

Stock Selection: Research and Results May 2017

Regime Change: From Neutral to Growth-Tilted

R&D: A Better Asset?

The Faith in Big Spenders Grows, While the Fed Takes a Resolute Stance

- Our regime indicator recently changed its forecast of what will be important when picking stocks, shifting from the neutral stance it's been in for four months to a growth-tilted one. What's caused the change are signs that investors are becoming excited about companies that ratchet up their capital expenditures and a flattening of the yield curve, the latter caused by a more resolute Fed and a couple of weak inflation reports. Those two factors comprise a third of the indicator. They've proved decisive because our valuations spreads have stabilized at a moderately below-average level. From here we could progress to a full-blown growth-*driven* market, for the first time in a decade, although it's equally likely that we'll round trip back to a neutral position.
- Growth stocks performed unusually well in this year's neutral setting, benefiting from two lackluster inflation reports, a weak GDP number, a tougher-talking Fed and the litany of problems besetting the Trump agenda. The run looks like what went on in the early-1990s. The setting still favors them, and as a result, valuation and capital deployment considerations are getting less weight in our modeling, while earnings quality and analyses of trends have become more important. In growth-tilted regimes good is good and we want to ride our winners. We're employing a GARP(y) strategy with the financials our remaining value bet.

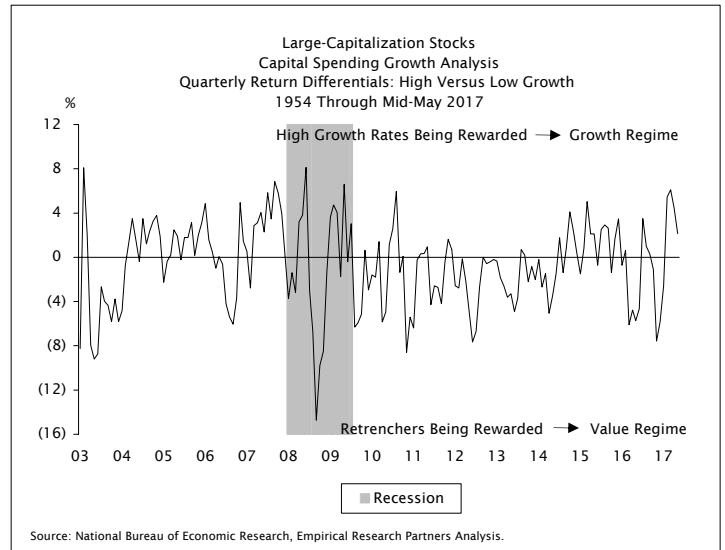
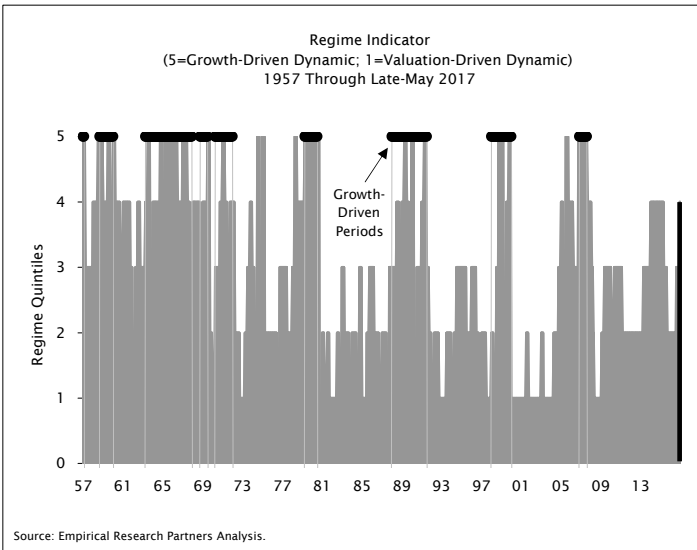
R&D: A Better Asset?

- The value of intellectual capital has held up better than that of traditional fixed assets, and as a result we've found that it's paid to quantify the resources going to research and development. To do that we build up an R&D stock asset by aggregating past expenditures. We use anywhere from two years of data for the autos and auto parts to 8 years for pharmaceuticals and biotech, while in the tech sector the window varies from three-to-four years.
- Companies in the top-quintile of our R&D stock-to-market cap measure have outperformed the market by +6 percentage points per annum since 1975, and by a little more than that in this decade. The sector-neutral results are about a point less, with the best performance, +8 to +9 points of alpha per year, in the semiconductor and biotech industries. The greater the volatility of fundamentals the more likely it is that the intellectual property can get mispriced. The idea works even if we take cap out of the equation, with the ratio of R&D stock-to-assets generating +4 points of excess return a year. In this decade the performance was the same whether we used either cap or assets were in the denominator, and the important thing was acknowledging the existence of the asset. That's apparent in the win rate and 55% of stocks with top-quintile R&D stock-to-asset ratios have outperformed the market since 2010.
- We've long used the R&D stock in our quantitative models, adding it to book value to create an adjusted number for book. This work leads us to believe it should stand alone, as it's been consistently useful in the technology and health care sectors. We expect that to continue. Appendix 1 that begins on page 9 presents the large-cap stocks that populate either the best quintile of R&D stock-to-capitalization or that based on the ratio to assets. Amazon, Ferrari, Autodesk, Intuit and Bristol Myers Squibb are among the diverse group of stocks on the list.

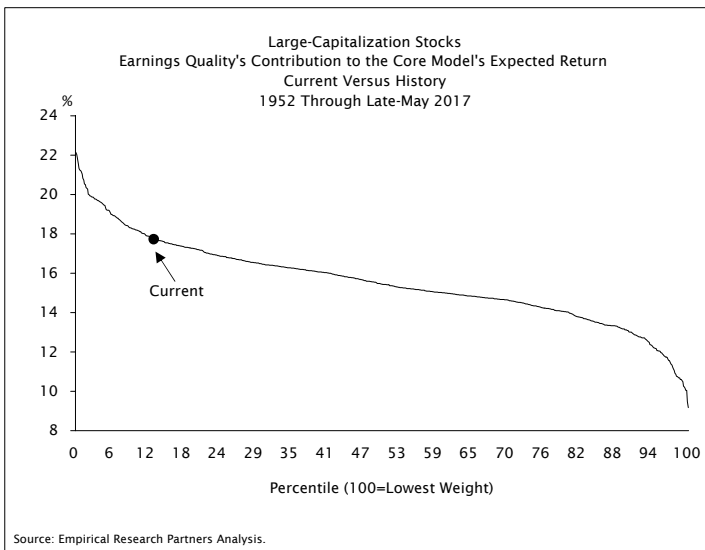
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Conclusions in Brief

