The Earnings Mirage: Why Corporate Profits are Overstated and What It Means for Investors

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In this piece, I'm going to introduce a new methodology for measuring the profitability and valuation of corporations. In applying the methodology, I'm going to encounter a massive discrepancy in corporate capital allocation. To explain the discrepancy, I'm going to attempt to show that reported company earnings are systematically overstated relative to reality. After identifying the likely causes of the overstatement, I'm going to explore their implications for individual stock selection and overall stock market valuation.

INTRODUCTION: SUMMARY OF EACH SECTION OF THE PIECE

The piece will contain six sections, listed below with navigation links:

- Section 1: The Problem with Conventional Equity-Based Measures of Profitability and Valuation
- Section 2: Introducing Integrated Equity
- Section 3: The Profitability Gap
- Section 4: The Overstated Earnings Hypothesis
- Section 5: Implications for Investors and Allocators
- Section 6: Using the Integrated Equity Methodology to Value Markets and Individual Stocks

In the next several paragraphs, I'm going to briefly summarize each section, highlighting charts and tables that are likely to be of interest to readers.

Summary of Section 1: The Problem with Conventional Equity-Based Measures of Profitability and Valuation

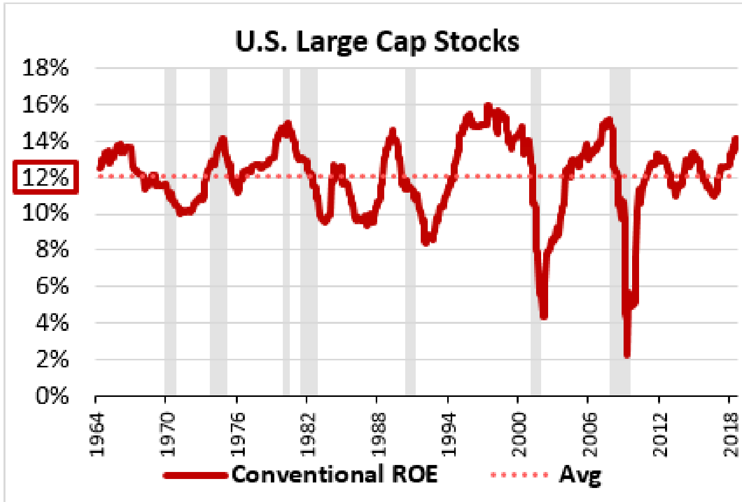
In the first section of the piece, I'm going to examine the problem with conventional equity-based measures of profitability and valuation. The conventional approach to measuring the profitability of corporate investment is to calculate the return on equity (ROE), defined as earnings divided by equity.

(1) Profitability = Return on Equity = Earnings / Equity

Unfortunately, this approach produces distorted results. The distortion arises from the fact that shareholder equity is not upwardly adjusted for inflation under U.S. generally accepted accounting principles (GAAP). Nominal earnings therefore rise faster than equity over time, producing inflated ROEs.

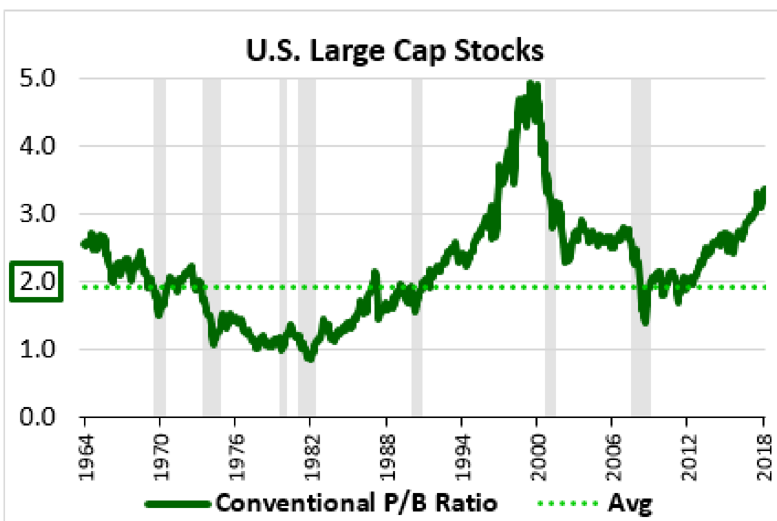
* Pseudonym

For an illustration of the distortion, consider the chart below, which shows the conventional ROE of the OSAM U.S. Large Cap Stock Universe from 1964 through 2018:



The ROE averages out to more than 12% per year. We know this number is exaggerated because it's roughly twice as high as other return parameters for the index: the total return, the return from growth and dividends, the average earnings yield, and so on.

The same distortion arises in equity-based measures of valuation such as the popular price-to-book (P/B) ratio. For our purposes, "book value" and "equity" refer to the same thing. Because equity is not upwardly adjusted for inflation under U.S. GAAP, nominal share prices rise faster than book values over time, producing inflated P/B ratios. The chart below illustrates the distortion:

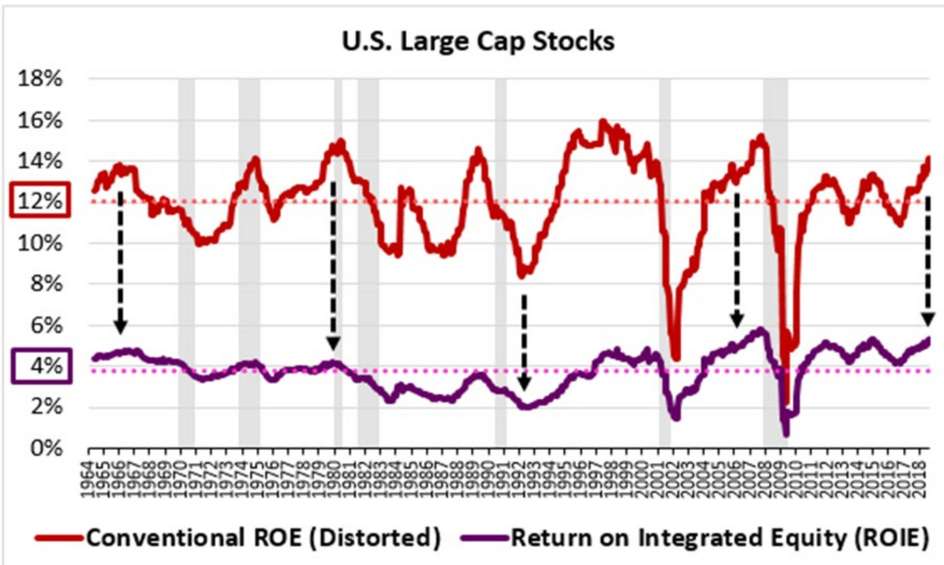


In theory, stocks should trade at par to their book values, with average P/B ratios of 1.0. The approximate 2.0 average observed in the chart is therefore twice as high as it should be.

Summary of Section 2: Introducing Integrated Equity

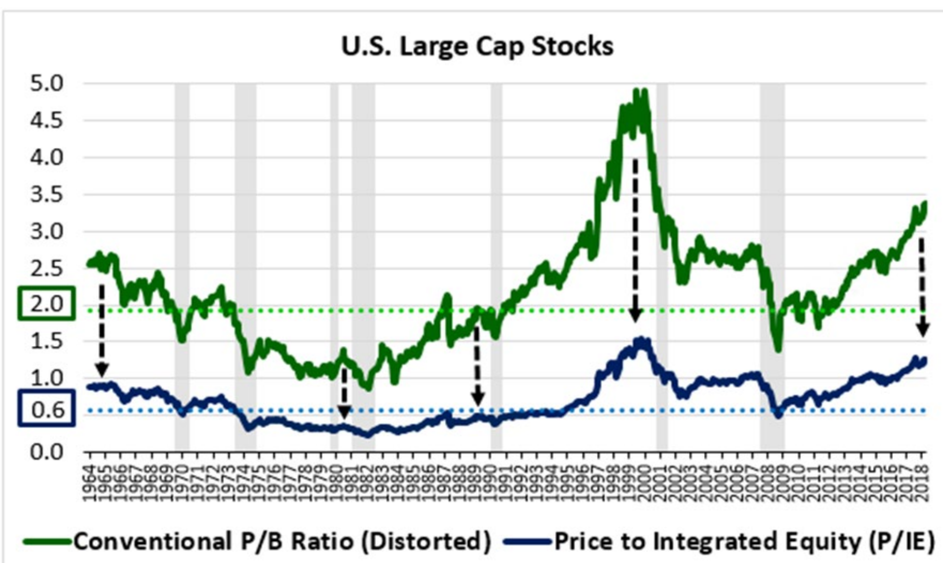
In the second section of the piece, I'm going to introduce and explain a methodology for correcting the inflationary distortions associated with conventional ROE and P/B measures. This methodology, which I'm going to refer to as "integrated equity," deconstructs book values into constituent units of retained earnings and individually adjusts those units for inflation. It then integrates the units back together to form a properly inflation-adjusted book value measure.

The chart below shows how ROE changes when book value is calculated using the integrated equity methodology. We refer to the improved ROE measure that it generates as "ROIE," short for return on integrated equity:

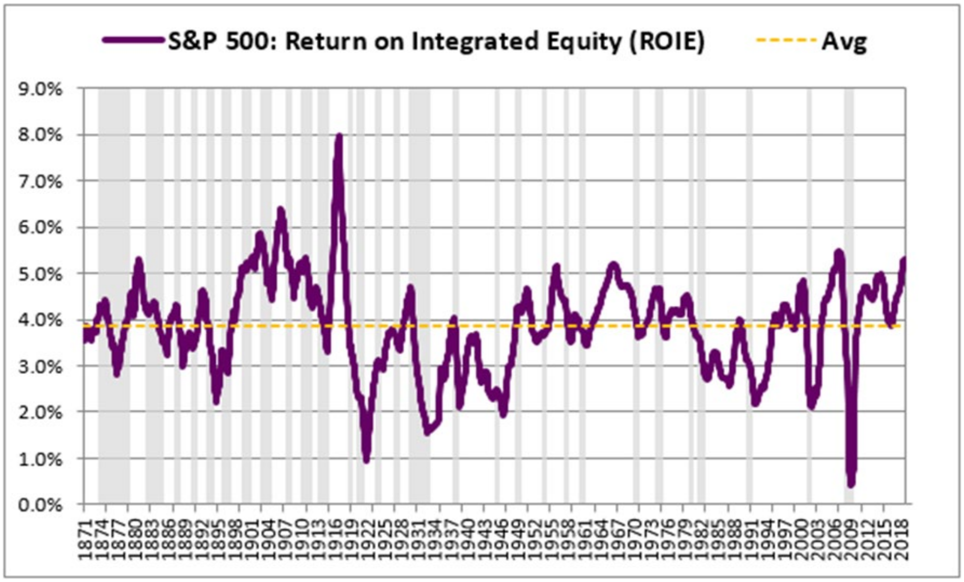


As you can see, the measure drops from an average of roughly 12% to an average of roughly 4%.

We refer to the improved P/B measure that the framework generates as the "P/IE" ratio, short for price to integrated equity. The measure's average over the period falls from 2.0 to roughly 0.60:



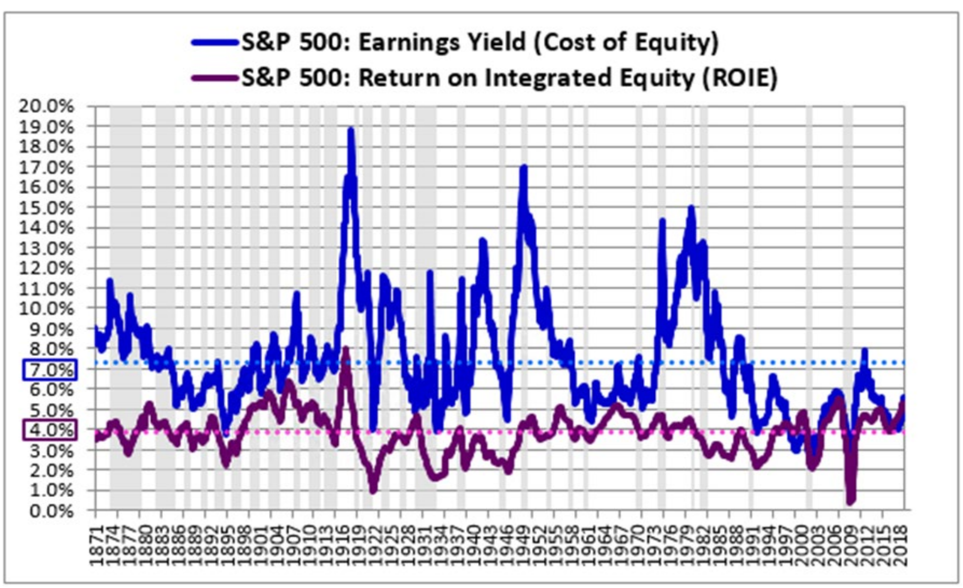
A major advantage to the integrated equity methodology is that it doesn't require access to reported book value information. It calculates book values on its own, from scratch. All it needs for the calculation are two inputs: earnings and dividends. It can therefore generate historical profitability data all the way back to January 1871, the first month of available earnings and dividend information for U.S. equities:



Official data on the profitability of U.S. corporations begins in the late 1920s. The integrated equity methodology pushes that start date back to 1871, allowing us to explore a period of market history that would otherwise be hidden from us.

Summary of Section 3: The Profitability Gap

In the third section of the piece, I'm going to explore a discrepancy that emerges when the integrated equity methodology is used to generate improved measurements of return on equity. This discrepancy is illustrated in the chart below, which shows the ROIE of the S&P 500 alongside its earnings yield from 1871 through 2018:



The ROIE, shown in purple, represents an approximation of the return that the index could have generated by investing. The earnings yield, shown in blue, represents an approximation of the index's cost of equity, i.e., the return that it could have generated by reducing its equity through dividends and share buybacks. As you can see, the ROIE is significantly lower than the earnings yield in almost every period of the chart. We refer to this unexpected result as the profitability gap. Its occurrence violates economic theory, which predicts that corporations will only invest when the expected return on the investment exceeds the cost, including the opportunity cost of not being able to do other things with the capital.

The simplest available explanation for the profitability gap is that corporate investment and corporate capital allocation are inefficient. Corporations unwittingly deploy capital into wasteful, low-return projects when they could earn much higher rates of return by recycling capital back into their prices through dividends and share buybacks. We refer to this explanation as the "inefficient investment" hypothesis. In the section, I'm going to explore the evidence for and against it, including evidence from different sectors, industries, countries, factors and periods of history:

U.S. LARGE (1964 - 2018) (Inflation-Adjusted)	Return (on Equity)	Cost (of Equity)	DIFF	Avg Payout Ratio	Fundamental Return (ex ΔVal)	Total Return (w/ ΔVal)
	Avg ROIE	Avg E-Yield				
HEALTHCARE	11.29%	4.68%	6.62%	47%	8.28%	8.43%
TECHNOLOGY	6.77%	4.17%	2.60%	41%	6.91%	5.96%
STAPLES	8.21%	6.10%	2.12%	52%	7.11%	7.22%
FINANCIALS	5.14%	7.67%	-2.53%	40%	5.85%	5.40%
ENERGY	4.65%	7.22%	-2.57%	56%	4.56%	5.89%
INDUSTRIALS	3.30%	6.25%	-2.95%	49%	5.36%	5.53%
DISCRETIONARY	1.34%	5.49%	-4.15%	57%	3.80%	5.11%
MATERIALS	1.38%	6.15%	-4.78%	58%	3.97%	4.11%
TELECOM	0.00%	6.15%	-6.15%	81%	3.85%	3.87%
UTILITIES	0.00%	7.85%	-7.85%	74%	4.65%	4.78%

I'm ultimately going to reject the inefficient investment hypothesis as an explanation for the profitability gap. It may explain a minor portion of the gap, but it's unlikely to represent the gap's primary cause.

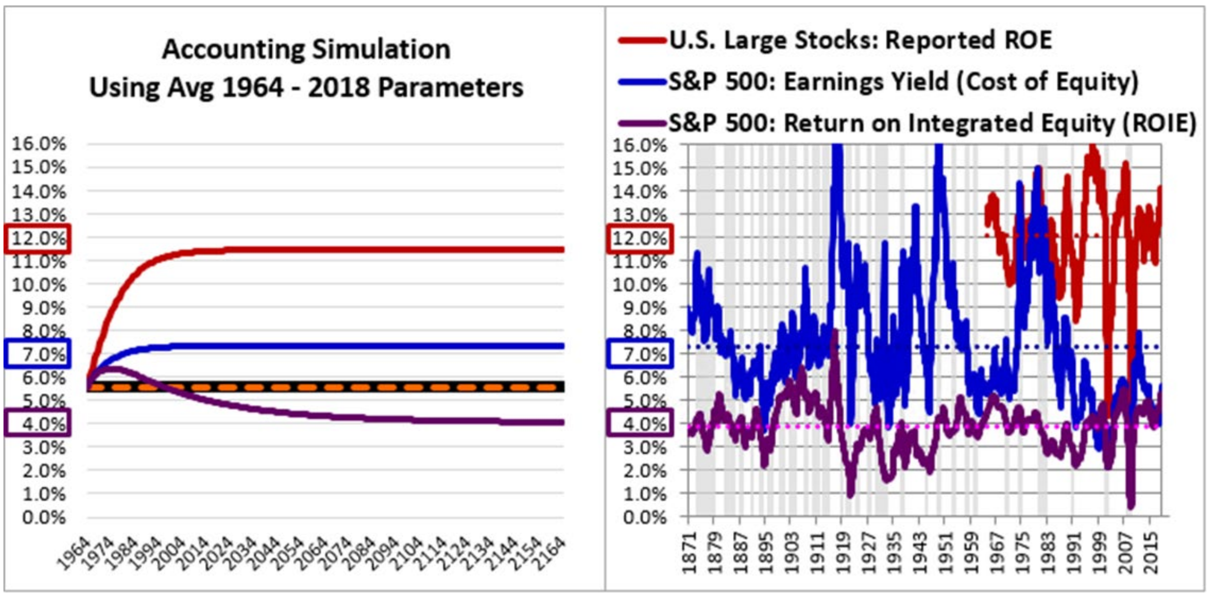
Summary of Section 4: The Overstated Earnings Hypothesis

In the fourth section of the piece, I'm going to examine a better explanation for the profitability gap. This explanation, referred to as the "overstated earnings" hypothesis, holds that the gap is an illusion that results from the incorrect reporting of earnings. Each quarter, when companies tell us that they're earning specific amounts of money, they're actually exaggerating—the true amounts that they're earning are significantly less. Mathematically, the exaggeration creates an illusory increase in the earnings yield and an illusory decrease in the return on equity, giving rise to an illusory profitability gap.

Most people react to the overstated earnings hypothesis with confusion and skepticism. They wonder how it could be possible for corporations to overstate their earnings year after year without anyone finding out. They also wonder why overstated earnings would cause returns on equity to be depressed rather than elevated. If these are the types of questions you have right now, don't worry: I'm going to carefully answer all of them in the piece.

In explaining the overstated earnings hypothesis, I'm going to focus on a critical deficiency that exists in the way that depreciation is measured. Depreciation expenses in GAAP are calculated using the historical costs of assets, as opposed to the current values. In the presence of inflation, these expenses become understated, causing earnings to become overstated.

To corroborate this overstatement, I'm going to share the results of an accounting simulation that successfully generates an <u>illusory</u> profitability gap in a hypothetical index that doesn't actually have one. The simulation begins by modeling an inflation-free earnings process with parameters that match the actual parameters of the S&P 500. It then introduces inflation into that process and recalculates nominal earnings using GAAP accounting rules. At equilibrium, the calculated nominal earnings become significantly overstated relative to reality, causing a profitability gap to emerge. This gap ends up matching the <u>actual</u> profitability gap observed in the <u>actual</u> S&P 500, suggesting that the actual gap is an illusion as well:



To conclude the section, I'm going to attempt to quantify the average degree of earnings overstatement that has occurred over the course of market history. I'm going to arrive at a number somewhere between 20% and 25%.

Summary of Section 5: Implications for Investors and Allocators

In the fifth section of the piece, I'm going to explore the implications that the overstated earnings hypothesis carries for individual stock selection. In practice, the hypothesis points to a conclusion that respected value investors frequently emphasize: free-cash-flow (FCF) is better than other fundamentals in the measurement of value. I'm going to test that conclusion in the factor space, to see whether it holds up:

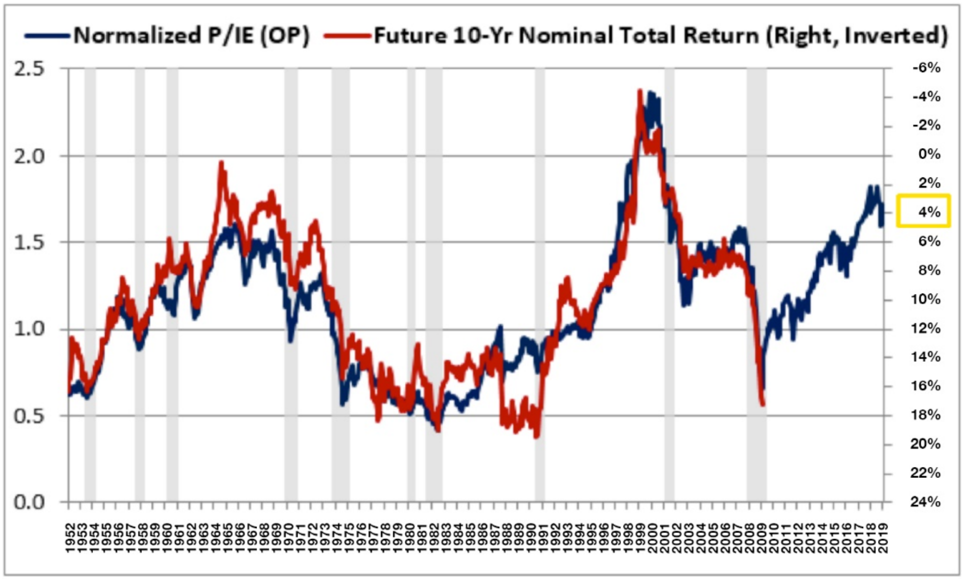
U.S. LARGE (1963 - 2018)	Avg Excess TR	Hit / Miss				Statistics			
		Hit Rate	Avg Gain	Miss Rate	Avg Loss	eff N	SD	t	p
MKT: LARGE	0.00%	46.5%	24.8%	53.5%	-21.6%	20,250	33.9%	-	-
VALUE: EV/FCF	3.70%	51.0%	26.7%	49.0%	-20.2%	4,070	33.2%	6.947	0.000
VALUE: P/FCF	3.49%	51.0%	26.2%	49.0%	-20.2%	4,071	32.6%	6.561	0.000
VALUE: P/OCF	2.46%	50.1%	25.0%	49.9%	-20.2%	4,070	31.1%	4.624	0.000
VALUE: EV/EBITDA	2.34%	50.1%	24.8%	49.9%	-20.3%	4,071	30.8%	4.391	0.000
VALUE: P/E	2.28%	50.5%	24.0%	49.5%	-19.9%	4,070	29.9%	4.291	0.000
VALUE: P/EBITDA	1.70%	49.5%	24.5%	50.5%	-20.7%	4,070	30.9%	3.196	0.002
VALUE: P/S	1.60%	48.7%	25.4%	51.3%	-21.0%	4,070	31.7%	3.002	0.004
VALUE: P/B	0.98%	48.2%	24.8%	51.8%	-21.1%	4,070	31.4%	1.841	0.073

I'm then going to explore the implications that the hypothesis carries for the valuation of the overall stock market. Contrary to what some might initially expect, the hypothesis is bullish for the current market's valuation. Free-cash-flow as a share of earnings is much higher today than it was in prior periods of history, suggesting that today's earnings are less overstated:

If today's earnings are less overstated, then today's market deserves a higher multiple.

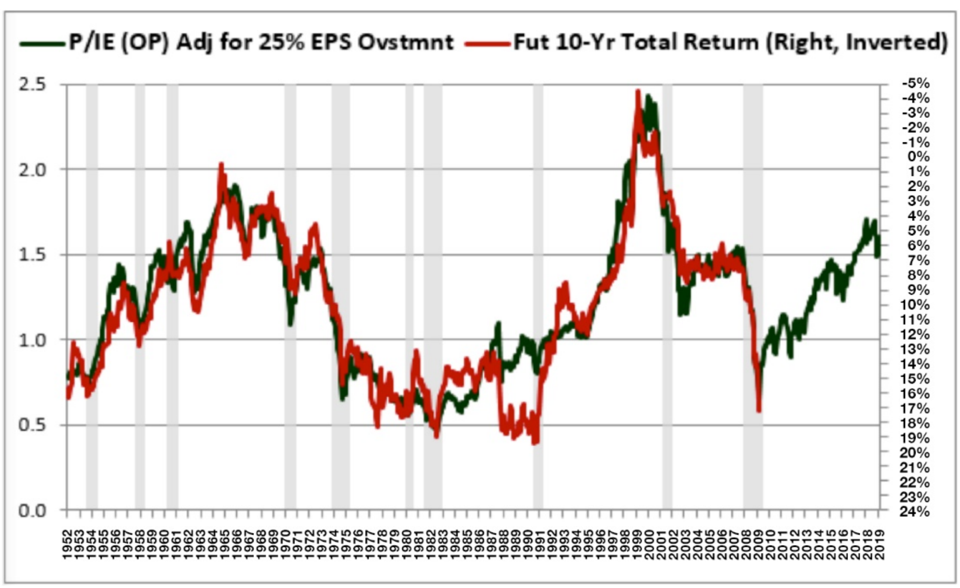
Summary of Section 6: Using the Integrated Equity Methodology to Value Markets and Individual Stocks

In the final section of the piece, I'm going to test the ability of the P/IE ratio to predict future returns in the S&P 500. The predictive performance is shown below:



The metric's correlation with future 10-year S&P 500 returns is 0.926, stronger than the Shiller CAPE and every other popular valuation metric tested in the sample.

To experiment further with the overstated earnings hypothesis, I'm going to discount historical reported earnings to undo the estimated 25% average overstatement that has occurred across history. I'm going to recalculate the P/IE ratio under the discounted numbers, to see if the return correlations improve. As you can see, they become exceptionally tight:



I'm going to conclude the piece by testing the P/IE ratio as a value factor in individual stocks. As expected, the metric outperforms its primary competitor, the price-to-book ratio. But it underperforms the simple price-to-earnings (P/E) ratio, even as it purports to smooth out the P/E ratio's cyclical fluctuations.

U.S. LARGE (1973 - 2018)	Avg Excess TR	Hit / Miss				Statistics			
		Hit Rate	Avg Gain	Miss Rate	Avg Loss	eff N	SD	t	p
MKT: LARGE	0.00%	46.8%	20.0%	53.2%	-17.6%	17,813	26.0%	-	-
VALUE: ttm P/E	2.31%	51.0%	22.5%	49.0%	-18.6%	3,579	28.0%	5.30	0.000
VALUE: P/IE	1.61%	49.8%	22.8%	50.2%	-19.4%	3,579	28.8%	3.69	0.000
VALUE: CAPE	1.51%	49.8%	23.9%	50.2%	-20.7%	3,579	30.5%	3.46	0.001
VALUE: P/B	1.28%	49.2%	23.4%	50.8%	-20.2%	3,579	29.9%	2.94	0.005

Drawing on insights from Factors from Scratch and Alpha Within Factors, I'm going to explain why it underperforms, and also why the Shiller CAPE underperforms in similar contexts.

PRELIMINARY CLARIFICATIONS AND DEFINITIONS

Unless stated otherwise, the following clarifications will apply throughout the piece:

- Inflation-Adjustment: All numbers and rates of return will be adjusted for inflation.
- Geometric Averaging: All averages will be geometric averages, which are the proper averages to use when analyzing returns. See this footnote[1] for the definition of a geometric average.
- Reinvested Dividends: All references to dividend returns will rest on the assumption that dividends are immediately and fully reinvested at market prices.
- Market-Cap Weighting: All indexes will be weighted by market capitalization.

Certain arguments in the piece will depend on claims that not every reader will agree with. Examples of such claims will include the claim that reinvested dividends and share buybacks are functionally equivalent to each other on a pre-tax basis, or that the corporate sector needs to invest in order to grow its earnings in real terms, or that the market's average earnings yield is a proxy for its average cost of equity. To save space in the main piece, I'm going to move their treatment to Appendix A. In that appendix, I'm going to intuitively demonstrate them using the example of a simple apartment business. As a general rule, if an idea presented in the piece doesn't initially make sense to you, go to Appendix A—it will probably be explained there:

- Appendix A: An Intuitive Example that Clarifies Important Claims Made in the Piece

One of the most important concepts in the piece will be the concept of equity. We need to precisely define it. For our purposes, a corporation's "equity," also referred to as its "book value," is the total amount of capital that shareholders have invested into it.[2] This amount is typically identical to the total amount of capital that the corporation has invested into the economy on a net basis, since the corporation invests, or is at least expected to invest, all of the capital that shareholders provide it with. When we calculate the return on equity, we're attempting to quantify the return in earnings that has been generated on that investment.

[1] A geometric average is calculated as the *n*-th root of *n* numbers multiplied by each other. An arithmetic average, which is the kind of average that we most often see and use, is calculated as the sum of *n* numbers divided by *n*.

[2] Because earnings already reflect the subtracted expense of depreciation, i.e., the cost of reversing depreciation, we can conceptualize this capital as non-depreciating when comparing it to earnings over time.

Simplistically, the equity funding that shareholders provide to corporations can be separated into two categories:

(a) Paid-In Capital: Capital that corporations receive from shareholders through initial capitalizations and new share sales (e.g., initial public offerings, follow-on offerings, etc.)
(b) Retained Earnings: Earnings that belong to shareholders and that would otherwise be distributed to them as dividends, but that instead get kept inside of corporations, to be invested on their behalf.

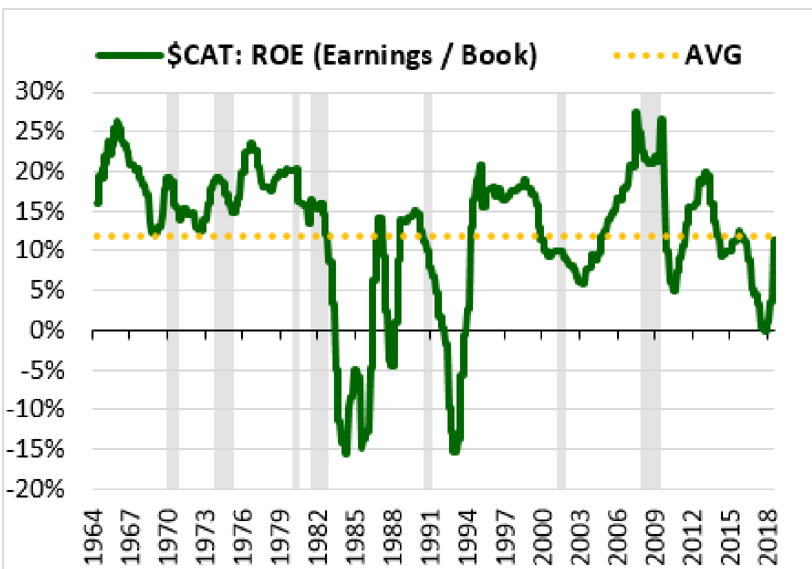
The second category, retained earnings, serves as the foundation for the integrated equity methodology. To calculate it for a given period, we take the difference between earnings and dividends over the period.

SECTION 1: THE PROBLEM WITH CONVENTIONAL EQUITY-BASED MEASURES OF PROFITABILITY AND VALUATION

The conventional method for calculating a company's return on equity (ROE) is to divide its net income for common shareholders, obtained from its income statement, by its common shareholder equity, obtained from its balance sheet. This approach creates severe distortions, which we illustrate below.

Conventional Return on Equity: An Illustration of the Distortions

To illustrate the distortions, consider the following chart, which shows the ROE for Caterpillar, Inc., ($CAT), a company that designs and manufactures industrial machinery:



From 1964 through 2018, Caterpillar generated an average ROE of roughly 12% per year. This number is quite strong, especially when we consider that it includes the effects of large losses incurred in the 1980s and early 1990s. Unfortunately, it significantly overstates the true profitability of Caterpillar's investments. We know it's an overstated number for two reasons:

First, it's almost double the 6.7% total return that Caterpillar generated over the period[3]. If Caterpillar actually managed to generate a 12% average return on its investments, then its shareholders should have received a return commensurate with that number in their actual accounts. But they didn't receive anything even close.

[3] We focus on real, inflation-adjusted returns here because ROE is a real quantity. Like the earnings yield, it's obtained by dividing one nominal number by another nominal number. Inflation cancels out of the ensuing expression, and therefore the expression should track with real returns.

Second, it's more than twice the 5.4% average earnings yield that Caterpillar traded at over the period. To a first approximation, we can think of a company's average earnings yield—earnings divided by price—as the average return that it would have delivered to its shareholders if it had used 100% of its earnings to pay dividends or buy back shares (the two are functionally equivalent—(see Appendix A: Claim #1). Since the return that a corporation generates by buying back shares is identical to the cost that it incurs by selling shares, we can treat the average earnings yield as an approximation of the average cost of equity for corporations (see Appendix A: Claim #3). The quoted numbers therefore suggest that Caterpillar's average return on equity (12%) over the period was more than double its average cost of equity (5.4%).

If Caterpillar's return on equity was twice its cost of equity, then why didn't the company take advantage of it? The company could have suspended its dividend and aggressively sold new shares in the market, using the proceeds to invest at the much higher rate of return. Instead, it did the opposite, paying out roughly half of its earnings as dividends and using a significant portion of the remainder to buy back its own shares. Amazingly, its share count today is less than in January 1964, even with the effects of employee stock issuance included.

The actual skin-in-the-game decisions of Caterpillar's management, which are far more reliable than any abstract accounting number, suggest that the company's true average ROE was significantly less than the 12% depicted in the measure. Of course, this doesn't mean that the company's financial reports are incorrect. They're perfectly consistent with U.S. accounting standards. What's incorrect is our way of measuring ROE under those standards. In the next subsection, I'm going to explain the cause of the error.

The Causes of the Distortion: Historical Cost Accounting and Inflation

As a general rule, ROE numbers obtained by dividing earnings by book values tend to be significantly overstated relative to reality. To understand the origins of this distortion, we need to understand how accounting in the United States and in most parts of the world is carried out. There are two general frameworks for accounting: replacement cost accounting and historical cost accounting. In a replacement cost framework, corporations continually adjust the stated values of their assets to match the current values of those assets, conceptualized as the cost of replacing them. In a historical cost framework, corporations permanently record the values of their assets as the initial cost that was paid for them.[4]

To illustrate the difference with a real-world example, suppose that you bought a beachfront home in Orange County, California in the 1950s for $10,000. In a replacement cost framework, you would carry that home on your "personal" balance sheet at whatever the current cost of creating or acquiring a home just like that—in that location—would be. Today, that cost might be something like $5,000,000. So, you would carry the home as an asset valued at $5,000,000. In a historical cost framework, you would carry the home at the original price that you paid for it—$10,000. A big difference, especially when it comes time to pay taxes.

The advantage to replacement cost accounting is that it yields results that better depict the true economic value of a company's assets. The disadvantage is that it's inherently hypothetical and subjective. Unless an asset trades actively in a market, there's no easy way to estimate its "replacement cost." The concept can therefore be manipulated and abused to paint a false picture of a company's health and performance.

The advantage to historical cost accounting is that it's objective and unambiguous. The cost of something is a known transaction that can be checked and verified, a fact that helps protect the method from manipulation and abuse. The disadvantage is that the true economic value of a thing will change over time, including in the upward direction. Historical cost approaches are unable to properly reflect that change.

[4] The typical U.S. convention is to carry investments at gross historical cost in one account, and then subtract accumulated depreciation via a contra account.

Prior to the Great Depression, accounting in the United States was not the standardized, well-regulated practice that it is today. Firms were able to use favored accounting methods to inflate their apparent performances without fear of reprisal. During and after the Great Depression, a narrative emerged that partially blamed replacement cost accounting for the stock market crash and economic downturn that had occurred. The claim was that companies had exploited the nuance and ambiguity inherent in replacement cost approaches to significantly overstate their earnings and book values. The overstatement caused investors to wrongly think that the companies deserved to trade at exorbitant prices, contributing to the bubble.

When the Securities and Exchange Commission (SEC) was created in 1934, one of its core tasks was to enforce the newly established rules on financial reporting. Given the freshness of the country's experience in the Great Depression, both the SEC and the accounting industry took a strong stand in favor of the historical cost standard.[5] That standard has remained the official SEC-enforced GAAP standard ever since. The inherited equity data that today's investors and researchers use—which includes the data presented above for Caterpillar—follows that standard.[6]

Why does this matter? It matters because it affects the relationship between book values and other fundamentals over time. Macroeconomic quantities such as prices, sales and earnings tend to track closely with each other. We therefore tend to assume that book values will track with these quantities as well. But in a historical cost framework, that assumption isn't necessarily going to be true. A book value in a historical cost framework is not a quantity that is tethered to current economic conditions. Rather, it's a historical record—specifically, a record of past investment transactions at their original cost. In theory, it's capable of tracking with other macroeconomic aggregates, but it doesn't have to track with them.

The problem emerges when inflation is introduced. Prices, sales and earnings tend to rise with inflation. Holding everything else constant, higher prices in the economy mean higher selling prices for companies which mean higher nominal sales and therefore higher nominal earnings. Because book values are historical records of past transactions, they don't follow this chain. They have no link to inflation. Consequently, as companies make investments, the nominal earnings associated with those investments, which get a boost from inflation, tend to grow faster than the reported book values of the investments themselves, which are stuck at historical cost. This divergence causes measured ROEs—which are calculated by dividing earnings by book values—to become inflated.

To be clear, inflation doesn't cause measured ROEs to go to infinity. Instead, it causes them to mathematically stabilize at overstated levels (see Appendix A: Claim #4). The eventual degree of overstatement will depend, among other things, on the amount of historical inflation that has taken place, the age of the company in question, its payout ratio, and the rate at which it depreciates and turns over its assets. Caterpillar is a very old company, with roots that go back to the late 19th century. Unlike newer companies such as Facebook and Twitter, the historical costs of many of its assets are costs that were paid a long time ago, when prices were orders of magnitude lower than they are today.

Importantly, the problems introduced by inflation extend to all book-value-based metrics—not just ROE, but also the popular price-to-book (P/B) ratio. When we track the P/B ratios of companies, we notice that the average P/B ratio across the market tends to be quite elevated. In theory, we would expect it to come in somewhere around 1.0, with stocks generally trading at par to their equity values. In practice, however, we find P/B ratios averaging out to numbers in the 2's, 3's, or even higher. This happens because the book values

[5] For an excellent survey of the history of historical cost accounting in the United States, see "The SEC Rules Historical Cost Accounting: 1934 to the 1970s" by Stephen Zeff.

[6] In recent decades, international financial reporting standards (IFRS) have become more liberal with respect to allowing replacement cost or "fair value" approaches to be used in specific circumstances, but these standards are still rooted in a historical cost framework.

are being stated at historical cost. Accumulated inflation is causing them to become understated in current price terms.

SECTION 2: INTRODUCING INTEGRATED EQUITY

For the purpose of measuring corporate investment profitability, historical cost accounting is actually preferable to replacement cost accounting. It's preferable because it calculates book value in a way that matches the total amount of money that shareholders have invested into a company (and that the company, conversely, has invested on their behalf). We need to know what that amount is in order to correctly measure the profitability of the associated investments.

The problem with traditional historical cost accounting is that it doesn't adjust historical costs for inflation. It therefore computes book values from terms that are inconsistent with each other across history. In this section, I'm going to introduce a methodology for correcting this problem. The methodology will allow us to determine the inflation-adjusted historical cost book value of any company or index back to its inception.

The Wrong Way to Inflation-Adjust a Book Value

The standard way of adjusting a historical transaction for inflation is to multiply it by the increase in the consumer price index (CPI) that has occurred since the transaction occurred.[7] Unfortunately, we can't use this approach to adjust a book value for inflation because a book value is not a single transaction that occurred on a single date. Rather, it's a sum of transactions that occurred on a set of prior dates, going back years, decades and sometimes even centuries. Each of those transactions will have occurred at a different CPI level, and therefore each transaction will need to be adjusted using a different factor.

