Empirical Research Partners
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March 6, 2018

# Portfolio Strategy March 2018

## *Where We Stand: The Bond Surrogates, Back on Earth*
## *The Semis: Gang Members, For Better or Worse*

*Playing Defense is Now an Option*

- The valuations of the Bond Surrogates, the 10% of the equity market with relative returns most tied to moves in the bond market, have returned to earth, as the unusual premium they carried in the post-Crisis period has been wrung out. The process has been painful and the utilities, REITs and consumer staples have lagged the market by more than (30) percentage points since April of 2016. That was the date at which the real earnings of the bottom 80% of the income distribution finally moved above the peak level of the prior cycle, spurring consumption and causing this expansion to begin to resemble its predecessors. The unwinding of the Bond Surrogate phenomenon was a function of not only rising interest rates, but also differentials in growth rates and changes in investors' perceptions of their stability. The top line of the tech sector has been growing at five times that of utilities or staples, making stability an expensive commodity. As the pace of investment in commercial real estate picked up and as retailers have downsized, the REITs have come to be seen as less reliable and no longer a viable alternative to bonds.
- The pharmaceuticals haven't been members of the Surrogate fraternity, never quite able to make the cut. The doubling in the growth rate of the over-65 population called into question their pricing power, making the stocks' earnings prospects less secure. A degradation in margins validated the concerns. The stocks now look cheap enough to merit some consideration, and they could help diversify cyclically-focused portfolios.
- The flattening out of the market's valuation structure is well timed, because threats to the status quo are mounting. While we don't think the odds favor a meaningful acceleration in inflation, the risk of an error in monetary policy is up. There are some similarities to the guns-and-butter era of the 1960s. More important, the administration appears to be following through on its protectionist rhetoric, a real threat to the Bretton Woods II world order. We're interested in making portfolios somewhat more balanced, and Appendix 1 on page 13 ranks the pharmaceuticals using our fundamental model, that pays no attention to momentum.

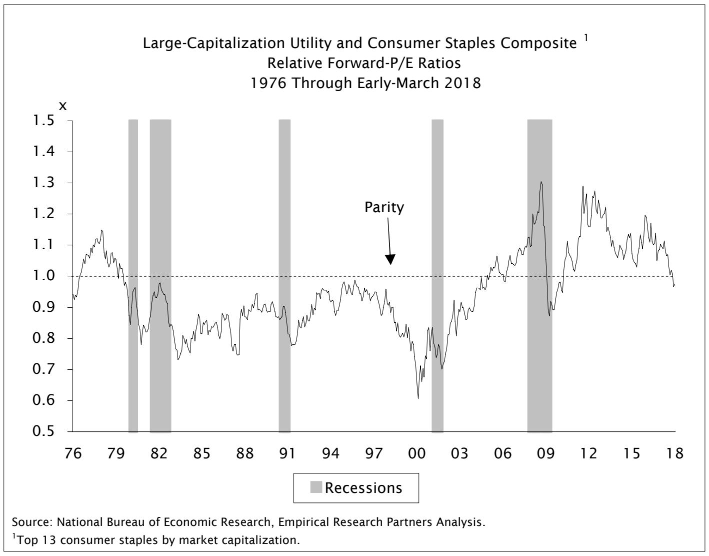
*The Semis: Gang Members, For Better or Worse*

- Throughout this expansion we've liked the semis and they've consistently been among the market's leadership. They've benefited mightily from the build out of the cloud and demand has been strong while at the same time the companies' capital intensity declined. That's led to exceptional free cash flow margins, putting the stocks among the market's elite. As the use of semiconductors has become ubiquitous, the stocks' risk characteristics have come to resemble those of the market itself.
- More than elsewhere, in semiconductors, the money has been made from betting against skepticism in the face of good news. That's because cycles have been smoothed out by increases in the breath of demand. Free cash flow yields, measured on a point-in-time or normalized basis, the key measures, remain reasonably supportive.
- What concerns us about the semis is that their capital spending has been booming for the better part of two years. Last year, they, together with the FANG stocks, accounted for 60% of all the growth in outlays by the core of the S&P 500 (i.e., ex-commodities). We see that linkage in the 60%+ relative return correlation between the FANG and semiconductor issues. The operating leverage of the entire equity market is increasingly tied to the build out of the cloud, making it one big bet. For those with outsized bets on semis, like our Distrusted Fifty portfolio, we think it's sensible to pare them a bit. Appendix 2 on page 13 ranks the stocks using our growth model. Most are still well ranked.

Nicole Price (212) 803-7935 Sungsoo Yang (212) 803-7925 Yi Liu (212) 803-7942 Yu Bai (212) 803-7919 Yuntao Ji (212) 803-7920 Janai Haynes (212) 803-8005

# Conclusions in Brief

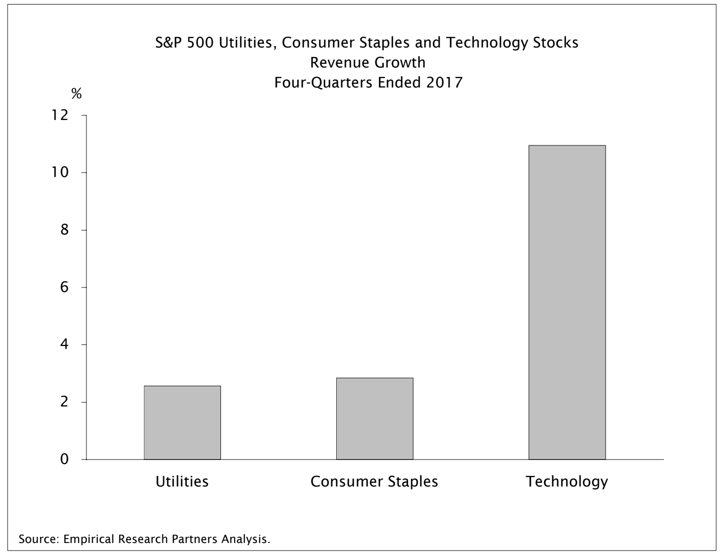
- The post-Crisis valuation premium of the bond surrogates has been wrung out...




Large-Capitalization Utility and Consumer Staples Composite [1]
Relative Forward-P/E Ratios
1976 Through Early-March 2018

Source: National Bureau of Economic Research, Empirical Research Partners Analysis.
[1]Top 13 consumer staples by market capitalization.

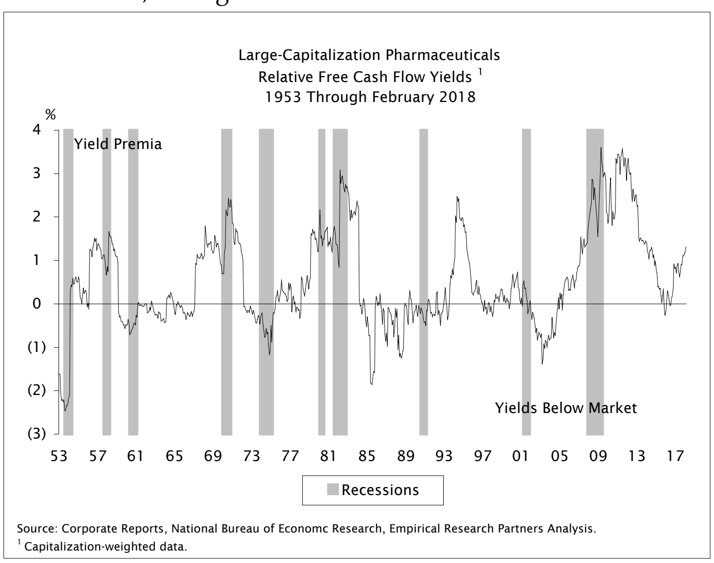
- …As higher interest rates brought the mispricing of their growth rates to the fore:




S&P 500 Utilities, Consumer Staples and Technology Stocks
Revenue Growth
Four-Quarters Ended 2017

Source: Empirical Research Partners Analysis.

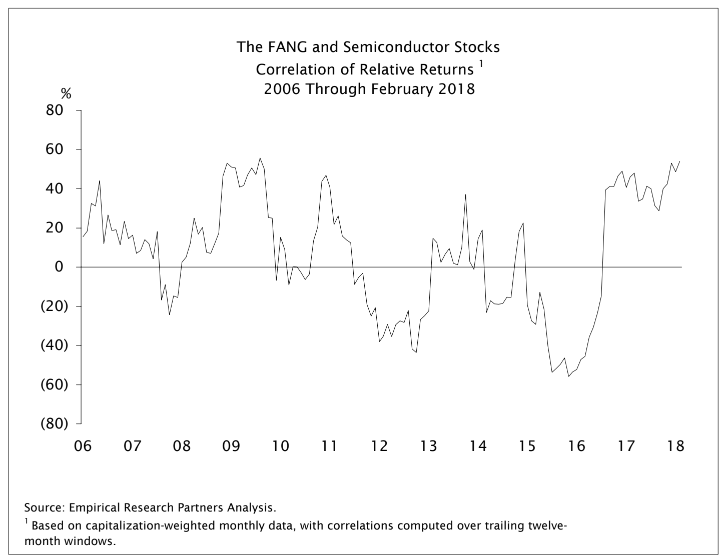
- As a result, we're becoming interested in the pharmaceuticals, surrogate wannabes:




Large-Capitalization Pharmaceuticals
Relative Free Cash Flow Yields [1]
1953 Through February 2018

Source: Corporate Reports, National Bureau of Economc Research, Empirical Research Partners Analysis.
[1] Capitalization-weighted data.