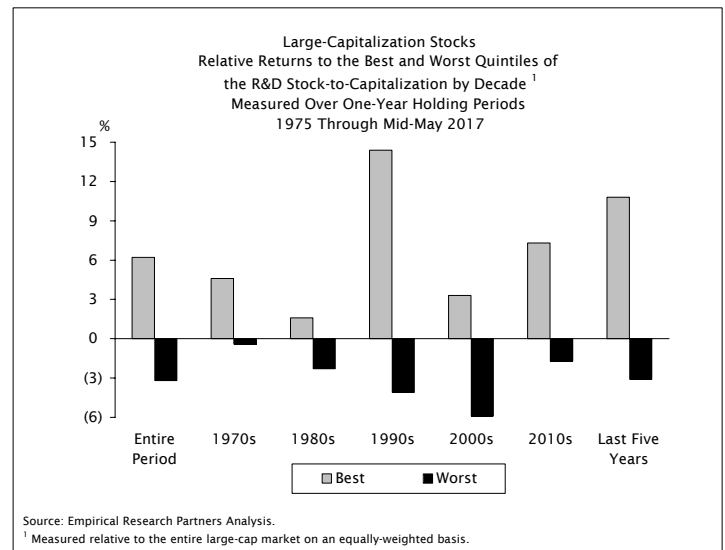
- Our regime indicator has shifted to a growth-tilted stance...
- ...In part because investors are more excited about capital spending:



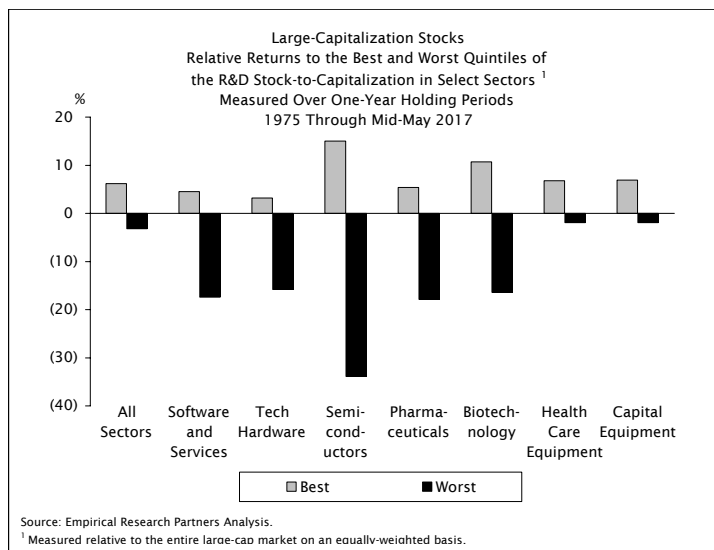
- In a growth-tilted regime earnings quality is important:



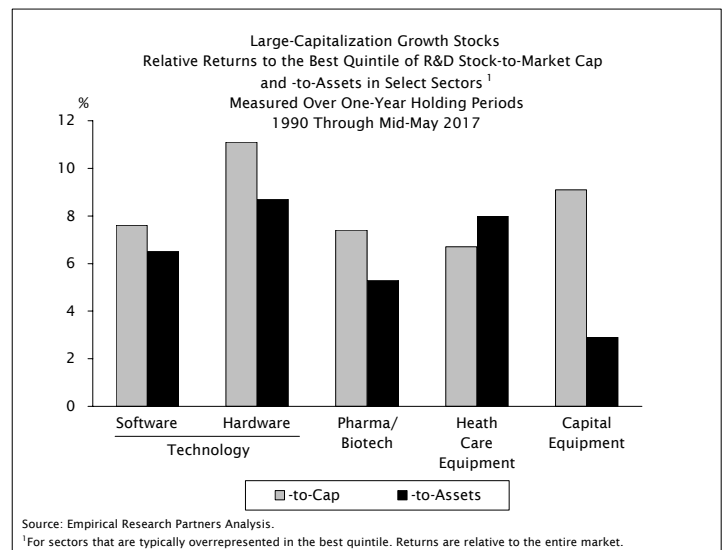
- It's been profitable to buy R&D on the cheap...



- ...With the best results in volatile industries like semis and biotech:



- The R&D-to-assets ratio has also helped stock picking:

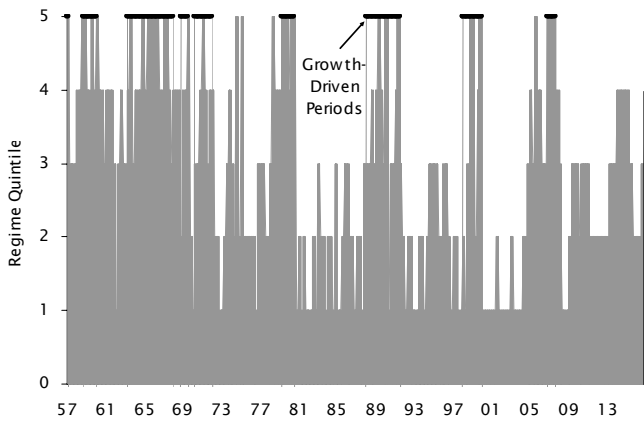


Regime Change: From Neutral to Growth-Tilted

Faith in Big Spenders Reemerges

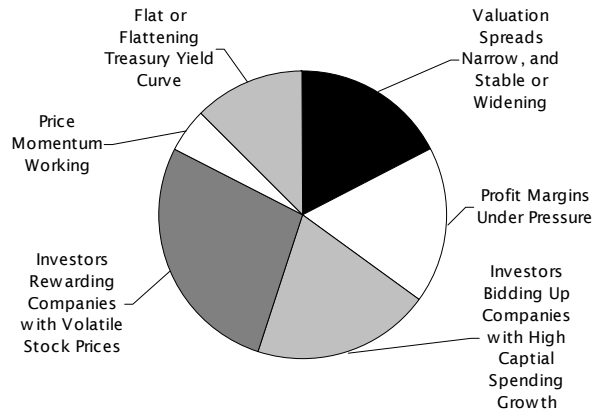
Our U.S. regime indicator, that predicts what mindset will prevail when picking stocks, recently shifted from the neutral stance it had been in for four months to a growth-tilted one (see Exhibit 1).¹ From here a move to a full-blown growth-driven regime is possible, although it's equally likely that there will be a return to a neutral stance. That's what happened back in Fall of 2015, the previous time we were in a growth-tilted regime. We were last in a growth-driven regime a decade ago, at the peak of the commodities boom. As shown by the black horizontal lines at the top of the chart, such periods tend to be short-lived and often foreshadow the end of the cycle.

Exhibit 1: Regime Indicator
(5=Growth-Driven Dynamic; 1=Valuation-Driven Dynamic)
1957 Through Late-May 2017



Source: Empirical Research Partners Analysis.

