflect more conscious efforts to reduce SBC. To illustrate, operating margin expansion w/ SBC, on average, was 471 bps from CY Q1/22 to CY Q1/23 which was ~16% higher than operating margin expansion ex-SBC at 408 bps, which implies improvement. This reflects a reversal of trends vs. last quarter when ~22% of the operating margin expansion y/y was driven by SBC. Companies with the highest y/y OM expansion w/SBC in CY Q1/23 included **S, PATH, HCP, XM,** and **SMAR** while companies with the highest contraction included **AI, TEAM, VEEV, PANW,** and **PEGA.**

(Note: RBC covered companies in bold throughout report)

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Expansions vs. new logos

What is the metric? We derived how much of SaaS company's growth is likely attributed to expansions within the existing installed base vs. new logos.

Why it is relevant? We believe that in times of macro uncertainty, we see an increased incumbency bias. In addition, as customers focus on cost savings, the reality is that it is easier to grow with existing customers (especially if those existing customers exhibit high gross retention) than to sell to new ones, particularly if selling solutions that are either greenfield or going against a large, established vendor. Through our analysis, we analyze y/y and q/q trends in the expansion/new logos mix as well as identify software vendors that we think can benefit amidst these trends.

How do we measure it? While few companies explicitly disclose new vs. existing business, we look at NRR versus key top-line metric growth rates to directionally measure the mix. Key top-line growth rate reflects the underlying metric used to calculate NRR, which is typically ARR, recurring revenue or total revenue. For companies that do not disclose ARR, we derive ARR using revenue. To illustrate our methodology, assuming the company uses revenue to calculate NRR, we look at revenue growth as a function of two components – growth from expansions and growth from new logos, both of which sum up to total revenue growth. As an example, if a company is growing revenue by 25% and has an NRR of 120%, we assume 20% growth is coming from expansions while the remainder 5% is coming from new logos. In other words, most of the business in a given year is dependent on upselling to existing customers, with the balance coming from landing new logos. **It is important to note this is not an exact approach to determine the new vs existing mix given NRR is often a TTM metric vs growth that is often a point in time as we are only directionally looking to understand the q/q and y/y trends of how the mix has changed.**

Assumptions/limitations to calculations:

- We looked at the latest fiscal quarter ending March 2023 for on-quarter names and April 2023 for off-quarter names and made q/q and y/y comparisons for 21 SaaS companies.
- In order to analyze the new logo/expansions data, we look at the following data points:
 - 1) Key metric growth y/y
 - a. Key metric reflects the top-line figure the company uses as a basis for NRR calculation. Companies use different metrics to calculate NRR, which typically include ARR, revenue, recurring revenue or ACV.
 - b. For companies that don't provide ARR (or ACV in case of OKTA and ZI), we derive "Implied ARR" using revenue.
 - c. We have used organic key metric growth rate companies available as M&A can distort the new logo/expansion mix data. Most companies in our universe don't include M&A contribution in their NRR until it becomes fully organic (i.e. until one year after the acquisition closes).
 - 2) Net retention rate (NRR):
 - a. We'd note each company calculates NRR differently and as such, are not exact comparisons to each other.
 - b. Most software companies report NRR on a TTM basis (even methodologies amongst these companies vary). For companies which don't use ARR and instead use revenue, ACV or recurring revenue, the growth metric is quarterly as we'd note expansions/new logo mix is not precise and just an estimate due to a lack of accurate data. For example - negative new logo growth is essentially NM. We give special credit to TWLO's NRR figure, which is reported on a quarterly basis, enabling investors to estimate how much growth in any given quarter comes from net new customers versus existing customer expansion.
 - c. For companies that provide NRR in threshold, we assume NRR equal to the threshold.

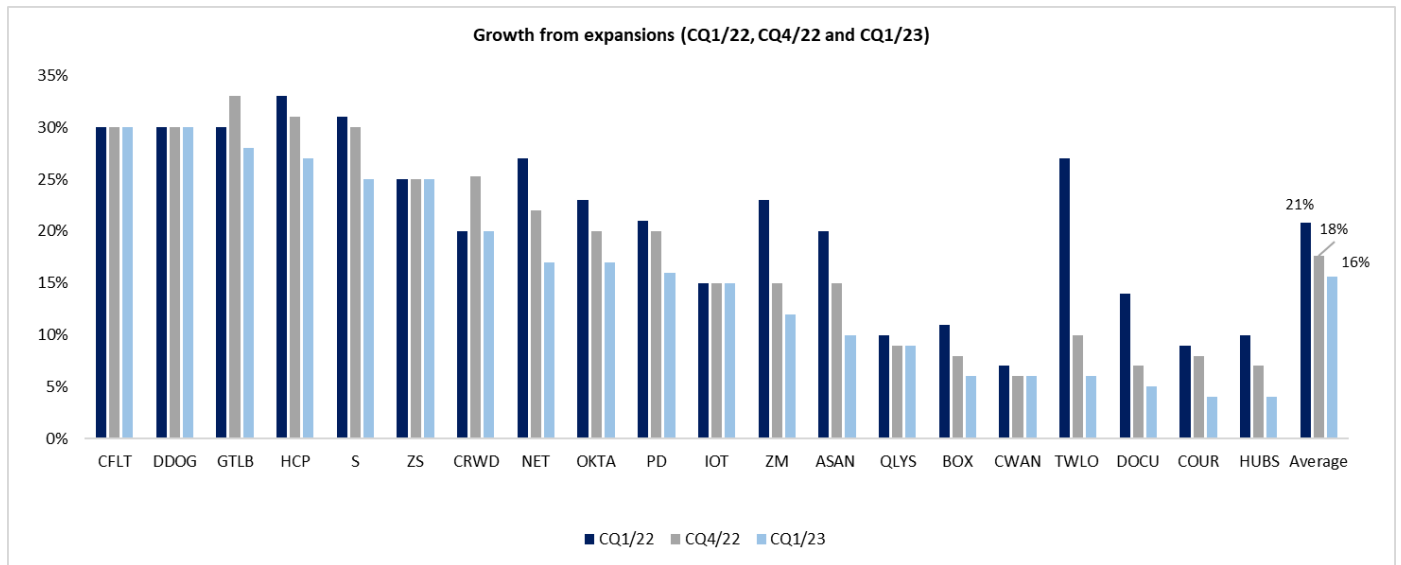


- 3) Growth from expansions
 - a. We determine growth from expansions as $(1 - \text{NRR})$. This represents the absolute portion of the growth that comes from expansions.
 - b. As an example, for a company with NRR of 120% and key metric (say revenue) growth of +25%, we assume growth from expansions to be $(1 - 120\%)$ or +20%. In other words, of the +25% revenue growth, +20% is growth from expansions.
- 4) Growth from new logos
 - a. We determine growth from new logos as key metric growth minus growth from expansions. This represents the absolute portion of the growth that comes from new logos.
 - b. Same example as above, growth from new logos would be 25% (revenue growth) minus 20% (growth from expansions), or +5%. In other words, of the +25% revenue growth, +20% is growth from expansions while the remainder +5% is growth from new logos.
- 5) Percentage of key metric growth from expansions
 - a. This represents the mix of expansions, essentially what percentage of the growth in key metric is driven by expansions.
 - b. This is calculated by dividing growth from expansions by total key metric growth.
- 6) Percentage of key metric growth from new logos
 - a. This represents the mix of new logos, essentially what percentage of the growth in key metric is driven by new logos.
 - b. This is calculated by dividing growth from new logos by total key metric growth.
 - c. Note that the percentage of key metric growth from expansions and percentage of key metric growth from new logos sum up to a 100%.

In addition, we'd point to Appendix Exhibit 19-22 for the underlying data.

In the following chart, we plot y/y growth from expansions (described above #3) in CQ1/22, CQ4/22 and CQ1/23.

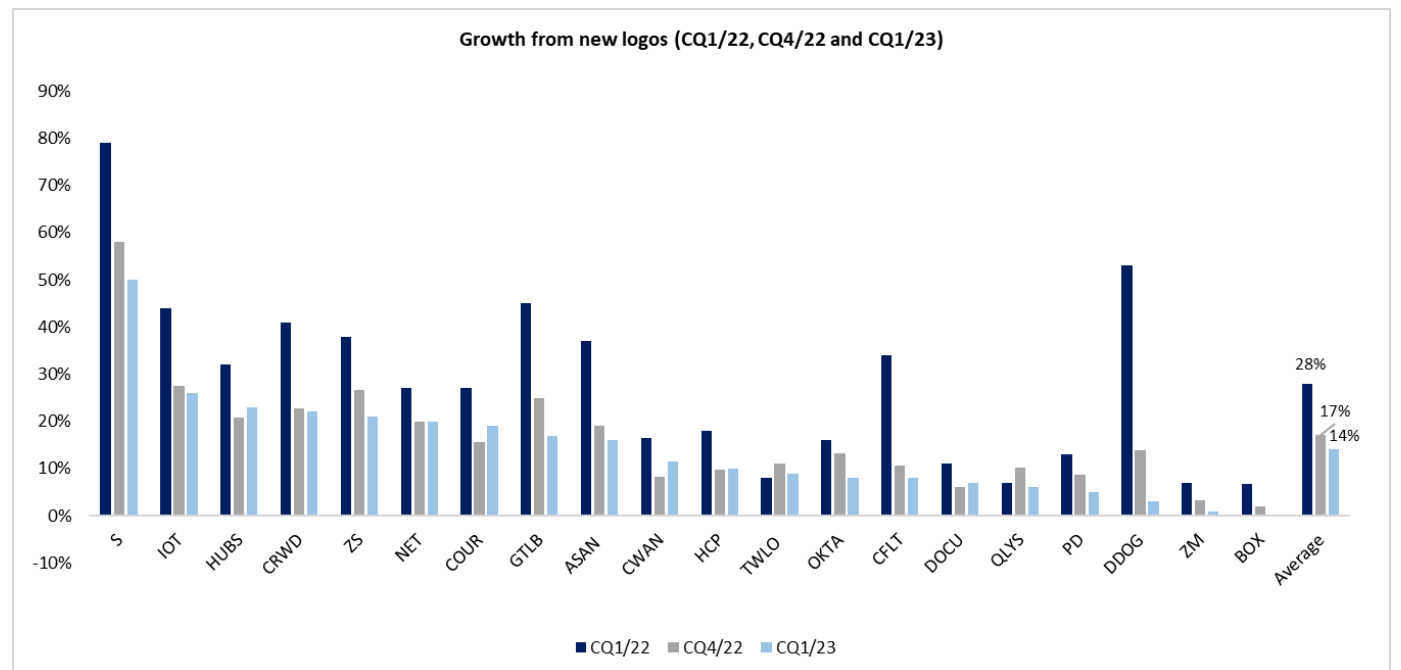
Exhibit 1 – Decelerating trend in growth from expansions (CQ1/22, CQ4/22 and CQ1/23)



Source: Company reports, FactSet, RBC Capital Markets

The following chart plots the second component of growth – y/y growth from new logos (described above #4) in CQ1/22, CQ4/22 and CQ1/23.

Exhibit 2 – Decelerating trend in growth from new logos (CQ1/22, CQ4/22 and CQ1/23)



Source: Company reports, FactSet, RBC Capital Markets

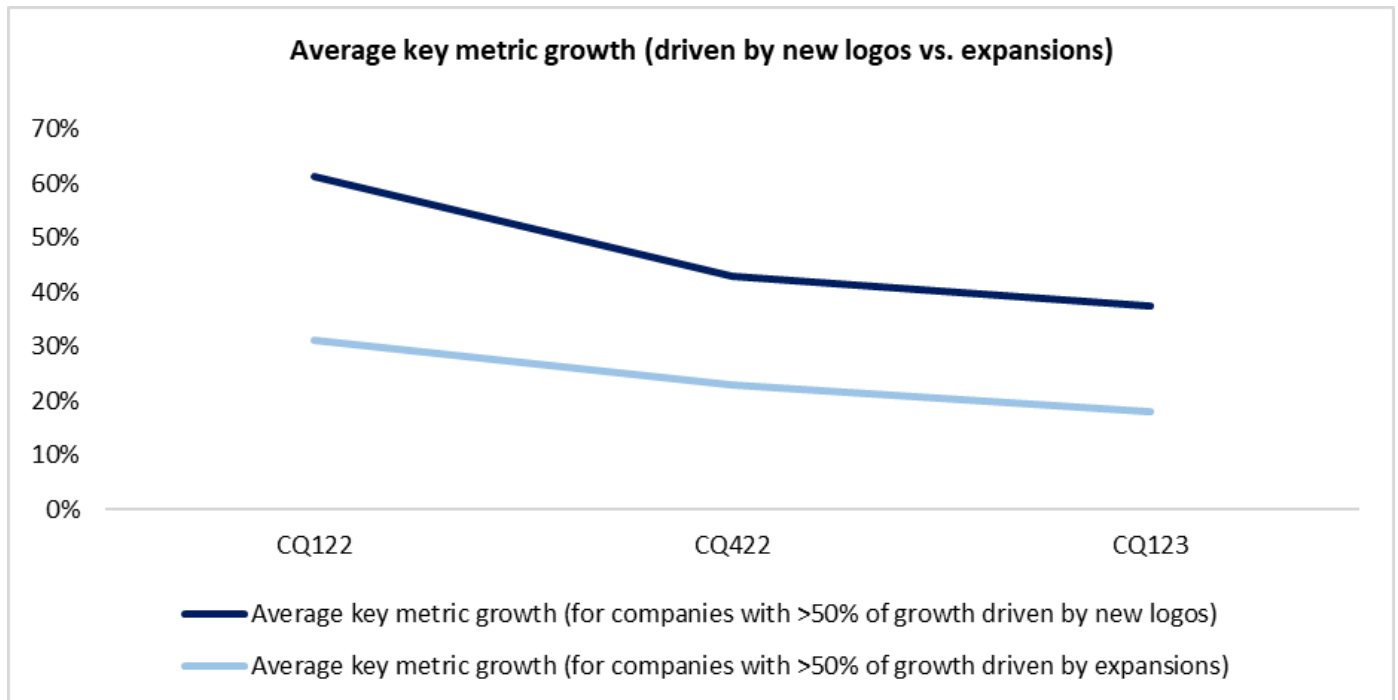


Key observations:

- On average and vs CQ122 and CQ422, fundamental data in CQ123 deteriorated across both expansions and new logos.
- To illustrate, average new logo growth was 14% in CQ1/23, down from 17% in CQ4/22 and 28% in CQ1/22. This trend was similar on the expansion side, with average growth from expansions at 16% in CQ1/23, down from 18% in CQ4/22 and 21% in CQ1/22.
- On average, growth from new logos was down 48% y/y in CQ1/23 vs. growth from expansions, which was down 28% y/y in the same period. Compared to CQ4/22, growth from new logos was down 21% q/q vs. expansions down 18% q/q.
- Another interesting point is that in CQ1/22 average growth was weighted more towards new logos at 28% vs. expansions at 21%, which has now changed in CQ1/23 with 16% on expansions vs. 14% on new logos. This is in-line with the qualitative commentary around more reliance on expansions and existing customers while new logo growth comes under pressure.
- While both customer expansions and new logo growth have decelerated since four quarters ago, new logo growth has decelerated at a faster rate. NRR has not increased y/y for any of these 21 names.
- Average growth of the key metrics (which includes ARR, implied ARR, revenue, subscription revenue growth) has declined significantly given the macro headwinds with +29% average growth in CQ1/23, down from a seasonally strong +35% in CQ4/22 and +49% in CQ1/22.
- Companies with the highest increase in expansions in CQ1/23 vs. CQ1/22 (growth in expansions CQ1/23 – growth in expansions CQ1/22) were **CFLT, CRWD, DDOG, IOT, and ZS**. We'd highlight that that expansions were flat for these names (no increase in NRR) while the rest declined.
- Companies with the highest increase in growth from new logos in CQ1/23 vs. CQ1/22 (growth from new logos CQ1/23 – growth from new logos CQ1/22) were **TWLO, QLYS, DOCU, CWAN, and ZM**.
- Companies with the highest deceleration in growth from expansions in CQ1/23 vs. CQ1/22 (growth in expansions CQ1/23 – growth in expansions CQ1/22) were **TWLO, ZM, NET, ASAN** and **DOCU**.
- Companies with the highest deceleration in growth from new logos in CQ1/23 vs. CQ1/22 (growth from new logos CQ1/23 – growth from new logos CQ1/22) were **DDOG, S, GTLB, CFLT, and ASAN**.

The following chart plots average top-line metric growth for companies which have >50% of the top-line metric growth coming from expansions (<50% from new logos) vs. companies with <50% of the top-line metric growth coming from expansions (>50% from new logos).