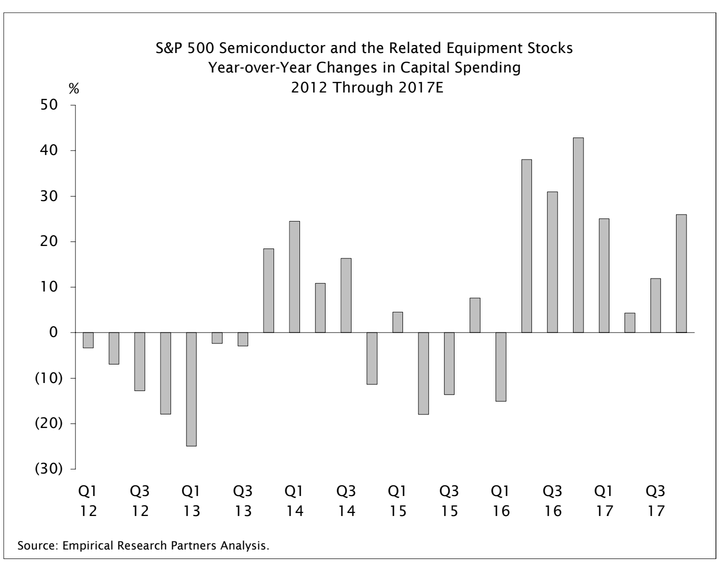
- The semis and FANG stocks are joined at the hip…




The FANG and Semiconductor Stocks
Correlation of Relative Returns [1]
2006 Through February 2018

Source: Empirical Research Partners Analysis.
[1] Based on capitalization-weighted monthly data, with correlations computed over trailing twelve-month windows.

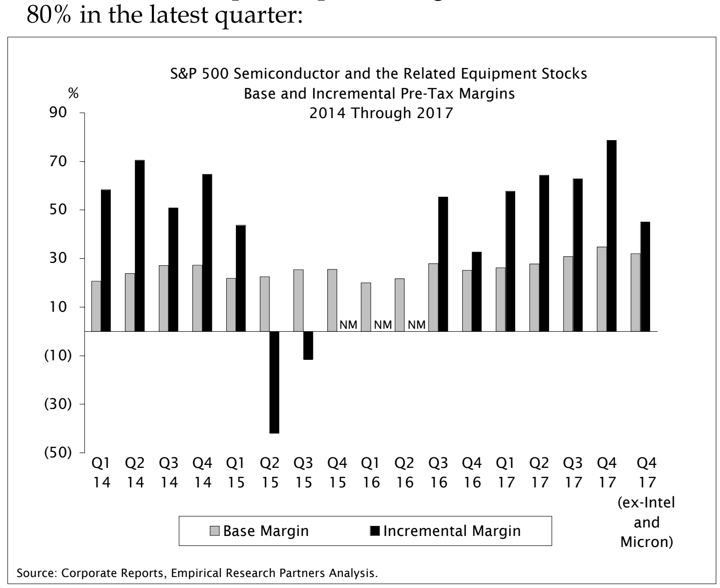
- …And the semis' capital spending has surged, making us a little nervous:




S&P 500 Semiconductor and the Related Equipment Stocks
Year-over-Year Changes in Capital Spending
2012 Through 2017E

Source: Empirical Research Partners Analysis.

- Their incremental pre-tax profit margins were a remarkable 80% in the latest quarter:




S&P 500 Semiconductor and the Related Equipment Stocks
Base and Incremental Pre-Tax Margins
2014 Through 2017

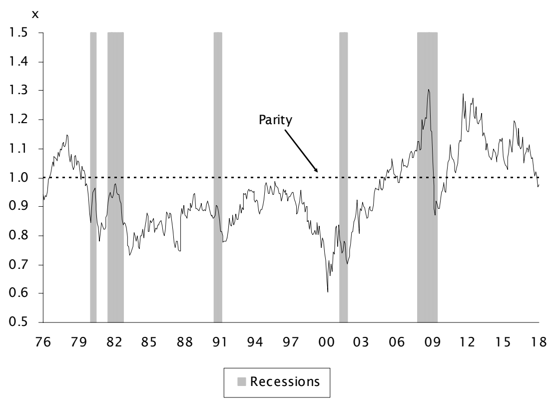
Source: Corporate Reports, Empirical Research Partners Analysis.

# Where We Stand: The Bond Surrogates, Back on Earth

## *Playing Defense is Now an Option*

We've been playing offense throughout this decade because we thought we were being paid to do so, and, it was the right thing to do. What also prompted us to do that was that the price of playing defense was prohibitive. That's no longer the case. The Bond Surrogates, the 10% of the market with relative performance most tied to moves in the bond market, have been humbled, and the valuation premium they'd carried throughout the post-Crisis period has been wrung out (see Exhibit 1). They've performed quite poorly in the last couple of years as investors came to the realization that this expansion wouldn't turn out to be entirely different from its predecessors (see Exhibits 2 and 3). That realization occurred when the bottom 80% of the income distribution saw their real incomes pass through the 2007 peak level. The revaluation occurred across the board, in utilities, staples and REITs (see Exhibits 4 through 6). Their multiples could still prove to be vulnerable, but a lot of damage has already been done. We're now back to ground zero and that gives us a wider palette of colors to paint with.

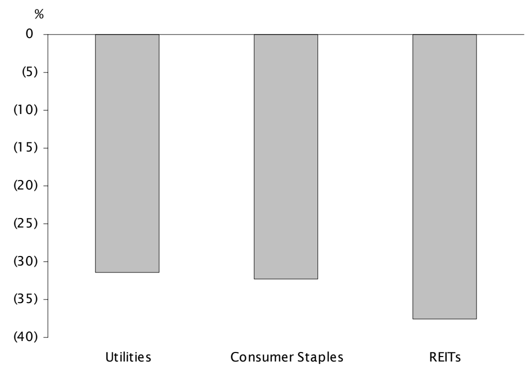
**Exhibit 1: Large-Cap Utility and Consumer Staples Composite[1]
Relative Forward-P/E Ratios
1976 Through Early-March 2018**




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

[1]Top 13 consumer staples by market capitalization.

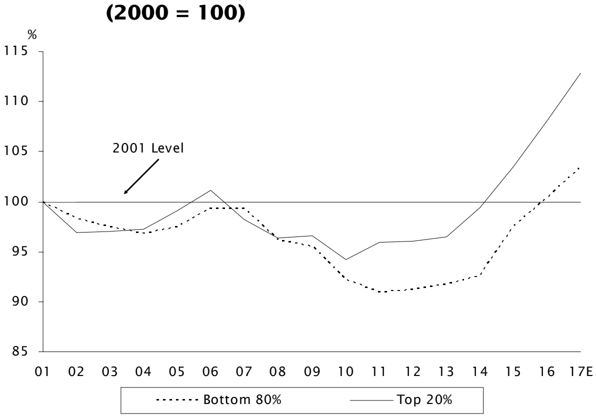
**Exhibit 2: Large-Cap Utilities, Consumer Staples and REITs
Relative Returns[1]
April 2016 Through February 2018**




Source: Empirical Research Partners Analysis.

[1]Capitalization-weighted data.

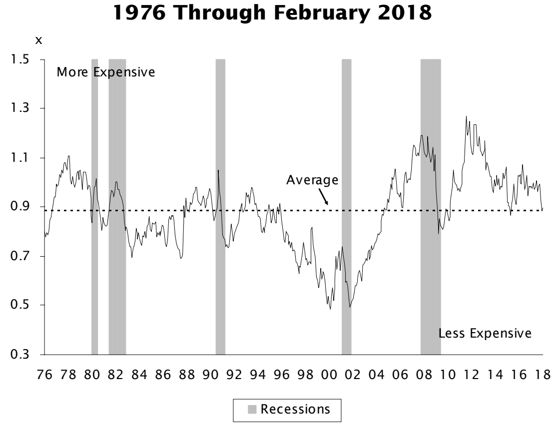
**Exhibit 3: Real Household Income by Quintile[1]
2001 Through 2017E
(2000 = 100)**




Source: U.S. Census Bureau, Empirical Research Partners Analysis.

[1]In 2016 dollars.

**Exhibit 4: Large-Capitalization Utilities[1]
Relative Forward-P/E Ratio
1976 Through February 2018**

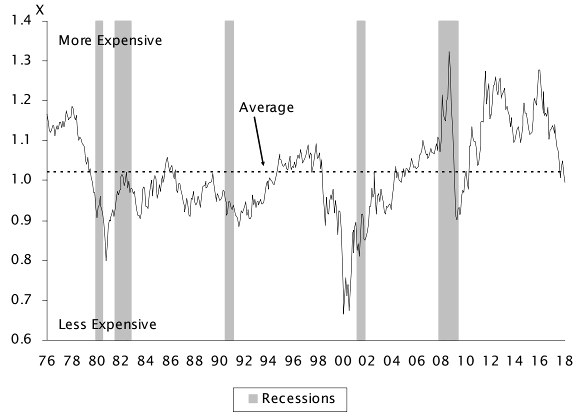



Source: Corporate Reports, National Bureau of Economic Research, Empirical Research Partners Analysis.

[1]Capitalization-weighted data.

The repricing of the Surrogates was in part, but not entirely, a function of interest rates. The utilities and consumer staples sectors continue to be seen as viable alternatives to holding bonds. We see that in the correlations of their relative returns to moves in the bond market, that's been around 65% in the last six months (see Exhibits 7 and 8). That's not the case for the REITs where the linkage began to break down a year ago, in a manner eerily reminiscent of what happened to energy MLPs five years before (see Exhibits 9 and 10). As the supply of commercial real estate increased and retailers retrenched, the REITs have no longer been regarded as worthy of the Surrogate moniker.

