

The Base Rate Book – Sales Growth

Integrating the Past to Better Anticipate the Future

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Authors

Michael J. Mauboussin

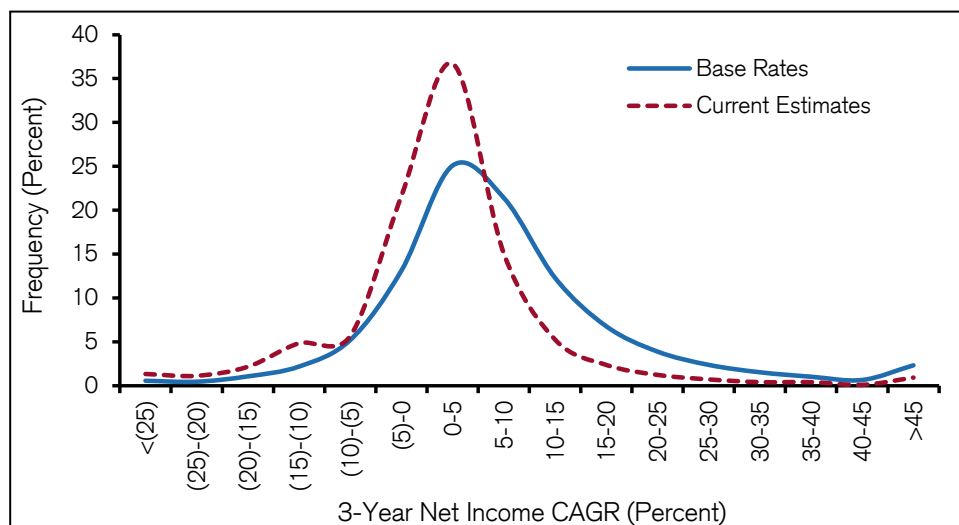
michael.mauboussin@credit-suisse.com

Dan Callahan, CFA

daniel.callahan@credit-suisse.com

Darius Majd

darius.majd@credit-suisse.com



Source: Credit Suisse HOLT® and FactSet Estimates.

“Pallid’ statistical information is routinely discarded when it is incompatible with one’s personal impressions of a case.”

Daniel Kahneman¹

- Successful active investing requires a forecast that is different than what the market is discounting.
- Forecasts about outcomes relevant to us commonly suffer from biases of optimism and overconfidence.
- Research reveals that consideration of the results for an appropriate reference class can enhance the quality of forecasts.
- Sales growth is the most important value driver for most companies.
- This report shows the base rate of sales growth rates for a large sample of companies over more than six decades. We sort the companies into deciles, allowing for easy identification of an appropriate reference class.
- We provide a method to integrate individual views with base rates in order to improve forecasts.

Introduction

An investor's primary task is to determine whether the expectations for future financial performance, as implied by the stock price, are too optimistic or pessimistic relative to how the company is likely to perform. In other words, the intelligent investor seeks gaps between expectations and fundamentals.² This approach does not require forecasts of pinpoint accuracy, but rather only judgments as to whether the expectations embedded in the shares are too high or low.

Sales growth is the most important driver of corporate value.³ For companies that earn a return on invested capital in excess of the cost of capital, growth amplifies value creation. For those that earn a return below the opportunity cost, growth destroys value. Sales growth ripples through the income statement by determining operating leverage and the degree of economies of scale a company can realize.

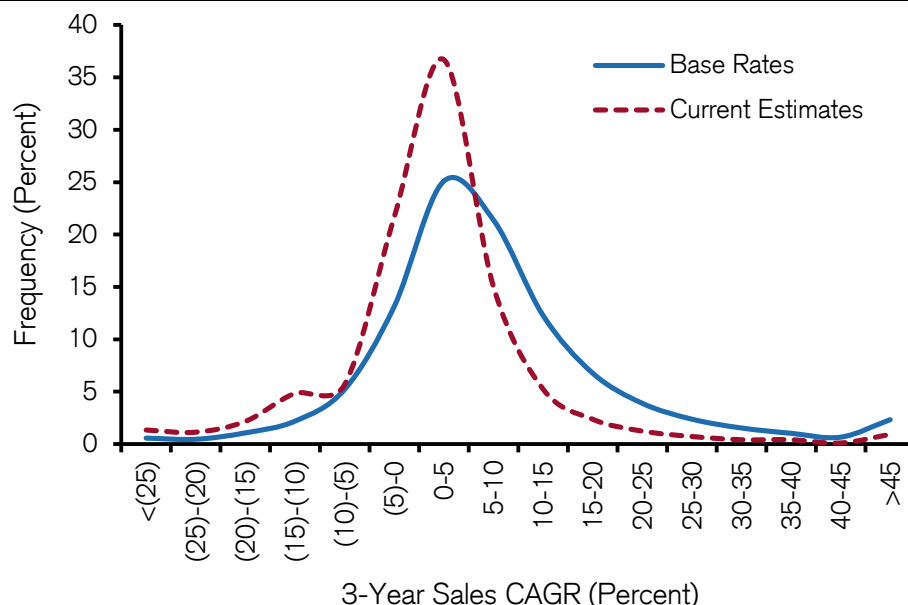
Naturally, executives want their companies to generate healthy rates of sales growth, and more than a third of the companies in the S&P 500 Index provide guidance for sales growth.⁴ Researchers who study forecasts find two common biases: optimism and overconfidence.

Optimism about predictions that are personally important encourages perseverance in the face of adversity but also offers a distorted view of likely outcomes.⁵ Consider that only about one-half of new businesses survive five or more years. Notwithstanding that fact, a survey of thousands of entrepreneurs found that more than 8 of 10 of them rated their odds of success at 70 percent or higher, and fully one-third did not allow for any probability of failure at all.⁶ The bottom line on optimism: "People frequently believe that their preferred outcomes are more likely than is merited."⁷

Overconfidence also distorts the ability to make sound predictions. This bias reveals itself when an individual's confidence in his or her subjective judgments is higher than the objective outcomes warrant. For instance, more than five thousand people answered 50 true-false questions and provided a confidence level for each. On average, they were 60 percent correct but were 70 percent confident in their answers. When these subjects were 100 percent confident in their response, they were correct only 77 percent of the time.⁸ Most people, including financial analysts, place too much weight on their own information.⁹

Overconfidence shows up in forecasts as ranges of outcomes that are too narrow.¹⁰ As a case in point, researchers asked chief financial officers to predict the results for the stock market, including high and low growth rates of return within which the executives were 80 percent sure the results would land. They were correct only one-third of the time.¹¹

Exhibit 1 shows how this bias manifests in forecasts of revenue growth. The solid line is the distribution of sales growth rates, annualized over three years and adjusted for inflation, for the 1,000 largest companies in the world by market capitalization. These base rates reflect results from 1950 to 2014. The dashed line is the distribution of available analyst forecasts for the sales growth rates of the largest 1,000 companies today.

Exhibit 1: Overconfidence – Range of Sales Growth Rates Too Narrow

Source: Credit Suisse HOLT® and FactSet Estimates.

Note: FactSet consensus estimates as of February 19, 2016.

Consistent with the overconfidence bias, the range of expected outcomes is narrower than what the results of the past suggest is reasonable. Specifically, the standard deviation of estimates is 12.2 percent versus a standard deviation of 18.4 percent for the past growth rates. Forecasts are commonly too optimistic and too narrow. The best explanations for the pattern of faulty forecasts include behavioral biases and distortions encouraged by incentives.¹²

Knowing that we are prone to optimism and overconfidence means we need to adopt techniques to manage those biases. One useful approach is to examine the experience of many companies over time, or base rates, and thoughtfully integrate those base rates with our own view. This is not our typical approach. As Daniel Kahneman, the eminent psychologist, notes bluntly, “People who have information about an individual case rarely feel the need to know the statistics of the class to which the case belongs.”¹³

The classic way to make a forecast is to gather information, combine it with our own view, and project an outcome. Left to our own devices, this is how we naturally go about forecasting. Here’s an example: In February 2015, Elon Musk, chairman, product architect, and chief executive officer of Tesla Motors, proposed that the company would be able to grow its sales 50 percent compounded annually for the next decade.¹⁴ How would you assess that proposition?