Exhibit 3 – Steeper deceleration in key metric growth y/y where growth is primarily driven by new logos vs. expansions



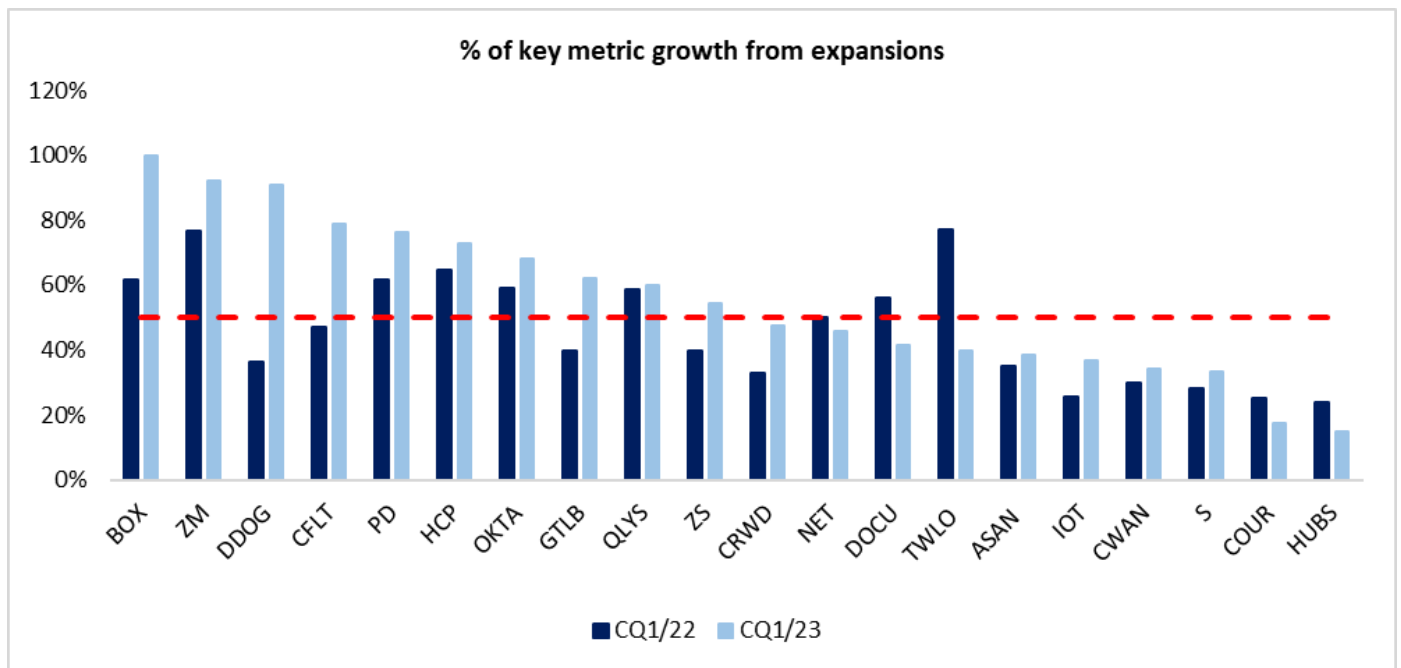
Source: Company reports, FactSet, RBC Capital Markets

Key observations:

- Of the companies with >50% of key metric growth from expansions in CQ1/22, key metric growth decelerated by 13 points on average vs. 24 points of deceleration for companies with >50% exposure to new logos in CQ1/22.
- This essentially shows that companies who have been historically more dependent on expansions had a less steep decline in key growth rates compared to companies that were more reliant on new logos.
- While we’ve heard management teams discuss this qualitatively, we think this data provides an additional layer of evidence behind this perspective.

The following chart plots percentage of key metric growth, which is attributed to expansions while the remainder is attributed to new logos. As a reminder and keeping the prior example, 25% revenue growth of which 20% is attributed to expansions and 5% to new logos. Percentage of growth from expansions is $20\%/25\%=80\%$, implying 80% of the growth is coming from expansions.

Exhibit 4 – Percentage of growth from existing expansions



Source: Company reports, FactSet, RBC Capital Markets

Key observations:

- In CQ1/23, 55% of the key metric growth was driven by expansions vs. 45% from new logos. In CQ1/22, 46% of the key metric growth was driven by expansions vs. 54% from new logos. Essentially, dependence on expansions continues to grow in CQ1/23, up 900 bps y/y and up 300 bps q/q.
- Companies with the key growth metric primarily driven by new logos vs. expansions this quarter include **HUBS, COUR, S, CWAN, and IOT.**
- Companies with the key growth metric primarily driven by expansions vs. new logos this quarter include **BOX, ZM, DDOG, CFLT, and PD.**
- Companies including **DDOG, BOX, CFLT, GTLB, and ZM** saw a significant increase in the reliance on expansions. **ZS** went from less than 50% of key metric growth coming from expansions in Q1/22 to over 50% of growth from expansions in Q1/23.

Our thoughts:

- Both new logos and expansions were down both y/y and q/q. Compared to last year where companies seemed to be more reliant on new logo wins, this trend has reversed with companies increasingly leaning into expansions.
- Even though growth has slowed down for both new logos and expansions, we'd note that new logos have declined at a steeper rate. Additionally, compared to CQ1/22, customers have not seen expansions or an increase in NRR for any of the 21 SaaS companies we analyzed. We think this makes sense given longer deal cycles, more requirements for approvals, and tightening budgets.



- As a result, while underlying metrics seemed to deteriorate this past quarter, we believe companies that are more reliant on expansions are likely to be more resilient in the near-term. To that, our analysis depicts vendors that can sell back into their base appear in a better position vs. vendors that rely more heavily on new logo acquisition in a downturn.
- On the other hand, if the macro improves throughout the year, it is also likely that companies more reliant on new logos could rebound quickly, given that new logo growth trends have larger peaks and pits.



Large customer growth

What is the metric? We measure the change in large customers and new logo adds sequentially to understand exposure to enterprise businesses and track growth. Many companies do not provide this metric, though we will continue to expand our data set as we get more data points. Each company defines a large customer differently, though we think that it provides some high-level insights into which companies may be better positioned and which are under pressure.

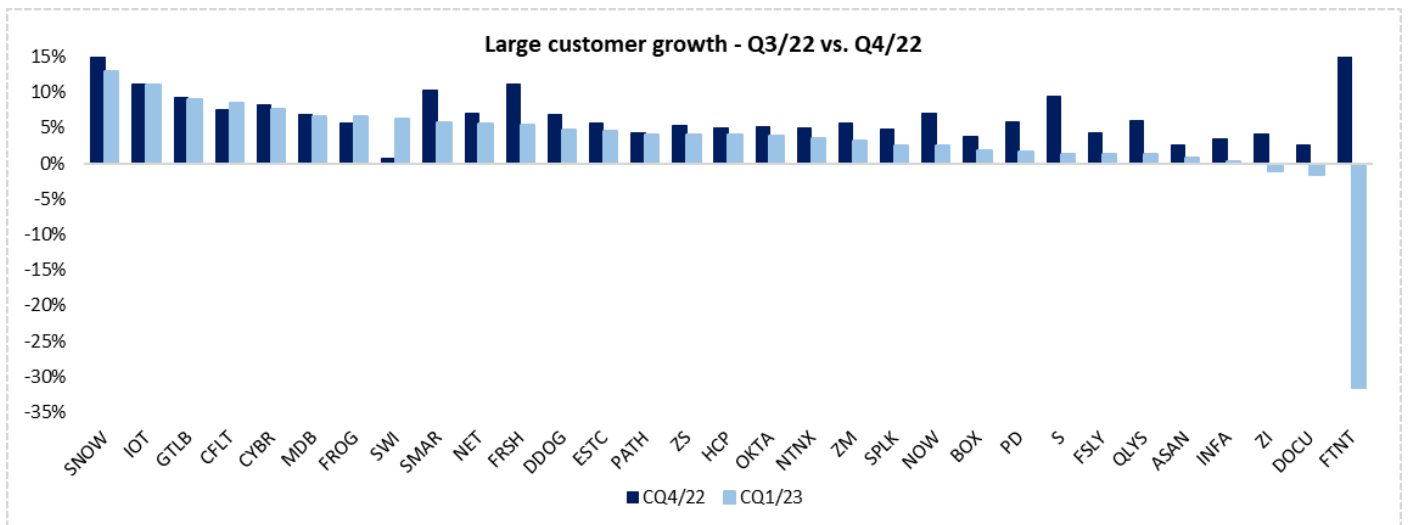
Why it is relevant? This is relevant because it provides an additional lens through which we can see more detail on the health of a company’s most strategic customers. The enterprise segment is an important growth lever for many software companies and are generally a stickier portion of the customer base. Particularly in this macro, enterprise businesses are likely more resilient while smaller-mid size businesses are seeing more impacts and tightening their budgets further.

How do we measure it? We looked through transcripts and filings to collect any data points over the past five calendar quarters. We also included how each company defines the data point. We then look at sequential changes vs y/y changes.

Assumptions/limitations of calculations:

- Many companies don’t disclose this information, so the list isn’t as comprehensive across software, though we think that it is a good starting point to grow from.
- How companies define a large customer is different company by company and as a result the data points are not directly comparable.
- Based on the size of the company, the percentages or growth rates could be more or less sensitive.
- Even if the large customer growth for one company is growing faster, it could still contribute less to revenue. For example, if company A is growing its \$100K customers 50%+, but that customer cohort only represents 10% of revenue, it is less meaningful than a company growing \$100K+ customers at the same rate when that cohort represents 50% of revenue.

Exhibit 5– Large customers q/q growth in CQ123 compared to q/q growth in CQ422



Source: Company reports, FactSet, RBC Capital Markets



Exhibit 6– Large customers data and definitions

Ticker	Large customers						Sequential growth					Definition
	Q4/21	Q1/22	Q2/22	Q3/22	Q4/22	Q1/23	Q1/22	Q2/22	Q3/22	Q4/22	Q1/23	
ASAN	NA	NA	462	493	506	510	NA	NA	7%	3%	1%	Customers with >\$100K in annual spend
BOX	1420	1472	1530	1586	1646	1677	4%	4%	4%	4%	2%	Customers with ACV >\$100K annually
CFLT	732	791	857	921	991	1075	8%	8%	7%	8%	8%	Customers with ARR >100K+
CYBR	890	960	1000	1200	1300	1400	8%	4%	20%	8%	8%	Customers with ARR >\$100K
DDOG	2010	2250	2420	2600	2780	2910	12%	8%	7%	7%	5%	Customers with ARR >\$100K
DOCU	852	886	992	1052	1080	1063	4%	12%	6%	3%	-2%	Customers with ACV >\$300K
ESTC	890	960	1010	1050	1110	1160	8%	5%	4%	6%	5%	Customers with ACV >\$100K
FROG	537	599	647	696	736	785	12%	8%	8%	6%	7%	Customers with ARR >\$100K
FRSH	1,416	1547	1648	1717	1908	2013	9%	7%	4%	11%	6%	Customers with ARR >\$50K
FSLY	467	488	499	511	533	540	4%	2%	2%	4%	1%	Customers with TTM revenue >\$100K
FTNT	122	90	122	153	181	124	-26%	36%	25%	18%	-31%	Deals that sizes >\$1M
GTLB	492	545	593	638	697	760	11%	9%	8%	9%	9%	Customers with ARR >\$100K
HCP	655	704	734	760	798	830	7%	4%	4%	5%	4%	Customers with ARR >\$100K
INFA	1,660	1732	1791	1852	1916	1921	4%	3%	3%	3%	0%	Customers with >\$100K subscription ARR
IOT	806	897	989	1113	1237	1375	11%	10%	13%	11%	11%	Customers with >\$100K in ARR
MDB	1307	1379	1462	1545	1651	1761	6%	6%	6%	7%	7%	Customers with >\$100K in ARR
NET	1416	1537	1749	1908	2042	2156	9%	14%	9%	7%	6%	Customers with annual revenue >\$100K
NOW	1,349	1403	1464	1532	1641	1682	4%	4%	5%	7%	2%	Customers with ACV >\$1M
NTNX	1662	1747	1841	1918	2013	2085	5%	5%	4%	5%	4%	Customers with LTV >\$1M
OKTA	3100	3305	3525	3740	3930	4080	7%	7%	6%	5%	4%	Customers with ACV >\$100K
PANW	1077	1160	1240	1262	NA	1496	8%	7%	2%	NA	NA	Customers with LTM bookings >\$1M
PATH	1493	1574	1660	1711	1785	1858	5%	5%	3%	4%	4%	Customers with ARR >\$100K
PD	594	655	689	710	752	764	10%	5%	3%	6%	2%	Customers with ARR >\$100K
QLYS	125	128	139	151	160	162	2%	9%	9%	6%	1%	Customers revenue >\$500K
S	520	591	755	827	905	917	14%	28%	10%	9%	1%	Customers with ARR >\$100K
SMAR	1026	1108	1220	1346	1484	1569	8%	10%	10%	10%	6%	Customers with ACV >\$100K
SNOW	184	206	246	287	330	373	12%	19%	17%	15%	13%	Customers with product revenue >\$1M
SPLK	675	690	723	754	790	810	2%	5%	4%	5%	3%	Customers with ARR >\$1M
SWI	829	852	879	882	889	945	3%	3%	0%	1%	6%	Customers with TTM spend >\$100K
ZI	1452	1623	1763	1848	1926	1905	12%	9%	5%	4%	-1%	Customers with ACV >\$100K
ZM	2725	2916	3116	3286	3471	3580	7%	7%	5%	6%	3%	Customers with TTM revenue >\$100K
ZS	1751	1891	2089	2217	2337	2432	8%	10%	6%	5%	4%	Customers with ARR >\$100K

Source: Company reports, FactSet, RBC Capital Markets



Exhibit 7– Large customer new logo adds data

Ticker	New logo adds					Sequential growth			
	Q1/22	Q2/22	Q3/22	Q4/22	Q1/23	Q2/22	Q3/22	Q4/22	Q1/23
ASAN	NA	NA	31	13	4	NA	NA	-58%	-69%
BOX	52	58	56	60	31	12%	-3%	7%	-48%
CFLT	59	66	64	70	84	12%	-3%	9%	20%
CYBR	70	40	200	100	100	-43%	400%	-50%	0%
DDOG	240	170	180	180	130	-29%	6%	0%	-28%
DOCU	34	106	60	28	-17	212%	-43%	-53%	-161%
ESTC	70	50	40	60	50	-29%	-20%	50%	-17%
FROG	62	48	49	40	49	-23%	2%	-18%	23%
FRSH	131	101	69	191	105	-23%	-32%	177%	-45%
FSLY	21	11	12	22	7	-48%	9%	83%	-68%
FTNT	-32	32	31	28	-57	-200%	-3%	-10%	-304%
GTLB	53	48	45	59	63	-9%	-6%	31%	7%
HCP	49	30	26	38	32	-39%	-13%	46%	-16%
INFA	72	59	61	64	5	-18%	3%	5%	-92%
IOT	91	92	124	124	138	1%	35%	0%	11%
MDB	72	83	83	106	110	15%	0%	28%	4%
NET	121	212	159	134	114	75%	-25%	-16%	-15%
NOW	54	61	68	109	41	13%	11%	60%	-62%
NTNX	85	94	77	95	72	11%	-18%	23%	-24%
OKTA	205	220	215	190	150	7%	-2%	-12%	-21%
PANW	83	80	22	NA	NA	-4%	-73%	NA	NA
PATH	81	86	51	74	73	6%	-41%	45%	-1%
PD	61	34	21	42	12	-44%	-38%	100%	-71%
QLYS	3	11	12	9	2	267%	9%	-25%	-78%
S	71	164	72	78	12	131%	-56%	8%	-85%
SMAR	82	112	126	138	85	37%	13%	10%	-38%
SNOW	22	40	41	43	43	82%	2%	5%	0%
SPLK	15	33	31	36	20	120%	-6%	16%	-44%
SWI	23	27	3	7	56	17%	-89%	133%	700%
ZI	171	140	85	78	-21	-18%	-39%	-8%	-127%
ZM	191	200	170	185	109	5%	-15%	9%	-41%
ZS	140	198	128	120	95	41%	-35%	-6%	-21%

Source: Company reports, FactSet, RBC Capital Markets

Key observations:

- Companies with the highest large customer growth q/q include SNOW, IOT, GTLB, CFLT, and CYBR.
- Companies with the highest large customer new logo growth q/q include SWI, FROG, CFLT, IOT, and GTLB.
- Companies with the lowest large customer growth q/q include FTNT, DOCU, ZI, INFA, and ASAN.
- Companies with the lowest large customer new logo growth q/q include FTNT, DOCU, ZI, INFA, and S.
- Companies with the highest large customer growth y/y include SNOW, S, IOT, CYBR, and SMAR.



- Companies with the lowest large customer growth y/y include **FSLY, INFA, SWI, BOX,** and **PD**. All companies grew large customers greater than 10% y/y.
- We think that absolute metrics should be looked at along with the percentages to understand the context. In particular, new logo growth is much more sensitive because it is based on smaller numbers.
- On average, large customer growth is lower q/q at 3% in CQ1/23 vs. 7% in CQ4/22, 7% Q3/22, 9% in CQ2/22, and 6% in CQ1/22.

Our thoughts:

- In CQ1/23, large customer growth slowed by 400 bps on a sequential basis from CQ4/22. We think that this is expected given that CQ4/22 tends to be a seasonally strong quarter.
- That said, q/q growth in CQ1/23 was also down 300 bps from Q1/22, which means that since this last year, sequential large customer growth has slowed. This is also expected given the macro headwinds through CY/22 and into CY/23.
- Broadly, this metric is important because it provides an additional layer of visibility when assessing the defensibility of a company and its competitive position. In more uncertain macro conditions, the SMB segment comes under pressure and, as a result, management teams start to tighten their budgets, delay investments, or cancel deals. While larger customers also see some of those headwinds, they are usually better positioned, which again creates more stability across our software coverage.
- As a reminder, one caveat to this is that in some cases, enterprises may have longer approval cycles and more processes that could result in longer deal cycles and delays. These may be quick for SMBs since they are smaller and may not have as many checks in place. Another caveat is that for some companies, large customers may not provide as much contribution to revenue even if they are growing at a faster rate. As such, it is important to benchmark growth rates with the absolute scale of large customers as well as top-line metrics.
- Additionally, tracking large customer adds is a helpful metric when looking at the maturing business models as they move up market and a good reminder that not every customer is created equal. For example, adding one enterprise customer may be more impactful to the top-line than 10 SMB customers, but all else equal would show up as declining new logo adds.
- Overall, we'd note that large customer growth continued to remain under pressure in CQ1/23 and is lower on a sequential basis compared to last quarter and last year.



Sales efficiency

What is the metric? Sales efficiency measures how companies are allocating their sales dollars to generate top-line growth. The metric essentially shows for every dollar spent, how much impact is seen on revenue or gross profit. The goal is to drive the highest sales with the least amount of resources.

