

How XBRL Data Can be Used for Macro-Analysis

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You've probably seen the common headline, something along the lines of "S&P earnings up 10%." It's something that most of us take on faith, simply because there is no data provided, and not something that many of us can or will, in fact, check. That would mean going through 500 financial reports, making a detailed spreadsheet, and then updating it frequently. Sounds easier just to accept the headline.

But in the past 10 years, the financial performance of the stocks in the Standard and Poor's (S&P) 500 index of listed companies has been filed with the SEC in a format called Extensible Business Reporting Language (XBRL). XBRL is intended to produce computer-readable financial statements and, with a bit of work, it should be possible to copy the data into a database.

So, the question becomes: Could XBRL be used to see what is happening across these 500 companies, and maybe glean some insights that haven't been published yet? Let's see how that might work.

As each of the 500 companies in the S&P 500 index publish four reports annually, we have 2,000 reports to deal with each year. And, if the data is to be examined in aggregate, it makes sense to write some software to import this data into a database.

The XBRL financial statements are available on the SEC web site and consist of a series of up to six files, depending on the purpose. For example, one file will contain all the items and data, another will show how it is to be presented (ie current assets before total assets), and another will show how the data is to be calculated (ie current assets are added to total assets). Each one of these files is in XML format and there is some software available for reading files of this format. For this project we needed just the file with all the items and data. We wrote a couple of programs in Java that read through this file, determined the elements and its value and date, and stored that into a database.

The Challenges to Analysis

Once that was done we still had a number of challenges to overcome. They include the following:

How comparable is the data? To answer this question, we must compare and aggregate all the data to ensure that companies are using consistent currencies and XBRL elements. If we look at the element “Assets,” all 500 companies have stated a value for this within their last XBRL statements. But, looking at the element “Liabilities,” there are 161 companies that do not use this term. Companies such as Accenture will provide values for “Liabilities-Current” and “Liabilities-Noncurrent,” but not a total amount for the two. So, for the terms where values are missing, those will need to be calculated.

At other times, there will be a need to look at more than one element name. For instance, 237 of the 500 companies use the XBRL tag “Revenues.” There are 277 that use the tag “RevenueFromContractWithCustomerExcludingAssessedTax,” 44 use “RevenueFromContractWithCustomerIncludingAssessedTax,” and nine use “OperatingLeasesIncomeStatementLeaseRevenue.” If you are quick with math, that totals 567 companies. That means that some will use two or three terms, so they need to be gathered in a particular order to ensure that every company has a revenue amount.

When does the fiscal year end? To make comparisons easy, it would be nice to see that all the financial years end on the same date, expected to be December 31. But, of the 500, 361 match the calendar year with the fiscal year, with the remaining 139 scattered over 38 other possible year-end dates.

How long is a fiscal quarter? It seems like a stupid question, as there are 12 months in a year, and three months in a quarter. What is less obvious is that the number of days can vary, and not just for leap years. The first three months of the year have 90 days (sometimes 91), the second quarter has 91, and the third and fourth quarters have 92 days each. If revenue grew two percent between the first and third quarters, is that really growth at all, or just a couple of extra days?

Some companies attempt to use a consistent number of weeks in an attempt to be more comparative. Consider the explanation from Apple:

The Company’s fiscal year is the 52- or 53-week period that ends on the last Saturday of September. A 14th week is included in the first fiscal quarter every five or six years to realign the Company’s fiscal quarters with calendar quarters. The Company’s fiscal years 2020 and 2019 span 52 weeks each. Unless otherwise stated, references to particular years, quarters, months and periods refer to the Company’s fiscal years ended in September and the associated quarters, months and periods of those fiscal years.

They are trying to take the year and divide into consistent quarters, each consisting of 13 weeks, or 91 days. That leaves an extra day or two per year to deal with, which they adjust every five or six years. This last happened in 2017, when their first quarter was 97 days long. It caused an alarm in the first quarter of 2018, when sales fell 4.5%. This, however, was not surprising when the duration of the quarter fell 6%.

So how about years? Are they comparable? Well, no. Of the 500, 389 have a 365-day year. Twenty-five had a 370-day year, 50 at 363, and 35 at 364.