The natural way would be to open a spreadsheet and start counting. How big is the global automobile market? What share of total auto sales do electric cars have? Where will the market share of electric cars go? What share will Tesla have? And so forth. Combine this assessment with some knowledge of the company’s current and future offerings and you can come up with a forecast. You can do a similar exercise for the battery business. You would then compare the results of your analysis to Musk’s aspired growth rate.

Using Kahneman’s language, you have collected “information about an individual case.” But what you haven’t considered is “the statistics of the class to which the case belongs.” We don’t use base rates as much as we should for a couple of reasons. First, you trust and value the work you’ve done and hence are inclined to place

a lot of weight on it. Second, base rates are rarely at your fingertips. You have to find a suitable reference class and incorporate the information appropriately.

Though decision scientists have known for a long time that the proper integration of base rates improves the quality of forecasts, the technique remains remarkably underused.¹⁵ We believe this reflects the human desire for a narrative. Causality is clear in stories about the specifics, which makes those scenarios vivid. Base rates, on the other hand, are largely antiseptic and hence less appealing to the mind.

Base Rates of Sales Growth

We analyze the distribution of sales growth rates for the top 1,000 global companies by market capitalization since 1950.¹⁶ This sample represents roughly 60 percent of the global market capitalization and includes all sectors. The population includes companies that are now “dead.” The main reason public companies cease to exist is they merge or are acquired.¹⁷

We calculate the compound annual growth rates (CAGR) of sales for 1, 3, 5, and 10 years for each firm. We adjust all of the figures to remove the effects of inflation, which translates all of the numbers to 2014 dollars.

Exhibit 2 shows the results for the full sample. In the panel on the left, the rows show sales growth rates and the columns reflect time periods. Say you want to know what percent of the universe grew sales at a CAGR of 15-20 percent for three years. You start with the row marked “15-20” and slide to the right to find the column “3-Yr.” There, you’ll see that 6.8 percent of the companies achieved that rate of growth. The panel on the right shows the sample sizes for each growth rate and time period, allowing us to see where that percentage comes from: 3,261 instances out of the total of 48,136 ($3,261/48,136 = 6.8$ percent).

Exhibit 2: Base Rates of Sales Growth (1950-2014)

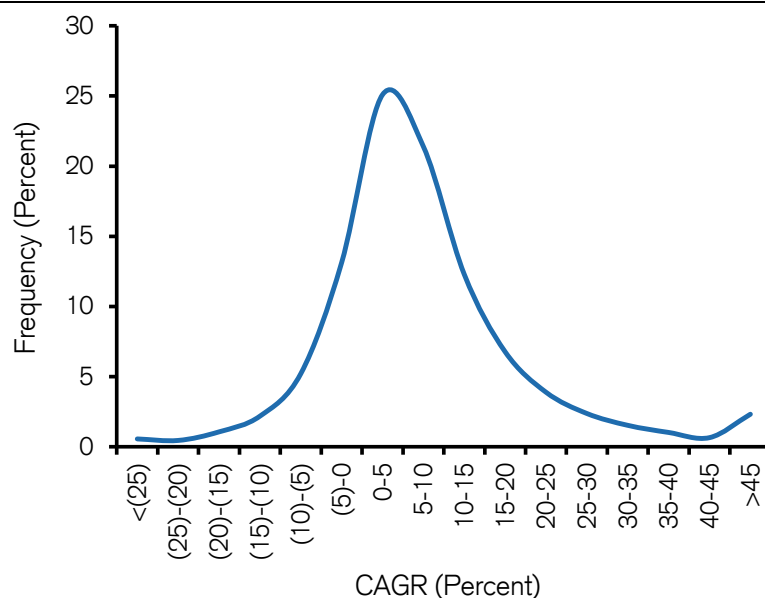
Full Universe	Base Rates				Full Universe	Observations			
Sales CAGR (%)	1-Yr	3-Yr	5-Yr	10-Yr	Sales CAGR (%)	1-Yr	3-Yr	5-Yr	10-Yr
<(25)	1.8%	0.6%	0.3%	0.0%	<(25)	947	273	152	14
(25)-(20)	1.0%	0.5%	0.3%	0.1%	(25)-(20)	524	221	113	30
(20)-(15)	1.7%	1.1%	0.7%	0.3%	(20)-(15)	859	515	307	110
(15)-(10)	3.1%	2.2%	1.7%	0.9%	(15)-(10)	1,608	1,053	758	334
(10)-(5)	6.2%	5.2%	4.3%	3.4%	(10)-(5)	3,174	2,509	1,925	1,235
(5)-0	12.1%	13.1%	13.0%	13.1%	(5)-0	6,236	6,319	5,842	4,785
0-5	20.6%	25.1%	28.8%	34.6%	0-5	10,597	12,079	12,897	12,668
5-10	18.0%	21.4%	24.2%	28.2%	5-10	9,272	10,300	10,828	10,321
10-15	11.4%	12.3%	12.5%	11.2%	10-15	5,899	5,916	5,607	4,120
15-20	6.8%	6.8%	6.0%	4.3%	15-20	3,520	3,261	2,666	1,580
20-25	4.5%	3.9%	3.1%	1.9%	20-25	2,322	1,874	1,393	679
25-30	3.0%	2.4%	1.9%	1.0%	25-30	1,541	1,145	845	359
30-35	2.0%	1.5%	1.0%	0.5%	30-35	1,031	739	441	178
35-40	1.3%	1.0%	0.7%	0.3%	35-40	695	495	301	96
40-45	1.0%	0.7%	0.4%	0.2%	40-45	523	317	191	62
>45	5.4%	2.3%	1.1%	0.3%	>45	2,799	1,120	509	92
Mean	15.0%	8.0%	6.7%	5.5%	Total	51,547	48,136	44,775	36,663
Median	5.8%	5.5%	5.2%	4.7%					
StDev	287.0%	18.4%	12.0%	7.8%					

Source: Credit Suisse HOLT®.

Note: CAGR = compound annual growth rate.

Exhibit 3 is the distribution for the three-year sales growth rate. This represents, in a graph, the corresponding column in exhibit 2. The mean, or average, growth rate was 8.0 percent per year and the median growth rate was 5.5 percent. The median is a better indicator of the central location of the results because the distribution is skewed to the right. The standard deviation, 18.4 percent, gives an indication of the width of the bell curve.

Exhibit 3: Three-Year CAGR of Sales (1950-2014)



Source: Credit Suisse HOLT®.

Note: CAGR = compound annual growth rate.

While the data for the full sample are a start, you want to hone the reference class of base rates to make the results more relevant and applicable. One approach is to break the universe into deciles based on a company's sales in the prior year. Within each size decile, we sort the observations of growth rates into bins in increments of five percentage points (except for the tails).

There is a modest survivorship bias because each sample includes only the firms that survived for that specified period. For example, a company in our 10-year sample would have had to have survived for 10 years. About one-half of all public companies cease to exist within ten years of being listed.¹⁸

The heart of this analysis is exhibit 4, which shows each decile, the total population, and an additional analysis of mega companies (those with sales in excess of \$50 billion). Here's how you use the exhibit. Determine the base sales level for the company that you want to model. Then go to the appropriate decile based on that size. You now have the proper reference class and the distribution of growth rates over the various horizons.

Let's use Tesla as an example. Musk said he hoped to grow sales 50 percent per year for the next decade from a sales base of \$6 billion (actual sales for 2015 were \$4 billion). You first find the correct reference class, which is the decile that has a sales base of \$4.5 - \$7 billion. Next you examine the row of growth that is marked ">45," representing sales growth of 45 percent or more. Going to the column "10-Yr," you will see that no companies achieved this feat. Indeed, you have to go down to 30-35 percent growth to see any companies, and even there it is only one-fifth of 1 percent of the sample.