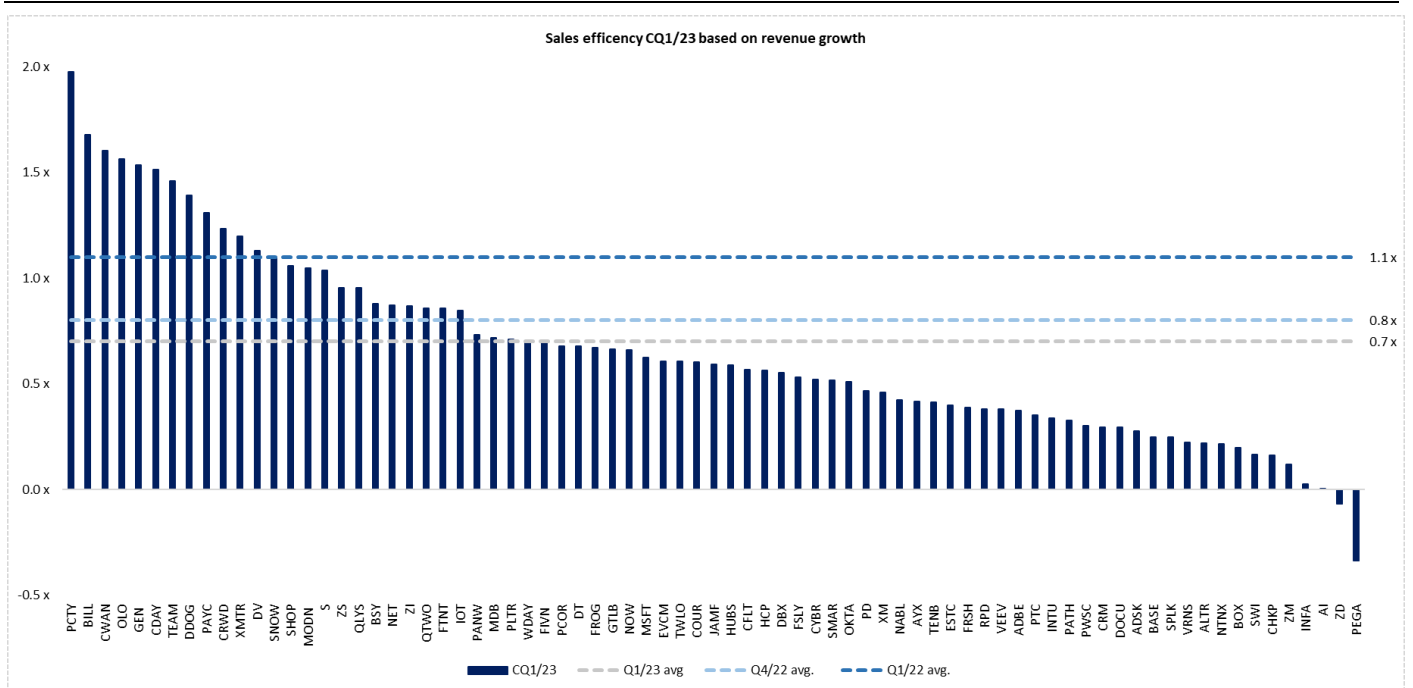
Why it is relevant? It is relevant to understand how much of a company's sales dollars contribute to growth, which we see as another component of productivity and cost optimization. Companies that have higher sales efficiency can be better positioned to protect their margins and generate growth, which continues to be a key focus for investors. On the other hand, companies with lower sales efficiency may not be effectively allocating their salesforce or need to revise their go-to-market strategies.

How do we measure it? First, we measure revenue divided by non-GAAP sales and marketing expenses as well as gross profit divided by non-GAAP sales and marketing expenses to see the portion of spend. Then we also calculate the change from the current quarterly revenue – previous years quarterly revenue divided by previous year quarterly non-GAAP sales and marketing expense to better understand sales efficiency from a top-line growth perspective in sequential basis.

Assumptions/limitations of calculations:

- Slowed travel and more virtual meetings could result in lower sales costs and thus higher sales efficiency earlier, which may have impacted expenses.
- Some revenue growth metrics may be skewed based on M&A.
- Sales expenses can be defined differently company by company.
- Company-specific events can skew results like an in-person conference, event, etc.

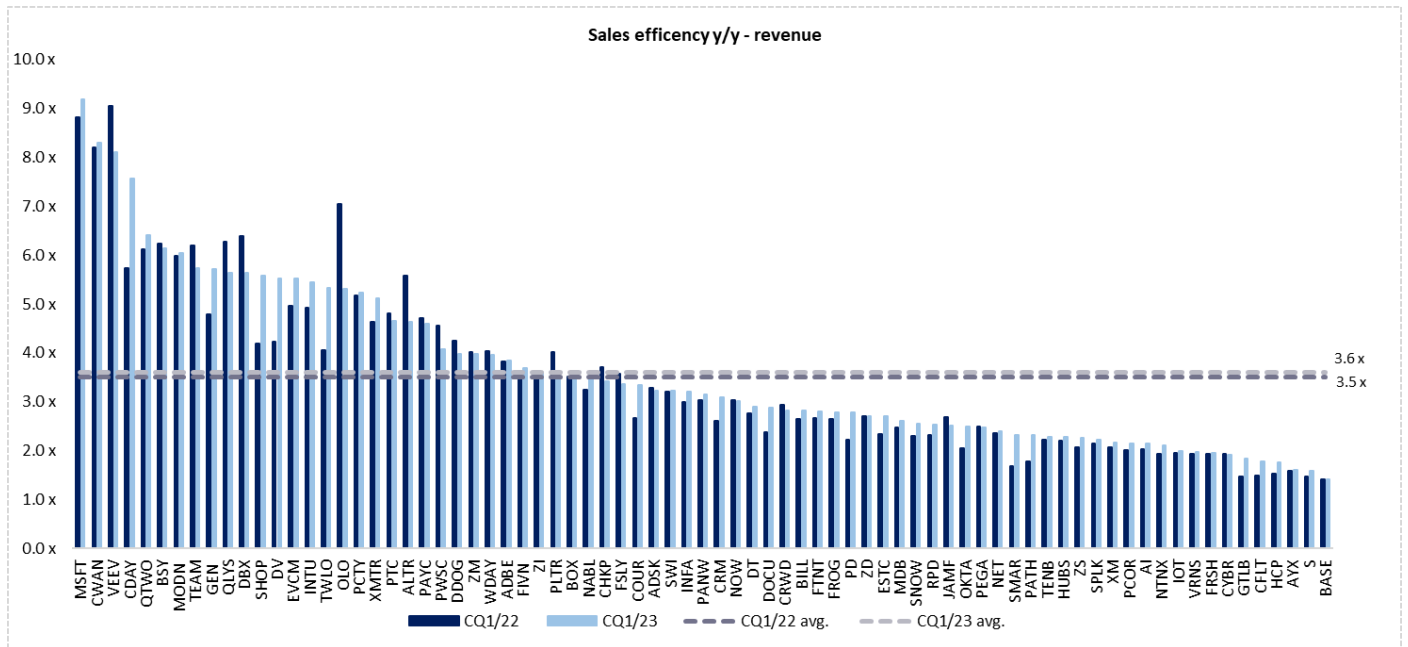
Exhibit 8 – CQ1/23 sales efficiency based on revenue growth



Source: Company reports, FactSet, RBC Capital Markets

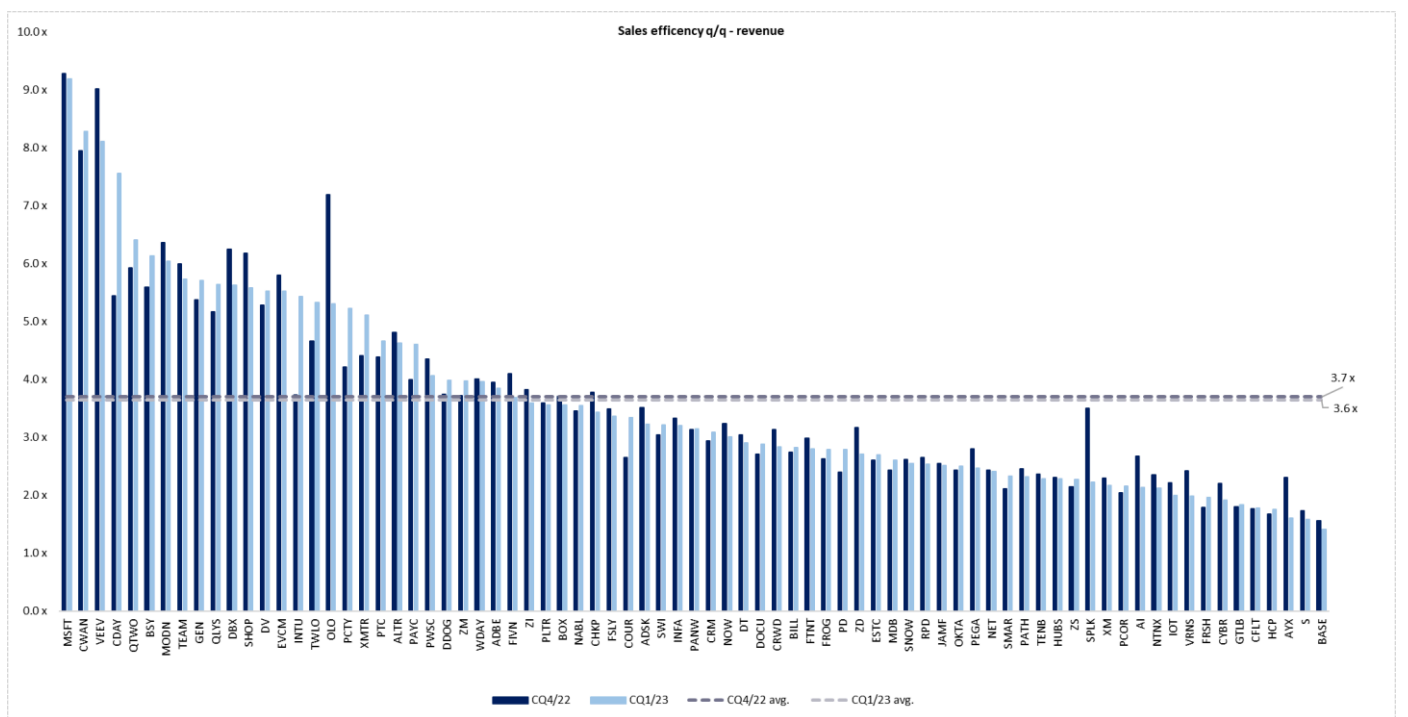


Exhibit 9 – Sales efficiency CQ1/23 and CQ1/22 – revenue



Source: Company reports, FactSet, RBC Capital Markets

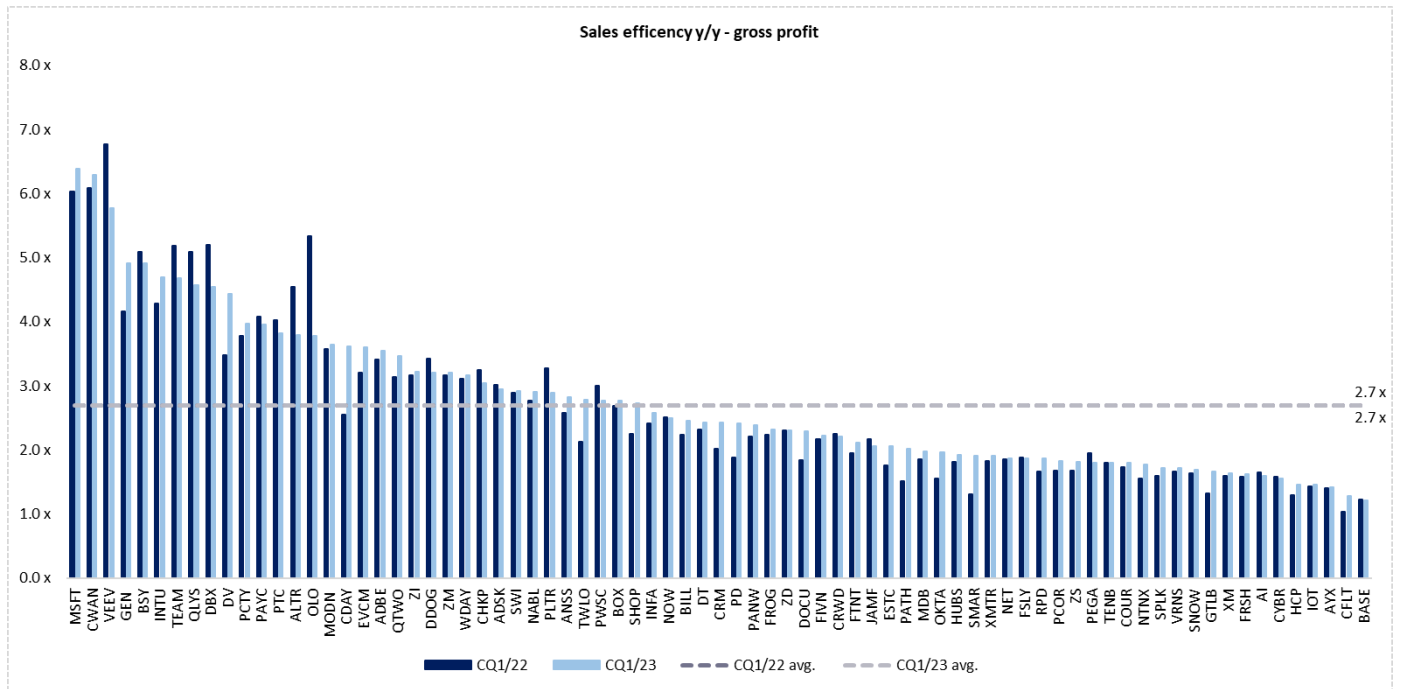
Exhibit 10 – Sales efficiency CQ1/23 and CQ4/22 – revenue



Source: Company reports, FactSet, RBC Capital Markets

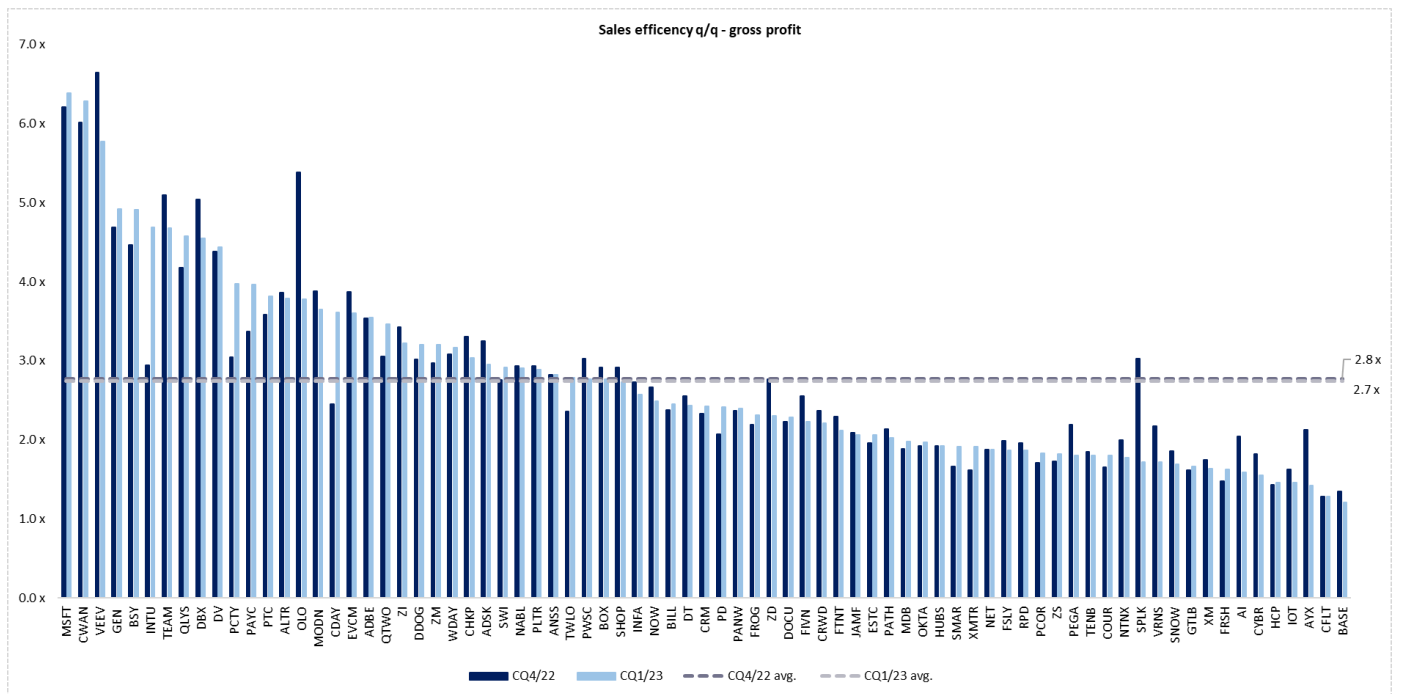


Exhibit 11 – Sales efficiency CQ1/23 and CQ1/22 – gross profit



Source: Company reports, FactSet, RBC Capital Markets

Exhibit 12 – Sales efficiency CQ1/23 and CQ4/22 – gross profit



Source: Company reports, FactSet, RBC Capital Markets



Key observations:

- Companies with the highest sales efficiency based on revenue growth (CQ1/23 revenue – CQ1/22 revenue divided by CQ1/22 S&M) are PCTY, BILL, **CWAN, OLO**, and **GEN**. The average CQ1/23 sales efficiency is 0.7x compared to 1.1x in CQ1/22.
- Companies with the highest sales efficiency based on CQ1/23 revenue are **MSFT, CWAN, VEEV**, CDAY, and **QTWO**. The average sales efficiency this quarter was 3.6x compared to 3.5x in CQ1/22.
- Companies with the highest sales efficiency based on CQ1/23 gross profit are **MSFT, CWAN, VEEV, GEN**, and **BSY**. The average sales efficiency this quarter was 2.7x, in-line with CQ1/22.
- Companies with the lowest sales efficiency based on revenue growth (CQ1/23 revenue growth – CQ1/22 revenue growth divided by prior S&M) are **PEGA, ZD**, AI, **INFA**, and **ZM**.
- Companies with the lowest sales efficiency based on CQ1/23 revenue are **BASE**, S, AYX, HCP, and CFLT.
- Companies with the lowest sales efficiency based on CQ1/23 gross profit are S, **BASE**, CFLT, AYX, and **IOT**.