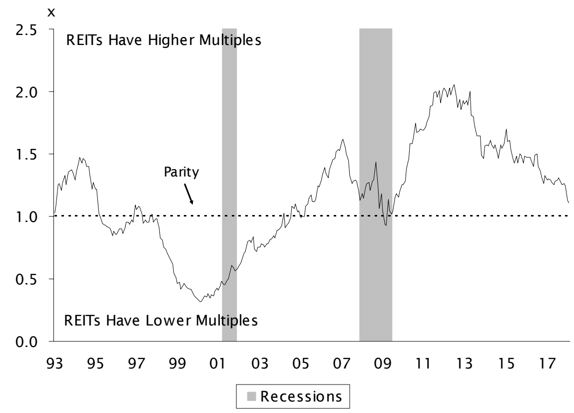
**Exhibit 5: Large-Capitalization Consumer Staples[1]**
**Relative Forward-P/E Ratio**
**1976 Through February 2018**




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

[1]Capitalization-weighted data.

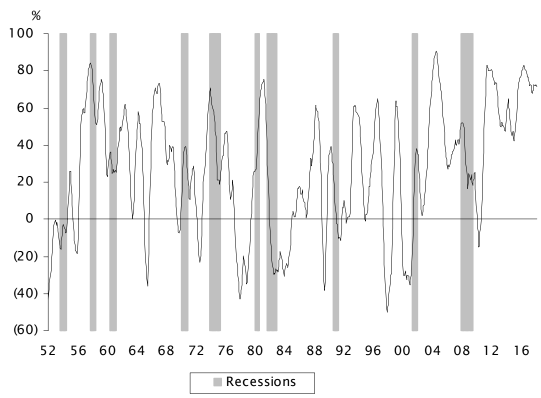
**Exhibit 6: REITs**
**Cash Flow from Operation Multiple Relative to Large-Cap Stocks Gross Cash Flow Multiple[1]**
**1993 Through February 2018**




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

[1]Capitalization-weighted data.

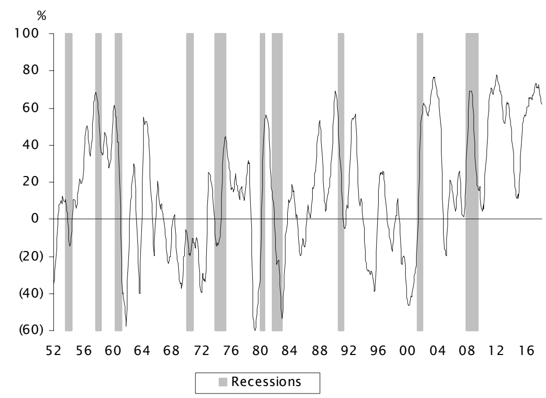
**Exhibit 7: Large-Capitalization Utility Stocks**
**Correlation of Relative Returns with the Total Return of Ten-Year Treasury Bonds[1]**
**1952 Through February 2018**




Source: National Bureau of Economic Research, Ibbotson Associates, Bloomberg L.P., Empirical Research Partners Analysis.

[1]Constructed using trailing one-year data; returns are capitalization-weighted and smoothed on a trailing six-month basis. Performance of longer bond used prior to 1977.

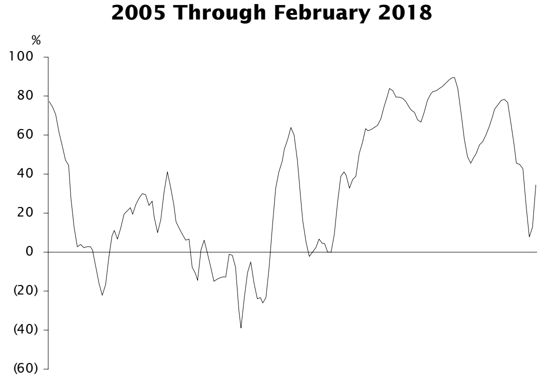
**Exhibit 8: Large-Capitalization Consumer Staples Stocks**
**Correlation of Relative Returns with the Total Return of Ten-Year Treasury Bonds[1]**
**1952 Through February 2018**




Source: National Bureau of Economic Research, Ibbotson Associates, Bloomberg L.P., Empirical Research Partners Analysis.

[1]Constructed using trailing one-year data; returns are capitalization-weighted and smoothed on a trailing six-month basis. Performance of longer bond used prior to 1977.

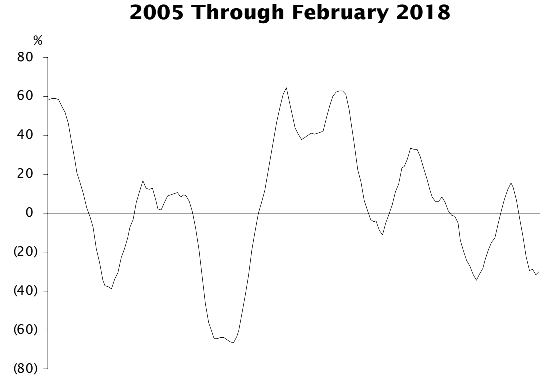
**Exhibit 9: REITs[1]**
**Correlation of Relative Returns with the Total Return of Ten-Year Treasury Bonds[2]**
**2005 Through February 2018**




Source: Bloomberg L.P., Empirical Research Partners Analysis.

[1]Excluding operating companies.
[2]Constructed using trailing one-year data; returns are capitalization-weighted and smoothed on a trailing three-month basis.

**Exhibit 10: Energy MLPs**
**Correlation of Relative Returns with the Total Return of Ten-Year Treasury Bonds[1]**
**2005 Through February 2018**

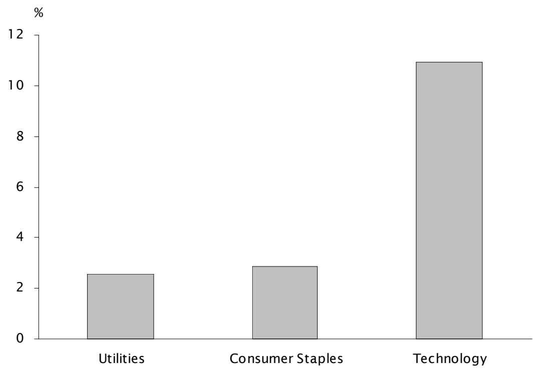



Source: Bloomberg L.P., Empirical Research Partners Analysis.

[1]Constructed using trailing one-year data; returns are capitalization-weighted and smoothed on a trailing three-month basis.

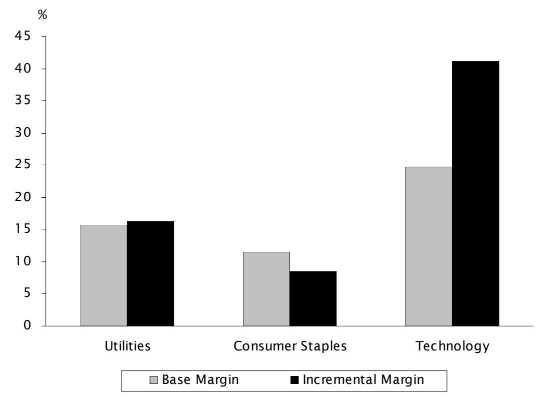
There's also been the matter of top-line growth and operating leverage, that's been most impressive in the tech sector, that alone has underpinned the results for the entire market (see Exhibits 11 and 12). As expected, the combination of overvaluation, sub-par growth and less reliable fundamentals ultimately proved lethal to the Surrogates. The sell-off in the bond market pushed them over the cliff where they'd been precariously perched.

**Exhibit 11: S&P 500 Utilities, Consumer Staples and Technology Stocks Revenue Growth Four-Quarters Ended 2017**




Source: Empirical Research Partners Analysis.

**Exhibit 12: S&P 500 Utilities, Consumer Staples and Technology Stocks Base and Incremental Margins Four-Quarters Ended 2017**

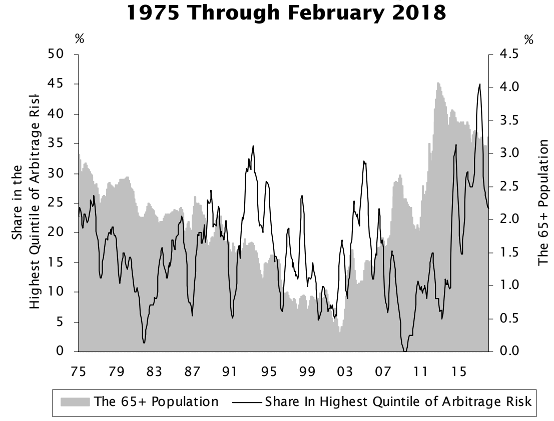



Source: Empirical Research Partners Analysis.

## *Pharmaceuticals Rising*

The pharmaceuticals haven't been full-fledged members of the Surrogate fraternity but have resided on the fringes of it, never quite making the cut. One thing that's held them back is that they've been engulfed in controversy, as the market has feared that the doubling of the growth rate of the over-65 population would lead to pricing pressures, as the funding limits of the payor system became binding (see Exhibit 13). The higher arbitrage risk readings coincided with margin degradation, albeit from high levels (see Exhibit 14). The stocks' fundamental stability scores have come down as well, as virtually everything else in the economy came to appear more stable as the expansion rolled on (see Exhibit 15). Nevertheless, as in staples, there's more going on here than simply being cyclically out of favor.