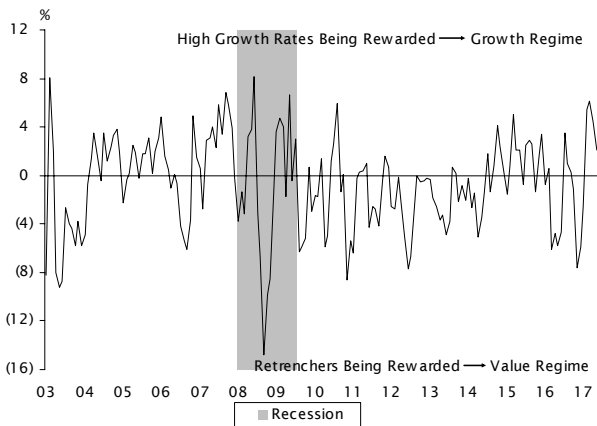
Exhibit 2: U.S. Regime Indicator
What Foretells a Market with a Growth Dynamic
1952 Through May 2017



Source: Empirical Research Partners Analysis.

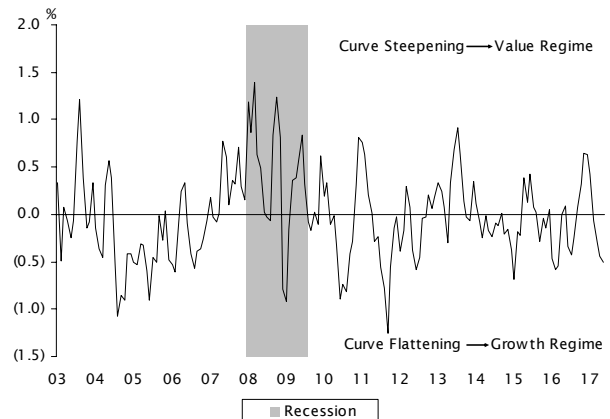
The regime indicator is made up of six types of factors, and two of them, that comprise a third of it, have driven the shift to a growth stance (see Exhibit 2). Investors have been favorably disposed to companies that boost their capital expenditures by most, and, the Treasury yield curve has flattened (see Exhibits 3 and 4). Those factors were enough to cause the indicator to change its recommendation because valuation spreads are below average, meaning that for the most part we're not getting paid to make an entire portfolio worth of traditional value bets (see Exhibit 5). They've contracted by two standard deviations since peaking in February of last year.

Exhibit 3: Large-Capitalization Stocks
Capital Spending Growth Analysis
Quarterly Return Differentials: High Versus Low Growth
2003 Through Mid-May 2017



Source: National Bureau of Economic Research, Empirical Research Partners Analysis.

Exhibit 4: The U.S. Treasury Yield Curve¹
Three-Month Change in Spreads
2003 Through Mid-May 2017



Source: National Bureau of Economic Research, Empirical Research Partners Analysis.

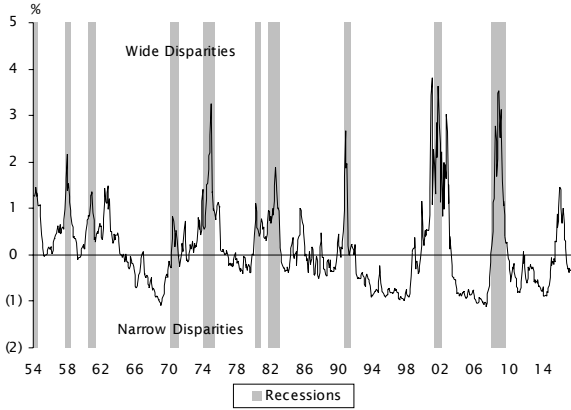
¹Measured between the 10-year and 3-month U.S. Treasury.

¹Stock Selection: Research and Results January 2017. "Regime Change: From Value-Tilted to Neutral."

Politics Create a Sharp Turn in Sentiment

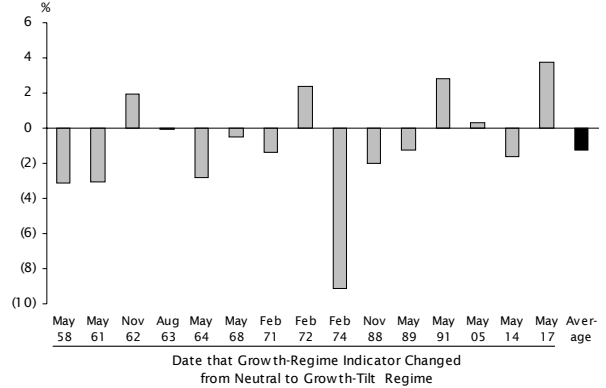
Our indicator recommended a value tilt from February of 2016 until late-January of this year when it returned to a neutral stance. Since then growth stocks have performed better than expected, benefiting from a more resolute Fed, seasonal weakness in the economic data, a couple of disappointing inflation reports and the litany of problems besetting the Trump agenda. The closest analog to the current episode occurred in the early-1990s, when disinflationary pressures mounted following the S&L crisis (see Exhibit 6).

Exhibit 5: Large-Capitalization Stocks Valuation Spreads The Top Quintile Compared to the Average 1954 Through Mid-May 2017



Source: National Bureau of Economic Research, Empirical Research Partners Analysis.

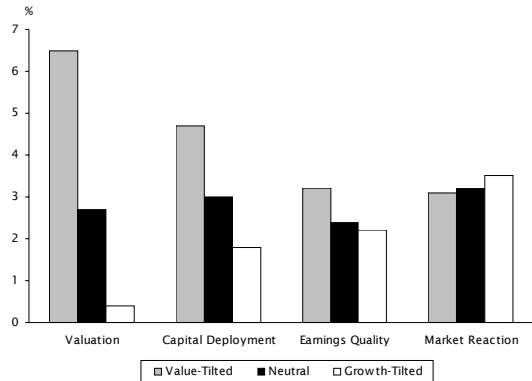
Exhibit 6: Large-Capitalization Growth Stocks Relative Returns Five Months Prior to a Shift from Neutral to Growth-Tilt Regime 1954 Through Late-May 2017



Source: Empirical Research Partners Analysis.

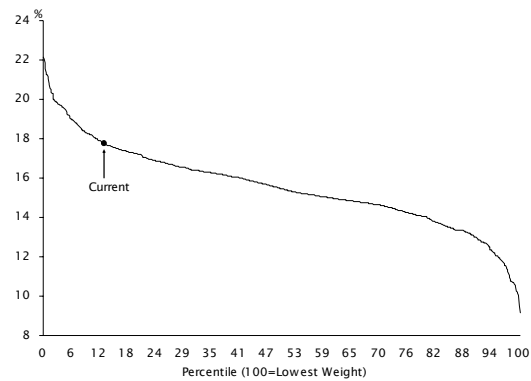
In growth-tilted regimes investors are often becoming more excited about the prospects for Corporate America, leading them to care less about valuation and the conservative deployment of capital (see Exhibit 7). To take advantage of that we vary the factor weights in our quantitative models, within bounds, based on the level of our valuation spreads and our read of regime. In a growth-tilted one more emphasis goes to analyses of stock price behavior and to our earnings quality super factor, that's focused on the *production* of free cash flow (see Exhibit 8). Valuation considerations get less weight than normal.