We have challenges slicing across the various elements and periods, but analysis can be done. If we start with the cleanest element of all – Assets – what do we get?

GICS Sector	2021 Q3	2020 Q3	Change \$	Change
Communication Services	2,633,339,940,000	2,452,815,649,000	180,524,291,000	7.36%
Consumer Discretionary	2,068,736,248,000	1,899,245,430,000	169,490,818,000	8.92%
Consumer Staples	1,359,796,612,000	1,355,812,647,000	3,983,965,000	0.29%
Energy	1,351,653,028,000	1,297,994,199,000	53,658,829,000	4.13%
Financials	25,101,038,710,000	22,663,426,506,000	2,437,612,204,000	10.76%
Health Care	5,676,659,355,000	5,395,631,644,000	281,027,711,000	5.21%
Industrials	2,245,291,965,000	2,209,888,226,000	35,403,739,000	1.60%
Information Technology	2,680,653,763,000	2,452,626,596,000	228,027,167,000	9.30%
Materials	739,637,606,000	701,132,967,000	38,504,639,000	5.49%
Real Estate	640,764,656,000	585,726,017,000	55,038,639,000	9.40%
Utilities	1,626,763,340,000	1,556,519,049,000	70,244,291,000	4.51%
Grand Total	43,281,541,739,000	39,809,552,563,000	3,471,989,176,000	8.72%

So, all sectors in the S&P 500 have grown in assets, with an average increase of 8.7% over the 12-month period, with the 500 companies combined adding \$3.472 trillion to their growth. But, while all sectors overall increased their assets, 108 companies saw their assets decrease by a combined \$321 billion. While there is no key industry that decreased, nine of the top 10 increases occurred in the finance sector, led by JP Morgan, whose assets grew by \$511 billion.

Looking at equity, we find that two possible elements are needed to gather the full list. The first element “StockHoldersEquity,” is used by 460 companies, while the remainder have chosen the element “StockHoldersEquityIncludingPortionAttributableToNoncontrollingInterest.”

GICS Sector	2021 Q3 Equity	2020 Q3 Equity	Change	Percent
Communication Services	1,035,552,914,000	970,164,985,000	65,387,929,000	6.74%
Consumer Discretionary	463,393,310,000	370,663,003,000	92,730,307,000	25.02%
Consumer Staples	412,313,771,000	392,681,511,000	19,632,260,000	5.00%
Energy	585,508,987,000	561,314,926,000	24,194,061,000	4.31%
Financials	2,892,776,791,000	2,690,203,123,000	202,573,668,000	7.53%
Health Care	986,189,718,000	898,724,086,000	87,465,632,000	9.73%
Industrials	568,315,221,000	520,116,870,000	48,198,351,000	9.27%
Information Technology	961,441,613,000	857,398,622,000	104,042,991,000	12.13%

Materials	303,116,734,000	271,838,860,000	31,277,874,000	11.51%
Real Estate	245,774,416,000	226,328,862,000	19,445,554,000	8.59%
Utilities	432,870,307,000	416,086,445,000	16,783,862,000	4.03%
Grand Total	8,887,253,782,000	8,175,521,293,000	711,732,489,000	8.71%

Here we find a near identical overall percentage change in equity as in assets – 8.7%. But this is overall; some sectors had higher increases in equity, while others saw lower increases. The Consumer Discretionary sector's equity gained 25%, while raising assets by less than 9%; 40% of the sector growth came from Amazon, which had a combination of additional retained earnings and additional paid-in capital. Of Amazon's \$37.8 billion increase in Shareholders' Equity, \$26.2 billion came from earnings and \$11.6 billion came from paid-in capital. All equity was issued as part of stock-based compensation and the employee benefit plan.

Taking a look at the various income statement items adds an extra degree of difficulty, as now we must pay attention to the start date and end date for those statements. After all, nine-month statements will show both the three and nine months ending on the same date and, when we take this together with the differing year ends, we cannot determine what has been published in the latest quarter.

Looking at revenue, we know that there will be three different XBRL elements that need to be gathered, depending on which one is utilized by each of the 500 companies. And here we will look at periods of 99 days or less, to capture the different-sized fiscal quarters. Note that, for fourth quarters, companies rarely show fourth-quarter specific data, so many will not have anything to present.

