Remarks on the Calculation of Earnings in the S&P 500 Index

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In two publications, Jeremy J. Siegel [2009a, 2009b] questioned Standard & Poor's methodology for calculating the earnings of the S&P 500 Index, arguing that it gave far too much influence to firms with big losses and low market values and thereby distorted the valuation of the S&P 500 Index. While Siegel's arguments are valid from an investor's point of view, his suggestions on how to address the issue are questionable.

A CHALLENGE TO S&P'S EARNINGS

In a February 2009 op-ed piece in the *Wall Street Journal*, "The S&P Gets Its Earnings Wrong," Jeremy Siegel [2009a] questioned S&P's methodology for calculating the underlying earnings of the S&P 500 Index. Does it make sense that a loss of a small, economically irrelevant company can distort the earnings picture of an index that serves as a proxy for the economic well-being of the whole country? In addition, the influence of such a loss could, in theory, be unlimited no matter how small the firm is. Investors might get confused and misled if they take the S&P 500 earnings at face value and do not conduct additional research on their composition.

SIEGEL'S METHODOLOGY

As an alternative, Siegel proposes using market-value-weighted earnings of the components. This method is not correct, however, as shown below. When S&P aggregates earnings for its 500 Index, each component's earnings included in the index's earnings are derived from the component's adjusted market value, that is, the weight each company carries in the S&P 500 Index. For example, when AIG's $99 billion loss was included in the index's earnings, this negative earnings contribution to the index was based on AIG's whole market value covered in the index with Investable Weight Factor 1. Siegel's methodology of market-value-weighted earnings would apply the weight adjustment twice.

In his piece in Yahoo! Finance [2009b] in April 2009, Siegel uses a two-company universe of Exxon Mobil (XOM) and AIG to illustrate his methodology. XOM has a market value of $350 billion and total earnings of $45 billion, while AIG has a market capitalization of $15 billion and an annual loss of $99 billion. Thus, XOM has a weight of more than 95%, and AIG has a weight of less than 5% in this two-stock index. According to the S&P earnings calculation method, this two-stock index shows a loss of $54 billion, which, Siegel argues, gives too much weight to the smaller AIG. To reach the desired results, Siegel uses the weight factors of 95% for XOM's market value and 5% for AIG's market value a second time to end up with a new market capitalization for his two-stock index of $335 billion. The new weight for XOM now exceeds 99%

and AIG accounts for less than 1% of the total market capitalization. Siegel now applies the original weight factors of 95% for XOM's earnings and 5% for AIG's loss and thus shows an aggregate profit of $39 billion for the index comprising the two stocks. Based on this adjusted market capitalization, the newly adjusted price-to-earnings ratio becomes a much more favorable 9 (335/39) as compared to a negative price-to-earnings ratio of 6.8 (365/–54) according to the S&P method.

Assume that a component's weight in a market-capitalization-weighted index is w_i, where w_i is the ratio of the component's adjusted market value included in the index m_i to the index's market value M. Then, according to Siegel's methodology, each component's adjusted market value included in the index is changed to $\tilde{m}_i = w_i m_i$, the total market value of the index is changed to $\tilde{M} = \Sigma \tilde{m}_i$, and each component's weight w_i is actually changed to a new weight $\tilde{w}_i = \tilde{m}_i / \tilde{M} = w_i m_i / \tilde{M}$, and the ratio of any two components' new weights is changed to the ratio of the square of the components' original weights: $\tilde{w}_i / \tilde{w}_j = w_i m_i / w_j m_j = w_i^2 / w_j^2$. Therefore, the new weights $\tilde{w}_i = w_i^2 / \Sigma w_j^2$ both increase the influence of big components and at the same time significantly reduce the influence of small companies.

Because Siegel [2009a] proposed to "weight each firm's earnings by its relative market weight, identical to how they calculate returns on the S&P 500," the weights should be based on components' market values at the beginning of a period. Assume that the earnings delivered from a component's adjusted market value m_i and $\tilde{m}_i$ are e_i and $\tilde{e}_i$. Then Siegel's weighted earnings $w_i e_i = \frac{\tilde{m}_i}{m_i} e_i = \tilde{e}_i$ revert to S&P's methodology, which is mathematically correct but with new implied weights $\tilde{w}_i$. However, instead of the weights at the beginning of a period, in his two-stock example quoted here, the weights at the end of a period were used to weight the earnings, which caused two logical errors: First, this is not the way the returns on the S&P 500 Index are computed; second, these weighted earnings are dependent not only on the weights of the stocks at the beginning of a period and their earnings generated during the period but also on these stocks' performance during the period: for better (worse) performing stocks, the earnings included in the index are incorrectly increased (decreased).

Essentially, Siegel's methodology is creating a new weighted index such that each component's weight is the square of the original weight before normalization (adjusting by a factor of Σw_j^2), and this new index, which is heavily biased in favor of large-capitalization companies, should have its own weighted returns, valuation ratios, and so on. Therefore, Siegel's methodology to reduce the influence of large profits/losses of small companies in the index is arbitrary at best and not an objective generic solution. As Blitzer [2009] pointed out in his defense of S&P's methodology: "Prof. Siegel's approach—applying the weights based on market values to the results based on a company's earnings—effectively mixes apples and oranges."