Exhibit 7: Large-Capitalization Stocks Relative Returns to the Top Quintiles of Our Super Factors in Select Regimes Measured Over One-Year Holding Periods 1954 Through Late-May 2017



Source: Empirical Research Partners Analysis.

Exhibit 8: Large-Capitalization Stocks Earnings Quality's Contribution to the Core Model's Expected Return Current Versus History 1952 Through Late-May 2017



Source: Empirical Research Partners Analysis.

Conclusion: Putting Body English on the Ball

Our regime indicator provides us with a framework for assessing the sentiment of investors. We use its message to tweak the way we assemble the components of our quantitative models, and more broadly, to inform our thinking. Stocks are harder to model in growth regimes because disbelief is temporarily suspended, and the here and now takes precedence. In that setting we pay more attention than normal to cash flow and profit generation and the reactions of investors to it. Generally, good is good, and we want to hold on to our winners.

R&D: A Better Asset?

Intellectual Property is Different

There's been a meaningful change in the make up of corporate assets in the past two decades, with intellectual property taking on greater importance. For example, in 1996 outlays for software represented around 9% of private-sector investment outlays and now their share is 15% (see Exhibit 9). R&D expenditures have gone up too, rising from 12% to 15% of the total. Together those two categories represent 10% of the base of fixed assets, up from a 7.5% share 20 years ago (see Exhibit 10). We'd expect the share of assets to grow more slowly than that of expenditures because in estimating the stock the Bureau of Economic Analysis assumes that both categories have short useful lives. They're using just over two years for software and a little more than five for R&D expenditures.

Exhibit 9: Private Non-Residential Investment Outlays Software and R&D Shares 1947 Through 2016

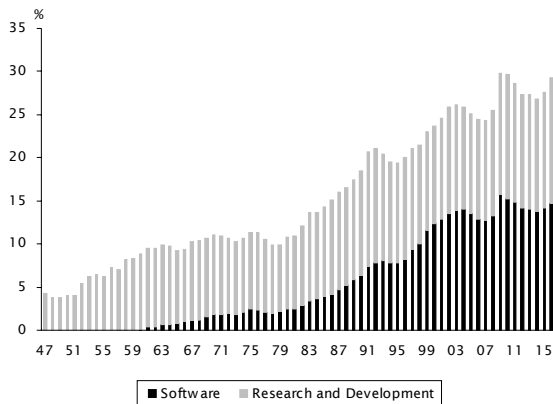
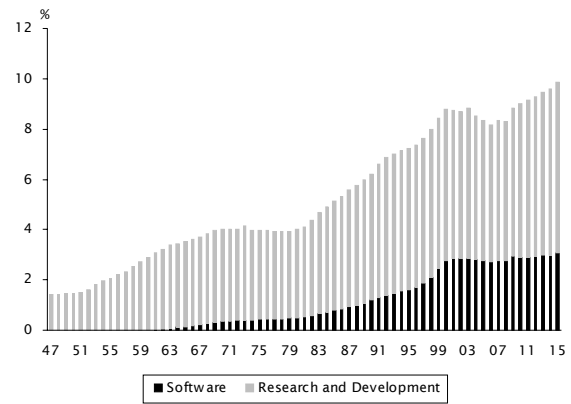


Exhibit 10: Private Non-Residential Fixed Assets Software and R&D Shares 1947 Through 2015



Source: Bureau of Economic Analysis, Empirical Research Partners Analysis.

Source: Bureau of Economic Analysis, Empirical Research Partners Analysis.

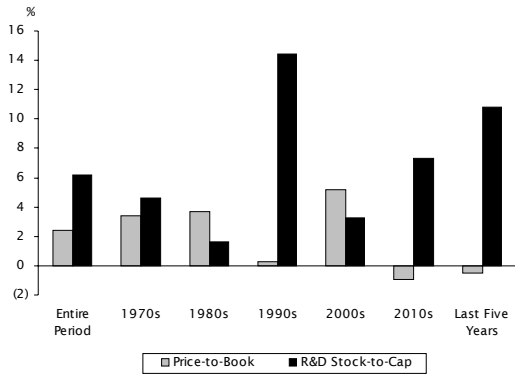
Equity investors have behaved as though intellectual property was the more valuable asset, while their outlook for traditional fixed assets is less rosy. That's apparent in Exhibit 11 that presents the relative returns earned by stocks populating the lowest quintile of price-to-book, relative to those for companies with lowly-valued R&D. To produce the latter measure we establish an R&D asset by aggregating past expenditures. We add up three-to-four years of them in the technology sector and eight years of data in pharmaceuticals and biotechnology. In autos the window is just two years, while in most other sectors it's three to four.² In this and subsequent charts the performance of companies that have R&D assets, around 40% of the total, is compared to that for the entire large-cap market. Our conclusions wouldn't change if the comparator were only those companies carrying that asset.

Since the 1990s in particular, paying attention to the valuation of R&D has proven to be far more useful than that focusing on that of book value. Some of the performance differential has to do with where the low multiples of book value have been concentrated, and those stocks have been predominantly drawn from six sectors: financials, REITs, utilities, energy, industrial commodities and consumer durables (see Exhibit 12). The problems of the two commodity sectors have weighed on the results of that group. The composition of the R&D-heavy companies is considerably different, with software most overrepresented in the low-multiple bucket. The tech, pharmaceuticals, biotech and auto sectors perpetually populate that universe. The tide has been rising for most of those businesses and that's reflected in the sterling performance of those with lowly-valued R&D stocks (see Exhibit 13). For example since 1990 there's been almost +10 points of annual alpha in the tech sector and about +4.5 points in health care when measured on a sector-relative basis.

The longer-term record of the R&D construct is impressive too, generating significant excess returns in four of the last five decades (see Exhibit 14). Stocks in the best quintile of R&D stock-to-capitalization have outperformed the broad market by more than +6 percentage points per annum since 1975, leading in 57.5% of all months. Over the long run the best performance has come in the semiconductor and biotechnology industries, where sentiment can swing widely, giving us opportunities to buy intellectual capital at a discount (see Exhibit 15). That's turned out to be a good idea.

²Li, W. C. Y. and Bronwyn H. Hall, 2016. "Depreciation of Business R&D Capital," U.S. Bureau of Economic Analysis Working Paper.

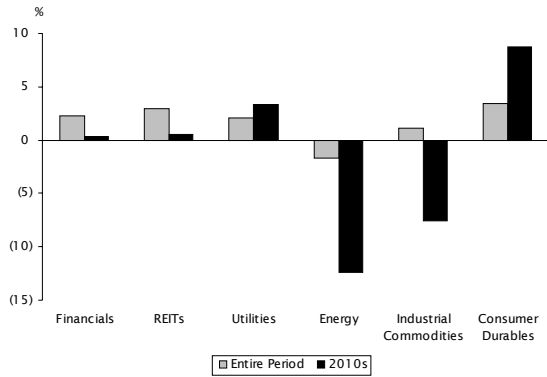
Exhibit 11: Large-Capitalization Stocks
Relative Returns to the Best Quintiles of Price-to-Book and R&D Stock-to-Capitalization¹
Measured Over One-Year Holding Periods 1975 Through Mid-May 2017



Source: Empirical Research Partners Analysis.

