

WHITE PAPER No. 29

NUMERACY, INNUMERACY
AND HARD SLOGGING

GREYCOURT

White Paper No. 29 – *Numeracy, Innumeracy and Hard Slogging*

“If you swallow a toad when the market opens, you will encounter nothing more disgusting the rest of the day.”

- Paraphrase of a remark attributed to the famous misanthrope, Nicolas de Chamfort (1741 – 1794)¹

Nearly twenty years ago the eminent ecologist, Garrett Hardin,² bemoaned our lack of “numeracy.”

“[L]iteracy is not enough ... we also need numeracy, the ability to handle numbers and the habit of demanding them. A merely literate person may raise no question when a journalist speaks of ‘the inexhaustible wealth of the sea,’ or ‘the infinite resources of the earth.’ The numerate person, by contrast, asks for figures and rates.”³

The broad public took Dr. Hardin to heart, so much so that one country, Great Britain, even launched a National Numeracy Strategy in every school in the land.

But no sooner had we begun to congratulate ourselves on our new-found numeracy than along came that other major civic scold, John Bogle,⁴ alleging that numeracy is at the very heart of investor frustration. In a recent speech entitled *Don't Count On It! The Perils of Numeracy*, Bogle said:

“My thesis is that today, in our society, in economics, and in finance, we place too much trust in numbers. *Numbers are not reality*. At best, they're a pale reflection of reality. At worst, they're a gross distortion of the truths we seek to measure.”⁵
[Emphasis in the original.]

¹ Chamfort's actual remark was, “Swallow a toad in the morning and you will encounter nothing more disgusting the rest of the day.”

² Dr. Hardin is probably best known for his environmental parable, *The Tragedy of the Commons*, Science, vol. 162, pp. 1243-1248 (1968).

³ *An Ecolate View of the Human Predicament*. This article appeared in McRostie (ed.), *Global Resources: Perspectives and Alternatives* (University Park Press, 1985). The essay was expanded into Hardin's book, *Filters Against Folly* (Penguin, 1985).

⁴ In case he needs any introduction, Mr. Bogle is the founder and former CEO of The Vanguard Group.

⁵ John C. Bogle, *Don't Count On It! The Perils of Numeracy*, keynote address before the Landmines in Finance Forum of the Center for Economic Policy Studies at Princeton University (October 18, 2002).

Far be it from me to choose sides between such towering *eminences grises* – let’s just say that they are both right. Bogle is surely correct: numerate investors have focused so hard on the gross return expectations developed by modern portfolio theorists that we have frequently missed the forest for the trees. But Hardin is also right: frustration with investment results is all-too-often the result of innumeracy, that is, our failure to appreciate the true import of the numbers we are looking at.

Let’s follow Bogle’s calculations, as set forth in his speech,⁶ and see where they lead. Imagine an investor – we’ll call her Edith – who at age twenty-five is the happy recipient of a \$10 million inheritance from her grandmother. Aside from being a very fortunate young lady, Edith is also no fool, having studied modern portfolio theory at Vassar. Edith decides that she would like to do the same for her own grandchildren one day – leave them a handsome inheritance. Noting that the long-term return on stocks is 11.3%,⁷ Edith asks her family’s long-time advisor, Mildew Trust Co., to invest the entire \$10 million in stocks. A simple calculation tells Edith that, fifty years hence, when she is seventy-five, *she should be able to pass on to her grandchildren a trust fund worth a cool \$2.8 billion*. This should certainly earn her the distinction of Everyone’s Favorite Grandma.

What Edith Forgot

Unfortunately, Edith forgot a few things in her eagerness to generate terrific total returns and become Everyone’s Favorite Grandma. Let’s observe what is actually far more likely to happen to that wonderful sum of \$2.8 billion.