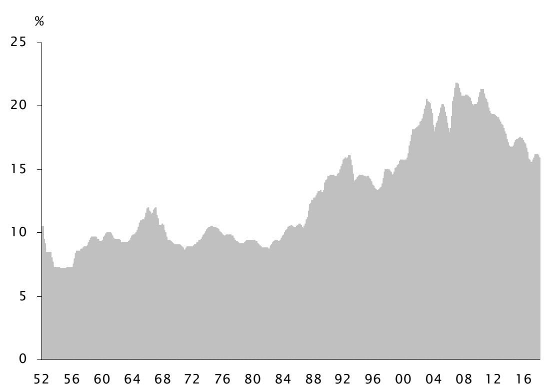
**Exhibit 13: Large-Capitalization Pharmaceutical Stocks Share in the Highest Quintile of Arbitrage Risk[1] and Year-over-Year Changes in the 65+ Population 1975 Through February 2018**




Source: Bureau of Labor Statistics, Empirical Research Partners Analysis.

[1]Data smoothed on a trailing three-month basis.

**Exhibit 14: Large-Capitalization Pharmaceutical Stocks Profit Margins[1] 1952 Through February 2018**

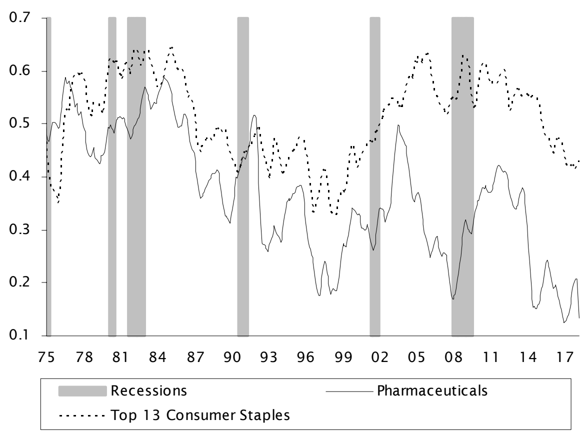



Source: Empirical Research Partners Analysis.

[1]Based on trailing four-quarter data smoothed on a trailing three-month basis.

All of the above has weighed on the valuation of the pharmaceuticals that now sell at a (20)% P/E discount to the market, a number that puts them in the same ballpark as the big banks (see Exhibit 16). Their free cash flow yields are now +130 basis points above that of the market, a level last seen in late-2013 (see Exhibit 17). We've thought a premium of two points or more was required to make them obvious value buys, and given that we haven't had that we've preferred the biotech issues, believing they represented better bang for the buck (see Exhibit 18). That's still the case, but the gap in free cash flow yields has closed.

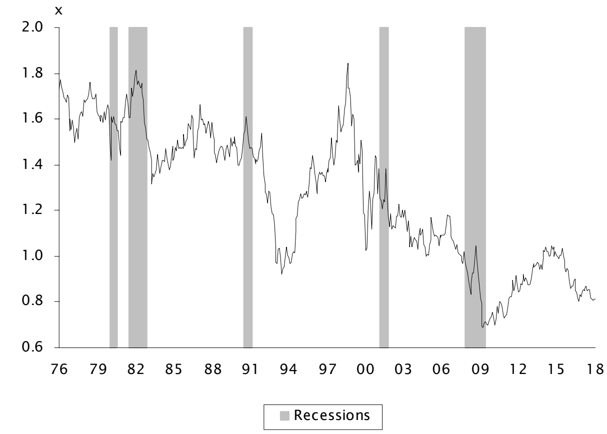
**Exhibit 15: Large-Capitalization Pharmaceutical and Consumer Staples Stocks Fundamental Stability Scores[1] 1975 Through February 2018**




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

[1]Equally-weighted data smoothed on a trailing six-month basis.

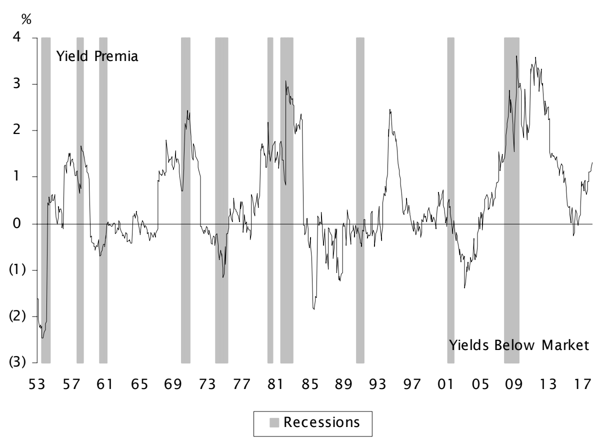
**Exhibit 16: Large-Capitalization Pharmaceuticals Relative Forward-P/E Ratio 1976 Through February 2018**




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

[1]Capitalization-weighted data.

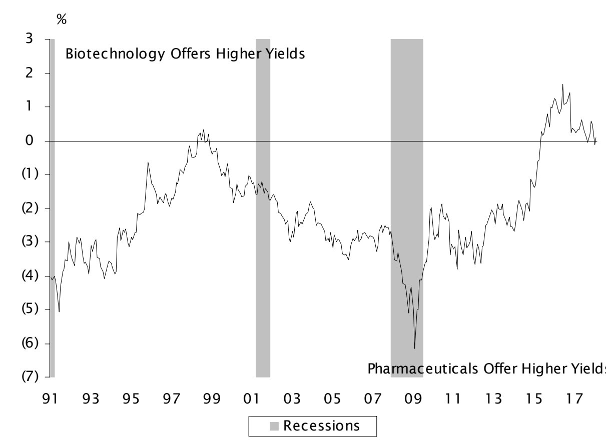
**Exhibit 17: Large-Capitalization Pharmaceuticals Relative Free Cash Flow Yields[1] 1953 Through February 2018**




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

[1]Capitalization-weighted data.

**Exhibit 18: Large-Capitalization Biotechnology Stocks Compared to the Pharmaceuticals Differentials in Free Cash Flow Yields[1] 1991 Through February 2018**




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

[1]Capitalization-weighted data.

### *Conclusion: The Sell-Off Couldn't Have Come at a Better Time*

The flattening out of the market's valuation structure is well timed, because the threats to the status quo are mounting. While we don't think the odds favor a meaningful acceleration in inflation, the risk of monetary error is up.[1] The analogy with the "guns-and-butter" era of the mid-to-late 1960s isn't far fetched. It's not hard to imagine a circumstance where the Fed's independence comes under fire.

More threatening is the Administration's decision to (temporarily?) follow through on its protectionist rhetoric. We suspect its understanding of how the Bretton Woods II regime fostered increases in profit margins and multiples is lacking.

Of the bond surrogate-type stocks we're becoming interested in the pharmaceuticals, that now offer reasonable valuations. Appendix 1 on page 13 ranks them using our fundamental model, that pays no attention to momentum.

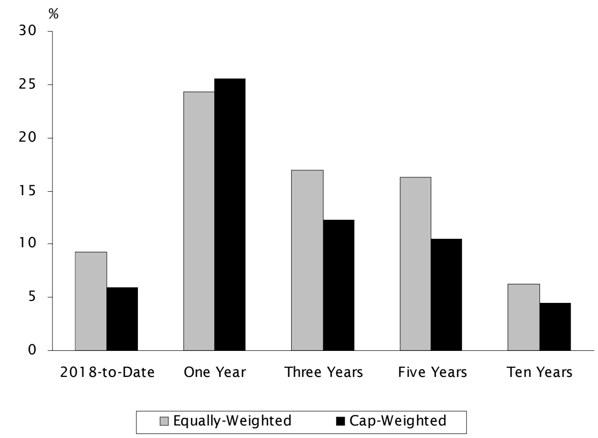
[1]*Portfolio Strategy* February 2018. "Dissecting Inflation: Frameworks That Tell the Story."

# The Semis: Gang Members, For Better or Worse

### *The Cyclical and Secular in Synch, Making it Tricky*

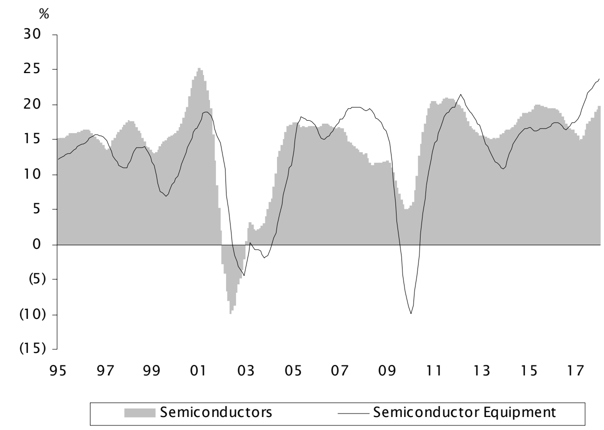
The semiconductor stocks have been exceptional performers throughout this expansion as a series of forces came together to push profit and free cash flow margins to almost unprecedented levels (see Exhibits 19 through 21). Demand has been strong and capital intensity didn't rise procyclically (see Exhibits 22 and 23).

**Exhibit 19: Large-Capitalization Semiconductor Stocks Relative Returns: Equally- and Cap-Weighted Monthly Data Compounded to Annual Periods Ten Years Ending February 2018**




Source: Empirical Research Partners Analysis.