Returning to the example of Caterpillar, let's suppose that we want to build an inflation-adjusted measure of the company's 1983 book value, expressing that value in 2018 dollars. The table below shows the history of prior net investments that made up the company's book value as of that date[8]:

CATERPILLAR ($CAT)
(2018 CPI = 252.7)

Date	Investment (Net) ($MM)	CPI	Date	Investment (Net) ($MM)	CPI
Pre-1964	451	?	1974	130	51.9
1964	85	31.3	1975	211	55.6
1965	127	31.9	1976	314	58.4
1966	113	32.9	1977	280	62.3
1967	56	34.0	1978	353	67.9
1968	39	35.6	1979	436	76.9
1969	54	37.7	1980	265	86.4
1970	75	39.8	1981	428	94.1
1971	97	41.1	1982	124	97.7
1972	70	42.5	1983	-362	101.4
1973	156	46.3	Sum = 1983 Book	3,504	101.4

[7] The CPI tracks a weighted-basket of goods and services. For a transaction involving a specific good or service, the change in the CPI may not accurately reflect the change in the cost of that specific good or service. For changes in the CPI to accurately represent changes in costs, transactions need to be aggregated together in the context of large, economically-representative stock indexes.

[8] These "net" investment numbers are net of depreciation, debt issuance, and divestments such as dividends and share buybacks. Admittedly, the depreciation portion of this netting is distorted by the fact that the depreciation expense is calculated from the historical cost of the investment, which is not adjusted for inflation. We will discuss this distortion when we examine the "overstated earnings" hypothesis.

We want to express the $3,504MM number in 2018 prices. In any other context, we would simply multiply it by 2.5, which is the increase in the CPI that occurred from 1983 to 2018 (= 252.7 / 101.4). But we can't do that here. The $3,504MM number is not a transaction that occurred at 1983 prices. Rather, it's a sum of transactions that occurred on prior dates, at the price levels of those prior dates.

Consequently, if all we do is multiply $CAT's 1983 book value by the 2.5X CPI increase that occurred from 1983 to 2018, we will be under-adjusting every investment contained in its book value that occurred before that date. For example, we will effectively be treating the $127MM investment that occurred in 1965 as if it had been $315MM in today's dollars (= $127MM * 252.7 / 101.4). The truth, however, is that it was more than three times that amount, $1,066MM (= $127MM * 252.7 / 31.9).

Deconstructing Book Values into Units of Retained EPS

To properly adjust $CAT's book value for inflation, we need to adjust each net investment transaction that it was formed from based on the specific year in which that transaction occurred. We therefore need a way to deconstruct the company's book value into a collection of date-specific historical net investment transactions. In this subsection, I'm going to describe an efficient way to do that.

Recall that we defined equity, i.e., book value, as the cumulative sum of retained earnings and paid-in capital. Together, these two funding sources finance all of the net investments of a corporation. If we can quantify the occurrence of each funding source across history, then we can quantify the corporation's history of net investments. And if we make the reasonable assumption that the funding sources were invested at or around the time that they came into the company, then we can know what date to use when adjusting them for inflation.

What we need to do, then, is determine $CAT's history of retained earnings and paid-in capital. Determining the retained earnings part is easy—it's given by the difference between earnings and dividends in each period. Determining the paid-in capital part is more complicated. We're going to have sift through a lot of messy data to find it.

Fortunately, if we keep our focus strictly on per share quantities—specifically, book value per share—then we can get away with ignoring the paid-in capital part. Paid-in capital increases book value, but it also increases share count, reducing the effect on book value per share.

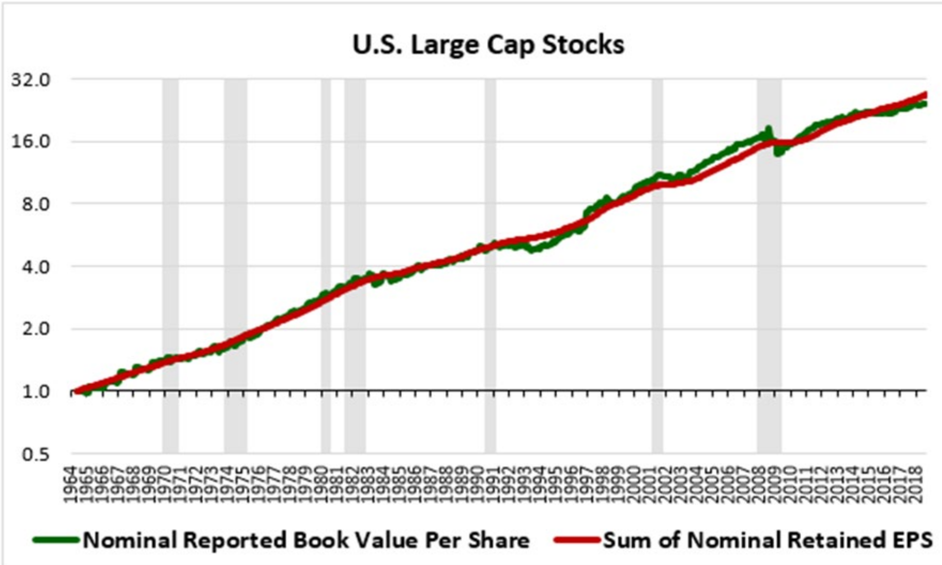
Events that affect paid-in capital, such as share buybacks and dilutive offerings, cause changes in book value per share when the shares are bought or sold at prices above or below book value per share. In a large, diversified index—the kind of index that we're going to use the methodology on—the effects of purchases and sales at different price points relative to book tend to offset, minimizing the net impact on the aggregate measure. [9]

To deconstruct book values into date-specific investment transactions, what we need to do, then, is specify the history of retained earnings per share (EPS). That history will be approximately equal to the per share history of net investments.

To demonstrate this point in practice, the chart below shows two lines. The first line, depicted in green, is the nominal reported book value per share of the overall U.S, Large Cap Stock index from 1964 through 2018.

[9] Given the effects of inflation, companies tend to trade, on average, at prices that are higher than their reported book values per share. Consequently, buyback events tend to cause downward deviations in reported book values per share, with dilution events causing upward deviations. These deviations have the potential to significantly distort price-to-book ratios and ROE measures. A benefit to using the sum of retained EPS as a proxy for book value per share is that doing so eliminates such distortions, offering a more useful and meaningful representation of the total historical per share equity investment that shareholders have made in the companies.

The second line, depicted in red, is $CAT's nominal reported book value per share of the same index in 1964 plus the running total of nominal retained EPS that the index accumulated in subsequent years.[10]



The two lines track each other very closely, confirming that reported book value per share can be effectively represented as the cumulative sum of retained EPS over time.[11]

[10] The match between the lines is stronger in the earlier period of the chart for three reasons. First, the accounting standards used to calculate reported book value contained fewer one-time accounting items. Second, share buybacks were significantly less common. Third, the market's price-to-book ratio was closer to 1.0 during the period, reducing the impact of paid-in-capital

[11] Deviations between the measures are more pronounced in later periods of the chart because reported book values include the effects of one-time accounting items that are not always included in the earnings series that we use to calculate retained earnings. Over the last few decades, as the GAAP standard has increasingly departed from the traditional historical cost standard, the frequency of these items has increased. A useful benefit to the integrated equity methodology is that it removes the items from the measure, offering a better representation of the total historical cost investment that shareholders have made.

Completing the Calculation: The Initial Equity Problem

The methodology that we're going to use to construct inflation-adjusted book values consists of three basic steps:

Step 1: Deconstruct book values into prior retained EPS events.
Step 2: Adjust those events for inflation based on the dates in which they occurred.
Step 3: Reconstruct book values by adding the inflation-adjusted retained EPS events back together.

I'm going to refer to this methodology as the "integrated equity" methodology. The name is appropriate because the methodology calculates equity by integrating the individual parts of equity, i.e., the individual units of retained EPS that have been accumulated and invested over time. The integrated equity methodology stands in contrast to the conventional, reported way of determining equity, which is to simply read it off the balance sheet.

The table below illustrates how the integrated equity methodology is carried out. We want to determine a company's inflation-adjusted book value on some date—in this case, $CAT's inflation-adjusted book value as of 1983, expressed in 2018 prices. We start by specifying the retained EPS numbers that $CAT generated in each year prior to 1983. We then inflation-adjust those numbers up to 2018 prices based on the years in which they occurred. Finally, we add the inflation-adjusted retained EPS numbers together. We end up with a properly inflation-adjusted measurement of the company's 1983 book value:

CATERPILLAR ($CAT)					
Year	Retained EPS	Retained EPS (Infl-Adj to 2018)	Year	Retained EPS	Retained EPS (Infl-Adj to 2018)
Pre-1964	?	?	1974	0.11	0.92
1964	0.06	0.46	1975	0.19	1.53
1965	0.09	0.74	1976	0.28	2.19
1966	0.08	0.60	1977	0.24	1.82
1967	0.06	0.45	1978	0.31	2.31
1968	0.02	0.18	1979	0.37	2.64
1969	0.08	0.56	1980	0.28	1.89
1970	0.05	0.34	1981	0.31	1.94
1971	0.07	0.42	1982	0.09	0.54
1972	0.06	0.37	1983	-0.52	-3.12
1973	0.14	0.75	Sum = 1983 Book	?	?

Unfortunately, we're missing a critical piece of information in the calculation: the company's retained EPS for years prior to 1964, the earliest year that we have earnings and dividend data for. The company's history of retained EPS goes much farther back than that date—in theory, it goes all the way back to 1892, the year that Benjamin Holt incorporated the Holt Manufacturing Company, the original seed of today's Caterpillar. We need that history to complete the calculation.

To be clear, we know what the company's reported book value per share was in 1964—around 0.36. We therefore know what it's cumulative history of nominal net investment was up to that date. But we don't know when in the 1892 to 1964 period those investments actually occurred. Consequently, we can't properly adjust them for inflation.

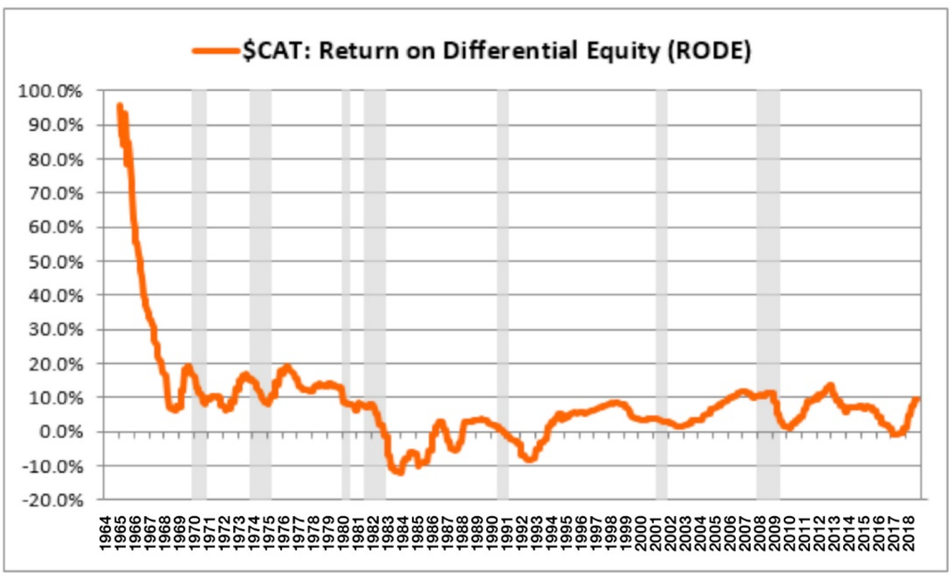
In any calculation of this type, we're going to run into this same problem, which we refer to as the "initial equity" problem. There's going to be some date when our earnings and dividend data begins. We won't know anything about the retained EPS events that occurred prior to that date. Consequently, we won't be able to specify or inflation-adjust any of the associated investments. The company's inflation-adjusted equity value on the date will therefore be unknown to us, preventing us from calculating inflation-adjusted equity values for subsequent dates. The problem is illustrated in the table: because we don't know the pre-1964 values highlighted in red, we can't complete the retained EPS summation, and therefore we can't calculate the 1983 book value highlighted in green.

In the case of $CAT, the initial equity problem is alleviated by the fact that the company's pre-1964 equity is only a small contributor to its 1983 equity. The company grew dramatically from 1964 to 1983, reducing the relative importance of its pre-1964 investments to its 1983 total. Still, those earlier investments make a difference to the calculation.

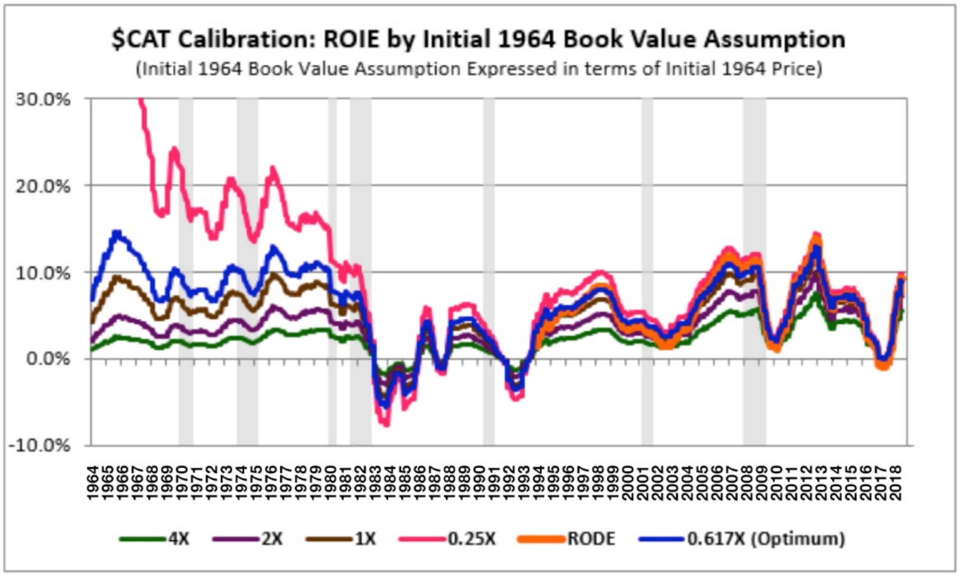
Solving the Initial Equity Problem: A Calibration Technique

It turns out that we can accurately estimate the initial equity of a company by calibrating it to match other data that we have access to. To avoid burdening readers, I've transferred the bulk of the description of the technique into the appendices. In this subsection, I'm going to briefly summarize the logic behind it, so that readers can determine whether they want to explore it further.

We start by developing a metric for measuring incremental ROE, which we refer to as the return on differential equity, or "RODE." The RODE is immune to the initial equity problem because it's calculated from the difference in equity between dates rather than from an outright value on a given date. We describe it in detail in Appendix B:



After charting the RODE, we test out different possible values for the initial equity in the integrated equity calculation, using those values to generate different charts of ROIE. We describe this process in detail in Appendix C:



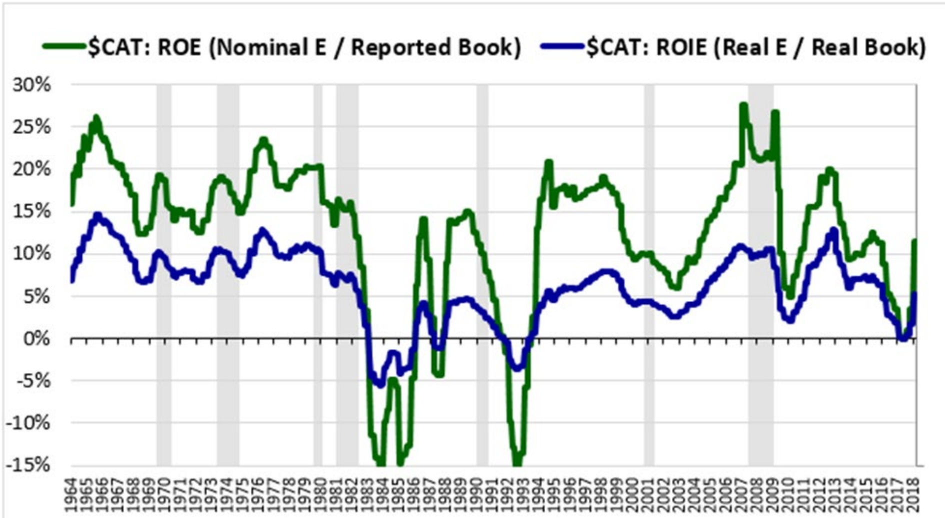
We then choose the initial equity value associated with the ROIE chart that exhibits the tightest possible fit with the RODE chart. For Caterpillar, the optimal initial 1964 equity value ends up being 0.617 times the company's initial inflation-adjusted 1964 price. That value represents the best available estimate of the sum of the inflation-adjusted paid-in capital and retained EPS events that occurred in the company prior to 1964. We therefore assign it as the initial equity value in the integrated equity calculation.

In this process, we're effectively backfitting the initial equity assignment to produce a result that's maximally consistent with ROE data calculated through a different method, the RODE method. Note that what I've shared here is just a high-level summary—if you'd like to see a more detailed description of the technique, please refer to the following appendices:

- Appendix B: Calculating the Return on Differential Equity
- Appendix C: Solving for Initial Equity

Results for Large Cap Companies

When we divide $CAT's inflation-adjusted earnings by the inflation-adjusted book value generated using the integrated equity methodology, we obtain the ROE measure shown below in blue:



We refer to this measure as the return on integrated equity (ROIE). It's lower than the conventional unadjusted ROE depicted in green because it's derived from a properly inflation-adjusted book value rather an understated book value calculated using inconsistent price terms.

The table below provides a sample of the data that the integrated equity methodology produces for different large cap companies:

INDIVIDUAL STOCKS (1964 - 2018) (Inflation-Adjusted)	Total Return	Avg Payout Ratio	Avg E-Yield	Avg ROIE (EPS/IE)	Avg ROE (EPS/Book) (Not inflation adjusted)	Avg P/IE (Harmonic)	Avg P/B (Harmonic) (Not inflation adjusted)
$CVS	11.07%	35%	6.64%	10.38%	17.04%	1.48	2.36
$BA	10.86%	38%	7.45%	7.61%	25.56%	0.88	1.51
$JNJ	10.21%	38%	4.69%	14.41%	20.57%	2.84	4.25
$PFE	8.19%	55%	4.99%	11.52%	22.63%	2.13	3.89
$XOM	7.29%	52%	8.83%	7.75%	15.61%	0.84	1.70
$CAT	6.66%	47%	5.43%	6.19%	11.95%	0.77	1.86

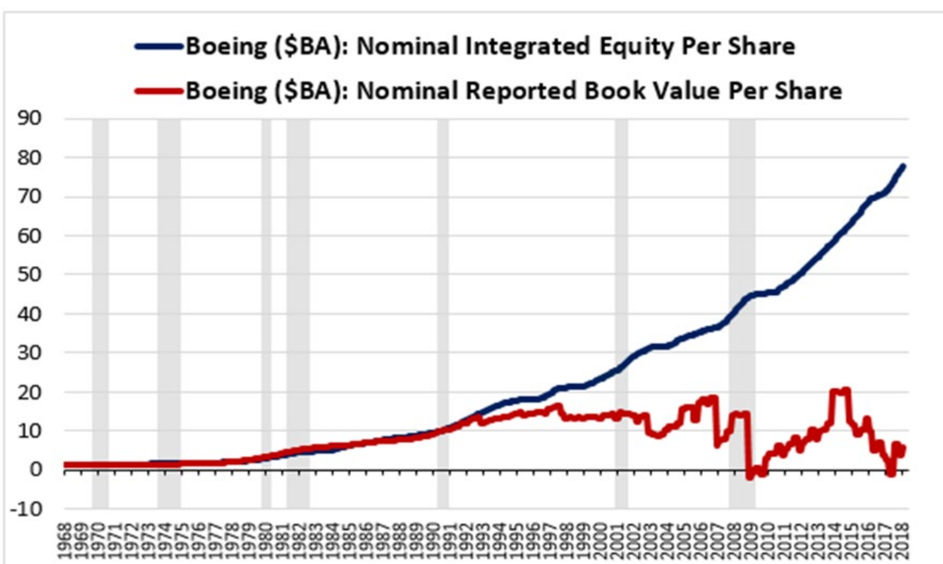
As you can see, the methodology eliminates the distortions highlighted earlier. In contrast to the exaggerated ROE numbers calculated using traditional nominal methods, the integrated equity methodology produces ROIE numbers that make more sense and that fit more closely with other information that we have about the companies—their actual returns, their average cost of equity, and so on. Similarly, in contrast to the obviously exaggerated P/B ratios calculated using the traditional nominal approach, the methodology produces P/IE ratios that are much closer to unity, 1.0.

In addition to its inflation-related benefits, the integrated equity methodology offers several accounting-related benefits. First, when calculating retained EPS, it uses an earnings series that excludes (or that can be chosen to exclude) non-recurring accounting items. It can therefore reduce distortions associated with asset writedowns. GAAP rules on asset writedowns represent an asymmetric departure from the historical cost standard. If an acquired asset falls in value (think: HP's acquisition of Autonomy), the asset is effectively required to be carried at replacement cost. But if the asset rises in value (think: Google's acquisition of YouTube, or Facebook's acquisition of Instagram), it's required to be carried at historical cost. This asymmetric approach produces paradoxical outcomes in which companies that have made bad investments experience large declines in their book values and therefore large increases in their calculated ROEs.

Second, the methodology eliminates the book value distortions introduced by share buybacks. Mathematically, when share buybacks are conducted at prices above book value, book value per share shrinks. This wouldn't necessarily be a problem, except for the fact that GAAP book values tend to be persistently understated across the market. Most companies trade at prices that are higher than their stated book values, and therefore most share buybacks end up causing artificial book value per share shrinkage to occur. The shrinkage amplifies the distortions that we've described up to this point—book values that were *already* understated become even *more* understated.

Instead of treating share buybacks as an outflow that changes book value, the integrated equity methodology treats them as a growth-producing investment just like any other, indistinguishable from any other deployment of capital that might generate EPS growth. The methodology doesn't change anything in response to them—in fact, it doesn't even notice them. All its notices are the retained earnings used to fund them and the subsequent EPS growth that they bring about, which are the only things that matter when measuring ROE. Consequently, when company's conduct share buybacks at market prices significantly above book value per share—a frequent occurrence, given that reported book values tend to be understated—the artificial book value per share shrinkage that would otherwise occur is avoided.

If you examine the table, you'll notice that Boeing ($BA) has an average reported ROE in the stratosphere—almost 26%. That ROE is not reflective of the company's actual investment performance but is instead the result of a series of fictitious accounting losses incurred over the last two decades mixed in with a history of share buybacks conducted at artificially high reported P/B ratios. Together, these processes have caused the company's reported book value per share to shrink to almost nothing, dramatically inflating the company's reported ROE. The shrinkage is illustrated in the chart below[12]:



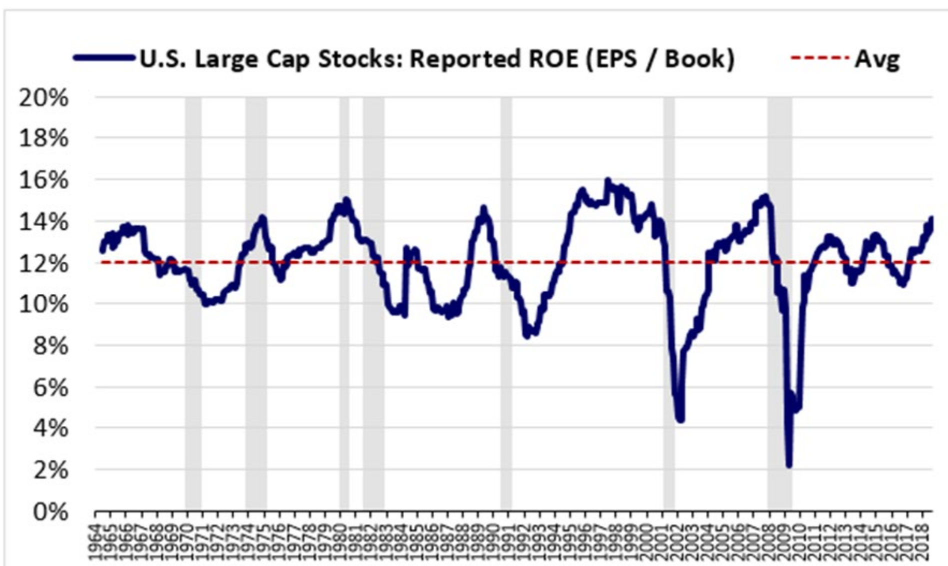
[12] The reason that $BA's average P/B ratio in the table isn't as elevated as its average ROE is that the P/B average was calculated as a harmonic average. If it had been calculated as an arithmetic average, the recent explosion in the company's P/B ratio would have driven the average up to 7.30.

The blue line represents $BA's nominal book value per share calculated using the integrated equity methodology without adjusting any of the retained EPS terms for inflation. The red line represents $BA's officially reported book value per share. As you can see, the two lines initially track each other very closely, confirming the point we made earlier that nominal book value per share can be accurately represented as the historical sum of nominal retained EPS. But then, starting in the mid-1990s, the company's reported book value implodes, falling completely off its prior trend. This implosion is the result of changes in accounting rules combined with the company's increased reliance on share buybacks.

Applying the Methodology to the S&P 500

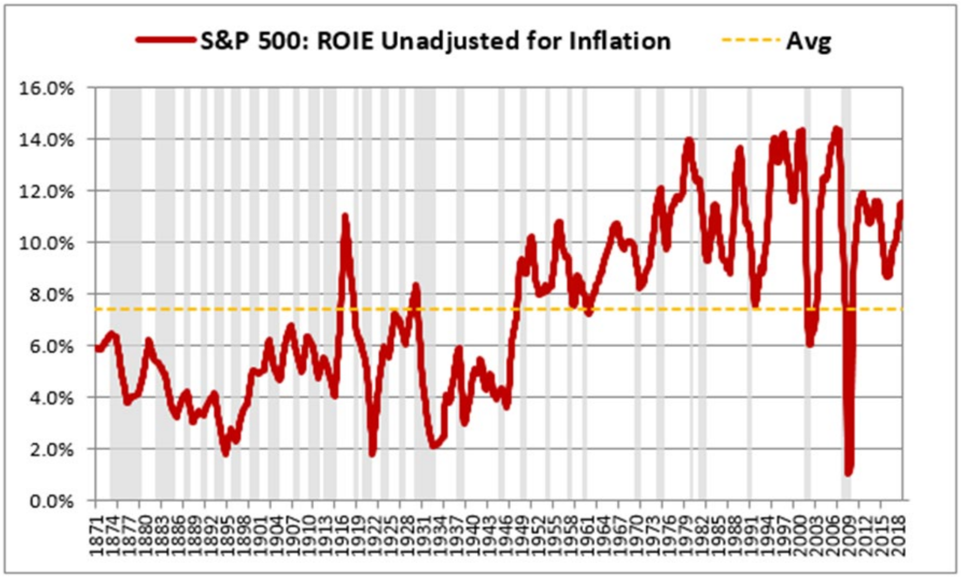
In this subsection, we're going to apply the integrated equity methodology to the S&P 500. We're going to start by applying the methodology without adjusting the retained EPS terms for inflation. The monstrous result that we obtain will confirm the unreliability of the conventional ROE measures that investors typically use. We're then going to apply the method with proper inflation-adjustment, noting the clean, coherent, symmetric result that follows.

The chart below shows the conventional, inflation-unadjusted reported ROE of the OSAM U.S. Large Cap Stock index from 1964 through 2018. This index is a market-cap-weighted proxy for the S&P 500 that comes with readily available reported book value information. To calculate the ROE of the index, we divide the index's aggregate nominal earnings by its aggregate reported book value:

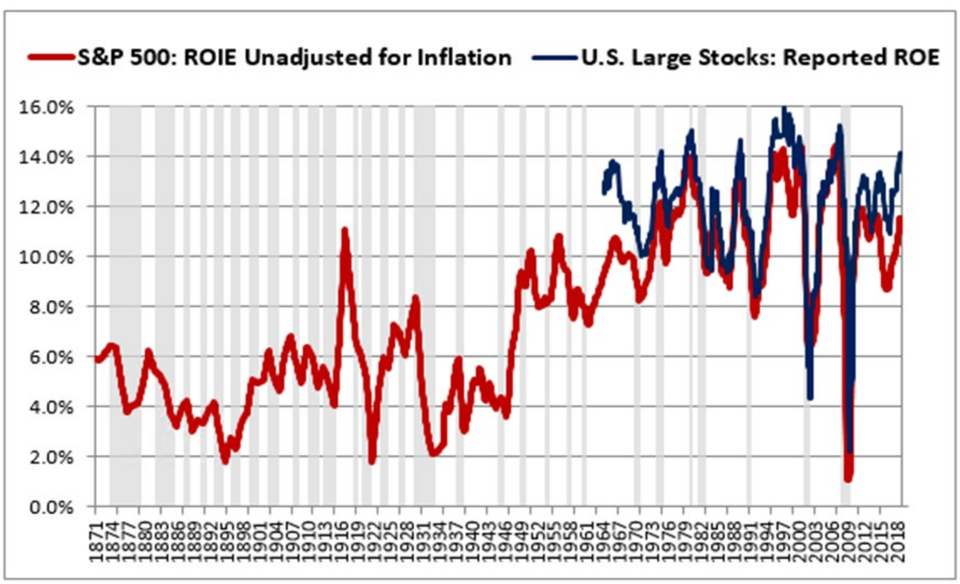


As was the case earlier with $CAT, the numbers appear to be exaggerated—a 12% average ROE doesn't make sense for an index with an approximate 6% total return and an approximate 6% average cost of equity. Other than that discrepancy, however, the chart appears to be relatively normal. It doesn't look like a chart that was created from a grossly flawed calculational process.

To see how this chart got to where it is, we can use the integrated equity methodology to build a similar chart for the S&P 500 that extends much farther back in time. To generate such a chart, all we need to do is apply the integrated equity methodology without adjusting any of the retained EPS numbers for inflation. Because the methodology makes its calculations strictly from earnings and dividends, we can take the chart all the way back to the first S&P 500 data point, January 1871.[13] If we do that, we will obtain the following result:



As you can see, this chart is a lopsided mess. Unless we're willing to believe that the U.S. corporate sector experienced a profitability phase shift during the late 1940s, we can't take it seriously. But notice that it's roughly the <u>same</u> chart as the previous OSAM Large Stock chart, just taken back farther in time.[14] The chart below shows an overlay of the two charts:



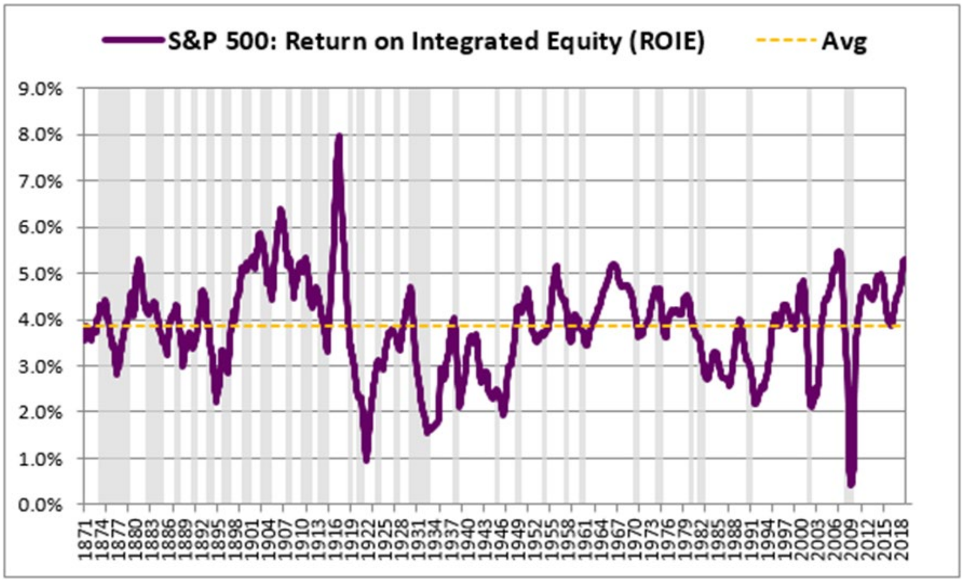
The inflation unadjusted ROIE for the S&P 500 (red) and the reported ROE for the OSAM U.S. Large Stock index (blue) are essentially the <u>same</u> measures. One just goes back farther into the past, courtesy of the methodology. In taking the chart back, we're able to see the way in which inflation has distorted it.

[13] The chart includes data for the historical seed of the S&P 500 prior to its 1957 inception. The data were obtained from the Cowles Commission and S&P Corporation via Robert Shiller's website.

[14] The fact that the inflation-unadjusted ROIE methodology can produce numbers that oscillate around the same 12% level as the reported ROEs (which were obtained from an entirely different data source) corroborates the accuracy of the "integrated equity" approach. The overlap in the chart proves that if a correct initial value can be specified, book value per share can be accurately represented as the total sum of retained earnings per share over time.

Notice that the biggest jumps in the chart occur in the decades that had the highest inflation, with the first jump occurring during the post-war inflation of the late 1940s and the second jump occurring during the inflation of the 1970s and early 1980s. Given the slow overall pace of asset turnover, the lingering effects of that inflation don't quickly go away—they stay in the data and are still partially there today.

Now, let's see what happens when we properly inflation-adjust the retained EPS terms in the integrated equity calculation. We obtain the clean, coherent, mean-reverting ROIE chart shown below—a dramatic improvement:



The period of the chart that we haven't seen before is the period prior to 1929, the starting year for the profitability data given in the National Income and Products Accounts. Looking back at the pre-1929 period, we see that ROIEs in the period were roughly on par with where they are today. They were especially high in the run up to the U.S. entry into World War I, at which point they abruptly crashed, partly in response to the passage of a steep excess profits tax. They subsequently rebounded during the roaring twenties into the September 1929 stock market peak.

Summarizing and Checking the Results

The table below provides a summary of relevant data for the S&P 500 from January 1871 through December 2018:

S&P 500 (Inflation-Adjusted)	Return (on Equity) Avg ROIE	Cost (of Equity) Avg E-Yield	DIFF	Avg Payout Ratio	Fundamental Return (ex ΔVal)	Total Return (w/ ΔVal)
1871 - 2018	3.85%	7.33%	-3.48%	59%	6.42%	6.84%

The column shaded in green shows the index's average return on equity calculated using the integrated equity methodology (ROIE). The column shaded in blue shows the index's average cost of equity, which we approximate as its average earnings yield. The column shaded in yellow shows the difference between the index's average return on equity and its average cost of equity. The final three columns show the index's average payout ratio, its average fundamental return from growth and dividends (with the effects of valuation changes removed) and its average total return (with the effects of valuation changes included).

We can check the validity of the numbers in the table using a simple calculational method called the "payout ratio" method. To check the average return on equity number, we take the index's rolling average EPS growth over the period, 1.66% per year, and divide that growth by the approximate 41% of earnings that the index historically invested into growth. This technique effectively "scales up" the index's growth to reflect what that growth would have been if the index had invested 100% of its earnings into it. We end up with a number equal to 4.02%. That number is the fundamental return that accrued to shareholders "per unit of earnings deployed into investment," which is the same as "per unit of equity "or "per unit of book value." It's therefore an indirect measure of the index's return on equity over the period. As expected, it roughly checks with the 3.85% number shown in the table.

To check the average cost of equity number, we take the index's average return from dividends over the period, 4.52%, and divide it by the approximate 59% of earnings that the index historically devoted to paying dividends. We end up with a number equal to 7.65%. That number is an estimate of the return that the index would have generated if it had paid all of its earnings out as dividends, to be reinvested at market prices, or if it had done the equivalent by buying back shares directly at market prices.[15] It's the return embedded in those prices, making it an indirect measurement of the index's cost of equity. As expected, it checks with the 7.33% number shown in the table.

For comparison, the table below shows results obtained through the integrated equity method alongside results obtained through the payout ratio method. The return on equity terms are shaded in light green and the cost of equity terms are shaded in light blue. As you can see, the terms line up very closely with each other across the two methods:

S&P 500 (Inflation-Adjusted)	Integrated Equity Method		DIFF	Check: Payout (PO) Ratio Method				Fund Return (ex ΔVal)	Total Return (w/ ΔVal)
	Return	Cost		Avg PO Ratio	(Full EPS) Growth Return		(Full EPS) Dividend Return		
	Avg ROIE	Avg E-Yield			Earnings (Per Share)	Sales (Per Share)			
1871 - 2018	3.85%	7.33%	-3.48%	59%	4.02%	-	7.65%	6.42%	6.84%

In summary, we can be confident in the analytic accuracy of the numbers calculated via the integrated equity method because they match numbers calculated using an entirely different method, the payout ratio method. For interested readers, I explain the payout ratio method in greater detail in:

- Appendix D: The Payout Ratio Method

To allow for validity checks, the appendix contains sector, industry, and country data generated using both methods. It also contains sales-based results, allowing us to quantify the impact that recent profit margin changes have had on ROIEs.

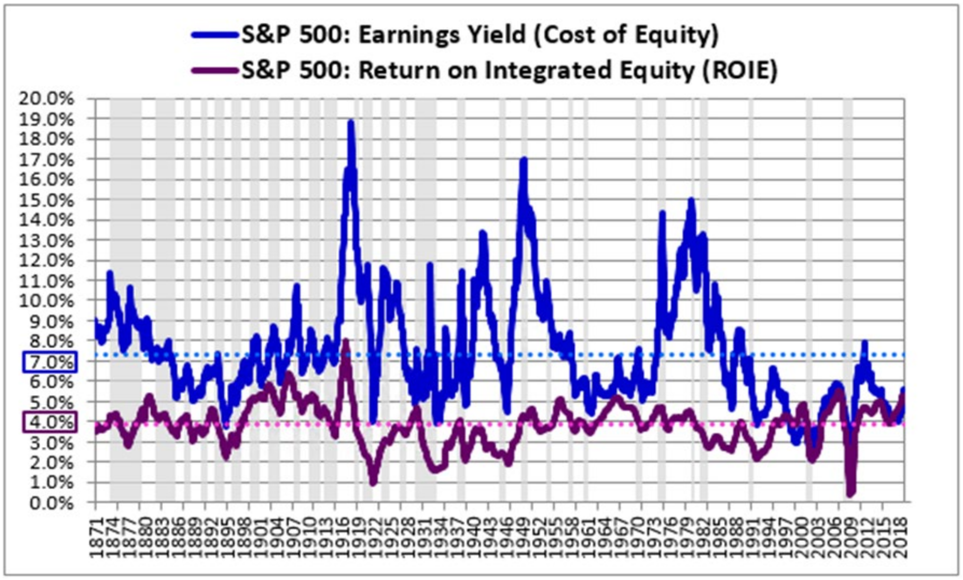
[15] Bear in mind that this is just an estimate. There are stipulations that can make it more true, or less true.

SECTION 3: THE PROFITABILITY GAP

In theory, the corporate sector's return on equity should be greater than or equal to its cost of equity. However, when we measure the actual numbers, we find that the opposite is true. The corporate sector's measured cost of equity is significantly higher than its measured return on equity. In this section of the piece, we're going to investigate this puzzling result.

The Profitability Gap Explained

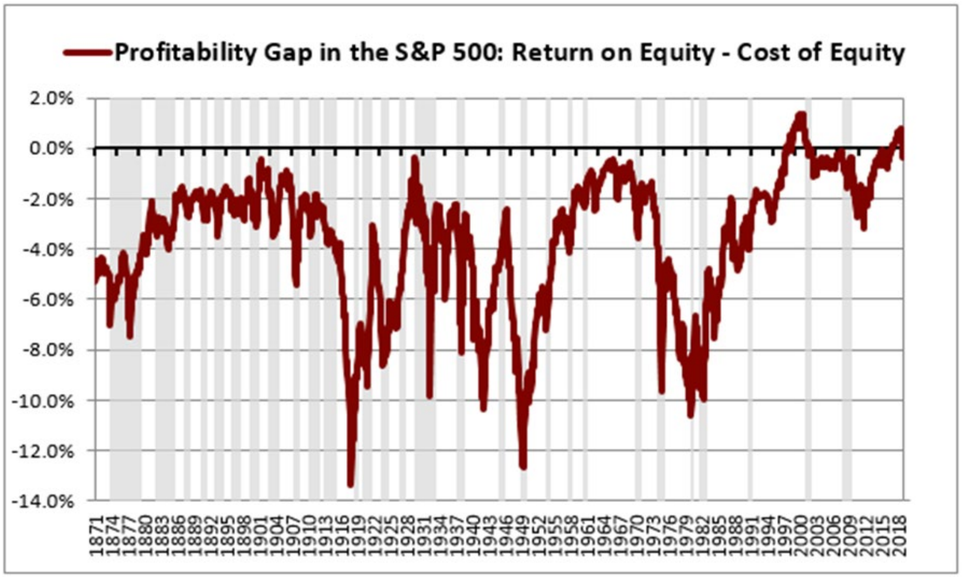
The chart below shows the earnings yield and the ROIE of the S&P 500 from January 1871 through December 2018:



The average earnings yield over the period, shown as the dotted blue line, comes out to 7.33%. That number is an approximation of the index's average cost of equity, which we can think of as the average return that it would have earned if it had recycled all of its earnings back into its price through dividends and share buybacks (see Appendix A: Claim #3). The average ROIE over the period, shown as the dotted purple line, comes out to 3.85%. That number is an approximation of the index's average return on equity, which we can think of as the average return that the index would have earned if it had directed all of its earnings into investment.