Given these criteria, there are 417 companies that had comparable data for the third quarter.

GICS Sector	2021 Q3	2020 Q3	change	Percent
Communication Services	274,525,674,000	236,212,391,000	38,313,283,000	16.22%
Consumer Discretionary	414,587,331,000	368,797,290,000	45,790,041,000	12.42%
Consumer Staples	351,914,820,000	340,911,798,000	11,003,022,000	3.23%
Energy	272,931,571,000	156,661,305,000	116,270,266,000	74.22%
Financials	271,760,741,000	242,166,683,000	29,594,058,000	12.22%
Health Care	557,483,082,000	496,335,164,000	61,147,918,000	12.32%
Industrials	311,609,583,000	261,920,523,000	49,689,060,000	18.97%
Information Technology	231,239,896,000	198,767,433,000	32,472,463,000	16.34%
Materials	95,323,272,000	74,022,034,000	21,301,238,000	28.78%
Real Estate	30,803,473,000	26,430,155,000	4,373,318,000	16.55%
Utilities	82,169,980,000	74,348,211,000	7,821,769,000	10.52%
Grand Total	2,894,349,423,000	2,476,572,987,000	417,776,436,000	16.87%

We can see that the S&P 500 companies came out of the Covid economy on a solid basis, increasing their revenue by about a billion dollars per company. The notable powerhouse was the energy sector, with all companies in that sector showing a positive increase on the back of rising crude and natural gas prices.

But does this increase in revenue translate to increasing profits? Here we again look at the latest quarter (Q3), and focus on two XBRL elements: “NetIncomeLoss” (405 records) and “NetIncomeLossAvailableToCommonStockholdersBasic” (47 records).

GICS Sector	2021 Q3	2020 Q3	change	Percent
Communication Services	51,563,241,000	34,889,860,000	16,673,381,000	47.79%
Consumer Discretionary	29,378,891,000	23,486,711,000	5,892,180,000	25.09%
Consumer Staples	22,114,462,000	25,835,356,000	(3,720,894,000)	-14.40%
Energy	23,173,457,000	(8,302,920,000)	31,476,377,000	-379.10%
Financials	79,493,991,000	81,154,323,000	(1,660,332,000)	-2.05%
Health Care	65,312,100,000	39,413,979,000	25,898,121,000	65.71%
Industrials	31,586,603,000	9,908,380,000	21,678,223,000	218.79%
Information Technology	55,873,243,000	39,568,673,000	16,304,570,000	41.21%
Materials	10,955,468,000	5,456,170,000	5,499,298,000	100.79%
Real Estate	6,965,121,000	2,699,351,000	4,265,770,000	158.03%
Utilities	10,183,447,000	11,143,631,000	(960,184,000)	-8.62%
Grand Total	386,600,024,000	265,253,514,000	121,346,510,000	45.75%

With only three of the 11 sectors seeing a decline in profits, the additional revenue did indeed boost profits overall substantially. The largest dollar increase was the \$7.7 billion improvement at Google, while the largest decrease was seen at Berkshire Hathaway (\$19.7 billion decrease).

There has been quite a bit of press coverage about supply chains and how they will affect inventory. Are the S&P 500 companies having trouble keeping inventory on their balance sheets? Here, we look at the XBRL Element “InventoryNet.” The XBRL Taxonomy has elements for a few types of inventory (raw materials, work in process), but the most used is “InventoryNet,” with a few companies using “InventoryFinishedGoodsNetOfReserves.” What we find first is that only 300 of the 500 companies hold inventory, including many consumer-discretionary companies such as Ebay, Etsy and Facebook holding no inventory at all. Seventy-seven companies had a reduction in inventory, while Amazon, Walmart and Home Depot had a combined \$19.3 billion increase in inventory.