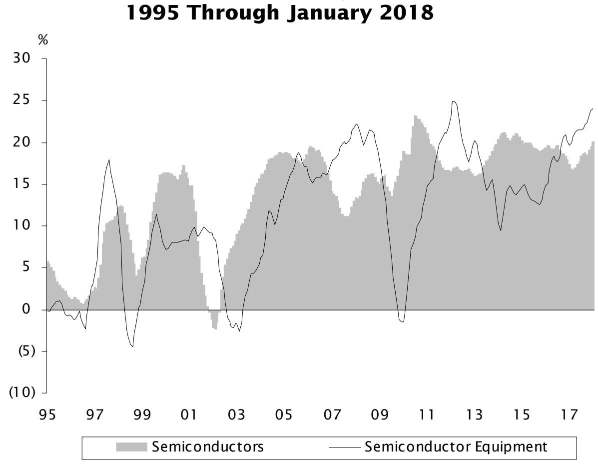
**Exhibit 20: Large-Capitalization Semiconductor and the Related Equipment Stocks Profit Margins[1] 1995 Through January 2018**




Source: Empirical Research Partners Analysis.

[1]Based on trailing four-quarter data smoothed on a trailing three-month basis.

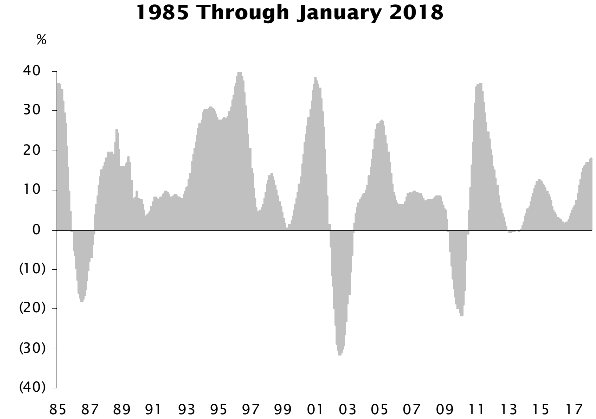
**Exhibit 21: Large-Capitalization Semiconductor and the Related Equipment Stocks Free Cash Flow Margins[1] 1995 Through January 2018**




Source: Empirical Research Partners Analysis.

[1]Based on trailing four-quarter data smoothed on a trailing three-month basis.

**Exhibit 22: Large-Capitalization Semiconductor and the Related Equipment Stocks Revenue Growth[1] 1985 Through January 2018**

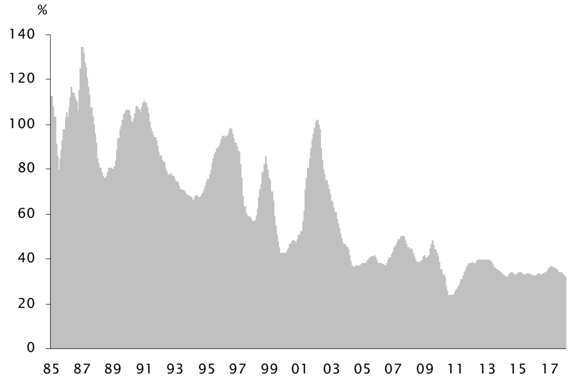



Source: Empirical Research Partners Analysis.

[1]Based on trailing four-quarter data smoothed on a trailing three-month basis.

The run of strong fundamentals has shown up in the industry's sector-relative beta as well as in its fundamental stability profile. Both have come to resemble the market average, not the typical state of affairs (see Exhibits 24 and 25). The stability framework shown in the second chart weighs the level and variability of ROEs, the volatility of earnings growth, the dispersion of analysts' estimates, financial leverage and beta (see Exhibit 26). The change in the stock's personality has been picked up in some of our other risk measures including the arbitrage risk, the unexplained volatility of the stock after accounting for beta (see Exhibit 27). Downside risk, that measures the stock's volatility when it's underperforming the market, has fallen too (see Exhibit 28). Some of what we're seeing here is the byproduct of the reduced capital intensity and a more oligopolistic industry structure, and some of it is simply the result of good luck. In recent years that's come from the build out of the cloud.

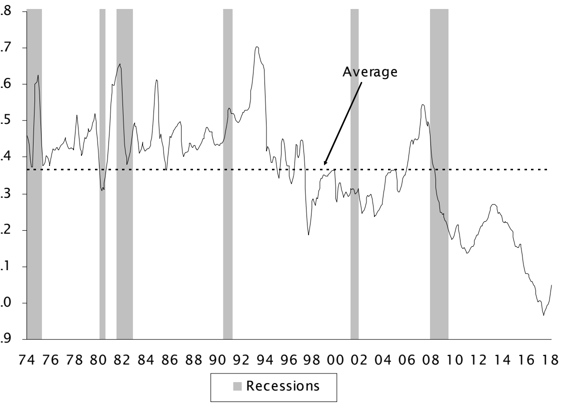
**Exhibit 23: Large-Capitalization Semiconductor and the Related Equipment Stocks Capital Expenditures as a Share of Gross Cash Flow[1] 1985 Through January 2018**




Source: Empirical Research Partners Analysis.

[1]Based on trailing four-quarter data smoothed on a trailing three-month basis.

**Exhibit 24: Large-Capitalization Semiconductor and the Related Equipment Stocks Beta to Technology Sector[1] 1974 Through February 2018**




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

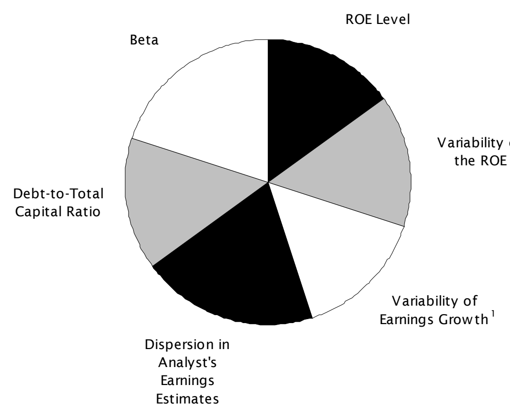
[1]Computed over five-year windows; equally-weighted average smoothed on a trailing three-month basis.

**Exhibit 25: Large-Capitalization Semiconductor and the Related Equipment Stocks Average Fundamental Stability Score[1] 1975 Through January 2018**


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

[1]Data smoothed on a trailing six-month basis.

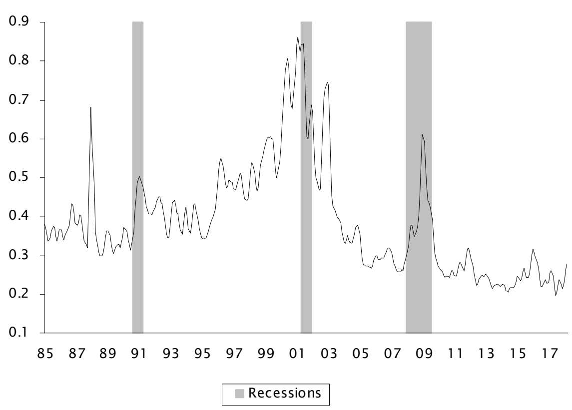
**Exhibit 26: Fundamental Stability Score Factor Composition As of February 2017**




Source: Empirical Research Partners Analysis.

[1]Computed over the trailing 12 quarters.

**Exhibit 27: Large-Capitalization Semiconductor and the Related Equipment Stocks Arbitrage Risk[1] 1985 Through Late-February 2018**




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

[1]Equally-weighted data smoothed on a trailing three-month basis.

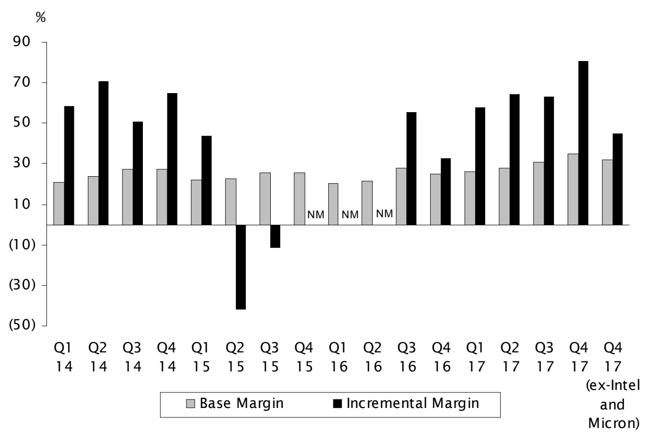
**Exhibit 28: Large-Capitalization Semiconductor and the Related Equipment Stocks Downside Risk[1] 1985 Through Late-February 2018**


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

[1]Data smoothed on a trailing three-month basis.

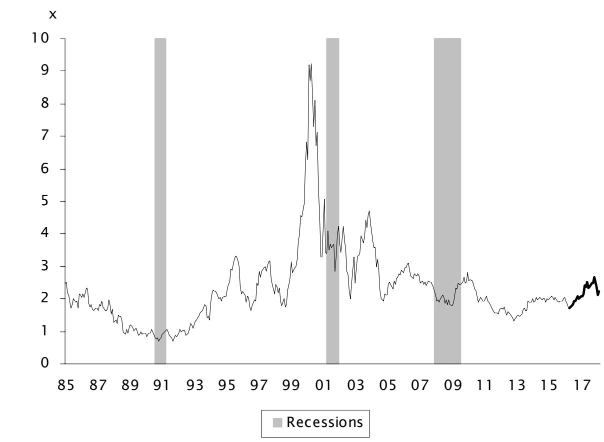
Lately the operating leverage produced by the semis has been extraordinary, and in the latest quarter their pre-tax incremental margins topped 80%, compared to a base level of 35% (see Exhibit 29). Intel and Micron Technology figured large in that result and if we remove them from the composite the incremental number declines to 45%, a still impressive showing.

