

Performance of DJIA Stocks Using Fundamental Indexation

Thomas M. Krueger and Mark A. Wrolstad

Abstract

During the decade beginning on December 31, 1999, an equal-weighted portfolio of the Dow Jones Industrial Average (DJIA) stocks outperformed the market capitalization and price-weighted portfolios, with ending values of \$1,020, \$731, and \$777 on the \$1,000 originally invested, respectively. The net income and free cash flows-weighted portfolios performed the best with identical ending values of \$1,082. The portfolio with the lowest standard deviation measure of total risk was weighted on net income (14.26%) and the portfolio with the highest total risk was weighted on total assets (27.78%). All portfolios had their worst performance in 2008, while the best performance varied across portfolios but were limited to the years 2003, 2006 and 2009.

I. Introduction

Using eleven different weighting methods, we look at the performance of portfolios of DJIA stocks over the past decade. The financial literature contains information on a myriad of potential weighting strategies, of which we have chosen four different approaches for weighting portfolios. The first allocation strategy we will consider is price-weighting. The Dow Jones Industrial Average (DJIA) uses a price-weighting scheme to determine the index value. Among the DJIA's virtues are its longevity, wide dissemination, and ease of calculation. Most investments textbooks deride the Dow Jones Industrial Average because it is price-weighted instead of the assumed superior approach of being market capitalization-weighted (i.e., Gitman & Joehnk, 2008, 94-96, Reilly & Brown, 2003, 168).

A trillion dollar industry has developed around investing in indexes weighted upon market capitalization. The advantages often cited for being market capitalization-weighted include clearly identifying the investable opportunity set, revealing the average return for investors in a particular asset class, and the increasingly suspect assertion that this technique is mean-variance efficient (Arnott, 2005). Examples of market capitalization-weighting include the NASDAQ Composite, the NYSE Composite, the Russell 2000 Index, and a number of other international indexes. The best know market capitalization-weighted index has been the S&P 500 which became "float-weighted" in 1995. Float weighting uses only the number of shares (called "float") available for public trading rather than the traditional "number of shares outstanding". A major concern expressed by critics of market capitalization-weighting is that this approach tends to over-weight overpriced stocks and to under-weight underpriced stocks in the index. This happens because the market price of stocks can vary from their fundamental value for a variety of reasons often referred to as "market noise" (Carrel, 2006). This concern, of course, would also be relevant for the price-weighted DJIA.

A third alternative is to equally-weight securities in a portfolio. An example of this

Thomas M. Krueger, is Professor of Finance, University of Wisconsin-La Crosse, Krueger.thom@uwlax.edu; Mark A. Wrolstad, Professor of Finance, Winona State University, mwrolstad@winona.edu

approach is the Value Line Index. An advantage to this approach is its lack of dependence upon market prices which can vary over time for a variety of reasons other than changing intrinsic M<value. However, McQuarrie (2008) found that his equal weighted S&P 500 portfolio index had over 200 bps higher volatility than either the cap-weighted S&P Index or the fundamental attribute-weighted Research Affiliates Fundamental 1000 Index (RAFI).

The fourth indexing alternative is to base the index upon fundamental factors of firms in order to avoid using the market value of the common stock (Estrada, 2008; Treynor, 2005). The motivation for discarding cap-weighting in favor of fundamental business metrics is the assumption that markets are not totally efficient (Estrada, 2008). The result of this approach is a portfolio that minimizes the return drag of over-weighting overpriced stocks and underweighting underpriced stocks that can be a significant problem with the approaches mentioned above. An example of this approach is the RAFI, which weights companies by factors such as book equity value, free cash flow, total cash dividends, and total sales. This report examines these four indexing approaches, including asset allocation based on a variety of fundamental factors

II. Literature Review

A large amount of research in the past decade has been devoted to helping profit-maximizing investors decide which of the above weighting approaches would help them achieve optimum returns with their investable funds. Arnott (2005) found that fundamental indexes outperformed the S&P 500 by approximately 2% of annual returns between 1962 and 2004. Fundamentals-weighted indexes also outperformed the equal-weighted S&P 500 and the CRSP universe, with lower risk. McQuarrie (2008) found that an equal-weight S&P 500 index outperformed the RAFI Composite with a 13.11% versus 12.47% geometric average return while the S&P 500 itself had a return of only 10.39%. Thus there does not seem to be agreement as to which of these approaches is the best one to obtain optimal investment results.