The first thing Edith forgot: variance drain

Edith calculated her compound annual return on her trusty financial calculator, but she simply projected an 11.3% straight-line return. Alas, even if Edith averages 11.3% a year over fifty years, she isn’t going to get an 11.3% return *every year* – such returns don’t happen in the capital markets. Sometimes her return will be better, sometimes worse. Specifically, assuming that her returns exhibit a Standard Deviation (S.D.) of 16, then two-thirds of the time her return is likely to fall between +27.3% and –4.7%. One-third of the time her return will be higher or lower than that. And this variability in the return series – the price volatility that is inherent in owning equity securities – will profoundly reduce her terminal net wealth. Indeed, the greater the volatility of the returns the lower will be her terminal wealth, assuming that we keep the annual compound return constant. If we assume, as we have, an average variability of 16% (roughly the S.D. of US large company stock returns over Bogle’s measuring period), we find that the best Edith can hope for after

⁶ That is to say, I have applied the Bogle total return rates to a different set of dollars, just to make it more interesting.

⁷ Bogle, *op. cit.*, note 4, p.5.

fifty years of compounding is about \$1.5 billion.⁸ (Not to be an alarmist, but if the S.D. of Edith's returns turns out to be closer to 20%, as has been the case over longer periods of time with US large cap stocks, Edith's terminal wealth will be reduced further, to \$1 billion. But let's hope for the best.) We'll forgive Edith for this lapse – her grandchildren will still be billionaires – but variance drain is an issue to which too many investors (and some investment professionals!) don't pay enough attention.⁹

The second thing Edith forgot: inflation

As Bogle points out, over the past fifty years inflation has averaged 4.2%.¹⁰ Therefore, the *real* rate of return on US stocks is not 11.3%, but only 7.1%. Surely Edith doesn't want to leave her grandchildren worthless, inflated dollars, but real buying power. Alas, then, her original dream of leaving several billion dollars to her grandchildren has turned out to be a fantasy. The real value of her legacy is “only” \$182 million. Even so, her grandchildren will be centimillionaires.

The third thing Edith forgot: investment costs

Stock market indices produce gross returns, but investors generate only returns that are net of the costs of obtaining them. These costs include investment management fees, brokerage commissions, spreads between bid and ask prices and (something many investors overlook) market impact¹¹ and opportunity cost.¹² Bogle estimates that such costs come to at least 2% per year.¹³ While we are confident that Mildew Trust Co. could run that number up considerably higher, we'll settle for Bogle's number. Net of investment costs, therefore, Edith's return is likely to be about 5.1%. This brings her future grandchildren's inheritance down to \$67 million. Well, even so, it's nothing to sniff at.

The fourth thing Edith forgot: taxes

If Edith had been born into life as a pension plan or charitable endowment, she could obtain her investment returns without worrying about having Uncle Sam as her investment partner. But as a taxpaying future grandmother, Edith must pay ordinary income tax rates

⁸ Variance drain costs Edith 128 basis points of annual compound return, bringing her effective return (for net wealth purposes) down from 11.3% to 10.02%.

⁹ In adjusting our final wealth calculations for the variability of the returns, we have used the simple approximation: $C = R - \sigma^2/2$, where R is the mean return and σ is the variance in the return. See Tom Messmore, *Variance Drain*, *Journal of Portfolio Management* (Summer 1995), p. 106.

¹⁰ Bogle, *op. cit.*, note 4, p.6.

¹¹ Market impact refers to the fact that, since money managers tend to be huge investors, the mere fact that they are attempting to buy a stock will force the price of that stock up, substantially increasing the cost of the transaction. An identical problem occurs when the manager tries to sell a stock: the large sell order will cause the stock price to decline, reducing the sales proceeds. The combination of buying higher and selling lower has a huge impact on managers' abilities to produce competitive returns.

¹² Opportunity cost refers to the loss of value that occurs between the time Mildew Trust Co. decides to buy or sell a stock and when the transaction actually occurs.