¹Measured relative to the entire large-cap market on an equally-weighted basis.

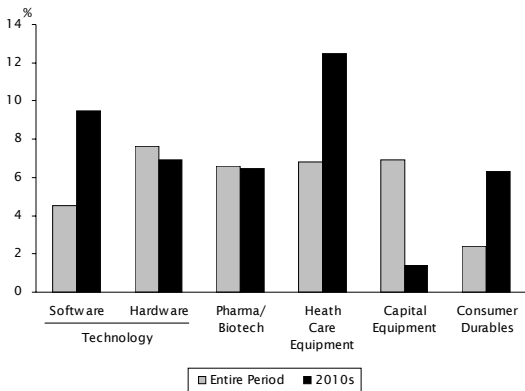
Exhibit 12: Large-Capitalization Stocks
Relative Returns to the Best Quintile of Price-to-Book Ratios in Select Sectors¹
Measured Over One-Year Holding Periods 1975 Through Mid-May 2017



Source: Empirical Research Partners Analysis.

¹For sectors that are typically overrepresented in the best quintile. Returns are relative to the entire market.

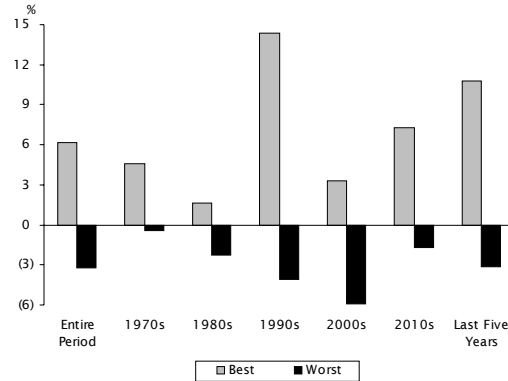
Exhibit 13: Large-Capitalization Stocks
Relative Returns to the Best Quintile of R&D Stock-to-Capitalization in Select Sectors¹
Measured Over One-Year Holding Periods 1975 Through Mid-May 2017



Source: Empirical Research Partners Analysis.

¹For sectors that are typically overrepresented in the best quintile. Returns are relative to the entire market.

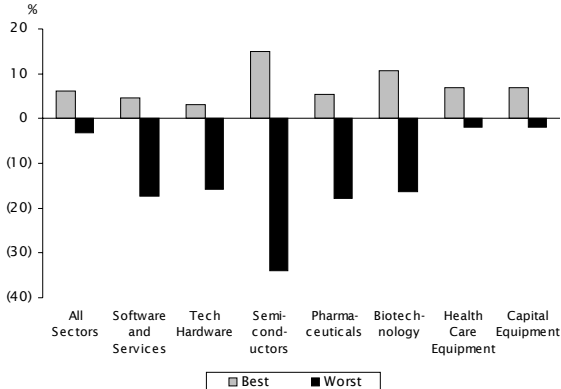
Exhibit 14: Large-Capitalization Stocks
Relative Returns to the Best and Worst Quintiles of the R&D Stock-to-Capitalization by Decade¹
Measured Over One-Year Holding Periods 1975 Through Mid-May 2017



Source: Empirical Research Partners Analysis.

¹Measured relative to the entire large-cap market on an equally-weighted basis.

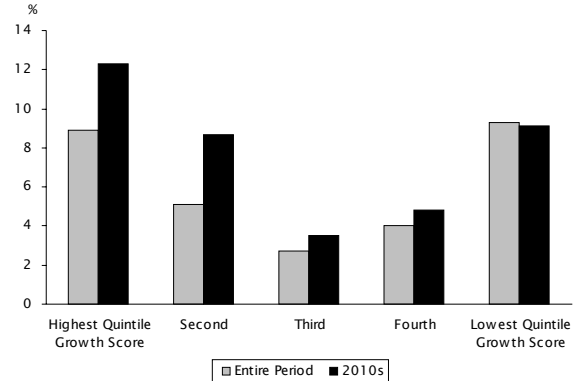
Exhibit 15: Large-Capitalization Stocks
Relative Returns to the Best and Worst Quintiles of R&D Stock-to-Capitalization in Select Sectors¹
Measured Over One-Year Holding Periods 1975 Through Mid-May 2017



Source: Empirical Research Partners Analysis.

¹Measured relative to the entire large-cap market on an equally-weighted basis.

Exhibit 16: Large-Capitalization Stocks
Relative Returns to the Best Quintile of R&D Stock-to-Capitalization¹
Contingent on Growth Scores 1975 Through Late-May 2017



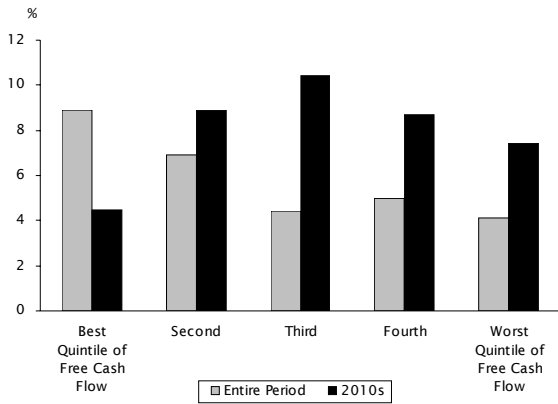
Source: Empirical Research Partners Analysis.

¹Measured relative to the entire large-cap market on an equally-weighted basis.

Other Considerations: Growth Status and Free Cash Flow Yield

We were curious as to whether buying R&D on the cheap was most efficacious if the company had strong growth credentials. We examine that idea in Exhibit 16 (overleaf) that disaggregates the performance of the stocks in the best quintile of R&D stock-to-cap according to their growth scores. The better returns came at the two ends of the spectrum, those with the best and worst scores, a pattern that continued in the current decade. There's both a GARP and value dimension at work here, and sometimes the R&D stock measure has pointed us toward distressed situations that subsequently recovered. We also looked into whether the R&D multiple was synergistic with free cash flow yield and found it was over the long run, but not in the 2010s (see Exhibit 17). That combination remains intuitively appealing.