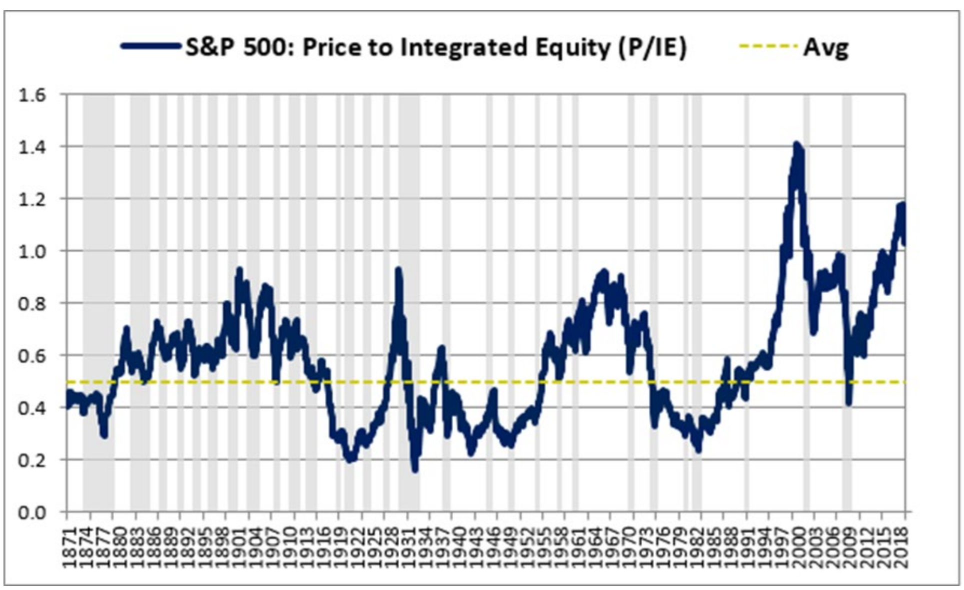
We refer to the gap between these two measures as the "profitability gap." Over the full course of market history, the gap averages out to 3.48% (=7.33% - 3.85%). The existence of the gap suggests that corporate investment has not been profitable enough to justify the missed opportunity to pay dividends and buy back shares. Per unit of earnings deployed, corporate investment generated an annual return that was 3.48% less than the return that could have been delivered through those alternatives.[16]

[16] Technically, the return from "corporate investment" that we're speaking of here includes a contribution from share buybacks. But it's only a small contribution, because buybacks were illegal for much of the period and have only recently become popular as a method of returning cash to (exiting) shareholders.



Given the size of the profitability gap, why did corporations historically deploy almost half of their earnings into investment? Why didn't they instead deploy all of their earnings into dividends, or use all of their earnings to buy back shares (after doing so became legal)? That's the question that we have to answer. To frame the question in terms of the cost of equity and the return on equity, if the corporate sector's average cost of equity was 3.48% higher than its average return on equity, then why did it expand its equity by retaining and reinvesting its earnings? Why didn't it instead contract its equity, shrink it, give it back to its shareholders? If the calculated numbers are correct, that would have been the most accretive thing to do.

In addition to showing up in profitability data, the profitability gap shows up in valuations. Consider the chart below, which shows the ratio of the S&P 500's price to its integrated equity ("P/IE") from January 1871 through December 2018. Recall that the P/IE ratio is similar to the price-to-book ratio, except that it uses an inflation-adjusted book value calculated using the integrated equity methodology:



On a harmonic basis, the ratio averages out to roughly 0.50 over the period. The implication is that equity that historically got put into companies at par ended up trading on average in the market at 50% of par. That's how corporate investments that originally offered a 3.85% return got transformed into dividend and share buyback opportunities offering a 7.33% return—the market, in its apparent irrationality, discounted the companies and the equity investments inside them, increasing their implied returns.

So, it's not just corporations that are to blame for the profitability gap. It's also investors. Why are they selling stocks at average prices below the par value of equity? Why is $1 in the primary equity market—e.g., the IPO market or the retained earnings market—only worth an average of 50 cents in the secondary equity market, i.e., the publicly traded market? Why are investors creating irrational price conditions in which companies can generate a 3.48% excess return over new investment by contracting their equity, i.e., giving it back to shareholders?

It's important to emphasize that the irrational outcome that we're confronted with here is a direct analytic consequence of claims that corporations themselves are making. They're claiming to have earned money on behalf of their shareholders. But they aren't paying all of that money out to their shareholders. Instead, they're keeping a large portion, investing it back into their businesses. They claim that the underlying value of the money is being retained in the process. But when we add up the actual numbers, we find that they don't add up. A significant amount of shareholder value is being lost somewhere.

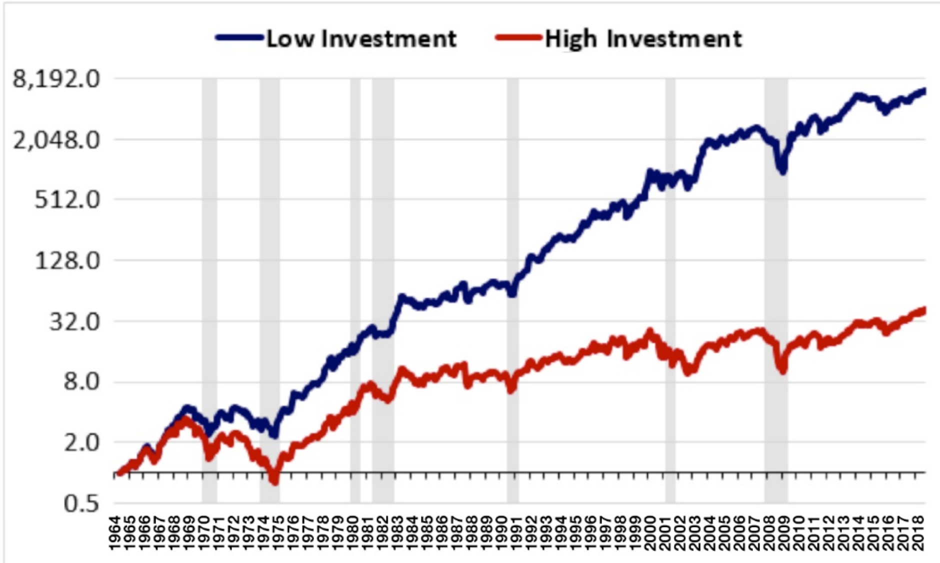
The Inefficient Investment Hypothesis

The simplest way to explain the profitability gap is to posit that corporate investment is naturally inefficient. When all of its expenses are included, it tends to produce low returns—in the case of the U.S. economy, returns that have historically averaged out to roughly 4% per year.

These returns are less than the average returns that public market investors have historically demanded. Consequently, corporate investment has tended to trade at a discount to its equity value in the market. That discount is the ultimate driver of the profitability gap, the condition that makes it possible for dividends and share buybacks to offer higher returns than the returns available on new investment. Unfortunately for shareholders, corporations have failed to fully capitalize on the gap. They've continued to expand their equity through new investments, even as the gap has been telling them to contract it.

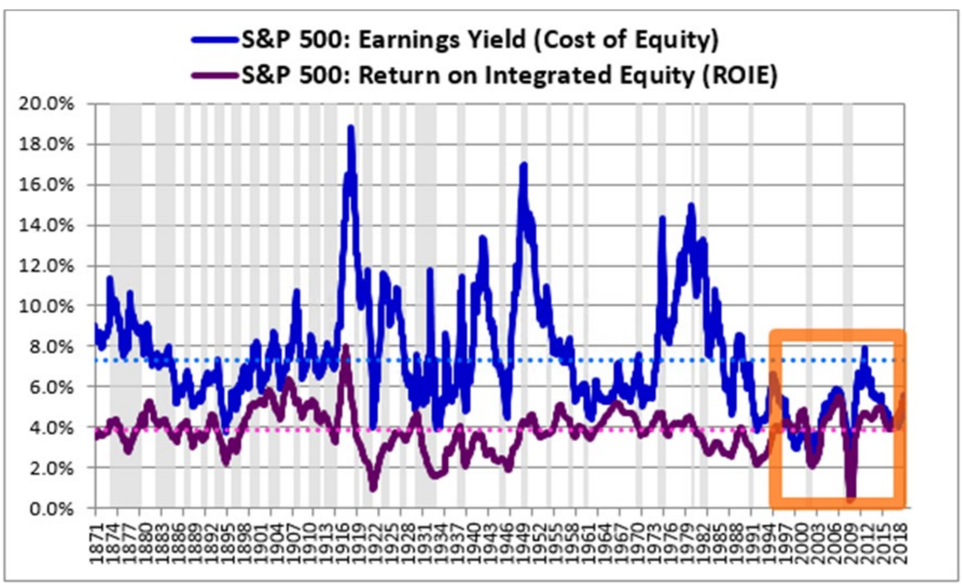
We refer to the hypothesis that investment is naturally inefficient as the "Inefficient Investment" hypothesis. It finds support in the inverse relationship that exists between investment propensity and returns in individual stocks. As the chart below shows, companies that invest heavily (i.e., "empire builders") tend to dramatically underperform companies that invest lightly. For equal-weighted quintiles, the return difference comes out to more than 10% per year over the 1964 to 2018 period, a staggering difference[17]:

[17] The chart shows the equal-weighted performance of U.S. stocks in the top and bottom quintiles of investment, with investment defined as the percentage change in assets over the prior year. The source for the data is Kenneth French's website. For more information on investment as a factor, see "A Five-Factor Asset Price Model" by Eugene Fama and Kenneth French.



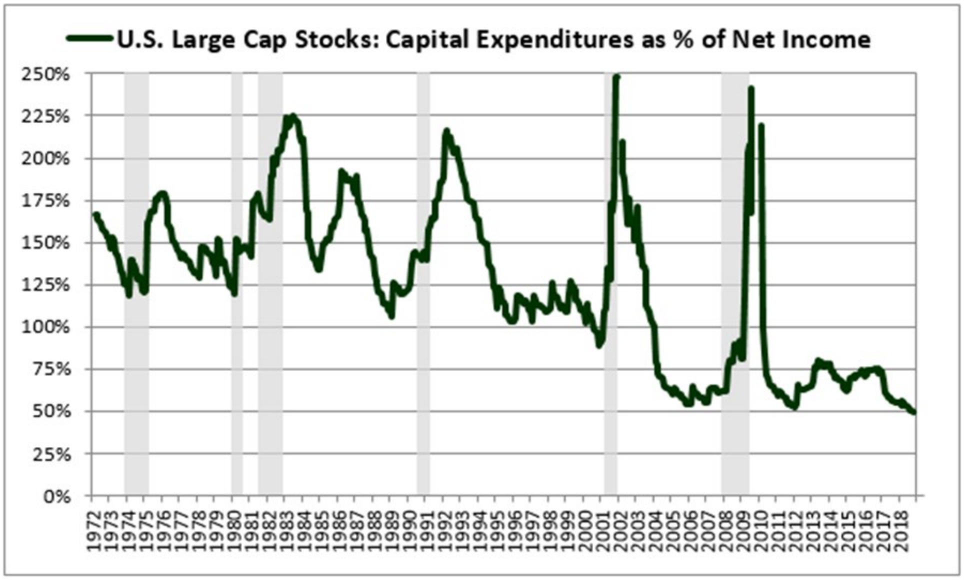
The hypothesis finds additional support in the market's ongoing trend towards higher valuations. Over the last few decades, average market valuations have increased substantially relative to the past, causing the gap between prices and equity values to shrink to almost nothing. From 1871 through 1995, the market's average P/IE ratio was 0.46, which means that corporate net investment traded, on average, at 46% of its par value. From 1995 to present, the market's average P/IE ratio has increased to almost double that average, 0.85.

This shrinkage is reflected in a shrinking profitability gap. Over the last two decades, the gap has compressed down to almost nothing:



The fact that the profitability gap has come down markedly over time is evidence that it was the result of an inefficiency. Historically, public markets offered returns that were too high relative to the returns available on new investment. The market is now correcting that discrepancy—not by raising the returns on new investment, but by reducing the returns available in public markets.

Despite the increase in valuations seen in recent decades, corporate managers have shown a reduced propensity to invest and an increased propensity to repurchase equity through share buybacks and acquisitions. The chart below shows capital expenditures as a percentage of net income for U.S. Large Cap Stocks from 1972 through 2018:



As you can see, capital expenditures have been in a clear downward trend. Advocates of the inefficient investment hypothesis can point to this downtrend as evidence that corporate managers are wizening up. They've developed an increased appreciation for the fact that investment tends to be a low-return proposition and are adjusting their capital allocation practices accordingly.

Interestingly, when we examine the profitability gap across different sectors, we encounter results that fit with our preconceptions. Sectors that we would expect to be prone to inefficient investment, such as the capital-intensive Utility sector, exhibit the largest profitability gaps. Conversely, sectors that we would expect to be highly efficient in their investments, such as the capital-light healthcare sector, exhibit no profitability gap at all, but instead, a profitability surplus:

U.S. LARGE (1964 - 2018) (Inflation-Adjusted)	Return (on Equity)	Cost (of Equity)	DIFF	Avg Payout Ratio	Fundamental Return (ex ΔVal)	Total Return (w/ ΔVal)
	Avg ROIE	Avg E-Yield				
HEALTHCARE	11.29%	4.68%	6.62%	47%	8.28%	8.43%
TECHNOLOGY	6.77%	4.17%	2.60%	41%	6.91%	5.96%
STAPLES	8.21%	6.10%	2.12%	52%	7.11%	7.22%
FINANCIALS	5.14%	7.67%	-2.53%	40%	5.85%	5.40%
ENERGY	4.65%	7.22%	-2.57%	56%	4.56%	5.89%
INDUSTRIALS	3.30%	6.25%	-2.95%	49%	5.36%	5.53%
DISCRETIONARY	1.34%	5.49%	-4.15%	57%	3.80%	5.11%
MATERIALS	1.38%	6.15%	-4.78%	58%	3.97%	4.11%
TELECOM	0.00%	6.15%	-6.15%	81%	3.85%	3.87%
UTILITIES	0.00%	7.85%	-7.85%	74%	4.65%	4.78%

To allow for further exploration of this topic, we present a slew of additional profitability data in Appendix E. Highlights include profitability data for 5 sectors going back to 1871, 28 industries going back to 1964, 10 countries going back to 1971, and a proxy for the popular buyback factor back going back to 1999.

- Appendix E: Integrated Equity Data for Sectors, Industries, Countries and Factors

It's important to recognize that the "inefficiency" in the inefficient investment hypothesis is an inefficiency that's detectable in hindsight, not necessarily in foresight, so it doesn't necessarily imply a "mistake" on anyone's part. People can only make decisions based on what they know in the present moment. From the perspective of the past, it may not have been possible to know that corporate investment would tend to deliver weak returns or that publicly traded securities were priced to deliver strong ones. Realistically, the only way to know that there's a discrepancy between these modes of allocation is to see the discrepancy play out over an extended period. Having now seen it, today's investors and corporate managers are in a better position to capitalize on it.

Reasons for Skepticism

We can tell a great story around the inefficient investment hypothesis, but we need to be careful with it. A 3.48% premium between the returns available from the purchase of existing assets and the returns available from the creation of new assets is an enormous premium, especially when compounded over 147 years. The sustained existence of such a premium for such a long period of time would represent a market failure of epic proportions.

It turns out that we can explain the profitability gap in a much more parsimonious way by questioning the earnings numbers that the corporate sector is reporting to us. As we will see in the next section, we have strong reasons to believe that those numbers are overstated. The overstatement explains the profitability gap almost perfectly.

SECTION 4: THE OVERSTATED EARNINGS HYPOTHESIS

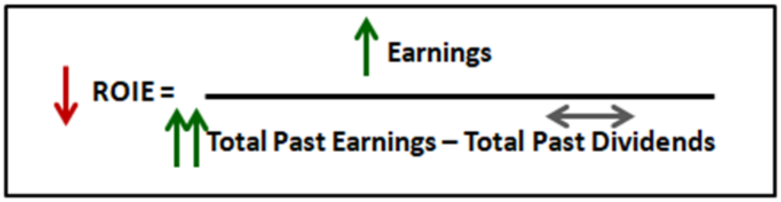
The profitability gap emerges because we take companies at their word. We trust that they've been earning what they say they've been earning. When we calculate the ROIEs and earnings yields associated with their earnings, we discover a gap.

But what if companies have actually been earning less than what they say they've been earning? What if they've been overstating their earnings? Let's think about how that would affect the numbers.

If earnings were overstated, then the earnings yield, which is calculated from reported earnings, would appear to be higher than it actually is. The calculated 7.33% average would be an exaggeration.

Similarly, if earnings were overstated, then total retained earnings, which are calculated as total past earnings minus total past dividends, would appear to be higher than they actually are. The companies would therefore appear to have invested more than they actually did invest. The methodology would hold them accountable for the additional investment that never took place, causing their measured ROIEs to appear lower than they actually are. The calculated 3.85% average would therefore understate their profitability—that is, the profitability of the true investments that they actually did make.

The logic here can be difficult to visualize, so I spell it out in the equations below:



Earnings overstatement causes calculated earnings yields to wrongly go up because it causes reported earnings to wrongly go up. Conversely, it causes calculated ROIEs to wrongly go down because it causes total reported past earnings, which feed into the total calculated amount of past investment, to wrongly go up by more than the reported earnings themselves.

The overstatement therefore causes the cost of equity to wrongly rise and the return on equity to wrongly fall. The result ends up being an illusory profitability gap. The return on equity appears to be lower than the cost of equity, even when they're actually equal to each other, because the return on equity gets understated and the cost of equity gets exaggerated.

We refer to the hypothesis that corporate earnings are systematically overstated as the "overstated earnings" hypothesis. Its chief proponent is the British economist Andrew Smithers.[18] If true, the hypothesis would suggest that there is no actual profitability gap—the apparent gap is a mirage, an illusion brought on by inaccurate earnings reporting.

If you're like most people, then your initial reaction to the hypothesis is probably to think that it's outlandish. How could it possibly be true that companies have overstated their earnings for so long without anyone finding out? A fair question indeed, but I would urge you to give the explanation a chance. As we look into it further, we will encounter overwhelming evidence in its favor.

Depreciation: Uncertainties and Inaccuracies

The accounting item that is most likely to give rise to an overstatement of earnings is depreciation. Depreciation, defined as the reduction in the economic value of assets due to aging, wear and tear, and obsolescence, is a substantial expense for most businesses. Unfortunately, it's a very difficult expense to accurately quantify (see Appendix A: Claim #5).

For an illustration of the uncertainty inherent in depreciation accounting, suppose that a company builds a new factory. When the company goes to calculate its earnings, it's not going to deduct the cost of the factory all in one period. Rather, it's going to deduct the cost incrementally in the form of depreciation charges applied over the factory's useful life. Crucially, the factory's useful life includes not only its physical lifespan, but also its lifespan as a competitive corporate asset, a state-of-the-art structure that can compete with

[18] In his 2009 book "Wall Street Revalued", Smithers pointed to the discrepancy between NIPA-based measures of U.S. Corporate ROE and average earnings yields for the S&P 500 as evidence that corporate earnings were overstated.

current technology in the generation of output. Unfortunately, we don't really know what the factory's useful life will be in this broader sense. We have to use accounting thumbrules to make an educated guess.

Suppose that the cost of the factory is $100MM, and that the company estimates (guesses?) the factory's useful life to be 20 years. If the company assigns a salvage value of $20MM to the factory, then on the straight-line method, the factory's annual depreciation expense will come out to $4MM per year (= ($100MM - $20MM) / 20). But now suppose that the technology that the factory utilizes becomes obsolete more quickly than expected, and that its true useful life as a competitive corporate asset ends up being only 10 years. What's going to happen?

Eventually, the company will find itself in a situation where it has to spend large amounts of money on upgrades and improvements to maintain the factory's profitability. The company isn't going to treat these upgrades as direct expenses. Since the upgrades extend the factory's useful life, it's going to "capitalize" them, add them to the balance sheet as investments. The reason it's allowed to do that is that the costs associated with reversing declines in the factory's competitiveness over time are already being counted in the depreciation charges that the company is incurring each year. There's no need to count those costs twice. The problem, however, is that the costs aren't being counted correctly. Consequently, the company's true cost of doing business through the factory will end up being understated, causing an overstatement in its earnings. Given the uncertainty and complexity inherent in any business enterprise, it's easy to see how a company's true earnings could be misreported in this way, even in the absence of deceptive intentions.

What we're doing in the integrated equity exercise is holding the corporate sector accountable for its claimed investment history. We're saying to corporate executives, "Look, you claimed to have retained and reinvested some amount of money over your history. Where did that money go? Why is it generating such a low rate of return?" If, as a historical matter, corporations have been understating their true depreciation costs, then we know the likely answer. A sizeable portion of the retained earnings that corporations claim to have invested into growth would have actually gone into what's sometimes called "maintenance capex", capital expenditures that simply reverse the effects of depreciation (in this case, effects that are not being reported correctly). There's no growth in that capex--it simply fends off a decline--which would explain why it has failed to generate a market-competitive rate of return[19].

Narrowing the Explanation: Distortions Associated with Historical Cost Accounting

To be fair, we don't know how often the useful lives of assets get overestimated in the way described above. Consequently, we don't know how often depreciation gets understated. It's entirely possible that the useful lives of assets could get overestimated just as often as they get underestimated, producing errors in depreciation that cancel each other out in the aggregate. But even if depreciation errors cancel each other out, reported earnings will still contain a major depreciation-related inaccuracy. This inaccuracy is associated with a topic discussed in an earlier section, historical cost accounting. When used in the presence of inflation, historical cost accounting causes depreciation to be systematically understated, even when the useful lives of assets are estimated correctly.

As explained earlier, depreciation cannot actually be measured empirically. It can only be estimated using theoretical accounting methods. In a historical cost accounting framework, those methods are referenced to the historical cost of the asset. The depreciation is calculated as a function of that cost, with a certain amount of the cost deducted from earnings in each period as an expense. As we saw in earlier sections, inflation causes the historical costs of assets to be understated relative to true costs in current dollars. It therefore

[19] To be clear, not at all maintenance expenditures are capitalized. Some types of maintenance expenditures, e.g., replacing the oil in a car, have to be undertaken for the asset to have the useful life that we've assumed it to have. Such expenditures do not appreciably increase the remaining useful life of the asset, and so they're expensed in the period in which they occur. Other kinds of maintenance expenditures, e.g., overhauling a power plant, aren't necessary for the asset to have the useful life that we've assumed it to have. Such expenditures appreciably extend the remaining useful life of the asset, and so they're capitalized and depreciated, i.e., expensed incrementally in future periods.

causes depreciation to be understated. Since depreciation is an expense, the result ends up being an overstatement of earnings.

For an illustration of the earnings distortion that inflation can introduce, suppose that Caterpillar builds a large production factory in 1965 at a cost of $10MM. Suppose further that the company depreciates the factory using the straight-line method down to a salvage value of $2MM over a 20-year useful life. Assume further that this useful life is correct--in the absence of additional investments, the factory really will last for 20 years before it becomes inoperable, obsolete, or otherwise uneconomic. Per the schedule, the company would then deduct $400,000 from its revenues each year as a non-cash expense. This amount is meant to approximate the cost of keeping the production factory in its current state of competitiveness as time passes. But now fast-forward to 1983. The CPI will have increased by a factor of roughly 3 times. The current-dollar cost of keeping the factory in its current state of competitiveness will likely be much higher than the nominal $400,000 being charged in depreciation each year. The company's reported earnings will therefore overstate the actual distributable cash flow leftover after the factory's true expenses have been paid.

Because inflation over the last two decades has been very low, it's not a pressing concern for investors or for the accounting profession. But it wasn't always as low as it is today. The decade of the 1970s saw severe inflation, and the effects of that inflation showed up in financial statements. In 1977, Harvard Business Review shared the results of a review of required replacement cost disclosures of the 100 largest U.S. companies at the time. The results revealed that earnings numbers measured using a replacement cost framework were 35% lower than officially reported GAAP earnings numbers, reflecting an overstatement of 50%:

Exhibit V
Effect on stockholders' equity and net income
(dollar figures in billions)

	Historical cost	Replacement cost	Increase (decrease)	Percentage increase (decrease)
Stockholders' equity	$ 208.1	$ 346.8	$ 138.7	66.7%
Net income	$ 30.9	$ 20.0	$ (10.9)	(35.3)%
Rate of return on stockholders' equity	14.9%	5.8%	(9.1)%	(61.1)%

The overstatement in question, then, is not a negligible effect that we can just ignore. It matters.

Quantifying the Average Degree of Earnings Overstatement Across History

It turns out that we can quantify the S&P 500's average degree of historical earnings overstatement by artificially shrinking the index's actual historical earnings until an appropriate match is obtained between the index's average cost of equity and its average return on equity. The table below shows the values that these variables take on under different levels of earnings shrinkage:

S&P 500: Assumed EPS Overstatement (1871 - 2018)	Recalculated Values After Correcting Assumed EPS Overstatement		
	Avg ROIE	Avg E-Yield	DIFF
0%	3.85%	7.33%	-3.48%
5%	3.99%	6.98%	-2.99%
10%	4.36%	6.67%	-2.31%
15%	4.77%	6.38%	-1.61%
20%	5.28%	6.11%	-0.83%
25%	5.88%	5.87%	0.01%

To construct the table, we go back in time and reduce the index's earnings in each month to undo postulated overstatements of 0%, 5%, 10%, 15%, and so on, recalculating the index's average ROIE and average earnings yield under the reduced earnings. We then select the degree of overstatement that minimizes the difference between these averages.

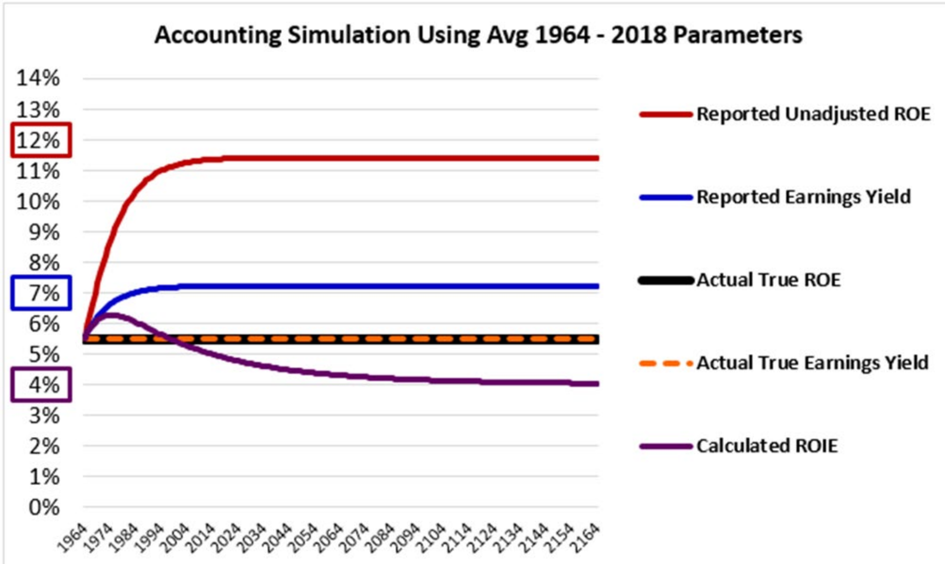
In the end, the optimal assumed degree of overstatement comes out to 25%. When we shrink the index's earnings to undo that degree of overstatement, we get an average return on equity that matches the average cost of equity over market history, consistent with economic theory.

Corroborating the Overstated Earnings Hypothesis through Simulation

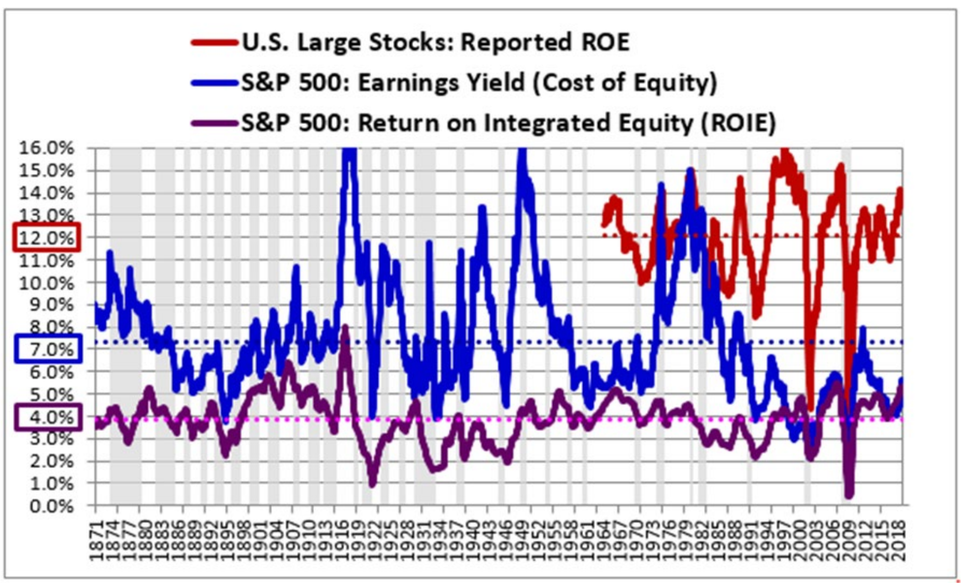
In Appendix F, we share the results of an accounting simulation that offers a powerful corroboration of the overstated earnings hypothesis. We start the simulation by building a perfectly efficient hypothetical index intended to mimic the S&P 500 in its average parameters (fundamental rate of return, interest rate, debt-to-equity ratio, depreciation rate, payout ratio, etc.). By stipulation, this index always trades at a true price-to-equity ratio of 1.0, with a cost of equity that's always equal to its return on equity.

After building the hypothetical index, we allow it to generate earnings in an inflation-free environment. When we calculate relevant metrics for the index at equilibrium, all of the metrics come out as expected, with no profitability gap. We then add inflation to the simulation and recalculate the same metrics using historical cost accounting rules. The metrics become distorted, leading to an illusory profitability gap that isn't actually real. Interestingly, the size of the illusory profitability gap ends up closely matching the size of the actual profitability gap seen in the actual S&P 500.

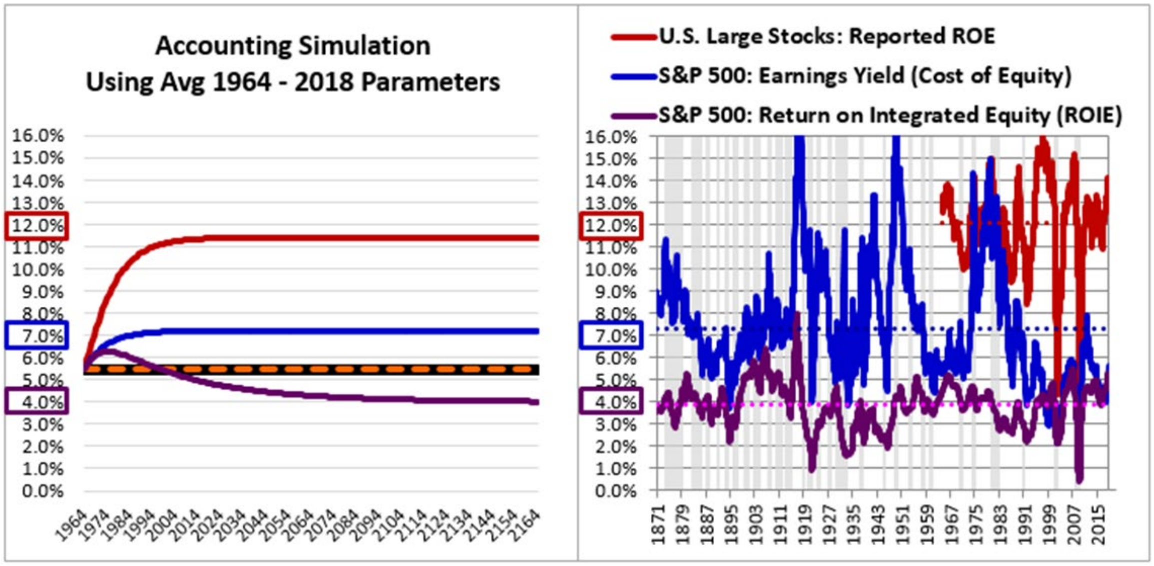
Ultimately, the illusory profitability gap arises from an inflation-related understatement of the index's assets, which leads to an understatement of the index's depreciation expenses. This understatement causes the earnings of the index to become overstated, which causes the index's reported earnings yield and calculated ROIE, which each start out at a true value of around 5.5%, to take on the following distortions over time:



Look carefully at the calculated numbers in the chart above—7% for the reported earnings yield, 4% for the calculated ROIE, and 12% for the reported unadjusted ROE. We've seen these numbers throughout the piece—they're the <u>same</u> average numbers calculated for the actual S&P 500:



For a better visualization of the similarities, the chart below shows the results of the simulation alongside the actual data for the S&P 500. As you can see, the simulation equilibrates at the same values that the actual index averages out to over time:



The fact that the S&P 500's profitability gap can be almost exactly reproduced in an accounting simulation as the illusory consequence of an inflation-related overstatement in earnings is strong evidence in favor of the overstated earnings hypothesis. Some form of earnings overstatement is almost certain to have taken place in the index over the course of history. The only real question is how severe that overstatement has been, and how much of the profitability gap it explains.

After presenting and discussing the simulation, we use it to build a mapping between inflation rates and varying degrees of earnings overstatement. The mapping is shown below:

Accounting Simulation Avg 1964 - 2018 Parameters	
Inflation Rate (Hypothetical)	**EPS Overstatement @ Equilibirum**
0%	0.0%
2%	19.1%
4%	32.2%
6%	41.3%
8%	48.0%
10%	53.1%

Applying the 2.07% inflation rate observed over the fully course of market history, the mapping estimates an average historical degree of earnings overstatement of approximately 20%, not far from the 25% that we estimated by a different method in the previous subsection.

A more extensive discussion of the simulation, with links to a spreadsheet that contains the actual numbers, is provided in the following appendix:

- Appendix F: The Overstated Earnings Hypothesis in Accounting Simulation
- Spreadsheet: Accounting Simulation

Historical Response to Inflation: SEC and FASB

The insight that inflation causes earnings to be overstated is not a new insight. The accounting industry has known about it and debated the proper response to it for many decades, going all the way back to the late 1940s, when inflation first started to receive attention as a public problem in the United States. It's reasonable to therefore wonder why the SEC or the Federal Accounting Standards Board (FASB) haven't ever mandated practices to correct for it.

The answer is that when inflation was at its peak in the United States, these bodies did mandate practices to correct for it. In 1976, the SEC published ASR 190, which required large companies to disclose what their financial numbers would have come out to under a replacement cost framework. FASB followed up in 1979 with the now superceded FAS 33, which required a similar disclosure. You can see an example of this disclosure in Walmart's annual report for 1981:

*Depreciation expense (current cost) for 1981 and 1980 is $21,674,000 and $17,508,000, respectively, of which $1,950,000 and $1,699,000, respectively, is included in cost of sales.

Selected Supplementary Financial Data Adjusted for Effects of Changing Prices (In average 1981 dollars)
(Dollars in thousands except per share data)

	1981	1980	1979	1978	1977
Revenues - as reported	**$1,655,262**	$1,258,268	$ 909,913	$ 686,223	$ 484,200
- in constant dollars	**1,655,262**	1,425,999	1,151,139	936,647	704,522
Net income - as reported	**55,682**	41,151			
- in constant dollars	**40,988**	30,765			
- in current cost	**50,177**	40,903			
Net income per common share* - as reported	**1.73**	1.34			
- in constant dollars	**1.27**	1.00			
- in current cost	**1.56**	1.33			
Net assets at year end - as reported	**248,309**	164,844			
- in constant dollars	**378,026**	274,416			
- in current cost**	**371,843**	307,942			
Cash dividends per common share* - as reported	**.20**	.15	.11	.08	.0425
- in constant dollars	**.20**	.17	.14	.11	.06
Market price per common share* - as reported	**30.00**	17.81	11.31	9.50	6.94
- in constant dollars	**28.68**	19.02	13.76	12.64	9.86
Average consumer price index	**249.1**	219.8	196.9	182.5	171.2

*Per share data prior to December 16, 1980, has been adjusted to reflect the 100% stock dividend paid on that date.

Notice that when a current cost framework is substituted for a historical cost framework in Walmart's accounting, the company's EPS drops and its book value rises, as expected. But these adjusted numbers are not the numbers that show up when an academic or a quant queries for "Walmart 1981 EPS." ASR 190 and FAS 33 only required the numbers to be presented as supplements—they were never treated as "official" numbers. Consequently, they don't show up in any of the historical data sources that today's investors and researchers use.

SECTION 5: IMPLICATIONS FOR INDIVIDUAL STOCK SELECTION AND OVERALL STOCK MARKET VALUATION

The overstated earnings hypothesis carries significant implications for individual stock selection and overall stock market valuation. In this section, I'm going to examine factor-based techniques borrowed from OSAM that investors can implement to take advantage of its effects. I'm then going to use the hypothesis to explain why inflation affects valuations, and why the current U.S. stock market may be cheaper relative to the past than it appears to be.

Individual Stock Selection: The Value of Free-Cash-Flow

The overstated earnings hypothesis calls into question the very way in which we measure "value." We normally use earnings to measure value, but earnings come with a large black box inside them—the black box of depreciation. Under GAAP rules, this black box gets filled in with an untested, unverified, and often arbitrary theoretical placeholder. What is the useful life of an asset? What is the annual cost of preserving its earnings power in the presence of deterioration, wear and tear, obsolescence, evolving market conditions, and so on? We don't know. All we can do is make educated guesses. These guesses often turn out wrong, evidenced by the profitability gap that we see in the data.

Even if we assume that corporate managers are accurate, on average, in estimating the useful lives of their assets, we know that their depreciation expenses will be wrongly stated in at least one respect: those expenses are calculated based on asset values that are understated at historical cost. The expenses themselves therefore end up being understated, causing earnings to be overstated.

What we don't know is the distribution of this overstatement across the market. If the overstatement is distributed more-or-less evenly across stocks, then it may not effect the stock selection process. But if the overstatement is distributed in an uneven way, it's going to fool valuation metrics into thinking that stocks with understated depreciation are cheap when they aren't, giving rise to adverse selection.

A better way to account for depreciation would be to track it not through arbitrary company guesses, but through its actual effects, by tracking actual capital expenditures themselves. That's what "free cash flow" attempts to do. It adds depreciation back to earnings, and then subtracts capex. Because it's tied to actual empirical flows, it's less likely to understate (or overstate) a company's true depreciation expenses.

The concern with free-cash-flow is that it treats all capex as maintenance capex, an expense that gets deducted from the result. It therefore penalizes companies that are engaged in genuine growth capex, causing their cost structures to appear larger than they actually are. But if, as the inefficient investment hypothesis asserts, corporate investment tends to produce low returns by its very nature, then penalizing growth capex may not be such a bad thing. The penalty is partially justified in light of the different risk that's being introduced, the risk of inefficient investment.