III. Research Method

This research contrasts portfolio performance arising from traditional allocation methods and a variety of fundamental factors to create portfolios of the DJIA companies in an effort to outperform the well-known index. Our research goes beyond price and shares outstanding to consider eight non-price portfolio-weighting variables. From the balance sheet, we allocate investment on the basis of total equity and total assets. From the income statement, we allocate investment on the basis of sales revenues, net income, and operating income (EBIT). From the cash flow statement, we allocate investment on the basis of cash flow from operations and free cash flow. Finally, checking the robustness of the RAFI dividend-weighted method, we allocate investment on the basis of dividends.

The thirty companies in the Dow Jones Industrial Average (DJIA) serve as the sample for this study. The initial sample is created on December 31, 1999. Table I presents a listing of the companies which were members of the Dow Jones Industrial Average during the decade. DJIA membership is quite stable. Over three fourths of the thirty companies in the DJIA are in the index for the entire ten-year sample period, which runs from 1999 through 2009.

Most of the membership volatility that occurs coincided with the recession in the latter part of the sample period. To deal with membership changes, sample membership is updated on an annual basis. The replacement company is assumed to be in place for the whole year in which it replaces another company that is dropped out of the index. For instance, on March 8, 2004, Kodak and International Paper were replaced by Pfizer and Verizon. Year-end 2003 financial statement values for Pfizer and Verizon are used for portfolio allocation purposes in the year 2004. As a consequence, the values presented in this paper will vary slightly from those presented in the financial press for the DJIA.

Total returns are used in this research as the independent variable. Price and dividend data were obtained from finance.yahoo.com. Data used in the allocation process was primarily obtained from Morningstar.com. Missing data were obtained from the individual company financial statements. Eleven portfolios are created in total. Three of them are weighted upon the traditional allocation models of price, market value of outstanding common stock, and equal weighting. In most cases, the observed values of the allocation variables are positive in all periods. For example, firms always have positive price, sales, and total assets levels. When no dividends are paid, no allocation is made to the company on the basis of this metric. In instances where an independent variable is negative (i.e., net income), it was assumed that the portfolio shorted the weighting of this DJIA member.

IV. Results

a. Measures of Portfolio Return and Return Volatility

Returns and risk for portfolio based on the various portfolio allocation approaches are shown in Table II. Among the common valuation techniques, the equal-weighted portfolio is the only allocation technique with a positive average rate of return for the entire decade. The equal-weighted technique's arithmetic mean exceeds the value-weighted approach by 3.91 percent. The best allocation technique is free cash flow which earned 1.96 percent per year on average. The worst arithmetic mean portfolio performance is that of the value-weighted portfolio which dropped an average of 1.69 percent per year.

The median return of the price-weighted portfolio was 1.83 percent worse than that of the value-weighted portfolio. Across the common valuation techniques, only the equal-weighted portfolio has a positive median. The highest median return is registered by the EBIT-weighted portfolio, at 4.72 percent. Meanwhile, the free cash flow-weighted portfolio is only slightly behind at 4.69 percent. The two lowest median returns are the price-weighted portfolio (-2.25%) and total assets-weighted portfolios (-1.80%).

When geometric returns of the common valuation techniques are considered, the value-weighted portfolio displays the worst performance at a negative 3.01 percent, as shown in Row 3 of Table II. As a consequence, the ending value of a \$1000 investment on December 31, 1999 is only \$731! The price-weighted portfolio is only slightly better with a geometric return of negative 2.49 percent and an ending value of \$777. By contrast, the equal-weighted portfolio has a slightly positive geometric return of 0.2 percent and a gain of \$20 for a \$1000 initial investment. Across the eight attribute weighting schemes, net income and free cash flows provide the highest geometric mean returns. Their identical 79 basis point annual gains result in a

terminal value for their portfolios of \$1,082. The total assets-weighted portfolio returns only 97 cents annually per dollar invested during the decade and have a terminal value of only \$737.