¹³ Bogle, *op. cit.*, note 4, p.6.

on interest, dividends and short-term capital gains, and capital gains tax rates on long-term gains. Bogle estimates that, over time, taxes eat up about 2% per year of investment returns.¹⁴ This reduces Edith's annual returns to 3.1% and her grandchildren's inheritance to \$25 million. A far cry from \$2.8 billion, to be sure, but still better than a poke in the eye with a sharp stick.

The fifth thing Edith forgot: spending

A girl's gotta live somehow, of course, and while we don't know exactly how much of Edith's inheritance she will spend each year, we have some pretty good yardsticks to use for comparison purposes. The Internal Revenue Service, for example, requires private charitable foundations to spend 5% of their endowment values (on average), and many nonprofit organizations also spend roughly 4% to 6% of their average endowment values each year. Of course, these are largely¹⁵ tax-exempt investors. But we also have the Uniform Principal and Income Act, which permits trustees to manage trusts as "unitrusts," adopting total return investment strategies and simply paying out to the income beneficiary a certain percentage of the value of the trust corpus each year. That percentage is fixed at 4% – indeed, if a trustee wishes to pay out more or less than 4% per year it must seek court approval to do so. While we harbor our private doubts about whether Mildew Trust Co. will spring for the unitrust idea, we'll give them the benefit of the doubt and assume that they do. Her spending brings Edith's annual return down to – oops. Edith's return has now moved into negative territory: -0.9% per year. In other words, instead of watching happily as her \$10 million grows to \$2.8 billion over the next half century, *Edith will be lucky to wind up with a bit over \$3 million*. Instead of Everyone's Favorite Grandma, Edith is likely to be remembered as That Old Witch Who *%##@! Away Our Inheritance (this is a family publication).

What Should Edith Do?

John Bogle has an answer to Edith's dilemma, and it will surprise no one who knows him: index funds.¹⁶ Perhaps we can be forgiven for suspecting that Mr. Bogle would also view index funds as the cure for world hunger, the solution to the Arab-Israeli conflict, and a handy way to deal with killer asteroids. But in this case he's on to something. If Edith had used index funds instead of Mildew Trust Co., she would have reduced both her investment costs (index fund fees are very low and, given their relatively low turnover, generate lower frictional investment costs than do active managers) and her taxes as well (lower turnover translates into lower taxes). While we don't subscribe to Bogle's claim that the use of index funds will "reduce both investment costs and taxes almost to the vanishing point,"¹⁷ if Edith could cut her cost- and tax-drag in half she would at least move

¹⁴ Bogle, *op. cit.*, note 4, p.6.

¹⁵ Private foundations pay a small excise tax on their investment income.

¹⁶ Bogle, *op. cit.*, note 4, p.6.

¹⁷ Bogle, *op. cit.*, note 4, p.7.

her long term rate of return back into positive territory. Adding 2% back to her bottom line annual return would bring her overall return to 1.1% and would allow Edith to grow her principal modestly and leave her grandchildren slightly more money than her grandmother left her.¹⁸ But that's if everything else goes exactly right. A far more likely outcome, we fear, is the one we reached a few paragraphs ago: Edith's \$10 million inheritance will gradually diminish in value, not grow.

One reason we don't share Mr. Bogle's unlimited enthusiasm for index funds is that he was speaking about a retail investor – instead of starting with \$10 million for purposes of his calculations, he started with \$1,000 – while we are speaking about families with a significant degree of affluence. Such families are almost always in far higher (and more complex) tax brackets than retail investors, and hence even the normal turnover and costs associated with the use of index funds will be problematic. Moreover, a US large capitalization index fund is hardly a clever portfolio strategy, nor one Edith – or any other investor – is likely to stick with through thick and thin.