SUMMARY AND CONCLUSIONS

Negative earnings from relatively small companies, such as losses from AIG during the recent financial crisis, may have an enormous impact on the aggregate earnings of an index. Some index providers, such as Financial Times, entirely exclude losses from components of indices when calculating price-to-earnings ratios. Because losses are as important as profits, it does not make sense to exclude them in the calculation of aggregate numbers. Price-to-earnings ratios of indices calculated this way can hardly be representative for a sector, an industry, a region, or an entire stock market. Taking earnings and losses at face value according to their index weight, as S&P does, therefore is the most prudent method. If a small company has a huge loss, so be it. If it has a distorting influence on an average due to its magnitude, so be it. We, whether we are analysts, money managers, statisticians, journalists, or any other participant in the economy, have no business changing reality or trying to make it look better or worse. We should feel free, however, to interpret it.

When Siegel published his op-ed piece on February 25, 2009, less than two weeks before the worst bear market since the Great Depression reached the bottom, the estimated S&P 500 Index earnings for 2008 were $39.73 (the actual figure was later reported as $14.88), yielding a rather high price-to-earnings ratio. He warned investors not to "fool [them]selves into thinking that this is an expensive market," because the earnings picture was distorted by the 2008 financial market crisis. Just when many investors were fleeing the stock market at its darkest time before the dawn, Siegel claimed that "those who venture into today's stock market are indeed buying good values." Although Siegel's methodology for recalculating earnings for the S&P 500 Index was incorrect, his point about using properly adjusted earnings and the implied price-to-earnings ratio to gauge the market direction helped him make this great call. Shiller [2000] made a similarly timely call about

nine years earlier, though in the opposite direction, when he published his famous book, *Irrational Exuberance*, in March 2000, on the eve of the dot-com bubble burst. In his book, Shiller warned that his price-to-earnings ratio for the S&P 500 Index hit 44.3 in January 2000,[1] which was much higher than the record of 32.6 reached in September 1929 shortly before the market crashed. He warned that "the outlook for the stock market into the next ten or twenty years is likely to be rather poor—and perhaps even dangerous" (Shiller [2000, p. xiii]).

Since extremely high or low earnings are not normal, Graham and Dodd suggested in their classical textbook *Security Analysis* of 1934 a basis of maximum appraisal for investment. Their approach "shifts the original point of departure, or basis of computation, from the current earnings to the average earnings, which should cover a period of not less than five years, and preferably seven to ten years" (Graham and Dodd [1934, p. 452]); "first because a continued or repeated performance is always more impressive than a single occurrence, and secondly because the average of a fairly long period will tend to absorb and equalize the distorting influences of the business cycle" (Graham and Dodd [1934, p. 429]). Campbell and Shiller [1988, 1998] and Shiller [1996, 2000] picked up on Graham and Dodd's idea and successfully used real (inflation-adjusted) price to multiple-year moving average of real earnings for forecasting long-term stock market returns and the present value of future real dividends. We think Graham and Dodd's approach of shifting the basis of computation from current earnings to multiple-year average earnings is a sound way of addressing Siegel's concerns. While the S&P 500 Index had very poor earnings of $14.88 in 2008, the seven-year average earnings came in at $52.48, absorbing the distorting influences of the 2008 crisis and providing a clearer earnings picture and thus a more useful guide to future earnings and a better indicator of future market direction.[2]

ENDNOTES

The authors thank Roderick Cameron and Margaret Keppler for their assistance and the reviewers for their thoughtful suggestion on an earlier version of this article. The authors are also grateful to David Blitzer and Howard Silverblatt for providing valuable earnings data for the S&P 500 Index.

[1]Shiller [2000] used the real S&P Composite Stock Price Index and the 10-year moving average of real S&P Composite earnings to calculate his price-to-earnings ratios.

[2]Based on the S&P 500 Index level as of the end of February 2009, the ratio of price to seven-year average earnings would have been 14.0. This compares to a price-to-earnings ratio of 49.4 based on the reported S&P 500 earnings for 2008. While the 2009 S&P 500 earnings increased 242.5 % from the prior year's level to $50.97, the seven-year average earnings were $55.82, reflecting a more modest annual growth rate of 6.4 %. Had the 2008 earnings for the S&P been calculated based on Siegel's methodology, they would have been $60.88 per index unit (based on beginning of quarter weights) or $70.50 (based on end of quarter weights)—in each case more than four times the $14.88 S&P calculated. The second figure is substantially larger than the first because in 2008 many companies suffered big losses and their stock prices dropped substantially, as AIG's did. Using end-of-quarter weights reduces the impact of those losses on the earnings of the index. For 2009, S&P earnings according to Siegel's methodology would have been $62.99 (beginning of quarter weights) and $60.58 (end of quarter weights).

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