Despite having relatively poor return performance, the value-weighted portfolio can claim to have a lower return variation than either the price-weighted or equal-weighted portfolios. Only the equal-weighted portfolio of the three common weighting schemes has a positive coefficient of variation. The coefficient of variation value of 9.39 suggests that investors experienced a nine percent level of total risk for every unit of return.

The two lowest levels of total risk are registered by the net income-weighted portfolio and the free cash flow-weighted portfolios. These two portfolios also have the lowest coefficients of variation, among those portfolios with positive values. At the other extreme, the largest standard deviations are registered by the total assets-weighted (27.78%) and equal-weighted portfolios (20.85%). The two worst coefficients of variation are posted by the operating income (EBIT)-weighted (33.4%) and the total asset-weighted portfolios (31.9%).

Given the fact that all eleven portfolios have the same thirty securities in them, we might expect the performance of the eleven portfolios in this study to be fairly similar. On an arithmetic means basis they are, with a range from only -1.69% to 2.22%. It is somewhat surprising that the different weighting approaches result in terminal portfolio values that range from \$731 to \$1082, a difference of \$351 after 10 years. When incorporating differences in the standard deviation, we find that the coefficients of variation ran from 8.01 to 33.4, the highest being over four times larger than the lowest.

b. Analysis of Maximum and Minimum Returns

Perhaps one portfolio allocation technique works best in rising markets, while another works best in falling markets. In order to gain some insight into the difference in performance across the various markets, Panel A of Table III reports the best and worst returns for each allocation scheme and the year in which each was recorded. For ease of understanding, percentages are presented in ratio terms. Scanning across the "Best" column, one can see that the best performance among the common valuation techniques was registered by the equal-weighted portfolio with a 31 percent rate of return in 2009. Only the 41 percent return of the total assets-weighted portfolio (also in 2009) did better. At the other extreme, the lowest "Best" performance was 22 percent, which was earned by the EBIT-weighted, net income-weighted, and operating cash flow-weighted portfolios which all occurred in 2003. The years in which the best performance was registered occurred six times in 2003, three times in 2009, and twice in 2006. Both of the highest "Best" returns were earned in 2009, while the lowest "Best" returns were earned in 2003.

By comparison, the "Worst" performance for all eleven portfolios was registered in 2008. In 2008, returns ranged from a negative 19 percent to a negative 51 percent. The portfolio weighted on total assets lost slightly more than half of its value, while the portfolio weighted upon net income lost slightly less than one-fifth of its value. Across the three common weighting methods, the price-weighted method experienced the greatest percentage decline.

To provide additional insight into the performance of the various attribute allocation

schemes, we looked at the performance of the best and worst security in each portfolio to see if any particular company played a major role in helping or hurting portfolio performance. Individual security performance is based on the weighting allocated to an individual DJIA member by the specified metric and the total return of that stock. These results are presented in the second panel of Table III. The largest single impact would have arisen from investing in Bank of America (BAC), which added thirty-three percent to the total assets-weighted portfolio return in 2009. In fact, Bank of America's 2009 performance had the greatest impact on the equal-weighted, total stockholders' equity-weighted, and total assets-weighted portfolios. The impact arising from Exxon Mobil's (XOM's) 2006 return is also the greatest for a specified index in three cases; sales-weighted, EBIT-weighted, and operating cash flow-weighted portfolios. If you also consider the impact of Altria (MO) in 2000 on the free cash flow-weighted and dividend-weighted portfolios, you will conclude that relatively few firms had the largest impacts across all eleven portfolios.