In the table below, we test free-cash-flow against other fundamental measures of value. We identify stocks that fell into the cheapest quintile of the U.S. Large Cap Stock Universe on different valuation metrics in each month from 1963 through 2018. We then calculate the arithmetic average of all of their subsequent one-year excess returns over the market.[20] We only include stocks that have data for all of the metrics, therefore we exclude financials and utilities[21]:

U.S. LARGE (1963 - 2018)	Avg Excess TR	Hit / Miss				Statistics			
		Hit Rate	Avg Gain	Miss Rate	Avg Loss	eff N	SD	t	p
MKT: LARGE	0.00%	46.5%	24.8%	53.5%	-21.6%	20,250	33.9%	-	-
VALUE: EV/FCF	3.70%	51.0%	26.7%	49.0%	-20.2%	4,070	33.2%	6.947	0.000
VALUE: P/FCF	3.49%	51.0%	26.2%	49.0%	-20.2%	4,071	32.6%	6.561	0.000
VALUE: P/OCF	2.46%	50.1%	25.0%	49.9%	-20.2%	4,070	31.1%	4.624	0.000
VALUE: EV/EBITDA	2.34%	50.1%	24.8%	49.9%	-20.3%	4,071	30.8%	4.391	0.000
VALUE: P/E	2.28%	50.5%	24.0%	49.5%	-19.9%	4,070	29.9%	4.291	0.000
VALUE: P/EBITDA	1.70%	49.5%	24.5%	50.5%	-20.7%	4,070	30.9%	3.196	0.002
VALUE: P/S	1.60%	48.7%	25.4%	51.3%	-21.0%	4,070	31.7%	3.002	0.004
VALUE: P/B	0.98%	48.2%	24.8%	51.8%	-21.1%	4,070	31.4%	1.841	0.073

Out of all the metrics, enterprise-value-to-free-cash-flow (EV/FCF) generates the highest returns, with price-to-free-cash-flow (P/FCF) in close second. Both metrics produce excess returns that are a full percentage point higher than the next best metric, price-to-operating-cash-flow (P/OCF), which doesn't subtract capex. The lowest ranking metric of all is the price-to-book ratio, with excess returns that fail to meet the 0.05 threshold for statistical significance.

The chart below shows the average historical sector exposures for the different metrics in the test:

U.S. LARGE (1963 - 2018)	Avg Excess TR	Average Sector Exposures							
		ENE	MAT	INDU	DISC	STPLS	HC	TECH	COM
MKT: LARGE	0.00%	9.8%	12.8%	19.8%	19.8%	11.6%	10.2%	12.8%	3.2%
VALUE: EV/FCF	3.70%	7.3%	12.4%	20.5%	20.7%	9.2%	10.3%	18.5%	1.0%
VALUE: P/FCF	3.49%	7.9%	13.6%	21.4%	21.8%	10.1%	9.2%	14.2%	1.7%
VALUE: P/OCF	2.46%	21.1%	17.0%	21.7%	15.9%	6.3%	2.8%	6.0%	9.2%
VALUE: EV/EBITDA	2.34%	20.6%	15.6%	20.2%	18.6%	6.8%	4.0%	7.9%	6.2%
VALUE: P/E	2.28%	14.6%	16.5%	23.7%	21.0%	9.0%	5.1%	6.7%	3.4%
VALUE: P/EBITDA	1.70%	19.9%	17.7%	21.9%	18.6%	6.5%	2.9%	4.3%	8.1%
VALUE: P/S	1.60%	9.1%	13.4%	24.3%	25.0%	16.7%	6.0%	4.7%	0.7%
VALUE: P/B	0.98%	17.4%	20.2%	22.0%	18.1%	6.2%	3.7%	6.4%	6.0%

[20] This approach is arguably more accurate than the conventional approach of building an equal-weighted factor portfolio because it weights each stock in history equally. The conventional approach weights older stocks more heavily than newer stocks because it puts them into past portfolios that had a smaller total number of stocks, causing them to take on a greater relative weighting.

[21] The effective sample size for each test ("eff N") is defined as the total number of non-overlapping monthly individual stock samples. The hit rate is the overall percentage of stocks that outperformed the market and the miss rate is the overall percentage that underperformed it. The average gain is the average gain on a hit and the average loss is the average loss on a miss.

As you can see, P/FCF has no strong overweight in any sector, and is roughly equal-weighted, on average, to the top performing healthcare, staples and technology sectors. The metric's outperformance, then, cannot be dismissed as a sector-related phenomenon.

Unsurprisingly, the income-based measures that completely ignore depreciation—P/OCF, enterprise-value-to-ebitda (EV/EBITDA) and price-to-ebitda (P/EBITDA) end up taking overweighted positions in the depreciation-heavy energy and materials sectors. They highlight the risk of ignoring specific types of expenses in the measurement of value—the value bet turns into a bet on sectors that happen to have larger exposures to those types of expenses.

In the chart below, we perform the same test on the small and mid-cap stock universe:

U.S. SMALL & MID (1963 - 2018)	Avg Excess TR	Hit / Miss				Statistics			
		Hit Rate	Avg Gain	Miss Rate	Avg Loss	eff N	SD	t	p
MKT: SMALL & MID	0.00%	44.6%	37.0%	55.4%	-29.8%	66,085	50.4%	-	-
VALUE: P/FCF	5.05%	50.3%	35.9%	49.7%	-26.1%	13,239	45.5%	11.533	0.000
VALUE: EV/FCF	4.90%	50.0%	35.7%	50.0%	-25.9%	13,239	45.4%	11.187	0.000
VALUE: P/OCF	3.96%	49.3%	36.4%	50.7%	-27.6%	13,239	46.7%	9.041	0.000
VALUE: EV/EBITDA	3.75%	49.4%	35.0%	50.6%	-26.7%	13,239	44.3%	8.547	0.000
VALUE: P/EBITDA	3.22%	48.7%	36.7%	51.3%	-28.6%	13,239	47.4%	7.345	0.000
VALUE: P/S	3.09%	47.8%	37.9%	52.2%	-28.8%	13,239	48.2%	7.058	0.000
VALUE: P/E	2.64%	48.7%	33.0%	51.3%	-26.1%	13,239	42.0%	6.025	0.000
VALUE: P/B	1.73%	46.9%	36.1%	53.1%	-28.7%	13,239	47.3%	3.941	0.000

Again, the free-cash-flow metrics finish at the top of the list. All of the metrics outperform to the statistically significant 0.05 threshold. Interestingly, the P/E ratio declines in its relative performance, finishing below the price-to-sales (P/S) ratio. Its underperformance likely results from the fact that earnings tend to be more erratic and unreliable in smaller companies.

The chart below shows the average sector exposures for the factors in the small and mid-cap test:

U.S. SMALL & MID (1963 - 2018)	Avg Excess TR	Average Sector Exposures							
		ENE	MAT	INDU	DISC	STPLS	HC	TECH	COM
MKT: SMALL & MID	0.00%	7.2%	10.0%	21.7%	22.4%	7.1%	12.1%	17.4%	1.9%
VALUE: P/FCF	5.05%	5.1%	11.6%	25.2%	26.6%	7.3%	7.9%	15.2%	1.0%
VALUE: EV/FCF	4.90%	4.6%	10.2%	24.2%	24.9%	6.6%	8.3%	20.3%	0.8%
VALUE: P/OCF	3.96%	13.5%	14.9%	25.3%	24.1%	6.9%	4.2%	7.2%	3.8%
VALUE: EV/EBITDA	3.75%	10.1%	13.3%	25.2%	26.6%	6.8%	4.5%	11.2%	2.3%
VALUE: P/EBITDA	3.22%	11.5%	15.3%	25.6%	27.4%	7.3%	4.1%	5.2%	3.5%
VALUE: P/S	3.09%	4.4%	11.6%	27.7%	30.7%	13.7%	4.9%	6.3%	0.7%
VALUE: P/E	2.64%	8.0%	13.9%	26.1%	29.2%	7.3%	4.8%	9.2%	1.3%
VALUE: P/B	1.73%	10.2%	16.0%	24.3%	24.4%	6.3%	4.8%	11.3%	2.5%

The P/FCF metric outperforms despite underweighting the top-performing healthcare and technology sectors, again confirming that the outperformance is unrelated to sector exposure.

Given these results, we might think that the optimal stock selection approach would be to abandon other measures of valuation and use free-cash-flow exclusively. The problem with this approach, however, is that it loses the risk-reduction benefits of diversification. Like all value metrics, free-cash-flow has experienced significant volatility in its historical performance. We don't know for certain what it's future performance will be. It therefore makes sense for us to diversify our value exposure, provided that we have other well-tested metrics that we can diversify into.

As a rule, any time a valuation metric is used to select stocks, the metric is going to inadvertently select stocks whose fundamentals happen to be exaggerated on that metric. The market will recognize the true value of the overstated company and will price it correctly, but the metric will wrongly think that the company is cheap, pulling it into the portfolio. Free-cash-flow is no exception here—using it as a metric in a value portfolio will inevitably bring certain companies into the portfolio whose free-cash-flows happen to be inflated by unusual items. These "fake" value companies will dilute the portfolio's value exposure, exposing it to beta, or to something worse. If, instead of placing our bets on a single metric, we use a diverse array of well-tested metrics in conjunction with each other, we can mitigate this unwanted effect. The different metrics will cover each other's blind spots, strengthening the overall value signal.

The table below illustrates the effects of this strengthening. The "AVERAGE: 8 METRICS" row shows the average of the individual top quintile excess returns of the eight metrics analyzed above. The "COMPOSITE (12.5%)" row shows the top quintile excess return of a composite metric that effectively blends the eight metrics together, assigning a 12.5% weight to its score on each of them:

U.S. LARGE (1963 - 2018)	Avg Excess TR	Hit / Miss				Statistics			
		Hit Rate	Avg Gain	Miss Rate	Avg Loss	eff N	SD	t	p
MKT: LARGE	0.00%	46.5%	24.8%	53.5%	-21.6%	20,250	33.9%	-	-
AVERAGE: 8 METRICS	2.32%	49.9%	25.2%	50.1%	-20.4%	4,070	31.4%	4.357	0.010
COMPOSITE (12.5%)	2.95%	51.6%	24.1%	48.4%	-19.5%	4,068	29.8%	5.547	0.000

As you can see, the composite metric generates a higher return than the average of the individual returns of the metrics that it's composed from. Figuratively speaking, the whole ends up being greater than the sum of its parts.

In the chart below, we separate the performances of the different valuation metrics into discrete time periods within the 1963 to 2018 period:

U.S. LARGE (VALUE: CHEAPEST QUINTILE) (1963 - 2018)	Arithmetic Average of Excess Total Returns by Period					
	1963-1975	1976-1985	1986-1995	1996-2005	2006-2018	
					2006-2012	2013-2018
EV/FCF	2.76%	3.28%	5.03%	6.88%	-0.71%	0.74%
P/FCF	2.69%	3.33%	4.87%	6.17%	0.22%	0.66%
P/OCF	3.03%	3.01%	2.28%	5.03%	0.80%	-0.42%
EV/EBITDA	2.29%	3.59%	2.10%	4.12%	0.61%	0.08%
P/E	2.93%	4.76%	0.58%	3.36%	1.09%	0.49%
P/EBITDA	2.06%	2.66%	1.24%	2.96%	1.41%	0.03%
P/S	1.40%	2.70%	0.54%	3.10%	-0.13%	0.44%
P/B	4.29%	1.50%	1.24%	0.94%	-0.35%	-1.71%
AVERAGE: 8 METRICS	2.68%	3.10%	2.23%	4.07%	0.37%	0.04%
COMPOSITE (12.5%)	3.69%	4.73%	2.88%	3.90%	0.66%	0.41%

Though the free-cash-flow measures perform better in an absolute sense, their outperformance is inconsistent. The composite measure is able to smooth out some of that inconsistency while maintaining attractive overall returns. The fact that it manages to deliver absolute returns that are stronger than the free-cash-flow metrics in half of the periods analyzed is a testament to the concept behind it. It successfully generates those returns from a collection of statistically inferior factors.

Free-Cash-Flow in Profitability Metrics

In addition to performing well in valuation metrics, free-cash-flow also performs well in profitability metrics. The table below shows the performance of the top quintile of U.S. Large Cap Stocks on four profitability metrics: free-cash-flow-to-book value (FCF/B), free-cash-flow-to-invested-capital (FCF/IC), conventional ROE (E/B) and conventional ROIC (E/IC):

U.S. LARGE (1963 - 2018)	Avg Excess TR	Hit / Miss				Statistics			
		Hit Rate	Avg Gain	Miss Rate	Avg Loss	eff N	SD	t	p
MKT: LARGE	0.00%	46.8%	23.4%	53.2%	-20.5%	18,352	31.8%	-	-
PROF: FCF/B	3.31%	51.3%	24.5%	48.7%	-19.1%	3,688	31.4%	6.330	0.000
PROF: FCF/IC	2.77%	49.6%	27.1%	50.4%	-21.1%	3,688	35.9%	5.293	0.000
PROF: ROIC (E/IC)	1.29%	47.1%	28.3%	52.9%	-22.7%	3,688	38.0%	2.458	0.019
PROF: ROE (E/B)	0.68%	47.3%	25.5%	52.7%	-21.6%	3,688	33.6%	1.291	0.173

As you can see, the free-cash-flow-based measures outperform the earnings-based measures by a wide margin.

Overstated Earnings and the DepCap Ratio

Outside of value and profitability, a simple OSAM metric that investors can use to flag companies at risk of overstated earnings is the ratio of depreciation to capex. Companies that exhibit low values of this ratio are more likely to be understating their depreciation, covering for the understatement by engaging in large relative amounts of capex.

In the table below, we show the performance of the top and bottom depreciation-to-capex (DepCap) quintiles of the U.S. Large Cap Stock Universe from 1963 through 2018:

U.S. LARGE (1963 - 2018)	Avg Excess TR	Hit / Miss				Statistics			
		Hit Rate	Avg Gain	Miss Rate	Avg Loss	eff N	SD	t	p
MKT: LARGE	0.00%	46.6%	24.4%	53.4%	-21.3%	21,808	33.4%	-	-
DEPCAP: TOP	1.04%	48.9%	24.3%	51.1%	-21.2%	4,382	31.8%	2.07	0.047
DEPCAP: BOTTOM	-2.04%	42.5%	28.8%	57.5%	-24.9%	4,340	41.4%	-4.015	0.000

The return spread between top and bottom DepCap quintiles comes in at roughly 3%—a respectable spread, especially considering that the metric doesn't directly tap into any value or profitability signals.

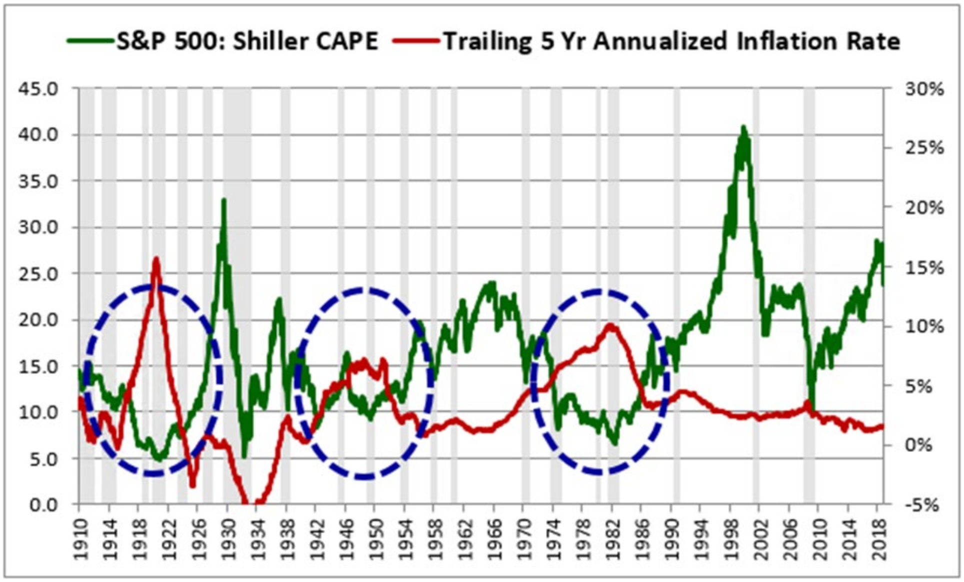
Like many factors, the DepCap ratio is more effective at identifying weak companies than strong ones. The implication is that an increased risk of earnings overstatement is more harmful to returns than a decreased risk is helpful.

Overstated Earnings and Stock Market Valuation: The Relevance of Inflation

Our natural reaction to the overstated earnings hypothesis is to view it as bad news for the stock market. All this time, we've operated under the assumption that companies in the market were earning a certain amount of money. When we find out that the amount has been systematically exaggerated, we come to wonder whether the market merits its current price, whether it's overvalued.

But valuation is about <u>relative</u> comparisons. The implications that the overstated earnings hypothesis carries for the current market's valuation will therefore depend on the relative severity of the overstatement across different periods of history. If earnings overstatements occurred to a greater extent in the past than they do today, then the current market's relative valuation would be <u>more</u> attractive than we thought. The hypothesis would then be <u>good news</u> for the current market, not bad news.

To work out the implications of the overstated earnings hypothesis, let's look back and examine the <u>cheapest</u> recorded periods of U.S. market history outside of the two major banking panics. First, we have the post-WW1 period in the late 1910s and early 1920s. Second, we have the post-WW2 period in the late 1940s and early 1950s. Third, we have the mid-1970s through the early 1980s. What do each these periods have in common? The answer: high levels of <u>inflation</u>.



Historically, high levels of inflation have been strongly associated with depressed valuations. There are two popular explanations for the association:

- Interest Rates: High levels of inflation leads to high interest rates, which imply high discount rates and therefore low valuations.
- Economic Damage: High levels of inflation depress investor sentiment by introducing uncertainty into the economy and impeding economic growth.

The problem with the first explanation, interest rates, is that in addition to causing high interest rates, high inflation causes high nominal growth, which warrants high valuations. If there's a variable that's relevant to valuation, it's the real interest rate, the interest rate relative to inflation. During the above inflationary periods, valuations remained depressed even when real interest rates were kept at very low levels, as they were, for example, in the late 1940s and the mid-1970s.

The problem with the second explanation, economic damage, is that the actual damage that the economy has experienced during inflationary periods hasn't been all that significant, certainly not significant enough to justify the deep reductions in valuation that occurred during the periods. As an example, the U.S. economy experienced far less damage during the inflation of the 1970s than it did during the 2009 financial crisis and aftermath. Still, it was punished with a much lower multiple.

Despite these problems, both explanations are likely to be true in the sense that they're believed to be true. The fact that investors believe the explanations to be true causes them to transact—buy and sell—in anticipation of their being true. These anticipatory transactions, in turn, give rise to correlations and outcomes that make the beliefs true, even when they aren't fully true in the theoretical sense.

With all that said, if we're looking for a genuinely compelling explanation for the relationship between inflation and valuation, we can find one in the overstated earnings hypothesis. In a historical cost accounting framework, high levels of inflation mean high levels of understated depreciation and therefore high levels of earnings overstatement. If the market, in its wisdom, is able to detect this overstatement, then we should expect it to assign lower multiples to the earnings. When we look back at inflationary periods in market history, that's exactly what we see happen.

Interestingly, the overstated earnings hypothesis vindicates the often-mocked "Rule of 18." The "Rule of 18" tells us that if the sum of the Dow's P/E ratio and the inflation rate is higher than 18, then stocks are going to fall. The actual number in the rule, 18, may not have a clear basis in anything, but the directionality of the rule is consistent with the accounting effect that inflation has on earnings. High levels of inflation mean that earnings are overstated and that the market deserves a lower multiple.

The overstated earnings hypothesis is therefore bullish for the current market. The inflation rate today is much lower than it was in the past, which means that current earnings are less overstated and that current multiples deserve to be higher. When we compare current multiples to past averages, the current market looks expensive—but those past averages are associated with different inflationary conditions, invalidating the comparison.

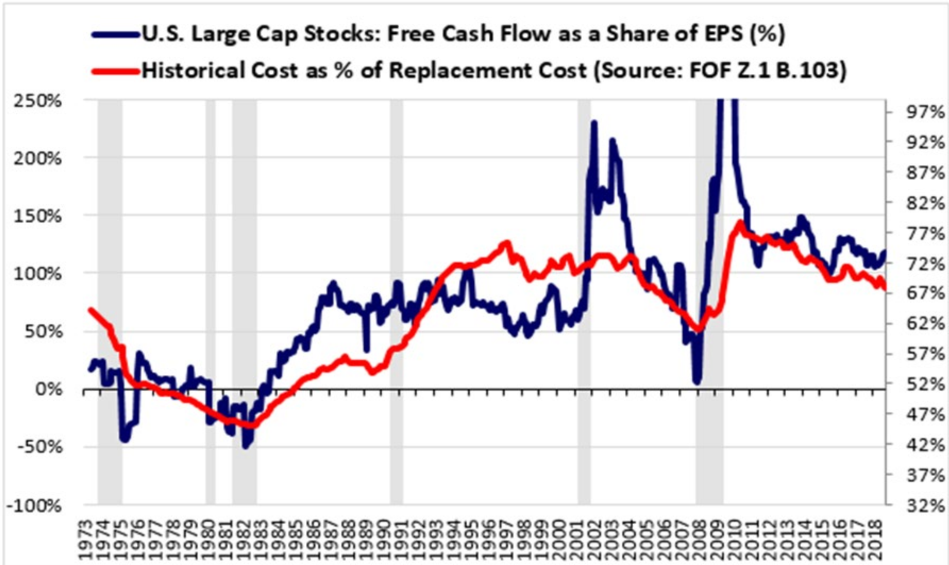
Using Free-Cash-Flow to Empirically Measure Earnings Overstatement

We can measure the degree of earnings overstatement that has taken place across different periods of history by comparing free-cash-flow to earnings. Instead of capturing depreciation through the use of accounting thumbrules, free-cash-flow captures depreciation by tracking actual empirical capex flows. Consequently, it provides a more accurate picture of the actual distributable earnings that companies are generating, particularly during inflationary periods.

We don't have free-cash-flow data for the post-WW1 and post-WW2 inflations, but we do have that data for the inflation of the 1970s and 1980s. In the chart below, we show the ratio of free-cash-flow (per share) to EPS for large cap stocks from 1973 through 2018. Crucially, we only include stocks that we have free-cash-flow data on—all other stocks are excluded:

The chart confirms our suspicions. Earnings during the inflation of the 1970s and 1980s appear to be significantly overstated, coinciding with very low levels of free-cash-flow. Earnings during the recent period, in contrast, appear to be significantly understated, coinciding with very high levels of free-cash-flow.

Using data from the Flow of Funds (Z.1, B.103), we can directly tie the free-cash-flow content of EPS to the difference between the historical cost value of the corporate sector's assets and the replacement cost value of those assets. Across history, whenever corporate asset values were excessively understated at historical cost, free cash flow was noticeably lower as a percentage of EPS, suggesting an inflation-related understatement in depreciation, exactly as we would expect:



Though falling inflation is a relevant factor in the recent increase in free cash flow as a share of earnings, it's not the only factor, and it may not even be the most impactful. Additional potential factors include:

(1) Changes in Accounting Standards - The incorporation of increasingly harsh accounting standards related to the treatment of potentially impaired assets and the expensing of research and development outlays have likely reduced the overstatement of earnings relative to the past, particularly in high-technology sectors.

(2) Structural Change - Though speculative, it's possible that structural changes in the economy have led to increases in the effective useful lives of the corporate sector's assets, reducing the corporate sector's true depreciation expense. Recall that the useful life of an asset depends on how quickly it becomes obsolete in the face of competition from technological improvements. If the overall pace of technological improvement in the economy is slower today than in the past, or if the channels for competition between corporations are weaker, then we should expect the corporate sector's assets to retain their economic value for longer periods of time. This would extend their useful lives and reduce the true depreciation expenses associated with them.

Regardless of the actual causes of the change, if today's earnings are less overstated than the earnings of the past, then today's market deserves a higher multiple.[22]

In conclusion, the overstated earnings hypothesis is bullish for the market, not bearish. It doesn't give us license to take valuations to extremes, but it does give us a sound basis for taking them higher than the averages of past eras. Of course, we've already taken them higher than those averages, so our work in that area is already done.

What the hypothesis does invalidate, however, is the notion, endorsed by some investors, that the market's earnings yield can reliably forecast its future return. This notion is already refuted by the fact that earnings fluctuate across economic cycles. But even if earnings didn't fluctuate, the market's earnings yield would still

[22] If profit margins are set to mean-revert, then this logic will not hold. The fact that earnings are currently understated relative to the past will simply mean that true profit margins are even more elevated on a relative basis than we thought they were, implying an even greater drop on a move back to the historical average.

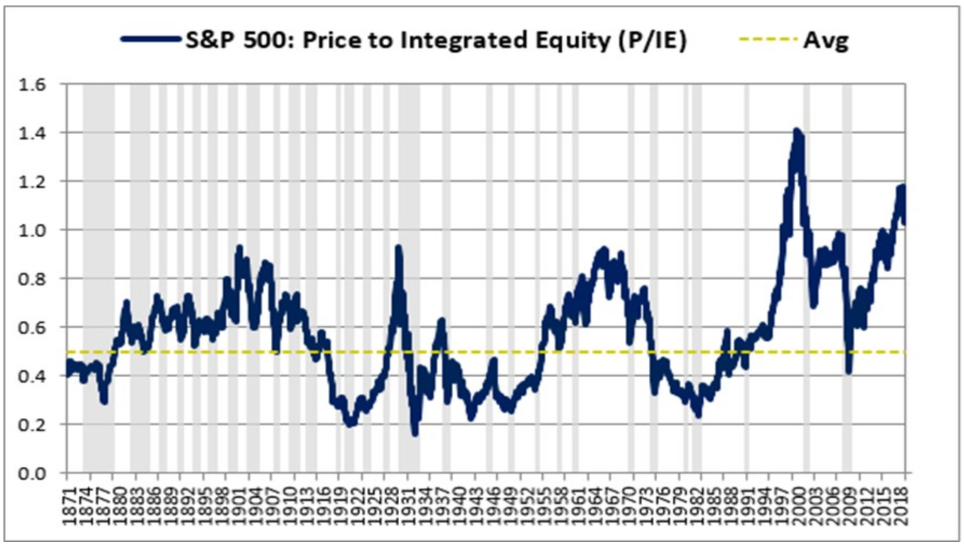
be unreliable as a predictor of its future return, because the reported earnings used to calculate the earnings yield are systematically overstated relative to reality.

SECTION 6: USING THE INTEGRATED EQUITY METHODOLOGY TO VALUE MARKETS AND INDIVIDUAL STOCKS

In this final section of the piece, I'm going to show how the integrated equity methodology can be used to construct a stock market valuation metric that outperforms other popular metrics.

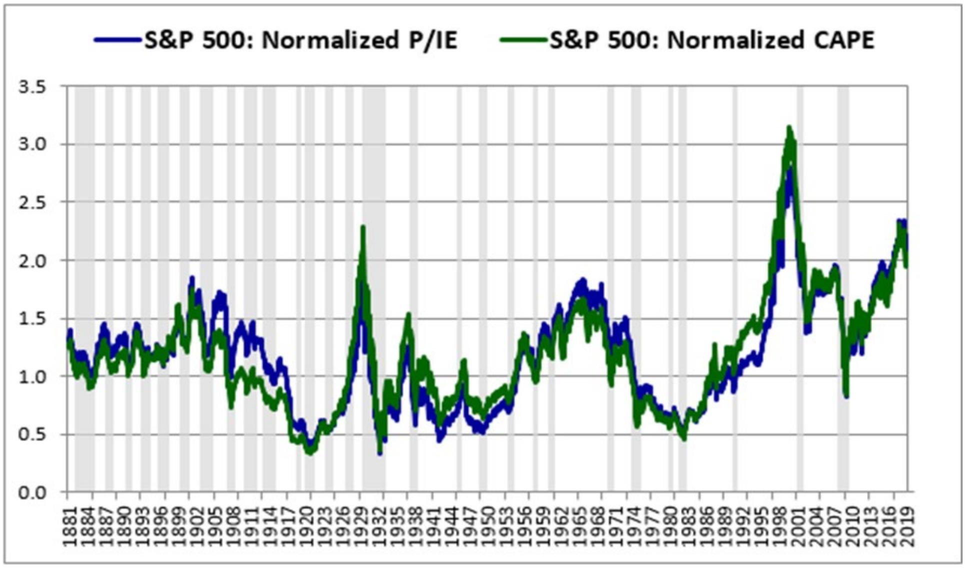
Price-to-Integrated Equity: The P/IE Ratio

In an earlier section, we examined a chart of the ratio between the S&P 500's price and its calculated integrated equity from January 1871 through December 2018. Here's that chart again:

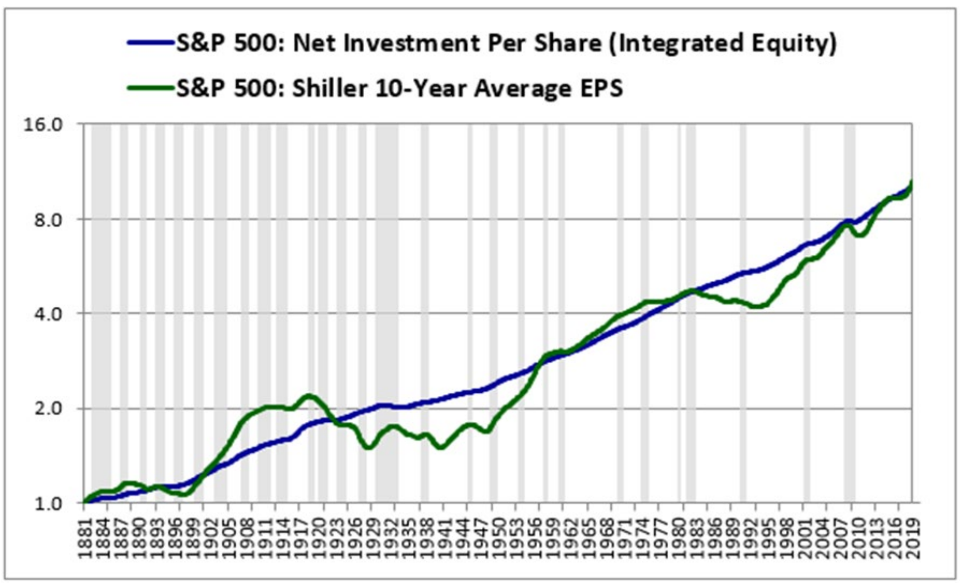


The ratio shown in the chart is a bona fide valuation metric. It measures the real price of the market relative to the real amount of money that has historically been put into it. We refer to it as the price-to-integrated equity ratio, or the "P/IE" ratio for short.

If we normalize the metric to its historic average, we find that it tracks very closely with the popular Shiller CAPE ratio. The chart below shows the two normalized measures alongside each other, with the end date increased to March 2019:



It's worth pausing to appreciate the elegance of the relationship between these two metrics. The metrics are tightly correlated because there's a close relationship between net investment and earnings. When measured in a properly inflation-adjusted manner, the cumulative net investment per share of the index tracks with its smoothed average real earnings per share:



Notice the difference in the smoothness of the blue line and the smoothness of the green line. The blue line, which represents the integrated equity term used in the denominator of the P/IE ratio, stays locked on its long-term trend. The green line, which represents the Shiller 10-year average earnings term used in the denominator of the CAPE ratio, oscillates arbitrarily around that trend depending on where in the various long-term profit cycles the 10-year averaging period happens to land. The difference between the two lines highlights a key advantage that the P/IE ratio has over the "cyclically-adjusted" P/E ratio: it's even less cyclical.

As a valuation metric, the P/IE ratio is similar to the price-to-book ratio and the Q-ratio. It's different from the price-to-book ratio in that it's constructed from consistent, inflation-adjusted prices. It's different from the Q-ratio in that it's based on a historical cost measurement of equity rather than a hybrid measurement that sometimes utilizes replacement cost techniques.

The practical advantage that the P/IE ratio has over both of these competing metrics is that it's readily calculable on a daily basis. Historical book value data for the broad U.S. equity market is expensive to obtain and is therefore inaccessible to many retail investors. Q-ratio data can only be obtained from the Flow of Funds report, which is published with a three-month lag. Integrated equity data, in contrast, can be easily calculated in real time from the data shared on S&P's website and in Robert Shiller's spreadsheet.

Testing the Performance of the P/IE Ratio

A better way to measure a valuation metric's accuracy is to examine its correlation with actual subsequent future returns.[23] That's what we're going to do in the next few subsections.

To begin the test, we show correlations between future S&P 500 10-year returns and the following metrics: the trailing-twelve-month (ttm) P/E ratio, the CAPE ratio, the total return (TR) CAPE ratio, which is an improvement designed to eliminate distortions associated with changing dividend payout ratios, and the P/IE ratio. We examine the correlations over dates ranging from January 1881, the first year of available CAPE data, through March 2019. Note that a more negative correlation indicates a stronger predictive relationship:

1881 - 2019	ttm P/E	CAPE	TR CAPE	P/IE
10 Yr Returns: Real	-0.365	-0.553	-0.578	**-0.692**
10 Yr Returns: Nominal	-0.400	-0.578	-0.608	**-0.671**

As you can see, the P/IE ratio outperforms all of the other metrics.

In the table below, we increase the start date of the test to January 1945:

1945 - 2019	ttm P/E	CAPE	TR CAPE	P/IE
10 Yr Returns: Real	-0.435	-0.657	-0.670	**-0.804**
10 Yr Returns: Nominal	-0.561	-0.831	-0.841	**-0.924**

Again, the P/IE ratio outperforms all of the other metrics.

An interesting proposed improvement to the CAPE involves adjusting the trailing 10-year earnings average for cyclical fluctuations in profit margins. The performance of the resulting metric, which we refer to as the PM CAPE, is shown in the table below. The analysis begins in 1962, the earliest date for which reliable S&P 500 profit margin data is available:

[23] When we take the P/IE metric calculated above and test its correlation with subsequent future returns, we expose ourselves to a small amount of look-ahead bias. In Appendix G, I explain why this bias does not undermine the test.

1962 - 2019	CAPE	PM CAPE	TR PM CAPE	P/IE
10 Yr Returns: Real	-0.593	-0.715	-0.737	**-0.748**
10 Yr Returns: Nominal	-0.819	-0.895	-0.908	**-0.911**

The margin is smaller, but the P/IE ratio again outperforms all of the metrics. Unlike the PM and TR PM CAPEs, it does so without the luxury of a post-hoc modification.

The table below shows the P/IE ratio's performance against the Q-ratio. The test starts in 1952, the earliest date for which quarterly Q-ratio data is available:

1952 - 2018	Q	P/IE
10 Yr Returns: Real	-0.688	**-0.763**
10 Yr Returns: Nominal	-0.842	**-0.912**

Again, the P/IE ratio outperforms.

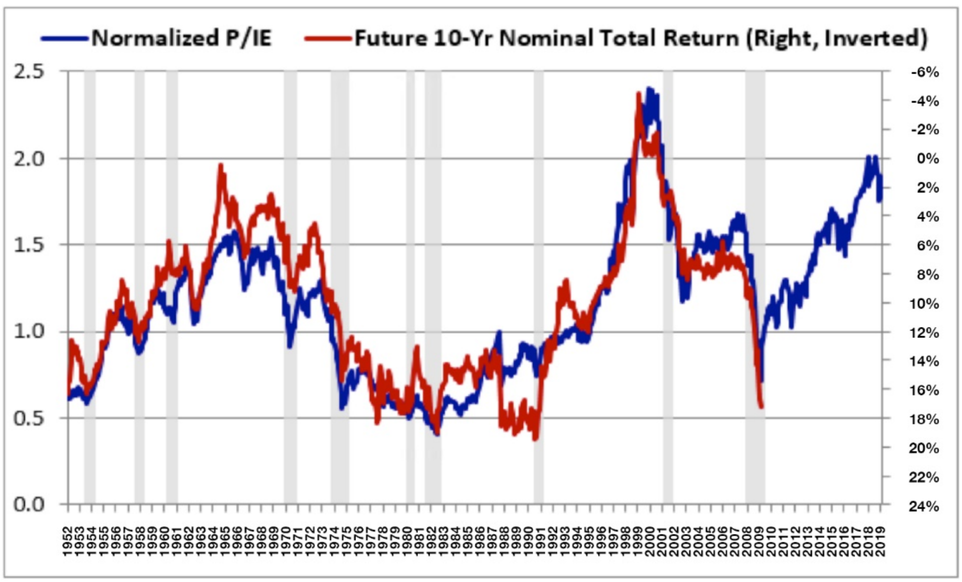
Finally, we show the P/IE ratio's performance in the OSAM U.S. Large Cap Stock universe alongside the price-to-ebitda ratio, the price-to-book ratio, the price-to-sales ratio:

U.S. Large: 1974 - 2018	P/EBITDA	P/B	P/S	P/IE
10 Yr Returns: Real	-0.733	-0.740	-0.776	**-0.802**
10 Yr Returns: Nominal	-0.864	-0.868	-0.904	**-0.913**

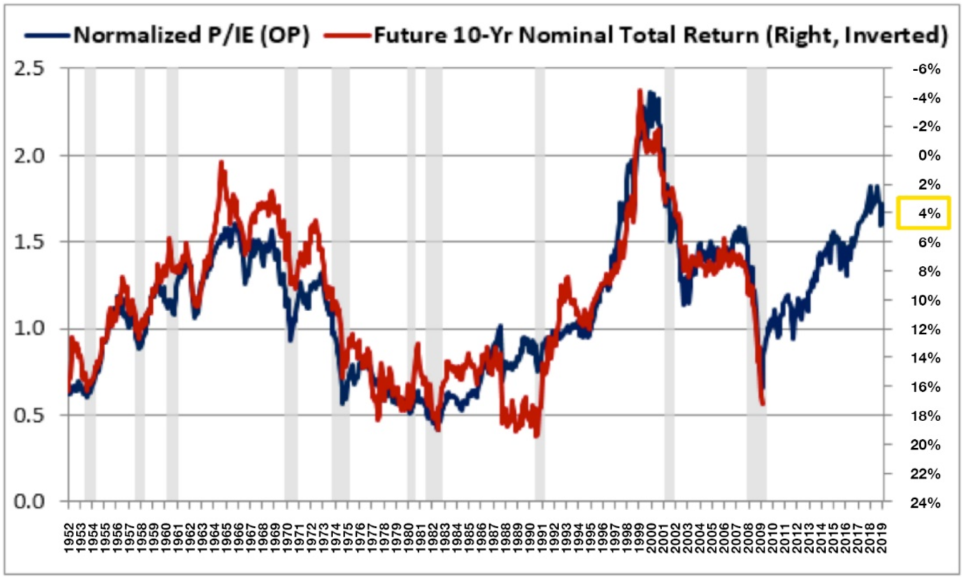
Again, the P/IE ratio outperforms all of the metrics. The margin of its outperformance isn't always large, but the consistency merits respect.

Estimating Future 10-Year Returns

The chart below shows the normalized P/IE ratio of the S&P 500 alongside its subsequent future 10-year nominal total returns (right axis, inverted) from January 1952 through March 2019. The correlation comes in at an exceptionally strong 0.916:



If you look closely at recent decades in the chart, you'll notice that the P/IE ratio has been consistently underpredicting returns. We can locate a possible explanation for this underprediction in accounting changes discussed earlier in the piece. As we saw in the free-cash-flow to EPS chart, the introduction of asymmetric accounting standards over the last two decades has caused reported GAAP earnings to become understated relative to the past. We used those earnings in the integrated equity methodology to calculate retained earnings. The understatement therefore passes through to our P/IE metric, pushing up on it in a way that overstates the market's current relative expensiveness and that impairs the metric's current predictive power.