Exhibit 4: Base Rates by Decile (1950-2014)

Sales: \$0-325 Mn					Sales: \$325-700 Mn					Sales: \$700-1,250 Mn				
Base Rates					Base Rates					Base Rates				
Sales CAGR (%)	1-Yr	3-Yr	5-Yr	10-Yr	Sales CAGR (%)	1-Yr	3-Yr	5-Yr	10-Yr	Sales CAGR (%)	1-Yr	3-Yr	5-Yr	10-Yr
<(25)	1.4%	0.5%	0.4%	0.0%	<(25)	1.0%	0.2%	0.1%	0.0%	<(25)	1.5%	0.4%	0.3%	0.2%
(25)-(20)	0.6%	0.2%	0.1%	0.0%	(25)-(20)	0.4%	0.4%	0.1%	0.0%	(25)-(20)	0.9%	0.3%	0.4%	0.1%
(20)-(15)	1.0%	0.4%	0.3%	0.3%	(20)-(15)	1.1%	0.7%	0.4%	0.1%	(20)-(15)	1.4%	0.8%	0.6%	0.3%
(15)-(10)	1.3%	1.2%	0.5%	0.6%	(15)-(10)	2.3%	0.9%	0.9%	0.7%	(15)-(10)	2.5%	1.9%	1.3%	0.9%
(10)-(5)	3.2%	1.8%	1.3%	0.7%	(10)-(5)	4.0%	2.6%	1.9%	2.3%	(10)-(5)	4.5%	3.5%	3.4%	2.3%
(5)-0	6.8%	5.6%	4.4%	3.7%	(5)-0	8.6%	7.3%	6.9%	6.8%	(5)-0	9.7%	9.4%	9.0%	9.8%
0-5	13.6%	15.2%	16.2%	17.5%	0-5	19.3%	23.7%	24.6%	27.4%	0-5	19.2%	22.9%	25.9%	32.1%
5-10	15.1%	18.9%	22.0%	30.8%	5-10	18.3%	23.5%	29.2%	35.4%	5-10	18.7%	23.3%	25.9%	31.0%
10-15	12.2%	14.9%	18.1%	19.5%	10-15	13.6%	16.3%	16.5%	16.1%	10-15	12.5%	14.8%	15.6%	14.5%
15-20	9.1%	10.6%	10.1%	9.7%	15-20	8.2%	8.3%	7.8%	5.8%	15-20	8.2%	8.3%	7.4%	5.1%
20-25	6.6%	6.3%	6.6%	6.1%	20-25	6.5%	4.9%	4.1%	2.9%	20-25	5.1%	4.5%	4.4%	2.2%
25-30	4.4%	4.8%	5.1%	3.8%	25-30	3.6%	2.9%	2.5%	1.2%	25-30	3.3%	3.2%	2.4%	1.0%
30-35	3.8%	3.4%	3.2%	2.6%	30-35	2.2%	2.1%	1.8%	0.7%	30-35	2.8%	2.1%	1.1%	0.3%
35-40	2.6%	2.9%	2.8%	1.6%	35-40	1.8%	1.6%	0.9%	0.3%	35-40	2.0%	1.6%	1.0%	0.1%
40-45	2.1%	2.0%	1.8%	1.1%	40-45	1.4%	1.1%	0.8%	0.1%	40-45	1.4%	0.8%	0.4%	0.1%
>45	16.0%	11.5%	7.1%	2.0%	>45	7.8%	3.5%	1.4%	0.1%	>45	6.3%	2.3%	0.9%	0.0%
Mean	73.7%	21.9%	16.8%	12.2%	Mean	16.7%	11.2%	9.4%	7.3%	Mean	12.9%	9.4%	8.0%	6.1%
Median	12.8%	12.0%	11.1%	9.3%	Median	8.6%	7.8%	7.3%	6.5%	Median	7.4%	7.0%	6.5%	5.5%
StDev	950.6%	42.5%	22.3%	11.9%	StDev	53.3%	16.2%	11.0%	7.2%	StDev	32.8%	13.6%	10.6%	7.1%

Sales: \$1,250-2,000 Mn					Sales: \$2,000-3,000 Mn					Sales: \$3,000-4,500 Mn				
Base Rates					Base Rates					Base Rates				
Sales CAGR (%)	1-Yr	3-Yr	5-Yr	10-Yr	Sales CAGR (%)	1-Yr	3-Yr	5-Yr	10-Yr	Sales CAGR (%)	1-Yr	3-Yr	5-Yr	10-Yr
<(25)	1.4%	0.4%	0.4%	0.0%	<(25)	1.5%	0.4%	0.2%	0.0%	<(25)	1.6%	0.5%	0.2%	0.0%
(25)-(20)	0.9%	0.4%	0.1%	0.1%	(25)-(20)	1.0%	0.2%	0.1%	0.1%	(25)-(20)	1.1%	0.4%	0.1%	0.0%
(20)-(15)	1.2%	0.8%	0.4%	0.4%	(20)-(15)	1.5%	1.0%	0.4%	0.1%	(20)-(15)	1.9%	0.9%	0.7%	0.0%
(15)-(10)	2.5%	1.7%	1.1%	0.8%	(15)-(10)	2.7%	1.8%	1.2%	0.3%	(15)-(10)	3.5%	2.0%	1.9%	0.6%
(10)-(5)	4.9%	3.9%	3.2%	2.1%	(10)-(5)	5.1%	4.8%	3.7%	2.7%	(10)-(5)	6.5%	5.2%	3.9%	2.8%
(5)-0	9.4%	10.6%	10.2%	10.3%	(5)-0	11.3%	12.0%	11.6%	13.1%	(5)-0	12.1%	14.4%	14.7%	15.2%
0-5	20.4%	24.7%	29.0%	36.6%	0-5	21.5%	26.5%	31.1%	38.1%	0-5	21.8%	26.1%	30.6%	40.5%
5-10	19.7%	23.9%	27.0%	30.2%	5-10	18.9%	22.5%	26.5%	28.7%	5-10	17.6%	22.5%	25.0%	27.7%
10-15	12.9%	13.3%	13.5%	12.3%	10-15	11.9%	12.8%	12.6%	10.3%	10-15	11.6%	11.8%	12.2%	8.6%
15-20	7.3%	7.3%	6.5%	4.1%	15-20	7.6%	6.8%	5.6%	4.5%	15-20	7.0%	7.1%	5.5%	3.1%
20-25	4.2%	4.1%	3.5%	1.5%	20-25	5.0%	4.4%	3.4%	1.1%	20-25	4.6%	3.6%	2.7%	0.8%
25-30	3.6%	3.0%	2.2%	0.8%	25-30	2.8%	2.4%	1.8%	0.8%	25-30	2.9%	2.2%	1.4%	0.4%
30-35	2.3%	1.9%	1.0%	0.3%	30-35	2.1%	1.4%	0.6%	0.1%	30-35	1.7%	1.3%	0.5%	0.1%
35-40	1.6%	1.0%	0.7%	0.1%	35-40	1.4%	1.0%	0.4%	0.1%	35-40	1.2%	0.7%	0.1%	0.0%
40-45	1.5%	0.6%	0.5%	0.2%	40-45	0.8%	0.7%	0.2%	0.1%	40-45	0.8%	0.4%	0.2%	0.0%
>45	6.2%	2.4%	0.8%	0.1%	>45	4.9%	1.3%	0.4%	0.0%	>45	4.1%	0.8%	0.2%	0.0%
Mean	12.8%	8.8%	7.3%	5.6%	Mean	10.2%	7.4%	6.3%	5.1%	Mean	8.7%	6.4%	5.4%	4.4%
Median	7.2%	6.3%	5.8%	5.0%	Median	6.2%	5.5%	5.2%	4.5%	Median	5.4%	5.1%	4.7%	4.0%
StDev	35.9%	14.2%	10.3%	6.8%	StDev	23.4%	12.1%	9.0%	6.1%	StDev	24.6%	11.3%	8.6%	5.7%