Our thoughts:

- We think that sales efficiency is a good metric when thinking about the bottom-line, as investors continue to focus the right balance between growth and profitability. We'd also note we use non-GAAP S&M expenses to calculate sales efficiency. (See our *Sales Efficiency in Software* primer report, 7/21/21).
- Based on revenue growth, sales efficiency declined to 0.7x this quarter compared to 0.8x in CQ4/22 and 1.1x in CQ1/22 on average. We also looked at revenue and gross profit sales efficiency within the quarter which decreased by 1 point sequentially.
- Overall, on a sequential basis, it had trended downwards slightly from last quarter which could be due to a variety of reasons from high expenses or headwinds to top-line growth.
- As a reminder, last quarter we called out some trends which may impact SE including: 1) slower/paused travel along with virtual meetings; 2) recent efforts around cost optimization and GTM restructuring; 3) a harder time selling to customers who are leaning back or tightening budgets, resulting in deal elongation and deal scrutiny; and 4) salespeople needing to be retrained or restructured to meet the needs of the market, which could be more expensive in the near-term. (Link to our GAI note: [Software and Internet Implications of GAI and ChatGPT](#)).

Margins and SBC

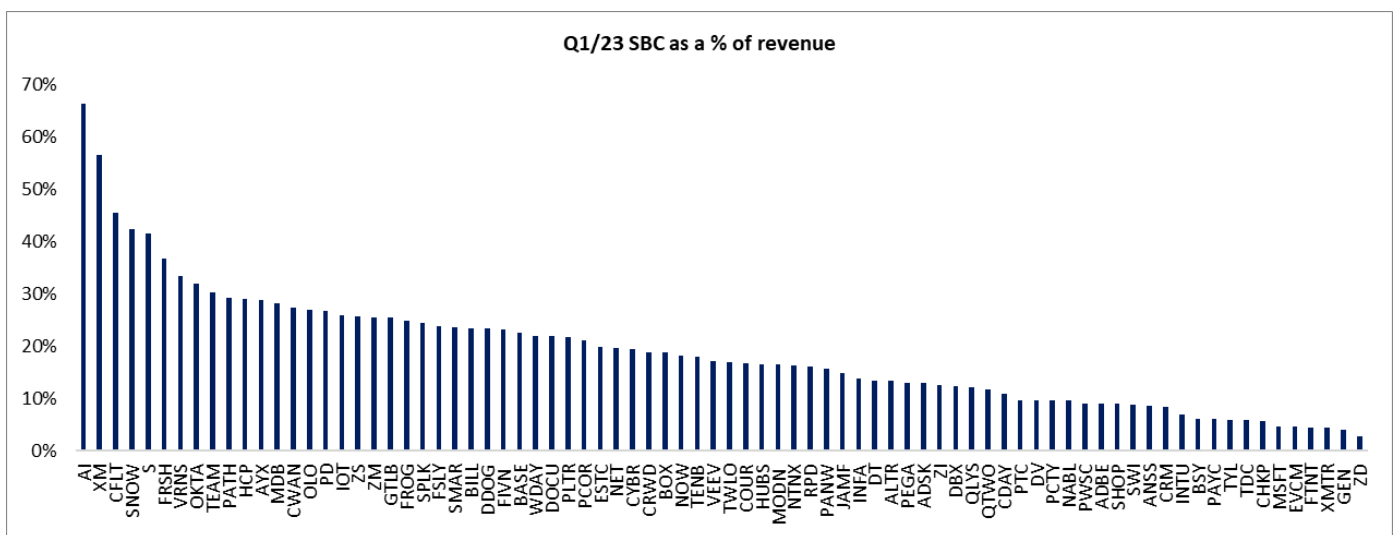
What is the metric? Instead of non-GAAP operation margin expansion, we direct focus to non-GAAP operation margin expansion including stock-based compensation (SBC) expense.

Why it is relevant? In an uneven macro environment, investors are seeking safety in high-quality, profitable software companies and pushing back on names with high levels of SBC (see our *Addressing the Stock-Based Compensation Debate* report, 8/1/22). Although we like management teams’ renewed focus on profitability, we believe excluding SBC while calculating non-GAAP margins overstates the margin expansion for many companies. Through this analysis, we identify these companies and how much of the margin expansion is driven by SBC as well as companies, which have shown SBC efficiency.

How do we measure it? We calculate non-GAAP operation margin expansion w/SBC and compare it to non-GAAP operating margin expansion ex-SBC to analyze the impact of SBC on margins q/q and y/y.

The following chart plots the SBC as a percentage of revenue for software companies.

Exhibit 13 – CQ1/23 SBC as a % of revenue



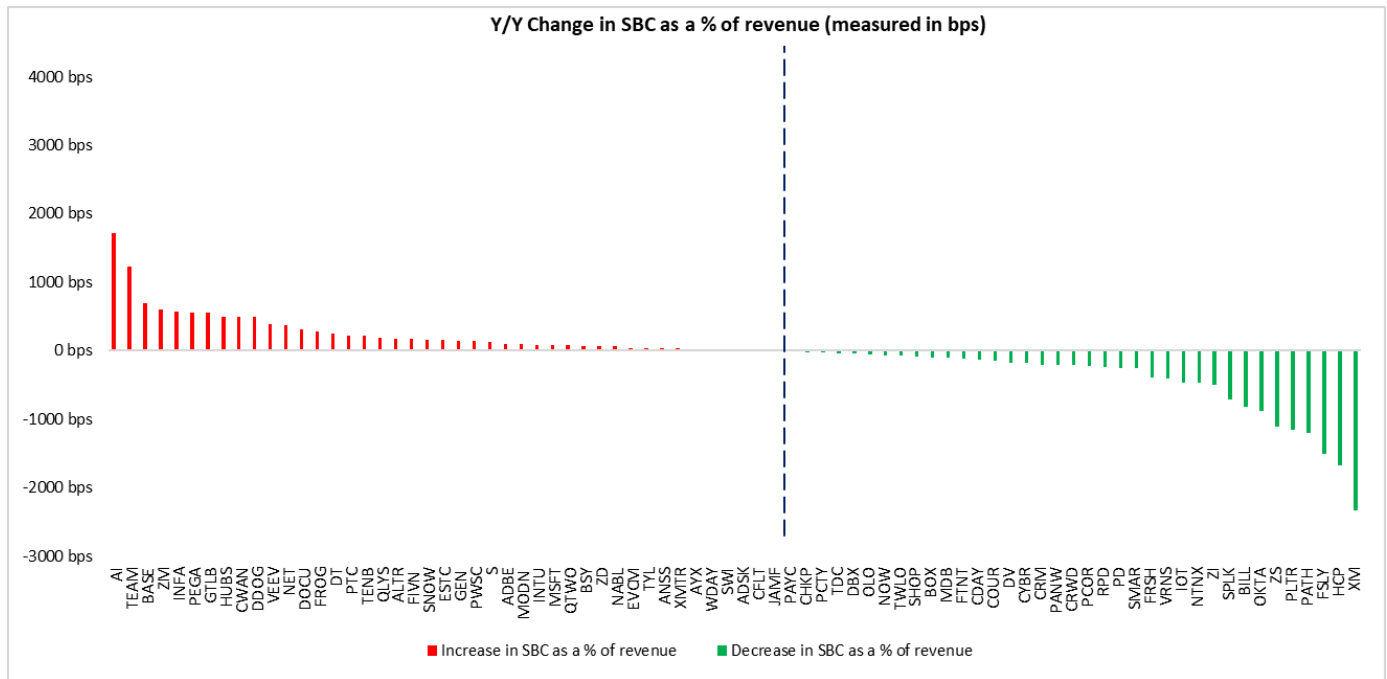
Source: Company reports, FactSet, RBC Capital Markets

Key observations:

- Companies with the highest SBC as a % of revenue in CQ1/23 were AI, XM, CFLT, SNOW and S.
- Companies with the lowest SBC as a % of revenue in CQ1/23 were ZD, GEN, XMTR, FTNT and EVCM.

The following chart plots the basis point difference between SBC as a % of revenue in CQ1/23 and SBC as a % of revenue in CQ1/22. In other words, it reflects the increase or decrease in SBC as a % of revenue from CQ1/22 to CQ1/23 in basis points.

Exhibit 14 – Y/Y change in SBC as a % of revenue (CQ1/23 vs. CQ1/22)



Source: Company reports, FactSet, RBC Capital Markets

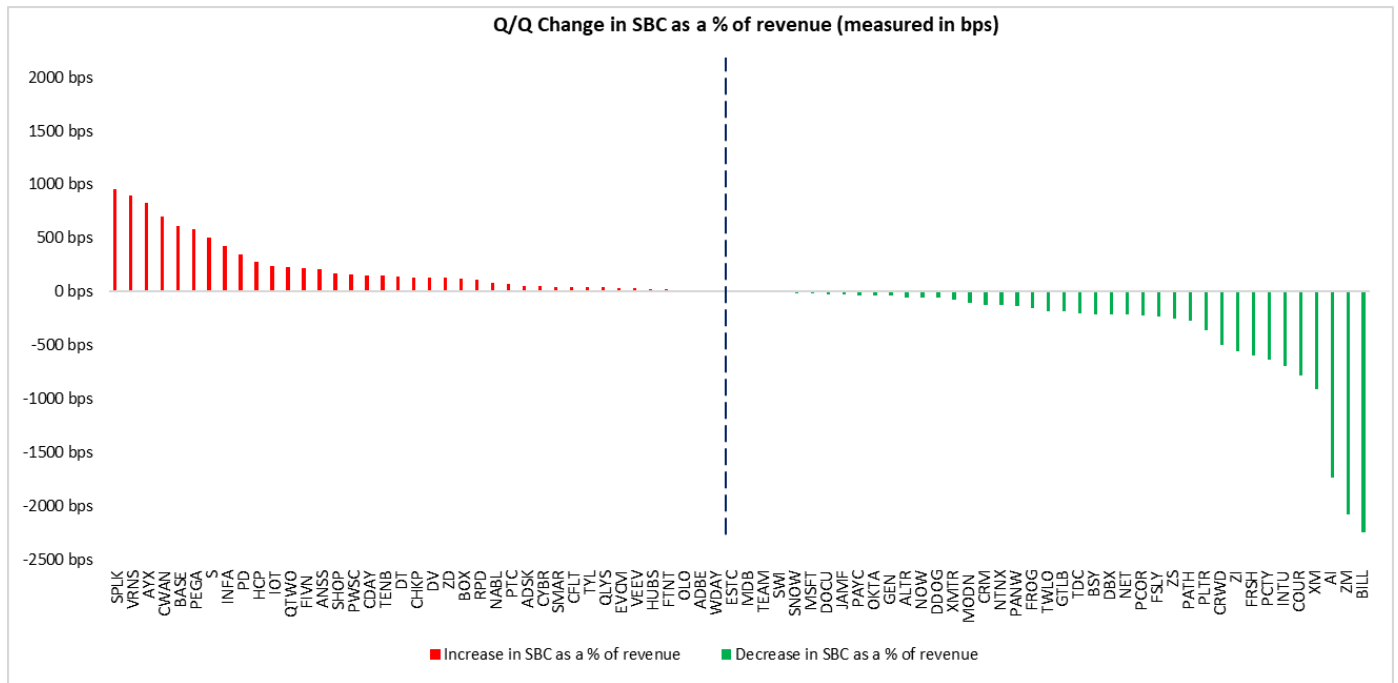
Key observations:

- Companies with the largest y/y increase (in bps) in SBC as a % of revenue were AI, TEAM, **BASE**, **ZM** and **INFA**.
- Companies with the largest y/y decrease (in bps) in SBC as a % of revenue were XM, HCP, **FSLY**, **PATH** and **PLTR**.

The following chart plots the basis point difference between SBC as a % of revenue in CQ1/23 and SBC margin as a % of revenue in CQ4/22. In other words, it reflects the increase or decrease in SBC as a % of revenue sequentially from CQ4/22 to CQ1/23 in basis points.



Exhibit 15 – Change in SBC as a % of revenue (CQ1/23 vs. CQ4/22)



Source: Company reports, FactSet, RBC Capital Markets

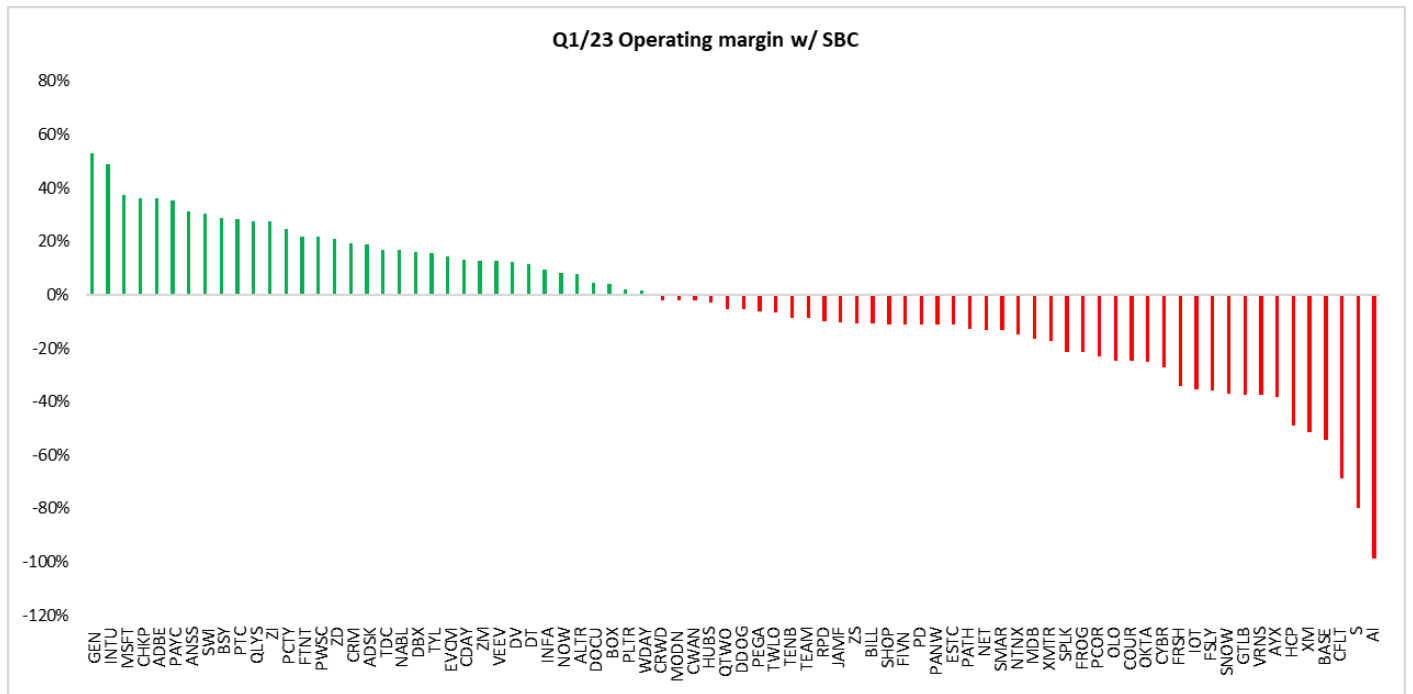
Key observations:

- Companies with the largest sequential increase (in bps) in SBC as a percentage of revenue were **SPLK**, **VRNS**, **AYX**, **CWAN** and **BASE**.
- Companies with the largest sequential decrease (in bps) in SBC as a % of revenue were **BILL**, **ZM**, **AI**, **XM** and **COUR**.

The following chart plots the SBC-adjusted non-GAAP operating margins for software companies.



Exhibit 16 – Q1/23 Non-GAAP Operating Margin w/SBC



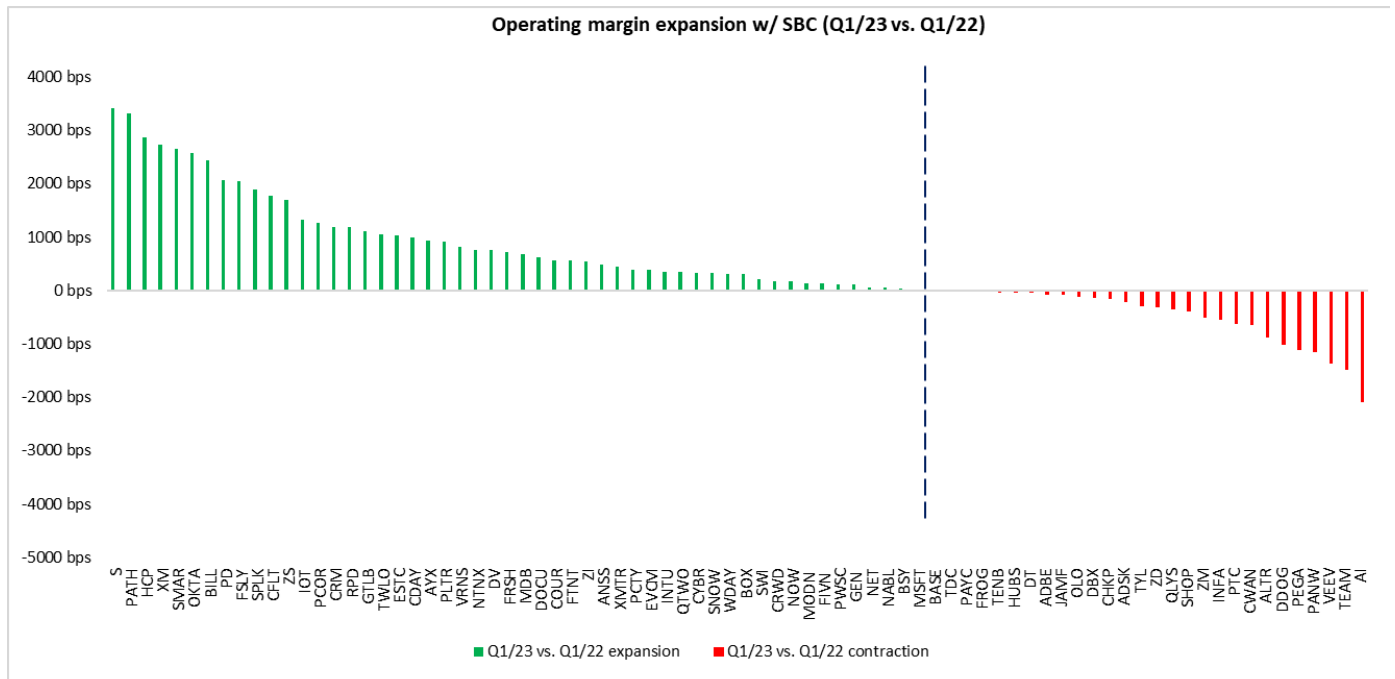
Source: Company reports, FactSet, RBC Capital Markets

Key observations:

- Companies with the highest SBC-adjusted operation margin in CQ1/23 were **GEN, INTU, MSFT, CHKP** and **ADBE**.
- Companies with the lowest SBC-adjusted operating margin in CQ1/23 were **AI, S, CFLT, BASE** and **XM**.