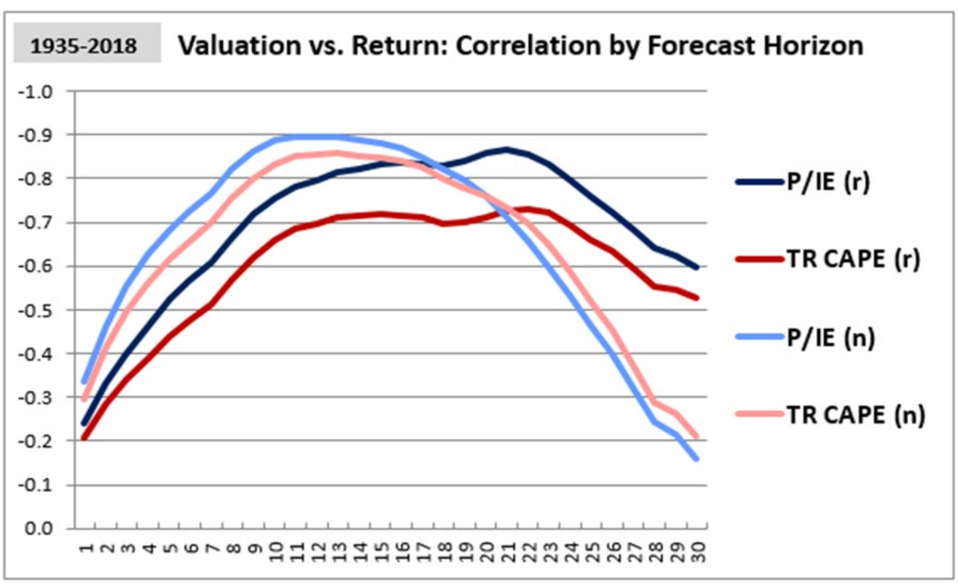


If we're willing to trust ourselves with a post-hoc adjustment, we can calculate the P/IE ratio using S&P's published operating earnings series in place of reported GAAP earnings. If we do that, we will notably improve the accuracy of the metric's recent predictions. The chart below shows the result:

The correlation rises to 0.926, driven by a clear narrowing of the gap seen over the last two decades. With the S&P 500 at 2830, the metric is currently predicting a future 10-year nominal return of between 3% and 4% per year. The metric is therefore telling us what every other popular metric has been telling us—stocks are historically expensive, priced for low future returns.

Acknowledging the Uncertainty

In the tests above, our choice to use a forecast horizon of 10 years was ultimately arbitrary—we cherry-picked that horizon because it produced the tightest overall fit. In the chart below, we show the performance of the P/IE measure from 1935 to 2018 on all future return horizons up to 30 years. The real return correlations are shown in dark colors (r) and the nominal return correlations are shown in light colors (n):



The nominal return correlations are exceptionally strong on 10-year horizons, but that strength drops off rapidly as the horizons are increased. The sharp drop-off increases the likelihood that the strength is spurious, the result of fragile historical coincidences rather than robust, recurring causal processes.

In contrast to the fragility of the nominal return correlations, the real return correlations are reasonably stable over the different forecast horizons. The relative improvement fits with theory—we expect valuations to correlate more robustly with real returns because those returns don't have the varying and unpredictable noise of inflation built into them.

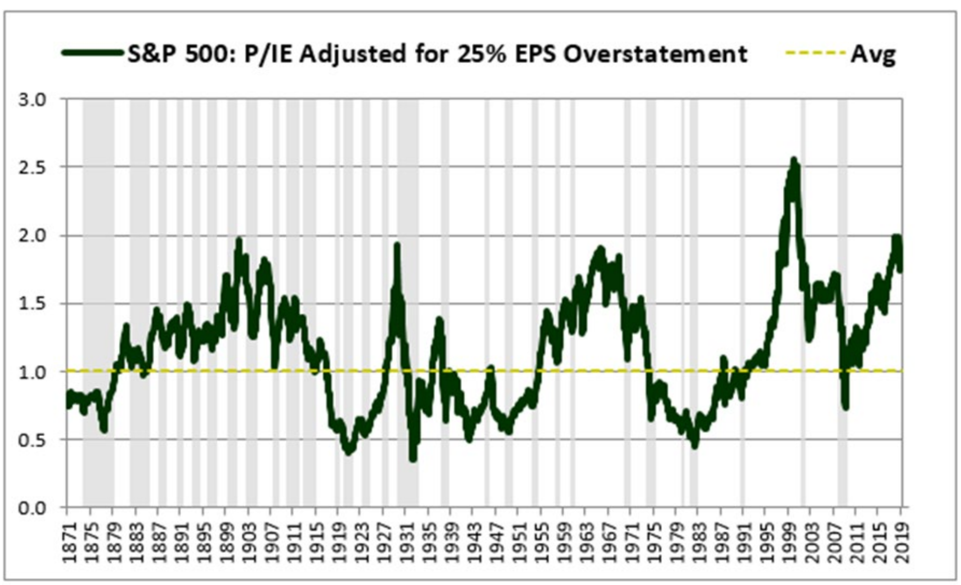
The metric's correlation with real returns isn't perfect, but we don't want perfect in this context. Perfect would be a sign of overfitting, the post-hoc exploitation of fortuitous coincidences in a model. Since valuation metrics only have part of the information that determines future returns, we should only want them to be partially correct in their predictions—anything more than that would be unreliable.

The 3% to 4% estimate shown above should therefore be interpreted as a highly uncertain estimate. It could easily turn out to be wrong—and probably will turn out to be wrong. All that any valuation metric can deliver is a rough range of future return estimates. The estimated range in this case is: "lower than normal."

Adjusting the P/IE Ratio for Earnings Overstatement

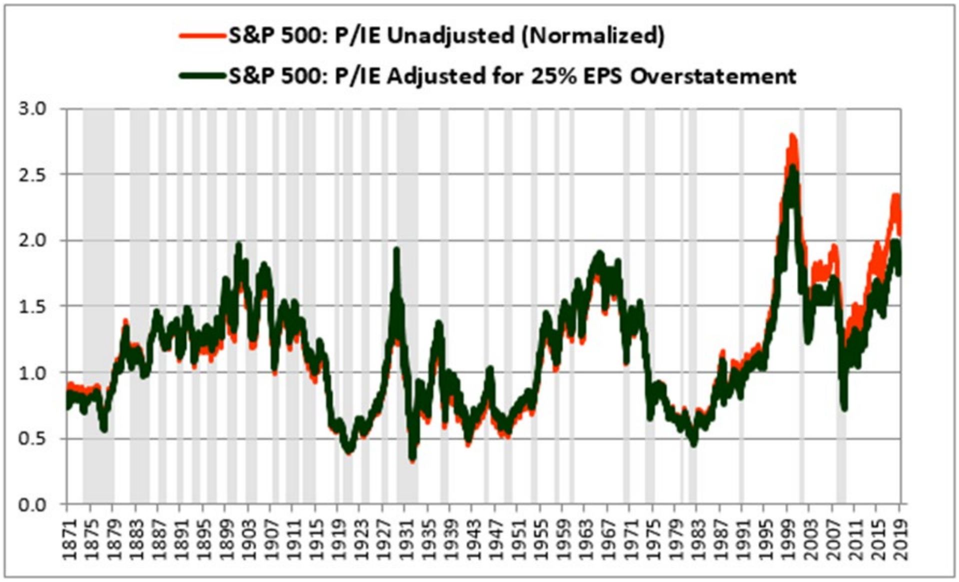
The P/IE ratio that we calculated for the S&P 500 above is technically incorrect. It was constructed from reported earnings that are systematically overstated. The retained earnings sum in its denominator exaggerates the true sum of retained earnings that the corporate sector has accumulated over its history, which is why the metric's harmonic average over the period comes out to 0.50, as opposed to the 1.0 that we would expect in an efficient market. The reason the metric is able to accurately predict returns is that it adequately depicts the relative differences between valuations across periods, even though its absolute levels are consistently off.

To arrive at a better representation of the market's historical valuation, we can shrink the S&P 500's historical reported earnings to account for the degree of overstatement that we believe took place. In the previous section, we estimated that earnings across history were overstated by an average of approximately 25%. If we shrink reported earnings across history to undo that overstatement, and we then recalculate the metric, we will obtain the following result:

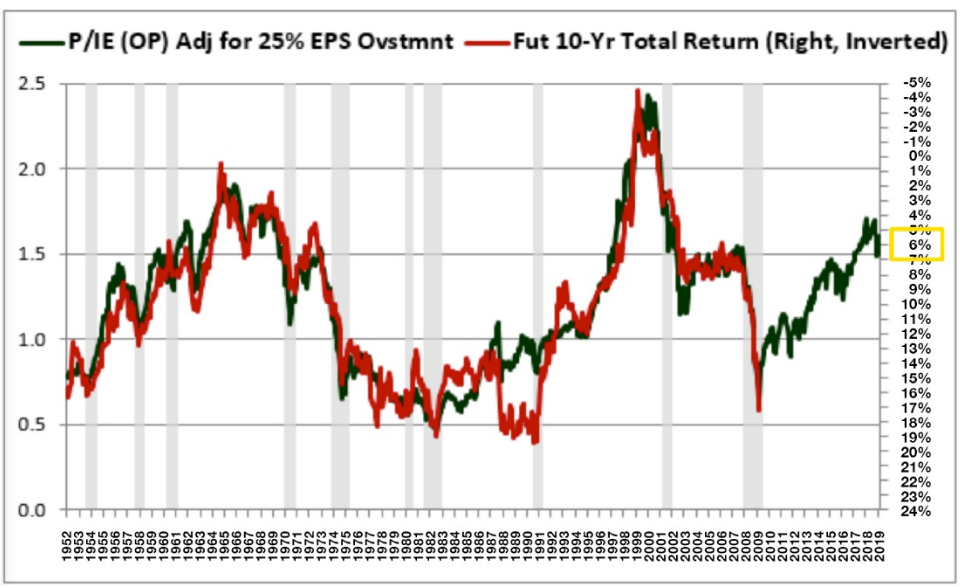


The metric's harmonic average increases to roughly 1.0, precisely what we would expect it to be in an efficient market.

Interestingly, the effect of the earnings reduction on the metric is not uniform across periods.[24] It benefits the current period on a relative basis:



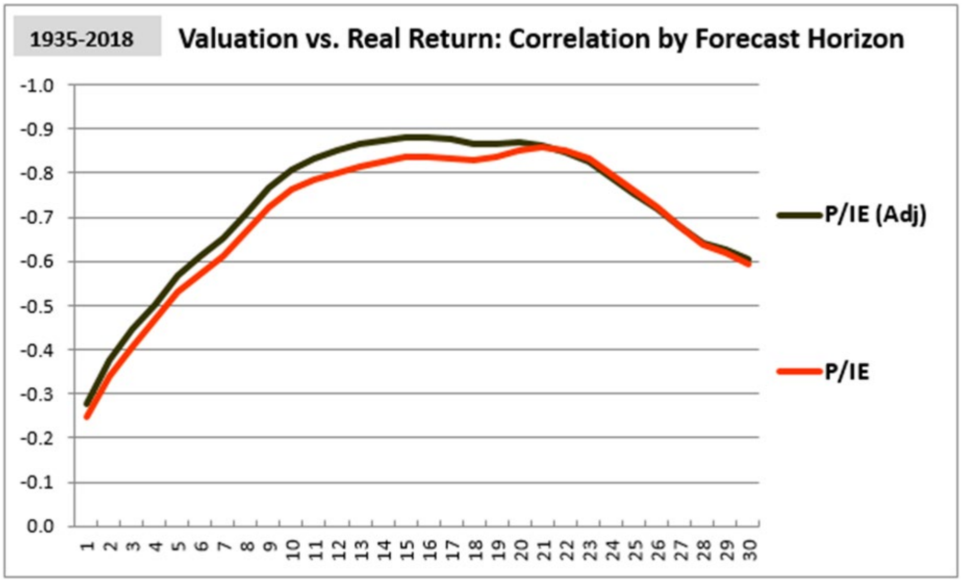
In the charts above, the adjustment was applied to reported GAAP earnings. If we shift to a measure that uses operating earnings, and apply the same adjustment, we get an <u>exceptionally</u> tight correlation with future nominal returns, 0.940. Projecting out the correlation, we end up with at an estimated future 10-year nominal return of just under 6%:



[24] The effect of the earnings reduction on the CAPE ratio, in contrast, is uniform.

Much of the correlation strength observed in the chart above is likely attributable to coincidence. Still, the fact that we can push the methodology to greater levels of predictive accuracy by making improvements that we know are needed under the overstated earnings hypothesis counts as a point in its favor.

The chart below shows real return correlations for the unadjusted P/IE ratio and the P/IE ratio adjusted for 25% earnings overstatement:



The downward adjustment to earnings produces a noticeable improvement across most of the tested horizons.

The P/IE Ratio in Individual Stocks

In 2018, OSAM's Travis Fairchild wrote a highly persuasive critique of the price-to-book (P/B) ratio as a factor for selecting individual stocks. He identified three ways in which book value understates corporate assets: (1) by understating the value of intangibles, (2) by understating the value of long-term assets such as real estate, and (3) by punishing companies that deploy large amounts of income into share buybacks. The impact of these distortions is confirmed in the P/B ratio's poor historical performance relative to other valuation measures.

As a factor for selecting individual stocks, can the P/IE ratio improve on the P/B ratio's problems? It's difficult to say, because most stocks don't have a large enough history to allow for a proper measurement of initial equity value. However, if we're willing to accept a possible reduction in performance, we can get around this problem by setting each company's initial equity value equal to an inflation-adjusted multiple of its earliest reported book value.

In the table below, we share the results produced by this approach. We compute the integrated equity of every U.S. Large Cap stock using an initial equity value equal to twice the initial reported book value, scaled to current prices. We then calculate the average excess one-year returns of stocks in the cheapest ("value") and most expensive ("glamour") P/IE ratio quintiles. We show those returns alongside equivalent returns for stocks in the cheapest and most expensive P/B ratio quintiles[25]:

U.S. LARGE (1973 - 2018)	Avg Excess TR	Hit / Miss				Statistics			
		Hit Rate	Avg Gain	Miss Rate	Avg Loss	eff N	SD	t	p
MKT: LARGE	0.00%	46.8%	22.2%	53.2%	-19.6%	17,813	28.9%	-	-
VALUE: P/IE	1.61%	49.8%	22.8%	50.2%	-19.4%	3,579	28.8%	3.33	0.002
VALUE: P/B	1.28%	49.2%	23.4%	50.8%	-20.2%	3,579	29.9%	2.65	0.012
GLAMOUR: P/B	-0.55%	45.2%	24.9%	54.8%	-21.6%	3,545	32.6%	-1.13	0.210
GLAMOUR: P/IE	-1.07%	44.2%	26.4%	55.8%	-22.9%	3,545	34.2%	-2.21	0.035

As you can see, the P/IE ratio beats the P/B ratio in identifying outperforming value stocks and underperforming glamour stocks. However, the effect isn't very large.

The P/IE ratio's inability to significantly outperform the P/B ratio shouldn't come as a surprise. The ratio doesn't fix the main problems that Travis identified in his piece. It does nothing to correct the understated value of intangibles such as R&D and brands, evidenced by the fact that it maintains the P/B ratio's strong underweighting to the R&D-intensive technology and healthcare sectors, as well as the P/B ratio's moderate underweighting to the brand-intensive consumer staples sector. These three sectors were the highest performing sectors in the market during the period:

U.S. LARGE (1973 - 2018)	Avg Excess TR	Average Sector Exposures								
		ENE	MAT	INDU	DISC	STPLS	HC	FIN	TECH	COM
MKT: LARGE	0.00%	8.2%	10.4%	17.3%	16.6%	10.3%	9.0%	16.6%	9.6%	2.1%
VALUE: P/IE	1.61%	11.8%	17.9%	20.4%	12.9%	4.9%	2.4%	21.9%	3.8%	4.0%
VALUE: P/B	1.28%	12.4%	14.5%	15.1%	11.6%	3.5%	2.1%	32.7%	4.7%	3.4%
GLAMOUR: P/B	-0.55%	4.5%	4.6%	12.5%	21.7%	11.8%	20.0%	4.8%	19.2%	1.0%
GLAMOUR: P/IE	-1.07%	3.8%	5.8%	14.2%	20.4%	18.3%	18.8%	3.6%	13.9%	1.1%

As for the understatement of long-term asset values, the P/IE ratio helps address the inflationary aspect of the understatement, but it doesn't help with any of the other aspects that Travis discussed in his piece. Those other aspects are likely to introduce greater distortions into the selection process because they aren't spread out across the index as uniformly as the effects of inflation are.

[25] To allow sufficient time for retained earnings to accumulate in the integrated equity calculation, we limit the analysis to companies that have data for both metrics going back at least 10 years.

To its credit, the P/IE ratio does address one of the distortions that Travis highlighted, the distortion associated with share buybacks. But that distortion may not be as pervasive in its contribution to the P/B ratio's woes as the other two distortions. At any rate, the P/IE ratio does offer some improvement over the P/B ratio. Improved accounting of share buybacks is likely to be part of the reason for that improvement.

The P/IE ratio's mediocre performance in this context suggests that it's not as accurate at measuring the value of individual stocks as it is at measuring the value of the overall stock market.[26] It's not alone in that respect—the CAPE ratio is also significantly less accurate when used to measure the value of individual stocks. CAPE enthusiasts are often surprised to see how poorly the CAPE ratio performs in the individual stock space, particularly in comparison with metrics such as the simple ttm P/E ratio that it easily beats in the overall market.

To illustrate the point, the table below shows the average excess returns of the cheapest quintiles of the Large Cap Stock Universe measured using the CAPE ratio and the simple ttm P/E ratio from 1973 to 2018[27]:

U.S. LARGE (1973 - 2018)	Avg Excess TR	Hit / Miss				Statistics			
		Hit Rate	Avg Gain	Miss Rate	Avg Loss	eff N	SD	t	p
MKT: LARGE	0.00%	46.8%	20.0%	53.2%	-17.6%	17,813	26.0%	-	-
VALUE: CAPE	1.51%	49.8%	23.9%	50.2%	-20.7%	3,579	30.5%	3.46	0.001
VALUE: ttm P/E	2.31%	51.0%	22.5%	49.0%	-18.6%	3,579	28.0%	5.30	0.000

As you can see, the cheapest CAPE ratio quintile generates lower average returns than the cheapest ttm P/E ratio quintile. Surprisingly, the cyclical averaging, which is the CAPE's primary selling point, makes its performance worse.

To understand why valuation metrics like the CAPE ratio, the P/IE ratio and the P/B ratio tend to produce lower-than-expected returns when used to select individual value stocks, we need to recall the mechanism through which the value factor works. As Chris Meredith, Patrick O'Shaughnessy and I explained in Factors from Scratch and Alpha Within Factors, the value factor works through a re-rating process. The process begins when the market develops an expectation that the fundamentals of certain companies will weaken going forward. It therefore prices those companies at a discount relative to their current fundamentals, turning them into "value stocks." On average, the fundamentals of the value stocks actually do weaken, but they don't weaken by as much as expected, and they eventually recover. The initial discount applied to them ends up being too large, forcing a subsequent re-rating that delivers excess returns to those who buy in at the beginning of the process.

Of course, not all value stocks follow this trajectory. Some value stocks turn out to be value traps whose fundamentals continue to deteriorate long after purchase, with no eventual recovery. The effectiveness of a value metric is determined, in part, by how well it can distinguish these value traps from the desirable value

[26] Part of the reason for the difference lies in the different ways that inflation affects comparisons. Broad market valuation metrics attempt to compare a market's current valuation to its prior valuations. Inflation matters significantly to those comparisons because rates of inflation are different across different periods of time. The effect of Inflation on comparisons between stocks in the same period, however, is much less pronounced, because the stocks all live under the same inflationary conditions. The relative benefit of using an inflation-adjusted measure such as the P/IE ratio to choose between them isn't as large because the effect of inflation on them is more uniform.

[27] The sample is limited to companies that have trading histories of at least ten years, the minimum amount of time needed to calculate a CAPE.

stocks that are going to recover and deliver attractive returns. The results shown in the table suggest that the CAPE ratio, the P/IE ratio and the P/B ratio are not as effective as the ttm P/E ratio in making that distinction. This shouldn't come as a surprise—the fact that they measure "value" using fundamentals from the distant past rather than the recent past makes them more likely to select structurally unprofitable businesses that are in long-term decline.

To illustrate the point with a familiar example, suppose that a brick-and-mortar movie rental company enters into long-term decline in the presence of heavy competition from a disruptive internet-based competitor. As the decline plays out and the stock price of the company falls, how will its CAPE, its P/IE ratio and its P/B ratio respond?

The company's CAPE ratio is going to fall significantly, because its new lower share price will get divided by its average earnings over the last 10 years, which will be much stronger than its recent earnings. Its P/IE and P/B ratios will fall significantly because its new lower share price will get divided by integrated equity and book value terms that will be stuck at historical investment cost (unless and until major writedowns occur). The market will recognize that the equity of the company is impaired, unable to generate the rates of return that it used to generate. It will therefore price the equity at a large discount to par. All three of the measures will flag the company as "cheap," drawing it into the portfolio and riding it down on its journey to zero.

The ttm P/E ratio is different from these measures in that it tracks a quantity that's sensitive to recent fundamental performance. It focuses on the trailing-twelve-month earnings, which would not be strong for a given company if the company were in serious decline, and which will soon come to reflect any such decline that might begin. The distressed company in our example will have recent earnings that are deeply negative, eliminating any possibility that the ttm P/E ratio might mistakenly identify it as a worthwhile value stock.

The process of selecting value stocks involves a trade-off. On the one hand, we don't want a hyper-sensitive, ultra-short-term metric that will rule out companies at the slightest sign of fundamental weakness. A metric of that type will get caught up in noise and will be unable to identify attractively priced companies whose challenges are only temporary. On the other hand, we don't want a blind, sluggish, unresponsive metric that measures value based on what a company was doing 10, 20 or 30 years ago. A metric of that type will end up drawing in every soon-to-be-bankrupt value trap that exists in the market, because every such company is going to look cheap relative to what it was earning way back then. What we want is a valuation metric that can optimally navigate this tradeoff. The evidence suggests that the ttm P/E ratio does a better job of navigating it than the other metrics in the table.

When we analyze valuation at the broad market level, we're engaged in a completely different exercise from the exercise above. We're comparing the market to its own history, seeking to infer its likely future returns from the returns that it produced when it traded at similar valuations in the past. In this effort, we don't have to worry about value traps. All of the good stocks in the market and all of the bad stocks are being aggregated together into a single index, where they cancel out and form a long-term fundamental trend. We want metrics that can accurately represent that trend and that can accurately depict where prices are relative to it. The ttm P/E ratio is poorly equipped for this task because it's highly sensitive to short-term cyclical fluctuations. The P/IE ratio, the P/B ratio, and the CAPE ratio are better equipped because they neutralize those fluctuations, either by ignoring them altogether, or by averaging them out.

Appendix A

AN INTUITIVE EXAMPLE THAT CLARIFIES IMPORTANT CLAIMS MADE IN THE PIECE.

RESEARCH BY JESSE LIVERMORE: JUNE 2019

In this Appendix, I'm going to explain and defend important claims made in the piece through the use of an intuitive example. The claims are listed in order below:

- Claim #1: Dividends and Buybacks are Functionally Equivalent as Pre-Tax Sources of Return
- Claim #2: To Sustainably Grow Real EPS Over Time, Corporations Needs to Invest Out of Retained Earnings
- Claim #3: The Corporate Sector's Average Earnings Yield is a Proxy for its Average Cost of Equity
- Claim #4: In a Historical Cost Framework, Reported ROEs will Rise, but they won't Normally Go to Infinity
- Claim #5: Depreciation is a Significant Source of Potential Error in Earnings Accounting

Example: ABC Capital

Suppose that a new company, called ABC Capital, is formed to invest in real estate. The company sells 500,000 shares at $100 per share, for a total of $50MM in initial capital raised. The company then borrows $150MM from creditors at a 5% interest rate. It uses the total proceeds, $200MM, to purchase land and fund the construction of a state-of-the-art 1,000-unit luxury apartment tower. Of this total cost, $20MM is apportioned to the cost of the land and $180MM is apportioned to the cost of constructing the tower, to include costs associated with design, regulatory approval, materials, equipment, construction and amenity purchases.

The table below shows the company's balance sheet after the tower investment:

ABC Capital ($)	Total	Per Share (500,000 Shares O/S)
Assets	200,000,000	400
Land	20,000,000	40
Construction	180,000,000	360
Liabilities	150,000,000	300
Debt @ 5%	150,000,000	300
Equity	50,000,000	100

The tower consists of 1,000 individual apartment units, so the effective cost of each unit is $200K. The company charges $3,000 per month in rent for each unit and operates at 95% average occupancy.

The table below shows the company's annual revenues and expenses on a per unit, total and per share basis:

ABC Capital ($)	Per Unit	Total	Per Share (500,000 Shares O/S)
Revenues	34,200	34,200,000	68.40
Expenses	30,450	30,450,000	60.90
Depreciation	5,000	5,000,000	10.00
Operating	17,950	17,950,000	35.90
Interest	7,500	7,500,000	15.00
Pre-Tax Income	3,750	3,750,000	7.50
Taxes (20% rate)	750	750,000	1.50
Net Income	3,000	3,000,000	6.00

The company's $20MM land investment is treated as a non-depreciating asset. The $180MM apportioned to the construction of the tower is depreciated down to a scrap value of $30MM on a straight-line basis using a 30-year useful life. This treatment reflects the assumption that if the company fails to make continuing investments in the tower, it will become uninhabitable, undesirable, or otherwise uncompetitive as a living destination in 30 years. The expected sale value of its remains at that time will be $30MM.

The total annual depreciation charge for the tower comes out to $5MM per year (= ($180MM - $30MM) / 30). This charge is meant to represent the expected cost of extending the tower's useful life by one year--the cost of upgrading and improving the tower's foundations, structures, amenities, facilities, interiors, systems, appliances, furniture and so on as they deteriorate and become obsolete over time. The company has to pay that cost in order to preserve the quality of the product that the tower delivers to its customers, which is the basis for its earnings power.

The tower's annual operating expense comes out to $17.95MM. This number covers all expenses that do not appreciably extend the tower's 30-year estimated useful life, to include management expenses, selling expenses, advertising expenses, cleaning expenses, utility expenses, expenses associated with the replacement of consumable items (e.g., air filters, lighting, etc.), ordinary and routine repair expenses, security expenses, recreational expenses, and so on.

After subtracting depreciation, operating expenses, and the interest expense on the debt (5% of $150MM = $7.5MM), the company earns pre-tax income of $3.75MM. The company is not classified as a REIT and pays effective federal and state corporate taxes at a rate of 20%, $750K per year. That leaves $3MM remaining in net income, $6 per share.

For the purpose of the example, let's assume that there's no inflation or cyclicality in the industry or broad economy in which ABC Capital operates, and that in each subsequent year out to infinity, the company will continue to earn exactly $3MM in net income. Let's assume further that the market is perfectly efficient, and that the company will always trade at a price equal to the value of its equity, also referred to as its book value, $100 per share. You buy 1,000 shares of the company, for a total personal investment of $100,000 and total annual earnings of $6,000. Those earnings will constitute the fundamental return on your investment.

Claim #1: Dividends and Buybacks are Functionally Equivalent as Pre-Tax Sources of Return

If the company's earnings are paid out to you as a dividend, you will receive $6 per share in cash each year. That $6 will represent a 6% return on the prior year's investment. But the $6 in cash is not going to continue to earn 6%. Once out of the fund, it will earn the cash rate. The table below shows what the trajectory of your investment will be under an assumed cash rate of 0%:

Year	2019	2020	2021	...	3019
Price Per Share = Book Value ($)	100.00	100.00	100.00	...	100.00
Dividend Per Share ($)	6.00	6.00	6.00	...	6.00
# Shares Owned	1,000	1,000	1,000	...	1,000
Amount Invested in Fund	100,000	100,000	100,000	...	100,000
Total Dividends Accumulated	-	6,000	12,000	...	6,000,000
Investment Value ($)	100,000	106,000	112,000	...	6,100,000
Annualized Return	-	6.00%	5.83%	...	0.41%

As you can see in the table, the overall investment will eventually turn into a large pool of accumulated cash dividends earning 0% and a relatively tiny stake in the fund earning 6%. The annualized return on the investment, measured from the 2019 start date, will therefore converge on the 0% return of the cash dividend pool.

For the overall investment to earn a 6% annualized return over the long-term, you will have to get each dividend back into the equity of the company. You can do that by reinvesting the dividends, using them to buy shares from other shareholders in the market.

If we assume that you reinvest your dividends at the $100 market price, the trajectory of your investment will play out as follows:

Year	2019	2020	2021	...	3019
Price Per Share = Book Value ($)	100.00	100.00	100.00	...	100.00
Dividend Per Share ($)	6.00	6.00	6.00	...	6.00
# Shares Purchased	-	60	64	...	1.14E+27
# Shares Owned	1,000	1,060	1,124	...	2.02E+28
Investment Value ($)	100,000	106,000	112,360	...	2.02E+30
Annualized Return	-	6.00%	6.00%	...	6.00%

In theory, your total return will hold steady at 6% per year out to infinity. In practice, the reinvestment process will push you up against a supply wall. Eventually, there won't be any other shares for you to buy—<u>you</u> will own the entire company. At that point, the only way for you to continue to earn the annualized 6% will be for the company to stop paying the dividend to you and to instead invest it elsewhere at that rate.

In the example, you earn a 6% return because you use the dividends that you receive to purchase additional shares from shareholders that want to sell. Under current U.S. law, you realize a tax liability in this process—the dividends are immediately taxable at 15% or 20%, depending on your income level. If the company is optimally managed, it will prevent you from having to incur that liability by withholding the dividends from you and using the associated money to buy the shares for you, through the implementation of a share buyback program.

The table below shows what the trajectory of your investment will be if the company uses all of its earnings to buy back shares from shareholders that want to sell. The money used to repurchase shares will get removed from the company's equity via the treasury stock account, which is a contra account to the equity. At the same time, the company's outstanding share count will shrink, driving up all of its per share values, to include its price per share, assuming that the market is efficient:

Year	2019	2020	2021	...	3019
Assets	200,000,000	200,000,000	200,000,000	...	200,000,000
Land	20,000,000	20,000,000	20,000,000	...	20,000,000
Construction	180,000,000	180,000,000	180,000,000	...	180,000,000
Liabilities	150,000,000	150,000,000	150,000,000	...	150,000,000
Debt @ 5%	150,000,000	150,000,000	150,000,000	...	150,000,000
Equity	50,000,000	50,000,000	50,000,000	...	50,000,000
Paid-In Capital	50,000,000	50,000,000	50,000,000	...	50,000,000
Retained Earnings	0	3,000,000	6,000,000	...	3.00E+09
Treasury Stock	0	-3,000,000	-6,000,000	...	-3.00E+09
Shares Outstanding	500,000	471,698	445,000	...	0.00
Price Per Share = Book Value	100.00	106.00	112.36	...	2.02E+27
Earnings	3,000,000	3,000,000	3,000,000	...	3,000,000
Earnings Per Share	6.00	6.36	6.74	...	1.21E+26
# Shares Owned	1,000	1,000	1,000	...	1,000
Investment Value ($)	100,000	106,000	112,360	...	2.02E+30
Annualized Return	-	6.00%	6.00%	...	6.00%

To form the table, we assume that the shares continue to trade exactly at book value, and that their prices rise after each fractional purchase to reflect the associated increase in book value caused by the purchase. Under this assumption, your overall return will end up being exactly the same as in the reinvested dividend case. Note that the 3019 number is purely theoretical—you will become the sole shareholder of the company long before that date arrives, at which point share buybacks will no longer be possible.

In the reinvested dividend case, the per share values of the company stayed constant, and your share count increased by 6% per year. In the share buyback case, the situation is reversed: the per share values of the company increase by 6% per year, and your share count stays constant.

ABC Capital	Your # of Shares	Per Share Values
Reinvested Dividends	Increase by 6% per year	Constant
Share Buybacks	Constant	Increase by 6% per year

Either way, you end up in the same place. The reason you end up in the same place is that the action itself—the action of putting cash earnings back into equity by purchasing additional shares from existing shareholders—is the same. Whether this action takes place inside the company, at the direction of management, or outside the company, at your direction, only matters to one thing: the taxes that you end up paying.

Claim #2: To Sustainably Grow Real EPS Over Time, Corporations Needs to Invest Out of Retained Earnings

On a cash basis, the ABC Company earns $16 per share each year. Of that amount, $10 is charged to depreciation, leaving $6 leftover as earnings. If the $10 depreciation expense is correctly stated, then, absent changes in the market, the company should be able to maintain $6 per share in earnings indefinitely into the future, even if it pays the entirety of those earnings out to shareholders as dividends. The entire point of calling the $6 "earnings" is to indicate that the company has gained something relative to its prior position. If the gain is real, the company should be able to distribute it to shareholders without suffering a decline relative to its prior position.

If a portion of the $6 has to be "invested" back into the apartment tower to preserve the company's current output, then the company's earnings have been overstated. The company's true earnings power is not $6—it's $6 minus the amount of additional required "investment." Similarly, if the company could sustainably maintain its current output capacity while distributing more than the $6 per share that it reports in earnings, then its earnings have been understated. Its true earnings power is $6 plus the extra distributable amount.

In the case of ABC Company, let's assume that the company's depreciation expense is accurately stated at $10. Let's assume further that the company makes no investments out of retained earnings, choosing to instead pay 100% of its earnings to shareholders as dividends. Under these assumptions, will it be possible for the company to grow its earnings over time?

Generally speaking, the answer is no. To grow its earnings, the company needs to grow its revenues. To grow its revenues, it needs to rent out more apartments. Since it doesn't have any more apartments to rent out, it needs to devote a portion of its earnings to the construction or acquisition of additional apartments. It can't do that if it's paying out the entirety of its earnings as dividends.

To be fair, this claim requires qualification. There are a number of possible paths through which the company can grow its earnings in the absence of earnings reinvestment. But these paths are trivial and cannot be utilized by the corporate sector as a whole, at least not over the long run. Let's examine each path individually:

- Equity Issuance: Trivially, the company can grow its earnings by raising new equity capital, using the proceeds to invest in new towers. Technically, this move will allow the company to keep paying out all of its earnings as dividends. But if it continues to trade at its book value, and if it invests the new equity capital at the same ROE that its existing equity is generating, then the earnings boost that it gets from the new towers will be exactly offset by the share count increase that it suffers as a result of the equity issuance, leaving its earnings per share—the metric that shareholders actually care about—unchanged.
- Price Increases: The company can grow its earnings by raising its prices. Instead of charging $3,000 a month for rent, for example, it can charge $4,000. If the demand for its apartment offerings is sufficiently strong, then it will be able to maintain high occupancy at this higher price point, generating higher revenue and therefore higher earnings. But this mode of earnings growth is only available to individual partitions of the economy—individual companies, industries, and so on. It's not available to the corporate sector as a whole because if the corporate sector raises its prices, the higher prices will lead to a higher consumer price index (CPI), which is a weighted average of all prices in the economy. The CPI increase will offset the associated growth in the corporate sector's earnings, yielding no real growth.[1]
- Expense Reduction: The company can experience growth in its earnings through a reduction in its wage, interest and tax expenses. But there's a limit to how low its expenses can go. They can't go below zero, for example. Ultimately, the corporate sector's expenses represent income for other sectors of the economy. If those expenses are substantially reduced, the other sectors will be deprived of the income needed to purchase the corporate sector's output. The result will be weakness in revenues, offsetting the benefit from lower expenses.
- Increased Leverage: The company can grow its earnings by increasing its leverage. If the interest rate charged on its debt is lower than the rate of return that it generates on its investments before interest and taxes, then it can boost its earnings by taking on additional debt. But there's a limit to the amount of additional debt that it can safely and sustainably take on. Credit investors will enforce that limit through the interest rates that they charge.
- Improved Capacity Utilization: If a company has idle capacity, it can experience earnings growth through the increased utilization of that capacity over time. Suppose, for example, that the apartment tower has a large number of rooms to rent out because it was recently constructed and is not yet well known in the community. As word gets out about the quality of the living experience that it's offering, its idle capacity will fill up and its sales and earnings will grow. This growth will not require any further investment. The point is trivial, however, because the idle capacity that the company will be selling to achieve the growth will have been the result of prior investments that it made. Those investments had not yet been utilized, and so the growth had not yet shown up.[2]

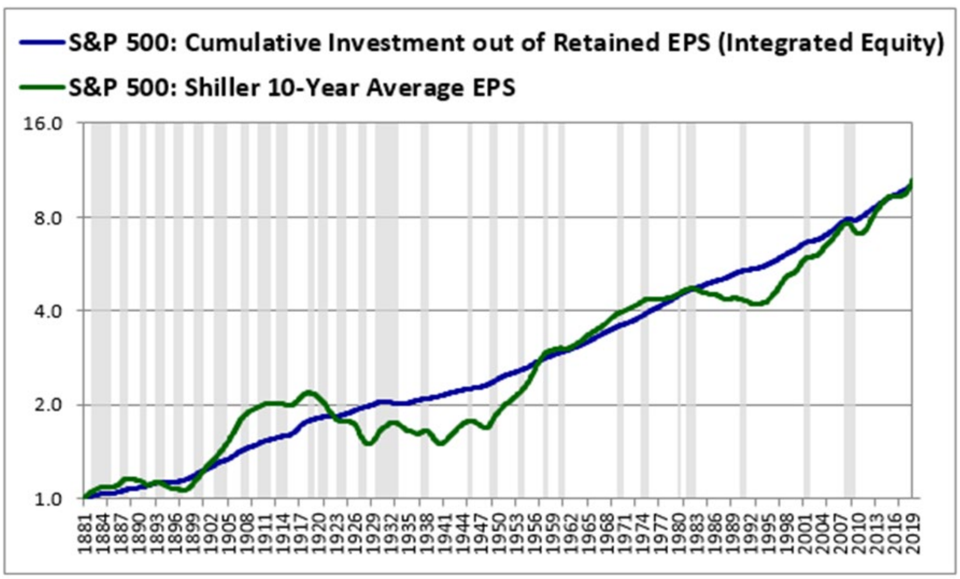
[1] To be fair, if the corporate sector manages to increase its prices by more than its expenses, then it will experience earnings growth in excess of inflation. But in this process, it will simply be taking a share of real output away from the other sectors of the economy, an approach that is unsustainable in the long run.

[2] Even in rare cases where a company seems to have an infinite and apparently free supply of a product to offer–think Facebook and its social network–the existence of that supply will have been the result of a prior investment. In Facebook's case, the prior investment was the build-out of the infrastructure for the social network. Given the "winner take all" nature of social network businesses, the investment became hyper-profitable, allowing the company to grow its earnings years and decades into the future, without requiring large, costly additional investments. Obviously, the level of profitability that Facebook managed to generate on its initial investment is the exception, not the rule.

- Copying Innovation: Innovation comes at a cost—the cost of research and development. After someone has paid that cost and developed an innovation, others can often copy it, sometimes free of charge. This does not represent an investment-free path to growth, however, because the copying process requires outlays. To convert a copied idea into actual output, money has to be invested into it.

For the overall corporate sector, none of these options represent sustainable, investment-free paths to real earnings per share (EPS) growth. Even if one of the options did represent such a path, a barrier would be needed to prevent everyone from taking that path, driving profitability down through competition. In a capitalist economy, the barrier that prevents everyone from partaking in available growth opportunities is the fact that they require you to make an investment, which comes at the cost of a deferral of your consumption, a reduction in your liquidity, and the risk of a permanent loss of your capital.

The relationship between real growth per share and retained earnings investment is corroborated in the historical data. Over the last 148 years, the U.S. corporate sector's real EPS growth has tracked very closely with the total amount that it has invested out of retained earnings. On a long-term basis, there hasn't been any "extra" real growth from equity issuance, price increases, increased leverage, expense reduction, improved capacity utilization, or the copying of innovation:



Claim #3: The Corporate Sector's Average Earnings Yield is a Proxy for its Average Cost of Equity

We can define "fundamental return" as the return generated from fundamentals, i.e., growth (in EPS) and income (dividends). Let's suppose that the corporate sector uses all of its earnings over a given period to buy back its own shares at market prices (and cancel them). What will its average fundamental return over the period be?

The mathematical answer is that its average fundamental return will be whatever its average earnings yield over the period was. That's because each fractional repurchase that it makes will cause its share count to drop and its EPS to rise by the percentage of its price that the repurchase represents. Since all of its earnings are being used to repurchase shares, this percentage will just equal its earnings divided by its price, i.e., its earnings yield. Its EPS will end up growing at the rate of its earnings yield, and that growth will constitute its fundamental return.

To illustrate the point using actual numbers, suppose that the corporate sector trades at a steady 6% earnings yield, which means that it earns 6% of its price each year. If it takes all of that money and buys back shares, it will increase its EPS each year by the same percentage, 6%. Its EPS will therefore grow at a 6% rate. Since it won't be paying any dividends, its dividend return will be 0%. Similarly, since it won't be making any investments out of retained EPS, it won't (sustainably) get any extra return from growth. It will therefore end up with an average fundamental return of 6%, equal to its 6% average earnings yield.