Sales: \$4,500-7,000 Mn		Base Rates			
Sales CAGR (%)		1-Yr	3-Yr	5-Yr	10-Yr
<(25)		1.7%	0.5%	0.3%	0.0%
(25)-(20)		1.1%	0.7%	0.2%	0.2%
(20)-(15)		1.7%	1.0%	0.7%	0.1%
(15)-(10)		3.8%	2.8%	1.9%	1.1%
(10)-(5)		6.6%	5.5%	4.4%	4.1%
(5)-0		12.7%	14.6%	15.3%	15.3%
0-5		21.8%	27.8%	33.0%	40.5%
5-10		19.2%	21.4%	23.4%	26.6%
10-15		11.3%	10.9%	10.7%	7.8%
15-20		6.4%	6.2%	5.5%	2.7%
20-25		3.8%	3.7%	2.2%	0.8%
25-30		3.0%	1.9%	1.1%	0.5%
30-35		1.8%	1.2%	0.6%	0.2%
35-40		0.9%	0.5%	0.3%	0.0%
40-45		0.7%	0.4%	0.2%	0.0%
>45		3.7%	1.0%	0.4%	0.0%
Mean		8.0%	5.8%	5.0%	4.0%
Median		5.2%	4.5%	4.2%	3.7%
StDev		23.0%	11.8%	8.8%	6.1%

Sales: \$7,000-12,000 Mn		Base Rates			
Sales CAGR (%)		1-Yr	3-Yr	5-Yr	10-Yr
<(25)		2.0%	0.5%	0.4%	0.0%
(25)-(20)		1.2%	0.5%	0.2%	0.1%
(20)-(15)		1.8%	1.2%	0.7%	0.6%
(15)-(10)		3.4%	2.9%	2.4%	1.0%
(10)-(5)		8.0%	7.2%	6.2%	4.5%
(5)-0		14.4%	16.8%	17.6%	18.5%
0-5		22.0%	27.6%	31.6%	40.4%
5-10		18.4%	20.3%	23.5%	25.1%
10-15		10.9%	10.7%	9.6%	6.5%
15-20		5.4%	5.4%	4.1%	2.2%
20-25		3.8%	3.1%	1.7%	0.7%
25-30		2.2%	1.5%	1.2%	0.3%
30-35		1.6%	1.0%	0.4%	0.1%
35-40		0.9%	0.4%	0.2%	0.1%
40-45		0.8%	0.3%	0.1%	0.0%
>45		3.2%	0.6%	0.1%	0.0%
Mean		7.0%	4.8%	4.0%	3.3%
Median		4.3%	3.8%	3.5%	3.2%
StDev		25.8%	10.8%	8.4%	5.9%

Sales: \$12,000-25,000 Mn		Base Rates			
Sales CAGR (%)		1-Yr	3-Yr	5-Yr	10-Yr
<(25)		2.5%	0.9%	0.3%	0.0%
(25)-(20)		1.3%	0.6%	0.6%	0.1%
(20)-(15)		2.3%	1.8%	1.3%	0.5%
(15)-(10)		3.7%	2.9%	2.5%	1.4%
(10)-(5)		8.0%	7.4%	6.6%	5.8%
(5)-0		16.2%	18.8%	18.9%	20.4%
0-5		22.6%	27.8%	33.3%	40.5%
5-10		17.9%	20.1%	21.3%	21.2%
10-15		9.6%	9.3%	8.4%	6.7%
15-20		5.0%	4.4%	3.8%	2.6%
20-25		3.1%	2.7%	1.6%	0.7%
25-30		2.3%	1.3%	0.8%	0.1%
30-35		1.4%	0.9%	0.4%	0.0%
35-40		0.9%	0.4%	0.3%	0.0%
40-45		0.5%	0.3%	0.0%	0.0%
>45		2.6%	0.5%	0.1%	0.0%
Mean		5.1%	3.8%	3.3%	2.9%
Median		3.6%	3.2%	2.9%	2.8%
StDev		17.8%	10.5%	8.3%	6.0%

Sales: >\$25,000 Mn		Base Rates			
Sales CAGR (%)		1-Yr	3-Yr	5-Yr	10-Yr
<(25)		3.2%	1.4%	1.0%	0.1%
(25)-(20)		1.5%	0.8%	0.5%	0.2%
(20)-(15)		2.3%	1.9%	1.3%	0.7%
(15)-(10)		4.7%	3.4%	3.0%	2.1%
(10)-(5)		8.9%	9.1%	8.1%	8.4%
(5)-0		16.7%	19.4%	21.1%	23.2%
0-5		21.8%	27.2%	32.7%	37.3%
5-10		16.1%	18.5%	18.2%	20.6%
10-15		9.2%	9.3%	8.6%	5.9%
15-20		5.5%	4.3%	3.3%	1.3%
20-25		3.4%	2.2%	1.3%	0.2%
25-30		2.4%	1.1%	0.4%	0.0%
30-35		1.0%	0.4%	0.2%	0.0%
35-40		0.7%	0.5%	0.1%	0.0%
40-45		0.5%	0.2%	0.1%	0.0%
>45		2.0%	0.3%	0.0%	0.0%
Mean		4.0%	2.7%	2.2%	1.9%
Median		2.8%	2.3%	2.1%	2.0%
StDev		18.1%	10.8%	8.6%	6.0%

Sales: >\$50,000 Mn		Base Rates			
Sales CAGR (%)		1-Yr	3-Yr	5-Yr	10-Yr
<(25)		3.4%	1.5%	1.6%	0.0%
(25)-(20)		1.9%	0.7%	0.5%	0.1%
(20)-(15)		2.3%	1.9%	1.0%	0.5%
(15)-(10)		5.3%	3.9%	2.6%	1.9%
(10)-(5)		9.8%	11.1%	9.3%	7.8%
(5)-0		17.2%	21.0%	22.9%	28.3%
0-5		21.9%	27.2%	34.8%	38.7%
5-10		15.5%	17.3%	17.3%	18.6%
10-15		8.8%	9.5%	6.9%	3.5%
15-20		5.3%	3.3%	2.3%	0.6%
20-25		3.4%	1.5%	0.7%	0.0%
25-30		2.3%	0.7%	0.1%	0.0%
30-35		1.0%	0.1%	0.1%	0.0%
35-40		0.5%	0.3%	0.0%	0.0%
40-45		0.4%	0.1%	0.0%	0.0%
>45		1.2%	0.0%	0.0%	0.0%
Mean		2.6%	1.5%	1.3%	1.3%
Median		2.3%	1.6%	1.6%	1.3%
StDev		15.6%	9.9%	7.9%	5.2%