GICS Sector	2021 Q3	2020 Q3	change	percent
Communication Services	10,176,405,000	9,692,150,000	484,255,000	5.00%
Consumer Discretionary	180,315,173,000	141,665,689,000	38,649,484,000	27.28%
Consumer Staples	141,256,651,000	126,931,479,000	14,325,172,000	11.29%

Energy	41,702,891,000	39,307,047,000	2,395,844,000	6.10%
Financials	20,191,000,000	19,361,000,000	830,000,000	4.29%
Health Care	156,188,544,000	148,112,209,000	8,076,335,000	5.45%
Industrials	106,761,811,000	97,272,985,000	9,488,826,000	9.75%
Information Technology	75,061,866,000	64,124,864,000	10,937,002,000	17.06%
Materials	52,474,543,000	46,517,707,000	5,956,836,000	12.81%
Real Estate	499,000,000	411,000,000	88,000,000	21.41%
Utilities	7,271,000,000	6,207,000,000	1,064,000,000	17.14%
Grand Total	791,898,884,000	699,603,130,000	92,295,754,000	13.19%

So, all sectors increased their inventory, with the bulk of the increase coming in the Consumer Discretionary sector. Note that some of the sectors are light in the data collected, as Berkshire Hathaway is the only company in the Financials sector. The Real Estate sector has only one company as well – Weyerhaeuser.

Some companies in the Energy sector increased their inventory value without necessarily holding more goods. As stated in the Exxon filings:

Crude oil, products and merchandise inventories are carried at the lower of current market value or cost, generally determined under the last-in first-out method (LIFO). The Corporation's results for the third quarter of 2020 included a before-tax credit of \$153 million, as rising prices reduced the charge against the book value of inventories. This adjustment, which is included in "Crude oil and product purchases", together with a market adjustment to inventory for equity companies included in "Income from equity affiliates", resulted in a \$113 million after-tax credit to earnings (excluding noncontrolling interests) in the third quarter of 2020.

While commodity prices can have an effect on inventory, it doesn't explain the majority of this list. Supply chains have tightened because of increased demand, but the large corporations of the world continue to get the goods they ask for. And, given rising sales and profits, these large companies are asking for more.

Turning to the cash-flow statement, we find only 47 companies that show cash flow for a three-month period ending around September 2021. If we widen the search to a longer period, in this case more than 260 days (to capture 9-month statements), we produce 384 with comparable numbers to 2020.

GICS Sector	2021 Q3	2020 Q3	change	percent
Communication Services	229,850,579,000	183,304,807,000	46,545,772,000	25.39%
Consumer Discretionary	108,922,614,000	100,532,291,000	8,390,323,000	8.35%
Consumer Staples	59,572,685,000	51,611,688,000	7,960,997,000	15.42%
Energy	111,250,825,000	49,511,521,000	61,739,304,000	124.70%
Financials	203,218,816,000	80,675,072,000	122,543,744,000	151.90%

Health Care	213,781,308,000	169,428,477,000	44,352,831,000	26.18%
Industrials	102,959,544,000	67,537,167,000	35,422,377,000	52.45%
Information Technology	268,958,175,000	221,130,925,000	47,827,250,000	21.63%
Materials	43,470,702,000	35,844,740,000	7,625,962,000	21.27%
Real Estate	32,102,803,000	26,805,038,000	5,297,765,000	19.76%
Utilities	52,493,518,000	59,702,593,000	(7,209,075,000)	-12.07%
Grand Total	1,426,581,569,000	1,046,084,319,000	380,497,250,000	36.37%

Not surprisingly, cash flow from operations has grown along with net profits. Even with more cash consumed for greater inventories, cash flow jumped substantially. Utilities appears to be the outlier, with only 12 of the 27 reporting entities showing a positive change. The largest decrease in the utilities sector – Atmos Energy Corp – provides a reason in their notes:

A historic winter storm impacted supply, market pricing and demand for natural gas in our service territories in mid-February. During this time, the governors of Kansas and Texas each declared a state of emergency, and certain regulatory agencies issued emergency orders that impacted the utility and natural gas industries, including statewide utilities curtailment programs and orders encouraging or requiring jurisdictional natural gas utilities to work to ensure customers were provided with safe and reliable natural gas service.

Due to the historic nature of this winter storm, we experienced unforeseeable and unprecedented market pricing for gas costs, which resulted in aggregated natural gas purchases during the month of February of approximately \$2.3 billion. These gas costs were paid by the end of March 2021.