The following chart plots the basis point difference between non-GAAP operating margin w/ SBC in CQ1/23 and non-GAAP operating margin w/SBC in CQ1/22. In other words, it reflects the expansion or contraction in non-GAAP operating margin w/ SBC in Q1/23 vs. Q1/22 in basis points as we feel it provides a more accurate picture of margin expansion.

Exhibit 17 – Operating Margin Expansion w/ Stock-Based Compensation from CQ1/22 to CQ1/23



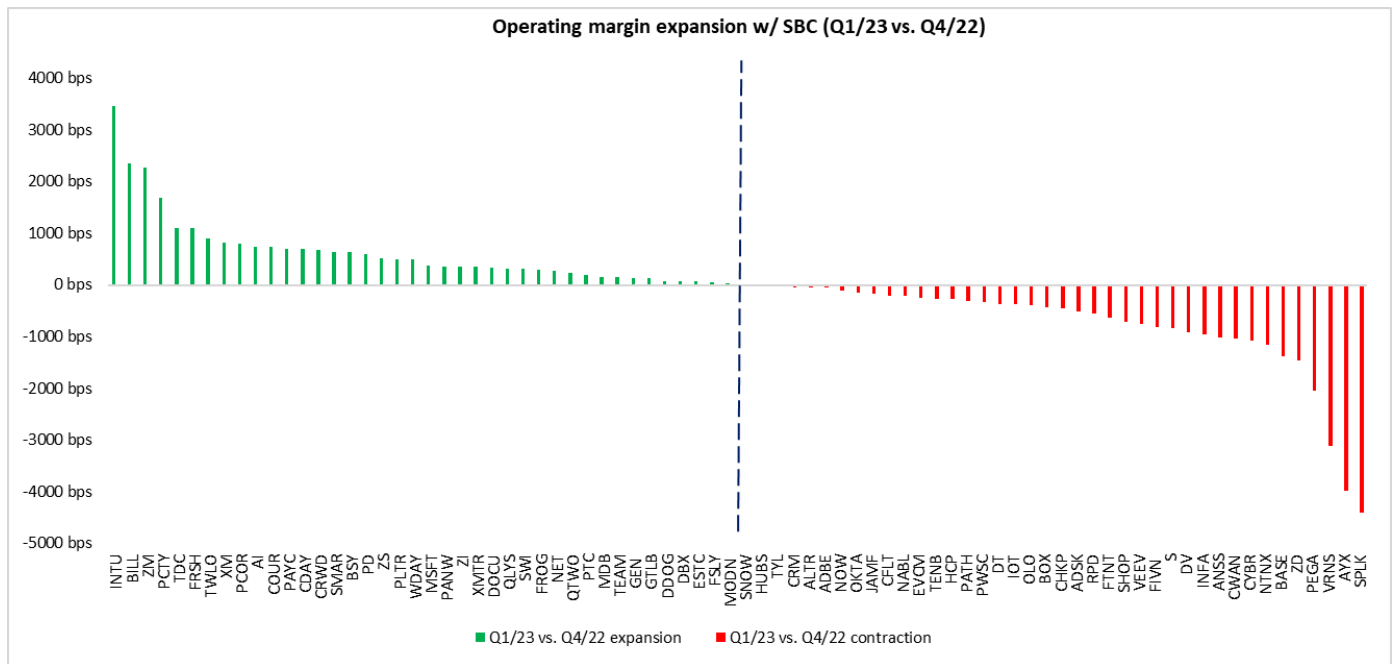
Source: Company reports, FactSet, RBC Capital Markets

Key observations:

- Companies with the largest y/y expansion (in bps) in non-GAAP operating margin w/ SBC were S, **PATH**, HCP, XM and **SMAR**.
- Companies with the largest y/y contraction (in bps) in non-GAAP operating margin w/ SBC were AI, TEAM, **VEEV**, **PANW** and **PEGA**.
- From CQ1/22 to CQ1/23, operating margin expansion w/ SBC, on average, was 471 bps, which was ~16% higher than operating margin expansion excluding SBC at 408 bps. This implies on average, software names showed SBC efficiency in CQ1/23 vs. ~22% of the operating margin expansion y/y driven by SBC in CQ4/22.

The following chart plots the basis point difference between non-GAAP operating margin w/ SBC in CQ1/23 and non-GAAP operating margin w/SBC in CQ4/22. In other words, it reflects the sequential expansion or contraction in non-GAAP operating margin w/ SBC in CQ1/23 vs. CQ4/22 in basis points as we feel it provides a more accurate picture of margin expansion.

Exhibit 18 – Operating Margin Expansion w/ Stock-Based Compensation from CQ4/22 to CQ1/23



Source: Company reports, FactSet, RBC Capital Markets

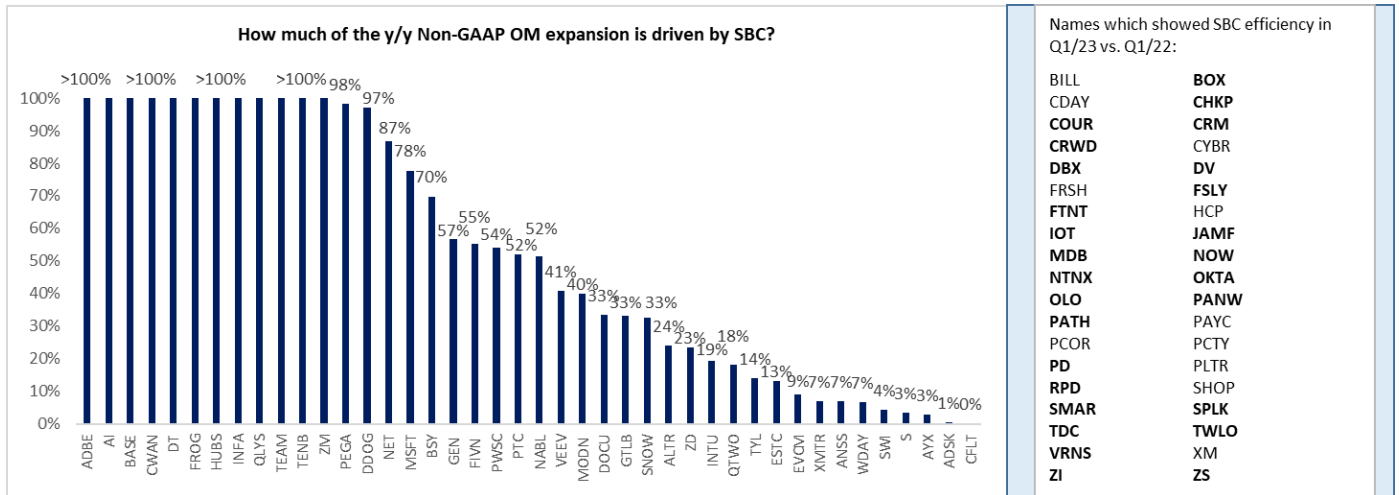
Key observations:

- Companies with the largest sequential expansion (in bps) in non-GAAP operating margin w/ SBC were INTU, BILL, **ZM**, PCTY and TDC.
- Companies with the largest sequential contraction (in bps) in non-GAAP operating margin w/ SBC were **SPLK**, AYX, **VRNS**, **PEGA** and **ZD**.
- Operating margin expansion w/ SBC q/q was 46% higher than operating margin expansion ex-SBC in CQ1/23 vs. 23% in CQ4/22, 37% in CQ3/22 and -229% in CQ2/22. We believe this is likely due to a conscious effort from management teams to reduce SBC as well as increased layoffs in the 2H/22 leading to higher operating margins.

The following chart compares y/y operating margin expansion including SBC vs. y/y operating margin expansion excluding SBC and plots what percentage of y/y operating margin expansion (ex-SBC) is driven by the exclusion of SBC. As an example, if non-GAAP operating margin expanded by 200 bps from CQ1/22 to CQ1/23 while non-GAAP operating margin expansion was only 50 bps when including SBC, the percentage of operating margin expansion contributed by SBC is 75%.

A second example, if non-GAAP operating margin expanded by 200 bps from CQ1/22 to CQ1/23 while non-GAAP operating margin expansion actually improved to 250 bps when including SBC, we see that company as exhibiting SBC efficiency.

Exhibit 19 – Company-by-company analysis of SBC as a driver for non-GAAP operating margin expansion



Source: Company reports, FactSet, RBC Capital Markets

Key observations:

- Of the 80 companies analyzed, 12 had >100% of the non-GAAP OM expansion driven by stock-based compensation, including **ADBE**, **AI**, **BASE**, **CWAN**, **DT**, **FROG**, **HUBS**, **INFA**, **QLYS**, **TEAM**, **TENB** and **ZM**.
- Of the 80 companies, 10 had greater than or equal to 50% (less than 100%) of non-GAAP operating margin expansion driven by stock based compensation, 20 had 0-50% and 38 of them for which y/y margin expansion actually improved when including SBC vs. when excluding SBC (See Exhibit 21). Names showing SBC efficiency y/y include **BOX**, **CHKP**, **COUR**, **CRM**, **CRWD**, **DBX**, **DV**, **FSLY**, **FTNT**, **IOT**, **JAMF**, **MDB**, **NOW**, **NTNX**, **OKTA**, **OLO**, **PANW**, **PATH**, **PD**, **RPD**, **SMAR**, **SPLK**, **TDC**, **TWLO**, **VRNS**, **ZI**, and **ZS** in our coverage.
- Companies including **ADBE**, **BASE**, **DT**, **HUBS**, **INFA** and **ZM** in our coverage showed positive non-GAAP operating margin expansion y/y but actually contracted margins y/y when including SBC. This reflects how excluding SBC can distort the view on margin expansion.

Our thoughts:

- As reflected above, for ~half (42 out of 80) of the companies analyzed, SBC is a key contributor to non-GAAP margin expansion and thus, it should be important to analyze SBC to get the real picture on margin expansion.
- For some companies, SBC contributes >50% to operating margin expansion; we’d like to see a concerted effort from management teams to bring down SBC and focus on the true efficiencies of the business.
- In general, given investor focus on the topic, we have seen more conscious efforts from management teams around reducing stock-based compensation, which we think is reflected in the y/y trends. A special mention to **BSY**, which has introduced adjusted OI w/SBC margin as a key guidance metric in place of adjusted EBITDA margin. Over time, we expect SBC to come down and form a smaller part of the margin expansion.



Appendix

Exhibit 20 – Deriving customer expansion/new logo mix CQ1/22

Ticker	NRR - Definition	Key metric	Calendar Q1 2022			
			Key metric growth	NRR	Customer expansion	New customer growth
ASAN	Dollar-based net retention rate	Revenue	57%	120%+	20%	37%
BOX	Net Retention Rate	Implied ARR	18%	111%	11%	7%
CFLT	Dollar-Based Net Retention Rate	Implied ARR	64%	130%+	30%	34%
COUR	Net Retention Rate for Paid Enterprise Customers	Implied ARR	36%	109%	9%	27%
CRWD	Dollar-Based Net Retention Rate	ARR	61%	120%+	20%	41%
CWAN	Net Revenue Retention Rate	ARR	24%	107%	7%	17%
DDOG	Dollar-Based Net Retention Rate	Implied ARR	83%	130%+	30%	53%
DOCU	Dollar-Based Net Retention Rate	Implied ARR	25%	114%	14%	11%
GTLB	Dollar-Based Net Retention Rate	Implied ARR	75%	130%+	30%	45%
HCP	Net Dollar Retention Rate	Implied ARR	51%	133%	33%	18%
HUBS	Subscription Dollar Net Revenue Retention Rate	Subscription revenue	42%	110%+	10%	32%
IOT	Dollar-Based Net Retention Rate	ARR	59%	115%+	15%	44%
NET	Dollar-Based Net Retention Rate	Implied ARR	54%	127%	27%	27%
OKTA	Dollar-Based Net Retention Rate	Implied ARR	39%	123%	23%	16%
PD	Dollar-Based Net Retention Rate	Implied ARR	34%	121%	21%	13%
QLYS	Net Dollar Expansion Rate	Implied ARR	17%	110%	10%	7%
S	Dollar-Based Net Retention Rate	ARR	110%	131%	31%	79%
TWLO	Dollar-Based Net Expansion Rate	Revenue	35%	127%	27%	8%
ZI	Net Annual Retention Rate	Implied ARR	49%	116%	NA	NA
ZM	Net Dollar Expansion Rate, Enterprise	Implied Enterprise ARR	30%	123%	23%	7%
ZS	Dollar-Based Net Retention Rate	Implied ARR	63%	125%+	25%	38%

Source: Company reports, FactSet, RBC Capital Markets

Exhibit 21 – Deriving customer expansion/new logo mix CQ4/22

Ticker	NRR - Definition	Key metric	Calendar Q4 2022			
			Key metric growth	NRR	Customer expansion	New customer growth
ASAN	Dollar-based net retention rate	Revenue	34%	115%+	15%	19%
BOX	Net Retention Rate	Implied ARR	10%	108%	8%	2%
CFLT	Dollar-Based Net Retention Rate	Implied ARR	41%	just under 130%	30%	11%
COUR	Net Retention Rate for Paid Enterprise Customers	Implied ARR	24%	108%	8%	16%
CRWD	Dollar-Based Net Retention Rate	ARR	48%	125%	25%	23%
CWAN	Net Revenue Retention Rate	ARR	14%	106%	6%	8%
DDOG	Dollar-Based Net Retention Rate	Implied ARR	44%	130%+	30%	14%
DOCU	Dollar-Based Net Retention Rate	Implied ARR	13%	107%	7%	6%
GTLB	Dollar-Based Net Retention Rate	Implied ARR	58%	133%	33%	25%
HCP	Net Dollar Retention Rate	Implied ARR	41%	131%	31%	10%
HUBS	Subscription Dollar Net Revenue Retention Rate	Subscription revenue	28%	107%	7%	21%
IOT	Dollar-Based Net Retention Rate	ARR	43%	115%+	15%	28%
NET	Dollar-Based Net Retention Rate	Implied ARR	42%	122%	22%	20%
OKTA	Dollar-Based Net Retention Rate	Implied ARR	33%	120%	20%	13%
PD	Dollar-Based Net Retention Rate	Implied ARR	29%	120%	20%	9%
QLYS	Net Dollar Expansion Rate	Implied ARR	19%	109% cc	9%	10%
S	Dollar-Based Net Retention Rate	ARR	88%	130%	30%	58%
TWLO	Dollar-Based Net Expansion Rate	Revenue	21%	110%	10%	11%
ZI	Net Annual Retention Rate	Implied ARR	34%	104%	4%	30%
ZM	Net Dollar Expansion Rate, Enterprise	Implied Enterprise ARR	18%	115%	15%	3%
ZS	Dollar-Based Net Retention Rate	Implied ARR	52%	125%+	25%	27%

Source: Company reports, FactSet, RBC Capital Markets



Exhibit 22 – Deriving customer expansion/new logo mix Q1/23

Ticker	NRR - Definition	Key metric	Key metric growth	Calendar Q1 2023		
				NRR	Customer expansion	New customer growth
ASAN	Dollar-based net retention rate	Revenue	26%	110%+	10%	16%
BOX	Net Retention Rate	Implied ARR	6%	106%	6%	0%
CFLT	Dollar-Based Net Retention Rate	Implied ARR	38%	130%+	30%	8%
COUR	Net Retention Rate for Paid Enterprise Customers	Implied ARR	23%	104%	4%	19%
CRWD	Dollar-Based Net Retention Rate	ARR	42%	120%+	20%	22%
CWAN	Net Revenue Retention Rate	ARR	18%	106%	6%	12%
DDOG	Dollar-Based Net Retention Rate	Implied ARR	33%	130%+	30%	3%
DOCU	Dollar-Based Net Retention Rate	Implied ARR	12%	105%	5%	7%
GTLB	Dollar-Based Net Retention Rate	Implied ARR	45%	128%	28%	17%
HCP	Net Dollar Retention Rate	Implied ARR	37%	127%	27%	10%
HUBS	Subscription Dollar Net Revenue Retention Rate	Subscription revenue	27%	104%	4%	23%
IOT	Dollar-Based Net Retention Rate	ARR	41%	115%+	15%	26%
NET	Dollar-Based Net Retention Rate	Implied ARR	37%	117%	17%	20%
OKTA	Dollar-Based Net Retention Rate	Implied ARR	25%	117%	17%	8%
PD	Dollar-Based Net Retention Rate	Implied ARR	21%	116%	16%	5%
QLYS	Net Dollar Expansion Rate	Implied ARR	15%	109% cc	9%	6%
S	Dollar-Based Net Retention Rate	ARR	75%	125%+	25%	50%
TWLO	Dollar-Based Net Expansion Rate	Revenue	15%	106%	6%	9%
ZI	Net Annual Retention Rate	Implied ARR	23%	104%	NA	NA
ZM	Net Dollar Expansion Rate, Enterprise	Implied Enterprise ARR	13%	112%	12%	1%
ZS	Dollar-Based Net Retention Rate	Implied ARR	46%	125%+	25%	21%