Attributed-weighted portfolios are also highly dependent upon a relatively small number of stocks when looking at the low side of their performance range. For instance, the losses of Microsoft in 2000 had the largest negative, single stock impact on the price-weighted and value-weighted portfolios when it dropped these portfolio returns by 4 percent and 13 percent, respectively. Exxon Mobil, ironically supplies both the largest positive impact (as mentioned in the last paragraph) and negative impact on the equal-weight weighted, sales-weighted, EBIT-weighted, net income-weighted, operating cash flows-weighted, and free cash flows-weighted portfolios.

c. Analysis of Correlations and Mean Differences

Additional analysis consisted of measuring pair-wise total return correlations across all eleven portfolios. Given the consistency of most returns and risk measures (exhibited in Table II), years with most extreme performance on a portfolio basis (Panel A of Table III), and individual component basis (Panel B of Table III), it is not surprising that a vast majority of correlations are above 0.94. There are only two correlation coefficients with values below 0.90, both of which are at the 0.87 level. One is the correlation between the returns of the value-weighted portfolio and total assets-weighted portfolio and the other is the value-weighted portfolio and the dividend-weighted portfolio correlation. Tests of correlation significance found that that the only pair-wise combination that is statistically significant at the 0.10 level of confidence is the value-weighted portfolio and free cash flow-weighted portfolio combination. Looking back at Table II, one can see that the value-weighted portfolio declined by 1.69 percent, while the free cash flow-weighted portfolio rose 1.96 percent, on average.

V. Conclusions

Assuming that financial markets are inefficiently pricing securities, a profit-maximizing investor would like to avoid over-priced stocks and allocate more money to under-priced securities. Unfortunately, this is not done reliably using the popular, price-weighted Dow Jones Industrial Average or other approaches that are based upon the market price of stocks. Some evidence was presented suggesting that firm fundamentals are better allocation criteria. However, high correlations tend to minimize the relative value of selecting information found in the financial statements.

The sample period chosen for this research has been an extremely volatile decade. There was the aftermath of the Dot-Com bubble, the 9/11 terrorist attacks, the sub-prime mortgage crisis, and the election of a powerful coalition of left-of-center political leaders attempting to change the economic direction of this country. Extreme stock market highs and lows were all compressed into this one decade. Our study supports the findings of other studies that suggest that price-weighting and valuation-weighting methods may not lead to the optimal performance of a portfolio. Across the financial statements, over this period and based on financial statement information studied here, the cash flow statement appears to provide the most fertile ground for above average rates of return to the passive, long-term investor.. The average terminal value for portfolios based on cash flow statement values exceeded the income statement-based portfolios' average terminal value by \$35 and the balance sheet-based portfolio's average terminal value by \$180. Further research, across extended time periods or based on financial ratios, may shed additional light on security weighting techniques that magnify investor return.

Table I. Dow Jones Industrial Average Membership			
Stock in DJIA for Entire Decade			
3M Company	Coca-Cola	Intel	Microsoft
Alcoa Incorporate	DuPont	International Business Machines	Procter & Gamble
American Express	Exxon Mobil	Johnson & Johnson	United Technologies
AT&T	General Electric	J.P. Morgan	Walmart
Boeing	Home Depot	McDonald's	Walt Disney
Caterpillar	Hewlett-Packard	Merck	
Changes in DJIA Membership			
On 4/8/04	Kodak & International Paper	Replaced by	Pfizer & Verizon
On 2/19/08	Altria & Honeywell	Replaced by	Bank America & Chevron
On 9/22/08	AIG	Replaced by	Kraft
On 6/8/2009	Citigroup & General Motors	Replaced by	Travelers & Cisco