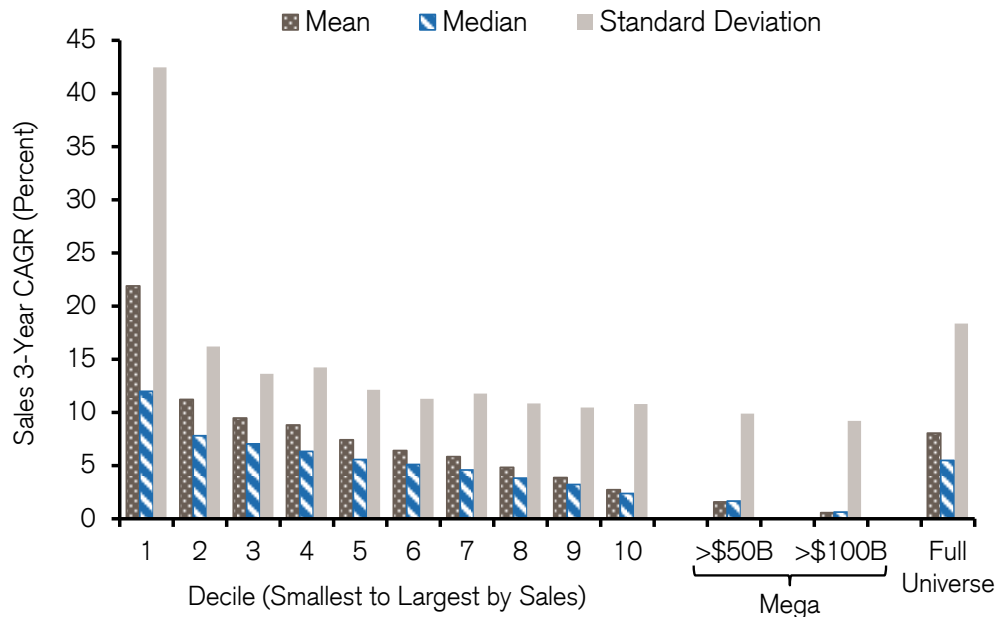
Full Universe		Base Rates			
Sales CAGR (%)		1-Yr	3-Yr	5-Yr	10-Yr
<(25)		1.8%	0.6%	0.3%	0.0%
(25)-(20)		1.0%	0.5%	0.3%	0.1%
(20)-(15)		1.7%	1.1%	0.7%	0.3%
(15)-(10)		3.1%	2.2%	1.7%	0.9%
(10)-(5)		6.2%	5.2%	4.3%	3.4%
(5)-0		12.1%	13.1%	13.0%	13.1%
0-5		20.6%	25.1%	28.8%	34.6%
5-10		18.0%	21.4%	24.2%	28.2%
10-15		11.4%	12.3%	12.5%	11.2%
15-20		6.8%	6.8%	6.0%	4.3%
20-25		4.5%	3.9%	3.1%	1.9%
25-30		3.0%	2.4%	1.9%	1.0%
30-35		2.0%	1.5%	1.0%	0.5%
35-40		1.3%	1.0%	0.7%	0.3%
40-45		1.0%	0.7%	0.4%	0.2%
>45		5.4%	2.3%	1.1%	0.3%
Mean		15.0%	8.0%	6.7%	5.5%
Median		5.8%	5.5%	5.2%	4.7%
StDev		287.0%	18.4%	12.0%	7.8%

Source: Credit Suisse HOLT®.

In total, exhibit 4 shows results for 44 reference classes (11 size ranges times 4 time horizons) that should cover the vast majority of possible outcomes for sales growth. The appendix contains the sample sizes for each of the reference classes. Bear in mind that these data are adjusted for inflation and that most forecasts reflect inflation expectations. We will show how to incorporate these base rates into your forecasts for sales growth in a moment. For now, it's useful to acknowledge the utility of these data as an analytical guide and a valuable reality check.

Getting to the proper reference class is crucial, but there are some useful observations about the whole that are worth noting. To begin, as firm size increases the mean and median growth rates decline, as does the standard deviation of the growth rates. This point has been well established empirically.¹⁹ Exhibit 5 shows this pattern for annualized growth rates over three years. The lesson is to temper expectations about sales growth as companies get larger.

Exhibit 5: Growth Rates and Standard Deviations Decline with Size

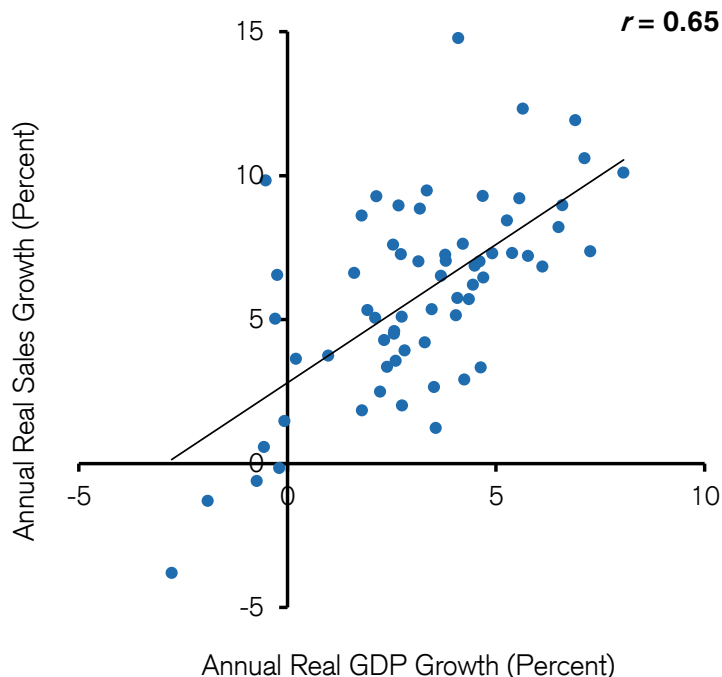


Source: Credit Suisse HOLT®.

Note: Growth rates are annualized over three years.

Exhibit 6 shows that sales growth follows gross domestic product (GDP) reasonably closely. U.S. GDP growth and the median sales growth in the same year have a correlation coefficient of 0.65. (Positive correlations fall in the range of 0 to 1.0, where 0 is random and 1.0 is a perfect correlation.) From 1950-2014, U.S. GDP grew at 3.2 percent per year, adjusted for inflation, with a standard deviation of 2.3 percent.

Corporate sales growth was higher than that of the broader economy for a few reasons. First, companies growing rapidly often need access to capital and hence choose to go public, likely creating a selection bias. Second, some companies, including contract manufacturers, generate growth that is not captured in the GDP figures. Finally, some companies grow outside the U.S., which shows up in sales growth but fails to be reflected in GDP.²⁰

Exhibit 6: Median Sales Growth Is Correlated with GDP Growth

Source: Credit Suisse HOLT® and Bureau of Economic Analysis.

Note: Sales growth is for the top 1,000 global companies by market capitalization in each year.

Finally, notwithstanding our natural tendency to anticipate growth, 23 percent of the companies in the sample had negative sales growth rates for 3 years, after an adjustment for inflation, and 20 percent shrank for 5 years. Whereas a decline in sales need not be bad if it occurs for the right reasons, few analysts or corporate leaders project shrinking sales unless there is a clear strategy of divestiture.²¹

Using Base Rates to Model Growth

We have established that there are two ways of making a forecast. You can do bottom-up research, which is the most natural method, or you can turn to a base rate. The research in decision making shows that the bottom-up approach is subject to biases and that incorporating the base rate generally improves the quality of the forecast. Yet we don't want to lean too much on either our own analysis or the base rate. We want to combine the two intelligently.

There is a technique to combine the two approaches, which we will apply to our sales growth data.²² Correlation is the key to the method. The correlation coefficient measures the degree of linear relationship between variables in a pair of distributions. The value of a correlation coefficient can fall between -1.0 (the rise in one variable perfectly correlates with the fall of the other) and 1.0 (both variables move in tandem). A zero correlation indicates randomness. We will examine a single variable, sales growth, measured over time, and all of the correlations are positive.

If the correlation between two distributions is high, then what happened before gives you a really good sense of what will follow. For example, the correlation for cash flow return on investment (CFROI®) for companies in the consumer staples sector is about 0.90 from one year to the next.²³ That means if you know Unilever's CFROI from last year, you can forecast it this year with a great deal of accuracy. The bottom-up work is highly relevant.

*CFROI® is a registered trademark in the United States and other countries (excluding the United Kingdom) of Credit Suisse Group AG or its affiliates.