This would not be the only S&P Utility to suffer the same fate.

If cash flow from operations went up, was less cash needed from financing operations?

GICS Sector	2021 Q3	2020 Q3	change	percent
Communication Services	(77,969,966,000)	(53,597,907,000)	(24,372,059,000)	45.47%
Consumer Discretionary	(31,830,521,000)	50,495,505,000	(82,326,026,000)	-163.04%
Consumer Staples	(54,475,393,000)	(23,714,551,000)	(30,760,842,000)	129.71%
Energy	(80,098,276,000)	9,587,491,000	(89,685,767,000)	-935.45%
Financials	558,382,152,000	1,280,186,941,000	(721,804,789,000)	-56.38%
Health Care	(96,401,640,000)	(19,083,974,000)	(77,317,666,000)	405.14%
Industrials	(68,131,381,000)	53,596,109,000	(121,727,490,000)	-227.12%
Information Technology	(173,953,882,000)	(134,900,745,000)	(39,053,137,000)	28.95%
Materials	(29,028,852,000)	(2,782,157,000)	(26,246,695,000)	943.39%
Real Estate	8,161,852,000	(1,891,460,000)	10,053,312,000	-531.51%
Utilities	24,008,762,000	21,835,707,000	2,173,055,000	9.95%
Grand Total	(21,337,145,000)	1,179,730,959,000	(1,201,068,104,000)	-101.81%

Absolutely, the S&P 500 went from a consumer of financing to a provider, changing by \$1.2 trillion. More than half of this change came from the finance sector, which incurred the top six decreases. In the case of JP Morgan, the change was due to taking in fewer deposits than the year before. Boeing, in the industrials sector, made a \$33.5 billion reversal and repaid more in 2021 than it borrowed. Whether or not their plane troubles are over is unknown, but it appears that financing is not a problem.

The final cash-flow category is cash for investing activities.

GICS Sector	2021 Q3	2020 Q3	Change	percent
Communication Services	(159,832,564,000)	(114,276,469,000)	(45,556,095,000)	39.86%
Consumer Discretionary	(84,859,967,000)	(82,896,615,000)	(1,963,352,000)	2.37%
Consumer Staples	(5,787,159,000)	(10,581,608,000)	4,794,449,000	-45.31%
Energy	(16,904,148,000)	(52,529,075,000)	35,624,927,000	-67.82%
Financials	(393,465,670,000)	(765,468,966,000)	372,003,296,000	-48.60%
Health Care	(97,733,376,000)	(127,373,041,000)	29,639,665,000	-23.27%
Industrials	(43,804,044,000)	(42,628,661,000)	(1,175,383,000)	2.76%
Information Technology	(101,443,810,000)	(71,019,963,000)	(30,423,847,000)	42.84%
Materials	(14,821,111,000)	(11,061,594,000)	(3,759,517,000)	33.99%
Real Estate	(39,157,143,000)	(14,677,270,000)	(24,479,873,000)	166.79%
Utilities	(74,689,429,000)	(69,956,817,000)	(4,732,612,000)	6.77%
Grand Total	(1,032,498,421,000)	(1,362,470,079,000)	329,971,658,000	-24.22%

There is no doubt that the S&P 500 companies are continuing to invest, with seven of 11 sectors increasing investment as the economy expands and shakes off its pandemic woes. The overall decrease came from the finance sector as JP Morgan purchased fewer securities than last year.

Promise Fulfilled

XBRL does (eventually) deliver on its promise to be machine readable. With this feature alone it means that simple and complex analysis can be done right from the XBRL files. Coupled with a database to allow for faster retrieval over multiple companies, it becomes easier to make corporate and industry comparisons. However, the lack of software available to move files on the SEC web site into the accountant friendly excel format will restrict its usage for a while.

Standardization of terms used for the same elements is a bit of a challenge, but not insurmountable. The taxonomy of terms has reached the point where there is little need for extensibility; instead, there is often a choice between two or more suitable terms. But, with all the technology now available, usage and refinement should get us to the point where it becomes trivial to compare multiple financial statements. Hopefully this happens soon.