**Exhibit 29: S&P 500 Semiconductor and the Related Equipment Stocks Base and Incremental Pre-Tax Margins 2014 Through 2017**




Source: Corporate Reports, Empirical Research Partners Analysis.

**Exhibit 30: Large-Capitalization Semiconductor and the Related Equipment Stocks Relative Price-to-Sales Ratio[1] 1985 Through February 2018**

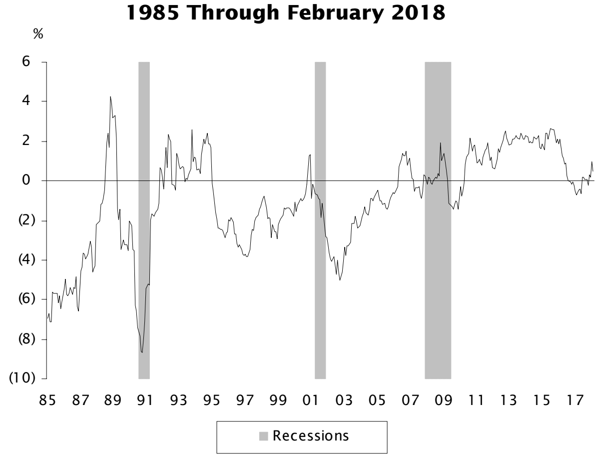



Source: National Bureau of Economic Research, Empirical Research Partners Analysis.

[1]Equally-weighted data.

The strength of the margins has surprised investors who've bid up the stocks and we see that in their relative price-to-sales ratios (see Exhibit 30). The relative free cash flow yields of semiconductors companies are less impressive than they were earlier in the expansion while those of equipment manufacturers are little changed (see Exhibits 31 and 32). If we substitute normalized free cash flow into the yield calculation, a measure computed over a backward-looking five-year window, the pictures remain the same (see Exhibits 33 and 34).

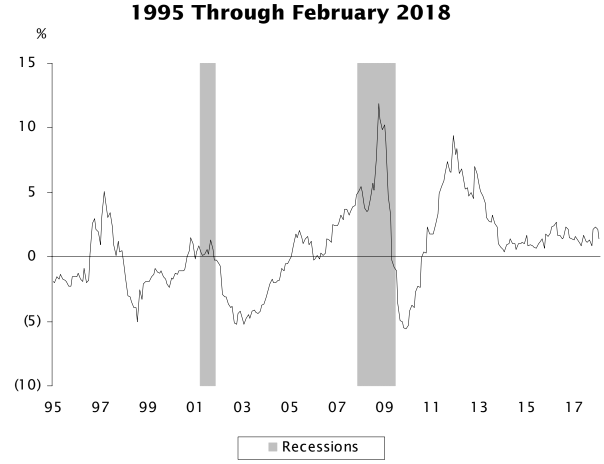
**Exhibit 31: Large-Capitalization Semiconductor Stocks Relative Free Cash Flow-to-Enterprise Value[1] 1985 Through February 2018**




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

[1]Equally-weighted data.

**Exhibit 32: Large-Cap Semiconductor Equipment Stocks Relative Free Cash Flow-to-Enterprise Value[1] 1995 Through February 2018**



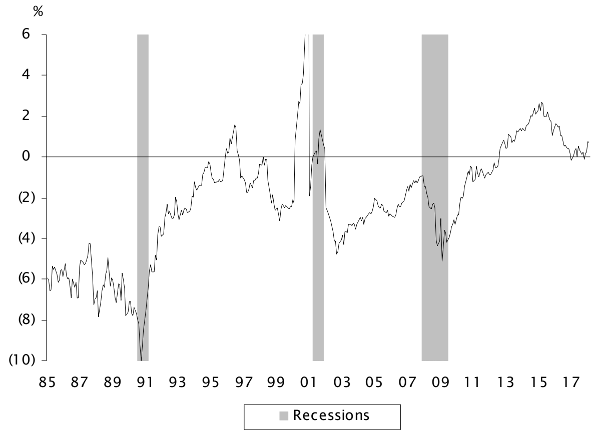

Source: Corporate Reports, National Bureau of Economic Research, Empirical Research Partners Analysis.

[1]Equally-weighted data.

### *Stock Picking: What's Worked*

We tested what's worked when picking semi stocks drawing upon 50 years of data. What we were trying to understand is *when* we should buy or sell the stocks, so we evaluated their performance relative to the market rather than to one another. We measured relative returns over one-year periods, using both buy-and-hold portfolios and compounded monthly data, and also looked at win rates.

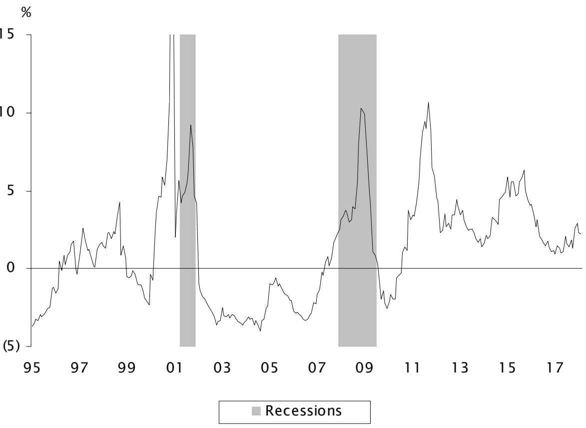
**Exhibit 33: Large-Capitalization Semiconductor Stocks Relative Normalized Free Cash Flow Yields[1] 1985 Through Late-February 2018**




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

[1]Equally-weighted data.

**Exhibit 34: Large-Cap Semiconductor Equipment Stocks Relative Normalized Free Cash Flow Yields[1] 1995 Through Late-February 2018**

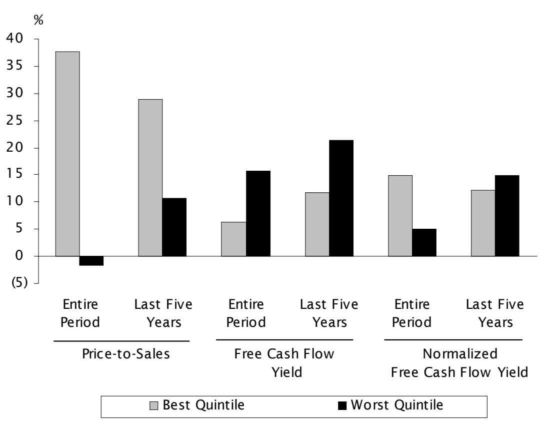



Source: Corporate Reports, National Bureau of Economic Research, Empirical Research Partners Analysis.

[1]Equally-weighted data.

We began with valuation data and there were a couple of notable findings. The cyclicality of the industry, combined with the upward trajectory in margins, has meant that lots of alpha has come from buying the stocks when they're selling at low multiples of sales (see Exhibit 35). The win rates, the shares of months and stocks outperforming, were also encouraging (see Exhibit 36). Yields based on free cash flow normalized over five-year windows have been a little better than those that simply using a trailing four-quarter number. That's because the duration of winning streaks has frequently been underestimated. That's apparent in the win rates too. The stocks selling at the lowest yields have also done well but with less consistency.

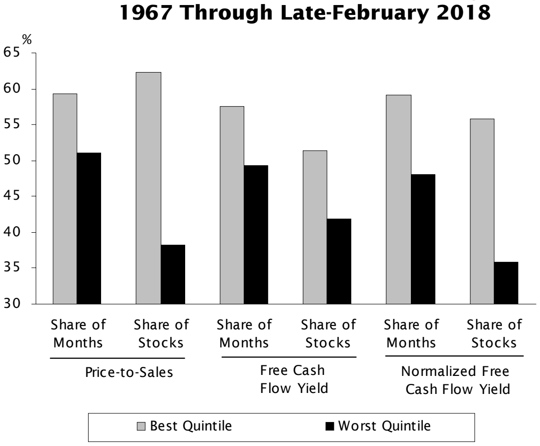
**Exhibit 35: Large-Capitalization Semiconductor and the Related Equipment Stocks Relative Returns to the Best and Worst Quintiles of Price-to-Sales Ratios and Free Cash Flow Yields[1] Measured Over One-Year Holding Periods 1967 Through Late-February 2018**




Source: Empirical Research Partners Analysis.

[1]Ranked across the market. Returns relative to the equally-weighted market.

**Exhibit 36: Large-Capitalization Semiconductor and the Related Equipment Stocks Best and Worst Quintiles of Price-to-Sales Ratios and Free Cash Flow Yields[1] Share of Months and Stocks Outperforming Measured Over One-Year Holding Periods 1967 Through Late-February 2018**



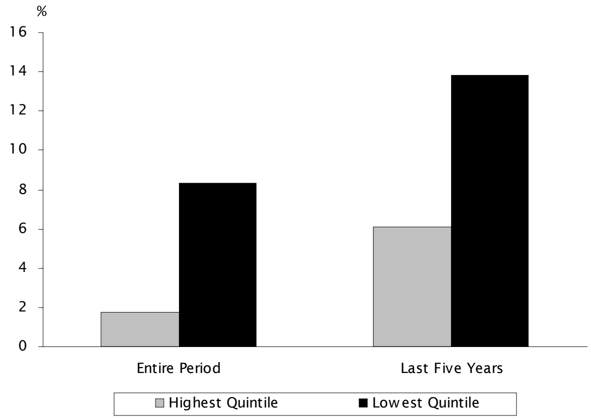

Source: Empirical Research Partners Analysis.