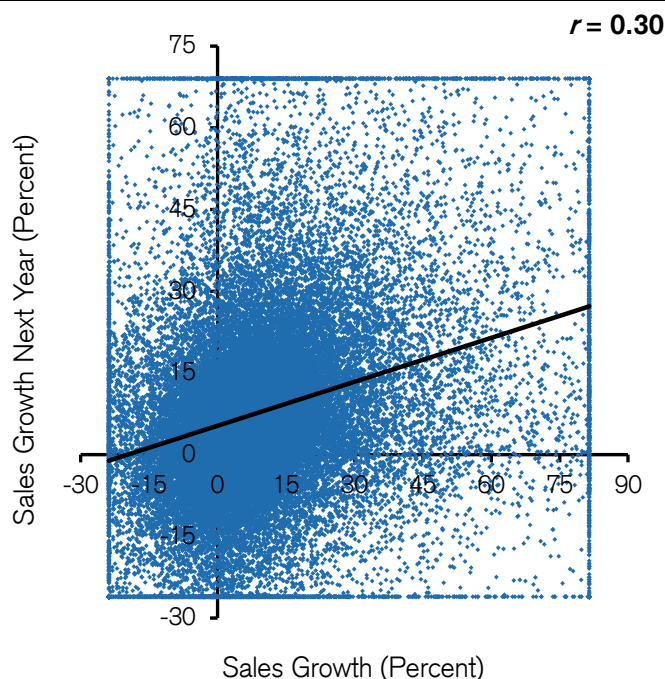
If the correlation is low, what happened before provides no inkling of what will happen next. Take the annual total shareholder returns for the S&P 500 as a case.²⁴ The correlation from year to year, from 1928 through 2015, is essentially zero. Telling you last year's return provides no help in forecasting the return for this year. Your best forecast is the average of the reference class.

The basic idea is that the correlation determines how you should weight the bottom-up analysis and the base rate. For Unilever, a sensible forecast is nine parts last year's CFROI and one part last year's average sector CFROI, the base rate. For your S&P 500 forecast, you should place minimal weight on what happened last year and rely largely on the average return since 1928, the base rate.

Studying base rates for sales growth is logical for two reasons. First, sales growth is the most important driver of value for most companies. Second, sales growth has a higher correlation from year to year than does earnings growth, which is the most commonly discussed item on the income statement.²⁵ Sales growth is important and more predictable than profit growth.

Exhibit 7 shows that the correlation coefficient is 0.30 for the year-to-year sales growth rate.²⁶ This includes the top 1,000 global companies by market capitalization from 1950 to 2014. Roughly 50,000 company years are in the data, and all of the figures are adjusted for inflation.

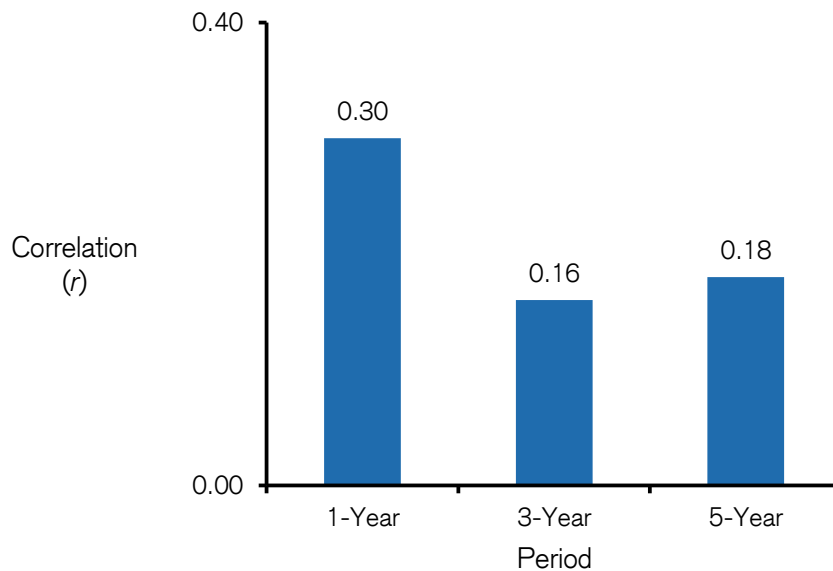
Exhibit 7: Correlation of One-Year Sales Growth Rates



Source: Credit Suisse HOLT® and Credit Suisse.

Note: Data winsorized at 2nd and 98th percentiles.

Not surprisingly, the correlations are lower for longer time periods. Exhibit 8 shows the correlations for one-, three-, and five-year horizons for the full population of companies. The base rate for the reference classes, the median growth rate, should receive the majority of the weight for forecasts of three years or longer. In fact, you might start with the base rate and seek reasons to move away from it.

Exhibit 8: Correlation of Sales Growth Rates for 1-, 3-, and 5-Year Horizons

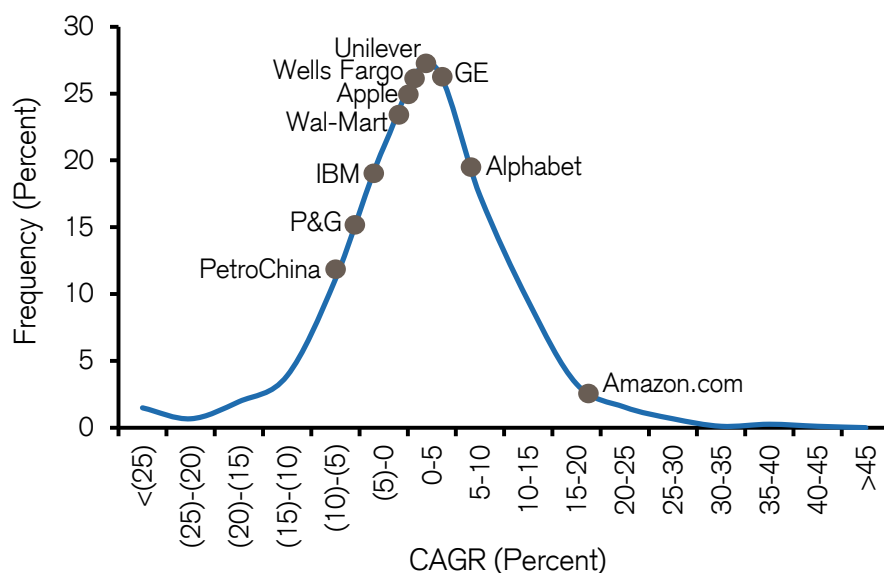
Source: Credit Suisse HOLT® and Credit Suisse.

This approach to modelling regression toward the mean does not say that some companies will not grow rapidly and others will not shrink. We know that companies will fill the tails of the distribution. What it does say is that the best forecast for a large sample of companies is something close to the median, and that companies that anticipate sales growth well in excess of the median are likely to be disappointed.

Current Expectations

Exhibit 1 shows the current expectations for sales growth over three years for a thousand public companies around the world. The median expected growth rate is 1.7 percent. Exhibit 9 represents the three-year sales growth rates, adjusted for inflation, which analysts expect for ten companies with sales in excess of \$50 billion. We superimposed the expected growth rates on the distribution of historical sales growth rates for the reference class of mega companies.

Exhibit 9: Three-Year Expected Sales Growth Rates for Ten Mega Companies



Source: Credit Suisse HOLT® and FactSet Estimates.

Note: FactSet consensus estimates as of February 19, 2016; Growth rates are annualized; P&G = Procter & Gamble, IBM = International Business Machines, and GE = General Electric.

Analysts expect negative sales growth for four of the ten, which corporate actions or commodity prices can largely explain. The standard deviation of growth rates for this small sample is 7.0 percent.

Summary

Active investing requires having a point of view that is different than that of the stock market. Implicit in such a variant perception is a forecast of outcomes that is at odds with what the market price implies.

Research shows that optimism and overconfidence can creep into our forecasts and distort them. This is especially pronounced when the outcomes have personal relevance. Research also shows that incorporating a base rate can improve the quality of our forecasts. Notwithstanding the utility of this method, it remains substantially underutilized.