To understand why we focus on the average earnings yield in this context, suppose that we're working with a collection of time periods of equal size. If we raise the corporate sector's price in a given period, so that its earnings yield drops to 4%, and then we lower its price in the next period, so that its earnings yield rises to 10%, and then we raise its price in the period after that, so that its earnings yield falls back down to 6%, and so on, deploying 100% of its earnings into share buybacks in each period, each purchase will generate an annualized rate of return equal to the average earnings yield in that period. As we buy back shares across all the periods, we're going to generate an overall return equal to the geometric average of all the different annualized rates of return, i.e., the geometric average of all the different earnings yields.

Now, the term "cost of equity" is hard to pin down and can be defined in a number of different ways. We're going to define it in a very specific way. A company's cost of equity is the current cost to the company of issuing new shares. This cost assumes that the company's equity will forever remain exactly where it currently is—that it won't experience any future investment-related increases.

To complete the argument, if the average earnings yield of the overall corporate sector equals the average fundamental return that it earns when it uses all of its earnings to buy back shares (and cancel them), then, by symmetry, the corporate sector's average earnings yield must also equal the average cost that it incurs when it does the opposite: issues new shares. Per our definition, that cost is the corporate sector's cost of equity. We can therefore equate the corporate sector's average earnings yield with its average cost of equity over time.

Claim #4: In a Historical Cost Framework, Reported ROEs will Rise, but they won't Normally Go to Infinity

In our example, we assumed that ABC Capital operated in an economy with zero inflation. To switch things up, let's now assume that the company operates in an economy with positive inflation. If the company is an average company, then its nominal rent prices will tend to rise over time at the rate of inflation. The increases in its rent prices will allow its nominal earnings to grow in the absence of investment. But they won't lead to proportionate growth in the company's reported book value, because book values are reported at historical cost. The ratio of the company's nominal earnings to its reported book value, otherwise known as its return on equity (ROE), will therefore increase over time.

How high will the company's ROE go? Will it go to infinity? Surprisingly, the answer depends on the company's dividend payout ratio. If the company reinvests any portion of its retained earnings, then its reported ROE will eventually stop increasing, equilibrating at some artificially elevated value. But if the company does not reinvest any portion of its retained earnings—that is, if it implements a payout ratio of 100%—then its reported ROE will rise forever, all the way up to infinity. I lay out the mathematics behind this result in the text below.

In the absence of adjustments for inflation, the ROE of a company will rise and will reach equilibrium when its rate of nominal earnings (E) growth equals its rate of nominal book value (BV) growth. At that point, the numerator and the denominator in the expression of ROE will be growing at the same rate, allowing the ROE to stay constant. So, as an equilibrium ROE condition, we have:

(1) Rate of E Growth = Rate of BV Growth

Now, the rate of BV growth is just:

(2) Rate of BV Growth = (BV + ΔBV) / BV

where ΔBV is the change in book value. But the change in book value is simply retained earnings. We can therefore write ΔBV as:

(3) ΔBV = Retained Earnings = Earnings * (1 - Payout Ratio)

Inserting (3) into (2) we get:

(4) Rate of BV Growth = (BV + Earnings * (1 - Payout Ratio)) / BV

Mathematically, BV is just (Earnings / ROE). Substituting that fact into (4), we get:

(5) Rate of BV Growth = (Earnings / ROE + Earnings * (1 - Payout Ratio)) / (Earnings / ROE)

Dividing the numerator by (Earnings / ROE), we get:

(6) Rate of BV Growth = 1 + ROE * (1 - Payout Ratio))

If G is the annualized percentage change in nominal earnings, then the nominal earnings growth rate expressed in a form consistent with (2) is:

(7) Rate of E Growth = 1 + G

Combining (1), (6) and (7), and solving for ROE, we get:

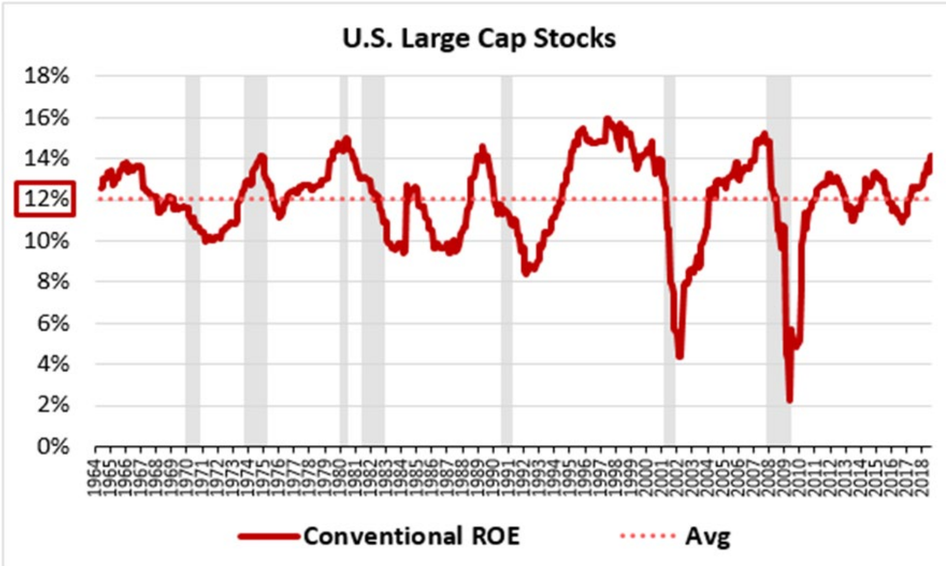
(8) ROE = G / (1 - Payout Ratio)

This equation specifies the equilibrium value that ROE will rise to in an inflation-unadjusted historical cost accounting framework.

To check the equation, we can see if it yields a result that fits with the actual reported ROE of U.S. Large Cap Stocks. From 1964 to 2018, the annual percentage change in nominal earnings for U.S. Large Cap Stocks, which is the variable G in the equation, was 6.29% per year. The average dividend payout ratio was 51.49%. Plugging these numbers into the equation we get:

(9) ROE = 6.29% / (1 - 51.49%) = 12.96%

The actual reported ROE for the period was 12.02%—on par with the number predicted by the equation:



To answer the earlier question, the equation for equilibrium ROE given in (8) tells us that the ROE will only go to infinity if the dividend payout ratio is 100%. This conclusion makes intuitive sense. If a company pays out all of its earnings as dividends, it won't have any retained earnings, and therefore its reported book value won't ever grow. With its earnings growing on pace with inflation, and its reported book value stuck at a constant, unchanging value, the ratio between its earnings and its reported book value, i.e., its ROE, will increase forever.

Now, if a company does invest out of retained earnings, its reported book value will tend to grow over time. The rate of growth of will be determined by the amount of earnings that the company retains relative to its reported book value. As its nominal earnings grow with inflation over time, this amount will get larger, causing its reported book value to grow at a faster pace. Eventually, the rate of growth of its reported book value will come to equal the rate of growth of its nominal earnings, at which point the equilibrium specified in (8) will have been reached. The ROE will then stop increasing.

Claim #5: Depreciation is a Significant Source of Error in Earnings Accounting

As the tower ages over time, it's going to lose value as a place to live. This "loss" will represent a real loss to the company. From an accounting perspective, it gets captured in the company's $5MM annual depreciation expense, a non-cash expense that reduces the company's earnings.

Because the company is incurring a $5MM annual depreciation charge, the money that it spends on the upkeep of the tower does not get deducted from revenue as an expense. Instead, the company "capitalizes" it, i.e., adds it to the balance sheet as a new investment. The justification for capitalizing it is that the loss associated with the tower's depreciation has already been counted in the $5MM charge. To treat the cost of reversing that loss as an additional expense would be to count the underlying loss twice.

Depreciation is an extremely important expense in the calculation of net income. This is true not just for apartments, but for all corporate assets. Historically, the average annual depreciation expense incurred by large cap stocks has been around 5% of sales. That's roughly the same percentage as net income itself, which has also averaged out to around 5% of sales. On average, then, each percentage change in the depreciation charge translates into a similar percentage change in actual earnings.

Given the importance of depreciation as an expense in the corporate sector's cost structure, it's crucial that the expense be represented correctly. Unfortunately, the way in which it's represented under prevailing accounting rules introduces a significant risk of error. The expense doesn't actually get measured empirically, but is instead estimated using various accounting thumbrules: a 5-year useful life for this type of asset, a 10-year useful life for that type of asset, and so on. These thumbrules result from industry conventions rather than from rigorous examinations of the assets themselves. It's therefore easy for them to turn out to be wrong.

In the tower example, we arrived at the $5MM number by assigning a 30-year useful life to the tower. How do we know that 30 years is the right number to use? Why not 20 years? Why not 40 years? The truth is that we could have used either of these numbers, or some other number. Our basis for doing so would have been just as strong as our basis for using the number 30.

If we had used 20 years instead of 30 years, our annual depreciation expense would have come out to $7.5MM rather than $5MM. Our pre-tax earnings would have fallen from $3.75MM to $1.25MM, a 66% drop, all from the arbitrary choice of a different thumbrule.

To be fair, depreciation is a difficult expense to accurately capture in real estate, so the example that we've offered here represents a worst-case example. But the underlying problem extends to all industries. There's no reliable way to empirically measure deprecation, no reliable way to get immediate feedback when it's measured incorrectly, and therefore no reliable way to detect and correct earnings misstatements associated with it. This is a problem because corporations have a strong incentive to understate depreciation where they can. In doing so, they make their earnings performances look stronger. The market then rewards them with higher stock prices.

In the case of real estate, the prevalent accounting thumbrules probably overstate depreciation. Since real estate is an important component of the corporate sector's asset base, it's plausible to think (hope?) that this overstatement would offset the corporate sector's natural incentive to understate depreciation in other contexts, leaving us with an earnings measure that's generally accurate in the aggregate.

Unfortunately, there's a bigger problem to worry about with respect to the way depreciation is calculated: the problem of inflation. Recall that U.S. GAAP requires companies to calculate depreciation using the historical costs of their assets as the starting basis. As prices in the economy inflate over time, these costs become understated in current price terms. The actual costs of preserving the assets and extending their useful lives ends up rising, but the depreciation expenses that are meant to capture those costs stay constant, since they're tied to the initial values of the assets, values that cannot be upwardly adjusted in GAAP. Consequently, the depreciation charges end up being systematically understated in the presence of inflation, leading to the systematic overstatement of earnings. We discuss this overstatement in more detail in Section 4 and Appendix F.

Appendix B

CALCULATING THE RETURN ON DIFFERENTIAL EQUITY

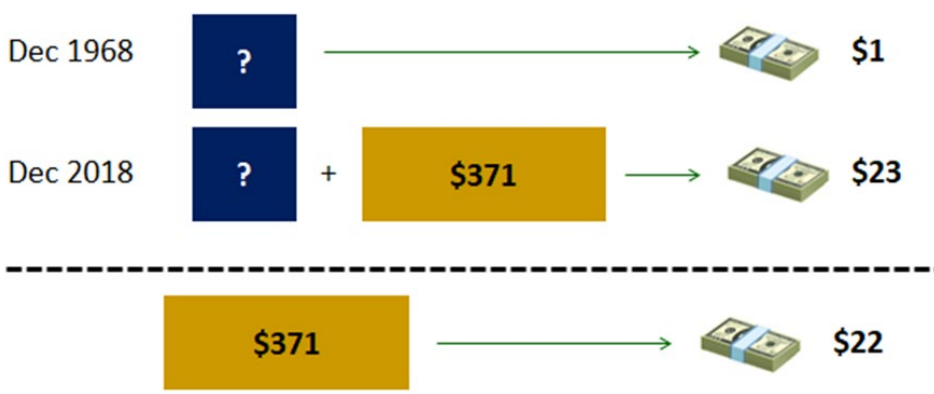
RESEARCH BY JESSE LIVERMORE: JUNE 2019

In this appendix, I'm going to introduce a technique for measuring the incremental ROE of a company or index over a given period. This technique will be used in Appendix B to solve the initial equity problem.

To frame the technique, let's imagine investing as an activity in which we use cash to build machines that spit out cash. Suppose that I start out in December 1968 already owning a cash machine that spits out $1 per year. We don't know how much I paid to build or acquire this machine, so we don't know what the machine's ROE is. But we know what it spits out each year—$1.

Suppose further that I take 100% of the cash proceeds of this machine and use them to build new machines that spit out cash. In the same way, I reinvest the proceeds of those new machines, building even more new machines, and so on in a compounding process. At the end of the process, I end up with a collection of machines—the original machine plus the new ones that I built—that are now producing a total of $23 per share.

Let's assume that the total amount of money that I reinvested into the new machines over the period was $371 dollars. The question that we want to answer is, given these numbers, what is the implied ROE on the new machines?



We can solve for the answer using simple math. We know that the original machine produces $1 per year. We also know that the final collection of machines, which includes the original machine and all the new machines, produces $23 per year. It follows that the new machines produce the difference, $22 per year. We know how much those machines cost—$371 in total, which is the full amount that was reinvested over the period. It follows that the ROE on the new machines—the cashflow stream they spit out divided the amount of cash that went into building them—is $22 /$371, or roughly 6%.

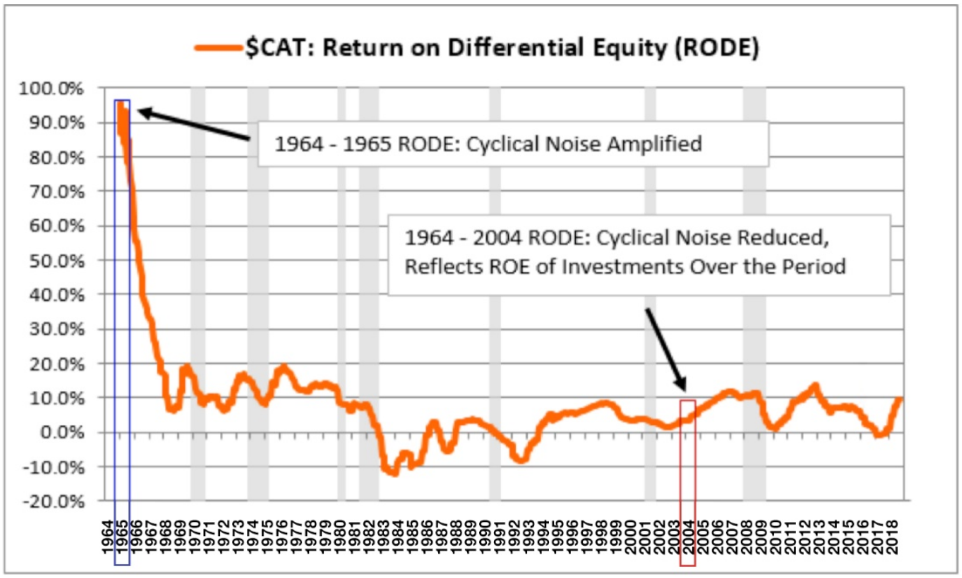
I'm going to refer to this 6% value as the return on differential equity, or "RODE". The RODE over a specified period is given by the following equation. Note that all numbers must be inflation-adjusted:

- RODE = Change in EPS / Sum of Retained EPS

When we calculate the RODE, we're taking the earnings added by an interim investment process—i.e., the difference between the earnings at the beginning of the process and the end of the process—and dividing those earnings by the total amount of money that went into the process. In this way, we're calculating the return on the differential equity that was added by the process, hence the name.

Crucially, to calculate the RODE for an investment process, we don't need to know the equity or book value at the beginning or the end of the process. All we need to know is the intervening change in equity that occurred during the process, i.e., the total intervening investment that took place within it.

The following chart shows $CAT's RODE for periods starting in 1964 and ending on subsequent dates ranging from 1965 through 2018:



Notice that $CAT's RODE for the one-year period from 1964 through 1965 was extremely high—on the order of around 95%. That's because the change in its earnings over that year (the numerator in the RODE) was very large relative to the amount that it reinvested over the year (the denominator in the RODE). But the change in its earnings over the year was not caused by any of the investments that it made during the year. Rather, the change was caused by cyclical fluctuations in the company's business. Consequently, the company's RODE for the 1964 to 1995 period doesn't provide any useful information on its incremental ROE during that period.

As the ending boundary of the RODE calculation is increased from 1965 to later dates, the RODE numbers become significantly more informative. The denominator of the metric gets larger, reducing the amplification of short-term noise. The numbers then begin to track with the actual returns that the company's intervening investments are producing. We see this effect, for example, in the 2004 data point. It represents the change in earnings from 1964 to 2004 divided by the change in equity. There's still cyclicality in the number, because we're comparing earnings on two individual dates in history, but the cyclicality isn't amplified to the same extent. The overall ratio ends up being driven primarily by the underlying ROE of the investments that were added during the period, bringing it to a more sensible level, roughly 5%.

When calculated across an extended period of time, the RODE provides a reasonably accurate measurement of a company's incremental ROE. In Appendix B, we explain how to use long-term RODE data to back-calculate initial equity values and solve the initial equity problem.

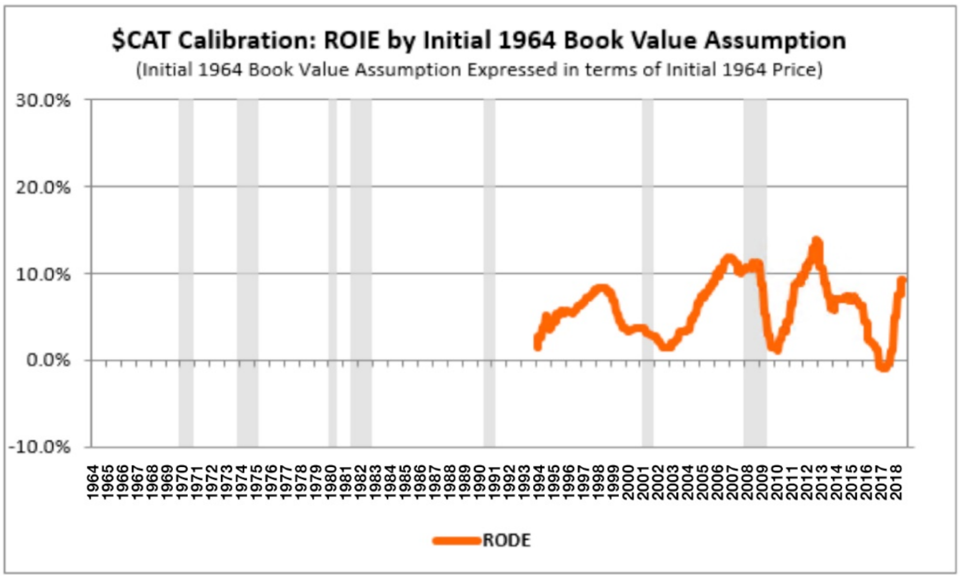
Appendix C

SOLVING FOR INITIAL EQUITY

RESEARCH BY JESSE LIVERMORE: JUNE 2019

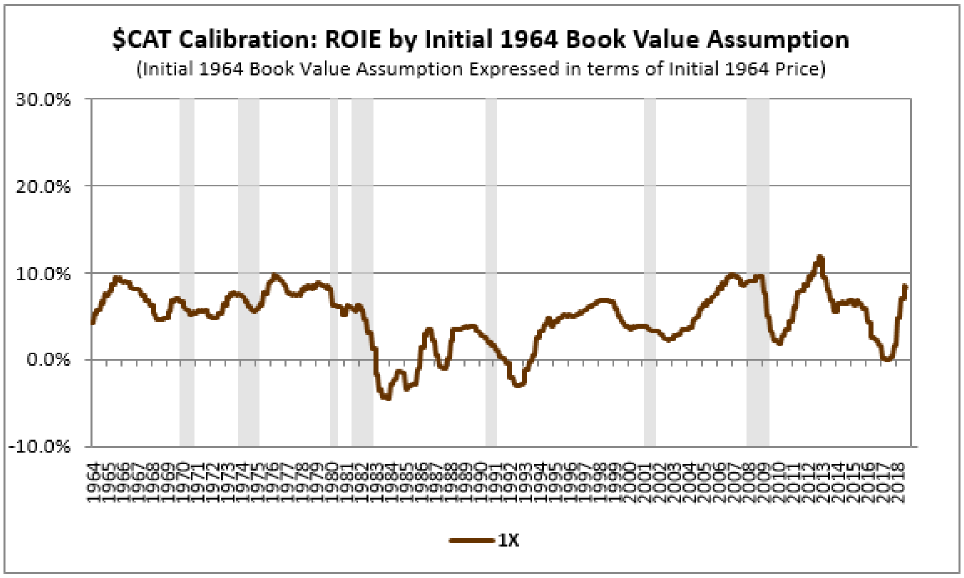
In this appendix, I'm going to explain how we can use the return on differential equity (RODE) measure described in Appendix A to solve the initial equity problem.

The process is best explained in terms of our earlier example of Caterpillar ($CAT). We start by calculating $CAT's RODE for periods beginning in 1964 and ending on dates ranging from 1993 through 2018. We choose these distant years as the end dates for the calculations because we want to minimize the amplification of cyclical noise in the RODE measure. We then plot the results for each ending date:

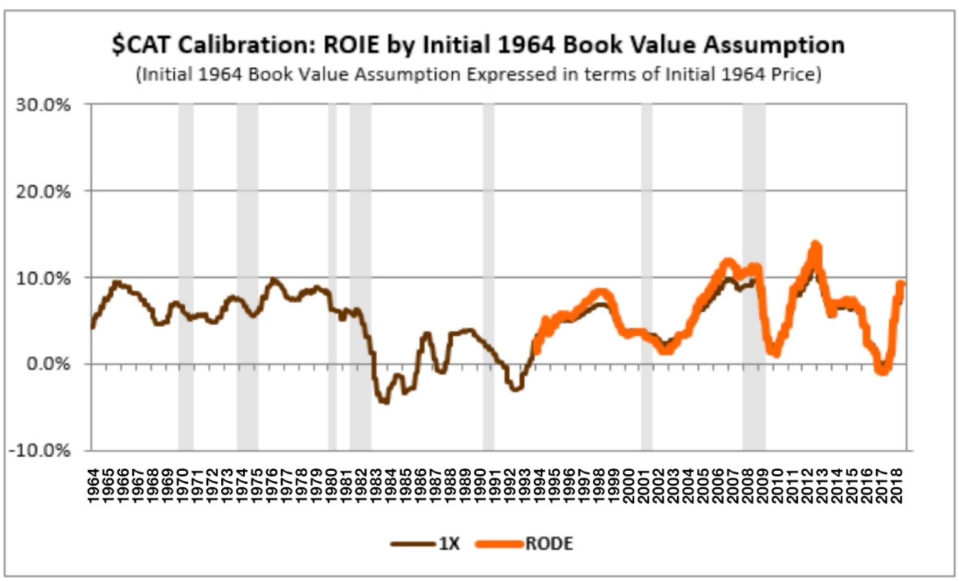


That's the first step. In the second step, we <u>assume</u> an arbitrary number for the unknown 1964 equity value and compute a subsequent time series of integrated equity values based on that starting number. We then divide the real EPS on each date by the associated integrated equity values that we calculate, obtaining a time series of the return on integrated equity (ROIE).

The chart below provides an example of one way of completing the second step. We arbitrarily assume that the company's inflation-adjusted equity value in 1964 was exactly equal to its inflation-adjusted price on that date. We then add the company's subsequent history of real retained EPS to that starting value to obtain future integrated equity values. Finally, we divide the real EPS on each date by those values, obtaining the ROIE series shown below:

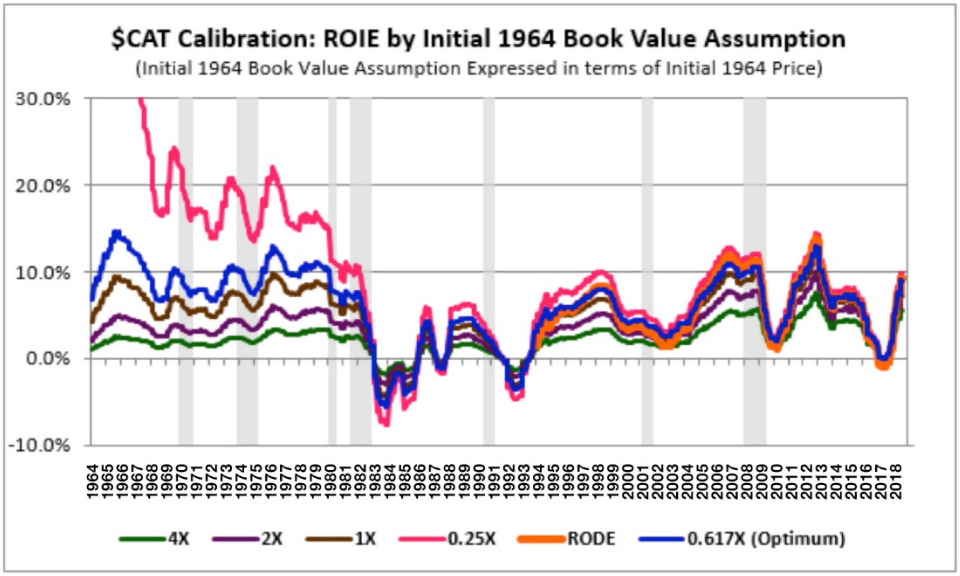


In the third step, we put these two series together on the same chart and compare them. We calculate the square difference between the lines and use that as an approximation for the accuracy of our initial 1964 equity assumption:



As expected, the ROIE measure (brown) tracks closely with the RODE (orange). The close fit suggests that $CAT's true 1964 equity value was somewhere in the vicinity of its inflation-adjusted 1964 price.

To complete this iterative process, we continue to experiment with different initial equity assumptions, setting the assumed 1964 equity value to different multiples of the inflation-adjusted 1964 price—0.25X, 0.5X, 2X, 3X, 4X, and so on:



As you can see in the chart, all of the calculated ROIEs converge on the RODE over time, regardless of the initial equity assumptions used to calculate them. That's because the effects of errors in the initial equity assumptions tend to shrink as time passes. As the company grows in real terms, its distant prior equity becomes a smaller and smaller contributor to its subsequent equity, reducing the impact of any initial inaccuracies.

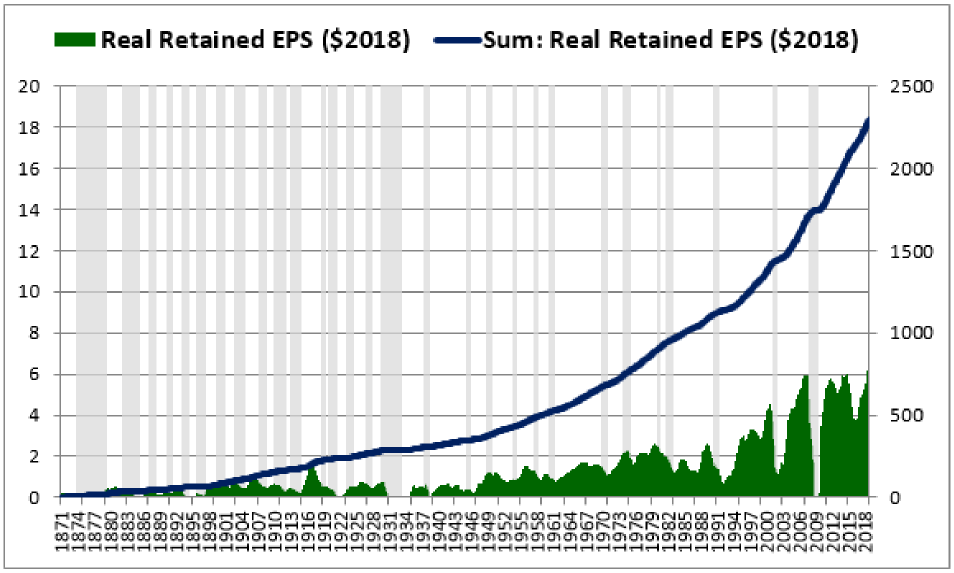
Some of the calculated ROIEs, however, do a better job of converging on the RODE than others. The ROIE calculated using an initial 0.25X estimate, shown in pink, does an especially poor job in that respect—it overshoots the RODE across the entire range of the chart, generating absurdly high ROIE numbers in the early periods. We can therefore throw it out as an incorrect estimate. The 4X estimate, shown in green, does the opposite. It significantly undershoots the RODE, producing deeply depressed ROIE numbers in the early periods of the chart. We can throw it out by the same logic.

What we're searching for, in the end, is the initial equity assumption that leads to the smallest possible square difference between the calculated ROIE and the RODE. In the case of $CAT, that estimate ends up being 0.617X. In other words, if we assume that $CAT's true, inflation-adjusted equity value in 1964 was 0.617 times its inflation-adjusted price on that date, and we implement the integrated equity methodology based on that assumption, the subsequent ROIEs that we calculate will exhibit the closest possible match with the subsequent long-term RODEs.

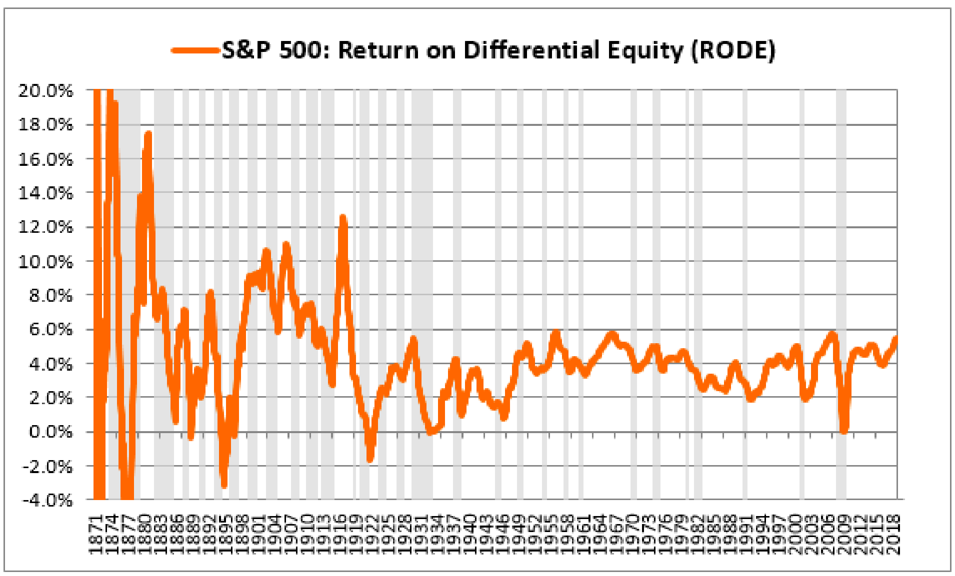
We've therefore found a solution to the initial equity problem. We can use the RODE as a calibration tool to solve for the critical missing link in the integrated equity calculation—i.e., the initial inflation-adjusted equity value. In doing this, we're effectively backfitting the initial equity assignment to produce a result that's consistent with reliable return on equity data obtained through a different method, the RODE method.

Some readers might object that this approach involves cheating because it uses future data to infer past data. But using future data to infer past data is only cheating if the inferred past data is then used to predict the future data all over again, in a circle. We're not making any predictions here. All we're doing is studying the past. We're extrapolating an observed trend backwards from the future into the past, to figure out where things were in the past. That's a perfectly valid approach to use in acquiring knowledge.

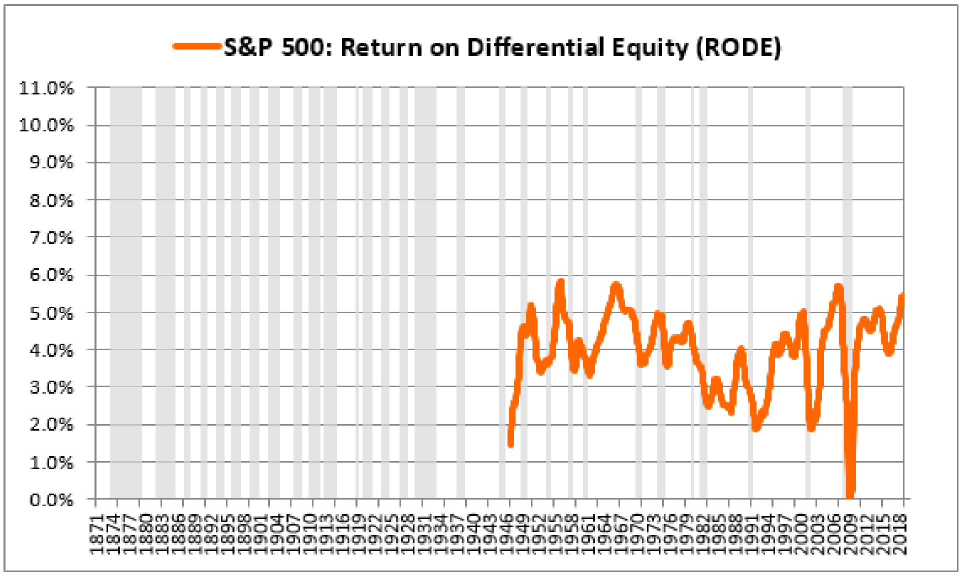
Now, let's see what happens when we use this same approach to calculate an ROIE for the S&P 500. We start by calculating the EPS that the S&P 500 retained on each date in its history (green). We then inflation-adjust that EPS to 2018 prices and calculate its running sum across the period:



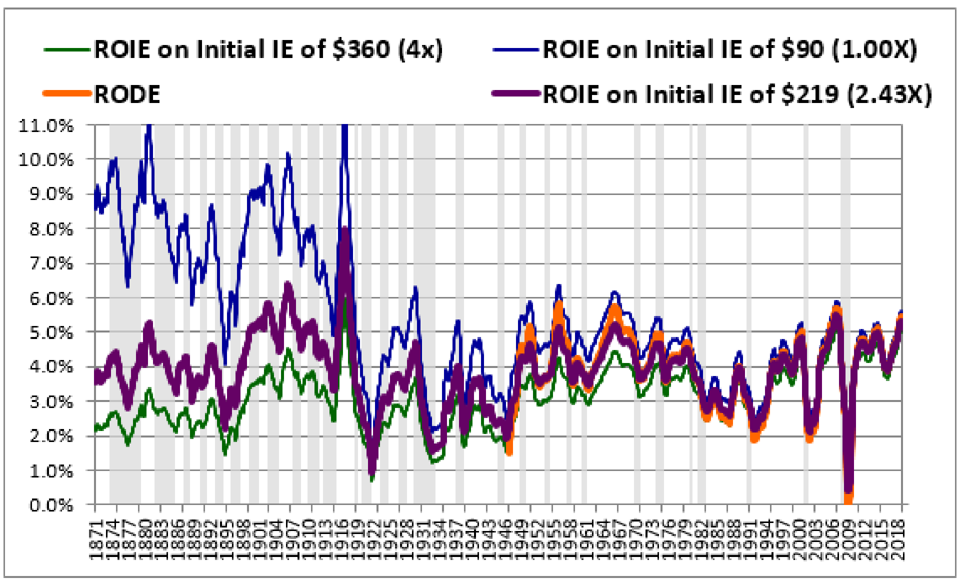
We then calculate the index's RODE for periods ranging from 1871 through every future date:



As expected, the initial numbers end up being erratic, so we cut them off, limiting the analysis to periods that end on distant future dates—in this case, dates after 1950:



We then test out different numbers for the initial January 1871 equity value, using those numbers to compute different return on integrated equity (ROIE) series. We pick the value associated with the ROIE series that most closely matches the RODE:

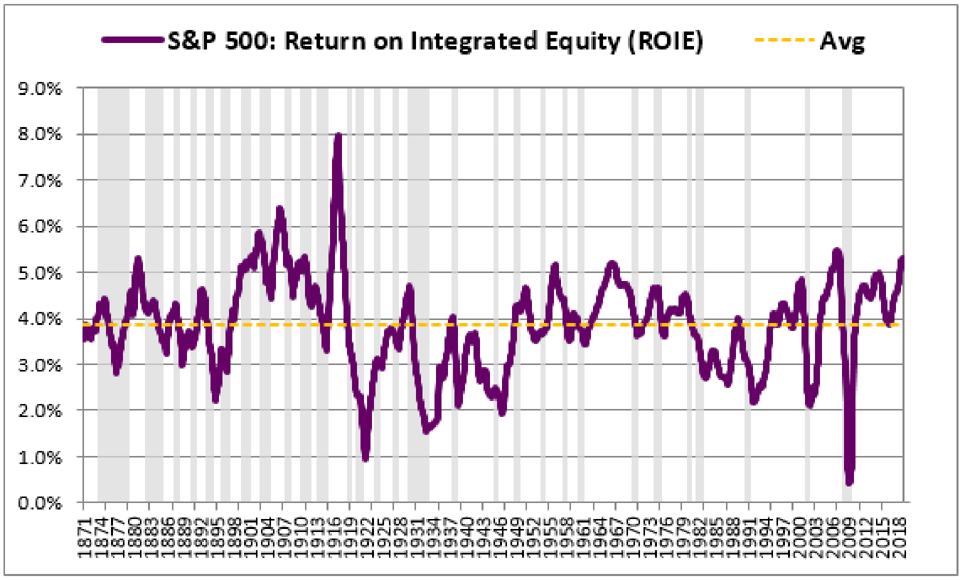


The S&P's actual inflation-adjusted price in January 1871 was $90. If we use that number as the initial equity value for the index, we get the ROIE series shown in blue. That series is unreasonably high in the early periods of the chart and overshoots the RODE in the later periods. We can therefore rule out $90 as an initial equity estimate.

If we try out a much larger number—say, $360, 4 times the index's January 1871 price—we get the ROIE series shown in green. It's unreasonably low in the early periods of the chart and undershoots the RODE in the later periods. So, we can rule out $360 by the same logic.

We continue to computationally evaluate different initial equity values in this way, eventually converging on a maximally accurate initial value. In this case, that value ends up being $219—2.43 times the initial 1871 price. If we use $219 as the index's initial 1871 equity value, we get the ROIE series shown in purple. It exhibits the closest possible match with the RODE, minimizing the square difference between the lines. Conveniently, it also produces reasonable, balanced, symmetric numbers in the early period of the chart, numbers that are very likely to be correct, at least to a first approximation.

At the end of the process, we end up with the clean, orderly, mean-reverting chart shown below:



When applied to a large, well-diversified index with a long history such as the S&P 500, the integrated equity methodology tends to be very accurate, especially in later years of the analysis, after the index has had time to accumulate large amounts of retained EPS.

Appendix D

THE PAYOUT RATIO METHOD

RESEARCH BY JESSE LIVERMORE: JUNE 2019

In this appendix, I'm going to introduce the payout ratio method, a shorthand method for measuring both the return on equity and the cost of equity. The payout ratio method estimates what the growth return and the dividend return of a company or index would have been if the company or index had deployed 100% of its EPS into each type of return, respectively. At the end of the appendix, I'm going to share sector, industry, country and factor data generated using the payout ratio method, to allow for comparisons with the integrated equity method.

For proper context, recall that corporations can deliver fundamental returns to shareholders in one of two ways: (1) by generating growth in their per share fundamentals and (2) by paying out dividends that then get reinvested.

To calculate the return from growth, we simply annualize the rate of change of the fundamental that we're focused on—in this case, earnings. Since 1871, S&P 500 earnings per share have increased at an average inflation-adjusted annual rate of 1.91%. That's the index's return from growth.

To calculate the return from dividends, we simply take the difference between the annualized total return (with dividends) and the annualized price return (without dividends). Since 1871, the annualized inflation-adjusted total return of the S&P 500 has been 6.84%. The annualized inflation-adjusted price return has been 2.32%. The return from dividends has therefore been 6.84% - 2.32% = 4.52%.

Now, the return from growth was generated by reinvesting a portion of earnings. The return from dividends was generated by paying out a portion of earnings. To implement the payout ratio method, we adjust each of these return sources to reflect what their return contributions would have been if 100% of earnings had been devoted to them. In this way, we put both sources on an equal comparative footing.

From 1871 to present, roughly 59% of S&P 500 EPS was paid out as dividends, producing a dividend return of 4.52% per year. It follows that if 100% of the index's EPS had been paid out, the return would have been roughly equal to 4.52% / 59% = 7.65%. That number—7.65%—is the S&P 500's full-EPS dividend return.

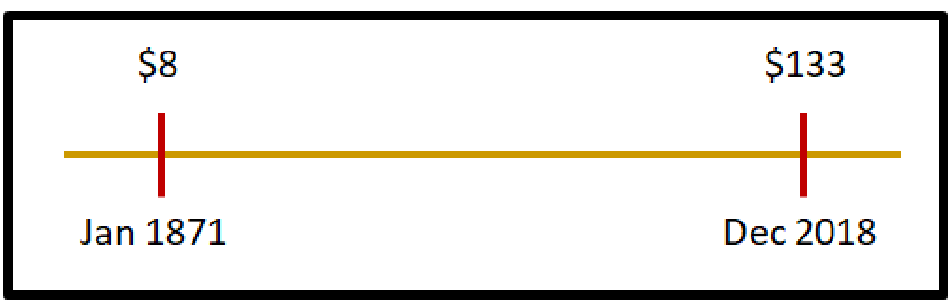
Over the same period, roughly 41% of S&P 500 EPS was retained and reinvested, yielding growth of 1.91% per year. It follows that if 100% of the index's EPS had been reinvested at that rate, the return would have been roughly equal to 1.91% / 41% = 4.67%. That number—4.67%—is the S&P 500's full-EPS growth return.