[1]Ranked across the market. Returns relative to the equally-weighted market.

The biggest money has been made by buying the stocks when times were bad, and establishing position when revenue growth was weak worked out better than doing so when it was strong (see Exhibit 37). Reductions in capital spending have generally been greeted more favorably than big increases, although in the last five years that hasn't mattered (see Exhibit 38).

Putting the pieces together, our growth stock model, that's GARP-y in character, has a very good track record when picking semiconductor stocks (see Exhibit 39). The model's willingness to make disciplined contrarian bets has held it in good stead. The chance of winning with a top-ranked stock has been considerably better than that for a lowly-ranked one.

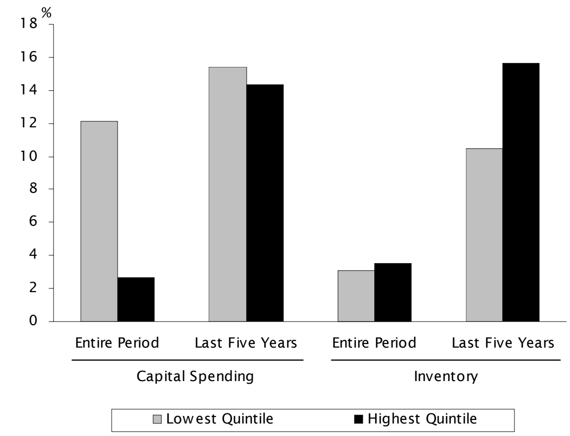
**Exhibit 37: Large-Capitalization Semiconductor and the Related Equipment Stocks Relative Returns to the Highest and Lowest Quintiles of Revenue Growth Measured Over One-Year Holding Periods 1967 Through Late-February 2018**




Source: Empirical Research Partners Analysis.

[1]Ranked across the market. Returns relative to the equally-weighted market.

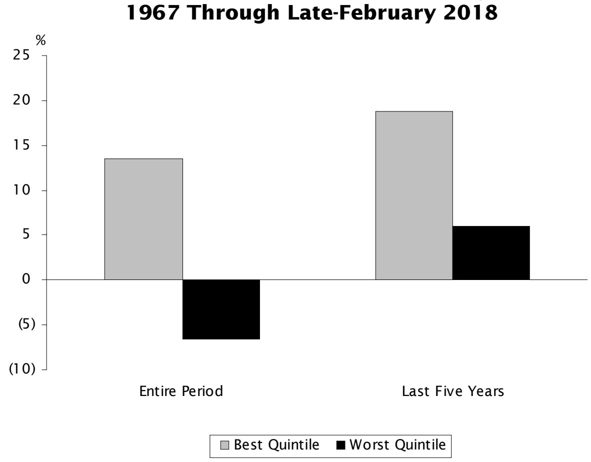
**Exhibit 38: Large-Capitalization Semiconductor and the Related Equipment Stocks Relative Returns to the Lowest and Highest Quintiles of Capital Spending and Inventory Growth Measured Over One-Year Holding Periods 1967 Through Late-February 2018**




Source: Empirical Research Partners Analysis.

[1]Ranked across the market. Returns relative to the equally-weighted market.

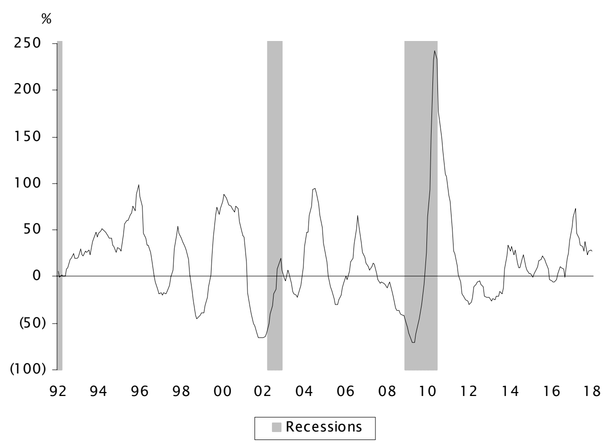
**Exhibit 39: Large-Capitalization Semiconductor and the Related Equipment Stocks Relative Returns to the Best and Worst Quintiles of the Growth Model[1] Measured Over One-Year Holding Periods 1967 Through Late-February 2018**




Source: Empirical Research Partners Analysis.

[1]Ranked across the market. Returns relative to the equally-weighted market.

**Exhibit 40: North American Semiconductor Billings[1] Year-over-Year Changes 1992 Through January 2018**




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

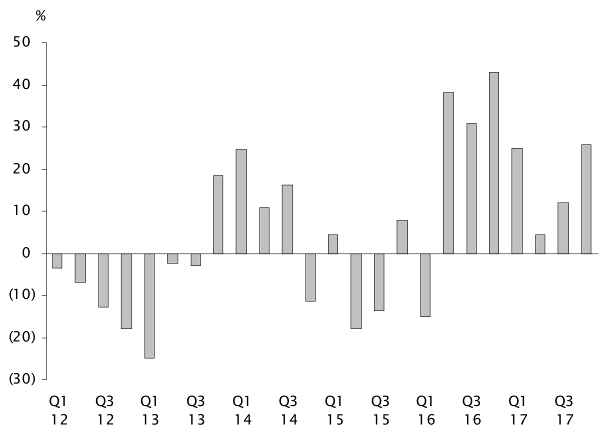
[1]Data smoothed on a trailing three-month basis.

## *Conclusion: Is There Good Reason to Abandon Ship?*

The cyclicality of the semiconductor industry means that the easy money has been made when times were bad and we could simply wait for them to improve. Our analysis of five decades of data makes that clear. We're far from that circumstance today as demand is strong and capital spending is booming (see Exhibits 40 and 41). The build out of the cloud has had a lot to do with what we're seeing in the data throughout the tech sector. In the last year the relative returns of the semiconductors have been almost 55% correlated with those of the FANG stocks (see Exhibit 42). Together the two have accounted for a whopping 60% of all the capital spending growth of the core (i.e., ex-energy and industrial commodities) of the S&P 500 (see Exhibit 43). Cloud-related spending has accounted for almost two-thirds of the growth in all domestic technology hardware outlays.

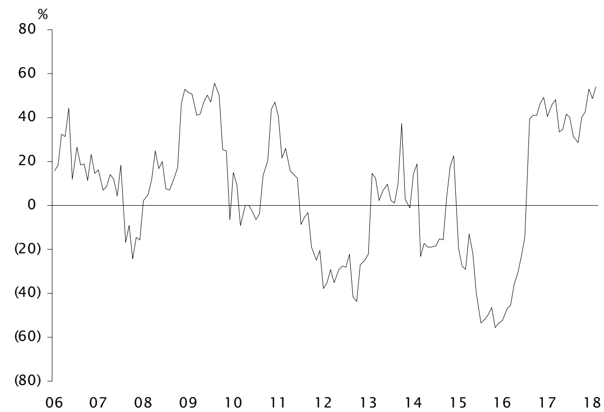
The valuation of the semis doesn't look excessive, and the risk of the businesses looks like it's declined as semiconductors have become the building block that what goes into much of what goes on in developed world economies. Today ownership of stocks comes down to a judgment call about how long the cloud-related boom will go on (see Exhibit 44).

**Exhibit 41: S&P 500 Semiconductor and the Related Equipment Stocks Year-over-Year Changes in Capital Spending 2012 Through 2017E**




Source: Empirical Research Partners Analysis.

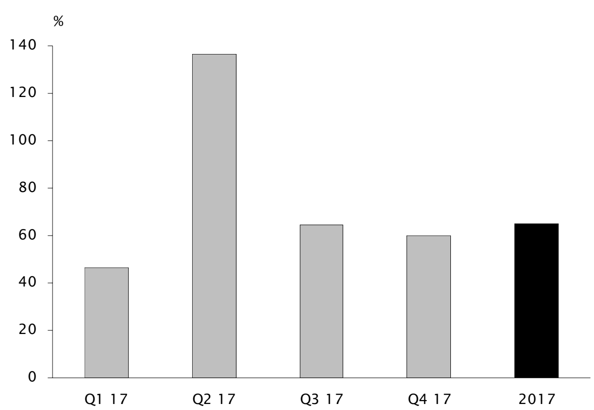
**Exhibit 42: The FANG and Semiconductors Stocks Correlation of Relative Returns[1] 2006 Through February 2018**




Source: Empirical Research Partners Analysis.

[1]Based on capitalization-weighted monthly data, with correlations computed over trailing twelve-month windows.

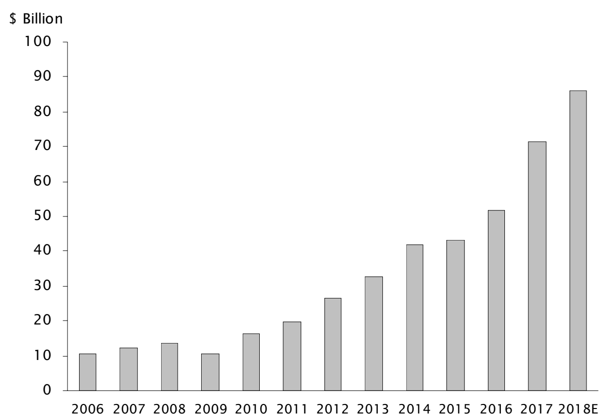
**Exhibit 43: S&P 500 Core Stocks[1] Share of Increase in Capital Spending Coming from FANG and Semiconductor Issues 2017**




Source: Empirical Research Partners Analysis.