While we don't know Edith well enough to advise her in any detail (we only invented her a few minutes ago), we do have some general advice for her, and it goes like this:

Variance drain. First, Edith – and all sensible investors – needs to pay close attention to the problem of variance drain. She should develop a sophisticated portfolio strategy that maximizes her investment returns while minimizing her risk – that is, the volatility of those returns. The lower the price volatility Edith's portfolio exhibits, all else being equal, the richer she will ultimately be. A US large cap investment portfolio is far too volatile an investment strategy not just from a risk tolerance perspective, but from a mathematical perspective.

Inflation. Inflation is the insidious cancer of the investment world, quietly but effectively destroying wealth over time. We have been fortunate in recent years that inflation has been largely under control. But inflationary periods come and go, and while the last one (1973 – 1981) has gone, a new one is surely coming, sooner or later. Edith could permanently add assets to her portfolio that tend to perform well during periods of unexpected inflation – real estate, commodities, inflation-protected bonds – but the problem with this tactic is that it will tend to bring down her long-term rate of return. If she is extremely perspicacious, she could add those assets to her portfolio just before inflation breaks out and dump them just before inflation is tamed. (In which case, Edith should be advising us, not the other way around.)

Taxes. Like inflation, tax rates come and go, but like death, they will always be with us. Edith needs to adopt tax-efficient strategies throughout her investment portfolio, *e.g.*:

¹⁸ We haven't mentioned the problem presented by the fact that Edith is likely to have more than one grandchild, meaning that, per capita, her grandchildren will be significantly less well-off than she was. All-in, families compound faster than investment capital.

- ✓ Her asset allocation strategy should be designed using estimated *after-tax* returns (and adjusting expected correlations and volatilities as appropriate). Otherwise, she will not be deploying her assets efficiently.
- ✓ She should pay close attention to asset *location* issues. Putting the right investments in the wrong pockets can seriously compromise Edith's returns. (Should hedge funds be put in the intentionally defective grantor trust or the cascading GRAT?)
- ✓ She should develop tax-aware strategies in each asset class. A strategy that works in US large cap, for example, will likely be suboptimal elsewhere in the portfolio.
- ✓ She should work with investment managers who exhibit proper awareness of the tradeoffs between alpha generation and tax consequences. The production of alpha generally implies taking investment actions that will cause tax consequences for the investor. If the anticipated alpha isn't great enough to compensate the investor for the tax cost, the actions shouldn't be taken.
- ✓ She should aggressively harvest tax losses throughout the year and across all managed accounts.

Investment costs. Edith needs to optimize (not minimize) her investment costs, primarily by (a) being aware of the damage such costs can cause to her portfolio, (b) allocating investment fees to asset classes and managers who actually have a chance to add value (and away from asset classes and managers who have little chance to do so), and (c) keeping portfolio turnover to a minimum.

Spending. If Edith is anything like the rest of us, her post-inheritance lifestyle will be considerably more opulent than her pre-inheritance lifestyle. But while \$10 million (or \$100 million, or \$1 billion) seems like a lot of money, there is no amount of money that profligate spending can't decimate over time. If Edith can keep her spending closer to 3% of her principal than 4%, she will have a far better chance to maintain and grow her wealth. Better yet, Edith could structure her lifestyle so that the additional 1% of spending (over 3%) is discretionary. In other words, during negative periods in the capital markets Edith could reduce spending to 3%, then increase it to 4% when the markets are strong. Although most investors aren't aware of it, income from investment portfolios is path-dependent, that is, the income a portfolio will produce depends not just on the rate of return and risk level of a portfolio, but on how the returns happen. Consider the following two scenarios,¹⁹ each describing a possible first five years of investment performance in Edith's \$10 million account, with her spending kept constant at 4% per year:

¹⁹ The scenarios were suggested by AllianceBernstein, although I used different values in making the calculations. See Robert A. Weiss, CFA, *Income vs. Wealth: Making the Tradeoff...An Update* (Sanford C. Bernstein, 2001).