Table II. Comparisons of Return and Risk Measures Across Various Allocation Methods											
	Common Valuation Techniques			Income Statement Accounts			Balance Sheet Accounts		Cash Flow Statement Accounts		
	Price	Value	Equal	Sales	EBIT	Net Income	Total Stockholder Equity	Total Assets	Operating Cash Flows	Free Cash Flows	Dividend
Arithmetic Mean %	-0.29	-1.69	2.22	1.79	0.50	1.71	1.83	0.87	1.89	1.96	1.90
Median %	-2.25	-0.42	0.29	1.51	4.72	3.47	3.23	-1.80	3.24	4.69	1.32
Geometric Mean %	-2.49	-3.01	0.20	0.30	-0.87	0.79	-0.07	-3.00	0.59	0.79	-0.07
Value of \$1000	\$777	\$731	1020	1030	917	1082	993	737	1060	1082	993
Standard Deviation %	21.30	16.9	20.85	18.02	16.71	14.26	20.19	27.78	16.65	15.69	20.45
Coefficient of Variation	-74.5	-10.0	9.39	10.1	33.4	8.3	11.0	31.9	8.81	8.01	10.8

Table III. Analysis of Maximum and Minimum Returns											
Panel A: Index Performance: Annual Returns											
	Common Valuation Techniques			Income Statement Accounts			Balance Sheet Accounts		Cash Flow Statement Accounts		
	Price	Value	Equal	Sales	EBIT	Net Income	Total Stockholder Equity	Total Assets	Operating Cash Flows	Free Cash Flows	Dividends
Best	0.26	0.29	0.31	0.27	0.22	0.22	0.28	0.41	0.22	0.22	0.29
Year	2003	2006	2009	2003	2003	2003	2003	2009	2003	2006	2009
Worst	-0.40	-0.29	-0.35	-0.28	-0.32	-0.19	-0.33	-0.51	-0.26	-0.27	-0.34
Year	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008
Panel 2: Insights to Component Performance: Single Stock Contribution to Index Function of company weighting by index metric x company's total return in specified year											
	Price	Value	Equal	Sales	EBIT	NI	TSE	TA	OCF	FCF	DIV
Largest Contribution	MCD 0.03	IBM 0.05	BAC 0.04	XOM 0.06	XOM 0.07	GM 0.18 (short)	BAC 0.18	BAC 0.33	XOM 0.07	MO 0.10	MO 0.13
Year	2009	2001	2009	2006	2006	2007	2009	2009	2006	2000	2000
Lowest Contribution	MSFT -0.04	MSFT -0.13	XOM -0.03	XOM -0.08	XOM -0.13	XOM -0.06	BAC -0.09	C -0.19	XOM -0.07	XOM -0.08	HPQ -0.18
Year	2000	2000	2008	2001	2008	2001	2008	2008	2001	2001	2001
C: Citigroup; BAC: Bank of America; EK: Eastman Kodak; GM: General Motors; HPQ: Hewlett-Packard; IBM: International Business Machines; MCD: McDonald's; MO: Altria; MSFT: Microsoft, XOM: Exxon Mobil											

References

- Arnott, Robert, Jason Hsu, and Philip Moore. "Fundamental Indexation", *Financial Analysts Journal*. Vol. 61, No. 2 (2005), pp. 83-99.
- Carrel, Lawrence, "Index Wars", www.smartmoney.com/investing/etfs/index-wars-19933/, August 16, 2006.
- Estrada, Javier. "Fundamental Indexation and International Diversification", *The Journal of Portfolio Management*, Spring 2008, pp. 93-109.
- Gitman, Lawrence J. and Michael D. Joehnk, *Fundamentals of Investing*, Prentice Hall, 2008
- McQuarrie, Edward F., "Fundamentally Indexed or Fundamentally Misconceived: Locating the Source of RAFI Outperformance". *The Journal of Investing*, Winter 2008, pp. 29-37.
- Milne, R.D., "The Dow-Jones Industrial Average Re-Examined", *Financial Analyst Journal*, 22 (6), 1966, 83-88.
- Reilly, Frank K. and Keith C. Brown, *Investment Analysis and Portfolio Management*, 7th Edition, Thomson/South-Western, 2003.
- Treynor, Jack, "Why Market-Valuation-Indifferent Indexing Works", *Financial Analysts Journal*. Vol. 61, No. 5 (2005), pp. 65-69.