Source: Company reports, FactSet, RBC Capital Markets

Exhibit 23 – Growth from Customer Expansions vs. New Logos

Ticker	Calendar Q1 2022		Calendar Q4 2022		Calendar Q1 2023	
	Customer expansion	New customers	Customer expansion	New customers	Customer expansion	New customers
ASAN	20%	37%	15%	19%	10%	16%
BOX	11%	7%	8%	2%	6%	0%
CFLT	30%+	34%	30%+	11%	30%	8%
COUR	9%	27%	8%	16%	4%	19%
CRWD	20%	41%	25%	23%	20%	22%
CWAN	7%	17%	6%	8%	6%	12%
DDOG	30%+	53%	30%+	14%	30%+	3%
DOCU	14%	11%	7%	6%	5%	7%
GTLB	30%+	45%	33%+	25%	28%	17%
HCP	33%	18%	31%	10%	27%	10%
HUBS	10%+	32%	7%	21%	4%	23%
IOT	15%+	44%	15%+	28%	15%+	26%
NET	27%	27%	22%	20%	17%	20%
OKTA	23%	16%	20%	13%	17%	8%
PD	21%	13%	20%	9%	16%	5%
QLYS	10%	7%	9%	10%	9%	6%
S	31%	79%	30%	58%	25%	50%
TWLO	27%	8%	10%	11%	6%	9%
ZI	NA	NA	4%	30%	NA	NA
ZM	23%	7%	15%	3%	12%	1%
ZS	25%+	38%	25%+	27%	25%+	21%
Average	21%	28%	18%	17%	16%	14%

Source: Company reports, FactSet, RBC Capital Markets



Exhibit 24 – Employee productivity

Ticker	Revenue (M)		Gross Profit		Employee headcount		Revenue per employee (K)		GP per employee (K)	
	CY/21	CY/22	CY/21	CY/22	CY/21	CY/22	CY/21	CY/22	CY/21	CY/22
ADBE	15785	17606	14170	15768	25988	29239	\$ 607	\$ 602	\$ 545	\$ 539
ADSK	4386	5005	4054	4624	12600	13700	\$ 348	\$ 365	\$ 322	\$ 338
ALTR	532	572	408	458	2800	3000	\$ 190	\$ 191	\$ 146	\$ 153
ANSS	1931	2073	1748	1902	5100	5,600	\$ 379	\$ 370	\$ 343	\$ 340
AYX	536	855	492	768	2000	2900	\$ 268	\$ 295	\$ 246	\$ 265
BASE	124	155	109	136	562	646	\$ 220	\$ 240	\$ 194	\$ 210
BOX	874	991	650	762	2172	2487	\$ 403	\$ 398	\$ 299	\$ 306
CDAY	1024	1246	426	555	7462	8526	\$ 137	\$ 146	\$ 57	\$ 65
CFLT	388	586	270	417	1981	2761	\$ 196	\$ 212	\$ 136	\$ 151
COUR	415	524	252	335	1138	1401	\$ 365	\$ 374	\$ 221	\$ 239
CRM	26492	31352	20749	24526	73541	79390	\$ 360	\$ 395	\$ 282	\$ 309
CRWD	1452	2241	1111	1702	6965	7273	\$ 208	\$ 308	\$ 160	\$ 234
CWAN	252	303	191	228	1371	1728	\$ 184	\$ 176	\$ 139	\$ 132
CYBR	503	592	426	487	2100	2750	\$ 239	\$ 215	\$ 203	\$ 177
DBX	2158	2325	1714	1881	2667	3118	\$ 809	\$ 746	\$ 643	\$ 603
DDOG	1029	1675	803	1346	1500	2300	\$ 686	\$ 728	\$ 535	\$ 585
DOCU	2107	2516	1718	2065	7461	7336	\$ 282	\$ 343	\$ 230	\$ 282
DV	333	452	278	375	800	902	\$ 416	\$ 502	\$ 348	\$ 415
ESTC	608	862	469	657	2888	2966	\$ 211	\$ 291	\$ 162	\$ 221
EVCN	490	621	328	403	2200	2300	\$ 223	\$ 270	\$ 149	\$ 175
FINV	610	779	387	477	2138	2380	\$ 285	\$ 327	\$ 181	\$ 200
FROG	207	280	174	235	1000	1300	\$ 207	\$ 215	\$ 174	\$ 181
FRSH	371	498	303	410	4600	5400	\$ 81	\$ 92	\$ 66	\$ 76
FSLY	354	433	204	232	976	1112	\$ 363	\$ 389	\$ 210	\$ 208
FTNT	3342	4417	2559	3333	10195	12595	\$ 328	\$ 351	\$ 251	\$ 265
GTLB	253	424	224	380	1630	2170	\$ 155	\$ 196	\$ 138	\$ 175
HCP	321	476	272	404	1850	2400	\$ 173	\$ 198	\$ 147	\$ 168
HUBS	1301	1731	1052	1431	5895	7433	\$ 221	\$ 233	\$ 179	\$ 193
INFA	1444	1505	1191	1218	5500	6000	\$ 263	\$ 251	\$ 217	\$ 203
IOT	428	653	310	479	1616	2266	\$ 265	\$ 288	\$ 192	\$ 212
JAMF	366	479	297	390	2212	2796	\$ 166	\$ 171	\$ 134	\$ 139
MDB	874	1284	637	966	3544	4619	\$ 247	\$ 278	\$ 180	\$ 209
MSFT	168088	198270	115856	135620	201000	228300	\$ 836	\$ 868	\$ 576	\$ 594
NABL	347	372	301	317	1330	1400	\$ 261	\$ 266	\$ 226	\$ 226
NET	656	975	516	763	2439	3217	\$ 269	\$ 303	\$ 212	\$ 237
NOW	5896	7245	4793	5970	16881	20433	\$ 349	\$ 355	\$ 284	\$ 292
NTNX	1394	1581	1148	1260	6264	6480	\$ 223	\$ 244	\$ 183	\$ 194
OKTA	1300	1858	1002	1442	5030	6013	\$ 258	\$ 309	\$ 199	\$ 240
OLO	149	185	122	138	639	712	\$ 234	\$ 260	\$ 191	\$ 194
PANW	4256	5502	3201	4049	11527	13932	\$ 369	\$ 395	\$ 278	\$ 291
PATH	892	1059	775	908	4013	3833	\$ 222	\$ 276	\$ 193	\$ 237
PAYC	1056	1375	898	1167	5381	6349	\$ 196	\$ 217	\$ 167	\$ 184
PCOR	515	720	433	602	2885	3568	\$ 178	\$ 202	\$ 150	\$ 169
PCTY	636	853	448	606	4724	5876	\$ 135	\$ 145	\$ 95	\$ 103
PD	281	371	238	315	948	1166	\$ 297	\$ 318	\$ 251	\$ 270
PEGA	1212	1318	900	976	6133	6145	\$ 198	\$ 214	\$ 147	\$ 159
PLTR	1542	1906	1271	1541	2920	3838	\$ 528	\$ 497	\$ 435	\$ 402
PTC	1807	1933	1485	1596	6626	6503	\$ 273	\$ 297	\$ 224	\$ 245
PWSC	559	631	376	429	3099	3232	\$ 180	\$ 195	\$ 121	\$ 133
QLYS	411	490	332	398	1823	2143	\$ 226	\$ 229	\$ 182	\$ 186
QTSO	501	566	260	292	2028	2249	\$ 247	\$ 252	\$ 128	\$ 130
RPD	535	685	388	500	2353	2623	\$ 228	\$ 261	\$ 165	\$ 190
S	205	422	123	305	1200	2100	\$ 171	\$ 201	\$ 103	\$ 145
SHOP	4612	5600	2509	2812	10000	11600	\$ 461	\$ 483	\$ 251	\$ 242
SMAR	551	767	434	602	2539	3191	\$ 217	\$ 240	\$ 171	\$ 189
SNOW	1219	2066	855	1467	3992	5884	\$ 305	\$ 351	\$ 214	\$ 249
SPLK	2674	3654	2065	2974	7000	8000	\$ 382	\$ 457	\$ 295	\$ 372
SWI	719	719	656	654	2147	2305	\$ 335	\$ 312	\$ 306	\$ 284
TDC	1917	1795	1215	1105	7200	7000	\$ 266	\$ 256	\$ 169	\$ 158
TENB	541	683	446	548	1617	1900	\$ 335	\$ 360	\$ 276	\$ 288
TWLO	2842	3826	1520	1958	7867	8156	\$ 361	\$ 469	\$ 193	\$ 240
TYL	1595	1850	782	864	6800	7200	\$ 235	\$ 257	\$ 115	\$ 120
VEEV	1851	2155	1393	1607	4506	5482	\$ 411	\$ 393	\$ 309	\$ 293
VRNS	390	474	342	417	2065	2143	\$ 189	\$ 221	\$ 166	\$ 194
WDAY	5139	6216	3976	4783	15200	17700	\$ 338	\$ 351	\$ 262	\$ 270
XMTR	218	381	57	148	788	914	\$ 277	\$ 417	\$ 73	\$ 161
ZD	1417	1391	1200	1197	4900	4400	\$ 289	\$ 316	\$ 245	\$ 272
ZI	747	1098	666	980	2742	3540	\$ 273	\$ 310	\$ 243	\$ 277
ZM	4100	4393	3122	3480	6787	8484	\$ 604	\$ 518	\$ 460	\$ 410
Average							\$ 299	\$ 321	\$ 227	\$ 244

Source: Company reports, FactSet, RBC Capital Markets



Exhibit 25 – Sales Efficiency, calendar quarters – revenue

Ticker	Sales efficiency based on growth					Sales Efficiency based current quarter				
	Q1/22	Q2/22	Q3/22	Q4/22	Q1/23	Q1/22	Q2/22	Q3/22	Q4/22	Q1/23
ADBE	0.6 x	0.5 x	0.4 x	0.4 x	0.4 x	3.8 x	3.8 x	3.8 x	3.9 x	3.8 x
ADSK	0.6 x	0.5 x	0.4 x	0.3 x	0.3 x	3.3 x	3.4 x	3.3 x	3.5 x	3.2 x
AI	0.7 x	0.4 x	0.1 x	-0.1 x	0.0 x	2.0 x	2.5 x	2.4 x	2.7 x	2.1 x
ALTR	0.3 x	0.5 x	-0.1 x	0.6 x	0.2 x	5.6 x	4.2 x	3.8 x	4.8 x	4.6 x
AYX	0.6 x	0.9 x	1.3 x	1.5 x	0.4 x	1.6 x	1.6 x	1.9 x	2.3 x	1.6 x
BASE	0.3 x	0.5 x	0.4 x	0.3 x	0.2 x	1.4 x	1.6 x	1.5 x	1.6 x	1.4 x
BILL	8.1 x	5.5 x	2.5 x	1.8 x	1.7 x	2.6 x	2.5 x	2.6 x	2.7 x	2.8 x
BOX	0.6 x	0.5 x	0.4 x	0.4 x	0.2 x	3.5 x	3.6 x	3.7 x	3.7 x	3.6 x
BSY	1.7 x	1.2 x	0.4 x	0.4 x	0.9 x	6.2 x	5.9 x	6.0 x	5.6 x	6.1 x
CDAY	1.4 x	1.0 x	1.1 x	0.9 x	1.5 x	5.7 x	5.4 x	5.8 x	5.4 x	7.6 x
CFLT	0.9 x	0.8 x	0.7 x	0.6 x	0.6 x	1.5 x	1.6 x	1.7 x	1.8 x	1.8 x
CHKP	0.3 x	0.3 x	0.3 x	0.3 x	0.2 x	3.7 x	3.6 x	3.8 x	3.8 x	3.4 x
COUR	1.0 x	0.7 x	0.7 x	0.5 x	0.6 x	2.7 x	2.6 x	2.7 x	2.6 x	3.3 x
CRM	0.7 x	0.6 x	0.4 x	0.4 x	0.3 x	2.6 x	2.7 x	2.8 x	2.9 x	3.1 x
CRWD	1.6 x	1.5 x	1.4 x	1.5 x	1.2 x	2.9 x	2.9 x	2.9 x	3.1 x	2.8 x
CWAN	NA	NA	1.4 x	1.3 x	1.6 x	8.2 x	7.5 x	7.5 x	8.0 x	8.3 x
CYBR	0.3 x	0.4 x	0.5 x	0.3 x	0.5 x	1.9 x	1.9 x	2.0 x	2.2 x	1.9 x
DBX	0.6 x	0.5 x	0.4 x	0.3 x	0.6 x	6.4 x	6.0 x	6.2 x	6.3 x	5.6 x
DDOG	2.9 x	2.8 x	2.6 x	1.9 x	1.4 x	4.3 x	4.2 x	4.1 x	3.7 x	4.0 x
DOCU	0.5 x	0.4 x	0.4 x	0.3 x	0.3 x	2.4 x	1.9 x	2.6 x	2.7 x	2.9 x
DT	0.8 x	0.8 x	0.7 x	0.7 x	0.7 x	2.8 x	2.8 x	3.1 x	3.0 x	2.9 x
DV	2.0 x	1.9 x	1.6 x	1.4 x	1.1 x	4.2 x	5.0 x	4.9 x	5.3 x	5.5 x
ESTC	0.9 x	0.8 x	0.7 x	0.6 x	0.4 x	2.3 x	2.3 x	2.4 x	2.6 x	2.7 x
EVCM	2.0 x	1.6 x	1.2 x	1.0 x	0.6 x	5.0 x	5.5 x	5.6 x	5.8 x	5.5 x
FIVN	1.2 x	1.2 x	1.1 x	0.8 x	0.7 x	3.6 x	3.9 x	3.8 x	4.1 x	3.7 x
FROG	1.1 x	1.0 x	0.9 x	0.7 x	0.7 x	2.6 x	2.5 x	2.8 x	2.6 x	2.8 x
FRSH	NA	NA	0.6 x	0.5 x	0.4 x	1.9 x	1.6 x	1.9 x	1.8 x	2.0 x
FSLY	0.6 x	0.6 x	0.8 x	0.8 x	0.5 x	3.6 x	3.0 x	3.3 x	3.5 x	3.4 x
FTNT	0.9 x	0.8 x	0.9 x	0.9 x	0.9 x	2.7 x	2.7 x	2.9 x	3.0 x	2.8 x
GEN	0.3 x	0.1 x	0.4 x	1.5 x	1.5 x	4.8 x	4.7 x	4.7 x	5.4 x	5.7 x
GTLB	NA	NA	1.0 x	0.9 x	0.7 x	1.5 x	1.5 x	1.7 x	1.8 x	1.8 x
HCP	NA	NA	0.8 x	0.6 x	0.6 x	1.5 x	1.6 x	1.6 x	1.7 x	1.8 x
HUBS	0.9 x	0.8 x	0.7 x	0.6 x	0.6 x	2.2 x	2.2 x	2.3 x	2.3 x	2.3 x
INFA	NA	NA	0.1 x	-0.1 x	0.0 x	3.0 x	2.8 x	3.1 x	3.3 x	3.2 x
INTU	1.8 x	-0.2 x	1.2 x	0.4 x	0.3 x	4.9 x	3.3 x	3.8 x	3.7 x	5.4 x
IOT	NA	NA	1.0 x	1.0 x	0.8 x	2.0 x	2.0 x	2.1 x	2.2 x	2.0 x
JAMF	1.0 x	0.9 x	0.8 x	0.7 x	0.6 x	2.7 x	2.6 x	2.7 x	2.5 x	2.5 x
MDB	1.3 x	1.2 x	1.1 x	0.8 x	0.7 x	2.5 x	2.1 x	2.4 x	2.4 x	2.6 x
MODN	0.6 x	0.7 x	0.8 x	0.9 x	1.0 x	6.0 x	6.8 x	6.4 x	6.4 x	6.0 x
MSFT	1.5 x	1.0 x	1.1 x	0.2 x	0.6 x	8.8 x	8.2 x	9.8 x	9.3 x	9.2 x
NABL	0.3 x	0.3 x	0.2 x	0.2 x	0.4 x	3.2 x	3.2 x	3.4 x	3.5 x	3.5 x
NET	1.2 x	1.2 x	1.1 x	0.9 x	0.9 x	2.4 x	2.3 x	2.5 x	2.4 x	2.4 x
NOW	0.8 x	0.7 x	0.7 x	0.6 x	0.7 x	3.0 x	2.9 x	3.2 x	3.2 x	3.0 x
NTNX	0.3 x	0.0 x	0.3 x	0.3 x	0.2 x	1.9 x	1.8 x	2.1 x	2.4 x	2.1 x
OKTA	1.3 x	0.9 x	0.8 x	0.7 x	0.5 x	2.1 x	2.1 x	2.0 x	2.4 x	2.5 x
OLO	1.9 x	3.1 x	2.3 x	2.1 x	1.6 x	7.0 x	6.4 x	7.8 x	7.2 x	5.3 x
PANW	0.8 x	0.8 x	0.7 x	0.8 x	0.7 x	3.0 x	3.2 x	3.0 x	3.1 x	3.1 x
PATH	0.7 x	0.5 x	0.4 x	0.1 x	0.3 x	1.8 x	1.8 x	2.1 x	2.5 x	2.3 x
PAYC	1.3 x	1.2 x	1.2 x	1.1 x	1.3 x	4.7 x	3.6 x	3.7 x	4.0 x	4.6 x
PCOR	0.9 x	0.9 x	0.9 x	0.8 x	0.7 x	2.0 x	2.0 x	2.1 x	2.0 x	2.2 x
PCTY	1.7 x	1.5 x	1.6 x	1.7 x	2.0 x	5.2 x	4.3 x	4.2 x	4.2 x	5.2 x
PD	0.7 x	0.6 x	0.6 x	0.6 x	0.5 x	2.2 x	2.2 x	2.5 x	2.4 x	2.8 x
PEGA	0.5 x	-0.4 x	0.1 x	0.5 x	-0.3 x	2.5 x	1.9 x	1.9 x	2.8 x	2.5 x
PLTR	1.4 x	1.1 x	1.0 x	0.8 x	0.7 x	4.0 x	4.0 x	3.6 x	3.6 x	3.6 x
PTC	0.4 x	0.2 x	0.2 x	0.1 x	0.4 x	4.8 x	4.2 x	4.7 x	4.4 x	4.7 x
PWSC	NA	0.4 x	0.3 x	0.4 x	0.3 x	4.5 x	4.3 x	4.4 x	4.4 x	4.1 x
QLYS	1.0 x	1.2 x	1.2 x	1.0 x	1.0 x	6.3 x	5.6 x	5.6 x	5.2 x	5.6 x
QTWO	1.0 x	0.9 x	0.9 x	0.7 x	0.9 x	6.1 x	6.3 x	6.1 x	5.9 x	6.4 x
RPD	0.8 x	0.8 x	0.6 x	0.5 x	0.4 x	2.3 x	2.4 x	2.6 x	2.7 x	2.5 x
S	1.2 x	1.5 x	1.6 x	1.7 x	1.0 x	1.5 x	1.5 x	1.7 x	1.7 x	1.6 x
SHOP	1.2 x	0.9 x	1.1 x	1.4 x	1.1 x	4.2 x	4.2 x	5.0 x	6.2 x	5.6 x
SMAR	0.8 x	0.8 x	0.8 x	0.6 x	0.5 x	1.7 x	1.8 x	1.9 x	2.1 x	2.3 x
SNOW	1.7 x	1.8 x	1.6 x	1.3 x	1.1 x	2.3 x	2.4 x	2.7 x	2.6 x	2.5 x
SPLK	0.6 x	0.6 x	0.8 x	1.0 x	0.2 x	2.1 x	2.3 x	2.8 x	3.5 x	3.2 x
SWI	-1.1 x	-1.1 x	0.0 x	0.0 x	0.2 x	3.2 x	3.0 x	3.0 x	3.0 x	2.2 x
TEAM	2.2 x	1.8 x	2.3 x	1.9 x	1.5 x	6.2 x	5.0 x	6.0 x	6.0 x	5.7 x
TENB	0.7 x	0.6 x	0.6 x	0.5 x	0.4 x	2.2 x	2.2 x	2.3 x	2.4 x	2.3 x
TWLO	2.0 x	1.6 x	1.3 x	0.8 x	0.6 x	4.1 x	4.0 x	4.0 x	4.7 x	5.3 x
VEEV	1.4 x	1.5 x	1.4 x	1.3 x	0.4 x	9.1 x	8.6 x	8.3 x	9.0 x	8.1 x
VRNS	0.5 x	0.5 x	0.5 x	0.3 x	0.2 x	1.9 x	2.0 x	2.2 x	2.4 x	2.0 x
WDAY	1.0 x	0.9 x	0.9 x	0.8 x	0.7 x	4.0 x	3.9 x	4.0 x	4.0 x	4.0 x
XM	0.9 x	0.9 x	0.8 x	0.5 x	0.5 x	2.1 x	2.2 x	2.3 x	2.3 x	2.2 x
XMTR	5.3 x	5.3 x	4.9 x	2.5 x	1.2 x	4.6 x	5.7 x	5.1 x	4.4 x	5.1 x
ZD	-0.7 x	-0.7 x	0.0 x	-0.1 x	-0.1 x	2.7 x	2.8 x	2.9 x	3.2 x	2.7 x
ZI	2.2 x	2.2 x	1.7 x	1.3 x	0.9 x	3.6 x	3.6 x	3.7 x	3.8 x	3.6 x
ZM	0.6 x	0.4 x	0.2 x	0.2 x	0.1 x	4.0 x	3.8 x	3.7 x	3.7 x	4.0 x
ZS	1.4 x	1.3 x	1.1 x	1.0 x	1.0 x	2.1 x	2.0 x	2.1 x	2.1 x	2.3 x