	Scenario #1 Annual Return	Scenario #2 Annual Return
Year 1	15%	-10%
Year 2	20%	5%
Year 3	30%	30%
Year 4	5%	20%
Year 5	-10%	15%
Average annual return:	12.0%	12.0%
Compound annualized return: ...	11.1%	11.1%
Standard deviation:	15.3%	15.3%
Terminal wealth:	\$13,808,569	\$13,808,569

Total income to

Edith over five years:..... \$3,537,990.....\$2,775,635

In these two scenarios the average annual return is the same and Edith's terminal wealth is the same. But because the *pattern* of the returns is different, the actual income Edith earns is much higher in Scenario #1, where she experiences her good years earlier.

Sticking to her strategy. Finally, despite the many provocations Edith is likely to face over the course of half a century, she will need to stick to her long-term investment strategy with almost superhuman endurance.

Hard slogging

There is a Chinese parable about the Sage who, having performed an important service to the empire, was asked by the Emperor what he would like as his reward. "All I ask," replied the Sage, "is one grain of rice today, two grains tomorrow, four the next day and so on throughout the remainder of my poor lifetime." "Ah," said the Emperor, "surely you must ask for more than that!" But the Sage was firm in his modesty and the Emperor agreed to the bargain. It was only a few months later that the Emperor learned there was not enough rice in all of China to meet his obligation to the Sage. Whereupon, recognizing that he had been evilly tricked, the Emperor had the Sage executed, bringing to a brutal but effective end this particular episode in the thrill of compound interest.

And that is precisely the point: nothing compounds forever, or even for very long. Trees start from small seedlings but don't grow to the sky. Some species spawn thousands of offspring, threatening to overwhelm the earth, but few of these offspring live long enough to reproduce. Malthusians²⁰ have warned for more than two centuries that human population growth would quickly overwhelm the world's resources, causing the species to collapse. But it never happens: between disease, famine, war and economic and

²⁰ Thomas Malthus wrote his famous paper, *An Essay on the Principle of Population*, in 1768.

technological progress, the compounding never comes close to what a straight line projection would suggest.

Einstein is famously supposed to have remarked that, while the theory of relativity is certainly interesting, the most remarkable thing in the world is compound interest. But the truth is (talk about disagreeing with an *eminence grise*!) that the most remarkable thing about compound interest is how frequently its existence tends to be, as Hobbes said of the lives of the English poor, “nasty, brutish and short.”²¹

We have explored some of the reasons why the magic of compound interest rarely plays out in the lives of investors, but there are others as well: psychological factors, sociological issues, family dynamics, social and economic disruptions, the collapse of civil societies, and so on. But whatever the reasons, managing an investment portfolio in a taxable, family environment is probably the most formidable intellectual and psychological challenge Edith, or any other family, will ever face. The sad and simple fact is that most affluent families, faced with the challenges identified by Mr. Bogle and those just mentioned, will not grow their wealth over time, or even maintain it, but will watch helplessly as it disappears before their very eyes.

We are all so numerate these days that total return numbers trip lightly off our tongues. But those are sly devils as numbers go, Miltonesque Satans luring us into traps from which, unless we are very wary, there is no escape. And what escape there is involves not just a numerate understanding of how things actually compound and how they don't, but a very large degree of hard slogging, the paying of minute attention to the issues that count – if, that is, like Edith, we hope to pass along our wealth intact to a future generation.

We will be happy to discuss this memo at your convenience.

GREYCOURT & CO., INC.
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(This paper was written by Gregory Curtis, Greycourt's Chairman. Mr. Curtis can be reached at Greycourt & Co., Inc., 607 College Avenue, Pittsburgh, PA 15232, (412) 361-0100, fax 412-361-0300, gcurtis@greycourt.com, www.greycourt.com)

²¹ Thomas Hobbes, *Leviathan* (1660). “No arts; no letters; no society; and which is worst of all, continual fear and danger of violent death; and the life of man, solitary, poor, nasty, brutish, and short.”