S&P 500: 1871 - 2018	Payout Ratio Method		
Source	Avg % of EPS Deployed into Source (=a)	Return Contribution from Source (=b)	Return Contribution per 100% of EPS Deployed (=b/a)
Growth	41%	1.91%	**4.67%**
Dividends	59%	4.52%	7.65%

Ultimately, the 4.67% full-EPS growth return, highlighted in yellow, is a measure of the S&P 500's return on equity—the thing that we've been attempting to measure this whole time. It's the fundamental return that accrues to shareholders "per unit of earnings deployed into investment", which is the same as "per unit of equity " or "per unit of book value", given that equity and book value are simply accumulations of earnings that get retained and reinvested over time.

Similarly, the 7.65% full-EPS dividend return is an approximation of what the index's return would have been if all of its earnings had been used to pay out dividends (or buy back shares, had that been legal). It's the return that's embedded in the prices of the shares. We can therefore think of it as the index's cost of equity.

The advantage of the payout ratio method is that it's quick and easy—we only need a few numbers to calculate it. The disadvantage is that its growth component is vulnerable to cyclical distortion. Calculating a growth rate requires comparing earnings at two different points in time—in the above case, S&P 500 earnings in January 1871 ($8 in real terms) and December 2018 ($133 in real terms). If the numbers on either of those dates turn out to be depressed or elevated relative to trend, then the associated distortions will show up in the calculated full-EPS growth return and therefore the estimated ROE.



To mitigate the risk of cyclical distortions in the ROE estimate, we can calculate the growth rate as a rolling average. In other words, instead of calculating a single growth rate from January 1871 through December 2018, we can calculate a growth rate from January 1871 to January 2003, then February 1871 to February 2003, then March 1871 to March 2003, and so on in, averaging all of the respective growth rates together. In the tables presented below, we use rolling periods sized to create 15 years of variation in the starting and ending values of the growth rate calculation—roughly two economic cycles. When the S&P 500's rolling growth rates are averaged together in that way, the 4.67% number drops to 4.02%.

To further reduce the risk of cyclical distortion, we can use the method to calculate full-EPS sales growth in addition to full-EPS earnings growth. Sales growth is a more cyclically stable quantity than earnings growth. When there's a large difference between the two types of growth, that's often a sign that cyclical forces are at play.

The table below provides a template for how we're going to display sector, industry, country and factor data in this appendix:

S&P 500 (Inflation-Adjusted)	Integrated Equity Method		DIFF	Backup: Payout (PO) Ratio Method				Fund Return (ex ΔVal)	Total Return (w/ ΔVal)
	Return	Cost		Avg PO Ratio	(Full EPS) Growth Return		(Full EPS) Dividend Return		
	Avg ROIE	Avg E-Yield			Earnings (Per Share)	Sales (Per Share)			
1871 - 2018	4.07%	7.33%	3.26%	59%	4.02%	-	7.65%	6.42%	6.84%

As an estimate of the return on equity, the earnings growth (per 100% of EPS deployed) backs up the average ROIE. In the case of the S&P 500, the two measures, shaded in light green, end up matching almost perfectly. In smaller indexes with shorter histories, they usually won't match each other as closely. But they'll be generally near each other, within a percentage point or two.

As an estimate of the cost of equity, the dividend return (per 100% of EPS deployed) backs up the average earnings yield. The two measures, shaded in light blue, are almost always very close to each other. That's because (1) they measure the same thing—i.e., the cost of equity, and (2) the dividend calculation isn't vulnerable to cyclical distortion in the same way that the growth calculation is.

At the far-right end of the table, there are two return measures. First, the "fundamental" return that the index delivered strictly from growth and dividends, and second, the actual total return. The difference between the two returns is the index's annualized change in valuation over the period.

The difference between the return on equity and the cost of equity is highlighted in yellow. A negative difference implies a profitability gap—a condition in which the return on equity is insufficient to justify the cost of equity.

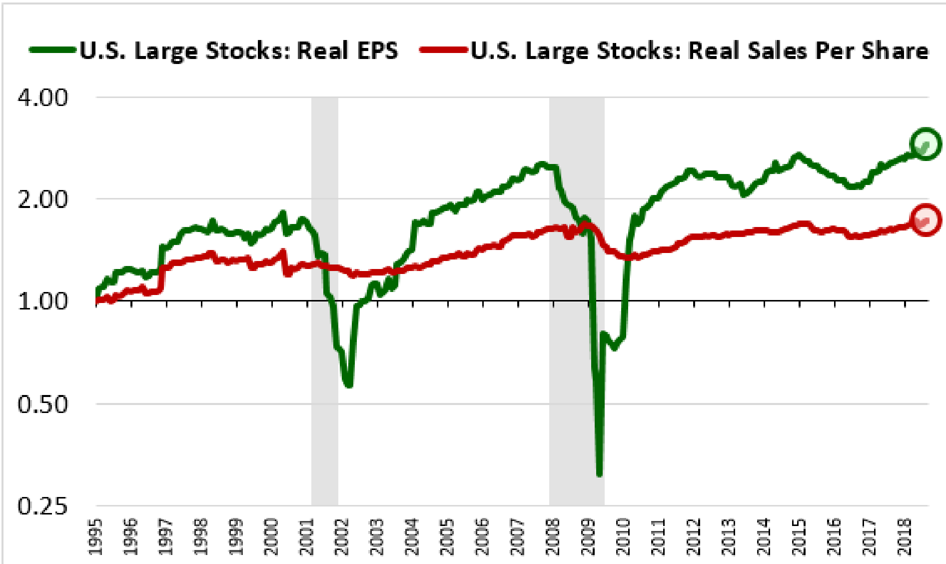
What follows is a reproduction of the data shown in the main piece, but with results for the payout ratio method shown alongside results for the integrated equity method.

Data for U.S. Equities by Size and Period

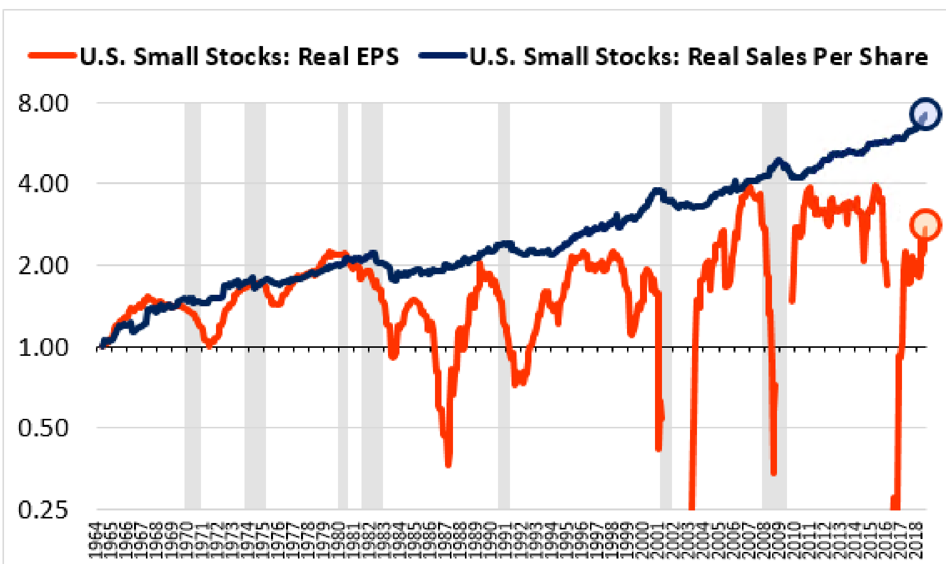
We begin with data on U.S. equities by size and period:

U.S. EQUITIES (Various) (Inflation-Adjusted)		Integrated Equity Method		DIFF	Backup: Payout (PO) Ratio Method				Fund Return (ex ΔVal)	Total Return (w/ ΔVal)
		Return	Cost		Avg PO Ratio	(Full EPS) Growth Return		(Full EPS) Dividend Return		
		Avg ROIE	Avg E-Yield			Earnings (Per Share)	Sales (Per Share)			
S&P	1871 - 2018	4.07%	7.33%	-3.26%	59%	4.02%	-	7.65%	6.42%	6.84%
Initial 1964 Equity Value Calculated Using Calibration Technique										
LARGE	1964 - 2018	3.74%	6.19%	-2.45%	51%	4.17%	3.40%	6.42%	5.55%	5.87%
ALL	1964 - 2018	4.04%	5.96%	-1.92%	51%	4.27%	3.99%	6.16%	5.63%	6.17%
SMALL	1964 - 2018	3.76%	4.29%	-0.52%	52%	2.20%	5.89%	4.31%	4.02%	7.29%
Initial 1995 Equity Value Calculated Using Calibration Technique										
LARGE	1995 - 2018	6.56%	4.57%	1.99%	52%	7.75%	3.49%	4.89%	7.08%	8.56%

The OSAM U.S. equity indices come with sales data, so we can use them to track the effects of profit margin changes. As you can see in the last row, large cap ROIEs and full-EPS growth rates over the last two decades have been very strong, with the profitability gap, shown in the "DIFF" column, reversing into a surplus. That strength, however, is primarily attributable to a large increase in profit margins. As the chart below confirms, the strong earnings growth (boxed in green) has not been matched in sales growth (boxed in red):



Earnings for the small cap universe are currently in a downturn. This downturn is depressing the calculated full-EPS earnings growth return (boxed in orange) relative to the full-EPS sales growth return (boxed in blue) in the table. It's also depressing the fundamental return, which is partly calculated from earnings growth:



Readers should not put too much stock in the small cap results because small cap earnings tend to be erratic and unreliable. That's why, in the table of factor performance shown in the main piece, the P/E ratio was not as effective as a factor in small and mid-caps as it was in large caps.

Data for U.S. Sectors and Industries

The table below shows Cowles sector results for industrials, railroads, utilities, coal and shipping from 1873 to 1929:

HISTORICAL U.S. SECTORS (1873 - 1929) (Inflation-Adjusted)	Integrated Equity Method		DIFF	Backup: Payout (PO) Ratio Method				Fund Return (ex ΔVal)	Total Return (w/ ΔVal)
	Return	Cost		Avg PO Ratio	(Full EPS) Growth Return		(Full EPS) Dividend Return		
	Avg ROIE	Avg E-Yield			Earnings (Per Share)	Sales (Per Share)			
INDUSTRIALS	5.40%	10.72%	-5.32%	54%	4.22%	-	10.29%	7.97%	8.43%
RAILROADS	4.33%	7.50%	-3.17%	66%	4.39%	-	7.37%	6.21%	6.42%
UTILITIES	3.18%	7.91%	-4.73%	71%	2.08%	-	8.03%	6.21%	7.61%
COAL	3.40%	7.13%	-3.73%	57%	3.00%	-	5.89%	1.45%	3.10%
SHIPPING	2.25%	5.34%	-3.08%	51%	-8.20%	-	7.08%	-2.37%	0.89%

The table below shows results for modern U.S. GICS sectors from 1964 to 2018:

U.S. LARGE (1964 - 2018) (Inflation-Adjusted)	Integrated Equity Method		DIFF	Backup: Payout (PO) Ratio Method				Fund Return (ex ΔVal)	Total Return (w/ ΔVal)
	Return	Cost		Avg PO Ratio	(Full EPS) Growth Return		(Full EPS) Dividend Return		
	Avg ROIE	Avg E-Yield			Earnings (Per Share)	Sales (Per Share)			
HEALTHCARE	11.29%	4.68%	6.62%	47%	10.51%	11.79%	5.26%	8.28%	8.43%
TECHNOLOGY	6.77%	4.17%	2.60%	41%	6.10%	5.08%	4.38%	6.91%	5.96%
STAPLES	8.21%	6.10%	2.12%	52%	8.70%	6.95%	6.77%	7.11%	7.22%
FINANCIALS	5.14%	7.67%	-2.53%	40%	4.03%	3.38%	8.52%	5.85%	5.40%
ENERGY	4.65%	7.22%	-2.57%	56%	5.15%	5.38%	6.99%	4.56%	5.89%
INDUSTRIALS	3.30%	6.25%	-2.95%	49%	4.15%	2.11%	6.38%	5.36%	5.53%
DISCRETIONARY	1.34%	5.49%	-4.15%	57%	-0.03%	-0.24%	5.62%	3.80%	5.11%
MATERIALS	1.38%	6.15%	-4.78%	58%	0.34%	0.59%	5.82%	3.97%	4.11%
TELECOM	0.00%	6.15%	-6.15%	81%	-29.98%	-14.79%	8.56%	3.85%	3.87%
UTILITIES	0.00%	7.85%	-7.85%	74%	-8.01%	-3.08%	8.01%	4.65%	4.78%

The table below separates the energy, materials and utilities sectors into underlying industries. To increase the number of companies, we've expanded the universe from U.S. Large Cap stocks to All U.S. Stocks:

U.S. ALL CAP INDUSTRIES (1964 - 2018) (Inflation-Adjusted)	Integrated Equity Method		DIFF	Backup: Payout (PO) Ratio Method				Fund Return (ex ΔVal)	Total Return (w/ ΔVal)
	Return	Cost		Avg PO Ratio	(Full EPS) Growth Return		(Full EPS) Dividend Return		
	Avg ROIE	Avg E-Yield			Earnings (Per Share)	Sales (Per Share)			
ENERGY									
ENERGY SERVICES	5.24%	3.89%	1.35%	48%	5.24%	2.65%	4.66%	3.98%	5.67%
REFINING/STORAGE/TRANSPORTATION/MARKETING	6.56%	7.54%	-0.98%	52%	8.22%	13.27%	7.19%	7.09%	8.04%
INTEGRATED/E&P	5.27%	7.27%	-1.99%	56%	5.89%	5.17%	7.14%	4.61%	6.03%
MATERIALS									
CONSTRUCTION/GLASS PACKAGING/PAPER	6.33%	6.80%	-0.47%	51%	6.62%	11.03%	6.39%	6.40%	6.97%
CHEMICALS	3.85%	6.45%	-2.60%	56%	3.69%	4.14%	6.36%	5.31%	5.59%
METALS/MINING	2.05%	5.45%	-3.41%	58%	1.17%	5.94%	5.99%	4.41%	4.93%
UTILITIES									
GAS/WATER	0.00%	7.13%	-7.13%	68%	-2.71%	-0.94%	7.40%	5.00%	5.51%
ELECTRIC/POWER	0.00%	8.13%	-8.13%	74%	-8.39%	-4.38%	8.44%	4.80%	4.69%

The table below separates the industrial, consumer discretionary and financial sectors into underlying industries:

U.S. ALL CAP INDUSTRIES (1964 - 2018) (Inflation-Adjusted)	Integrated Equity Method		DIFF	Backup: Payout (PO) Ratio Method				Fund Return (ex ΔVal)	Total Return (w/ ΔVal)
	Return	Cost		Avg PO Ratio	(Full EPS) Growth Return		(Full EPS) Dividend Return		
	Avg ROIE	Avg E-Yield			Earnings (Per Share)	Sales (Per Share)			
INDUSTRIALS									
INDUSTRIAL SERVICES	7.31%	5.53%	1.78%	46%	8.52%	13.26%	5.76%	6.64%	6.59%
CAPITAL GOODS	8.04%	6.65%	1.39%	51%	8.98%	12.14%	6.69%	7.50%	8.00%
TRANSPORTATION	6.89%	6.52%	0.37%	56%	7.69%	12.45%	6.50%	6.57%	7.40%
CONSUMER DISCRETIONARY									
ONLINE & DIRECT RETAIL	5.56%	4.54%	1.02%	31%	4.34%	4.94%	5.92%	7.11%	10.89%
HOUSEHOLD DURABLES	6.49%	6.43%	0.06%	49%	5.85%	9.01%	6.51%	6.22%	6.66%
HOTELS/RESTAURANTS	3.09%	3.67%	-0.58%	40%	2.40%	3.73%	4.33%	3.72%	6.11%
TRADITIONAL RETAIL	5.01%	5.79%	-0.78%	36%	6.30%	6.03%	6.44%	6.27%	6.69%
AUTOS	2.60%	7.59%	-4.99%	56%	3.35%	7.06%	7.76%	5.42%	6.52%
APPAREL/FOOTWEAR/LEISURE	0.00%	5.81%	-5.81%	43%	-0.78%	-1.04%	6.49%	3.04%	4.53%
FINANCIALS									
INSURANCE	8.48%	7.14%	1.33%	34%	6.90%	6.34%	9.81%	7.94%	8.41%
DIVERSIFIED FINANCIAL SERVICES	5.35%	7.28%	-1.93%	35%	4.83%	3.23%	8.01%	4.29%	5.09%
BANKING	4.07%	7.88%	-3.81%	46%	2.10%	1.41%	8.23%	5.87%	5.26%

The table below separates the consumer staples, healthcare and technology sectors into underlying industries:

U.S. ALL CAP INDUSTRIES (1964 - 2018) (Inflation-Adjusted)	Integrated Equity Method		DIFF	Backup: Payout (PO) Ratio Method				Fund Return (ex ΔVal)	Total Return (w/ ΔVal)
	Return	Cost		Avg PO Ratio	(Full EPS) Growth Return		(Full EPS) Dividend Return		
	Avg ROIE	Avg E-Yield			Earnings (Per Share)	Sales (Per Share)			
CONSUMER STAPLES									
TOBACCO/ALCOHOL	11.28%	6.23%	5.04%	53%	11.66%	6.94%	7.83%	9.27%	9.76%
HOUSEHOLD/PERSONAL PRODUCTS	7.86%	5.32%	2.54%	52%	8.15%	4.89%	5.78%	6.68%	6.55%
FOOD PRODUCTS AGRICULTURE	7.45%	6.50%	0.95%	50%	7.87%	6.19%	7.18%	7.15%	7.21%
FOOD/DRUG RETAIL	3.97%	6.08%	-2.11%	37%	5.09%	2.16%	7.46%	4.61%	5.63%
HEALTHCARE									
BIOPHARMACEUTICALS	11.87%	4.31%	7.57%	54%	11.07%	9.41%	4.82%	7.79%	8.70%
HEALTHCARE EQUIPMENT/SERVICES	6.20%	4.44%	1.77%	32%	6.91%	6.74%	4.63%	6.25%	7.44%
TECHNOLOGY									
SOFTWARE	11.73%	3.24%	8.49%	28%	11.11%	8.13%	3.47%	10.80%	7.75%
HARDWARE	6.95%	4.09%	2.86%	39%	5.72%	6.58%	4.23%	6.88%	5.70%

Data for Foreign Countries

The table below shows data for foreign countries over various date ranges:

FOREIGN COUNTRIES (Various Date Ranges) (Inflation-Adjusted)	Integrated Equity Method		DIFF	Backup: Payout (PO) Ratio Method				Fund Return (ex ΔVal)	Total Return (w/ ΔVal)
	Return	Cost		Avg PO Ratio	(Full EPS) Growth Return		(Full EPS) Dividend Return		
	Avg ROIE	Avg E-Yield			Earnings (Per Share)	Sales (Per Share)			
HONG KONG	15.97%	7.74%	8.23%	48%	11.52%	-	8.48%	10.99%	10.03%
SWEDEN	8.74%	8.28%	0.46%	38%	10.64%	-	9.00%	8.85%	10.14%
FRANCE	6.87%	7.32%	-0.45%	45%	6.10%	-	7.73%	6.99%	5.60%
SWITZERLAND	3.88%	6.28%	-2.40%	36%	5.96%	-	6.78%	4.67%	5.68%
GERMANY	3.62%	6.49%	-2.87%	43%	4.38%	-	6.72%	5.57%	5.01%
AUSTRALIA	4.09%	7.27%	-3.18%	58%	4.80%	-	7.47%	5.68%	5.09%
JAPAN	0.76%	4.16%	-3.40%	35%	1.14%	-	4.39%	2.01%	3.65%
BELGIUM	4.20%	8.31%	-4.11%	57%	6.33%	-	8.96%	5.82%	6.56%
U.K.	4.44%	8.73%	-4.30%	46%	4.83%	-	9.03%	6.49%	6.06%
NETHERLANDS	4.10%	10.89%	-6.79%	42%	4.52%	-	11.02%	6.29%	7.25%

Data for the Buyback Factor

The table below shows data for the cumulative buyback-to-retained-earnings factor from 1999 to 2018:

U.S. LARGE: BBRE Buybacks to Retained Earnings (1999 - 2018) (Inflation-Adjusted)	Integrated Equity Method		DIFF	Backup: Payout (PO) Ratio Method				Fund Return (ex ΔVal)	Total Return (w/ ΔVal)
	Return	Cost		Avg PO Ratio	(Full EPS) Growth Return		(Full EPS) Dividend Return		
	Avg ROIE	Avg E-Yield			Earnings (Per Share)	Sales (Per Share)			
U.S. LARGE CAPS TRADING SINCE 1999									
TOP QUINT	10.40%	5.30%	5.10%	36%	12.87%	-	5.99%	9.74%	7.93%
UNIVERSE	8.87%	5.20%	3.67%	50%	8.06%	-	5.63%	7.19%	5.22%
BOTTOM QUINT	2.39%	4.31%	-1.93%	63%	-1.57%	-	5.31%	4.42%	3.39%
EX FINANCIALS & TECHNOLOGY									
TOP QUINT	12.41%	5.22%	7.19%	41%	15.66%	-	5.33%	10.49%	7.97%
UNIVERSE	10.96%	5.29%	5.67%	51%	9.72%	-	5.45%	7.55%	5.81%
BOTTOM QUINT	2.27%	4.45%	-2.18%	62%	6.96%	-	5.09%	4.54%	3.67%

Appendix E

INTEGRATED EQUITY DATA FOR SECTORS, INDUSTRIES, COUNTRIES AND FACTORS

RESEARCH BY JESSE LIVERMORE: JUNE 2019

In this Appendix, I'm going present and discuss integrated equity data for sectors, industries, countries and factors. In addition to showcasing the method and satisfying our curiosities, the data can help us pin down the ultimate causes of the profitability gap.[1]

Data for U.S. Equities by Size and Period

We begin with data on U.S. equities by size and period[2]:

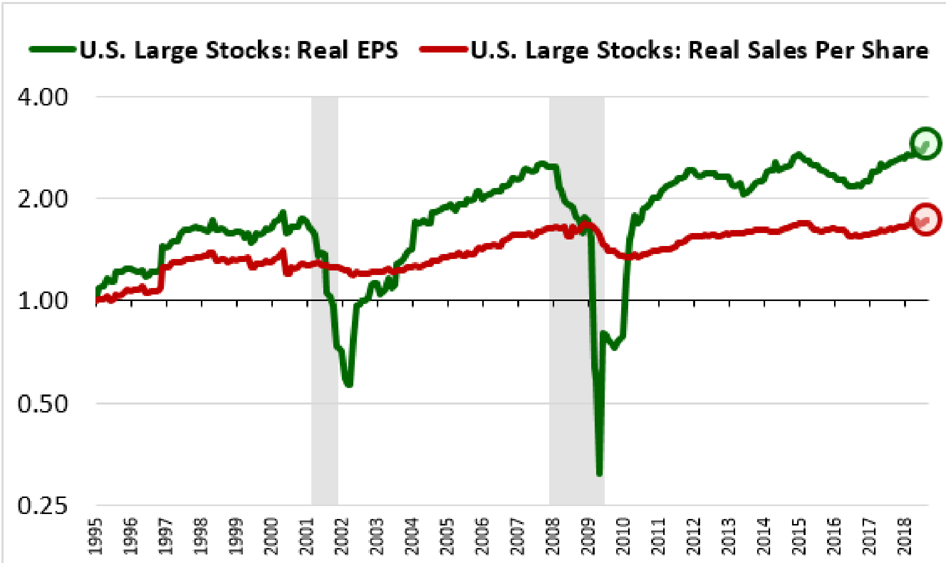
U.S. EQUITIES (Various) (Inflation-Adjusted)		Return (on Equity) Avg ROIE	Cost (of Equity) Avg E-Yield	DIFF	Avg Payout Ratio	Fundamental Return (ex ΔVal)	Total Return (w/ ΔVal)
S&P	1871 - 2018	3.85%	7.33%	-3.48%	59%	6.42%	6.84%
Initial 1964 Equity Value Calculated Using Calibration Technique							
LARGE	1964 - 2018	3.74%	6.19%	-2.45%	51%	5.55%	5.87%
ALL	1964 - 2018	4.04%	5.96%	-1.92%	51%	5.63%	6.17%
SMID	1964 - 2018	3.63%	5.61%	-1.99%	50%	5.15%	6.78%
SMALL	1964 - 2018	3.76%	4.29%	-0.52%	52%	4.02%	7.29%
Initial 1995 Equity Value Calculated Using Calibration Technique							
LARGE	1995 - 2018	6.56%	4.57%	1.99%	52%	7.08%	8.56%

As you can see in the last row, large caps have enjoyed very strong ROIEs over the last two decades, with the profitability gap, shown in the "DIFF" column, reversing into a surplus—a condition in which the return on equity exceeds the cost of equity. This strength, however, is not the result of an actual increase in the corporate sector's gross output. Rather, it's the result of an increase in the corporate sector's profit margin[2],

[1] For readers that would like to compare the integrity equity data to similar data produced by the payout ratio method, I share the results of both methods alongside each other in Appendix B.

[2] The data for the 1964-2018 and 1995-2018 periods were computed using recalibrated initial 1964 and 1995 book value estimates, respectively. The purpose of this recalibration is to clear out the residual effects of low-return investments that occurred prior to the periods of interest, allowing the average numbers to more accurately reflect the profitability trends that occurred inside those periods.

the share of its gross output that it has been able to claim for itself, at the expense of other stakeholders. The normalized chart below confirms that the strong earnings growth observed over the period has not been matched in sales growth:



We can use the payout ratio method to estimate the contribution that the profit margin increase has made to the ROIE increase. From 1995 through 2018, the rolling average real sales per share growth of the U.S. Large Stock universe was approximately 1.67% per year. Dividing that number by the 48% of EPS that was deployed into investment, we get 3.49% real sales per share growth per unit of invested EPS, significantly below the 6.56% calculated ROIE. The profit margin increase has therefore been a key contributor to the observed ROIE increase. If it had not occurred, i.e., if profit margins had stayed constant, the implied return on equity (3.49%) would have been lower than the average earnings yield (4.57%), consistent with the pattern seen across the rest of market history.

The question is, when measuring investment profitability for the period, should we give corporations credit for the effects of the profit margin increase? One could answer yes on the grounds that the increase resulted from cost-cutting investments and is a relevant component of the return on those investments. The associated EPS growth is a causal consequence of the profitable substitution of capital for labor and should therefore be included when measuring the returns on that capital.

But one could also answer no on the grounds that the true driver of the profit margin increase over the period—changes in interest rates, industry dynamics, employee bargaining power, tax rates, regulatory enforcement, and so on—was not investment, but rather luck. Corporations happened to be in the right place at the right time, with strong secular tailwinds behind them. The strength that they experienced in the presence of those tailwinds is neither sustainable nor repeatable, and therefore they shouldn't be given credit for it in the analysis.

Data for U.S. Sectors

To calculate returns on equity, the integrated equity methodology does not require access to reported book value data. We can therefore use it to generate data for U.S. sector indices organized by the Cowles commission, which go back to 1873. Results for the five major late 19th century sectors—industrials, railroads, utilities, coal and shipping—are shown below:

HISTORICAL U.S. SECTORS (1873 - 1929) (Inflation-Adjusted)	Return (on Equity)	Cost (of Equity)	DIFF	Avg Payout Ratio	Fundamental Return (ex ΔVal)	Total Return (w/ ΔVal)
	Avg ROIE	Avg E-Yield				
INDUSTRIALS	5.40%	10.72%	-5.32%	54%	7.97%	8.43%
RAILROADS	4.33%	7.50%	-3.17%	66%	6.21%	6.42%
UTILITIES	3.18%	7.91%	-4.73%	71%	6.21%	7.61%
COAL	3.40%	7.13%	-3.73%	57%	1.45%	3.10%
SHIPPING	2.25%	5.34%	-3.08%	51%	-2.37%	0.89%

The results confirm that the profitability gap is a phenomenon that predates the modern era. In terms of the sectors themselves, the table tells us what we probably already knew: utilities, coal mining, and especially shipping are low-return businesses. The only way to make money in them over the long-term is to buy them on the cheap and hope that they pay out their cash flows.

The table below shows data for modern U.S. GICS sectors sorted by their profitability gaps (least negative gap to most negative gap):

U.S. LARGE (1964 - 2018) (Inflation-Adjusted)	Return (on Equity)	Cost (of Equity)	DIFF	Avg Payout Ratio	Fundamental Return (ex ΔVal)	Total Return (w/ ΔVal)
	Avg ROIE	Avg E-Yield				
HEALTHCARE	11.29%	4.68%	6.62%	47%	8.28%	8.43%
TECHNOLOGY	6.77%	4.17%	2.60%	41%	6.91%	5.96%
STAPLES	8.21%	6.10%	2.12%	52%	7.11%	7.22%
FINANCIALS	5.14%	7.67%	-2.53%	40%	5.85%	5.40%
ENERGY	4.65%	7.22%	-2.57%	56%	4.56%	5.89%
INDUSTRIALS	3.30%	6.25%	-2.95%	49%	5.36%	5.53%
DISCRETIONARY	1.34%	5.49%	-4.15%	57%	3.80%	5.11%
MATERIALS	1.38%	6.15%	-4.78%	58%	3.97%	4.11%
TELECOM	0.00%	6.15%	-6.15%	81%	3.85%	3.87%
UTILITIES	0.00%	7.85%	-7.85%	74%	4.65%	4.78%

The table highlights the two different ways that companies can convert their earnings into returns for shareholders. First, they can allocate their earnings to investments that will lead to future growth. Second, they can use their earnings to pay dividends that will be reinvested and that will therefore compound at the rate of return embedded in their share prices.[3]

[3] Share buybacks produce the exact same pre-tax outcome for shareholders, but the process happens inside the company rather than outside.

Companies with low levels of investment profitability can only deliver competitive returns to shareholders through the second option, the dividends option. To deliver those returns, they need to trade at attractive valuations. Given that the market demands a competitive return from them, it will drive them down to those valuations, if they aren't already there. Their costs of equity will therefore tend to be significantly higher than their returns on equity, implying large profitability gaps.

To be clear, these gaps are not the source of the "inefficiency" in the inefficient investment hypothesis. Rather, the source of the inefficiency is the payout ratio. Companies with profitability gaps over a given period are paying out less than they should be paying out. To get to average returns on equity that are below their average costs of equity, they have to waste some portion of their earnings on suboptimal investments, a portion that would have been better allocated to dividends and share buybacks.[4] From a shareholder perspective, the more they waste, the higher their earnings yields and profitability gaps have to get in order to make up for the losses and ensure a competitive return.

It's neither a coincidence nor a mistake, then, that the sector with the lowest ROIEs in the table—Utilities—had the highest average earnings yield and the highest profitability gap. That result is to be expected, given the sector's very low level of investment profitability.[5] If there's a mistake, it's in the fact that even though the sector had a large profitability gap, it still deployed 26% of its earnings into investment. It could have delivered a much higher return to its shareholders—on the order of 8% per year—if it had instead recycled those earnings back into its cheap share price.[6]

Interestingly, the fact that Technology and Healthcare sit at the top of the list, with profitability surpluses, may be partly related to the fact that they are the two sectors that are most reliant on research and development. In 1973, FASB ruled that investments in research and development cannot be capitalized but must instead be immediately fully expensed in the period in which they occur. The immediate expensing of investments leads to understated earnings, which leads to higher ROIEs and lower average earnings yields.

[4] This logic doesn't necessarily apply in reverse to high ROIE sectors. The fact that their average ROIEs are higher than their average earnings yields doesn't mean that their payout ratios should have been lower. They should invest until their incremental return on equity falls below their cost of equity. It's perfectly conceivable that their return on equity over a period could be layered, with high incremental returns on the upper-layer opportunities and lower incremental returns on the lower-layer opportunities. If they do the right thing and invest until they reach the layer at which the return equals the cost, they will end up with an average return that exceeds the cost—a surplus—even as they rightly pay out some of their earnings to their shareholders.

[5] The average ROIE for the sector is listed at 0.00% because the ROIE numbers were too low to calculate—the sector's real earnings were in decline for almost the entire period.

[6] This point assumes that because utility company earnings declined sharply in real terms over the period, utility company investments during the period actually produced a low or zero return. It's possible that those investments did produce a return, and that the return helped offset an even larger fundamental decline that was set to occur for unrelated reasons. But that larger fundamental decline would then have to be credited to the ROIEs of other historical investments that the sector made, investments that did not turn out to be as profitable over the long-term as was expected.

Data for U.S. Industries

The table below separates the energy, materials and utilities sectors into underlying industries. To increase the number of companies, we've expanded the universe from U.S. Large Cap Stocks to All U.S. Stocks:

U.S. ALL CAP INDUSTRIES (1964 - 2018) (Inflation-Adjusted)	Return (on Equity) Avg ROIE	Cost (of Equity) Avg E-Yield	DIFF	Avg Payout Ratio	Fundamental Return (ex ΔVal)	Total Return (w/ ΔVal)
ENERGY						
ENERGY SERVICES	5.24%	3.89%	1.35%	48%	3.98%	5.67%
REFINING/STORAGE/TRANSPORTATION/MARKETING	6.56%	7.54%	-0.98%	52%	7.09%	8.04%
INTEGRATED/E&P	5.27%	7.27%	-1.99%	56%	4.61%	6.03%
MATERIALS						
CONSTRUCTION/GLASS PACKAGING/PAPER	6.33%	6.80%	-0.47%	51%	6.40%	6.97%
CHEMICALS	3.85%	6.45%	-2.60%	56%	5.31%	5.59%
METALS/MINING	2.05%	5.45%	-3.41%	58%	4.41%	4.93%
UTILITIES						
GAS/WATER	0.00%	7.13%	-7.13%	68%	5.00%	5.51%
ELECTRIC/POWER	0.00%	8.13%	-8.13%	74%	4.80%	4.69%

The refining and construction materials industries were the strongest performers in the group. They invested profitably and traded at attractive earnings yields—a combination that allowed them to deliver strong total returns. Electric power companies and metals and mining companies were the worst performers, exhibiting very low ROIEs that dragged down their total returns over the period. Note that the ROIEs for electric power companies were too low to calculate using the methodology, which is how the sector managed to generate a total return of only 4.69% despite paying out 74% of earnings at an average earnings yield of 8.13%.

The table below separates the industrial, consumer discretionary and financial sectors into underlying industries:

U.S. ALL CAP INDUSTRIES (1964 - 2018) (Inflation-Adjusted)	Return (on Equity) Avg ROIE	Cost (of Equity) Avg E-Yield	DIFF	Avg Payout Ratio	Fundamental Return (ex ΔVal)	Total Return (w/ ΔVal)
INDUSTRIALS						
INDUSTRIAL SERVICES	7.31%	5.53%	1.78%	46%	6.64%	6.59%
CAPITAL GOODS	8.04%	6.65%	1.39%	51%	7.50%	8.00%
TRANSPORTATION	6.89%	6.52%	0.37%	56%	6.57%	7.40%
CONSUMER DISCRETIONARY						
ONLINE & DIRECT RETAIL	5.56%	4.54%	1.02%	31%	7.11%	10.89%
HOUSEHOLD DURABLES	6.49%	6.43%	0.06%	49%	6.22%	6.66%
HOTELS/RESTAURANTS	3.09%	3.67%	-0.58%	40%	3.72%	6.11%
TRADITIONAL RETAIL	5.01%	5.79%	-0.78%	36%	6.27%	6.69%
AUTOS	2.60%	7.59%	-4.99%	56%	5.42%	6.52%
APPAREL/FOOTWEAR/ LEISURE	0.00%	5.81%	-5.81%	43%	3.04%	4.53%
FINANCIALS						
INSURANCE	8.48%	7.14%	1.33%	34%	7.94%	8.41%
DIVERSIFIED FINANCIAL SERVICES	5.35%	7.28%	-1.93%	35%	4.29%	5.09%
BANKING	4.07%	7.88%	-3.81%	46%	5.87%	5.26%

Measured on total return, the best-performing industry was online retail, boosted by a large weighting to Amazon. But this return was primarily attributable to an increase in valuation—the actual return from growth and dividends was significantly lower. The second best-performing industry was insurance, boosted by a large weighting to Berkshire Hathaway. The worst-performing industry was apparel, footwear and leisure. It's ROIE was too low to calculate using the methodology.

The table below separates the consumer staples, healthcare and technology sectors into underlying industries:

U.S. ALL CAP INDUSTRIES (1964 - 2018) (Inflation-Adjusted)	Return (on Equity) Avg ROIE	Cost (of Equity) Avg E-Yield	DIFF	Avg Payout Ratio	Fundamental Return (ex ΔVal)	Total Return (w/ ΔVal)
CONSUMER STAPLES						
TOBACCO/ALCOHOL	11.28%	6.23%	5.04%	53%	9.27%	9.76%
HOUSEHOLD/PERSONAL PRODUCTS	7.86%	5.32%	2.54%	52%	6.68%	6.55%
FOOD PRODUCTS AGRICULTURE	7.45%	6.50%	0.95%	50%	7.15%	7.21%
FOOD/DRUG RETAIL	3.97%	6.08%	-2.11%	37%	4.61%	5.63%
HEALTHCARE						
BIOPHARMACEUTICALS	11.87%	4.31%	7.57%	54%	7.79%	8.70%
HEALTHCARE EQUIPMENT/SERVICES	6.20%	4.44%	1.77%	32%	6.25%	7.44%
TECHNOLOGY						
SOFTWARE	11.73%	3.24%	8.49%	28%	10.80%	7.75%
HARDWARE	6.95%	4.09%	2.86%	39%	6.88%	5.70%

The three industries with the highest ROIEs of all industries examined were tobacco, biopharmaceuticals, and software. Those high ROIEs didn't translate into commensurately high total returns, however, because the industries didn't invest all of their earnings—they put a meaningful chunk into dividends, which were reinvested at relatively expensive prices. Software's total returns were additionally depressed relative to its ROIE because it began the period trading expensively and experienced a significant subsequent decline in its valuation.

Data for Foreign Countries

The table below shows data for foreign countries:

FOREIGN COUNTRIES (Various Date Ranges) (Inflation-Adjusted)	Return (on Equity) Avg ROIE	Cost (of Equity) Avg E-Yield	DIFF	Avg Payout Ratio	Fundamental Return (ex ΔVal)	Total Return (w/ ΔVal)
HONG KONG	15.97%	7.74%	8.23%	48%	10.99%	10.03%
SWEDEN	8.74%	8.28%	0.46%	38%	8.85%	10.14%
FRANCE	6.87%	7.32%	-0.45%	45%	6.99%	5.60%
SWITZERLAND	3.88%	6.28%	-2.40%	36%	4.67%	5.68%
GERMANY	3.62%	6.49%	-2.87%	43%	5.57%	5.01%
AUSTRALIA	4.09%	7.27%	-3.18%	58%	5.68%	5.09%
JAPAN	0.76%	4.16%	-3.40%	35%	2.01%	3.65%
BELGIUM	4.20%	8.31%	-4.11%	57%	5.82%	6.56%
U.K.	4.44%	8.73%	-4.30%	46%	6.49%	6.06%
NETHERLANDS	4.10%	10.89%	-6.79%	42%	6.29%	7.25%

Japan had the lowest ROIE of all countries examined. But it also had the lowest average earnings yield, which means that it traded expensively. Because it traded expensively, with a low cost of equity, its profitability gap ended up being smaller than certain other countries, even though its profitability was worse. From a shareholder perspective, the fact that it traded with a low cost of equity is a bad thing—it's the reason why the country produced the lowest overall total return.