Source: Company reports, FactSet, RBC Capital Markets



Exhibit 26 – Sales Efficiency, calendar quarters – gross profit

Ticker	Sales Efficiency				
	Q1/22	Q2/22	Q3/22	Q4/22	Q1/23
ADBE	3.4 x	3.4 x	3.4 x	3.5 x	3.5 x
ADSK	3.0 x	3.1 x	3.1 x	3.2 x	3.0 x
AI	1.6 x	2.0 x	1.9 x	2.0 x	1.6 x
ALTR	4.5 x	3.3 x	3.0 x	3.9 x	3.8 x
ANSS	2.6 x	2.9 x	2.9 x	2.8 x	2.8 x
AYX	1.4 x	1.4 x	1.7 x	2.1 x	1.4 x
BASE	1.2 x	1.4 x	1.4 x	1.3 x	1.2 x
BILL	2.2 x	2.1 x	2.2 x	2.4 x	2.5 x
BOX	2.7 x	2.7 x	2.8 x	2.9 x	2.8 x
BSY	5.1 x	4.7 x	4.8 x	4.5 x	4.9 x
CDAY	2.5 x	2.5 x	2.5 x	2.4 x	3.6 x
CFLT	1.0 x	1.1 x	1.2 x	1.3 x	1.3 x
CHKP	3.3 x	3.1 x	3.3 x	3.3 x	3.0 x
COUR	1.7 x	1.7 x	1.7 x	1.7 x	1.8 x
CRM	2.0 x	2.1 x	2.2 x	2.3 x	2.4 x
CRWD	2.3 x	2.2 x	2.2 x	2.4 x	2.2 x
CWAN	6.1 x	5.7 x	5.6 x	6.0 x	6.3 x
CYBR	1.6 x	1.5 x	1.6 x	1.8 x	1.6 x
DBX	5.2 x	4.9 x	5.1 x	5.0 x	4.6 x
DDOG	3.4 x	3.4 x	3.2 x	3.0 x	3.2 x
DOCU	1.8 x	1.6 x	2.1 x	2.2 x	2.3 x
DT	2.3 x	2.4 x	2.6 x	2.6 x	2.4 x
DV	3.5 x	4.1 x	4.1 x	4.4 x	4.4 x
ESTC	1.8 x	1.7 x	1.8 x	2.0 x	2.1 x
EVCN	3.2 x	3.6 x	3.6 x	3.9 x	3.6 x
FIVN	2.2 x	2.3 x	2.4 x	2.6 x	2.2 x
FROG	2.2 x	2.1 x	2.3 x	2.2 x	2.3 x
FRSH	1.6 x	1.3 x	1.5 x	1.5 x	1.6 x
FSLY	1.9 x	1.5 x	1.8 x	2.0 x	1.9 x
FTNT	2.0 x	2.0 x	2.2 x	2.3 x	2.1 x
GEN	4.2 x	4.1 x	4.0 x	4.7 x	4.9 x
GTLB	1.3 x	1.4 x	1.5 x	1.6 x	1.7 x
HCP	1.3 x	1.3 x	1.4 x	1.4 x	1.5 x
HUBS	1.8 x	1.8 x	1.8 x	1.9 x	1.9 x
INFA	2.4 x	2.2 x	2.5 x	2.7 x	2.6 x
INTU	4.3 x	2.6 x	3.0 x	2.9 x	4.7 x
IOT	1.4 x	1.5 x	1.5 x	1.6 x	1.5 x
JAMF	2.2 x	2.1 x	2.2 x	2.1 x	2.1 x
MDB	1.9 x	1.6 x	1.8 x	1.9 x	2.0 x
MODN	3.6 x	4.2 x	4.0 x	3.9 x	3.6 x
MSFT	6.0 x	5.6 x	6.8 x	6.2 x	6.4 x
NABL	2.8 x	2.7 x	2.8 x	2.9 x	2.9 x
NET	1.9 x	1.8 x	1.9 x	1.9 x	1.9 x
NOW	2.5 x	2.4 x	2.6 x	2.7 x	2.5 x
NTNX	1.6 x	1.4 x	1.7 x	2.0 x	1.8 x
OKTA	1.6 x	1.6 x	1.6 x	1.9 x	2.0 x
OLO	5.3 x	4.8 x	5.7 x	5.4 x	3.8 x
PANW	2.2 x	2.3 x	2.2 x	2.4 x	2.4 x
PATH	1.5 x	1.5 x	1.8 x	2.1 x	2.0 x
PAYC	4.1 x	3.1 x	3.1 x	3.4 x	4.0 x
PCOR	1.7 x	1.6 x	1.7 x	1.7 x	1.8 x
PCTY	3.8 x	3.0 x	3.0 x	3.0 x	4.0 x
PD	1.9 x	1.8 x	2.1 x	2.1 x	2.4 x
PEGA	1.9 x	1.3 x	1.3 x	2.2 x	1.8 x
PLTR	3.3 x	3.2 x	2.8 x	2.9 x	2.9 x
PTC	4.0 x	3.4 x	3.9 x	3.6 x	3.8 x
PWSC	3.0 x	2.9 x	3.0 x	3.0 x	2.8 x
QLYS	5.1 x	4.6 x	4.5 x	4.2 x	4.6 x
QTWO	3.1 x	3.2 x	3.2 x	3.1 x	3.5 x
RPD	1.7 x	1.8 x	1.9 x	2.0 x	1.9 x
S	1.0 x	1.0 x	1.2 x	1.3 x	1.2 x
SHOP	2.2 x	2.2 x	2.5 x	2.9 x	2.7 x
SMAR	1.3 x	1.4 x	1.5 x	1.7 x	1.9 x
SNOW	1.6 x	1.7 x	1.7 x	1.9 x	1.7 x
SPLK	1.6 x	1.8 x	2.3 x	3.0 x	1.7 x
SWI	2.9 x	2.7 x	2.8 x	2.8 x	2.9 x
TEAM	5.2 x	4.3 x	5.1 x	5.1 x	4.7 x
TENB	1.8 x	1.8 x	1.9 x	1.9 x	1.8 x
TWLO	2.1 x	2.1 x	2.0 x	2.4 x	2.8 x
VEEV	6.8 x	6.4 x	6.2 x	6.6 x	5.8 x
VRNS	1.7 x	1.8 x	1.9 x	2.2 x	1.7 x
WDAY	3.1 x	3.0 x	3.1 x	3.1 x	3.2 x
XM	1.6 x	1.7 x	1.8 x	1.7 x	1.6 x
XMTR	1.8 x	2.2 x	2.0 x	1.6 x	1.9 x
ZD	2.3 x	2.4 x	2.4 x	2.8 x	2.3 x
ZI	3.2 x	3.2 x	3.3 x	3.4 x	3.2 x
ZM	3.2 x	3.0 x	2.9 x	3.0 x	3.2 x
ZS	1.7 x	1.7 x	1.7 x	1.7 x	1.8 x