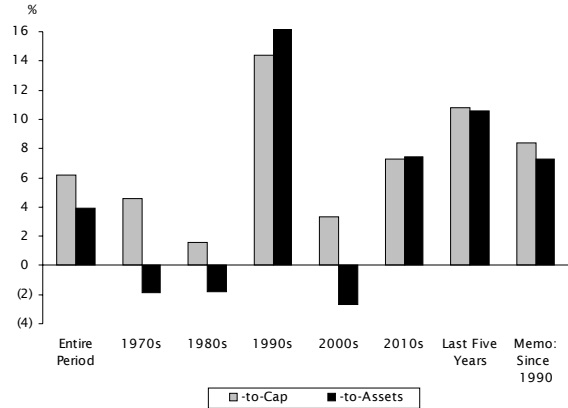
Exhibit 17: Large-Capitalization Stocks Relative Returns to the Best Quintile of R&D Stock-to-Capitalization¹ Contingent of the Free Cash Flow Yield 1975 Through Mid-May 2017



Source: Empirical Research Partners Analysis.

¹Measured relative to the entire large-cap market on an equally-weighted basis.

Exhibit 18: Large-Capitalization Stocks Relative Returns to the Best Quintiles of R&D Stock-to-Capitalization and -to-Assets By Decade¹ 1975 Through Late-May 2017



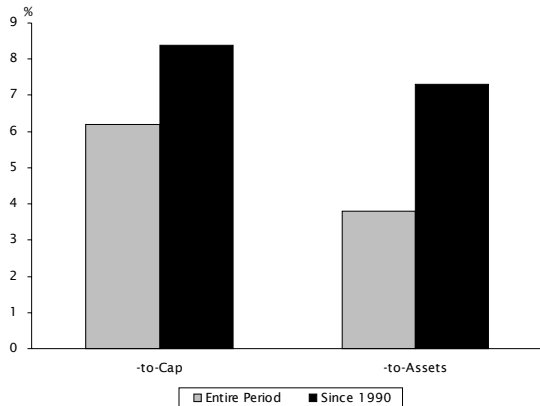
Source: Empirical Research Partners Analysis.

¹Measured relative to the entire large-cap market on an equally-weighted basis.

Taking Value Out of the Equation

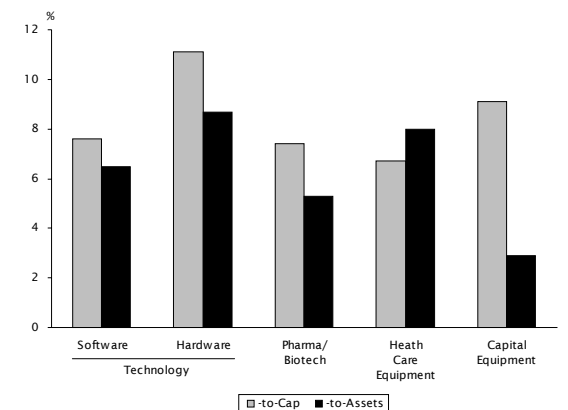
Finally, we considered an alternative to the R&D-to-cap ratio, that has a distinct value flavor in that it has capitalization in its denominator. We constructed an R&D-to-assets ratio and found that over the long run it's been less powerful than the cap-based ratio, although since the Nineties the two have performed similarly (see Exhibit 18). When we restrict the universe to just large-cap growth stocks, the cap-based measure has been a bit better, in part attributable to better results in the industrial capital equipment sector (see Exhibits 19 and 20).

Exhibit 19: Large-Capitalization Growth Stocks Relative Returns to the Best Quintiles of R&D Stock-to-Capitalization and -to-Assets Measured Over One-Year Holding Periods 1975 Through Mid-May 2017



Source: Empirical Research Partners Analysis.

Exhibit 20: Large-Capitalization Growth Stocks Relative Returns to the Best Quintiles of R&D Stock-to-Capitalization and -to-Assets in Select Sectors¹ Measured Over One-Year Holding Periods 1975 Through Late-May 2017



Source: Empirical Research Partners Analysis.

¹For sectors that are typically overrepresented in the best quintile. Returns are relative to the entire market.

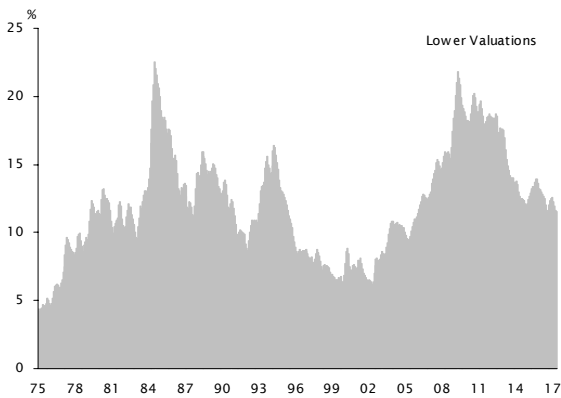
Conclusion: An Idea Worth Modeling

We've long taken account of R&D in our quantitative modeling, combining the stock measure we create with book value and then computing a price multiple with the sum of the two in the denominator. This research suggests that's not the ideal methodology because it dilutes the message from the R&D signal. The R&D stock multiple should stand alone, and it may be better to use the multiple of assets in our growth stock framework where valuation carries less weight. We plan to change our methodology in updates to our models to be made this Summer.

The history of R&D stock-to-cap ratios tells stories that are sometimes different from conventional valuation measures. In Exhibits 21 through 24 we chart it for Johnson & Johnson, Amgen, Adobe and Applied Materials. They've all seen wild swings in the valuation accorded to R&D in their market caps. When they're in favor the ratio is in the 5% to 10% range, when they're not it could reach 20% or higher. In the parts of the market where intellectual capital plays an important role, the stock of R&D is a useful anchor when trying to establish where the value lies. It's a book value for the New Millennium.

Appendix 1 that begins on page 9 presents a list of large-cap stocks that screen in either the best quintile of our R&D stock-to-capitalization measure or a second one based on the ratio of R&D-to-assets. It also includes growth score, free cash flow yield and core model ranks. As usual, most of the stocks are drawn from the technology, health care and auto sectors. At present R&D assets equate to 12% of market cap for the technology stocks on the list, for health care issues it's 16%, and for the autos the number is 17%. Amazon, Intuit, Autodesk, Bristol Myers Squibb and Vertex Pharmaceutical are among the companies with exceptional R&D stock-to-assets ratios.

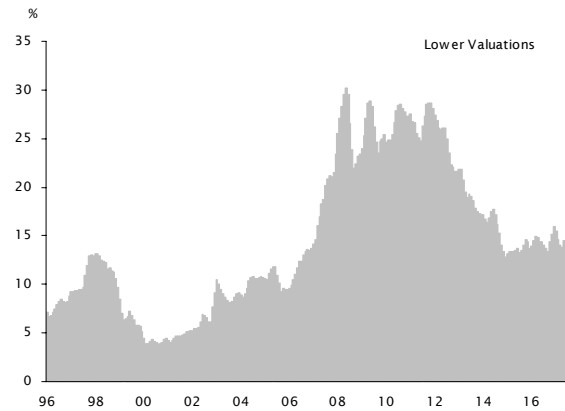
**Exhibit 21: Johnson & Johnson
R&D Stock-to-Market Cap¹
1975 Through Late-May 2017**



Source: Empirical Research Partners Analysis.