[1]Excludes financials, REITs, energy and industrial commodities.

**Exhibit 44: U.S. Cloud Computing Capital Expenditures 2006 Through 2018E**




Source: Byrne, D.M., Corrado, C.A. and Daniel E. Sichel. 2017. "Own-Account IT Equipment Investment," Fed Notes October 4, Empirical Research Partners Estimate.

Our work doesn't suggest an obvious course of action for those heavily invested in the semiconductor industry. The majority of the stocks still appear in the top-two quintiles of our growth model, and, as shown in Exhibits 33 and 34 free cash flow yields still sit at a premium to the market. Earnings quality is strong because margins are high and free cash flow production has remained impressive. The stocks are surrounded by controversy, apparent in their arbitrage risk scores, but that's almost always the case.

What's worrisome is that capital spending has been increasing at double-digit rates and demand is booming. Price-to-sales ratios are no longer depressed.

It seems to us that semiconductors will remain among the market's leadership until the duration of the cycle is seriously called into question. What's really important is the continuation of the cloud-spending boom. Our judgment is that if a portfolio has a large commitment to semis, like our Distrusted Fifty, it makes sense to trim it.

Appendix 2 on page 13 ranks the large-cap issues using our growth model. We've also included some risk measures: our Failure Model score, beta, arbitrage and downside risk.

**Appendix 1: Large-Capitalization Pharmaceutical Stocks**
**Fundamental Model Ranking Report**
**Sorted by Quintile**
**As of Early-March 2018**

| | | | Quintile Ranks (1=Best; 5=Worst) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Super Factors | | | | Memo: | | |
| Symbol | Company | Price | Valuation | Capital Deployment | Earnings Quality and Trend | Fundamental Model Rank | Free Cash Flow Yield | Forward-P/E Ratio | Market Capitalization ($ Billion) |
| PFE | PFIZER INC | $35.63 | 2 | 2 | 1 | 1 | 1 | 12.1 x | $213.0 |
| TEVA | TEVA PHARMACEUTICAL INDUSTRIES | 18.87 | 1 | 2 | 2 | 1 | 1 | 7.8 | 19.4 |
| PRGO | PERRIGO CO PLC | 79.57 | 2 | 1 | 1 | 1 | 2 | 15.0 | 11.2 |
| SNY | SANOFI | 39.19 | 1 | 3 | 3 | 2 | 1 | 11.7 | 98.8 |
| GSK | GLAXOSMITHKLINE PLC | 35.97 | 1 | 3 | 4 | 2 | 1 | 12.0 | 88.8 |
| AGN | ALLERGAN PLC | 148.19 | 1 | 5 | 2 | 2 | 1 | 9.5 | 49.3 |
| MYL | MYLAN NV | 40.69 | 1 | 4 | 4 | 2 | 2 | 7.5 | 21.8 |
| JAZZ | JAZZ PHARMACEUTICALS PLC | 140.67 | 2 | 4 | 4 | 2 | 1 | 10.8 | 8.4 |
| JNJ | JOHNSON & JOHNSON | 127.28 | 4 | 2 | 4 | 3 | 2 | 15.7 | 341.5 |
| NVS | NOVARTIS AG | 82.40 | 3 | 4 | 2 | 3 | 2 | 15.4 | 216.4 |
| BMY | BRISTOL-MYERS SQUIBB CO | 65.69 | 4 | 3 | 2 | 3 | 3 | 20.2 | 107.3 |
| AZN | ASTRAZENECA PLC | 32.97 | 3 | 2 | 2 | 3 | 4 | 19.2 | 83.5 |
| ZTS | ZOETIS INC | 80.44 | 5 | 3 | 1 | 3 | 4 | 26.5 | 39.2 |
| MRK | MERCK & CO | 53.70 | 3 | 3 | 4 | 4 | 4 | 12.9 | 146.4 |
| LLY | LILLY (ELI) & CO | 76.50 | 3 | 4 | 3 | 4 | 3 | 15.7 | 83.8 |
| NKTR | NEKTAR THERAPEUTICS | 84.55 | 5 | 5 | 4 | 5 | 5 | NM | 13.6 |

Source: Empirical Research Partners Analysis.

**Appendix 2: Large-Capitalization Semiconductor Stocks**
**Growth Model Ranking Report**
**Sorted by Capitalization within Model Rank**
**As of Early-March 2018**

| | | | Quintile Ranks (1=Best; 5=Worst) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Super Factors | | | | | Memo: | | | | | | |
| | | | Management Behavior | | | | | | | | | | | |
| Symbol | Company | Price | Capital Deployment | Earnings Quality and Trend | Market Reaction | Valuation | Growth Model Rank | Free Cash Flow Yield | Failure Model | Beta | Arbitrage Risk | Downside Risk | Forward-P/E Ratio | Market Capitalization ($ Billion) |
| MU | MICRON TECHNOLOGY INC | $47.62 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 5 | 5 | 1 | 4.7 x | $55.1 |
| LRCX | LAM RESEARCH CORP | 190.07 | 1 | 3 | 3 | 1 | 1 | 2 | 1 | 5 | 5 | 5 | 11.6 | 31.0 |
| KLAC | KLA-TENCOR CORP | 111.21 | 1 | 2 | 3 | 3 | 1 | 1 | 2 | 4 | 4 | 5 | 13.8 | 17.4 |
| MRVL | MARVELL TECHNOLOGY GROUP LTD | 23.31 | 1 | 1 | 2 | 4 | 1 | 2 | 1 | 2 | 3 | 2 | 17.9 | 11.6 |
| ON | ON SEMICONDUCTOR CORP | 23.86 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 5 | 4 | 4 | 13.8 | 10.2 |
| TER | TERADYNE INC | 44.90 | 1 | 1 | 2 | 3 | 1 | 2 | 1 | 3 | 5 | 5 | 18.0 | 8.8 |
| TSM | TAIWAN SEMICONDUCTOR MFG CO | 42.72 | 2 | 2 | 2 | 3 | 2 | 4 | 2 | 2 | 3 | 3 | 17.1 | 221.5 |
| TXN | TEXAS INSTRUMENTS INC | 106.53 | 3 | 1 | 1 | 5 | 2 | 3 | 2 | 4 | 4 | 3 | 21.4 | 104.8 |
| AVGO | BROADCOM LTD | 243.31 | 2 | 1 | 5 | 2 | 2 | 2 | 2 | 2 | 4 | 1 | 12.4 | 99.9 |
| AMAT | APPLIED MATERIALS INC | 57.07 | 4 | 2 | 2 | 2 | 2 | 1 | 2 | 5 | 5 | 4 | 12.8 | 60.0 |
| XLNX | XILINX INC | 70.80 | 1 | 2 | 4 | 5 | 2 | 2 | 2 | 3 | 4 | 1 | 25.9 | 18.0 |
| MXIM | MAXIM INTEGRATED PRODUCTS | 60.90 | 1 | 2 | 3 | 5 | 2 | 2 | 2 | 4 | 5 | 2 | 22.3 | 17.1 |
| MSCC | MICROSEMI CORP | 64.30 | 4 | 3 | 1 | 3 | 2 | 2 | 3 | 4 | 4 | 3 | 14.9 | 7.6 |
| INTC | INTEL CORP | 47.84 | 3 | 5 | 2 | 1 | 3 | 2 | 2 | 3 | 5 | 4 | 13.5 | 224.2 |
| NVDA | NVIDIA CORP | 232.21 | 5 | 1 | 1 | 5 | 3 | 4 | 4 | 5 | 5 | 1 | 37.1 | 140.7 |
| QCOM | QUALCOMM INC | 64.96 | 1 | 4 | 5 | 4 | 3 | 2 | 1 | 4 | 4 | 1 | 19.2 | 96.2 |
| NXPI | NXP SEMICONDUCTORS NV | 123.77 | 3 | 1 | 5 | 4 | 3 | 3 | 2 | 1 | 1 | 1 | 16.9 | 42.5 |
| STM | STMICROELECTRONICS NV | 22.08 | 5 | 3 | 1 | 3 | 3 | 4 | 4 | 2 | 4 | 4 | 17.4 | 20.1 |
| SWKS | SKYWORKS SOLUTIONS INC | 106.59 | 2 | 4 | 4 | 2 | 3 | 2 | 3 | 1 | 5 | 4 | 14.5 | 19.5 |
| QRVO | QORVO INC | 78.61 | 3 | 1 | 5 | 3 | 3 | 3 | 4 | 2 | 5 | 5 | 12.8 | 9.9 |
| ASML | ASML HOLDING NV | 191.93 | 2 | 4 | 1 | 5 | 4 | 4 | 4 | 4 | 4 | 1 | 27.4 | 83.3 |
| MCHP | MICROCHIP TECHNOLOGY INC | 89.02 | 4 | 4 | 4 | 3 | 4 | 2 | 5 | 3 | 5 | 4 | 15.5 | 20.9 |
| ADI | ANALOG DEVICES | 88.31 | 5 | 5 | 4 | 4 | 5 | 4 | 5 | 4 | 3 | 5 | 15.6 | 32.7 |
| AMD | ADVANCED MICRO DEVICES | 11.90 | 4 | 3 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 31.3 | 11.5 |

Source: Empirical Research Partners Analysis.