Source: Company reports, FactSet, RBC Capital Markets



Exhibit 27 – Non-GAAP Operating Margin Expansions with and without SBC

Ticker	Company	OM Expansion Y/Y		OM Expansion Q/Q				OM w/SBC Expansion Y/Y		OM w/SBC Expansion Q/Q			
		Q1/23 vs. Q1/22	Q2/22 vs. Q1/22	Q3/22 vs. Q2/22	Q4/22 vs. Q3/22	Q1/23 vs. Q4/22	Q1/23 vs. Q1/22	Q2/22 vs. Q1/22	Q3/22 vs. Q2/22	Q4/22 vs. Q3/22	Q1/23 vs. Q4/22		
ADBE	Adobe	-26 bps	-91 bps	61 bps	107 bps	-51 bps	-71 bps	-141 bps	56 bps	71 bps	-57 bps		
ADSK	Autodesk	-210 bps	196 bps	43 bps	1 bps	-451 bps	-211 bps	121 bps	82 bps	93 bps	-507 bps		
AI	C3.ai	-387 bps	639 bps	-172 bps	143 bps	-997 bps	-2098 bps	-3106 bps	-476 bps	744 bps	739 bps		
ALTR	Altair Engineering	-710 bps	-1713 bps	-931 bps	2041 bps	-106 bps	-880 bps	-2146 bps	-1236 bps	2556 bps	-53 bps		
ANSS	ANSYS, Inc.	518 bps	499 bps	123 bps	712 bps	-816 bps	483 bps	501 bps	-38 bps	1041 bps	-1021 bps		
AYX	Alteryx, Inc.	967 bps	215 bps	1900 bps	2023 bps	-3172 bps	940 bps	-134 bps	2267 bps	2803 bps	-3996 bps		
BASE	Couchbase	689 bps	1735 bps	-386 bps	111 bps	-771 bps	-10 bps	1608 bps	-447 bps	215 bps	-1387 bps		
BILL	Bill.com	1619 bps	182 bps	555 bps	786 bps	96 bps	2442 bps	510 bps	233 bps	-644 bps	2344 bps		
BOX	Box	215 bps	105 bps	233 bps	196 bps	-318 bps	314 bps	101 bps	418 bps	236 bps	-441 bps		
BSY	Bentley Systems, Inc.	103 bps	-341 bps	137 bps	-112 bps	419 bps	31 bps	-444 bps	88 bps	-243 bps	630 bps		
CDAY	Ceridian HCM Holding	874 bps	146 bps	-73 bps	-49 bps	850 bps	1000 bps	68 bps	-26 bps	262 bps	696 bps		
OFLT	Confluent	1783 bps	740 bps	582 bps	622 bps	-162 bps	1782 bps	348 bps	554 bps	1084 bps	-203 bps		
CHKP	Check Point Software Technologies	-186 bps	-42 bps	193 bps	-23 bps	-314 bps	-167 bps	-9 bps	175 bps	115 bps	-449 bps		
COUR	Coursera	417 bps	-388 bps	891 bps	-42 bps	-44 bps	566 bps	-768 bps	1162 bps	-566 bps	737 bps		
CRM	salesforce.com	992 bps	225 bps	278 bps	651 bps	-161 bps	1196 bps	169 bps	304 bps	762 bps	-40 bps		
CRWD	CrowdStrike Holdings, Inc.	-28 bps	-69 bps	-88 bps	-45 bps	174 bps	183 bps	-426 bps	-41 bps	-24 bps	675 bps		
CWAN	Clearwater Analytics	-148 bps	-77 bps	-132 bps	398 bps	-337 bps	-647 bps	-39 bps	-108 bps	533 bps	-1032 bps		
CYBR	CyberArk Software Ltd.	147 bps	175 bps	488 bps	504 bps	-1022 bps	331 bps	236 bps	487 bps	678 bps	-1070 bps		
DBX	Dropbox	-173 bps	-70 bps	201 bps	-168 bps	-135 bps	-131 bps	-269 bps	228 bps	-169 bps	79 bps		
DDOG	Datadog, Inc.	-512 bps	-220 bps	-370 bps	56 bps	23 bps	-1010 bps	-407 bps	-663 bps	-19 bps	80 bps		
DOCU	DocuSign	921 bps	67 bps	475 bps	79 bps	300 bps	614 bps	-322 bps	563 bps	48 bps	326 bps		
DT	Dynatrace, Inc.	196 bps	-38 bps	365 bps	102 bps	-233 bps	-48 bps	-19 bps	-17 bps	364 bps	-376 bps		
DV	DoubleVerify Holdings, Inc.	579 bps	704 bps	-42 bps	708 bps	-791 bps	752 bps	997 bps	-176 bps	856 bps	-925 bps		
ESTC	Elastic NV	1185 bps	143 bps	373 bps	604 bps	64 bps	1029 bps	91 bps	459 bps	410 bps	68 bps		
EVCM	EverCommerce	434 bps	368 bps	3 bps	284 bps	-221 bps	395 bps	381 bps	-34 bps	300 bps	-252 bps		
FINN	Finn	304 bps	408 bps	111 bps	392 bps	-608 bps	136 bps	198 bps	232 bps	532 bps	-826 bps		
FROG	JFrog, Ltd.	259 bps	-385 bps	471 bps	35 bps	138 bps	-26 bps	-399 bps	25 bps	53 bps	295 bps		
FRSH	Freshworks	332 bps	-1251 bps	1058 bps	35 bps	490 bps	717 bps	-1313 bps	1001 bps	-63 bps	1092 bps		
FSLY	Fastly, Inc.	536 bps	-891 bps	798 bps	820 bps	-192 bps	2050 bps	-393 bps	581 bps	1816 bps	47 bps		
FTNT	Fortinet, Inc.	444 bps	278 bps	347 bps	428 bps	-609 bps	556 bps	304 bps	402 bps	478 bps	-629 bps		
GEN	GenDigital	259 bps	-78 bps	-1110 bps	1355 bps	93 bps	113 bps	-153 bps	-1158 bps	1294 bps	130 bps		
GTLB	GitLab	1658 bps	170 bps	757 bps	792 bps	-62 bps	1109 bps	-1568 bps	1511 bps	1039 bps	127 bps		
HCP	Hashicorp	1197 bps	13 bps	738 bps	451 bps	-4 bps	2871 bps	875 bps	734 bps	1542 bps	-279 bps		
HUBS	Hubspot	466 bps	-187 bps	221 bps	445 bps	-14 bps	-34 bps	-956 bps	519 bps	437 bps	-34 bps		
INFA	Informatica	19 bps	-423 bps	371 bps	600 bps	-529 bps	-550 bps	-544 bps	382 bps	568 bps	-957 bps		
INTU	Intuit	424 bps	-3363 bps	755 bps	286 bps	2765 bps	342 bps	-4162 bps	564 bps	500 bps	3460 bps		
IOT	Samsara	857 bps	471 bps	339 bps	192 bps	-146 bps	1324 bps	641 bps	546 bps	517 bps	-380 bps		
JAMF	Jamf Holding Corp	-82 bps	-150 bps	163 bps	114 bps	-209 bps	-82 bps	-3257 bps	3104 bps	252 bps	-180 bps		
MDB	MongoDB, Inc.	573 bps	-1022 bps	1002 bps	436 bps	157 bps	677 bps	-1274 bps	1208 bps	583 bps	161 bps		
MODN	Model N	233 bps	546 bps	-376 bps	130 bps	-66 bps	140 bps	350 bps	-486 bps	239 bps	37 bps		
MSFT	Microsoft	103 bps	-166 bps	334 bps	-426 bps	361 bps	23 bps	-165 bps	282 bps	-470 bps	376 bps		
NABL	N-able	115 bps	22 bps	141 bps	95 bps	-143 bps	56 bps	-148 bps	129 bps	294 bps	-219 bps		
NET	Cloudflare Inc Class A	435 bps	-270 bps	622 bps	28 bps	55 bps	58 bps	-1006 bps	842 bps	-47 bps	270 bps		
NOW	ServiceNow, Inc.	96 bps	-260 bps	344 bps	183 bps	-171 bps	165 bps	-382 bps	382 bps	283 bps	-117 bps		
NTNX	Nutanix, Inc.	289 bps	-839 bps	1217 bps	1194 bps	-1283 bps	757 bps	-824 bps	1429 bps	1308 bps	-1155 bps		
OKTA	Okta, Inc.	1703 bps	657 bps	338 bps	896 bps	-188 bps	2584 bps	953 bps	572 bps	1210 bps	-151 bps		
OLO	Olo	-170 bps	26 bps	197 bps	-18 bps	-375 bps	-120 bps	247 bps	192 bps	-170 bps	-390 bps		
PANW	Palo Alto Networks, Inc.	-1366 bps	261 bps	-8 bps	-1835 bps	216 bps	-1158 bps	499 bps	-164 bps	-1845 bps	353 bps		
PATH	UiPath, Inc.	2109 bps	-20 bps	1149 bps	1559 bps	-578 bps	3312 bps	476 bps	1706 bps	1435 bps	-305 bps		
PAYC	Paycom	27 bps	-1148 bps	-92 bps	550 bps	663 bps	-19 bps	-1290 bps	-59 bps	633 bps	697 bps		
PCOR	Procore Technologies, Inc.	1044 bps	-236 bps	751 bps	-52 bps	580 bps	1272 bps	129 bps	318 bps	23 bps	802 bps		
PCTY	Pacify Holdings Corp	366 bps	-954 bps	62 bps	209 bps	1049 bps	398 bps	-1098 bps	-374 bps	186 bps	1684 bps		
PD	PagerDuty, Inc.	1824 bps	-105 bps	695 bps	287 bps	948 bps	2074 bps	-525 bps	695 bps	1304 bps	601 bps		
PEGA	Pegasystems	-567 bps	-3192 bps	355 bps	3733 bps	-1464 bps	-1125 bps	-3583 bps	249 bps	4251 bps	-2042 bps		
PLTR	Palantir Technologies, Inc.	-248 bps	-350 bps	-580 bps	546 bps	136 bps	913 bps	-86 bps	-434 bps	938 bps	496 bps		
PTC	PTC, Inc.	-410 bps	-864 bps	659 bps	-463 bps	259 bps	-623 bps	-1182 bps	909 bps	-535 bps	186 bps		
PWSC	PowerSchool	259 bps	218 bps	110 bps	108 bps	-176 bps	119 bps	98 bps	233 bps	121 bps	-333 bps		
QLYS	Qlysys, Inc.	-165 bps	-199 bps	-122 bps	-200 bps	357 bps	-356 bps	-112 bps	-232 bps	-330 bps	318 bps		
QWTO	Q2 Software	415 bps	81 bps	64 bps	-194 bps	465 bps	340 bps	-135 bps	158 bps	82 bps	235 bps		
RPD	Rapid7 Inc.	957 bps	565 bps	832 bps	316 bps	-456 bps	1191 bps	467 bps	705 bps	582 bps	-563 bps		
S	SentinelOne	3535 bps	1673 bps	1367 bps	832 bps	-337 bps	3413 bps	1715 bps	1404 bps	1135 bps	-841 bps		
SHOP	Shopify	-471 bps	-588 bps	-7 bps	682 bps	-557 bps	-386 bps	-679 bps	8 bps	1006 bps	-724 bps		
SMAR	Smartsheet	2409 bps	511 bps	645 bps	569 bps	684 bps	2862 bps	682 bps	1174 bps	164 bps	641 bps		
SNOW	Snowflake, Inc.	483 bps	311 bps	427 bps	-222 bps	-34 bps	325 bps	188 bps	520 bps	-364 bps	-19 bps		
SPLK	Splunk, Inc.	1181 bps	1208 bps	1776 bps	1656 bps	-3459 bps	1897 bps	1890 bps	2245 bps	2187 bps	-4415 bps		
SWI	SolarWinds Corp.	224 bps	-85 bps	180 bps	-182 bps	310 bps	215 bps	-211 bps	171 bps	-62 bps	317 bps		
TDC	Teradata Corp.	-50 bps	-1039 bps	16 bps	77 bps	897 bps	-13 bps	-1159 bps	113 bps	-72 bps	1105 bps		
TEAM	Atlassian Corp. Plc	-266 bps	-986 bps	398 bps	172 bps	151 bps	-1494 bps	-2991 bps	2058 bps	-718 bps	156 bps		
TENB	Terabele Holdings, Inc.	179 bps	-40 bps	579 bps	-241 bps	-119 bps	-34 bps	-388 bps	654 bps	-35 bps	-264 bps		
TWLO	Twilio	973 bps	-135 bps	-280 bps	678 bps	710 bps	1050 bps	-927 bps	162 bps	926 bps	890 bps		
TYL	Tyler Technologies	-263 bps	-70 bps	130 bps	-325 bps	3 bps	-300 bps	-66 bps	112 bps	-309 bps	-36 bps		
VEEV	Vevea Systems	-968 bps	-169 bps	192 bps	-258 bps	-733 bps	-1362 bps	-637 bps	303 bps	-266 bps	-761 bps		
VRNS	Varonis Systems, Inc.	420 bps	969 bps	646 bps	1027 bps	-2222 bps	823 bps	1321 bps	1252 bps	1368 bps	-3118 bps		
WDAY	Workday	339 bps	-48 bps	1 bps	-110 bps	496 bps	317 bps	118 bps	42 bps	-338 bps	495 bps		
XM	Qualtrics International	407 bps	82 bps	397 bps	13 bps	-85 bps	2739 bps	693 bps	1229 bps	-6 bps	823 bps		
XMTR	Xometry	475 bps	699 bps	256 bps	-751 bps	271 bps	442 bps	539 bps	336 bps	-779 bps	347 bps		
ZD	Ziff Davis	-258 bps	325 bps	-18 bps	773 bps	-1339 bps	-318 bps	310 bps	24 bps	814 bps	-1466 bps		
ZI	ZoomInfo Technologies	41 bps	34 bps	124 bps	93 bps	-209 bps	546 bps	37 bps	207 bps	-48 bps	351 bps		
ZM	Zoom Video Communications	99 bps	-141 bps	-125 bps	165 bps	199 bps	-506 bps	-515 bps	-549 bps	-1721 bps	2279 bps		
ZS	Zscaler, Inc.	577 bps	249 bps	-14 bps	76 bps	265 bps	1693 bps	330 bps	638 bps	203 bps	522 bps		
Average		408 bps	-85 bps	298 bps	343 bps	-148 bps	471 bps	-279 bps	409 bps	420 bps	-79 bps		

Source: Company reports, FactSet, RBC Capital Markets



Exhibit 28 – SBC Margin as a % of Revenue

Ticker	Company	SBC as a % of revenue				
		Q1/22	Q2/22	Q3/22	Q4/22	Q1/23
ADBE	Adobe	8%	9%	9%	9%	9%
ADSK	Autodesk	13%	14%	13%	12%	13%
AI	C3.ai	49%	87%	90%	84%	66%
ALTR	Altair Engineering	12%	16%	19%	14%	13%
ANSS	ANSYS, Inc.	8%	8%	10%	7%	9%
AYX	Alteryx, Inc.	29%	32%	28%	21%	29%
BASE	Couchbase	16%	17%	18%	16%	23%
BILL	Bill.com	32%	28%	32%	46%	23%
BOX	Box	20%	20%	18%	18%	19%
BSY	Bentley Systems, Inc.	5%	7%	7%	8%	6%
CDAY	Ceridian HCM Holding	12%	13%	12%	9%	11%
CFLT	Confluent	45%	49%	50%	45%	45%
CHKP	Check Point Software Technologies	6%	6%	6%	4%	6%
COUR	Coursera	18%	22%	19%	25%	17%
CRM	salesforce.com	10%	11%	11%	10%	8%
CRWD	CrowdStrike Holdings, Inc.	21%	25%	24%	24%	19%
CWAN	Clearwater Analytics	22%	22%	22%	20%	27%
CYBR	CyberArk Software Ltd.	21%	21%	21%	19%	20%
DBX	Dropbox	13%	15%	15%	15%	12%
DDOG	Datadog, Inc.	18%	20%	23%	24%	23%
DOCU	DocuSign	19%	23%	22%	22%	22%
DT	Dynatrace, Inc.	11%	11%	15%	12%	13%
DV	DoubleVerify Holdings, Inc.	11%	8%	10%	8%	10%
ESTC	Elastic NV	18%	19%	18%	20%	20%
EVCN	EverCommerce	4%	4%	5%	4%	5%
FIVN	Five9	22%	24%	22%	21%	23%
FROG	JFrog, Ltd.	22%	22%	27%	27%	25%
FRSH	Freshworks	41%	41%	42%	43%	37%
FSLY	Fastly, Inc.	39%	34%	36%	26%	24%
FTNT	Fortinet, Inc.	6%	5%	5%	4%	4%
GEN	GenDigital	3%	3%	4%	4%	4%
GTLB	GitLab	20%	37%	30%	27%	25%
HCP	Hashicorp	46%	37%	37%	26%	29%
HUBS	Hubspot	12%	19%	16%	16%	17%
INFA	Informatica	8%	9%	9%	9%	14%
INTU	Intuit	6%	14%	16%	14%	7%
IOT	Samsara	31%	29%	27%	24%	26%
JAMF	Jamf Holding Corp	15%	46%	16%	15%	15%
MDB	MongoDB, Inc.	29%	32%	30%	28%	28%
MODN	Model N	16%	18%	19%	18%	17%
MSFT	Microsoft	4%	4%	4%	5%	5%
NABL	N-Able	9%	11%	11%	9%	10%
NET	Cloudflare Inc Class A	16%	23%	21%	22%	20%
NOW	ServiceNow, Inc.	19%	20%	20%	19%	18%
NTNX	Nutanix, Inc.	21%	21%	19%	18%	16%
OKTA	Okta, Inc.	41%	38%	36%	32%	32%
OLO	Olo	27%	25%	25%	27%	27%
PANW	Palo Alto Networks, Inc.	18%	15%	17%	17%	16%
PATH	UiPath, Inc.	41%	36%	31%	32%	29%
PAYC	Paycom	6%	8%	7%	6%	6%
PCOR	Procure Technologies, Inc.	23%	20%	24%	23%	21%
PCTY	Palocity Holdings Corp	10%	11%	16%	16%	10%
PD	PagerDuty, Inc.	29%	33%	33%	23%	27%
PEGA	Pegasystems	8%	11%	12%	7%	13%
PLTR	Palantir Technologies, Inc.	33%	31%	29%	25%	22%
PTC	PTC, Inc.	8%	11%	8%	9%	10%
PWSC	PowerSchool	8%	9%	8%	8%	9%
QLYS	Qualys, Inc.	10%	11%	11%	12%	12%
QTWO	Q2 Software	11%	13%	12%	10%	12%
RPD	Rapid7 Inc.	18%	19%	18%	15%	16%
S	SentinelOne	40%	40%	40%	37%	42%
SHOP	Shopify	10%	11%	11%	7%	9%
SMAR	Smartsheet	26%	24%	19%	23%	24%
SNOW	Snowflake, Inc.	41%	42%	41%	43%	42%
SPLK	Splunk, Inc.	32%	25%	20%	15%	25%
SWI	SolarWinds Corp.	9%	10%	10%	9%	9%
TDC	Teradata Corp.	6%	7%	6%	8%	6%
TEAM	Atlassian Corp. Plc	18%	38%	22%	30%	30%
TENB	Tenable Holdings, Inc.	16%	19%	19%	17%	18%
TWLO	Twilio	18%	26%	21%	19%	17%
TYL	Tyler Technologies	6%	6%	6%	6%	6%
VEEV	Veeva Systems	13%	18%	17%	17%	17%
VRNS	Varonis Systems, Inc.	37%	34%	28%	24%	33%
WDAY	Workday	22%	20%	20%	22%	22%
XM	Qualtrics International	80%	74%	65%	66%	57%
XMTR	Xometry	4%	6%	5%	5%	4%
ZD	Ziff Davis	2%	2%	2%	1%	3%
ZI	ZoomInfo Technologies	18%	18%	17%	18%	13%
ZM	Zoom Video Communications	19%	23%	27%	46%	26%
ZS	Zscaler, Inc.	37%	36%	30%	28%	26%

Source: Company reports, FactSet, RBC Capital Markets



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Companies mentioned

Adobe Inc. (NASDAQ: ADBE US; \$495.18; Outperform)
Asana Inc (NYSE: ASAN US; \$25.01; Underperform)
Autodesk, Inc. (NASDAQ: ADSK US; \$213.50; Outperform)
Bentley Systems, Incorporated (NASDAQ: BSY US; \$53.29; Outperform)
Box, Inc. (NYSE: BOX US; \$29.84; Underperform)
Check Point Software Technologies Ltd. (NASDAQ: CHKP US; \$130.91; Sector Perform)
Clearwater Analytics Holdings Inc (NYSE: CWAN US; \$15.88; Outperform)
Cloudflare, Inc. (NYSE: NET US; \$67.63; Outperform)
Couchbase Inc (NASDAQ: BASE US; \$15.44; Outperform)
Coursera Inc (NYSE: COUR US; \$13.06; Outperform)
CrowdStrike Holdings, Inc. (NASDAQ: CRWD US; \$155.14; Outperform)
Datadog, Inc. (NASDAQ: DDOG US; \$95.75; Outperform)
DocuSign Inc (NASDAQ: DOCU US; \$53.85; Sector Perform)
DoubleVerify Holdings Inc (NYSE: DV US; \$37.19; Outperform)
Dynatrace, Inc. (NYSE: DT US; \$51.21; Outperform)
Elastic N.V. (NYSE: ESTC US; \$66.39; Outperform)
EverCommerce Inc (NASDAQ: EVCM US; \$11.29; Outperform)
Fastly Inc (NYSE: FSLY US; \$17.19; Underperform)
Fortinet, Inc. (NASDAQ: FTNT US; \$72.78; Sector Perform)
Gen Digital Inc. (NASDAQ: GEN US; \$18.63; Sector Perform)
Gitlab Inc (NASDAQ: GTLB US; \$51.24; Outperform)
HubSpot, Inc. (NYSE: HUBS US; \$519.32; Outperform)
Informatica Inc. (NYSE: INFA US; \$18.54; Outperform)
Jamf Holding Corp. (NASDAQ: JAMF US; \$19.43; Outperform)
Microsoft Corporation (NASDAQ: MSFT US; \$342.33; Outperform)
MongoDB Inc (NASDAQ: MDB US; \$379.90; Outperform)
Nutanix, Inc. (NASDAQ: NTNX US; \$29.19; Outperform)
Okta Inc (NASDAQ: OKTA US; \$75.75; Outperform)
Olo Inc. (NYSE: OLO US; \$7.13; Outperform)
Pagerduty, Inc. (NYSE: PD US; \$22.40; Outperform)
Palantir Technologies Inc. (NYSE: PLTR US; \$16.30; Underperform)
Palo Alto Networks, Inc. (NYSE: PANW US; \$246.53; Outperform)
Pegasystems Inc. (NASDAQ: PEGA US; \$50.20; Outperform)
Q2 Holdings, Inc. (NYSE: QTWO US; \$29.79; Sector Perform)
Qualys, Inc. (NASDAQ: QLYS US; \$131.01; Sector Perform)
Rapid7, Inc. (NASDAQ: RPD US; \$45.99; Outperform)
Salesforce, Inc. (NYSE: CRM US; \$211.76; Outperform)
Samsara Inc. (NYSE: IOT US; \$28.90; Outperform)
ServiceNow, Inc. (NYSE: NOW US; \$565.48; Outperform)
Smartsheet Inc. (NYSE: SMAR US; \$42.01; Sector Perform)
SolarWinds Corporation (NYSE: SWI US; \$10.31; Sector Perform)
Splunk Inc. (NASDAQ: SPLK US; \$108.02; Outperform)
Teradata Corporation (NYSE: TDC US; \$51.88; Sector Perform)
UiPath Inc (NYSE: PATH US; \$18.10; Sector Perform)
Varonis Systems, Inc. (NASDAQ: VRNS US; \$26.48; Outperform)
Veeva Systems Inc. (NYSE: VEEV US; \$200.05; Outperform)
Xometry, Inc. (NASDAQ: XMTR US; \$22.67; Sector Perform)
Ziff Davis, Inc. (NASDAQ: ZD US; \$67.15; Outperform)
Zoom Video Communications, Inc. (NASDAQ: ZM US; \$70.06; Outperform)
ZoomInfo Technologies Inc (NASDAQ: ZI US; \$26.82; Outperform)
Zscaler Inc (NASDAQ: ZS US; \$154.01; Outperform)



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