Data for the Buyback Factor

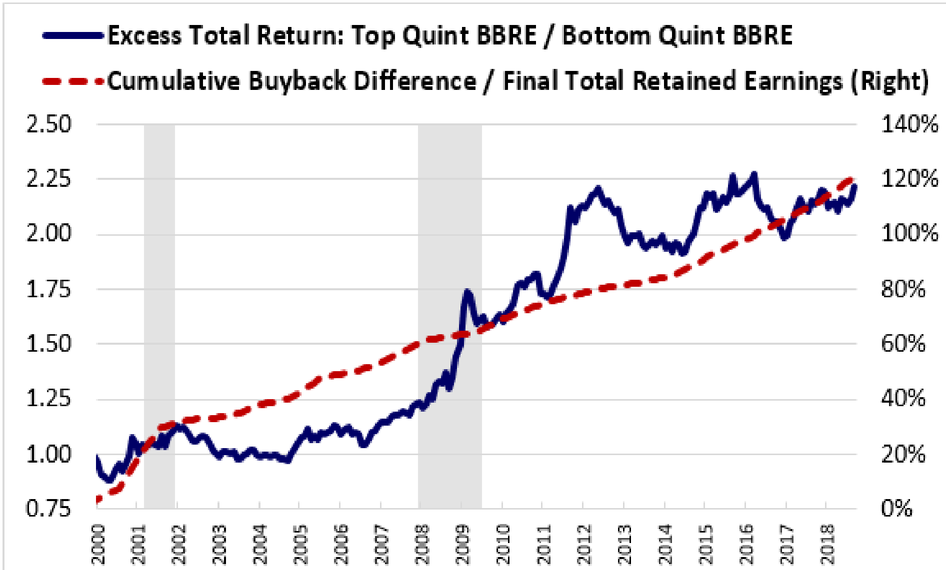
Given the attention that share buybacks receive, we're curious to see what the integrated equity methodology might calculate for the buyback factor. Unfortunately, we can't run the methodology on the buyback factor because it frequently turns over its holdings. As Chris Meredith, Patrick O'Shaughnessy and I explained in Factors from Scratch, turnover creates its own type of earnings growth—what we referred in the piece as "rebalancing" growth. When calculating ROIEs under the methodology, we have no easy way to separate rebalancing growth from the "holding" growth that the underlying companies are generating through their investments, which is the growth that we're interested in.

It turns out that we can still generate interesting buyback-related insights from the methodology. We just have to apply it to a turnover-free proxy for the buyback factor, rather than the buyback factor itself. We start by identifying current companies that have traded publicly for some continuous period of time—in this case, the last 20 years. For each of these companies, we calculate its buyback to retained earnings (BBRE) ratio, defined as the cumulative percentage of its retained earnings that it deployed into share buybacks over the full 20-year period. After calculating the BBRE for each company, we run the methodology on the top and bottom quintiles, which are static entities. We obtain the following results:

U.S. LARGE: BBRE (1999 - 2018) (Inflation-Adjusted)	Return (on Equity) Avg ROIE	Cost (of Equity) Avg E-Yield	DIFF	Avg Payout Ratio	Fundamental Return (ex ΔVal)	Total Return (w/ ΔVal)
U.S. LARGE CAPS TRADING SINCE 1999						
TOP QUINT	10.40%	5.30%	5.10%	36%	9.74%	7.93%
UNIVERSE	8.87%	5.20%	3.67%	50%	7.19%	5.22%
BOTTOM QUINT	2.39%	4.31%	-1.93%	63%	4.42%	3.39%
EX FINANCIALS & TECHNOLOGY						
TOP QUINT	12.41%	5.22%	7.19%	41%	10.49%	7.97%
UNIVERSE	10.96%	5.29%	5.67%	51%	7.55%	5.81%
BOTTOM QUINT	2.27%	4.45%	-2.18%	62%	4.54%	3.67%

As you can see, companies that ranked higher on BBRE—i.e., companies that devoted larger shares of their total retained earnings to buybacks over the full period—enjoyed much higher levels of investment profitability and generated much higher total returns. Of course, this doesn't prove any kind of causation or establish any kind of predictive association—a high BBRE could just as easily be a lagging effect of strong capital allocation and strong total returns as a leading predictor of them. But the relationship is interesting in light of separate evidence that companies that buy back large quantities of their shares tend to outperform in subsequent periods.

The chart below shows the trajectory of the top BBRE quintile's accumulation of excess returns alongside its accumulation of excess buybacks relative to the bottom BBRE quintile:



As you can see, the accumulation of excess buybacks relative to retained earnings doesn't happen at the end of the process, *after* the outperformance has occurred. Instead, it occurs coincidentally—and, in some periods, in advance.

CONCLUSIONS FROM THE DATA: INEFFICIENT INVESTMENT AND OVERSTATED EARNINGS

The tables above show that the profitability gap varies dramatically across different sectors, industries, and countries. In sectors, we saw large profitability surpluses in healthcare, technology and staples and large profitability gaps in utilities and telecom. In industries, we saw large profitability surpluses in tobacco, software, and pharma and large profitability gaps in apparel, autos, metals and mining and electric power generation. In countries, we saw large profitability surpluses in Hong Kong and large profitability gaps in Japan, Belgium, the U.K. and the Netherlands. This variance bolsters the case for the inefficient investment hypothesis because it's easier to explain under that hypothesis.

To explain the variance under the inefficient investment hypothesis, all we have to do is acknowledge that companies in different sectors, industries and countries have historically experienced different levels of investment profitability. The companies that went on to experience low levels of investment profitability weren't necessarily aware that this was going to happen in foresight, and so their capital allocation decisions ended up being inefficient in hindsight.

Explaining the variance under the overstated earnings hypothesis is more difficult. We have to posit that the sectors, industries and countries with profitability gaps overstated their earnings to a greater degree than the sectors, industries and countries with profitability surpluses. But do we have any reason to think that's the case? Do we have any reason to believe, for example, that companies in the consumer discretionary sector would have been more inclined to overstate their earnings than companies in the consumer staples sector? Or that companies in the apparel sector would have been more inclined to overstate their earnings than pharmaceutical companies? Or that companies in Hong Kong would have been more inclined to overstate their earnings than companies in the United Kingdom, which uses a similar accounting standard? Probably not, which makes the overstated earnings hypothesis harder to defend.

Of course, an advocate of the overstated earnings hypothesis can respond by pointing out that there's a crucial difference between seeing a profitability gap in a small partition of the economy and seeing a profitability gap across the entire economy. It's expected that companies concentrated in certain parts of the economy—certain sectors, industries and even geographical regions—will have invested unprofitably in hindsight. Those companies will obviously deserve to trade at discounts to their equity values, with associated profitability gaps. Their equity, after all, is impaired, it doesn't generate the market rate of return. But a situation in which companies trade at large average discounts to par, with large average profitability gaps, across the entire economy, for more than a century, is a very different situation. It implies an apparent level of inefficiency that's better explained in terms of inaccuracies in the accounting framework.

Appendix F

THE OVERSTATED EARNINGS HYPOTHESIS IN ACCOUNTING SIMULATION

RESEARCH BY JESSE LIVERMORE: JUNE 2019

In this appendix, we're going to walk through an accounting simulation that illustrates how an illusory profitability gap can emerge entirely from inflation-related inaccuracies associated with historical cost accounting. To allow readers to follow along with the simulation and experiment with it, we link to a spreadsheet containing the simulation below:

- Accounting Simulation Spreadsheet

Strategy for the Simulation: Four Phases

The simulation will proceed in four phases:

Phase I: Actual Real Values: In the first phase, we're going to construct a perfectly efficient hypothetical index with a cost of equity, a return on equity and a real fundamental return that are always equal to the real fundamental return observed in the S&P 500. We're also going to assume that the hypothetical index's depreciation rate and real interest rate match the average rates observed in the S&P 500. Assuming an environment of zero inflation, we're then going to compute the actual real financial quantities (assets, debt, equity, share price, EBIDA, depreciation, interest, earnings, dividends, etc.) that the hypothetical index ends up producing and accumulating over time. Note that these numbers will reflect the index's true quantities, expressed in real terms.

Phase II: Actual Nominal Values: In the second phase, we're going to upwardly-adjust the real numbers computed in Phase I to reflect what the underlying quantities would come out to if expressed in terms of a price index that is inflating at a certain specified rate. Note that these numbers will reflect the index's true quantities, expressed in nominal terms.

Phase III: Calculated Nominal Values: In the third phase, we're going to recalculate the nominal asset values, equity values, depreciation expenses and earnings in Phase II using historical cost accounting rules. Note that these nominal numbers will be distorted by the accounting framework and will not reflect actual true nominal quantities for the index. The earnings, in particular, will become overstated over time, laying the seeds for a profitability gap.

Phase IV: Calculated Real Values: In the fourth phase, we're going to apply the integrated equity methodology to the calculated nominal values in Phase III to calculate real values for the hypothetical index. Note that these real numbers will carry forward the distortions in Phase III and will not reflect actual true quantities for the index. Relative to the actual real values observed in Phase I, the index's cost of equity will show up as significantly overstated and its return on equity will show up as significantly understated, creating an illusory profitability gap.

The goal of the simulation will be to demonstrate that when we set the parameters of the hypothetical index to match the actual average parameters observed in the S&P 500 from 1964 to 2018, and we then apply historical cost accounting rules to calculate the earnings and equity values of the hypothetical index over time, the illusory numbers that we calculate end up closely matching the actual average reported numbers that we see in the S&P 500 over the period, suggesting that those numbers, and the profitability gap that they give rise to, are illusory as well.

Constructing the Simulation

If the S&P 500 were perfectly efficient, its cost of equity and return on equity would both be equal to its fundamental return at all times. For the 1964 to 2018 period, that return averaged out to 5.48%. Since the purpose of our hypothetical index is to represent a perfectly efficient version of the S&P 500, we're going to set its cost of equity, return on equity and fundamental return to be equal to 5.48% as well. Necessarily, an index with a cost of equity and a return on equity that are always the same will trade at a true P/IE ratio of 1.0.

In an effort to further mimic the S&P 500, we're going to set additional parameters for the hypothetical index as follows:

ACCOUNTING SIMULATION
*Note: Set to reflect approximate averages for U.S. Large Cap Stocks during the 1964-2018 period

Input Variables	Initial Equity ($)	100
	True ROE/E-Yield/Real Fund TR	5.48%
	Depreciation (as % Assets)*	3.42%
	Inflation*	3.90%
	Payout Ratio*	46.26%
	Debt/Equity*	38%
	Real Interest Rate*	3.87%

The depreciation[1], inflation, payout ratio, debt-to-equity[2] and real interest rate[3] parameters are each chosen to match the actual average parameters observed in the U.S. Large Cap Stock Universe during the 1964 to 2018 period.

[1] This term also includes the depletion of natural resources and the amortization of intangible assets.

[2] The average debt-to-equity ratio for the period is calculated using nonfinancial corporate debt in the numerator and nonfinancial corporate net worth at market value in the denominator, both of which are obtained from the flow of funds report (Z.1, B.103). Reported company equity cannot be used in the calculation of debt-to-equity because it is carried at historical cost and is therefore severely understated relative to reality.

[3] The real interest rate is calculated as the average of Moody's seasoned AAA and BAA bond yields minus the inflation rate.

Phase I: Actual Real Values

In Phase I, we calculate actual real values for the hypothetical index under the perfect efficiency assumption specified above. We start the index out in 1964 and allow it to generate earnings based on its characteristics:

Year	PHASE I: ACTUAL REAL VALUES								
	*Note: Assumes Market Efficiency --> Price = Actual Real Equity at all times								
	Assets	Debt	Equity	Price*	EBID	Deprec	Interest	Earnings	Dividend
1964	138.00	38.00	100.00	100.00	11.67	4.72	1.47	5.48	2.54
1965	142.06	39.12	102.94	102.94	12.01	4.85	1.51	5.64	2.69
1966	146.13	40.24	105.89	105.89	12.35	4.99	1.56	5.80	2.85
1967	150.21	41.36	108.85	108.85	12.70	5.13	1.60	5.96	3.00
1968	154.30	42.49	111.81	111.81	13.04	5.27	1.64	6.13	3.15
1969	158.42	43.62	114.79	114.79	13.39	5.41	1.69	6.29	3.29
1970	162.56	44.76	117.80	117.80	13.74	5.55	1.73	6.46	3.43
1971	166.73	45.91	120.82	120.82	14.09	5.70	1.78	6.62	3.57
1972	170.94	47.07	123.87	123.87	14.45	5.84	1.82	6.79	3.71
1973	175.20	48.24	126.95	126.95	14.81	5.99	1.87	6.96	3.84
1974	179.50	49.43	130.07	130.07	15.17	6.13	1.91	7.13	3.98

Note that all of these terms are real terms. The price index is not changing in this phase of the simulation.

Initial Values: 1964

Here are descriptions of how each initial 1964 term is calculated, listed in the order in which it is calculated:

- Equity: The index starts out with $100 in equity.
- Price: Per the efficiency condition, price must always equal equity, so price equals $100.
- Debt: The debt-to-equity ratio is set at 38%, so debt is $38.00 (=$100 * 38%).
- Assets: Assets equal debt plus equity, which is $138.00 (=$100 + $38).
- Earnings: Earnings are set at 5.48% of equity, therefore $5.48 (=$100 * 5.48%).
- Depreciation (Deprec): Depreciation is set at 3.42% of total assets (corresponding to an approximate 29 yr. average useful life for the overall balance sheet), so the depreciation expense comes out to $4.72 (=$138 * 38%).
- Interest: The real interest rate is set at 3.87% of debt. We arrive at this assigned number by taking the average nominal corporate interest rate for the period, 7.77%, and subtracting the average inflation rate, 3.90%. By subtracting inflation from the measure, we capture the real gain that accrues to the index when a portion of its debt is inflated away each year.
- EBID: To calculate EBID, i.e., earnings before interest and depreciation, we simply add interest and depreciation back to earnings. We get $11.67 (=$1.47 + $4.72 + $5.48)
- Dividend: The dividend is a value that is unknown to us in this phase of the simulation. The company will pay dividends based on what it thinks its nominal earning are, and we don't know what that number is yet. We're going to find out what it is when we get to Phase III, the section where we use GAAP rules to calculate nominal earnings. For 1964, the calculated number will end up being $2.54.

Subsequent Values: 1965 and Onward

The terms for subsequent years are calculated in the same way as above. The two exceptions are equity and debt:

- Equity: To calculate the subsequent equity of the index, we add the prior year's retained earnings to the prior year's equity—in other words, the prior year's equity, plus the prior year's earnings, minus the prior year's dividend. For 1965, that comes out to $102.94 (= $100 + $5.48 - 2.54).
- Debt: To calculate the index's subsequent debt, we assume that the index intentionally increases (or decreases) its real debt in all periods to maintain a constant 38% debt-to-equity ratio. For 1965, that means it increases its debt by $1.12 to $39.12.

Assets, which are equal to debt plus equity, reflect the increases in both terms. For 1965, the asset total comes out to $142.06 (= $138.00 + $5.48 - $2.54 + 1.12). As explained elsewhere in the piece, we assume that the difference between cash earnings (EBID, which equals $11.08) and actual earnings ($5.48) is used to refurbish the previously-existing asset base, counteracting its depreciation and allowing us to continue to carry it at the same value that it had in the prior period, in this case $138.00.

Phase II: Actual Nominal Values

In Phase II, we set up a consumer price index (CPI) and steadily increase it over time to match the specified inflation rate for the simulation, 3.90%. We then upwardly-adjust the real values in Phase I to accurately express them in terms of the increasing price index.

Year	CPI	PHASE II: ACTUAL NOMINAL VALUES								
		Obtained by Inflating the Actual Real Values in accordance with the CPI								
		Assets	Debt	Equity	Price	EBID	Deprec	Interest	Earnings	Dividend
1964	1.00	138.00	38.00	100.00	100.00	11.67	4.72	2.95	5.48	2.54
1965	1.04	147.60	40.64	106.96	106.96	12.48	5.04	3.16	5.86	2.80
1966	1.08	157.75	43.44	114.31	114.31	13.34	5.39	3.38	6.26	3.07
1967	1.12	168.48	46.39	122.09	122.09	14.24	5.76	3.60	6.69	3.36
1968	1.17	179.82	49.52	130.30	130.30	15.20	6.14	3.85	7.14	3.67
1969	1.21	191.81	52.82	138.99	138.99	16.22	6.55	4.10	7.62	3.98
1970	1.26	204.50	56.31	148.19	148.19	17.29	6.99	4.38	8.12	4.32
1971	1.31	217.94	60.01	157.92	157.92	18.42	7.45	4.66	8.65	4.67
1972	1.36	232.15	63.93	168.23	168.23	19.63	7.93	4.97	9.22	5.03
1973	1.41	247.21	68.07	179.14	179.14	20.90	8.45	5.29	9.82	5.42
1974	1.47	263.15	72.46	190.69	190.69	22.25	8.99	5.63	10.45	5.83

The only value that is not calculated in this way is nominal interest. We calculate it by multiplying the nominal interest rate (i.e., the real interest rate plus the inflation rate) by the nominal amount of debt. For 1964, that number comes out to $2.95 (= 7.77% * $38).

Phase III: Calculated Nominal Values

In Phase III, we calculate nominal values for the index under a historical cost accounting framework.

Conceptually, we can separate the values in the simulation into those that that are determined through direct measurements and those that are determined through the application of historical cost accounting rules:

- Determined through Direct Measurement: Debt, Price, EBID, Interest, Dividends.
- Determined IAW Historical Accounting Rules: Assets, Equity, Depreciation, Earnings.

For directly-measurable quantities, the calculated nominal values in Phase III are identical to the actual nominal values in Phase II. The accounting paradigm cannot introduce errors into these values because they're not determined through the application of accounting rules; rather, they're determined by simply looking at the quantities themselves, which are empirical and verifiable.

For quantities that are determined through the application of historical cost accounting rules, the values in Phase III will be different from Phase II because the values in Phase III will not have been properly adjusted to reflect the changing price index.

Year	PHASE III: CALCULATED NOMINAL VALUES								
	*Note: All values are the same as actual nominal values, except values that cannot be directly measured (Assets, Equity, Depreciation and Earnings). These non-directly-measurable values are calculated using a historical cost framework.								
	Assets*	Debt	Equity*	Price	EBID	Deprec*	Interest	Earnings*	Dividend
1964	138.00	38.00	100.00	100.00	13.15	4.72	2.95	5.48	2.54
1965	142.06	40.64	102.94	106.96	14.06	4.85	3.16	6.05	2.80
1966	146.55	43.44	106.20	114.31	15.03	5.01	3.38	6.65	3.07
1967	151.48	46.39	109.77	122.09	16.05	5.18	3.60	7.27	3.36
1968	156.87	49.52	113.68	130.30	17.13	5.36	3.85	7.92	3.67
1969	162.75	52.82	117.93	138.99	18.28	5.56	4.10	8.61	3.98
1970	169.14	56.31	122.56	148.19	19.48	5.78	4.38	9.33	4.32
1971	176.05	60.01	127.58	157.92	20.76	6.02	4.66	10.09	4.67
1972	183.53	63.93	133.00	168.23	22.12	6.27	4.97	10.88	5.03
1973	191.60	68.07	138.84	179.14	23.55	6.55	5.29	11.72	5.42
1974	200.29	72.46	145.14	190.69	25.07	6.84	5.63	12.60	5.83

Here is a description of how each nominal term is calculated:

- Debt, Price, EBID, Interest: Because these values are directly measurable, they are the same as in Phase II.
- Equity: For 1964, the index's nominal equity is the initial equity value, $100. To calculate the nominal equity for subsequent years, we increase the prior year's nominal equity by the prior year's nominal retained earnings. For 1965, the total comes out to $102.94 (= $100 + $5.48 - $2.54). The source of the discrepancy between the value in Phase II ($106.96) and the value in Phase III ($102.94) is that the value in Phase II is derived from terms that are upwardly-adjusted to reflect the increased price index, whereas the value in Phase III is derived from terms that are being carried at unadjusted historical cost. Consequently, the Phase III value understates the actual true nominal equity.
- Assets: To calculate the nominal value of the index's assets, we add the equity value to the debt. For 1965, the result comes out to $142.06 (= $102.94 + $40.64). The nominal assets end up being understated because the nominal equity is being understated.
- Depreciation: To calculate the nominal depreciation, we multiply the nominal value of the assets by the depreciation rate. For 1965, the number comes out to $4.85 (= $142.06 * 3.42%). This expense is understated relative to the actual nominal expense calculated in Phase II ($5.04) because the $142.06 asset value that it's calculated from is understated at historical cost.
- Earnings: To calculate the nominal earnings, we subtract interest and depreciation from EBID. For 1965, the number comes out to $6.05 (=$13.43 - $4.85 - $2.53). This number is overstated relative to the actual nominal earnings in Phase II ($5.86) because the depreciation expense is being understated.

- Dividend: We calculate the dividend by multiplying the calculated nominal earnings (which is what the company thinks its earnings are) by the payout ratio. For 1965, the number comes out to $2.80 (=$6.05 * 46.26%). (Note: this term is the official true dividend for the entire simulation and feeds back to the stated dividend values in all of the other phases, adjusted for inflation where applicable.)

Phase IV: Calculated Real Values

In Phase IV, we calculate real values for the index by applying the integrated equity methodology to the calculated nominal values in Phase III:

Year	PHASE IV: CALCULATED REAL VALES								
	Obtained by Inflation-Adjusting the Calculated Nominal Values per the Integrated Equity Methodology								
	Assets	Debt	Equity	Price	EBID	Deprec	Interest	Earnings	Dividend
1964	138.00	38.00	100.00	100.00	13.15	4.72	2.95	5.48	2.54
1965	143.59	40.64	102.94	102.94	13.54	4.67	3.04	5.82	2.69
1966	149.51	43.44	106.07	105.89	13.92	4.64	3.13	6.16	2.85
1967	155.78	46.39	109.38	108.85	14.31	4.61	3.21	6.48	3.00
1968	162.38	49.52	112.87	111.81	14.70	4.60	3.30	6.80	3.15
1969	169.34	52.82	116.52	114.79	15.09	4.59	3.39	7.11	3.29
1970	176.66	56.31	120.34	117.80	15.49	4.59	3.48	7.42	3.43
1971	184.34	60.01	124.33	120.82	15.89	4.60	3.57	7.72	3.57
1972	192.40	63.93	128.47	123.87	16.29	4.62	3.66	8.01	3.71
1973	200.85	68.07	132.78	126.95	16.69	4.64	3.75	8.30	3.84
1974	209.71	72.46	137.24	130.07	17.10	4.67	3.84	8.59	3.98

The only terms that end up being important here are the calculated real earnings and the calculated real equity:

- Earnings: The calculated real earnings are obtained by inflation-adjusting the calculated nominal earnings in Phase III back down to 1964 prices. For 1965, the calculated real earnings number comes out to $5.82 (= $6.05 * 1.000 / 1.039). This number is overstated relative to the actual real earnings number observed in Phase I ($5.64) because it's derived from the overstated nominal earnings number calculated in Phase III.
- Equity: The calculated real equity in each year is equal to the prior year's calculated real equity plus the prior year's calculated real retained earnings (i.e., calculated real earnings minus the real dividend). For 1966, the first year where a discrepancy emerges relative to Phase I, the calculated real equity comes out to $106.07 (=$102.94 + $5.82 - $2.69). This number is overstated relative to the actual true $105.89 number observed in Phase I because it's based on a 1965 earnings term that is overstated.

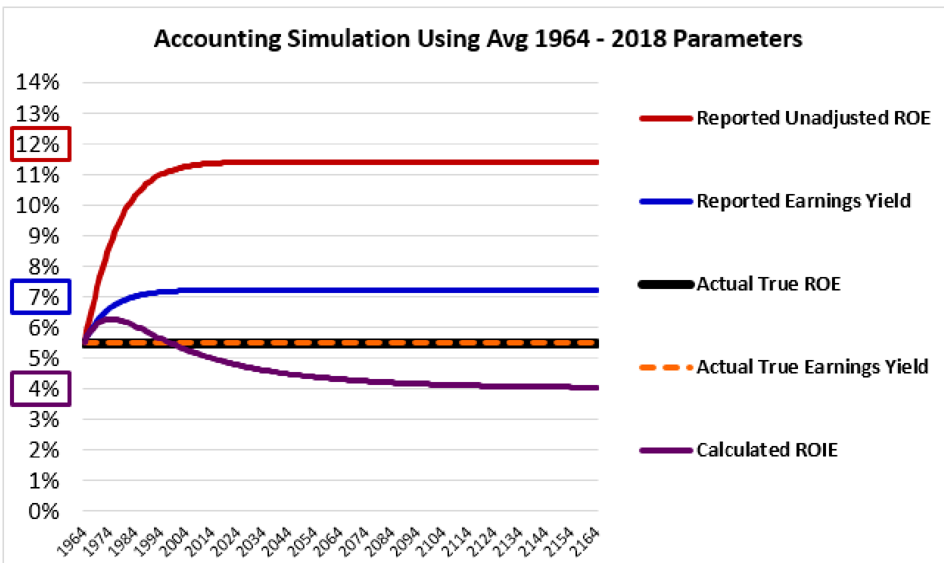
Calculating Metrics for the Index

Using values from the four phases of the simulation, we can calculate relevant metrics for the hypothetical index and observe their trajectories over time. We separate the metrics into reported, actual and integrated.

- The "reported" metrics—e.g., reported valuation (P/B ratio), reported cost of equity (reported earnings yield, or reported earnings divided by price) and reported return on equity (conventional inflation-unadjusted ROE, or reported earnings divided by reported equity)—are derived from the calculated nominal values in Phase III. Note that these values are incorrect. They've been artificially inflated by the overstatement of earnings and the understatement of equity.

- The "actual" metrics—e.g., actual valuation (price-to-equity ratio), cost of equity (earnings yield, or earnings divided by price) and return on equity (earnings divided by equity) are derived from the actual true numbers in Phase I and Phase II. Note that these metrics are the correct, true metrics for the index. Since they're ratios, we can use either Phase to calculate them, as long as we're consistent.
- The "integrated equity" metrics for the index—e.g., valuation (price-to-integrated equity ratio) and return on equity (current real earnings divided by initial real equity plus the sum of calculated real retained earnings)—are derived from calculated real values in Phase IV. These metrics are the metrics that we calculated in the piece using the methodology. As explained above, they're incorrect because they're derived from retained earnings and equity measurements that are overstated.

The chart below shows the trajectories of relevant metrics over time in the simulation:



All of the metrics start out at 5.48%, which is the actual true value of all of the quantities that the metrics are seeking to represent. As inflation builds, the reported metrics and the metrics calculated in accordance with the integrated equity methodology deviate from that value:

- Reported Unadjusted ROE (RED): The reported ROE, which is unadjusted for inflation, rises dramatically. Its numerator, earnings, becomes overstated, while its denominator, equity, becomes understated. The result ends up being a gross overstatement in the overall expression. Interestingly, the number that the ROE equilibrates at, 11.40%, is exactly equal to the reported nominal earnings growth rate (~6.127%) divided by the reported retention rate (i.e., one minus the 46.26% reported payout ratio, i.e., 53.74%), consistent with the formula that we derived in Appendix A, Claim #5.
- Reported Earnings Yield (BLUE): The reported earnings yield rises as the earnings become overstated.
- Calculated ROIE (PURPLE): The calculated return on integrated equity falls. In the presence of overstated earnings, the sum of real retained earnings becomes overstated, causing the equity term in the denominator to become overstated. Because this sum is cumulative, it eventually becomes

more overstated than the earnings term in the numerator, causing the overall ROIE expression to become understated. The point of inflection, where the overstatement in the denominator ends up exceeding the overstatement in the numerator, with the expression turning downward, happens approximately ten years into the simulation. Interestingly, the return on differential equity (RODE) measurement, which is described in Appendix B, equilibrates at the same value as the ROIE, confirming that it's a valid long-term proxy for the ROIE.

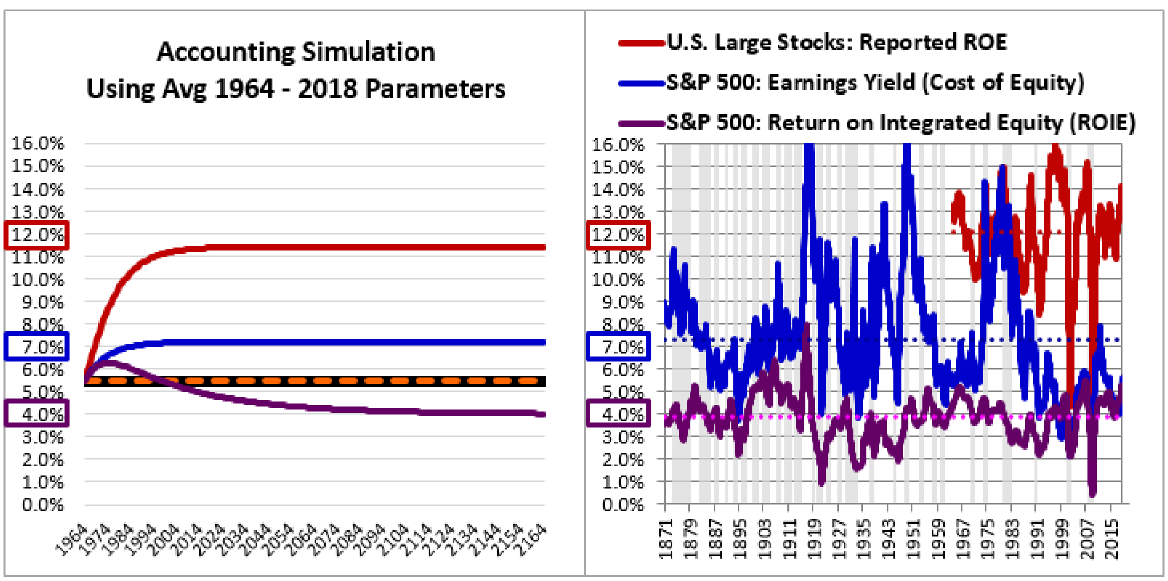
Given that the reported earnings yield equilibrates at a value (7.21%) that's significantly higher than the calculated ROIE (3.99%), the index ends up with a large profitability gap (3.22%).

Inferring the Primary Cause of the S&P 500's Profitability Gap

The simulation confirms what we already knew, which is that a perfectly-efficient index can develop an illusory profitability gap entirely from distortions associated with historical cost accounting. What we didn't know, and what we still don't know, is how much of the S&P 500's actual profitability gap is due to those distortions.

Recall that we set the environmental and operational parameters of the simulated index to be equal to the actual average parameters observed in the S&P 500 from 1964 to 2018. By comparing (1) the illusory profitability gap that emerges at equilibrium in the simulation due to flawed accounting and (2) the actual profitability gap seen in the actual S&P 500 over the period, we can estimate the relative contribution that accounting distortions are making to the actual gap.

The juxtaposed chart below facilitates the comparison. When we compare the differences between the blue line and the purple line in the simulation and the actual S&P 500, we see similar numbers for the lines (approximately 7% and 4%, respectively) and a similar gap between them (approximately 3%):



In the table below, we compare the metrics calculated in the simulation at equilibrium to the actual average calculated metrics for the S&P 500 over the period:

Parameters (1964 - 2018) [1.0 True P/IE] [5.48% Fund TR / True ROE] [46% Payout Ratio] [3.42% Depreciation] [3.90% Inflation] [38% Debt to Equity] [3.87% Real Interest Rate]	**Calculated Numbers**				
	Avg ROIE (Geometric)	**Avg E-Yield** (Geometric)	**Avg ROE** (Reported) (Geometric)	**Avg P/IE** (Harmonic)	**Avg P/B** (Reported) (Harmonic)
Simulation @ Equilibrium	3.99%	7.21%	11.40%	0.55	1.58
S&P 500: Actual	3.88%	6.34%	11.52%	0.59	1.93

As you can see, the metrics match each other very closely. We discuss each metric below:

- Avg ROIE: The equilibrium calculated ROIE in the simulation comes out to 3.99%, only 0.11% off from the ROIE calculated for the actual S&P 500.
- Avg E-Yield: The equilibrium average earnings yield in the simulation comes out to 7.21%, 0.87% higher than the 6.34% average earnings yield calculated for the actual S&P 500. The difference is noticeable, but we have to remember that the simulation assumes that the index always trades at fair value, with an actual true P/IE ratio of 1.0. This assumption does not apply to the actual S&P 500, which spent more time above fair value than below it during the 1964 to 2018 period. We should therefore expect the S&P 500's actual average earnings yield to be slightly depressed relative to the equilibrium earnings yield in our simulation, which is precisely what we see in the data.
- Avg Reported ROE: The average reported ROEs come out almost exactly the same, separated by only 0.12%.
- Avg P/IE: The average P/IE ratios come out roughly the same, separated by a difference of roughly 8%. The valuation point made above applies here. We should not be surprised that there's a difference between the average measured valuations of the index in the simulation and the index in reality. Unlike the index in the simulation, the actual index in reality traded at an average above fair value during the period.
- Avg P/B: The average P/B ratios come out roughly 30% apart, a fact that can again be explained by the actual index's greater expensiveness over the period.

The fact that the metrics line up so closely is strong evidence that the majority of the profitability gap observed in the actual S&P 500 is due to inflation-related earnings overstatement associated with the use of a historical cost framework. It's possible, and likely, that earnings have been overstated across history in other ways and for other reasons, but the historical cost reason is likely the main reason.

Estimating the Severity of Earnings Overstatement as a Function of Inflation

At equilibrium, the degree of earnings overstatement that emerges in the simulation is 32%. This number is associated with an inflation rate of 3.90%. By running the simulation at other rates of inflation, we can build a mapping between the inflation rate and the severity of earnings overstatement more generally. When comparing valuations across different periods of history, we can then use the mapping to correct for relevant differences in inflation.

In the table below, we show the degree of overstatement that emerges in the simulation under inflation rates ranging from 0% to 10%:

Accounting Simulation Avg 1964 - 2018 Parameters	
Inflation Rate (Hypothetical)	**EPS Overstatement @ Equilibirum**
0%	0.0%
2%	19.1%
4%	32.2%
6%	41.3%
8%	48.0%
10%	53.1%

In the piece, we estimated the average degree of earnings overstatement across the 1871 to 2018 period by searching for the degree of overstatement that, if reversed, would create the closest match between the average cost of equity and the average return on equity. We eventually arrived at an estimated degree of overstatement of 25%. We can corroborate this estimate using the table above by noting that inflation over the 1871 to 2018 period was 2.07%. That number corresponds to an estimated degree of overstatement of approximately 20%, not far from our earlier 25% estimate.

Appendix G

INITIAL EQUITY IN THE PIE RATIO CALCULATION

RESEARCH BY JESSE LIVERMORE: JUNE 2019

When we test the ability of the P/IE metric to forecast future returns, we're technically exposing ourselves to a small amount of look-ahead bias. In this Appendix, I'm going to explain why that bias is not a problem for the testing process.

To understand where the bias comes from, recall that the methodology estimates the initial equity value of a company or index using a calibration technique that incorporates data from the future (see Appendix B for details). If our goal is to conduct a historical analysis of profitability, then using future data to make an initial equity estimate is fine. But if our goal is to test the predictive power of the ensuing measure, then we can't allow it to have access to that data.

The table below shows the correlations between S&P 500 P/IE ratios constructed on different initial 1871 equity value assignments and future 10-year S&P 500 returns. A more negative correlation means a stronger relationship:

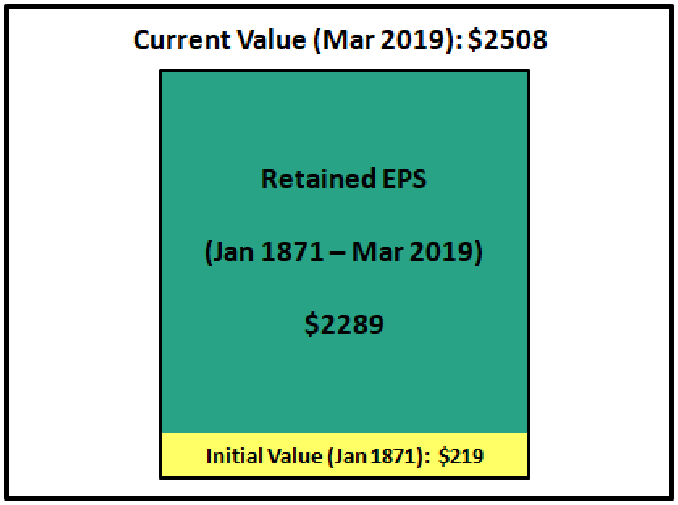
1881 - 2019 Correlation Coefficient (Pearson)	P/IE by Initial 1871 Integrated Equity Value Assignment ($)						
	45	68	90	180	219	270	360
10 Yr Returns: Real	-0.468	-0.523	-0.608	-0.698	-0.692	-0.667	-0.621
10 Yr Returns: Nominal	-0.628	-0.662	-0.708	-0.703	-0.671	-0.621	-0.552

Recall that when we were applying the methodology to the S&P 500, we didn't know what the S&P 500's initial 1871 book value was. We therefore needed to estimate it. Using the calibration technique described in Appendix C, we arrived at an initial estimate of $219 (in 2018 dollars). As the chart confirms, the real return correlations, which are the return correlations that matter most in the test, get stronger when we build metrics with initial equity values that are close to that value. This isn't a surprise—the correlations get stronger because the initial 1871 estimate is very close to the actual true 1871 value. But we can only know that by looking into the future, which we're not allowed to do in a predictive test.

Fortunately, when we constrain the analysis to the periods of market history that we're actually concerned about, e.g., the post-war periods from 1945 to present, any perceptible benefits of the look-ahead bias disappear. In fact, other initial assignments end up doing slightly better than our calibrated $219 choice:

1945 - 2019 Correlation Coefficient (Pearson)	P/IE by Initial 1871 Integrated Equity Value Assignment ($)						
	45	68	90	180	219	270	360
10 Yr Returns: Real	-0.823	-0.822	-0.821	-0.810	-0.804	-0.794	-0.779
10 Yr Returns: Nominal	-0.937	-0.937	-0.937	-0.929	-0.924	-0.916	-0.903

The reason the benefits disappear is that the contribution of the initial 1871 equity value to subsequent equity values becomes increasingly small and irrelevant as the index grows in size from its initial date. As the image below illustrates, the retained EPS becomes the overwhelmingly dominant contributor to the total equity sum, with the contribution of the initial equity value estimate shrinking in comparison. If we wanted to, we could even set the assumed initial 1871 equity value to zero. The current integrated equity value would only change by 8.7% (=$219 / $2508).



Consequently, we don't need to worry about the small amount of look-ahead bias that the calibration technique might introduce. To the extent that this bias exists, it's miniscule, and plays no role at all in driving the metric's predictive strength over the periods of market history that we're interested in.

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Hypothetical performance results shown on the preceding pages are backtested and do not represent the performance of any account managed by OSAM, but were achieved by means of the retroactive application of each of the previously referenced models, certain aspects of which may have been designed with the benefit of hindsight.

The hypothetical backtested performance does not represent the results of actual trading using client assets nor decision-making during the period and does not and is not intended to indicate the past performance or future performance of any account or investment strategy managed by OSAM. If actual accounts had been managed throughout the period, ongoing research might have resulted in changes to the strategy which might have altered returns. The performance of any account or investment strategy managed by OSAM will differ from the hypothetical backtested performance results for each factor shown herein for a number of reasons, including without limitation the following:

- Although OSAM may consider from time to time one or more of the factors noted herein in managing any account, it may not consider all or any of such factors. OSAM may (and will) from time to time consider factors in addition to those noted herein in managing any account.
- OSAM may rebalance an account more frequently or less frequently than annually and at times other than presented herein.
- OSAM may from time to time manage an account by using non-quantitative, subjective investment management methodologies in conjunction with the application of factors.
- The hypothetical backtested performance results assume full investment, whereas an account managed by OSAM may have a positive cash position upon rebalance. Had the hypothetical backtested performance results included a positive cash position, the results would have been different and generally would have been lower.
- The hypothetical backtested performance results for each factor do not reflect any transaction costs of buying and selling securities, investment management fees (including without limitation management fees and performance fees), custody and other costs, or taxes – all of which would be incurred by an investor in any account managed by OSAM. If such costs and fees were reflected, the hypothetical backtested performance results would be lower.
- The hypothetical performance does not reflect the reinvestment of dividends and distributions therefrom, interest, capital gains and withholding taxes.
- Accounts managed by OSAM are subject to additions and redemptions of assets under management, which may positively or negatively affect performance depending generally upon the timing of such events in relation to the market's direction.
- Simulated returns may be dependent on the market and economic conditions that existed during the period. Future market or economic conditions can adversely affect the returns.

9/27/19