¹Data smoothed on a trailing three-month basis.

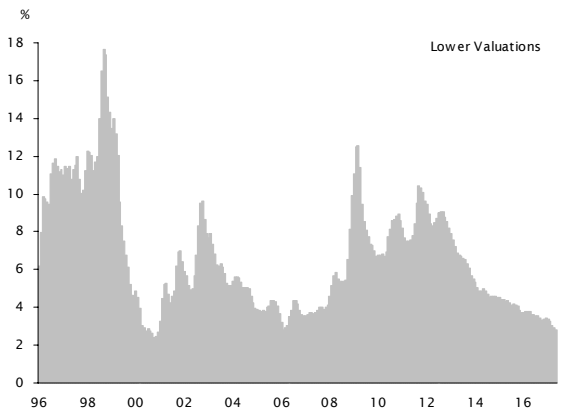
**Exhibit 22: Amgen
R&D Stock-to-Market Cap¹
1996 Through Late-May 2017**



Source: Empirical Research Partners Analysis.

¹Data smoothed on a trailing three-month basis.

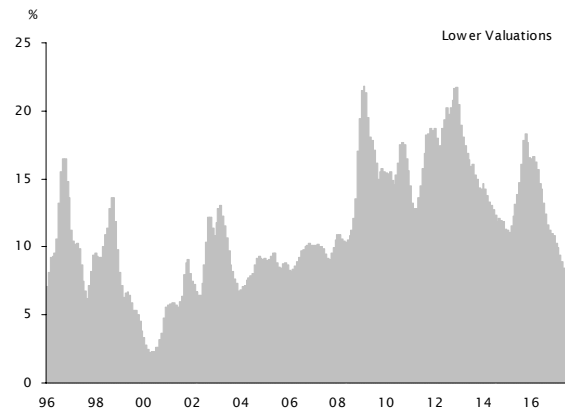
**Exhibit 23: Adobe
R&D Stock-to-Market Cap¹
1996 Through Late-May 2017**



Source: Empirical Research Partners Analysis.

¹Data smoothed on a trailing three-month basis.

**Exhibit 24: Applied Materials
R&D Stock-to-Market Cap¹
1996 Through Late-May 2017**



Source: Empirical Research Partners Analysis.

¹Data smoothed on a trailing three-month basis.

**Appendix 1: Large-Capitalization Stocks
R&D Stock Ranking Report
Sorted by R&D Stock-to-Capitalization and -to-Assets
As of Late-May 2017**

Symbol	Company	Price	Quintile Rank (1=Highest; 5=Lowest)					R&D Stock:		Forward- P/E Ratio	Market Capitalization (\$ Billion)
			R&D Stock -to-Market Capitalization	R&D Stock -to-Total Assets	Growth Score	Free Cash Flow Yield	Core Model Rank	-to-Cap	-to-Assets		
Consumer Durables											
ALV	AUTOLIV INC	\$106.90	1	2	4	4	4	10 %	11 %	17.0 x	\$9.4
GM	GENERAL MOTORS CO	33.22	1	3	4	1	2	24	5	5.4	50.1
HMC	HONDA MOTOR CO LTD	27.74	1	3	5	1	2	18	5	8.4	50.0
SNE	SONY CORP	35.55	1	4	4	1	2	14	4	16.1	45.0
F	FORD MOTOR CO	11.05	1	4	5	1	2	24	4	7.1	44.0
FCAU	FIAT CHRYSLER AUTOMOBILES NV	10.32	1	4	4	1	1	25	5	5.2	20.7
RACE	FERRARI NV	84.79	2	1	4	2	2	6	22	32.4	16.0
Retail and Other Consumer Cyclicals											
AMZN	AMAZON.COM INC	\$971.54	2	1	1	4	4	6 %	37 %	143.1 x	\$464.4
Capital Equipment											
PHG	KONINKLIJKE PHILIPS ELECTRONICS -ADR	\$35.33	1	2	4	1	1	13 %	12 %	18.9 x	\$32.9
TXT	TEXTRON INC	47.12	1	3	3	3	3	11	9	18.8	12.6
Technology:											
Software and Services											
TWTR	TWITTER INC	\$18.15	1	1	5	3	2	11 %	21 %	51.9 x	\$13.3
SNPS	SYNOPSYS INC	72.60	1	1	2	3	2	15	31	21.9	10.9
CDNS	CADENCE DESIGN SYSTEMS INC	34.02	1	1	1	3	2	15	64	24.7	9.5
SYMC	SYMANTEC CORP	29.79	1	2	1	5	3	9	9	15.0	18.1
CA	CA INC	31.50	1	2	4	1	2	9	9	12.7	13.2
TDC	TERADATA CORP	28.77	1	2	4	1	1	12	18	22.9	3.8
EA	ELECTRONIC ARTS INC	109.01	2	1	1	3	2	7	30	22.4	33.6
INTU	INTUIT INC	129.15	2	1	1	3	2	5	36	27.6	33.1
ADSK	AUTODESK INC	112.97	2	1	1	5	3	6	35	99.1	24.9
WDAY	WORKDAY INC	98.44	2	1	1	5	5	5	35	117.2	20.3
RHT	RED HAT INC	87.63	2	1	1	3	1	6	19	28.8	15.6
CTXS	CITRIX SYSTEMS INC	82.06	2	1	2	1	2	8	19	17.7	12.4
YNDX	YANDEX N.V.	28.47	2	1	1	4	3	5	23	0.5	9.2
SPLK	SPLUNK INC	66.43	2	1	1	5	5	5	28	74.2	9.2
SQ	SQUARE INC	21.64	2	1	2	5	4	6	30	NM	8.1
TEAM	ATLASSIAN CORP PLC	35.43	2	1	1	4	4	6	36	80.6	8.0
PTC	PTC INC	55.90	2	1	2	5	4	7	20	42.8	6.5
NOW	SERVICENOW INC	101.70	3	1	1	5	3	3	24	87.7	17.3
SHOP	SHOPIFY INC	90.02	4	1	1	5	5	2	26	NM	8.2
Hardware											
ERIC	TELEFONAKTIEBOLAGET LM ERICSSON	\$6.99	1	1	5	3	3	33 %	24 %	25.7 x	\$23.4
STX	SEAGATE TECHNOLOGY PLC	42.63	1	1	3	1	1	20	26	9.3	12.7
JNPR	JUNIPER NETWORKS INC	29.45	1	1	3	1	1	18	21	13.2	11.3
NTAP	NETAPP INC	39.49	1	1	4	1	1	16	19	12.9	10.7
KEYS	KEYSIGHT TECHNOLOGIES INC	37.56	1	1	2	2	2	12	21	15.6	6.9
BBRY	BLACKBERRY LTD	11.30	1	1	5	5	5	14	26	NM	6.0
NOK	NOKIA CORP	6.54	1	2	2	5	4	20	17	27.4	38.5
HPQ	HP INC	18.96	1	2	1	1	1	9	11	11.7	32.1
WDC	WESTERN DIGITAL CORP	88.03	1	2	2	1	3	15	13	7.7	25.6
ARRS	ARRIS INTERNATIONAL PLC	27.39	1	2	5	1	1	21	15	11.0	5.2
HPE	HEWLETT PACKARD ENTERPRISE	18.86	1	3	5	4	1	15	6	12.9	31.4
XRX	XEROX CORP	6.95	1	3	5	1	1	12	5	8.4	7.1
ANET	ARISTA NETWORKS INC	143.20	2	1	1	4	4	5	26	36.5	10.3
FFIV	F5 NETWORKS INC	125.99	2	1	1	1	1	8	27	15.0	8.2
Semiconductors											
INTC	INTEL CORP	\$35.86	1	1	3	1	2	18 %	27 %	12.6 x	\$168.9
QCOM	QUALCOMM INC	59.22	1	1	5	2	1	15	24	14.3	87.5
LRCX	LAM RESEARCH CORP	153.43	1	1	1	2	1	9	19	14.5	25.2
XLNX	XILINX INC	63.97	1	1	2	2	1	9	29	23.0	15.9
STM	STMICROELECTRONICS NV	16.11	1	1	3	4	2	24	43	20.9	14.7
MXIM	MAXIM INTEGRATED PRODUCTS	46.84	1	1	2	2	1	9	31	20.3	13.2
AMD	ADVANCED MICRO DEVICES	10.89	1	1	2	5	5	25	77	155.6	10.3
MRVL	MARVELL TECHNOLOGY GROUP LTD	16.36	1	1	4	5	4	30	54	13.9	8.3
TER	TERADYNE INC	34.91	1	1	3	3	1	10	26	18.7	7.0
MU	MICRON TECHNOLOGY INC	28.29	1	2	3	5	3	13	12	6.2	31.3
QRVO	QORVO INC	78.55	1	2	3	4	5	10	15	12.2	9.9
ON	ON SEMICONDUCTOR CORP	15.29	1	2	1	1	1	17	16	12.0	6.4
MSCC	MICROSEMI CORP	48.52	1	2	3	1	1	12	15	12.3	5.6
UMC	UNITED MICROELECTRONICS CORP -ADR	2.05	1	3	5	5	1	20	9	18.9	5.2
AMAT	APPLIED MATERIALS INC	44.91	2	1	1	2	1	8	21	14.4	48.5
KLAC	KLA-TENCOR CORP	102.49	2	1	1	2	1	8	24	16.0	16.1
Health Care:											
Pharmaceuticals											
JNJ	JOHNSON & JOHNSON	\$127.52	1	1	2	2	2	11 %	27 %	18.0 x	\$343.7
NVS	NOVARTIS AG	81.06	1	1	4	2	3	19	31	17.2	212.9
PFE	PFIZER INC	32.14	1	1	5	1	3	19	21	12.6	191.8
MRK	MERCK & CO	64.55	1	1	4	3	5	21	38	16.8	176.9
SNY	SANOFI	49.07	1	1	4	2	2	21	24	15.7	124.8
GSK	GLAXOSMITHKLINE PLC	42.96	1	1	2	2	2	24	34	15.1	105.0
BMJ	BRISTOL-MYERS SQUIBB CO	54.21	1	1	2	4	3	23	64	18.4	89.3
AZN	ASTRAZENECA PLC	34.08	1	1	4	4	5	29	41	18.4	86.3
LLY	LILLY (ELI) & CO	77.99	1	1	3	2	3	28	65	19.0	86.1
BIO	BIO-RAD LABORATORIES INC	219.36	1	1	3	5	4	15	24	77.0	6.5
QGEN	QIAGEN NV	32.75	1	2	3	3	4	9	17	26.4	7.5