In this piece we provide the base rates for sales growth rates for a large sample of global companies over a span of more than six decades. We start with sales growth because it is the most important value driver. We then provide a method to integrate our views with base rates to sharpen the quality of our forecasts.

Appendix: Observations for Each Base Rate by Decile (1950-2014)

Sales: \$0-325 Mn					Sales: \$325-700 Mn					Sales: \$700-1,250 Mn				
Observations					Observations					Observations				
Sales CAGR (%)	1-Yr	3-Yr	5-Yr	10-Yr	Sales CAGR (%)	1-Yr	3-Yr	5-Yr	10-Yr	Sales CAGR (%)	1-Yr	3-Yr	5-Yr	10-Yr
<(25)	64	21	16	0	<(25)	49	10	5	0	<(25)	72	20	11	6
(25)-(20)	30	8	5	2	(25)-(20)	18	17	5	1	(25)-(20)	42	13	16	3
(20)-(15)	48	16	15	12	(20)-(15)	52	34	21	6	(20)-(15)	67	35	25	11
(15)-(10)	62	53	22	25	(15)-(10)	112	44	42	30	(15)-(10)	117	85	58	36
(10)-(5)	148	83	57	32	(10)-(5)	194	124	90	100	(10)-(5)	209	158	147	92
(5)-0	317	257	197	157	(5)-0	418	348	324	293	(5)-0	452	426	392	386
0-5	629	692	733	745	0-5	943	1,135	1,149	1,175	0-5	897	1,037	1,134	1,259
5-10	700	864	993	1,314	5-10	896	1,125	1,365	1,519	5-10	873	1,057	1,132	1,218
10-15	565	679	816	834	10-15	664	782	771	692	10-15	586	672	683	569
15-20	420	486	456	412	15-20	402	396	366	249	15-20	381	378	325	199
20-25	306	287	299	260	20-25	318	237	190	125	20-25	237	202	194	87
25-30	206	218	228	164	25-30	177	137	116	53	25-30	153	146	106	41
30-35	176	153	144	109	30-35	106	103	82	28	30-35	131	93	50	12
35-40	122	133	128	69	35-40	87	77	44	13	35-40	92	72	42	5
40-45	98	92	81	47	40-45	68	54	37	4	40-45	67	37	19	2
>45	743	524	321	85	>45	382	168	64	3	>45	295	104	40	1
Total	4,634	4,566	4,511	4,267	Total	4,886	4,791	4,671	4,291	Total	4,671	4,535	4,374	3,927

Sales: \$1,250-2,000 Mn					Sales: \$2,000-3,000 Mn					Sales: \$3,000-4,500 Mn				
Observations					Observations					Observations				
Sales CAGR (%)	1-Yr	3-Yr	5-Yr	10-Yr	Sales CAGR (%)	1-Yr	3-Yr	5-Yr	10-Yr	Sales CAGR (%)	1-Yr	3-Yr	5-Yr	10-Yr
<(25)	62	16	16	1	<(25)	68	18	10	0	<(25)	80	23	8	1
(25)-(20)	40	19	6	3	(25)-(20)	45	10	5	3	(25)-(20)	53	18	6	1
(20)-(15)	55	34	17	14	(20)-(15)	67	42	17	3	(20)-(15)	96	42	30	1
(15)-(10)	114	74	47	27	(15)-(10)	121	75	48	11	(15)-(10)	173	92	80	23
(10)-(5)	220	167	131	76	(10)-(5)	231	205	149	92	(10)-(5)	320	240	168	99
(5)-0	420	455	417	368	(5)-0	511	510	467	443	(5)-0	601	668	636	540
0-5	915	1,063	1,190	1,312	0-5	968	1,128	1,245	1,289	0-5	1,080	1,212	1,321	1,434
5-10	881	1,026	1,110	1,082	5-10	853	956	1,062	973	5-10	872	1,045	1,079	981
10-15	577	570	553	440	10-15	538	545	506	349	10-15	572	548	526	306
15-20	328	316	268	147	15-20	343	288	223	152	15-20	345	327	239	111
20-25	188	175	143	55	20-25	224	189	138	37	20-25	226	166	116	28
25-30	162	131	91	29	25-30	128	102	74	26	25-30	145	101	62	13
30-35	102	83	40	12	30-35	94	59	24	4	30-35	83	61	23	2
35-40	72	43	27	4	35-40	61	42	15	2	35-40	60	34	4	1
40-45	65	25	19	7	40-45	36	28	8	2	40-45	40	19	10	0
>45	279	103	32	3	>45	221	56	18	0	>45	202	39	8	0
Total	4,480	4,300	4,107	3,580	Total	4,509	4,253	4,009	3,386	Total	4,948	4,635	4,316	3,541

Sales: \$4,500-7,000 Mn	Observations				Sales: \$7,000-12,000 Mn	Observations				Sales: \$12,000-25,000 Mn	Observations			
Sales CAGR (%)	1-Yr	3-Yr	5-Yr	10-Yr	Sales CAGR (%)	1-Yr	3-Yr	5-Yr	10-Yr	Sales CAGR (%)	1-Yr	3-Yr	5-Yr	10-Yr
<(25)	93	24	12	1	<(25)	125	28	19	1	<(25)	157	48	13	1
(25)-(20)	57	36	8	7	(25)-(20)	73	28	13	4	(25)-(20)	84	34	29	2
(20)-(15)	90	52	31	4	(20)-(15)	112	69	35	23	(20)-(15)	145	99	63	19
(15)-(10)	206	137	88	39	(15)-(10)	213	165	126	40	(15)-(10)	233	164	123	48
(10)-(5)	358	273	202	149	(10)-(5)	504	412	323	176	(10)-(5)	501	414	329	202
(5)-0	686	725	698	558	(5)-0	905	964	914	729	(5)-0	1,011	1,046	938	713
0-5	1,181	1,382	1,501	1,483	0-5	1,377	1,585	1,644	1,592	0-5	1,409	1,550	1,647	1,415
5-10	1,038	1,063	1,068	974	5-10	1,157	1,166	1,223	988	5-10	1,117	1,118	1,053	741
10-15	611	543	486	287	10-15	683	617	501	255	10-15	599	518	414	235
15-20	347	309	252	99	15-20	337	313	216	87	15-20	315	244	187	90
20-25	208	185	98	31	20-25	239	179	86	26	20-25	192	149	78	24
25-30	160	97	49	20	25-30	137	89	64	10	25-30	141	72	38	3
30-35	95	59	27	6	30-35	100	59	20	4	30-35	87	49	21	1
35-40	50	25	12	0	35-40	58	24	11	2	35-40	56	23	13	0
40-45	38	18	7	0	40-45	50	18	6	0	40-45	31	18	1	0
>45	201	49	16	0	>45	202	37	6	0	>45	164	26	3	0
Total	5,419	4,977	4,555	3,658	Total	6,272	5,753	5,207	3,937	Total	6,242	5,572	4,950	3,494