Source: Empirical Research Partners Analysis.

**Appendix 1 (cont.): Large-Capitalization Stocks
R&D Stock Ranking Report
Sorted by R&D Stock-to-Capitalization and -to-Assets
As of Late-May 2017**

Symbol	Company	Price	Quintile Rank (1=Highest; 5=Lowest)					R&D Stock:		Forward- P/E Ratio	Market Capitalization (\$ Billion)
			R&D Stock -to-Market Capitalization	R&D Stock -to-Total Assets	Growth Score	Free Cash Flow Yield	Core Model Rank	-to-Cap	-to-Assets		
Pharmaceuticals (cont.)											
AGN	ALLERGAN PLC	\$220.66	1	3	3	2	4	10 %	6 %	13.7 x	\$74.1
TEVA	TEVA PHARMACEUTICAL INDUSTRIES -ADR	28.76	1	3	5	1	4	25	8	5.9	29.2
MYL	MYLAN NV	39.59	1	3	3	1	4	13	8	7.5	21.2
ILMN	ILLUMINA INC	174.72	2	1	1	4	4	7	36	47.9	25.5
Biotechnology											
AMGN	AMGEN INC	\$154.07	1	1	2	1	1	15 %	22 %	12.4 x	\$113.4
CELG	CELGENE CORP	117.31	1	1	1	3	1	15	46	16.1	91.6
GILD	GILEAD SCIENCES INC	64.69	1	1	3	1	2	15	22	8.0	84.5
BIIB	BIOGEN INC	248.10	1	1	2	2	4	15	37	12.1	53.1
REGN	REGENERON PHARMACEUTICALS	461.37	1	1	1	4	3	12	76	35.6	49.0
VRTX	VERTEX PHARMACEUTICALS INC	116.59	1	1	1	5	2	14	133	70.0	29.0
BMRN	BIOMARIN PHARMACEUTICAL INC	88.36	1	1	1	5	5	19	74	NM	15.4
SGEN	SEATTLE GENETICS INC	66.67	1	1	1	5	4	13	155	NM	9.5
ALNY	ALNYLAM PHARMACEUTICALS INC	74.87	1	1	2	5	4	18	101	NM	6.5
IONS	IONIS PHARMACEUTICALS INC	45.14	1	1	1	5	1	21	106	NM	5.6
UTHR	UNITED THERAPEUTICS CORP	121.46	1	1	2	1	1	17	37	8.6	5.5
ALXN	ALEXION PHARMACEUTICALS INC	104.64	1	2	2	3	3	10	17	19.8	23.5
SHPG	SHIRE PHARMACEUTICALS GROUP -ADR	184.99	1	3	2	3	5	10	8	12.3	55.8
INCY	INCYTE CORP	136.16	2	1	1	5	4	7	123	NM	27.9
Health Care - Equipment and Services											
VAR	VARIAN MEDICAL SYSTEMS INC	\$95.95	2	1	3	4	3	7 %	19 %	23.7 x	\$8.8
EW	EDWARDS LIFESCIENCES CORP	113.54	3	1	1	4	5	4	22	32.2	23.9
ABMD	ABIOMED INC	134.74	4	1	1	5	5	2	24	53.2	5.9

Source: Empirical Research Partners Analysis.