Sales: >\$25,000 Mn	Observations				Sales: >\$50,000 Mn	Observations				Full Universe	Observations			
Sales CAGR (%)	1-Yr	3-Yr	5-Yr	10-Yr	Sales CAGR (%)	1-Yr	3-Yr	5-Yr	10-Yr	Sales CAGR (%)	1-Yr	3-Yr	5-Yr	10-Yr
<(25)	177	65	42	3	<(25)	78	29	26	0	<(25)	947	273	152	14
(25)-(20)	82	38	20	4	(25)-(20)	44	13	8	1	(25)-(20)	524	221	113	30
(20)-(15)	127	92	53	17	(20)-(15)	53	38	16	5	(20)-(15)	859	515	307	110
(15)-(10)	257	164	124	55	(15)-(10)	121	76	42	18	(15)-(10)	1,608	1,053	758	334
(10)-(5)	489	433	329	217	(10)-(5)	224	217	152	74	(10)-(5)	3,174	2,509	1,925	1,235
(5)-0	915	920	859	598	(5)-0	394	410	373	269	(5)-0	6,236	6,319	5,842	4,785
0-5	1,198	1,295	1,333	964	0-5	502	532	566	368	0-5	10,597	12,079	12,897	12,668
5-10	885	880	743	531	5-10	357	339	281	177	5-10	9,272	10,300	10,828	10,321
10-15	504	442	351	153	10-15	201	185	113	33	10-15	5,899	5,916	5,607	4,120
15-20	302	204	134	34	15-20	122	64	37	6	15-20	3,520	3,261	2,666	1,580
20-25	184	105	51	6	20-25	77	30	11	0	20-25	2,322	1,874	1,393	679
25-30	132	52	17	0	25-30	53	13	2	0	25-30	1,541	1,145	845	359
30-35	57	20	10	0	30-35	23	2	1	0	30-35	1,031	739	441	178
35-40	37	22	5	0	35-40	12	5	0	0	35-40	695	495	301	96
40-45	30	8	3	0	40-45	9	2	0	0	40-45	523	317	191	62
>45	110	14	1	0	>45	27	0	0	0	>45	2,799	1,120	509	92
Total	5,486	4,754	4,075	2,582	Total	2,297	1,955	1,628	951	Total	51,547	48,136	44,775	36,663

Source: Credit Suisse HOLT®.

Endnotes

- ¹ Daniel Kahneman, *Thinking, Fast and Slow* (New York: Farrar, Straus and Giroux, 2011), 249.
- ² Alfred Rappaport and Michael J. Mauboussin, *Expectations Investing: Reading Stock Prices for Better Returns* (Boston, MA: Harvard Business School Press, 2001).
- ³ *Ibid.* Growth only creates value when a company earns in excess of the cost of capital. Growth at a negative spread destroys value.
- ⁴ Benjamin Lansford, Baruch Lev, Jennifer Wu Tucker, "Causes and Consequences of Disaggregating Earnings Guidance," *Journal of Business Finance & Accounting*, Vol. 40, No. 1-2, January/February 2013, 26-54.
- ⁵ Kahneman, 257.
- ⁶ See Small Business Association, Office of Advocacy, "Frequently Asked Questions," January 2011 (<https://www.sba.gov/sites/default/files/sbfaq.pdf>) and Arnold C. Cooper, Carolyn Y. Woo, and William C. Dunkelberg, "Entrepreneurs' Perceived Chances for Success," *Journal of Business Venturing*, Vol. 3, No. 2, Spring 1988, 97-108.
- ⁷ Cade Massey, Joseph P. Simmons, and David A. Armor, "Hope Over Experience: Desirability and the Persistence of Optimism," *Psychological Science*, Vol. 22, No. 2, February 2011, 274-281. Also, David A. Armor, Cade Massey, and Aaron M. Sackett, "Prescribed Optimism: Is It Right to Be Wrong About the Future?" *Psychological Science*, Vol. 19, No. 4, April 2008, 329-331. For a more detailed discussion of optimism, see Tali Sharot, *The Optimism Bias: A Tour of the Irrationally Positive Brain* (New York: Pantheon Books, 2011).
- ⁸ Michael J. Mauboussin and Dan Callahan, "IQ versus RQ: Differentiating Smarts from Decision-Making Skills," *Credit Suisse Global Financial Strategies*, May 12, 2015.
- ⁹ Geoffrey Friesen and Paul A. Weller, "Quantifying Cognitive Biases in Analyst Earnings Forecasts," *Journal of Financial Markets*, Vol. 9, No. 4, November 2006, 333-365.
- ¹⁰ Jack B. Soll and Joshua Klayman, "Overconfidence in Interval Estimates," *Journal of Experimental Psychology: Learning, Memory, and Cognition*, Vol. 30, No. 2, March 2004, 299-314.
- ¹¹ Itzhak Ben-David, John R. Graham, and Campbell R. Harvey, "Managerial Miscalibration," *Quarterly Journal of Economics*, Vol. 128, No. 4, August 2013, 1547-1584.
- ¹² Bent Flyvbjerg, Massimo Garbuio, Dan Lovallo, "Better Forecasting for Large Capital Projects," *McKinsey on Finance*, Autumn 2014, 7-13. Also, Bent Flyvbjerg, "Truth and Lies about Megaprojects," *Speech at Delft University of Technology*, September 26, 2007.
- ¹³ Kahneman, 249.
- ¹⁴ Tesla Motors, Inc. Q4 2014 Earnings Call, February 11, 2015. See FactSet: callstreet Transcript, page 7.
- ¹⁵ Berkeley J. Dietvorst, Joseph P. Simmons, and Cade Massey, "Algorithm Aversion: People Erroneously Avoid Algorithms After Seeing Them Err," *Journal of Experimental Psychology: General*, Vol. 144, No. 1, February 2015, 114-126.
- ¹⁶ The sample size is somewhat smaller than 1,000 in the early years but reaches 1,000 by the late 1960s.
- ¹⁷ Most public companies "die" as the result of mergers and acquisitions. See Michael J. Mauboussin and Dan Callahan, "Why Corporate Longevity Matters: What Index Turnover Tells Us about Corporate Results," *Credit Suisse Global Financial Strategies*, April 16, 2014.
- ¹⁸ Madeleine I. G. Daepf, Marcus J. Hamilton, Geoffrey B. West, and Luís M. A. Bettencourt, "The mortality of companies," *The Royal Society Publishing*, Vol. 12, No. 106, April 1, 2015.
- ¹⁹ Michael H. R. Stanley, Luís A. N. Amaral, Sergey V. Buldyrev, Shlomo Havlin, Heiko Leschhorn, Philipp Maass, Michael A. Salinger, and H. Eugene Stanley, "Scaling Behaviour in the Growth of Companies," *Nature*, Vol. 379, February 29, 1996, 804-806. Also, Rich Perline, Robert Axtell, and Daniel Teitelbaum, "Volatility and Asymmetry of Small Firm Growth Rates Over Increasing Time Frames," *Small Business Research Summary*, No. 285, December 2006.

²⁰ Tim Koller, Marc Goedhart, and David Wessels, *Valuation: Measuring and Managing the Value of Companies*, 6th Edition (Hoboken, NJ: John Wiley & Sons, 2015), 126-127.

²¹ Sheridan Titman, K. C. John Wei, and Feixue Xie, "Capital Investments and Stock Returns," *The Journal of Financial and Quantitative Analysis*, Vol. 39, No. 4, December 2004, 677-700.

²² William M. K. Trochim and James P. Donnelly, *The Research Methods Knowledge Base*, Third Edition (Mason, OH: Atomic Dog, 2008), 166. See <http://www.socialresearchmethods.net/kb/regmean.php>.

²³ Michael J. Mauboussin, Dan Callahan, Bryant Matthews, and David A. Holland, "How to Model Reversion to the Mean: Determining How Fast, and to What Mean, Results Revert," *Credit Suisse Global Financial Strategies*, September 17, 2013.

²⁴ "Credit Suisse Global Investment Returns Yearbook 2016," *Credit Suisse Research Institute*, February 2016.

²⁵ Michael J. Mauboussin, Dan Callahan, and Darius Majd, "The Base Rate Book – Earnings Growth," *Credit Suisse Global Financial Strategies*, December 16, 2015. Louis K.C. Chan, Jason Karceski, and Josef Lakonishok, "The Level and Persistence of Growth Rates," *Journal of Finance*, Vol. 58, No. 2, April 2003, 643-684. Also, Michael J. Mauboussin, "The True Measures of Success," *Harvard Business Review*, October 2012, 46-56.

²⁶ We winsorize the top and bottom two percent of the growth rates. Companies with growth rates in the top two percent are generally extremely small firms or firms that engaged in a significant merger and acquisition activity.